



1. Uluslararası

# Cahit Arf

## Bilimsel Araştırmalar ve İnovasyon Kongresi

02-03 Mayıs 2026-Ankara

Arf  $\pi = \frac{\text{Hess of}}{X(X + \frac{k}{\pi} X)}$   
 $(\pi, \alpha, \beta, \gamma) = (2, \alpha, \sqrt{4}) = \frac{3}{2}$   
 $A_X = \sqrt{X} \Rightarrow X \sqrt{X} = X$   
 $\Gamma - \sqrt{X} = (2, 1) = \frac{1}{9} \left( \frac{11}{9} + K \right)$   
 $A_{\Gamma} = \frac{1}{9} \left( \sqrt{9} + \sqrt{9} \right) \Rightarrow \sqrt{9}$   
 $A = \sum_{i=1}^n (1 + \alpha_i)$   
 $A = \frac{1}{\pi}$   
 $A = (1) X = X^2$   
 $A_{\Gamma} = 2 \sqrt{X} \cdot \left( \frac{1}{\pi} = \frac{1}{9} \sqrt{9} = \frac{1}{9} \cdot 3 \right)$   
 $A_{\Gamma} = \left( \xi \right) = \sqrt{X^2 - 4X + 2}$   
 $A_X = \frac{A_{\Gamma} \left( X = 2(1 + \alpha) \right)}{\sqrt{2} \sqrt{X} - \sqrt{2} = \frac{1}{2} X^2}$   
 $A_{\Gamma} = X^2 - \frac{12}{2} \sqrt{X} = \frac{\sqrt{4} \cdot 22}{8.71}$   
 $A_{\Gamma} = 12 \cdot \frac{3}{2} = 18$   
 $A_{\Gamma} = X + \sqrt{X} + 2$   
 $\Gamma - \Gamma + A \frac{3}{2} = X \cdot X^2$   
 $A_{\Gamma} = (0) \sqrt{5^2 X^2 + 10 \sqrt{X}} =$   
 $\sqrt{10} = \sqrt{2} \cdot \sqrt{5} \cdot \sqrt{1}$   
 $X = \frac{1 \cdot 2}{\sqrt{2} \cdot \sqrt{2} - \sqrt{2} \cdot 2}$   
 $\left( \frac{1}{2} \right) = 2 \cdot 1 =$   
 $N_{\Gamma} = \epsilon \left( X^2 - X + 2 \right)$

EDİTÖRLER:

DOÇ. DR. EYÜP SABRİ KALA

DOÇ. DR. MUTLU YALVAÇ

DR. MUHAMMAD FAISAL





**ISARC Academy**

INTERNATIONAL SCIENCE AND ART RESEARCH CENTER

INTERNATIONAL **CAHİT ARF** SCIENTIFIC  
RESEARCH AND INNOVATION CONGRESS  
*May 02-03, 2026 / Ankara, Türkiye*

# PROCEEDINGS BOOK

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# CONGRESS ID

## CONGRESS TITLE

INTERNATIONAL CAHİT ARF SCIENTIFIC RESEARCH AND INNOVATION CONGRESS

## DATE and PLACE

Ma 02-03, 2026 / Ankara, Türkiye

## PARTICIPATION

Keynote & Invited

## PARTICIPANTS COUNTRY

Türkiye, India, Georgia, Morocco, Nigeria, Pakistan, South Africa, Romania Ukraine, Vietnam

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***INTERNATIONAL CAHİT ARF  
SCIENTIFIC RESEARCH AND INNOVATION  
CONGRESS-I***

*May 02-03, 2026 / Ankara, Türkiye*

***Congress Program***

*Participant Countries: Türkiye, India, Georgia, Morocco, Nigeria, Pakistan, South Africa, Romania Ukraine, Vietnam*

**Meeting ID: 869 6848 3150**

**Passcode: 827766**

**ZOOM LINK:**

<https://us06web.zoom.us/j/86968483150?pwd=XplfMqOE1lLAaujE1gVTNS5N5RXToa.1>

### **IMPORTANT, PLEASE READ CAREFULLY**

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Make sure your computer has a microphone and is working. You should be able to use screen sharing feature in Zoom. Attendance certificates will be sent to you as pdf at the end of the congress. Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session. **Before you login to Zoom please indicate your name surname and hall number, exp. Hall-1, Fatih KARIPOĞLU**

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### **TEKNİK BİLGİLER**

Bilgisayarınızda mikrofona olduğuna ve çalıştığına emin olun. Zoom'da ekran paylaşma özelliğine kullanabilmelisiniz. Katılım belgeleri kongre sonunda tarafınıza pdf olarak gönderilecektir. Kongre programında yer ve saat değişikliği gibi talepler dikkate alınmayacaktır. **Zoom'a giriş yaparken önce lütfen adınızı, soyadınızı ve SALON numaranızı yazınız, Örnek: Hall-1, Fatih KARIPOĞLU**

02.05.2026 / Hall-1, Session-1



Ankara Local Time

10<sup>00</sup> : 11<sup>00</sup>



Meeting ID: 869 6848 3150

Passcode: 827766

**HEAD OF SESSION: Assoc. Prof. Dr. Ümit İZGİ ONBAŞILI**

TOPIC TITLE	AUTHORS	AFFILIATION
Pre-Service Teachers' Views On Their Experiences Of Communicating In A Foreign Language In Etwinning Projects	Assoc. Prof. Dr. Ümit İZGİ ONBAŞILI Yüksek Lisan Öğrencisi Miraç UZAN	Mersin University
A Qualitative Inquiry Into The Experiences Of Provincial Etwinning Coordinators In Türkiye	Assoc. Prof. Dr. Ümit İZGİ ONBAŞILI Sevda TAMER Bircan KELEŞ	Mersin University/Mersin Provincial Directorate of National Education
Online Shopping Addiction Research In Türkiye: A Bibliometric Analysis Of Graduate Theses	Nermin TEKİN	Van Yüzüncü Yıl Üniversitesi
Artificial Intelligence In Sports Education	Prof. Dr. Sebahattin DEVECİOĞLU Rumeysa GÖÇER	Firat University

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

02.05.2026 / Hall-2, Session-1



Ankara Local Time

10<sup>00</sup> : 12<sup>15</sup>



Meeting ID: 869 6848 3150

Passcode: 827766

**HEAD OF SESSION: Assoc. Prof. Dr. Mutlu YALVAÇ**

TOPIC TITLE	AUTHORS	AFFILIATION
An Analysis Of The Nationalist Views Of Ahmet Kabaklı	PhD.Uğur EYİDİKER	Trakya University
The Cyprus Problem: Historical Background, Political Developments, And Search For Solutions	Mevlüt ARSLAN	Batman University
The Impact Of Fiscal Decentralization On Municipal Financial Sustainability In Georgia	Dr.Merab Vanishvili	Georgian Technical University, Georgia
Pension System Reform In Georgia: Analysis And Assessment	Dr.Merab Vanishvili	Georgian Technical University, Georgia
Liquidation Of Mukataa-Based And İcareteyn Based Waqf Real Estates In Return For The Payment Of A Compensation Payment	Assoc. Prof. Dr. Eyüp Sabri KALA	Marmara University
Microplastic Pollution In Groundwater And The Türkiye Perspective	Assoc. Prof. Dr. Mutlu YALVAÇ Mehmet Nurettin AŞKIN	Mersin University
Vermikompost Üretiminde Vermireaktör Kullanımı	Assoc. Prof. Dr. Mutlu YALVAÇ Mehmet Nurettin AŞKIN	Mersin University
An Investigation On The Architectural Characteristics Of Traditional Houses In The Rural Architecture Of Dökecek Village (Ovacık/Karabük)	Lect. Dr. Elif ÇETİN Y. Mimar Büşra ARSLAN	Karabük University
Comparative Analysis Of The Architectural And Typological Characteristics Of Traditional Ice Houses In Cultural And Climatic Contexts	Y. Mimar Büşra ARSLAN Lect. Dr. Elif ÇETİN	Karabük University

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

02.05.2026 / Hall-3, Session-2



Ankara Local Time  
10<sup>30</sup> : 12<sup>15</sup>



Meeting ID: 869 6848 3150  
Passcode: 827766

HEAD OF SESSION: *Dr. Saima Shaheen*

TOPIC TITLE	AUTHORS	AFFILIATION
Some Algebraic Identities Involving A Pair Of Generalized (A, A)-Derivations In Rings	Abdelkarim BOUA	Sidi Mohammed Ben Abdellah University/MOROCCO
The Key Issue Features On Translational And Mechanistic Appraisal Of Clinical Pharmacologists' Contributions To Personalized Medicine, Pharmacogenomic Integration, And Optimization Of Individualized Therapeutic Interventions	Nodar Sulashvili , Nato Alavidze , Nino Abuladze , Olga Shapoval , Marika Sulashvili , Tamar Okropiridze	Georgian National University/The University of Georgia/GEORGIA
Therapeutic Potential Of Ziziphus Mauritiana (Jujube) Tea In The Management Of Obesity	Tasawar Iqbal Sidra Altaf	University of Agriculture/PAKISTAN
Satellite-Augmented Social Safety Nets Using AI And Remote Sensing For Disaster-Triggered Cash Transfers	MUHAMMAD FAISAL	Allama Iqbal Open University
Thyroid Hormone Levels And Their Association With Plasma Zinc Levels Among Adolescent Afghan Refugees; A Cross-Sectional Study	Dr Saima Shaheen Dr Nabila Sher Dr. Kalsoom Tariq	Khyber Girls Medical College
Investigation Study on GNSS Antenna Types and Their Characteristics	J. Salai Thillai Thilagam M.V.R.Vittal D.V.Sri Hari Babu B.Siva Reddy P.C.Praveen Kumar	G. Pulla Reddy Engineering College/INDIA

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

02.05.2026 / Hall-4, Session-2



Ankara Local Time

10<sup>30</sup> : 12<sup>15</sup>



Meeting ID: 869 6848 3150

Passcode: 827766

**HEAD OF SESSION: Ar. Dr. Omer Shujat Bhatti**

TOPIC TITLE	AUTHORS	AFFILIATION
AI And Contemporary Business Practices In Architecture. A Case Of Architectural Design Industry In Pakistan	Ar. Dr. Omer Shujat Bhatti Ar. Hafiz Muhammad Ahmed Nadeem	School of Architecture & Planning/PAKISTAN
Poisonous Plants And Their Impact On Human And Animal Health: A Toxicological Review	Tasawar Iqbal Sidra Altaf	University of Agriculture
Provisions On Human Rights In The 2013 Constitution Of The Socialist Republic Of Vietnam	Le Nhat Tien	Thu Dau Mot University/VIETNAM
Protection Of Plants From White Aphids With The Application Of Endophytes	Raymond Oriebe Anyasi	University of South Africa
Integrated Nitrogen Management For Sustainable Crop Production	ELABBARI Chaimaa Pr. Labjar Najoua Pr.EL Hajjaji souad	Mohammed V University/MOROCCO
Social Participation Under Institutional Reform In Urban Vietnam: Organizational Dynamics And Citizen Engagement	Quang Ngoc Le Dieu Huyen Ho	Vietnam Academy of Social Sciences

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02.05.2026 / Hall-6, Session-2



Ankara Local Time  
10<sup>30</sup> : 12<sup>00</sup>



Meeting ID: 869 6848 3150  
Passcode: 827766

**HEAD OF SESSION: Major Gheorghe Giurgiu**

TOPIC TITLE	AUTHORS	AFFILIATION
Harnessing The Gut-Brain Axis: Probiotic Supplementation Attenuates Amphetamine-Induced Dependence	Dr.Huma Ikram, Maryam Ali Jan, Darakhshan J. Haleem	University of Karachi/PAKISTAN
Synthesis And Control Of Interactions In New Inorganic Carbon-Oxide Nanocomposites For Pollutant Treatment	TABTI Senouci BOUCHERDOUD Ahmed, DOUNAT Oukacha, BENDJELLOUL Meriem, SEGHER Abdelkarim, ELANDALOUSSI Elhadj.	University of Relizane
Ecopharmacovigilance In Focus: Advanced Multidimensional Systematically And Comprehensively Integrated Global Risk-Based Evaluation Of The Environmental And Public Health Impact Of Pharmaceutical Contaminants	Nodar Sulashvili , Nato Alavidze , Ia Egnatievi , Manana Giorgobiani , Elene Petriashvili , Mzia Tsiklauri , Marika Sulashvili , Igor Seniuk , Tamar Okropiridze , David Aphkhazava	East European University/Sulkhan-Saba Orbeliani University/National University of Pharmacy/GEORGIA/UKRAINE
Critical Dimensions In Transforming Medical Education Paradigms: An International Systematic Evaluation Of Innovative Pedagogical Approaches, Advanced Instructional Methodologies, And The Progressive Enhancement Of Clinical Competence Frameworks	Nodar Sulashvili , Nato Alavidze , Ia Egnatievi , Manana Giorgobiani , Elene Petriashvili , Mzia Tsiklauri , Marika Sulashvili , Igor Seniuk , Tamar Okropiridze , David Aphkhazava	East European University/Sulkhan-Saba Orbeliani University/National University of Pharmacy/GEORGIA/UKRAINE
Thyroid Function Across Menopausal Transition: A Cross- Sectional Study Of Peri-Menopausal And Post Menopausal Women	;Farida Ahmad, Afsheen Mahmood1, Azra Kanwal Amina Waqas Zara Khan	---
The Gut-Brain-Skin Axis In Acne: Impact Of Polenoderm	Major Gheorghe Giurgiu Prof. dr. Manole Cojocaru	Titu Maiorescu University/Deniplant-Aide Sante Medical Center/ROMANIA

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# PHOTO GALLERY

The image shows a Zoom meeting interface with two presentation slides. The top slide is titled "In this presentation, we discuss how nutraceuticals affect several factors in the pathophysiology of acne development and can improve the treatment outcomes." It includes logos for DENIPLANT, centrul medical aide sante, and FACULTATEA DE MEDICINA. The bottom slide is titled "eTwinning faaliyetinin illerdeki temsilcileri il koordinatörleridir. İllerde, çalışan gönüllü öğretmenlerin kaliteli projeler gerçekleştirmelerini teşvik etme ve yaygınlaştırma çalışmaları yürütmektedirler. 81 ilde görev yapan 82 (Ankara 2 koordinatör) il koordinatörü görev yapmaktadır." The Zoom interface shows participants like ISARC academy, Ngoc Le H4, and Ender YILDIRIM.

**In this presentation, we discuss how nutraceuticals affect several factors in the pathophysiology of acne development and can improve the treatment outcomes.**

**This study concentrates on the skin and gut microbes in acne, the role that the gut-brain-skin axis plays in the immunobiology of acne, and newly emerging microbiome-based therapies that can be applied to treat acne.**

**Acne therapies have focused on modulating this inflammatory response as well as targeting components of this cascade.**

PowerPoint Slayt Gösterisi - [eTwinning II Koordinatörleri Deneyimleri Üzerine Nitel Bir İnceleme] - Microsoft PowerPoint

eTwinning faaliyetinin illerdeki temsilcileri il koordinatörleridir. İllerde, çalışan gönüllü öğretmenlerin **kaliteli projeler gerçekleştirmelerini teşvik etme ve yaygınlaştırma çalışmaları** yürütmektedirler.

**81 ilde** görev yapan **82** (Ankara 2 koordinatör) il koordinatörü görev yapmaktadır.

zoom Workplace Toplantı Hall-1 Nermin TEKİN adlı kişinin e

ISARC academy... 1 Sevdâ Tamer Hall-1 Nermin TEKİN HALL-1, RUMEYSA GÖÇER HALL-1 Miraç Uzan Ender YILDIRIM

Türkiye'de Çevrimiçi Alışveriş Bağımlılığı Analizi Microsoft PowerPoint (Online) Dikimleniş Durumunda

Dosya Giriş Ekle Tasarım Geçişler Animasyonlar Slayt Gösterisi Gözden Geçir Görünüm

Yapıştır Kopyala - Biçim Boyacı Pano Yeni Slayt - Bölüm - Slaytlar

Metin Yönl - Metni Hizala - SmartArt'a Dönüştür - Yerleştir - Hızlı Stiller - Çizim

Şekli Dolgu - Şekli Anahat - Şekli Efektleri - Bul - Değiştir - Seç - Düzenleme

## ARAŞTIRMANIN AMACI VE ÖNEMİ

### Çalışmanın Amacı

Türkiye'de çevrimiçi alışveriş bağımlılığı temasında hazırlanan lisansüstü tezlerin metodolojik ve bibliyometrik özelliklerini inceleyerek literatürün gelişim seyrini ortaya koymak temel amaçtır. Bu kapsamda tezlerin; yayın yılı, üniversite, akademik düzey, yöntem ve konu başlıkları sistematik olarak analiz edilmiştir.

### Çalışmanın Önemi

Konunun son yıllarda kazandığı ivme, akademik çevreler tarafından bir problem olarak görülüp araştırma ihtiyacının ortaya çıktığını göstermektedir. Bu çalışma, literatürdeki boşlukları göstererek gelecek araştırmalar için stratejik bir yol haritası ve kapsamlı bir envanter sunmaktadır.

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

zoom Workplace Toplantı HALL-1, RUMEYSA GÖÇER adlı ki

ISARC academy... 1 Sevdâ Tamer HALL-1, RUMEYSA GÖÇER HALL-1 Miraç Uzan Hall-1 Nermin T...

## SPOR NEDİR ?

Spor, tek başına veya grup halinde yapılan, kendine ait özel kuralları bulunan ve genellikle bir yarışmaya dayalı olarak, bedensel ve zihinsel yeteneklerin gelişmesini sağlayan hem eğitici hem de eğlenceli bir etkinliktir.

Spor, aynı zamanda sosyalleştirici, toplumsal birleştirici bir rol üstlenir ve ruhsal ile fiziksel gelişimi destekleyen, rekabetçi, dayanışmayı teşvik eden ve kültürel değerleri pekiştiren bir olgudur.

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

zoom Workplace

HALL 1, RUMEYSA GÖÇER adlı ki...

ISARC academy...  
ISARC academy MELİKE KAYA  
1 Sevda Tamer  
HALL 1, RUMEYSA GÖÇER  
Hall-1 Nermin TEKİN  
HALL 1 Miraç Uzan  
Ümit

SPOR EĞİTİMİNDE YAPAY ZEKA - PowerPoint (Ünvan Etkinleştirilmedi)

Dosya Giriş Ekle Tasarım Geçişler Animasyonlar Slayt Görünümü Gözden Geçir Görünüm Ne yapınak istediğinizi söyleyin. Paylaş

Yapıştır Kopyala Yeni Slayt Bölüm Pencere Düzenle Sıfırla Biçim Boyacısı

K T A S Aa A- A- Paragraf

Metin Yönlendirme Metni Hizala SmartArt'a Dönüştür

Şekil Dolgusu Şekil Anahattı Şekil Etkiletileri Bul Değiştir Seç

19  
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21  
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23  
24  
25  
26  
27

Bu araştırma sonucunda sporcuların sadece fiziksel performanslarını artırmakla kalmayıp, aynı zamanda sakatlanma risklerini de minimize etmeye yönelik daha hedeflenmiş yaklaşımlar geliştirilebileceğini göstermektedir. Örneğin, YZ destekli sistemler sayesinde, sporcuların vücutlarının fizyolojik tepkilerini anlık olarak izleyerek antrenman yüklerini daha sağlıklı bir şekilde düzenlemek mümkün hale gelebilir.

Bu, hem sporcuların uzun vadeli kariyerlerini korumalarına yardımcı olur hem de kulüp yönetimlerinin daha verimli kararlar almasına olanak tanır. Yapay zeka, sporun geleceği açısından büyük fırsatlar sunduğu gibi, çeşitli etik, ekonomik ve toplumsal tartışmaları da beraberinde getirmektedir. Bu teknolojilerin potansiyeli, doğru kullanıldığında spor dünyasında devrim yaratabilir, ancak dikkatli ve sorumlu bir yaklaşım gerektirmektedir. YZ'nin sporda insan faktörüyle uyumlu şekilde kullanılması, sporcuların, teknik ekiplerin, yöneticilerin ve izleyicilerin faydasına olacak bir dengeyi sağlayacaktır.

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

zoom Workplace

HALL 1 Miraç Uzan adlı kişinin ek...

ISARC academy...  
ISARC academy MELİKE KAYA  
Hall-1 Nermin TEKİN  
HALL 1 Miraç Uzan  
1 Sevda Tamer  
Ender YILDIRIM  
HALL 1 RUMEYSA GÖÇER

eTwinning

eTwinning, farklı ülkelerden öğretmen ve öğrencileri dijital ortamda bir araya getiren uluslararası bir iş birliği platformudur. Uluslararası dijital iş birliği ortamı sunar. Gerçek iletişim bağlamında yabancı dil kullanımını destekler. Kültürlerarası etkileşim ve ortak öğrenmeyi geliştirir. Öğretmen adaylarının mesleki ve dil gelişimine katkı sağlar.

eTwinning

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

zoom Workplace

H2 Hall 2, Uğur EYİDİKER adlı kişinin

REC

Hall-2, Mevlüt ARSLAN H2-Büşra Arslan Hall 2, Uğur EYİDİKER Hall 2 Elif Çetin HALL-2 Mehmet Nurettin AŞKIN Eyup Sabri KALA

Otomatik kaydet ISARCS Ko... • bu bilgisayar konumuna kaydedildi

Dosya Giriş Ekle Çiz Tasarım Geçişler Animasyonlar Slayt Gösterisi Kaydet Gözden Geçir Görünüm Yardım Acrobat

Kaydet Teams'de Sun Paylaş

Yapıştır Yeni Slayt Fano F5 Slaytlar Yazı Tipi Paragraf Şekiller Yerleştir Hata Stilleri Düzenleme PDF oluşturma Dize Dize Dışarıya Ekentler Tasarımı

1 Giriş

2 Giriş

3 Giriş

4 Giriş

5 Giriş

## Giriş

Araştırmanın Konusu: Bu araştırmanın Konusu Ahmet Kabaklı'nın Milliyetçilik Düşüncesi Bağlamında Milliyetçilik Düşüncelerine Kaynaklık Eden Unsurların Ortaya Konmasıdır

Araştırmanın Amacı ve Önemi: Türk Muhafazakarlığı İçinde Türk İslam Sentezi Anadamarının Temsilcisi Olan Ahmet Kabaklı'nın Milliyetçi Görüşlerinin Temellerinin Anlaşılması ve Türk Muhafazakarlığı İçindeki Yerinin Anlaşılmasıdır

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

zoom Workplace

HALL-2 Mehmet Nurettin AŞKIN

REC


HALL-2 Mehmet Nurettin AŞKIN Eyup Sabri KALA H2-Büşra Arslan Hall 2 Elif Çetin Hall 2, Uğur EYİDİKER Hall-2, Mevlüt ARSLAN

## Yeraltı Sularında Mikroplastik Kirliliği ve Türkiye Perspektifi

Yeraltı suları, dünya genelinde iki milyardan fazla insan için kritik bir içme suyu kaynağı teşkil ederken, mikroplastiklerin bu sistemlerde tespit edilmesi çevresel sürdürülebilirlik ve halk sağlığı açısından yeni bir tehdit oluşturmaktadır.

Mikroplastiklerin tane boyutu ve yüzey özellikleri, akiferlerin geçirgenlik ve gözeneklilik özellikleriyle etkileşime girerek, bu parçacıkların klasik kirlenicilerden farklı olarak uzun süre kalıcı olmasına ve diğer zararlı maddeler için taşıyıcı yüzeyler oluşturmalarına neden olmaktadır.

HİDROJEOLOJİ · ÇEVRE MÜHENDİSLİĞİ · SU KALİTESİ



Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

VERMİKOMPOST-SUNUM

Giriş Ekle Çiz Tasarım Geçişler Animasyonlar Slayt Gösterisi Kayıt Gözden Geçir Görünüm

Brygada 1918 Semi Bold 38 A<sup>+</sup> A<sup>-</sup> A<sup>0</sup>

SmartArt'a Dönüştür Resim Şekiller Metin Kutusu Düzenle Hızlı Stiller Şekli Doğrusu Şekli Ana Hattı Eklenler

1 VERMİKOMPOST ÜRETİMİNDE VERMİREAKTÖR KULLANIMI

2 Vermikompost Üretiminde Vermireaktör Kullanımı

3 Neden Vermikompostlama?

4 Vermikompostlama nedir?

## Vermikompost Üretiminde Vermireaktör Kullanımı

Artan organik atık miktarı, sürdürülebilir atık yönetimi çözümlerine olan ihtiyacı artırmış ve vermikompostlaştırma çevre dostu bir yöntem olarak öne çıkmıştır. Çalışmalar, reaktör tasarımının süreç verimliliği üzerinde belirleyici olduğunu; özellikle sürekli beslemeli ve kapalı sistemlerin daha yüksek performans sağladığını göstermektedir. Sonuç olarak, uygun reaktör seçimi atık türü ve işletme hedeflerine göre optimize edilmelidir.

ORGANİK ATIK YÖNETİMİ BİYOLOJİK ARITMA SÜRDÜRÜLEBİLİRLİK

SOLUCAN KOMPOSTU

Kapak

Vermikompost

Atıklar ve Solucanlı Aktif Alan

Drenaj Deikileri

Slayt 2/19 Türkiye (Türkiye) Erişilebilirlik: Her şey hazır

Notlar Açıklamalar 19/9

## GİRİŞ

- Geleneksel konutlar, buldukları coğrafyanın iklimi, topoğrafyası ve kültürel yapısı ile şekillenmiştir.
- Kırsal mimari, yerel malzeme ve geleneksel yapım tekniklerine dayanan özgün bir yapı üretim biçimidir.
- Özellikle Karadeniz Bölgesi'nde taş ve ahşabın birlikte kullanıldığı yapılar öne çıkmaktadır.
- Günümüzde kırsal alanlardan göç ve bakım eksikliği, bu yapıların hızla bozulmasına neden olmaktadır.
- Bu çalışmada Dökecek köyündeki geleneksel konutların mimari özelliklerinin incelenmesi ve mevcut durumlarının değerlendirilmesi amaçlanmıştır.



zoom Workplace H2-Bügra Arslan adlı kişinin ekran REC paused

ISARC academy... H2-Bügra Arslan HALL-2 Doç. Dr. Mutlu YALVAG Hall 2 Elif Çetin Eyüp Sabri KALA Hall 2, Uğur EYİKER

## BUZHANELER

M.Ö. 4000 / Mezopotamya

### 1. Uluslararası Cahit Arf Billmsel Araştırmalar ve İnovasyon Kongresi

- Buzun muhafazası için inşa edilen ilk yapıların M.Ö. 4000 yılına rastladığı düşünülmektedir.
- M.Ö. 1780 yılına ait çivi yazılı bir tablette Kuzey Mezopotamya'da bulunan Terqa kasabasına ait bir yerde buzhanelerin olduğundan bahsedilmiştir.
- Ayrıca ilk buzhane Mari Kralı Zimri-Lim tarafından inşa ettirilmiştir.
- Buzluk ya da buzhane denilen bu yapıların tamamının ya da bir kısmının yerin altında olduğu, özellikle su kaynaklarının çevresinde bulunduğu belirtilmekte ve buzhanelerin yalıtımı için buzun erimesini önlemek amacıyla saman ve talaş kullanıldığı anlatılmaktadır (Öztürk ve Yaman, 2019).

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

zoom Workplace Hall-2: Mevlüt ARSLAN adlı kişni REC

ISARC academy... Hall-2: Mevlüt ARSLAN H2-Bügra Arslan Hall 2 Elif Çetin HALL-2 Doç. Dr. Mutlu YALVAG HALL-2 Mehmet Nurettin AŞ

## 2004 Annan Planı: Nihai Paradoks

Türk Tarafı (KKTC)	Rum Tarafı (GKRY)
%64.9 EVET	%75.8 HAYIR

24 Nisan 2004

### Paradoks

**Planda Ne Vardı?** Eşit statüde iki kurucu devletli Birleşik Kıbrıs Cumhuriyeti.

**Sonuç:** Evet diyerek çözümü destekleyen Türk tarafı uluslararası izolasyona mahkum edildi. Hayır diyerek çözümü reddeden Rum tarafı (GKRY), adanın tek yasal temsilcisi sıfatıyla ödüllendirildi.

1 atanmamış katılımcı

Dosya Giriş Ekle Tasarım Geçerli Animasyonlar Slayt Gösterisi Gözden Geçir Görünüm Ne yapmak istediğinizi söyleyin... Oturum Aç Paylaş

Yapıştır Kopyala Yeni Slayt Biçim Biçimci Yazı Tipi Paragraf SmartArt'a Donatılar Çizim Yerleştir Hızlı Stiller Şekli Efektleri Düzenleme Şekli Döngüsü Şekli Analizleri Şekli Seç - Değiştir - Seç -

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Oturum sahibi araçları Ara odalar Daha fazla Odadan çık

zoom Workplace Meeting Hall-2, Mevlüt ARSLAN's screen

ISARC Academy

Hall 2, Elif Çetin

HALL-2 Doç. Dr. Mutlu YALVAÇ

HALL-2 Mehmet Nurettin AŞKIN

Hall-2, MEVLÜT ARSLAN

Eyup Sabri KALA

H2-Büşra Arslan

Hall 2, Uğur EYLİ...

H2-Büşra Arslan

Hall 2, Uğur EYDİKER

20°C Bulutlu

10:12 AM 5/2/2026

2004 Annan Planı: Nihai Paradoks

Türk Tarafı (KKTC) Rum Tarafı (GKRY)

%64.9 EVET %75.8 HAYIR

24 Nisan 2004

Paradoks

Planla Ne Vardı? Eski statüde ki kurucu devleti Birleşik Krallık Cumhuriyeti.

Sonuç: Evet diyerek çözümü destekleyen Türk tarafı uluslararası izolasyona mahkum edildi. Hayır diyerek çözümü reddeden Rum tarafı (GKRY) adanmış laik yasal temsilcisi sıfatıyla kabul edildi.

Not eklemek için tıklayın

Audio Video Participants Chat React Breakout rooms Share Host tools More Leave room

zoom Workplace Meeting 1 Sevdâ Tamer's screen

PowerPoint Slayt Gözetimi - [eTwinning] Koordinatörlü Deneyimleri Üzerine Nitel Bir İnceleme - Microsoft PowerPoint

Türkiye'de öğretmenlerin eTwinning'e katılım ve performansını nasıl değerlendiriyorsunuz?

Yüksek katılım

Harika

Başarılı

Gurur verici

Yüksek performans

Nicelik iyi

Nitelik yetersiz

Gayet iyi

Türkiye'de öğretmenlerin eTwinning'e katılım ve performansını

Katılımcılar eTwinning'e katılımda eTwinning üye ülkeleri arasında Türkiye'nin birinci olduğunu belirtmişler ve bu durumu harika, başarılı ve gurur verici olarak ifade etmişlerdir. Öğretmenlerin özverili çalışmalarını sayesinde çok başarılı projelerin yapıldığı belirtilmiş ve bu durum yüksek performans olarak değerlendirilmiştir. Ancak katılımcılardan projeleri nicelik olarak yeterli bulmasına rağmen nitelik olarak yetersiz görenler de olmuştur.

Ö10 "Çok özverili, çalışkan öğretmenlerimiz var. Onların bu gayretleri sayesinde eTwinning ülkemizde ve Avrupa'da çok iyi bir yerde. Ancak Nitelikli projeler yapan öğretmen sayısı çok az."

Ö3 "Türkiye genelinde eTwinning'e katılım nicelik olarak çok yüksek; hatta Avrupa'da en aktif ve en çok kalite etiketi alan ülkemizdir. Öğretmenlerimizin performansı, merakı ve yeniliklere adaptasyonu gerçekten gurur verici seviyede. Ancak potansiyelimizin tamamını sahaya yansıtamıyoruz bence. İdari destek eksikliği ve sürecin "ekstra iş yükü" olarak görülmesi gibi önyargılar, birçok yetenekli meslektaşımızın sistemin dışında kalmasına neden oluyor. Bu engelleri aşp süreci dâhil olan öğretmenlerimiz ise, hem ulusal hem de Avrupa çapında harikalar yaratarak eğitimde fark oluşturuyorlar."

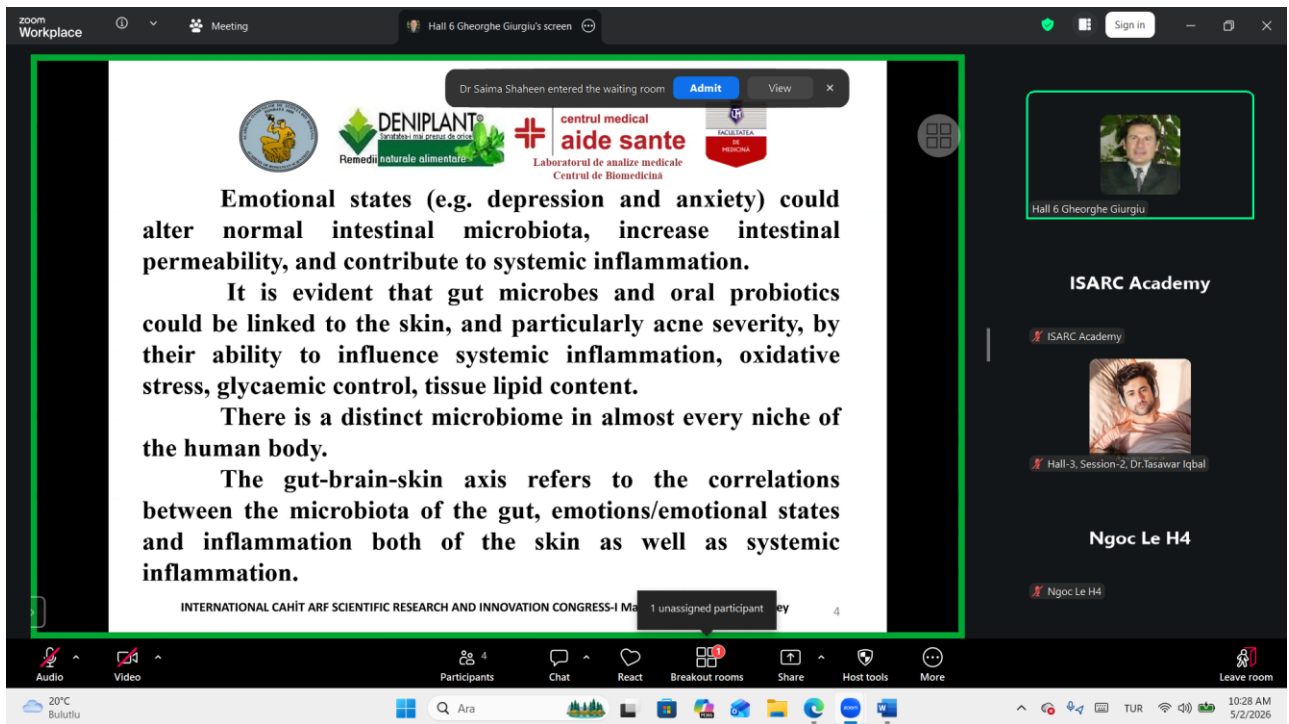
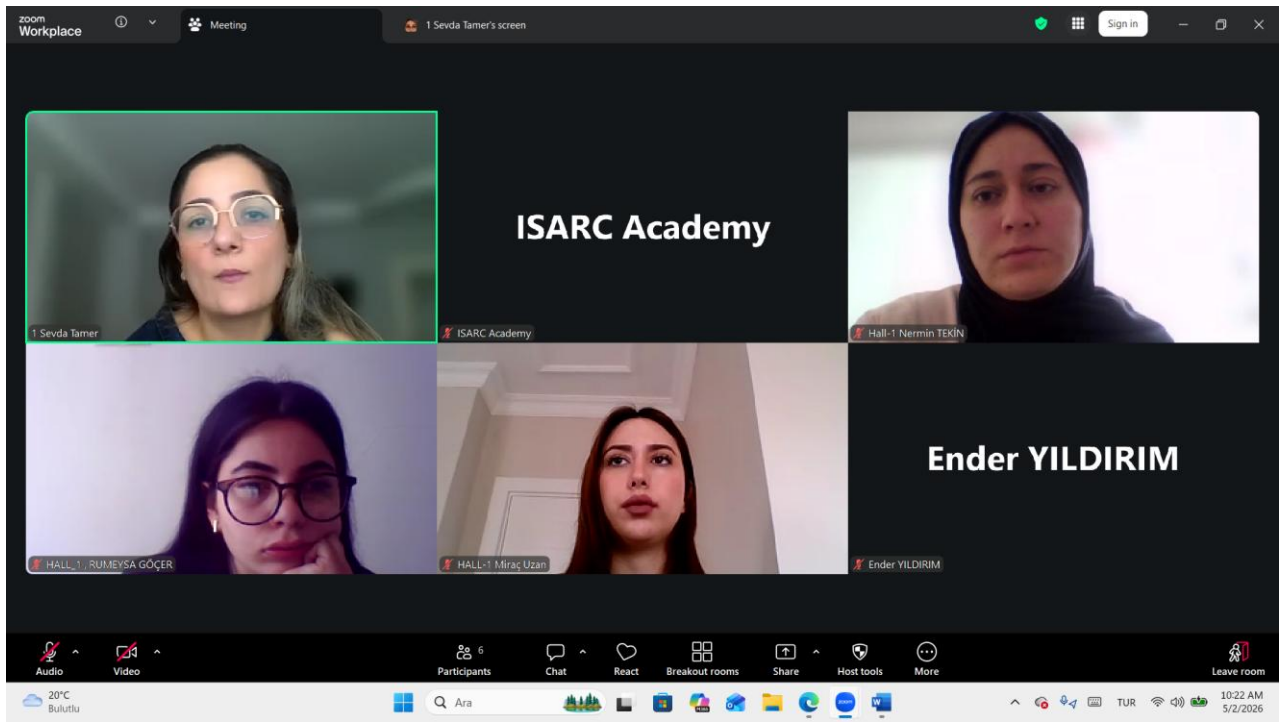
1 Sevdâ Tamer

SLAYT 22 / 29

Audio Video Participants Chat React Breakout rooms Share Host tools More Leave room

20°C Bulutlu

10:21 AM 5/2/2026



zoom Workplace Meeting Hall-3, Session-2, Dr.Tasawar Iqbal

Apple Tree Obesity Presentation - PowerPoint (Product Activation Fail...)

File Home Insert Design Transitions Animations Slide Show Review View

Clipboard New Slide Section Slides Font Paragraph Drawing Editing

1 2 3 4 5

Slide 2 of 12 English (United States)

1 mm yağmur Pazar

Participants Chat React Breakout rooms Share Host tools More

10:15 AM 5/2/2026

zoom Workplace Meeting Hall-6, Dr. Huma Ikram's screen

Harnessing The Gut-Brain Axis: Probiotic Supplementation Attenuates Amphetamine-induced Dependence

**Dr. Huma Ikram**  
Associate Professor  
Incharge, Neurochemistry and Biochemical Neuropharmacology Research Unit  
Department of Biochemistry, University of Karachi

ISARC Academy

Dr Saima Shaheen Ngoc Le H4

Dr Saima Shaheen Ngoc Le H4

Hall-6, Dr. Huma Ikram

20°C Bulufitu

Participants Chat React Breakout rooms Share Host tools More

10:36 AM 5/2/2026

zoom Workplace Meeting Hall-6, Dr. Huma Ikram's screen Dr Saima Shaheen's screen Sign in

**MHI - NAVATABAD MEDICAL COMPLEX PESHAWAR**  
**MEDICAL DIRECTOR**  
 1. **Meeting: Interdepartmental Meetings**

It was unanimously decided that structured interdepartmental meetings will be held on a monthly basis on GPO days preferably from 2:00 PM to 4:00 PM.

- The agenda for each meeting will be formulated and finalized by the Chairperson of the Department of Epidemiology.
- The meeting will focus on review of clinical services, academic activities, operational challenges, and quality improvement measures. All points must be discussed in before coming to the desk of Medical Director.

2. **Finalization of Duty Rosters**  
 It was resolved that:

- The duty roster of doctors and supporting staff for GPO and emergency shall be prepared and finalized by the chairperson of the Department.
- The Operation Theatre (OT) roster and allocation of OT tasks shall also be finalized under the authority of the Chairperson of the Department to ensure a fair distribution and efficient departmental functioning.

The meeting concluded with a collective commitment to strengthen departmental governance, enhance coordination, and uphold high standards of patient care, academic excellence, and administrative discipline.

**Dr. Saima Shaheen**  
 MEDICAL DIRECTOR

Doc. & date availed copy forwarded to:

- Chairman, MHI-MHC
- Hospital Director, MHI-MHC
- Chairperson Department of Epidemiology, MHI-MHC
- In-charge Epidemiology A, MHI-MHC
- In-charge Epidemiology B, MHI-MHC
- In-charge Epidemiology C, MHI-MHC

**Dr. Saima Shaheen**  
 MEDICAL DIRECTOR

**ISARC Academy**

Hall 6 Gheorghe Giurgiu ISARC Academy

**Dr Saima Shaheen Ngoc Le H4**

Dr Saima Shaheen Ngoc Le H4

Hall-6, Dr. Huma Ikram

Audio Video Participants 5 Chat React Breakout rooms Share Host tools More Leave room

20°C Bulutlu Ara 10:39 AM 5/2/2026

zoom Workplace Meeting Ngoc Le H4's screen Sign in

## Research Context and Significance



Vietnam is experiencing rapid urbanization alongside profound social transformation and institutional reform. This study examines how these parallel processes are reshaping social participation among urban residents, particularly their engagement with socio-political organizations and voluntary civil society organizations.

Based on survey data from 400 urban residents with diverse socio-demographic characteristics, this research analyzes participation levels, motivations, and interaction forms. The findings reveal a paradox between high nominal participation rates and limited actual engagement, reflecting broader trends of individualization and flexible participation patterns.

### Key Research Questions

- What is the level of participation in different organizational types?
- How are motivations and participation forms changing?
- What role do these organizations play in urban social life?

**ISARC Academy**

Hall 6 Gheorghe Giurgiu ISARC Academy

**Dr Saima Shaheen Ngoc Le H4**

Dr Saima Shaheen Ngoc Le H4

**RO Anyasi Sessi...**

Hall-6, Dr. Huma Ikram RO Anyasi\_Session 2\_Hall 4\_HONOR...

Audio Video Participants 6 Chat React Breakout rooms Share Host tools More Leave room

21°C Çok bulutlu Ara 10:45 AM 5/2/2026

# INTERNATIONAL SCIENCE AND ART RESEARCH CENTER

**KONU:** Kongre Katılımcı Bilgisi

**14.05.2026**

## İLGİLİ MAKAMA

1.ULUSLARARASI CAHİT ARF BİLİMSEL ARAŞTIRMALAR VE İNOVASYON KONGRESİ 02-03 MAYIS 2026 tarihleri arasında ANKARA 'da online olarak 9 farklı ülkeden (Türkiye:11 ve diğer Ülkeler:20 Toplam:31 akademisyen/araştırmacıların katılımı ile gerçekleşmiştir. Kongre, 16 Ocak 2020 Akademik Teşvik Ödeneği Yönetmeliğine getirilen “ Tebliğlerin sunulduğu yurt içinde veya yurtdışındaki etkinliğin uluslararası olarak nitelendirilebilmesi için Türkiye dışından en az 5 ülkeden farklı tebliğ sunan konuşmacının katılım sağlaması ve tebliğlerin yarıdan fazlasının Türkiye dışından katılımcılar tarafından sunulması esastır. ” değişikliğine ve Doçentlik kriterlerine uygun düzenlenmiştir.

Bilgilerinize arz edilir.  
Saygılarımla

  
Sefa Salih BİLDİRİCİ  
HEAD OF İSARC

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**ETWINNING PROJELERİNDE YABANCI DİLDE İLETİŞİM KURMA  
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Bu çalışma, eTwinning projelerine katılan öğretmen adaylarının yabancı dilde iletişim kurma deneyimlerine ilişkin görüşlerini incelemeyi amaçlamaktadır. eTwinning projeleri, öğretmen adaylarına farklı ülkelerden akranlarıyla iş birliği yapma, ortak ürünler geliştirme ve yabancı dili gerçek iletişim bağlamlarında kullanma fırsatı sunmaktadır. Araştırma nitel araştırma yaklaşımı çerçevesinde desenlenmiştir. Çalışma grubunu Türkiye, Yunanistan, Ürdün ve Moldova'dan eTwinning projelerinde aktif olarak yer alan 10 öğretmen adayı oluşturmaktadır. Veriler, Google Form aracılığıyla toplanan demografik sorular ve açık uçlu sorular yoluyla elde edilmiştir. Demografik veriler frekans ve yüzde ile açık uçlu yanıtlar ise betimsel analiz ile çözümlenmiştir. Form verileri, projelerde en sık kullanılan yabancı dilin İngilizce olduğunu; iletişim sürecinde en fazla WhatsApp, Microsoft Teams ve Google Meet araçlarının tercih edildiğini göstermektedir. Bulgular, öğretmen adaylarının yabancı dilde iletişim deneyimlerinin iletişim ortamına, etkileşim türüne ve bireysel dil yeterliği algılarına göre farklılaştığını göstermektedir. Katılımcıların önemli bir bölümü, yazılı iletişim ortamlarında kendilerini daha rahat ifade ettiklerini ve mesajlaşma temelli iletişimi daha güvenli bulduklarını belirtmiştir. Buna karşılık, çevrim içi toplantılarda anlık konuşma gerektiren durumların bazı katılımcılar için daha zorlayıcı olduğu; akıcı konuşamama, telaffuz kaygısı, hata yapma endişesi ve hızlı düşünememe gibi güçlüklerin öne çıktığı görülmüştür. Ortak iletişim araçlarının kullanımı, açık ve basit dil, görsel destekler ve çeviri araçları iletişimi kolaylaştıran unsurlar olarak öne çıkarken; teknik sorunlar, farklı dil düzeyleri, zamanlama güçlükleri ve sınav dönemleri iletişimi zorlaştıran etmenler arasında yer almıştır. Katılımcılar ayrıca bu deneyimin özgüvenlerini artırdığını, kültürlerarası farkındalıklarını geliştirdiğini ve uluslararası iş birliğine daha olumlu yaklaşımlarını sağladığını vurgulamıştır.

**Anahtar kelimeler:** eTwinning, öğretmen adayları, yabancı dil iletişimi, uluslararası işbirliği

## **PRE-SERVICE TEACHERS' VIEWS ON THEIR EXPERIENCES OF COMMUNICATING IN A FOREIGN LANGUAGE IN ETWINNING PROJECTS**

### **ABSTRACT**

This study aims to examine pre-service teachers' views on their experiences of communicating in a foreign language during eTwinning projects. eTwinning projects provide pre-service teachers with opportunities to collaborate with peers from different countries, develop joint products, and use a foreign language in authentic communication contexts. The study was designed within the qualitative research framework. The study group consisted of 10 pre-service teachers from Türkiye, Greece, Jordan, and the Republic of Moldova who had actively participated in eTwinning projects. All participants were female. Data were collected through demographic questions and open-ended questions administered via Google Forms. Demographic data were analysed using frequency and percentage, while open-ended responses were analyzed through descriptive analysis. The form data showed that English was the most frequently used foreign language and that WhatsApp, Microsoft Teams, and Google Meet were the most commonly preferred communication tools during the project process.

The findings indicated that pre-service teachers' experiences of communicating in a foreign language varied depending on the communication environment, the type of interaction, and their perceptions of their own language proficiency. A considerable number of participants stated that they felt more comfortable expressing themselves in written communication environments and found message-based communication safer and more manageable. In contrast, situations requiring spontaneous speaking during online meetings were more challenging for some participants, with difficulties such as limited fluency, pronunciation anxiety, fear of making mistakes, and difficulty thinking quickly coming to the fore. The use of common communication tools, clear and simple language, visual support, and translation tools emerged as factors facilitating communication, whereas technical problems, differences in language proficiency, time-related difficulties, and examination periods were among the factors making communication more difficult. Participants also emphasized that this experience increased their self-confidence, enhanced their intercultural awareness, and contributed to a more positive orientation toward international collaboration.

**Keywords:** eTwinning, pre-service teachers, foreign language communication, international collaboration

**TÜRKİYE’DE ETWINNING İL KOORDİNATÖRLERİNİN DENEYİMLERİ  
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Bu çalışma, Türkiye’de görev yapan eTwinning il koordinatörlerinin koordinasyon sürecine ilişkin deneyimlerini, bu görevin bireysel ve mesleki yansımalarını, karşılaştıkları güçlükleri, motivasyon kaynaklarını ve üniversite iş birliğine yönelik görüşlerini incelemeyi amaçlamaktadır. Araştırma nitel araştırma yaklaşımı çerçevesinde desenlenmiştir. Çalışma grubunu, Türkiye’nin farklı illerinde görev yapan 36 eTwinning il koordinatörü oluşturmaktadır. Katılımcılar farklı branş, mesleki kıdem ve koordinatörlük deneyimlerine sahiptir. Veriler, Google Form aracılığıyla toplanan demografik sorular ve açık uçlu sorular yoluyla elde edilmiştir. Betimsel veriler frekans ve yüzde ile özetlenmiş, açık uçlu yanıtlar ise tematik olarak yorumlanmıştır. Bulgular, il koordinatörlerinin eTwinning’i büyük ölçüde mesleki yenilenme, iş birliği, dijital dönüşüm, uluslararasılaşma ve öğretmenlere rehberlik etme bağlamında anlamlandırdıklarını göstermektedir. Katılımcılar, bu deneyimin dijital yeterlik, iletişim, liderlik, problem çözme, organizasyon becerileri ve özgüven üzerinde geliştirici etkiler oluşturduğunu vurgulamıştır. Mesleki roller açısından koordinatörlüğün mentörlük, proje danışmanlığı, okul ziyaretleri, yaygınlaştırma faaliyetleri ve öğretmenlerin mesleki gelişimini destekleme boyutlarında güçlendiği görülmüştür. Buna karşılık öğretmen ve idareci isteksizliği, kurumsal destek eksikliği, bürokratik engeller, teknik altyapı sorunları, zaman yönetimi güçlükleri ve gönüllülük esaslı çalışmaların yeterince görünür olmaması öne çıkan sorunlar arasında yer almıştır. Katılımcılar, bu görevi sürdürmelerini sağlayan temel etkenlerin öğretmen ve öğrenci gelişimine katkı sağlama, başarı hikâyelerine tanıklık etme, mesleki doyum yaşama ve güçlü bir iş birliği ağı içinde yer alma olduğunu belirtmiştir. Bulgular ayrıca bazı illerde eğitim fakülteleriyle eTwinning ITE kapsamında iş birliklerinin başlatıldığını ya da sürdürüldüğünü, ancak bu yapının iller arasında eşit düzeyde kurumsallaşmadığını

göstermektedir. Katılımcılar, üniversite iş birliğinin ders entegrasyonu, uygulamalı atölyeler, mentörlük ve akademisyen katılımı yoluyla güçlendirilmesi gerektiğini vurgulamıştır. Sonuç olarak çalışma, eTwinning il koordinatörlüğünün yalnızca teknik bir görev değil, yerel düzeyde dijital pedagojik dönüşümü ve mesleki öğrenme topluluklarını destekleyen çok boyutlu bir liderlik alanı olduğunu ortaya koymaktadır

**Anahtar kelimeler:** eTwinning, il koordinatörü, öğretmen mesleki gelişimi, üniversite iş birliği, nitel araştırma

### **A QUALITATIVE INQUIRY INTO THE EXPERIENCES OF PROVINCIAL ETWINNING COORDINATORS IN TÜRKİYE**

#### **ABSTRACT**

This study aims to examine the experiences of provincial eTwinning coordinators in Türkiye, focusing on their coordination practices, the individual and professional reflections of this role, the challenges they encounter, their sources of motivation, and their views on university collaboration. The study was designed within the qualitative research framework. The study group consisted of 36 provincial eTwinning coordinators working in different cities across Türkiye. The participants represented diverse teaching branches, levels of seniority, and lengths of coordination experience. Data were collected through demographic and open-ended questions administered via Google Forms. Descriptive data were summarized through frequencies and percentages, while open-ended responses were interpreted thematically. The findings showed that coordinators largely framed eTwinning as a context of professional renewal, collaboration, digital transformation, internationalization, and teacher guidance. Participants emphasized that this experience contributed positively to their digital competence, communication, leadership, problem-solving, organizational skills, and self-confidence. In terms of professional roles, the coordination process appeared to strengthen mentoring, project consultancy, school visits, dissemination practices, and support for teachers' professional development. However, teacher and administrator reluctance, lack of institutional support, bureaucratic barriers, technical infrastructure problems, time management difficulties, and the limited visibility of voluntary work emerged as major challenges. Participants reported that the key factors motivating them to continue in this role were contributing to teacher and student development, witnessing success stories, experiencing professional satisfaction, and being part of a strong collaborative network. The findings also indicated that in some provinces, collaboration with faculties of education had already been initiated or sustained within the scope of eTwinning ITE, although this structure had not been institutionalized equally across provinces. Participants underlined that university collaboration should be strengthened through

curriculum integration, practice-based workshops, mentoring, and greater academic involvement. Overall, the study suggests that provincial eTwinning coordination is not merely a technical responsibility, but a multidimensional leadership role that supports digital pedagogical transformation and professional learning communities at the local level.

**Keywords:** eTwinning, provincial coordinator, teacher professional development, university collaboration, qualitative research

**TÜRKİYE’DE ÇEVİRİMİÇİ ALIŞVERİŞ BAĞIMLILIĞI ÇALIŞMALARI:  
LİSANSÜSTÜ TEZLERİN BİBLİYOMETRİK ANALİZİ****Nermin TEKİN**

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Dijital dünyanın yeni bir seviyeye ulaşması ile birlikte tüketim alışkanlıkları büyük oranda değişim göstermiştir. Bu durum ile birlikte bazı alışkanlıklar patolojik boyutlara ulaşmış bulunmaktadır. Bu boyutlardan çevrimiçi alışveriş bağımlılığı toplumun sağlığını etkileyen psikolojik bir problem olarak ortaya çıkmıştır. Bu çalışma, Türkiye’de çevrimiçi alışveriş bağımlılığı temasında hazırlanan lisansüstü tezlerin metodolojik ve bibliyometrik özelliklerini inceleyerek literatürün gelişim seyrini ortaya koymayı amaçlamaktadır. Çalışmada nitel araştırma desenlerinden doküman analizi yöntemi kullanılmıştır. Belirlenen anahtar kelimeler ile arama yapılarak taranan 13 adet lisansüstü tez; yayın yılı, yazıldığı üniversite, akademik düzey, yazarı, yazarın alanı, çalışmanın yöntemi, çalışmanın konusu, veri toplama aracı, veri toplama yöntemi, örnekleme gibi çeşitli alt başlıklar ile sistematik olarak analiz edilmiştir. Elde edilen analizler frekans ve yüzdelik ile sayısal verilere dökülmüştür. Analiz edilen veriler sonucunda en çok tezin yüksek lisans düzeyinde (%92.3) yazıldığı, en fazla tez yazılan yılın 2023 ve sonrasında (%84.6) yazıldığı, Tez yazılan üniversitelerin büyük bir çoğunluğunun vakıf üniversitesi olduğu(% 61.5).Coğrafi açıdan İstanbul’da bir yoğunlaşma görülmekle birlikte birçok ilde çalışmaların olduğu ve çevrimiçi alışveriş bağımlılığının; narsisizm, duygu, stres, sosyal medya kullanımı gibi değişkenler ile birlikte korelasyona odaklanıldığı tespit edilmiştir. Bulgular çevrimiçi alışveriş bağımlılığı literatürünün çok yeni ve hızlı büyüyen bir durumda olduğunu göstermektedir. Konunun yakın zamanlarda kazandığı ivme, bu bağımlılık türünün akademik çevreler tarafından bir problem olarak görülüp araştırma ihtiyacının ortaya çıktığını göstermektedir. Bu çalışma literatürdeki boşlukları göstererek gelecek araştırmalar için stratejik bir yol haritası sunmaktadır.

**Anahtar Kelimeler:** Çevrimiçi Alışveriş Bağımlılığı, Lisansüstü Tezler, Bibliyometrik Analiz, Türkiye Literatürü.

**ONLINE SHOPPING ADDICTION RESEARCH IN TÜRKİYE: A BIBLIOMETRIC  
ANALYSIS OF GRADUATE THESES****ABSTRACT**

With the digital world advancing to a new level, consumption habits have undergone significant transformations. Consequently, certain behaviors have reached pathological dimensions, with

online shopping addiction emerging as a psychological problem impacting public health. This study aims to reveal the developmental trajectory of the literature by examining the methodological and bibliometric characteristics of graduate theses prepared on the theme of online shopping addiction in Türkiye. In this study, the document analysis method, one of the qualitative research designs, was employed. Thirteen graduate theses, identified through searches using specific keywords, were systematically analyzed under various subheadings such as publication year, university, academic level, author, author's field of study, research method, subject, data collection tools, data collection methods, and sample group. The data obtained were quantified using frequency and percentage analyses. The results indicate that the majority of the theses were conducted at the Master's level (**92.3%**), and the highest volume of production occurred in 2023 and beyond (**84.6%**). It was also found that a significant majority of the theses (**61.5%**) were written at foundation (private) universities. While there is a geographical concentration in Istanbul, studies are distributed across many provinces. Furthermore, it was determined that online shopping addiction research predominantly focuses on correlations with variables such as narcissism, emotion, stress, and social media usage. The findings demonstrate that the literature on online shopping addiction is very recent and rapidly growing. The momentum gained by this subject in recent years suggests that this type of addiction is increasingly recognized as a significant problem by academic circles, creating a profound need for research. This study provides a strategic roadmap for future research by highlighting existing gaps in the literature.

**Keywords:** Online Shopping Addiction, Graduate Theses, Bibliometric Analysis, Digital Consumption, Türkiye Literature.

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**ÖZET**

Teknolojik gelişmelerin hız kazanmasıyla birlikte yapay zekâ (YZ), spor eğitimi alanında önemli bir dönüşüm aracı haline gelmiştir. Bu çalışmanın amacı, yapay zekânın spor eğitimindeki kullanım alanlarını, sağladığı katkıları ve ortaya çıkarabileceği sınırlılıkları incelemektir. Araştırma, literatür taramasına dayalı betimsel bir çalışma olarak gerçekleştirilmiştir. Elde edilen bulgular, yapay zekâ uygulamalarının sporcuların performans analizi, antrenman planlaması, sakatlık risklerinin belirlenmesi ve strateji geliştirme süreçlerinde etkin bir şekilde kullanıldığını göstermektedir. Makine öğrenmesi, yapay sinir ağları ve görüntü işleme teknikleri sayesinde sporcuların hareketleri analiz edilmekte, bireyselleştirilmiş antrenman programları oluşturulmakta ve performans gelişimi desteklenmektedir. Ayrıca giyilebilir teknolojiler ve sanal gerçeklik uygulamaları, spor eğitiminde yenilikçi ve etkileşimli öğrenme ortamları sunarak eğitim kalitesini artırmaktadır. Bununla birlikte, yapay zekâ kullanımının veri gizliliği, etik sorunlar, teknolojik bağımlılık ve insan etkileşiminin azalması gibi bazı riskleri de beraberinde getirdiği belirlenmiştir. Ayrıca yapay zekâ sistemlerinin veri kalitesine bağımlı olması ve bağlamsal sınırlılıkları önemli dezavantajlar arasında yer almaktadır. Sonuç olarak, yapay zekâ spor eğitiminde önemli fırsatlar sunmakla birlikte, bu teknolojinin bilinçli, etik ve dengeli bir şekilde kullanılması gerekmektedir. İnsan faktörü ile yapay zekâ arasındaki dengenin korunması, sporun temel değerlerinin sürdürülebilirliği açısından büyük önem taşımaktadır.

**Anahtar kelimeler:** Yapay zekâ, Spor eğitimi, Performans analizi, Giyilebilir teknoloji, Sanal gerçeklik

**ARTIFICIAL INTELLIGENCE IN SPORTS EDUCATION****ABSTRACT**

With the rapid advancement of technology, artificial intelligence (AI) has become an important transformative tool in the field of sports education. The aim of this study is to examine the areas of use of artificial intelligence in sports education, its contributions, and the potential limitations

it may bring. The study was conducted as a descriptive research based on a literature review. The findings indicate that artificial intelligence applications are effectively used in performance analysis, training planning, injury risk assessment, and strategy development processes of athletes. Through techniques such as machine learning, artificial neural networks, and image processing, athletes' movements can be analyzed, personalized training programs can be developed, and performance improvements can be supported. In addition, wearable technologies and virtual reality applications enhance the quality of sports education by providing innovative and interactive learning environments. However, it has been determined that the use of artificial intelligence also brings certain risks such as data privacy issues, ethical concerns, technological dependency, and the reduction of human interaction. Furthermore, the dependence of AI systems on data quality and their contextual limitations are considered important disadvantages. In conclusion, while artificial intelligence offers significant opportunities in sports education, it is essential to use these technologies in a conscious, ethical, and balanced manner. Maintaining the balance between the human factor and artificial intelligence is crucial for the sustainability of the fundamental values of sport.

**Keywords:** Artificial intelligence, Sports education, Performance analysis, Wearable technology, Virtual reality

**AHMET KABAKLI'NIN MİLLİYETÇİ GÖRÜŞLERİ ÜZERİNE BİR  
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Ahmet Kabaklı edebiyat, hukuk, gazetecilik ve akademik alanda yaptığı çalışmalarıyla çok yönlü bir düşünce yapısı ortaya koymuştur. Kabaklı'nın edebiyat alanındaki çalışmaları Türk Edebiyat tarihinin oluşturulmasına büyük katkı sağlamıştır. Edebiyat alanındaki çalışmalarına Türk siyasi tarihi ve düşüncesine ilişkin düşüncelerini de ekleyen Kabaklı, Türk muhafazakarlığı içinde milliyetçi kanadın temsilcilerinden biri olmuştur. Türk kimliği ve Türk kültürü üzerine çeşitli eserleri olan Kabaklı'nın düşünceleri Türk İslam sentezi görüşünün gelişmesini sağlamıştır. Kabaklı "*Türk olmayı seviniz*" sözüyle Türk kültürünü ve milletini Batı'nın kültür şokları karşısında korumayı amaçlamıştır. Bu bağlamda Batı'nın emperyalist düşüncelerine karşı milliyetçiliği bir savunma mekanizması olarak önermiştir. Ahmet Kabaklı düşüncelerini kaleme aldığı gazetede sık sık Batı'nın düşüncelerini ve yaşam tarzını olduğu gibi kabul etmeyi benimseyen dönemin aydınlarına siyasi tenkitlere girişmiş, yaşadığı siyasi polemiklerle ön plana çıkmıştır.

Bu çalışmada Türk muhafazakarlığının içinde kendine has üslubuyla yer edinmiş Ahmet Kabaklı'nın Türkçülük ve milliyetçilik hakkındaki düşüncelerine ilişkin genel bir değerlendirme yapılmıştır.

**Anahtar kelimeler:** Ahmet Kabaklı, milliyetçilik, Türkçülük, sentez**AN ANALYSIS OF THE NATIONALIST VIEWS OF AHMET KABAKLI****ABSTRACT**

Ahmet Kabaklı offered a multifaceted intellectual structure through his work in the fields of literature, law, journalism, and academia. The work of Kabaklı in the field of literature made significant contributions to the establishment of the field of History of Turkish Literature. Integrating his views on Turkish political history and philosophy into his work in the field of literature, Kabaklı became one of the representatives of the nationalist wing within Turkish conservatism. Kabaklı, who has various works on Turkish identity and Turkish culture, enabled the development of the Turkish-Islamic synthesis movement. With his statement "Love being Turkish," Kabaklı aimed to protect Turkish culture and the Turkish nation against the cultural shocks of the West. In this context, he proposed nationalism as a defense mechanism against

the imperialist ideas of the West. In the newspaper where he penned his thoughts, Ahmet Kabaklı frequently engaged in political criticism of the intellectuals of the period who adopted the approach of accepting Western ideas and lifestyle as they were, and he became prominent through the political arguments he was involved in.

This study involves a general analysis of the views of Ahmet Kabaklı on Turkism and nationalism, through which he secured a place for himself within Turkish conservatism with his distinctive style.

**Keywords:** Ahmet Kabaklı, nationalism, Turkism, synthesis

## GİRİŞ

Ahmet Kabaklı (1924- 2001) başta beş ciltlik “*Türk Edebiyatı*” isimli eseri dahil olmak üzere kaleme aldığı tüm yazılarda Türk milli kimliği üzerinde durmuştur. Bu bağlamda milli değerlerin unutulmaması ve nesiller arası aktarılması için bir çaba içinde olduğu görülebilmektedir. Türk edebiyatının zaman içinde toplumsal olarak ihmal edildiği üzerinde duran Kabaklı, edebiyatın halk ve aydınlar arasında bir köprü görevi üstleneceğini düşünmüştür. Kabaklı sıklıkla geçmiş tarihe atıf yaparak milli değerlerin ancak milli kültür ve milli sanatın gençlere öğretilmesiyle korunabileceği düşüncesinde olmuştur. Dolayısıyla Kabaklı’nın ataların bilgisi ve deneyimleri dediği milli değerler her muhafazakâr düşünürde olduğu gibi Kabaklı’da da asli bir unsur halinde belirmiştir. Geçmiş ortak tarih bilinci ve tarihine hâkim olamayan milletlerin taklitçilikten öteye gidemeyeceği anlayışı hem Batı muhafazakarlığı hem de Doğu muhafazakarlığında yer alan önemli bir belirlenimdir.

Batı muhafazakarlığının kurucusu sayılan Edmund Burke’ün (1729-1797) muhafazakarlık düşüncesinde de gelenekler ve milli kültür toplumun devamlılığını sağlamaya yönelik olarak olduğu sürece son derece önemlidir. Yöneticiler değişse dahi toplumun birlikteliğini kolaylaştıran bu toplumsal kurumlar bir milletin var oluşsal unsurunu oluşturmaktadır. Dolayısıyla Burke toplumun birlikteliğini bozacak, nesillerin devamlılığını engelleyecek her türlü gelenek ve uygulamaya karşı çıkmıştır. Burke geleneksel değerleri faydacı bir anlayışla eklektik bir biçimde ele almıştır. Toplumsal birlikteliği zedeleyecek gelenekler yerine birlikteliği pekiştiren değerleri ön plana çıkarmıştır.

Burke’ün gelenekleri ve geçmiş değerleri seçmeci bir şekilde alıp kullanımına karşı Fransız klasik muhafazakârları Fransız Devrimi karşıtlığını, insan doğasının özgünlüğünü ve geçmiş geleneksel düzenin aynen geri getirilmesi gerektiği düşüncelerini savunmuşlardır. Başta Fransız muhafazakâr Joseph de Maistre (1753-1821) olmak üzere Fransız klasik muhafazakârlar Fransız Devrimi ile birlikte Aydınlanma felsefesine de karşı çıkmışlardır. Aydınlanmanın

geleneksel toplumsal kurumları ortadan kaldırdığını savunup, geleneksel Fransız monarşi yönetiminin yeniden tesis edilmesini ve kilisenin etkinliğinin eskisi gibi sağlanması gerektiğini savunmuşlardır. Fransız klasik muhafazakarlığı dahil Batı muhafazakarlığı içinde geleneksel yönetimler ve din önemli toplumsal kurumlar olarak kabul edilmiştir. Nitekim Batı medeniyetinin üç temel değer üzerinde kurulduğu literatürde kabul edilmektedir. Bu değerler sırasıyla Antik Yunan felsefesi, Roma hukuku ve Hristiyan ahlakıdır. Batı muhafazakarlığı da bu üç değeri kendisine dayanak noktası yapmıştır. Aydınlanmanın geleneksel kurumlara karşı getirdiği yıpratıcı etkiye karşı muhafazakârlar gelenek ve dinsel öğelere sarılmışlardır.

Doğu muhafazakarlığı da Batı muhafazakarlığı gibi geleneksel ve dinsel değerleri öne çıkaran bir gelişim izlemiştir. Sanayi Devriminin Batı'da yaşanması, Batı'nın teknolojiye ileri gitmesine yol açarak Doğu'nun Batı karşısında ekonomik açıdan geri kalmasına yol açmıştır. Değişen uluslararası ekonomik ve siyasi konjonktürel durum Batı'nın Doğuyu emperyalist emelleri için sömürmesine yol açmıştır. Muhafazakârlar bu durum karşısında çözümünü geleneksel toplumsal kurumların korunmasında ve İslam hukukuna uygun bir yaşam tarzının benimsenmesiyle benimsenmesinde bulmuşlardır. Osmanlı'da da bu düşünce ışığında muhafazakarlık Batı ve Doğu muhafazakarlığının kesişim alanını yansıtan bir biçimde gelişmiştir. Yeni Osmanlılar hareketiyle ideolojik bir alt yapıya kavuşan Türk muhafazakarlığı zamanla çeşitli bölümlere ayrılmıştır. Türk muhafazakarlığının bu kadar bölünmüşlüğüne rağmen hepsinin ortak noktası geleneksel değerlerin korunması ve bunların gelecek nesillere aktarılması olmuştur. Bu bağlamda Türk muhafazakarlığı klasik, İslamcı, liberal, milliyetçi gibi anadamar bölümlere ayrılmıştır.

Klasik Türk muhafazakarlığının kökenini Yeni Osmanlılar hareketine kadar götürmek mümkün olsa da bu kanadın esaslı temsilcileri Yahya Kemal Beyatlı (1884- 1958) ve ekolü olmuştur. Yahya Kemal "*imtidat*" görüşü çerçevesinde geçmiş, bugün ve geleceğin birbirinden ayıramayacağını savunurken kendinden sonraki birçok muhafazakâr düşünürü etkilemiştir. Yahya Kemal'in geçmişin üzerinde yükselen eserleri Türk milletinin milli kimlik inşa sürecinde Batı'nın karşısında toplumsal bir dayanak noktası olmuştur. Muhafazakarlık içinde Türk milletinin temel değerlerini içeren bir Türk İslam sentezi görüşü, Yahya Kemal Beyatlı'nın ifadesiyle Türk Müslümanlığı, Türk muhafazakarlığı açısından oldukça benimsenmiştir. Ahmet Kabaklı da edebiyatçı kimliği ön plana çıkan bir yazar olarak Türk İslam sentezi düşüncesini savunan önemli muhafazakâr düşünürlerden biri olmuştur. Yahya Kemal Beyatlı'dan farklı olarak Ahmet Kabaklı Türk İslam sentezi içinde daha fazla milliyetçi düşünceleriyle tanınmıştır. Ahmet Kabaklı milliyetçi muhafazakâr düşünceleri, geçmiş değerlere olan vurgusu

ve milli kültürün yükseltilmesine ilişkin yazılarıyla adeta Fransız klasik muhafazakâr düşüncenin Türkiye’deki bir takipçisi olmuştur.

### **METERYAL VE YÖNTEM**

Bu çalışmada Ahmet Kabaklı’nın eserlerinden yararlanılmış ve literatür taraması yapılarak elde edilen bilgiler karşılaştırmalı olarak derlenmiştir. Yapılan çalışma sonucu Ahmet Kabaklı’nın milliyetçiğe ilişkin düşünceleri, Türk muhafazakârlığı içindeki yeri ve Türk İslam sentezine katkısı ortaya konulmuştur.

### **BULGULAR**

#### **Ahmet Kabaklı’nın Hayatı**

Ahmet Kabaklı Elazığ Güllübağ’da 1924 yılında doğmuştur. Babası müezzinlik yapan Ömer Efendi ve annesi Münire Hanım’dır. Lise öğrenimine kadar Elazığ’da yaşayan Kabaklı 1948’de İstanbul Yüksek Öğretmen Okulu’nda Türk Dili ve Edebiyatı Bölümünü bitirmiştir. Öğretmen olarak Diyarbakır ve Aydın’da görev yapmıştır. Paris’te staj yapan Kabaklı 1960 yılında Ankara Üniversitesi Hukuk Fakültesi’ni de bitirmiştir. Kısa bir zaman avukatlık yapan Kabaklı çeşitli dergi ve gazetelerde yazılar yazmış ve gazetecilik de yapmıştır. Nurettin Topçu’nun (1909-1975) çıkardığı “*Hareket Dergisi*”nde eleştiri yazıları kaleme almıştır. Çok sayıda dergi ve gazetede başta siyasi hiciv olmak üzere çeşitli türlerde yazılar yayımlayan Kabaklı ölene kadar “*Türkiye Gazetesi*”nde yazılar yazmaya devam etmiştir. Kabaklı “*Türk Edebiyatı Cemiyeti*”nde çeşitli faaliyetlerde bulunmuş “*Türk Edebiyatı Vakfı*”nın kurulmasının öncülüğünü ve başkanlığını yapmıştır. 2001 yılında İstanbul’da vefat eden Kabaklı Eyüp’te gömülmüştür (Ayvazoğlu, 2001: 9-10). Kabaklı’nın edebi, fikir, eleştiri, deneme, roman, hikâye, röportaj, monografi ve tercüme alanlarında çok sayıda eseri bulunmaktadır. Özellikle “*Edebiyat Tarihi*”, “*Müslüman Türkiye*” ve “*Kültür Emperyalizmi*” en bilindik eserleridir.

#### **Edebiyat Milliyetçilik İlişkisi**

Kabaklı edebiyatı geçmiş ve gelecek arasında bir köprü olarak gördüğü için edebiyat milliyetçilik ilişkisi üzerinde ciddi çalışmalar yapmıştır. Kabaklı Edebiyatın sadece üniversitelerde akademik olarak işlenmesinin belirli bir kitleye hitap etmesine yol açtığını savunmuştur. Ortaya çıkan bu tekdüzeliği sona erdirmenin yollarını arayan Kabaklı, gençlere Türk edebiyatını milliyetçi bir üslupla anlatmaya çalışmıştır. Kabaklı edebiyatı insanı daha iyi Türk yapan, gelecek zamanlara yön veren bir estetik kaygı ve toplumu yükselten milli kültürün ana öznesi olarak görmüştür. Ona göre edebiyat bütün nesillerin düşünme, beğeni ve mukayese gücünün kaynağıdır. Bu güce sahip toplumlar milli duyguları nesilden nesile aktarabileceklerdir.

Nesiller arası kültür aktarımının kaynağı olarak gördüğü edebiyatı keskin hatlarla eski ve yeni edebiyat olarak ayırmayan Kabaklı, milli tarih ve kültürün kümülatif bir biçimde kendini yeniden ürettiğine inanmıştır. Kabaklı sadece edebiyat alanında değil yaşamın her alanında devamlılığı savunmuş, siyasi olarak yaşanan kopuşların toplumsal hayatta bir karşılığının olmadığını savunmuştur. Bu bağlamda edebiyat toplumsal hayatın tüm dönemlerini yansıtmaktadır. Dolayısıyla edebiyat Kabaklı'da toplumların kendilerini muhafaza etmesinin bir aracı olarak ortaya çıkmaktadır. Kabaklı milli bir edebiyat tarihinin yazımına ihtiyaç duyulduğunu belirterek Orhun Yazıtları ile başlayan bir edebiyat tarihi kaleme almıştır. Kabaklı bu eserinde on iki asırlık bir dönemi kapsayacak şekilde Türk milletinin edebiyat, sanat, yaşam, düşünce ve değerlerini içeren unsurlara yer vermiştir (Kabaklı, 1983a: VI-VII).

### **Türklerin Kökenine İlişkin Düşünceleri**

Türklerin kökenine ilişkin genel akademik araştırmalar çerçevesindeki görüşlere katılan Kabaklı, Orta Asya'yı Türklerin en eski ana yurdu olarak görmüştür. Orta Asya'yı devasa bir bozkır kıtası olarak betimleyen Kabaklı, Türklerin göçebe yaşam tarzının bir zorunluluk ve kader olduğu görüşünü savunmuştur. Ona göre göçebe bir hayat Türklerin yaşam tarzına, sanatına ve genetiğine de yansımıştır. Bu yaşam tarzı atın ilk olarak Türkler ve Moğollar tarafından evcilleştirilmesine yol açmıştır. Böylece toplumsal yaşamın temeline sirayet eden atlı bir yaşam tarzı gelişmiştir. Atla birlikte devam eden yaşam Türklerin yeni yerler keşfetmesine ve fethetmesini sağlamıştır. Kabaklı bu durumun Türklerin yeni devletler kurmasını kolaylaştırdığını savunarak, Türklerin fetihçi bir millete dönüştüğünü belirtmiştir (Kabaklı, 1983b: 3).

Ural Altay kavmiyetine Türklerin de mensubiyetine ilişkin genel teoriler Kabaklı tarafından da sıklıkla tekrarlanmaktadır. Kabaklı'ya göre Türklerin yaşadığı Orta Asya bölgelerine İranlı'lar tarafından Turan bu bölgede yaşayanlara da Turanlılar adı verilmiştir. Kabaklı Turan kelimesinin daha sonra Türkçü çevreler tarafından benimsendiğini ve kullanıldığını belirtmektedir. Kabaklı ise Turancılık fikrini ideolojik olarak Türklerin dil, kültür ve siyasi birlik kurmasını amaç edinen bir ülkü olarak açıklamıştır. Kabaklı birçok yazısında Türkçülük ve Turancılık fikrinin ideologlarından olan Ziya Gökalp'e (1876-1924) yer vermiş ve Turancılık fikrine olumsuz bakmamıştır. Türklerin yazın hayatında ileri bir seviyede olduğunu ispatlamaya çalışan Kabaklı, bu döneme ait eserleri şu şekilde sıralamaktadır: “ *Alp Er Tunga Efsanesi, Şu Efsanesi, Oğuz Kağan Destanı, Oğuz Han, Siyanpi Destanı, Bozkurt Efsanesi, Ergenekon Destanı, Kök- Türk Yazıtları, Kül Tigin Yazıtı, Türeyiş Efsanesi, Göç Efsanesi, Çaştani Bey Hikayesi, Manas Destanı*” (Kabaklı, 1993b: 2-3).

Kabaklı'ya göre Türklerin fetihçiliği ve göçebeliği beraberinde sürekli savaş hazırlığını, yeniliklere ve sürprizlere açık olmayı, disiplini, itaat etmeyi, gelecek görüşlülüğü ve kısa sürede teşkilatlanma yeteneği kazandırmıştır. Kabaklı Türklerin yaşam tarzına mistik bir anlam yükleyerek Türklerin kökeninin salt bir göçebe hayat olmadığı konusunu ispatlamaya çalışmıştır. Ayrıca Batı'nın kendisinden olmayan herkesi barbar olarak adlandırmasına karşılık olarak Türk kültürünün ve yaşamının üstünlüğünü ortaya koymaya çalışmıştır. Türk kültürünün göçebe yaşam tarzını Moğol boyları, çöl Bedevi ve Berberilerden ayıran Kabaklı, Türklerin kılan seviyesini aşarak bir medeniyet kurduğunu vurgulamaya çalışmıştır. Ona göre Türk milleti dünya üzerinde bir medeniyet kurabilmiş özgün ve sayılı milletlerdendir (Kabaklı, 1993b: 33).

### **Türklerde Toplumsal Yaşam ve Vatan Anlayışına Bakışı**

Tarihsel olarak Türklerin İslamiyet'in kabulünden önce göçebe yaşam sürmesinin vatan olgusunun içselleştirilmesi konusunda sorun yaşayıp yaşamadıkları noktasında çeşitli araştırmalar yapılmıştır. Türk muhafazakâr düşüncesi içinde Anadolu coğrafyası her zaman bir başlangıç tarihi olarak görülse de "*kablel tarih*" denilen eski Orta Asya tarihine de sıklıkla atıf yapılmaktadır. Bu bağlamda Türklerin gittikleri her yeri vatan coğrafyası olarak gördükleri ve orayı vatana çevirdikleri muhafazakâr fikriyatta kabul edilmektedir. Nitekim Orta Asya Türklerin tarih sahnesine ilk çıktığı yer olarak kabul edildiği için Türk milletinin doğuşunun simgesi olarak görülmüştür.

Ahmet Kabaklı Türklerin vatan anlayışını, eski kitabelere dayanarak, bir yere oraya sürekli oturmak, ekip biçmek ve savunmak için yerleştiklerini şeklinde tanımlamıştır. Dolayısıyla gittikleri her yeri kendine vatan edinen Türklerin fetihleri durmadığı için sürekli yeni yerlerin elde edilmesi ebedi vatanın oluşturulması açısından engel teşkil etmiştir. Eski vatan edinilen topraklar yeni yerler fethedildikçe unutulmasa da zamanla gözden düşmüştür. Kabaklı dahil birçok muhafazakâr düşünürde 18. yüzyılda başlayan yenilgiler ve geri çekilmelerle birlikte bir kırılma noktası ortaya çıkmış, Anadolu artık o dönemden itibaren ebedi vatan olarak nitelenmeye başlanmıştır. Böylelikle 1071 Malazgirt Zaferi ebedi vatanın kapılarının açıldığı kutlu bir tarih olarak kabul edilmeye başlamıştır. Bununla birlikte sınırlı bir vatan kavramı mevcut bir gerçeği yansıtırken hayallerdeki vatan sınırları Balkanlardan Orta Asya'nın bozkırlarına kadar büyük bir coğrafyayı kapsamıştır (Kabaklı, 1983b: 34-35).

Kabaklı Türklerin göçebe yaşam tarzının ve at kullanımının büyük çadırların taşınmasını kolaylaştırarak gittikleri yerde yerleşmelerini elverişli hale getirdiğini belirtmiştir. Kabaklı sıklıkla göçebeliğin olumlu etkisini dile getirmekte ve bu durumu şöyle açıklamaktadır: "*Türk'ün karakteri dünya görüşü, vücut yapısı da bozkır iklimine uymuştur. Bu iklim serttir.*"

*Toprak, insanları zor doyurduğu için sürekli bir mücadele hali sürüp gider. Bu haşın yaşama şartları Türk'ü akıncı yapmış ve yerleşik milletler üstünde ona zaferler kazandırmıştır”* (Kabaklı, 1983b: 35). Türklerin bu kadar geniş bir coğrafyaya yayılışı topraklar üzerinde kontrolü zorlaştırmıştır. Bu bağlamda Kabaklı Türklerin feodal ve adem-i merkezîyetçi bir yönetim uyguladıklarını savunmuştur. Ona göre Türklerin devlet teşkilatındaki bu kademeli yönetim yapısı Türklerin aristokratik bir devlet yönetimine sahip olduklarını göstermektedir. Muhafazakâr düşüncede ailenin önemi toplumsal yapının devamlılığı ve düzenin korunması açısından önemli bir toplumsal kurum olarak görülmektedir. Muhafazakâr bir düşünür olarak Kabaklı da Türklerle ilgili birçok konuda ailenin kutsallığına değinmiştir. Ona göre aile Türk toplumunun en küçük sosyal birimidir. Kadın yöneticiler erkeğin yanında yönetim yer alabilmekte fakat aile mutlak babanın otoritesinin altındadır. Bu yönüyle Türk aile yapısının kökeni ataerkil bir yapıdan oluşmuştur. Aile kurumunun varlığı ise yasal ve birbirine denk kişiler arasında yapılan evlilikle sağlanmaktadır (Kabaklı, 1983b: 36-37). Aileye olan kutsallığı din içinde açıklayan Kabaklı, Türklerin hiçbir zaman çok tanrıya inanmadığını savunmuştur. Ona göre Türkler gök ve doğaya ilişkin yaratıcı bir gücü her şekilde inanmayı seçmişlerdir. Bu gök Tanrı inancı, iman arayışlarının varlığı ve inanılan dinin yayılma çabası Türkleri İslam dinine yakınlaştırmıştır (Kabaklı, 1983b: 43-44).

### **Ahmet Kabaklı'da Osmanlılık, Türkçülük ve İslamcılık Akımlarının Önemi**

Ahmet Kabaklı Osmanlı Devleti'ni Türklerin maddi-manevi değerleriyle kurdukları ve yükselttikleri en güçlü medeni devlet olarak görmüştür. Fakat bu büyük devletin durumu zamanla toprakların genişlemesiyle birlikte yabancı unsurların artışına yol açmış ve Kanuni Döneminden itibaren bozulmuştur. Çok uluslu bir imparatorluk yönetiminde herhangi bir etnik unsurun ön plana çıkarılmasıyla devlet birliğinin bozulacağına yönelik siyasi politikalar Türk kelimesinin ve milliyetçilik düşüncesinin belli bir döneme kadar Osmanlı'da kullanılmasını engellemiştir. Kabaklı Balkanlarda başlayan ayrılıkçı siyasi hareketlerden kaynaklı olarak Osmanlı'nın Türk adının kullanılmasını gizlemeye hatta silmeye çalıştığını belirtmiş ve bu durumu eleştirmiştir. Ona göre siyasi birliğin korunabilmesi için Türk nüfus bilinçli bir şekilde geri planda bırakılmıştır (Kabaklı, 1983c: 17).

Tanzimat Fermanı (1839) bu durumun tamamen devlet politikasına dönüşmesine yol açmış ve Osmanlılık devlet siyasetine hâkim olmuştur. Kabaklı Türklerin geri bırakılması konusunda eleştiriler getirse de dönemin siyasi ve toplumsal yapısının incelendiğinde Osmanlılık fikrinin kaçınılmaz olduğunu vurgulamıştır. Hatta dönemin hâkim ideologları Şinasi (1826-1871) ve Namık Kemal'in (1840-188) Osmanlı olarak belirttikleri düşüncelerinde aslında Türklüğü

kastettiklerini savunmuştur. Devleti Osmanlılık fikrine iten temel etmenin Batılı devletlerin ve Rusya'nın kışkırtmaları sonucu milliyetçilik düşüncesinin yayılması olarak gören Kabaklı, bu durumun birlikte yaşama arzusunun ortadan kaldırarak devleti dağılmaya ittiğini savunmuştur (Kabaklı, 1983c: 18). Osmanlılık fikrinin azınlıkları bir arada tutamamış ve Osmanlı parçalanmaya başlamıştır. Kabaklı'ya göre Türk nüfusunun geri plana bırakılması sonuçları daha sonra ortaya çıkacak bir tarihsel hataya dönüşmüştür.

Türkçülük akımı ise Osmanlı Devleti'ni bir arada tutma çabalarının sonucu ortaya çıkan Osmanlılık ve İslamcılık akımlarından sonra önemli şekilde taraftar toplamış bir akımdır. Türkçülük akımının gelişmesinde başta Fransız tarihçiler olmak üzere Avrupalı tarihçiler ve Rusya'nın egemenliği altında bulunan topraklardan Osmanlı'ya göç eden Türk soylu düşünürlerin etkisi büyüktür. Kabaklı'ya göre Türkçülük akımı II. Meşrutiyet (1908) sonrası tüm aydınları etkileyerek Kuva-yi Milliye ruhunun oluşmasında etkili olmuştur. Ayrıca Türkçülük akımı Atatürk İnkılaplarına da kaynaklık etmiş ve yeni Türk devletinin kuruluşuna zemin hazırlamıştır. Ona göre Türkçülük dilde, soyda ve tarihsel olarak üç şekilde gelişmiş ve bu durum akımın sistemleşmesinin yolunu açmıştır. Soy Türkçülük, Türkçülük akımının eylemsel kısmını oluşturmuştur. Özellikle soy Türkçülük içindeki romantik bir kısım dünya üzerindeki tüm Türklerin kültürel birlikteliğini savunurken diğer kısım ise tüm Türkleri içine alan siyasal bir birliktelik arzulamıştır. Siyasal olarak sağlanmak istenen Türk birliği Pan-Turanizm ya da Turancılık olarak ortaya çıkmıştır. Daha önce belirtildiği üzere Turancılık fikrine sempatiyle yaklaşan Kabaklı tüm Türklerin siyasal olarak bir çatı altında toplanılmasını bir hayal olarak görmüştür (Kabaklı, 1983c: 22). Kabaklı'nın Türkçülük anlayışı daha realist ve sınırları belli bir Türkçülüğü yansıtmaktadır. Onun Türkçülüğü tarihi bir Türkçülüğü kapsamaktadır. Böylece Türklüğün ne kadar eski bir tarihe dayandığı ve yüksek bir medeniyetin ürünü olduğu vurgulanarak Batı'nın kültürel emperyalizminden kaçınılabilecektir.

İslamcılık akımı ise Osmanlılık fikrinin Osmanlıyı bir arada tutamayacağı anlaşıldıktan sonra Müslüman tebaanın Osmanlı'dan ayrılmasını engellemek ve Müslümanlar üzerinde siyasi bir güç oluşturabilmek için ortaya çıkmıştır. Ümmetçilik politikası İslamcılık akımının bir uygulaması olarak İslam devletleri arasında liderlik oluşturulabilmek için kullanılmaya çalışılmıştır. Bu politika özellikle II. Abdülhamit (1842-1918) Dönemi ve I. Dünya Savaşı (1914-1918) sırasında bir devlet politikasına dönüşmüştür. Kabaklı'ya göre ümmet politikası aynı Osmanlılık akımında olduğu gibi millet kavramı yerine kullanılmıştır. Böylelikle Osmanlı birliği yerine İslam birliği kurulması Osmanlı toprakları açısından daha anlamlı hale gelmiştir.

İslamcılık akımı kendi içinde ikiye ayrılmaktadır. Birinci kesim tüm Müslümanların birliğinin sağlamayı amaçlamıştır. Kabaklı'ya göre tüm Müslümanların birliği tüm Türklerin siyasi birliğinin sağlamaya yönelik düşünceler gibi hayal ürünü kalmaktadır. Çünkü İslam hem geniş bir coğrafyaya yayılmış hem de tüm İslam ülkeleri Osmanlı'nın siyasi olarak egemenliğini kabul etmeyebilecektir. İkinci kesim ise Kabaklı'nın da savunduğu ve Mehmet Akif Ersoy'un (1873-1936) öncüsü olduğu Osmanlı toprakları üzerinde yaşayan Müslümanların birliğini sağlamaya yönelik ilerici bir İslamcılıktır. Mehmet Akif'in İslamcılık anlayışında herhangi bir ırk ön plana çıkarılmadan tüm İslam dünyasının kalkınması ve gelişmesi hedeflenmiştir (Kabaklı, 1983c: 32-33).

Kabaklıya göre Mehmet Akif tam bu noktada dönemin Türkçü düşünürlerinden ayrılmaktadır. Turan fikrini asla kabul etmeyen Mehmet Akif'in milliyetçi olmadığını söylemek yanlış bir tespit olacaktır. Kabaklı Ziya Gökalp ve diğer Türkçü düşünürleri milliyetçiliğin etnik kökenine vurgu yaptıkları için Türkçü milliyetçi olarak adlandırırken, Mehmet Akif Ersoy'un İslamcı milliyetçi olduğunu savunmuştur. Son kertede Anadolu'nun işgali üzerine Mehmet Akif de Türklüğe vurgu yapmış ve bir Türk İslam birliğini arzulamıştır (Kabaklı, 2012: 70-71). Kabaklı'ya göre İslam ve Türklüğü birleştiren bir başka edip ve mutasavvıf Mevlâna Celaleddin Rumi'dir (1207-1273). Kabaklı Mevlana'nın Türkleri Moğollarla karıştırmadığını belirterek Türk kelimesini adalet, mertlik, saflık ve misafirperverlikle aynı anlamda kullandığını belirtmiştir. Ona göre Mevlâna Türklerin savaşçılığı ve iyiliğinin İslam'a yakışır düzeyde olduğunu belirtmiştir (Kabaklı, 1972: 159-162).

### **Milliyetçiliğin Etkisi**

Milliyetçilik düşüncesinin Türkiye'nin gerçeklerinden doğduğunu savunan Kabaklı, maddi-manevi kalkınma ve milli yükselişin bu akımın dayandığı temel noktalar olduğunu belirtmiştir. Ona göre milliyetçilik okul, fabrika ve market gibi üç temel simgeyi kendine konu edinmektedir. Böylece bu simgeler etrafında gelişen bilim, ekonomik kalkınma ve ahlak gelişmiş bir Türk toplumunu oluşturabilecektir. Türk milliyetçiliği bu bağlamda halk ve aydınların birliğini sağlayarak güçlü bir siyasi iktidarı yaratacaktır (Kabaklı, 1983c: 461). Muhafazakarlık düşüncesinde Kabaklı'nın da belirttiği gibi organik aydın kavramı sıklıkla vurgulanmıştır. Organik aydınlar mevcut siyasi iktidar ile halk arasında birer aracı kurum gibi hareket etmektedirler. Çift yönlü etkisi olan organik aydınların bir yandan mevcut siyasi iktidarın varlığını südürebilmesi için halkın iktidara istekleri aktarırken diğer yandan halkın kültürel olarak gelişmesini sağlamaktadır. Fakat bazen bu ilişki bozulmakta ve aydınlar halktan

kopuk bir şekilde faaliyet göstermektedir. Milliyetçilik bu noktada devreye girerek kopukluğu ortadan kaldırıp tam milli bütünlüğü sağlamaktadır.

Kabaklı Türk milliyetçiliğinin büyük bir coğrafi alanda Türkiyecilik düşüncesini oluşturduğunu savunmuştur. Ona göre Türkiyecilik “*geçmişte oluşturulmuş yüksek milli tarihin idrak ettirilerek, Türk İslam dünyasının manevi lideri olduğunun bilinci ışığında milli kimliğin kurularak büyük Türkiye’nin yeniden yaratılmasıdır*” (Kabaklı, 1983c: 461). Kabaklının milliyetçilik üzerinden yaptığı milli tarih anlatısı neredeyse bütün muhafazakâr düşüncülerde bulunmaktadır. Milli tarih bilincinin yaratılma aşmasında romantik bir üslupla özellikle geçmiş başarılar vurgulanır ve geçmiş tarihten kahramanlar yaratılır. Başarısızlıklara ve yenilgilere asla değinilmez. Bu bağlamda dini liderlik de her ülkenin muhafazakârları açısından kendi ülkesine yakıştırılır. Araplar ve İranlılar’da olduğu gibi Türk muhafazakârları da İslam liderliği konusunda Türkleri üstün görmüşlerdir. Kabaklı’nın Türkleri İslam önderi görmesi gibi Necip Fazıl Kısakürek (1904-1983) de Türklerin yıllarca İslamiyet’i koruduğunu savunarak Türkleri İslam’ın doğal lideri olarak görmüştür.

Ülke içinde birliğin sağlanması, milletin oluşturulması, onurlu ve bağımsız bir devletin varlığının devam ettirilmesi bakımından milliyetçilik Ahmet Kabaklı’nın düşüncelerinde kusursuz bir ideoloji olarak ortaya çıkmıştır. Onun için milliyetçilik bir millete şahsiyet kazandırarak milletin varlığını devam ettirebilecek nesillerin yetiştirilmesini sağlayabilecektir. Bu bağlamda milliyetçilik düşüncesinin ilkokuldan başlayarak milli bir eğitimle yeni nesillere aktarılmasını savunan Kabaklı, böylece ülkücü bir şiarı sahip uzman milli kadroların oluşturulabileceğini savunmuştur. Kabaklı Türk milliyetçiliğini devrimci değil gelişmeci, çatışmacı değil barışçıl olarak nitelemiştir (Kabaklı, 1983c: 462-463).

Ahmet Kabaklı Türk milliyetçiliğini İslam’dan ayrı düşünmez. Mehmet Akif’in görüşlerine zaman zaman atıf yapsa da Kabaklı’nın milliyetçilik anlayışında Türklük önemli bir şekilde yer tutar. Kabaklı milliyetçiliği Türk Müslümanlığı temelinde Türk İslam sentezine ulaşabilmektir. Nitekim Kabaklı “*Alperenler*” isimli eserinde milli kahraman tanımını şöyle yapmaktadır “*Bütün milletin ruhunda hayali ve hasreti bulunan, kendisine inanılan, güvenilen kendi çok sevilen; hayatı, yaptıkları, sözleri belli belirsiz de olsa milletçe bilinen kişiye, yalnız ve ancak O’na milli kahraman denilebilir.*” Bu bağlamda Türk milli kahramanlarının başında İslam peygamberi gelir diyerek milliyetçi düşüncesini İslam dini ile birleştirmiştir (Kabaklı, 2005: 237).

### **Milliyetçilik ve Kültür**

Emperyalizme “*Kültür Emperyalizmi*” isimli eserinde yoğun bir eleştiri getiren Ahmet Kabaklı, kültürel emperyalizmi en büyük sömürü aracı olarak görmüştür. Kabaklı'nın bu eleştiri Marksist teorisyenlerin eleştirilerinden farklı bir yapıyı yansıtmaktadır. Ona göre kültür emperyalizmi bir nevi manevi sömürgeciliktir. Kurumsallaşmasını henüz sağlayamamış milletler kurumsallaşmasını sağlamış ve güçlü bir devlet oluşturmuş milletler tarafından siyasi, askeri ve ekonomik olarak sömürülmeye mahkûm hale gelecektir. Emperyalist sömürü içinde ilk aşama ve milleti bozguna uğratan en önemli aşamayı kültürel emperyalizm oluşturmaktadır (Kabaklı, 2014: 11). Kültürel emperyalizme maruz kalan milletler milli şahsiyetini kaybedeceklerdir. Milli tarih ortadan kaldırılacağı için milli bir yozlaşma başlayacak ve vatan mefhumunun bir önemi kalmayacaktır. Milli değerlerin ortadan kaldırıldığı ve milli kültürle yetişmiş nesillerin olmayışı milletin bağımsızlığını tehlikeye atacaktır (Kabaklı, 2014: 23).

Kabaklı'ya göre kültürel emperyalizmin araçları din, film, şarkı, dans, kıyafet, yiyecek gibi sanat ve tüketim her alanında ortaya çıkmaktadır. Kültürel emperyalizmle sömürülen ülkeyi morfinle uyutulmuş aslana benzeten Kabaklı, Türkiye'de Noel'in gelişinin Kurban Bayramının gelişinden daha çok belli olduğu şeklinde popülist eleştiriler getirmiştir. Bu noktada dinsel eksikliğin kültürel emperyalizme neden olan başlıca unsurlardan biri olarak niteleyen Kabaklı, bu sömürüdeki en büyük sorumluluğu aydınların üzerine atmıştır. Kabaklı'ya göre aydınlar milli değerleri yeteri kadar halka anlatamadığı için kültürel bir emperyalizm ortaya çıkmaktadır (Kabaklı, 2014: 23). Kabaklı kültürel emperyalizme karşı çözüm anahtarı olarak ise milliyetçiliği göstermiştir. Ona göre aydınlar milliyetçi bir şuurla halkın bilinçlendirmelidir. Böylece millet kültürel bir rönesans yaşayarak kendi tarihine sahip çıkıp; kendi dilini, dinini ve örfünü yeniden keşfederek milli bir aydınlanma yaşayacaktır.

### **Güneydoğuya Dair**

Batı'nın emperyalist çıkarlarını sağlamak için yeni ırklar ve mezhepler icat ettiğini savunan Kabaklı, bazı partilerin bunları oy uğrana dile getirdiğini savunmuştur. Kabaklı ortak yaşanan coğrafyanın adının Türkiye olup burada yaşayanların Türk olduğunu belirterek her türlü ayrılıkçı düşüncelere karşı çıkmıştır. Ona göre Türkiye'nin kuruluşundan itibaren yapılan antlaşmalarla azınlık olarak Rum, Ermeni ve Yahudiler tanımlanmıştır. Kimsenin başka azınlık yaratmak gibi bir yetkisi yoktur. Türkler Anadolu coğrafyasını Bizans'tan fethetmiştir. Dolayısıyla başka etnik unsurların yok edilerek Anadolu'nun Türkleştirildiği büyük bir yalanı yansıtmaktadır. Anadolu'da yaşayan herkesi Türk olarak niteleyen Kabaklı, Kürtleri Türk milletinin asli unsuru olarak görmüştür (Kabaklı, 1993: 49). Güneydoğu Anadolu'nun bilerek geri bırakıldığı söylemlerine karşı çıkan Kabaklı, Türk milletinin hiçbir vatan toprağını ihmal

etmeyeceğini savunmuştur. Kabaklı “Türk olmayı seviniz” diye öğüt vererek Türkler ve Kürtlerin kardeşliğini tarihsel örneklerle ispatlama yoluna girişmiştir (Kabaklı, 1993: 51).

## SONUÇ

Ahmet Kabaklı daha fazla edebi kişiliği ve köşe yazılarıyla ön plana çıkmış olsa da Türk muhafazakârlığı içinde önemli bir yere sahiptir. Kabaklı düşüncelerini yaşadığı dönemde kimseden çekinmeden açıkça dile getirmiştir. Türkiye'nin uzun bir süre Batılılaşma ve çağdaşlaşma arasında kaldığını dile getirmiştir. Acele ve şuursuz bir Batılılaşma çabasının geleneksel toplumsal kurumları yok ettiğini savunan Kabaklı, Osmanlı'nın son dönemi ve Cumhuriyetle gelen bazı yenilikleri tenkit etmiştir. Batılılaşma ve çağdaşlaşma arasında çağdaşlaşmayı savunan Kabaklı, çağdaşlaşmayı modern bir örneği körü körüne bağlanmak yerine bilimsel ilerlemenin milli sembolü olarak görmüştür. Ahmet Kabaklı özellikle köşe yazılarında kopyacı olarak adlandırdığı ve kültürel emperyalizme yol açtığını savunduğu aydınlarla karşılıklı polemik içine girmiştir.

Kendisini doğrudan Türkçü veya Pan-İslamcı olarak nitelemeyen Kabaklı kültürel yozlaşmaya neden olduğunu düşündüğü kişiler karşısında milliyetçi bir çizgide yer almıştır. Vatanı, milleti, mekânı veya dini olmayan bir ilimin peşinden gitmiştir. Bu ilimi milli kalıplar içine sokmaya çalışmış ve Türk milletine özgü bir çağdaşlaşma arzulamıştır. Ahmet Kabaklı'nın önemi milli değerlerin üzerinde durması ve milli beraberliği bozan unsurlara karşı verdiği çözüm önerilerinden gelmektedir.

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**KIBRIS SORUNU: TARİHSEL TEMELLER, SİYASİ GELİŞMELER VE ÇÖZÜM  
ARAYIŞLARI****Mevlüt ARSLAN**

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Kıbrıs Sorunu, 20. yüzyılın ortalarından itibaren Türk ve Rum toplulukları arasında etnik temelli gerilimlerin, uluslararası müdahalelerin ve çeşitli siyasi müzakerelerin etkisiyle şekillenen karmaşık bir mesele olarak günümüze kadar sürmüştür. Kıbrıs adasının bir sorun olarak ortaya çıkması, tarihin ilk zamanlarından itibaren, 21.yy kadar süregelen, siyasi yönü ağır basan ve gündemde olmayı her zaman başarmış uluslararası gündemi meşgul etmiş bir sorun olmayı başarmıştır. Kıbrıs adasındaki çözümsüzlük son zamanlarda, Türkiye Cumhuriyeti'nin AB'ye üye olma serüveni yolculuğunda bir engel olarak, gündemin en ön sırasında kendisine her zaman yer bulmayı başarmıştır. Adanın stratejik önemi Kıbrıs sorununu günümüze değin çözülememesine sebep olmuştur. Adanın bu kadar stratejik bir öneme sahip olması; Ortadoğu'daki enerji kaynaklarına giden yollarına hakim bir konumda bulunması, Ortadoğu coğrafyasından Afrika kıtasına kadar uzayan rotayı denetleyebilmesi, Ortadoğu ve Süveyş'teki Kanal yoluna egemen bir coğrafi konuma sahip olması, Süveyş'ten Pasifik ve Hint sularına kadar devam eden denizlerdeki ticaret yollarının önemli bir kontrol noktası olması gibi sebeplere dayanmaktadır. Kıbrıs sorununun taraflarının bir den fazla olması, çözüm arayışlarının sonuçsuz kalmasının en büyük nedenlerindedir. Adanın üzerinde sürekli sakinleri olan Türk ve Rum tarafları haricinde, Türkiye, Yunanistan, İngiltere, Amerika Birleşik Devletleri ve Avrupa Birliği gibi aktörler de mevcuttaki meselenin taraflarıdır. Son zamanlarda Akdeniz havzasının güney kesimindeki bazı devletler, özellikle İsrail, deniz yetki alanı, münhasır ekonomik bölge, enerji kaynakları bulma çalışmaları hususunda, konuya müdahil olmuştur

Bu çalışma, Kıbrıs Sorunu' nun tarihsel temellerini, yaşanan siyasi gelişmeleri ve çözüm arayışlarını incelemektedir. Ayrıca, çözüm süreçlerinin başarıları ve başarısızlıklarına odaklanarak, geleceğe yönelik olası çözüm senaryolarını tartışmaktadır. Bu çalışmada Kıbrıs Adasındaki problemin Tarihsel Gelişim sürecin inceleyeceğiz. Bu araştırmada öncelikli olarak, adaya genel bir bakış ile coğrafi konumuna, Osmanlının egemen olduğu dönemde ve İngiltere'nin hakimiyetinde kaldığı süre zarfında adanın yönetimine ve döneme ait gelişmelere değinilecektir. Sonraki süreçte, 1960 yılında yapılan antlaşmalar ve bu antlaşmalarla neticesinde inşa edilen hukuki durum değerlendirilecektir. Bu çalışmanın sonunda ise, 1963 ve

sonrasında cereyan eden siyasi ve toplumsal hadiseler, Türkiye'nin 1974'teki askeri müdahalesi, KKTC'nin nasıl kurulduğu, süreç içinde vuku bulan olaylar ile sorunlara yönelik çıkar yolun ne olacağı arayışları, 1990'dan sonra meydana gelen siyasi ve toplumsal vakalar, BM'nin aldığı kararları ve en son gelişmeler gözden geçirilecektir.

**Anahtar Kelimeler:** Kıbrıs, Siyasi Gelişmeler, Doğal Kaynaklar, Stratejik Konum, Çözüm Önerileri

### **THE CYPRUS PROBLEM: HISTORICAL BACKGROUND, POLITICAL DEVELOPMENTS, AND SEARCH FOR SOLUTIONS**

#### **ABSTRACT**

The Cyprus Problem, shaped by ethnically based tensions between Turkish and Greek communities, international interventions, and various political negotiations since the mid-20th century, has persisted to the present day as a complex issue. The emergence of the island of Cyprus as a problem has ensured that it remains a politically charged issue that has consistently occupied the international agenda from the earliest times to the 21st century. Recently, the unresolved situation on the island of Cyprus has consistently been at the forefront of the agenda, serving as an obstacle in the Republic of Turkey's journey towards EU membership. The island's strategic importance has been a major factor in the failure to resolve the Cyprus problem to this day. The island's strategic importance. The Cyprus problem stems from several factors, including its strategic location dominating routes to energy resources in the Middle East, its control over the route extending from the Middle East to the African continent, its dominance over the Middle East and the Suez Canal route, and its importance as a control point for trade routes across the seas extending from Suez to the Pacific and Indian waters. The fact that there are more than one party to the Cyprus problem is one of the biggest reasons why the search for a solution has been unsuccessful. Besides the Turks and Greeks who are the permanent inhabitants of the island, actors such as Turkey, the UK, Greece, the USA, and the EU are also parties to the current issue. Recently, some states in the southern part of the Mediterranean basin, especially Israel, have become involved in the issue regarding maritime jurisdiction, exclusive economic zones, and energy resource exploration.

This study examines the historical foundations of the Cyprus Problem, the political developments that have taken place, and the search for a solution. It also focuses on the successes and failures of the solution processes and discusses possible solution scenarios for the future. In this study, we will examine the historical development process of the problem on the island of Cyprus. This research will primarily provide a general overview of the island, its

geographical location, its administration during the Ottoman and British periods, and the developments of that era. Subsequently, the agreements of 1960 and the resulting legal framework will be evaluated. Finally, this study will review the political and social events that occurred in 1963 and thereafter, Turkey's military intervention in 1974, how the Turkish Republic of Northern Cyprus (TRNC) was established, the events that unfolded during this period and the search for solutions to the problems, the political and social events that occurred after 1990, the UN resolutions, and the most recent developments.

**Keywords:** Cyprus, Political Developments, Natural Resources, Strategic Location, Solution Proposals

## 1. GİRİŞ

Kıbrıs adasının bir sorun olarak ortaya çıkması, tarihin ilk zamanlarından itibaren, 21.yy kadar süregelen, siyasi yönü ağır basan ve gündemde olmayı her zaman başarmış uluslararası gündemi meşgul etmiş bir sorun olmayı başarmıştır. Kıbrıs adasındaki çözümsüzlük son zamanlarda, Türkiye Cumhuriyeti'nin AB'ye üye olma serüveni yolculuğunda bir engel olarak, gündemin en ön sırasında kendisine her zaman yer bulmayı başarmıştır. Adanın stratejik önemi Kıbrıs sorununu günümüze değin çözülememesine sebep olmuştur. Adanın bu kadar stratejik bir öneme sahip olması; Ortadoğu'daki enerji kaynaklarına giden yollarına hakim bir konumda bulunması, Ortadoğu coğrafyasından Afrika kıtasına kadar uzayan rotayı denetleyebilmesi, Ortadoğu ve Süveyş'teki Kanal yoluna egemen bir coğrafi konuma sahip olması, Süveyş'ten Pasifik ve Hint sularına kadar devam eden denizlerdeki ticaret yollarının önemli bir kontrol noktası olması gibi sebeplere dayanmaktadır. Kıbrıs sorununun taraflarının bir den fazla olması, çözüm arayışlarının sonuçsuz kalmasının en büyük nedenlerindedir. Adanın üzerinde sürekli sakinleri olan Türk ve Rum tarafları haricinde, Türkiye, Yunanistan, İngiltere, Amerika Birleşik Devletleri ve Avrupa Birliği gibi aktörler de mevcuttaki meselenin taraflarıdır. Son zamanlarda Akdeniz havzasının güney kesimindeki bazı devletler, özellikle İsrail, deniz yetki alanı, münhasır ekonomik bölge, enerji kaynakları bulma çalışmaları hususunda, konuya müdahil olmuştur.

Bu çalışmada Kıbrıs Adasındaki problemin Tarihsel Gelişim sürecin inceleyeceğiz. Bu araştırmada öncelikli olarak, adaya genel bir bakış ile coğrafi konumuna, Osmanlının egemen olduğu dönemde ve İngiltere'nin hakimiyetinde kaldığı süre zarfında Adanın yönetimine ve döneme ait gelişmelere değinilecektir. Sonraki süreçte, 1960 yılında yapılan antlaşmalar ve bu antlaşmalarla neticesinde inşa edilen hukuki durum değerlendirilecektir. Bu çalışmanın sonunda ise, 1963 ve sonrasında cereyan eden siyasi ve toplumsal hadiseler, Türkiye'nin

1974'teki askeri müdahalesi, KKTC'nin nasıl kurulduğu, süreç içinde vuku bulan olaylar ile sorunlara yönelik çıkar yolun ne olacağı arayışları, 1990'dan sonra meydana gelen siyasi ve toplumsal vakalar, BM'nin aldığı kararları ve Doğu Akdeniz de keşfedilen enerji kaynaklarının Kıbrıs sorunu üzerinde yarattığı etkiyi, enerji jeopolitiğinin bölgenin güvenlik dinamiklerini ve rekabeti nasıl şekillendirdiği gözden geçirilecektir.

## 2. TARİHSEL ARKA PLAN VE SİYASİ GELİŞMELER

### 2.1.Kıbrıs Adasına Genel Bakış

Kıbrıs'ın Stratejik Önemi Akdeniz'de bulunan üçüncü büyük ada olması, hem Ortadoğu'yu, hem de Akdeniz'i kapsayan mükemmel konumu dolayısıyla her zaman göz önünde olmuştur (İnci,2012). Kıbrıs, Akdeniz'in en büyük iki adaları olan Sardinya ve Sicilya'dan sonraki en büyük üçüncü adasıdır. Yüzey alanı 9251 km<sup>2</sup> dir. Suriye'ye 98 km, Türkiye'ye 71 km, Mısır'a 316 km ve Yunanistan'a 900 km, uzaklıktadır (Sandıklı, 2010).



Ada, Marmara ile Ege denizleri vasıtasıyla Karadeniz'e, Batı Akdeniz suları ve Süveyş Kanalı yolu ile Kızıldeniz'e, Akdeniz yolu ile Suriye ve Irak kara parçaları vasıtasıyla İran (Basra) Körfezi'ne uzanmaktadır. Kıbrıs, her dönemde stratejik önemini korumuş, Faaliyete geçen Süveyş Kanalı ile birlikte stratejik önemi iyice artmıştır. Akdeniz ve Ortadoğu'da hakimiyet kurmak isteği olan tüm güçler için olmazsa olmaz bir stratejik nokta konumunda olmuştur. Özellikle 1950'lerde kapitalist Batılı güçler Kıbrıs'ı, SSCB deki Komünizmin Ortadoğu da takip edilmesi, bu tehlikenin kontrol altında tutulması ve yükselen Arap milliyetçiliğinin gözlenmesi için önemli bir merkez üs olarak kullanmıştır (İnci, 2012).

## 2.2.Kıbrıs' ın Siyasi Tarihçesi

Kıbrıs, tarih boyunca Mısır, Fenike, Asur ve Pers gibi birçok medeniyetin egemenliğine girmiş ve bu uygarlıkların kültürel izlerini taşıyan önemli bir Akdeniz adası olmuştur. MS 394 yılında Doğu Roma İmparatorluğu hâkimiyetine giren adada Ortodoks kilise teşkilatı kurulmuş, 649 yılında ise Hz. Ömer döneminde Müslümanlar tarafından fethedilmiştir. 964'te yeniden Bizans yönetimine geçen ada, 1191'de gerçekleşen Üçüncü Haçlı Seferi sonrasında Latin yönetimine geçmiş ve Guy de Lusignan önderliğinde Katolik Latin kilise teşkilatı oluşturulmuştur. Daha sonraki dönemlerde Ceneviz Cumhuriyeti ve Venedik Cumhuriyeti hâkimiyetinde kalan Kıbrıs, Doğu Akdeniz'de ticaret yollarının güvenliği açısından stratejik önem taşımaya devam etmiştir. Osmanlı İmparatorluğu, bölgedeki ticari güvenliği sağlamak amacıyla 1570'te başlattığı sefer sonucunda 1571 yılında adayı fethetmiş; bu dönemde Ortodoks halkın güvenliği sağlanmış ve Anadolu'dan getirilen nüfusla planlı bir iskân politikası uygulanmıştır. Osmanlı yönetimi altında 1571–1821 yılları arasında Kıbrıs çok toplumlu bir yapıya sahip olmuş ve görece istikrarlı bir toplumsal düzen oluşmuştur (Yürük, 2023). 19. yüzyılda ise Yunan milliyetçiliğinin temel ideolojilerinden biri olan Megali İdea doğrultusunda başlayan hareketler ada üzerindeki siyasi gelişmeleri etkilemiştir (Yalçın, 2017). 1877–1878'de gerçekleşen 93 Harbi sonrasında imzalanan Ayastefanos Antlaşması ve Berlin Kongresi sürecinde Birleşik Krallık, Osmanlı Devleti ile yaptığı anlaşma doğrultusunda Kıbrıs'ın yönetimini devralmıştır (Yürük, 2023). I. Dünya Savaşı sırasında İngiltere adayı tek taraflı olarak ilhak etmiş, bu durum 1923'te imzalanan Lozan Antlaşması ile Türkiye Cumhuriyeti tarafından kabul edilmek zorunda kalmış ve 1924 yılında Kıbrıs resmen İngiliz egemenliği altına girmiştir (Uçarol, 2015; Yürük, 2023).

Lozan Antlaşması sonrasında Kıbrıs'ta yaşayan Türklerden, Birleşik Krallık veya Türkiye vatandaşlığından birini tercih etmeleri istenmiş; Türk vatandaşlığını tercih edenler Türkiye'ye göç etmek zorunda kalmış ve bu süreç 1940'lara kadar devam etmiştir. İngiltere, 10 Mart 1925 tarihinde kral V. George'un kararıyla Kıbrıs adasının statüsünü İngiliz Taç Kolonisi olarak değiştirmiş ve Yüksek Komiserlik yerine valilik sistemi kurarak adayı doğrudan sömürge yönetimi altında idare etmeye başlamıştır. Bu dönemde Kıbrıs'taki Rum toplumunun temel siyasi hedefi, adanın Yunanistan'a bağlanmasını ifade eden Enosis ideali olmuştur. Rumlar bu amaç doğrultusunda çeşitli siyasi ve toplumsal girişimlerde bulunmuş; 1928'de Yunanistan, Enosis talebini uluslararası platformda ilk kez resmi olarak gündeme getirmiştir. 1931'de ise Rumların İngiliz yönetimine karşı başlattığı isyan hareketleri adadaki gerilimi artırmıştır (Vatansever, 2012).

II. Dünya Savaşı sonrasında Enosis fikri hem Kıbrıs'ta hem de Yunanistan'da daha güçlü şekilde gündeme gelmiş; Yunanistan Parlamentosu 1947 yılında Kıbrıs'ın Yunanistan'a bağlanması yönünde karar almıştır (Vatansever, 2012:1497). 1950'li yıllarda Rumların faaliyetleri artmış, özellikle III. Makarios'un başpiskopos olmasıyla birlikte Enosis hareketi daha da güçlenmiştir. 1954 yılında Yunanistan konuyu Birleşmiş Milletler gündemine taşımış ancak self-determinasyon talepleri kabul edilmemiştir. Bu süreçte Enosis hedefini gerçekleştirmek amacıyla kurulan EOKA örgütü silahlı eylemler gerçekleştirmiştir. Aynı dönemde İngiltere, adada özerk bir yönetim kurabilmek amacıyla çeşitli planlar hazırlamış ancak bu planlar Enosis hedefini karşılamadığı gerekçesiyle Rum tarafı tarafından reddedilmiştir.

Kıbrıs meselesi zamanla Türkiye, Yunanistan ve Birleşik Krallık arasında uluslararası bir sorun haline gelmiş; tarafların farklı çözüm yaklaşımları nedeniyle 1955 yılında Londra'da düzenlenen konferanstan sonuç alınamamıştır. Artan Türk-Rum çatışmaları sonrasında diplomatik girişimler yeniden hız kazanmış ve 11 Şubat 1959'da Zürih Antlaşması ile 19 Şubat 1959'da Londra Antlaşması imzalanmıştır. Türkiye, Yunanistan ve İngiltere'nin garantörlüğü altında iki toplumun ortaklığına dayanan yeni bir devlet kurulması kararlaştırılmış ve 16 Ağustos 1960'ta yürürlüğe giren anayasa ile Kıbrıs Cumhuriyeti resmen kurulmuştur (Vatansever, 2012).

### 2.3. Türkiye' nin Kıbrıs' a Müdahalesi (1974 Barış Harekatı)

1963 yılında III. Makarios tarafından önerilen anayasa değişiklikleri, Kıbrıs'ın iki toplumlu yapısını zayıflatacak ve Türk toplumunu azınlık konumuna düşürebilecek nitelikte olduğu gerekçesiyle Kıbrıs Türkleri tarafından reddedilmiştir. Bu gelişme iki toplum arasında ciddi çatışmaların başlamasına neden olmuş ve Kıbrıs Türkleri yönetim mekanizmalarından dışlanmıştır. 1963–1974 yılları arasında Türk ve Rum tarafları arasında çeşitli görüşmeler gerçekleştirilmiş olsa da tarafların çözüm konusundaki farklı yaklaşımları nedeniyle kalıcı bir uzlaşma sağlanamamıştır (İnci, 2012).

15 Temmuz 1974 tarihinde Nikos Sampson liderliğinde ve Yunanistan Albaylar Cuntası'nın desteğiyle gerçekleştirilen darbe sonucunda adanın Yunanistan'a bağlanması hedeflenmiştir. Bunun üzerine Türkiye, 1960 tarihli Garanti Antlaşması'ndan doğan haklarına dayanarak Bülent Ecevit başkanlığında 20 Temmuz 1974 tarihinde Kıbrıs'a askeri müdahalede bulunmuştur. Müdahale sonucunda Girne–Lefkoşa hattı Türk kuvvetlerinin kontrolüne geçmiş ve Birleşmiş Milletler Güvenlik Konseyi'nin 353 sayılı kararı doğrultusunda ateşkes ilan edilmiştir (Vatansever, 2012).

1974 müdahalesi sonrasında gerçekleştirilen nüfus değişimi ile Türkler adanın kuzeyine, Rumlar ise güney kesimine yerleşmiş ve Kıbrıs fiilen ikiye bölünmüştür. Türkiye'nin müdahalesi Kıbrıs Türk toplumunun güvenliğini sağlarken uluslararası alanda çeşitli tepkilere ve yaptırımlara da neden olmuştur (İnci, 2012). Bu süreçte Kıbrıs Türkleri siyasi ve idari yapılanma yoluna giderek 13 Şubat 1975 tarihinde Kıbrıs Türk Federe Devleti'ni ilan etmişlerdir. Ancak 1977–1983 yılları arasında gerçekleştirilen müzakerelerden iki toplum arasında kalıcı bir çözüm elde edilememiştir (Vatansever, 2012).

Müzakerelerden sonuç alınamaması üzerine Kıbrıs Türk tarafı self-determinasyon hakkına dayanarak 15 Kasım 1983 tarihinde Kuzey Kıbrıs Türk Cumhuriyeti'nin kurulduğunu ilan etmiştir. Böylece 1974 sonrasında oluşan fiili bölünme siyasi bir statü kazanmış ve Kıbrıs meselesi uluslararası alanda tartışılmaya devam eden bir sorun olarak varlığını sürdürmüştür.

#### **2.4.Kuzey Kıbrıs Türk Cumhuriyeti' nin Kuruluşu Sonrası Gelişmeler**

Kuzey Kıbrıs Türk Cumhuriyeti (KKTC), 15 Kasım 1983 tarihinde meclisteki 40 milletvekilinin oybirliğiyle ilan edilmiştir. 5 Mayıs 1985'te halkoyuna sunulan anayasa %70,18 oy oranıyla kabul edilmiş ve Rauf Denktaş %71 oy alarak KKTC'nin ilk cumhurbaşkanı seçilmiştir. Ancak KKTC'nin ilanı Birleşmiş Milletler tarafından kınanmış ve devleti yalnızca Türkiye tanımıştır. KKTC'nin ilanından sonra Rauf Denktaş, 2 Ocak 1984'te BM Genel Sekreteri Javier Pérez de Cuéllar'a iyi niyet teklifleri sunarak Kapalı Maraş'ın statüsü, havalimanlarının açılması ve kayıp şahıslar komitesinin faaliyete geçmesi gibi konularda çözüm önerileri getirmiştir. Ancak Maraş konusunda hazırlanan plan Rum lider Spyros Kyprianou tarafından kabul edilmemiştir. Aynı dönemde Türkiye ile KKTC karşılıklı olarak temsilciliklerini büyükelçilik seviyesine yükseltmiştir (Erişken, 2024).

1988 yılında Güney Kıbrıs'ta yapılan seçimleri Yorgo Vasiliu kazanmış ve Türk tarafıyla görüşmelere açık olduğunu belirtmiştir. Ancak müzakerelerde taraflar farklı yaklaşımlar sergilemiştir. Denktaş federatif bir yapı ve sınırlı serbest dolaşım önerirken, Rum tarafı adanın askerden arındırılması ve güvenliğin BM tarafından sağlanmasını talep etmiştir. Bu nedenle yapılan görüşmelerden somut bir sonuç elde edilememiştir (Demirel, 2016).

3 Temmuz 1990' da Avrupa Birliği'ne tam üye olmak için başvurusu yapan Rum tarafı, Kıbrıs meselesinin uluslararası boyutunu genişletmiştir. 1995'te aday ülke statüsü verilmiş, 1997 Lüksemburg Zirvesi sonrasında üyelik müzakereleri başlatılmış ve görüşmeler 31 Mart 1998'de fiilen başlamıştır. Avrupa Parlamentosu raporlarında Rum yönetimi adanın tek meşru temsilcisi olarak kabul edilmiş ve Türkiye "işgalci" olarak nitelendirilmiştir. Sonuç olarak Rum yönetimi,

“Kıbrıs Cumhuriyeti” adıyla 1 Mayıs 2004 tarihinde tüm adayı temsilen Avrupa Birliği’ne üye olmuştur (Vatansever, 2012).

### **2.5. Annan Planı**

Annan Planı, kronik bir hal alan Kıbrıs sorununa kesin bir çözüm bulunması maksadıyla hazırlanmıştır. Her ne kadar bu soruna bir çözüm getiremese de Annan planı, Kıbrıs sorunu açısından önemli bir yere sahiptir. BM Genel Sekreteri Kofi Annan’ın hazırladığı bu rapora ait belgelerin incelenmesi Ada’daki çözüm üretmemenin nedenlerini ve bu sorunun taraflarına ait öne sürülen tezlerini ortaya koymak bakımından elzemdir (Demirel,2016).

BM bu tekliflerinin sonrasında Rum tarafı, Türk tarafıyla görüşmeler yapılmasını kendi gündemlerinden çıkarmak istiyorlardı. Bu düşüncenin ortaya konulması sonrası BM’nin Genel Sekreterlik koltuğundaki isim olan Annan, tarafların başkanlarına, yüzyüze görüşmeler yapılması daveti yapmıştır. Bu çağrı sonrasında organize edilen, 1997 ile 2000 yıllarını kapsayan dönemde tarafların yaptığı dolaysız ve dolaylı müzakerelerden de her hangi bir netice alınamamıştır. 2001 yılında Denктаş, bir mektup yazarak Rum lider Klerides ile görüşme teklifinde bulunmuştur. Yapılan bu öneriye istinaden 2002 yılının Ocak ayında müzakereler yeniden başlamıştır. Annan’ın hazırladığı kapsamı geniş bir çözüm planı ile müzakereler sonuçlandırılmıştır. Annan planı, o güne değin sunulmuş olan çözüm önerilerinin kapsamı en geniş olanıdır. Bu planda, dolaysız olarak oluşturulacak devlet yönetiminin temelini teşkil edecek kaideler ile yeni yönetimin temel yasası bulunuyordu (İnci, 2012).

11 Kasım 2002’de Kofi Annan’ın Kıbrıs meselesine çözüm üretmek amacıyla hazırlığını yaptığı ilk plan sunulmuştur. Hazırlanan bu planda Kıbrıs “Birleşik Kıbrıs Cumhuriyeti” adı ile bilinecek, dış ülkelere nezdinde tek bir yönetim halinde hareket edip, içişlerinde ise denk haklara sahip iki düzenleyici devlet olacaktır. Rumlar ile Türkler tarafından itiraz edilince 10 Aralık 2002’de yeni bir Annan Planı (2. Annan Planı) hazırlanmıştır. Hazırlanan bu ikinci planda aslında birinci plandan çokça bir farklılık bulunmuyordu ancak Denктаş’ın Kopenhag’da yapılan zirveye katılmadığından dolayı bu planın bir anlamı olmamıştır (Şengün, 2016).

Üçüncü Annan planı Lahey’de 16 Şubat 2003’te taraflara sunulmuştur. Lahey’de sunulan üçüncü plan neticesinde Rum tarafı’ nın Cumhurbaşkanı Papadopoulos planının onaylanmasını halkoyu’na götüreceğini ve oylamanın neticesine göre bu anlaşmayı imzalayıp imzalamayacağına kesin hüküm vereceğini söylemiştir. Denктаş’ta plana onay vermeye tamamiyle isteksizdi (Şengün, 2016).

2002-2004 yılları arasında beş defa değişiklik yapılan Annan Planı, 24 Nisan 2004'te adada yaşayan her iki kesiminde birbirinden bağımsız olarak halkoyuna sunulmuştur. Türk tarafında yüzde 64,9'u evet, Rum tarafında ise yüzde 75,8'i hayır olan bir sonuç elde edilmiştir. Yapılan halkoylaması sonucunda öneri hukuksal açıdan hükümsüz olduğu için uygulamaya konulamamıştır. Ortaya çıkan bu durum, Rum kesimindeki idari yapının kuzey kesimini temsil etme şansının olmadığını ayrıca Türk kesimine yönelik "uzlaşmaz, çözüm istemez" gibi suçlamaları da bertaraf etmiştir. Fakat Türk tarafı "evet" oyu vermelerine rağmen cezalandırılan kesim olmaya engel olunamamıştır. Rumlar ise "hayır" oyuna karşın 1 Mayıs 2004'te adanın bütününe temsil eden taraf olarak AB'ye üyeliği kabul edilmiş, istediği amaçlarını hayata geçirmiştir (Vatansever, 2012).

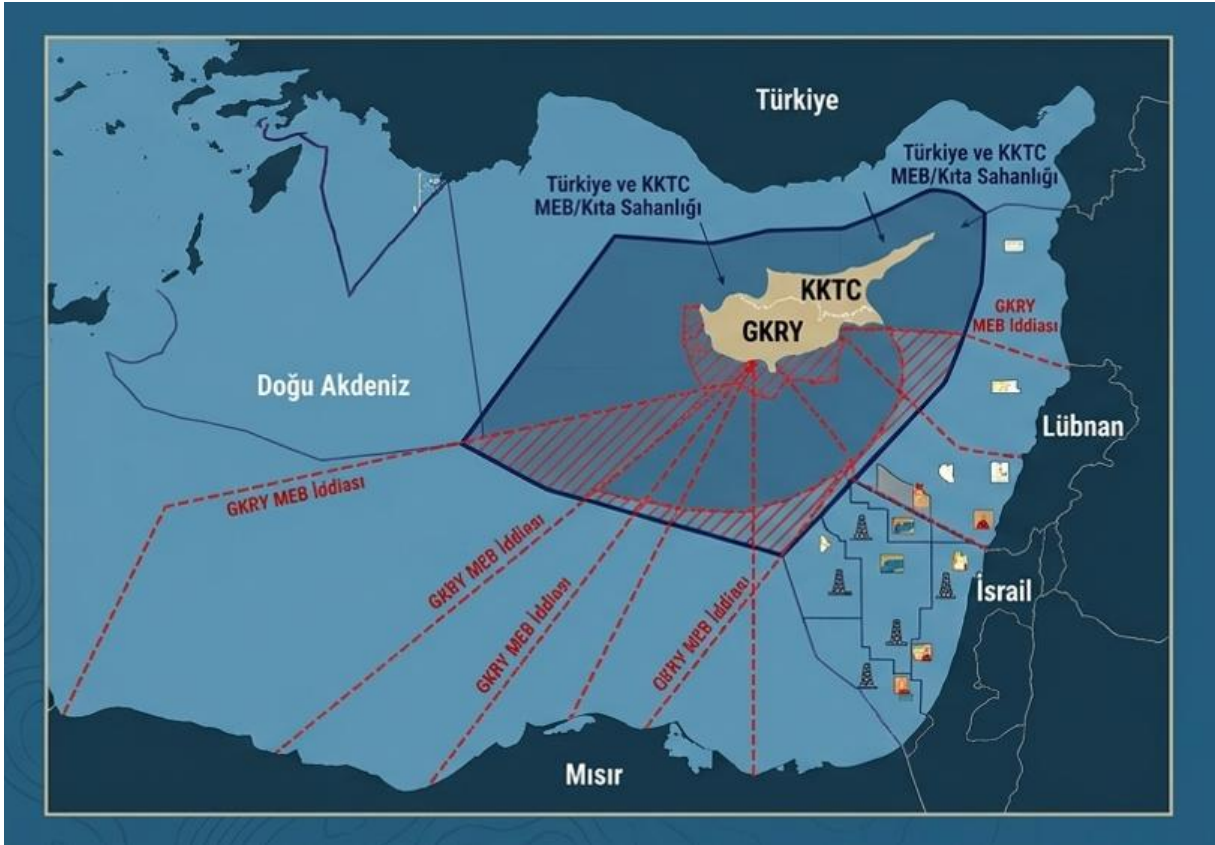
Bu plan, esas dinamikleri ve felsefesi bakımından fiili olarak yıkılmış olan ve yalnızca GKRY'nin temsilciliğini yaptığı "Kıbrıs Cumhuriyeti"nin devam ettiği düşüncesi ile hazırlanmış ve meseleye hukuki bir sorun olarak ele almıştır." Annan Planı, taşıdığı öz ve sahip olduğu ruh açısından Türklerin beklediklerini karşılamamaktan uzak, buna karşın Rumlar ile Yunanlıların amaçlarını yepyeni bir hukuki ve siyasi zemine evrilmesine yardımcı olmuştur. Annan Planı'nda, Türklerin olmazsa olmaz olan egemenlik hakkı kabul edilmemiştir (İnci, 2012).

## 2.6.Güncel Gelişmeler

Annan Planı'nın referandum sonucunda kabul edilmemesi sonrasında Türkiye, Kıbrıs sorununun çözümüne yönelik yeni girişimlerde bulunmuştur. Avrupa Birliği de çeşitli çözüm önerileri sunmuş ancak bu girişimler somut sonuç vermemiştir. AB üyesi devletler 2005 yılında Türkiye ile müzakerelerin devam edebilmesi amacıyla "ortak tutum belgesi" hazırlamış, ancak bu belgede Türkiye'nin adadaki varlığını kısa vadede, orta vadede ise Kıbrıs'taki Türk varlığını sona erdirmesini öngören hükümler yer aldığı için Türkiye tarafından kabul edilmemiştir. Bunun üzerine AB Dışişleri Bakanları 11 Aralık 2006'da alınan kararla Türkiye ile yürütülen müzakerelerde Gümrük Birliği ile bağlantılı 8 başlığı askıya almıştır. Kıbrıs sorununun çözümüne yönelik diplomatik çabalar kapsamında 21 Mart 2008'de Mehmet Ali Talat ile Dimitris Hristofyas bir araya gelmiş ve görüşmeler sonucunda Lokmacı Kapısı karşılıklı geçişlere açılmıştır. Bu süreçte çeşitli çalışma komisyonları kurulmuş ve taraflar 23 Mayıs 2008'de yeniden görüşerek siyasi eşitliğe dayalı iki bölge ve iki toplumlu federasyon modeline bağlılıklarını teyit etmişlerdir (Vatansever, 2012).

Kıbrıs meselesi devam ederken, Doğu Akdeniz'de enerji kaynaklarının keşfedilmesi, bölge devletleri arasında Münhasır Ekonomik Bölge (MEB) ve Kıta Sahaneliği sınırlandırması tartışmalarını alevlendirmiştir (Sağgöz, 2024). Güney Kıbrıs Rum Yönetimi, Doğu Akdeniz'de

egemenlik alanlarını genişletmeye yönelik adımlar atmıştır. Bu kapsamda GKRY, Mısır ile 17 Şubat 2003'te, Lübnan ile 17 Ocak 2007'de ve İsrail ile 17 Aralık 2010'da "Münhasır Ekonomik Bölge Sınırlandırma Anlaşmaları" imzalayarak Doğu Akdeniz'de deniz yetki alanlarını belirlemeye çalışmıştır. GKRY'nin 19 Eylül 2011'de Doğu Akdeniz'de petrol ve doğalgaz arama faaliyetlerine başlaması üzerine Türkiye, bu anlaşmaların Kıbrıs Türk halkının haklarını yok saydığını bundan dolayı Kuzey Kıbrıs Türk Cumhuriyeti ile "Kıta Sahanlığı Sınırlandırma Anlaşması" imzalanmıştır. GKRY ise kendisini adanın tek meşru yönetimi olarak görerek Doğu Akdeniz'de deniz yetki alanlarını belirlemeye yönelik anlaşmalar yapmış ve yabancı şirketlere petrol ve doğalgaz arama ruhsatları vermiştir. Bu gelişmeler Kıbrıs meselesini yalnızca siyasi bir sorun olmaktan çıkararak enerji ve deniz yetki alanları boyutuyla daha karmaşık bir uluslararası sorun haline getirmiştir (Vatansever, 2012).



Küresel aktörlerin bölge ile ilgili stratejilerini bakıldığında, ABD; bölgedeki enerji kaynaklarını Rus gazına alternatif olarak görmekte ve GKRY-Yunanistan-İsrail üçlü ittifakını (East Med) desteklemektedir. Rusya; GKRY ile olan güçlü ekonomik/mezhepsel bağları üzerinden Doğu Akdeniz'deki etkinliğini korumaya çalışmaktadır (Sağgöz, 2024; Avcı, 2021). Avrupa Birliği (AB); GKRY'yi 2004 yılında siyasi sorunlar çözülmeden üye yaparak taraflı bir tutum sergilemiş, enerji arz güvenliği için Doğu Akdeniz'i stratejik bir rezerv alanı olarak

konumlandırmıştır (Sağgöz, 2024). Çin ise; “Bir Kuşak Bir Yol” projesi çerçevesinden duruma bakmakta ve bölgeyi önemli bir ticaret durağı olarak görüp yatırımları ile varlık göstermeye çalışmaktadır.

6 Aralık 2021 tarihinde Colin Stewart, Kıbrıs’a giderek 14 Aralık’ta her iki tarafın katıldığı bir “Yıl Sonu Resepsiyonu” organize etmiştir. KKTC Cumhurbaşkanı Ersin Tatar, eşit siyasi egemenlik esasına dayanan tekliflerini 1-8 Temmuz 2022 tarihinde BM aracılığı ile Rum tarafına bildirmiştir. 2022 yılında, iki taraf da bir dizi güven artırıcı önlem teklifi getirmişleridir. GKRY Cumhurbaşkanı ve Dışişleri Bakanınca imzalanarak KKTC Cumhurbaşkanı’na gönderilen mektupta; Maraş bölgesinin çitle çevrili kesiminin BM’lere devredilmesi, KKTC ile dünya arasında ve GKRY ile Türkiye arasında yapılacak seyahat ve ticaretin kolaylaştırılması,, Türkiye’nin limanlarını ve hava sahasını da GKRY açması, Ercan Havalimanı’nın BM kontrolüne verilip uluslararası uçuşlara açılması ve son olarak Mağusa Limanı’nın AB Komisyonu yönetimi altında AB ile doğrudan ticarete açılması hususları yer almıştır. Haziran 2022’de KKTC lideri Ersin Tatar, parlamentoya danışmadan bu mektubu reddetmiştir. Bunun üzerine KKTC Lideri Tatar, Rum tarafına kendi maddelerinin yer aldığı ve altı başlıklı yeni bir mektup göndermiştir. Mektup’ ta, Kıbrıs’ın elektrik şebekesinin tümünü Türkiye’ye bağlayarak Türkiye-Kıbrıs-AB elektrik şebekesi oluşturmak, Ada’daki mayınları BM ile yapılacak işbirliği ile temizlenmesi, hidrokarbon, güneş enerjisi, su kaynakları ve yasadışı göç için çalışmalar yürütecek yeni komiteler kurmak vb. çalışmalara işaret etmiştir. fakat GKRY bu önerileri KKTC’yi kendileri ile eşit bir hale getirdiği için kabul etmemiştir (Erişken, 2024).

20 Eylül 2022 tarihinde gerçekleştirilen BM 77. Genel Kurulunda Türkiye Cumhuriyeti’ nin Cumhurbaşkanı Recep Tayyip Erdoğan’ ın yaptığı konuşmasında adada iki devlet ve iki toplum olduğunu; meselenin çözümü için ise adada yaşayan halka egemen eşitlik ve eşit uluslararası bir statü verilmesi ve KKTC’nin uluslararası arenada tanınması gerektiğini ifade etmiştir. Bu çağrının asıl amacı KKTC’nin uluslararası toplum tarafından tanınmasının bu meseleyi çözeceği anlayışı yatmaktadır. Sonrasında taraflar arasındaki statü farklılıkları sorununun ortadan kaldırılması ile sorunun çözümü için somut gelişmelerin yaşanması yüksek bir olasılık olarak görülmektedir. Bu zamana kadar Rum tarafının uzlaşma yanlısı olmayan tavrı ve adanın tek sahibi olduğu düşüncesi içerisinde hareket etmesi nedeniyle Kıbrıs meselesine bir çözüm üretilmemiştir (Erişken, 2024).

### 3. SONUÇ VE TARTIŞMA

Stratejik açıdan çok önemli bir konuma sahip Kıbrıs, bugüne kadar birden fazla milletin egemenliği altında kalmış ve Ada, 1571’den 1878’e değin Osmanlı tarafından hem hukuken

hem de fiilen idare edilmiştir ve Ada tarihinde en sorunsuz ve huzurlu dönemini bu yıllarda yaşamıştır. Fakat adada İngilizlerin hakimiyeti ile beraber, Kıbrıs sorunu diye bir sorun uluslararası alanda yer edinmiştir (Vatansever, 2012).

Kıbrıs'ın bir sorun olmasına neden olan belki de en önemli sebeplerinden bir tanesi adanın sahip olduğu stratejik konumdur. Öyleki Kıbrıs Adası tarihin her döneminde stratejik konumu nedeniyle diğer devletlerce önemli bir cazibe merkezi olarak görülmüştür. Ada üzerinde kendi hâkimiyetini kurmak isteyen imparatorlukların ve devletlerin uyguladıkları politikaları Kıbrıs'ta içinden çıkılmaz bir takım problemleri de beraberinde getirmiştir (Aydınyüz, 2021).

Kıbrıs sorunu günümüzde bile üzerinde bir çözüme varılamayan çok önemli bölgesel bir sorundur. İran-ABD-İsrail arasında 28 Şubat 2026 itibarıyla tırmanan savaş, Doğu Akdeniz ve Kıbrıs için ciddi askeri riskler oluşturmuştur. İngiliz üslerinin artan rolü, Kıbrıs'ı fiilen ileri bir askeri ve lojistik platforma dönüştürmüş durumda. Bugün ki durum nedeniyle değişen güvenlik paradigması, Kıbrıs sorununun çözümünü daha da çıkmaza sokmuştur. Güney Kıbrıs, artan tehdit algısı karşısında Batı ile entegrasyonu' nu hızlandırırken ABD ve AB ile güvenlik işbirliğini genişletmekte, İsrail ile askeri koordinasyonunu derinleştirmekte ve limanlarını Batı kullanımına açarak kendisini Doğu Akdeniz'de bir ileri karakol konumuna taşımaktadır. Ancak bu yönelim, çözümü kolaylaştırmak yerine, zorlaştırmaktadır; çünkü bir yandan Türk tarafının güvenlik kaygılarını artırırken diğer yandan adadaki güç dengesini daha da kırılğan hale getirmektedir. Kuzey Kıbrıs açısından ise bu yeni güvenlik ortamı, Türkiye ile bağların daha da güçlendirilmesini zorunlu kılmaktadır. Türkiye, Kıbrıs'ı artık sadece bir Kıbrıs meselesi olarak değil, Doğu Akdeniz güvenlik denkleminde merkezi bir unsur olarak görmektedir (Sağgöz, 2024; Avcı, 2021).

Sorunun kalıcı bir çözüme kavuşturulamamasında birkaç faktör etkilidir. Kıbrıs sorunu yalnızca Ada'da yaşayan iki halkın bir araya gelerek anlaşmaları sonucunda çözüme kavuşabilecek bir sorun değildir. Çünkü bu sorunun çözüme kavuşturulmasında başta Türkiye ve Yunanistan ile İngiltere'nin de aktif olarak çözüme katkı sağlaması gerekmektedir. Ancak bu şekilde yapılırsa kalıcı bir çözüm bulmak mümkün olabilir (Demirel, 2016).

Sonuç olarak, Kıbrıs'ta dikkat edilmesi gereken asıl husus, iki tarafın cebren birleştirilip bir yönetim inşaa edilmesi değil, iki toplumun uyum ve güven içinde beraberce yaşam sürdürebileceği bir toplum vadedilmelidir. Bunun gerçekleştirilebilmesi ise, uzun vadede Ege'deki sorunların Türkiye ile Yunanistan tarafında çözülmesi ve Türk-Yunan halklarının toplumsal yakınlaşmasıyla çözülebilir. Tarafların dışında yapılacak bir müdahaleyle ne iyi bir devlet ne de iyi bir toplum yaratılamayacağı aşikardır (Vatansever, 2012).

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## THE IMPACT OF FISCAL DECENTRALIZATION ON MUNICIPAL FINANCIAL SUSTAINABILITY IN GEORGIA

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**Abstract.** This paper is dedicated to a complex analysis of the fiscal decentralization process in Georgia and its causal relationship with the level of municipal financial sustainability. The relevance of the research is driven by the legislative changes implemented over the last decade, including the transition to a new Value Added Tax (VAT) distribution model since 2019, which fundamentally altered the budgetary architecture of local self-governments.

The aim of the paper is to determine the extent to which the existing fiscal model ensures real financial autonomy for municipalities and whether it reduces vertical fiscal imbalance. The study employs quantitative methodology, specifically a panel data analysis of the budgetary figures of Georgia's 64 municipalities for the period 2018-2024. To evaluate financial sustainability, a system of indicators is utilized, encompassing the self-sufficiency ratio (own-source revenue coefficient), the transfer dependency index, and the capacity for capital expenditure financing.

The research findings reveal that despite the declared progress in decentralization, the majority of Georgian municipalities still experience "fiscal illusion" and a high level of dependency on central transfers. The analysis shows that while the VAT distribution formula has increased the predictability of municipal revenues, it has failed to ensure the complete leveling of regional inequalities. The paper argues that to achieve financial sustainability, it is essential to optimize the local property tax base and diversify municipal borrowing authorities. The study concludes with practical recommendations focused on refining fiscal policy in accordance with the standards of the European Charter of Local Self-Government.

**Keywords:** Fiscal decentralization, municipal finance, financial sustainability, budgetary autonomy, VAT distribution, Georgia.

### 1. Introduction

In the contemporary system of public financial management, **fiscal decentralization** is regarded as one of the most critical instruments for fostering democratic governance and enhancing economic efficiency. The theoretical postulate that lower tiers of government possess an **informational advantage** in the provision of local public goods forms the core of the "**fiscal federalism**" concept. However, in transition economies like Georgia, the decentralization

process is often contentious and faces a fundamental dilemma: how to grant municipalities greater financial autonomy without undermining the country's macroeconomic stability or exacerbating **regional disparities**.

The **Local Self-Government Code**, adopted in Georgia in 2014, initiated a new wave of reforms, culminating in the 2019 amendments to the **Budget Code**. Specifically, the replacement of the equalization transfer system with a **Value Added Tax (VAT) sharing model** raised expectations regarding increased revenue predictability and the financial sustainability of municipalities. Despite this, empirical evidence suggests that for the majority of municipal units, **fiscal autonomy** remains largely formal, while their dependence on central government decisions remains high.

The **relevance of this research** stems from the fact that municipal financial sustainability is directly linked to the country's sustainable development. The **Association Agreement with the European Union** and the **European Charter of Local Self-Government** obligate Georgia to ensure that local authorities are equipped with adequate financial resources commensurate with their constitutional powers. At this stage, a critical evaluation is required to determine how effectively the VAT distribution formula functions and whether it creates sufficient incentives for municipalities to maximize the mobilization of their local economic potential.

The **research problem** lies in the pronounced asymmetry between the economic capacities of various municipalities. While Tbilisi and several large cities possess a significant **fiscal base**, mountainous and border regions remain almost entirely dependent on state transfers. This raises a vital question: to what extent does the current fiscal model promote municipal sustainability in the long run?

**Research Hypothesis:** The author posits that despite institutional progress in the decentralization process, a high degree of **vertical fiscal imbalance** persists in Georgia; furthermore, the financial sustainability of municipalities depends more on the distribution quotas established by the central government than on their own effective fiscal management.

## 2. Literature Review

The theoretical foundations of fiscal decentralization are rooted in classical public finance theory, which examines the optimal allocation of functions between different levels of government. In academic literature, the discussion of this issue is conventionally divided into two stages: "**First-Generation**" and "**Second-Generation**" fiscal federalism theories.

**2.1. Classical and Modern Theories of Fiscal Federalism.** Founding fathers of the classical theory, such as **Charles Tiebout (1956)** in his seminal work *"A Pure Theory of Local Expenditures"*, argue that local governments create a "market" where citizens "**vote with their feet.**" According to Tiebout, competition between municipalities leads to an increase in the quality of public services. This theory is complemented by **Wallace Oates' (1972) "Decentralization Theorem,"** which posits that local decision-making is more efficient because it is tailored to local preferences rather than a "**one-size-fits-all**" approach.

However, "**Second-Generation**" theories (**Weingast, 2009; Qian & Weingast, 1997**) shift the focus toward political incentives. They argue that decentralization is successful only when municipalities face "**Hard Budget Constraints**" and cannot expect the central government to bail out their deficits.

**2.2. Fiscal Decentralization in Transition Economies.** In the context of post-Soviet and Eastern European countries, the literature highlights the problem of **Vertical Fiscal Imbalance.** **Bird and Ebel (2007)** note that in many transition countries, decentralization occurred "**top-down,**" resulting in the transfer of responsibilities without adequate financial resources—a phenomenon known as **Unfunded Mandates.**

Studies on Poland and the Czech Republic (**Ebel & Yilmaz, 2002**) show that municipal financial sustainability is directly correlated with the share of local taxes in total revenue. A higher reliance on transfers often diminishes the motivation of local authorities to foster business development within their jurisdictions.

**2.3. Georgian Scientific Discourse.** In Georgia, fiscal decentralization has been studied by authors such as **D. Narmania**, who emphasizes the necessity of transforming the budgetary system. Particular attention is paid to the methodology of **equalization transfers.** Research (e.g., **UNDP Reports, 2020**) indicates that the 2019 reform, which introduced the **VAT sharing system,** partially resolved the issue of revenue predictability but raised new questions regarding fiscal autonomy.

Contemporary Georgian scholars (e.g., **Kh. Barbakadze, 2021**) point out that the primary barriers to municipal financial sustainability in Georgia are difficulties in **property tax administration** and the inefficient management of land resources.

Despite the broad theoretical base, the long-term impact of the 2019 VAT reform on the financial independence of small and mountainous municipalities remains under-researched.

### 3. Research Methodology

This study employs a **mixed-methods research design**, combining quantitative empirical analysis with qualitative legislative discourse. The object of the research is the **64 municipalities of Georgia** (including Tbilisi), and the study period spans **2018–2024**, allowing for a comparison of the fiscal situation before and after the VAT distribution reform.

**3.1. Data Sources.** The analysis utilizes data obtained from the following official sources:

- Annual and quarterly budgetary reports from the **Ministry of Finance of Georgia**.
- Data from the **National Statistics Office of Georgia (Geostat)** regarding regional GDP and demographic indicators.
- **Performance audit reports** from the State Audit Office of Georgia concerning municipal financial management.

**3.2. Indicators of Financial Sustainability.** To assess municipal financial sustainability, the paper utilizes two primary ratios that comply with international standards (**OECD, IMF**):

1. **Fiscal Autonomy Ratio ( $K_{fa}$ ):**

$$K_{fa} = \frac{\text{Own-Source Revenue}}{\text{Total Budgetary Revenue}}$$

This indicator measures a municipality's ability to fund its expenditures without central transfers.

2. **Vertical Fiscal Imbalance Index (VFI):**

This index illustrates the gap between a municipality's expenditure obligations and its own-source revenues, which is covered by state transfers. It is calculated using the following formula:

$$VFI = 1 - \left( \frac{S}{E} \right)$$

Where:

- **VFI** – Vertical Fiscal Imbalance Index (ranging from 0 to 1).
- **S** (Own-Source Revenue) – e.g., property tax, local fees.
- **E** (Total Expenditures) – Total municipal spending.

*Interpretation:*

- **VFI = 0:** Absolute fiscal balance; expenditures are 100% covered by own revenues.
- **VFI \to 1:** High imbalance; the municipality is almost entirely dependent on external transfers.

**3.3. Analysis Techniques.** The quantitative component involves **panel data regression analysis**. The **dependent variable** is the Municipal Financial Sustainability Index, while the **independent variables** include: the share of VAT in the municipal budget, population size and density, and the level of economic activity (number of local business entities).

**3.4. Qualitative Component.** For data interpretation, a **comparative legal analysis** is used, focusing on the amendments to the **Budget Code** that altered the transfer formula. Special attention is given to the transformation of the "equalization principle" into an "incentive-based principle."

**3.5. Research Limitations.** A key limitation of this study is the lack of precise statistics for **Gross Value Added (GVA)** at the municipal level, necessitating the use of alternative **proxy variables**.

#### **4. Main Body: Analysis of Fiscal Reform and Its Impact on Municipal Sustainability**

**4.1. The 2019 Fiscal Turning Point: From Equalization Transfers to the VAT Model.** Prior to 2019, the primary source of funding for Georgian municipalities was the **equalization transfer**, calculated through a complex formula that often created a perception of subjectivity. As a result of the reform, municipalities were legally entitled to **19% of the total volume of Value Added Tax (VAT)** mobilized nationwide.

From an academic perspective, this shift marked a transition toward a "**Revenue Sharing**" model. Analysis indicates that this change provided municipalities with a direct **fiscal interest** in local business activity, as increased consumption and production across the country are now directly reflected in their budgets.

**4.2. The Effect of VAT Distribution on Financial Predictability.** Empirical data demonstrates that since the reform, the average annual growth rate of municipal revenues has ranged between 12-15%.

**Table 1: Dynamics of VAT Share in Municipal Revenues (2019-2024)**

Year	VAT Volume (Million GEL)	Annual Growth (%)	Share in Total Revenue (%)
2019	950	-	~38%
2020	910	-4.2% (Pandemic Effect)	~35%
2021	1,120	+23%	~40%
2022	1,380	+23.2%	~42%
2023	1,610	+16.6%	~44%
2024	1,850	+14.9%	~45%

As shown in Table 1, the transition to the new VAT sharing model in 2019 provided a significant **fiscal stimulus** to municipal budgets. The slight decline in 2020 was directly linked to the COVID-19 pandemic and the reduction in national economic activity. However, a sharp upward trend began in 2021, driven by both economic recovery and **high inflationary processes** (which automatically increase nominal VAT figures).

Of particular note is the increasing share of VAT in total revenues, reaching 45% by 2024. This suggests that municipal financial sustainability is becoming increasingly dependent on a single tax source, creating a risk of so-called "**Fiscal Concentration.**"

However, a problem emerges in the distribution formula. The 19% share is distributed not based on where the tax was collected, but according to population size and other demographic factors. While this mechanism protects smaller municipalities, it somewhat limits the effect of "**local economic incentives.**"

**4.3. Vertical and Horizontal Fiscal Imbalance.** Despite revenue growth, analysis shows that the share of **own-source revenues** (property tax and local fees) in total budgets remains low.

- **Vertical Imbalance:** Municipal expenditure responsibilities (infrastructure, social packages) often exceed their stable revenues, forcing them to continue requesting "**special transfers**" from the central government.
- **Horizontal Inequality:** The VAT model has failed to eliminate the gap between Tbilisi and the rest of the regions. Tbilisi's budget still accumulates nearly half of the country's total municipal financial resources.

**4.4. Impact on Municipal Financial Sustainability.** Calculations of the **Fiscal Autonomy Ratio ( $K_{fa}$ )** show that while this indicator improved for most municipalities after the reform, it is an "**artificial**" improvement, as the 19% VAT share is classified as **non-own**

revenue. Consequently, municipalities have not become more independent, but rather "wealthier" at the expense of centralized resources.

**4.5. Divergence in Municipal Development: A Comparative Analysis of Batumi and Oni Municipalities.** To study the impact of the 19% VAT model, it is appropriate to compare two polarized municipalities: **Batumi**, a growing urban and tourism hub, and **Oni**, a mountainous, low-population, and demographically declining unit.

**Batumi Municipality: Capitalizing on the "Economic Boom".** For Batumi, the transition to the VAT reform served as an additional fiscal stimulus.

- **Investment Opportunities:** Increased national economic activity (construction, services) expanded the total VAT pool, allowing Batumi to plan **major capital projects** (e.g., coastal reinforcement, fleet renewal) without waiting for additional transfers.
- **Fiscal Effect:** The share of VAT in Batumi's budget showed stable growth, allowing the municipality to direct its **operating surplus** into co-financing projects with international donors.

**Oni Municipality: The "Equalization" Dilemma.** For Oni, where business activity is low and the population is shrinking, the reform presented a different picture.

- **Dependency on the Formula:** Oni's investment capacity is almost entirely dependent on the VAT distribution formula (population coefficient). Lacking a substantial local tax base, the reform provided only a **"survival budget."**
- **Investment Stagnation:** Unlike Batumi, VAT revenues in Oni primarily cover **current expenditures** (administration, social assistance). For capital projects (roads, water supply), the municipality remains dependent on the **Fund for Projects to be Implemented in the Regions (REG-Fund)**.

**Table 2: Comparative Analysis Results**

Indicator	Batumi Municipality	Oni Municipality
VAT Impact	Pro-cyclical (Reinforces growth)	Subsidiary (Maintains functions)
Financial Autonomy	High / Increasing	Low / Static
Source of Investment	Own Revenues + VAT	Primarily Central Transfers
Main Challenge	Urban Infrastructure Overload	Demographic Decline & Low Fiscal Base

The comparison between Batumi and Oni reveals that the current VAT distribution model, despite its progressiveness, does not ensure **horizontal fiscal equity**. Batumi receives resources for development, while Oni receives an instrument for mere maintenance. This

suggests that Georgia requires a more **differentiated approach**—perhaps establishing a higher VAT distribution coefficient for mountainous regions to prevent further **regional polarization**.

## 5. Conclusions and Recommendations

This study demonstrates that the fiscal decentralization reform implemented in Georgia—specifically the transition to the VAT sharing model—represents a significant step forward in terms of the predictability of municipal finances. However, empirical analysis and the comparative study of Batumi and Oni municipalities have revealed serious structural flaws that jeopardize long-term financial sustainability.

### 5.1. Key Findings

- **The Existence of a "Fiscal Illusion":** Despite nominal budget growth, the share of municipalities' own-source (local) revenues remains stagnant. The increase in VAT allocations has led to a "relaxation" of local governments regarding the improvement of local tax administration (e.g., property tax).
- **Exacerbation of Horizontal Imbalance:** The current VAT distribution formula fails to ensure regional equity. Urban centers benefit from **economies of scale**, while peripheral municipalities remain in "survival mode," devoid of resources for development.
- **Vulnerability to Exogenous Shocks:** Analysis of the pandemic period shows that over-reliance on VAT makes municipal budgets vulnerable to macroeconomic fluctuations.

**5.2. Recommendations and Pathways Forward.** Based on the research, the following reforms are recommended to enhance municipal financial sustainability:

- **A New, Differentiated Model of Fiscal Equalization:** It is essential to revise the internal distribution formula for the 19% VAT share. The introduction of a **"Specific Weight Coefficient"** for mountainous and economically depressed regions is recommended. The formula should be based not only on population size but also on territorial area and infrastructural needs.
- **Diversification of the Local Tax Base:** Municipalities should be granted greater authority to differentiate property tax rates. Furthermore, the partial **decentralization of Personal Income Tax (PIT)** (e.g., retaining 5% locally) should be considered to strengthen the link between local employment and budgetary revenues.
- **Liberalization of Municipal Borrowing Mechanisms:** For financially sustainable municipalities (such as Batumi, Kutaisi, and Rustavi), a simplified framework for

issuing **municipal bonds** should be established. This would reduce their dependence on state transfers for capital investments.

- **Digital Transformation in Administration:** The full integration of a unified **Municipal Financial Management System (PFMS)** with the Public Registry is recommended to ensure complete identification of the property tax base and to increase collection rates.

**Summary:** Fiscal decentralization in Georgia is at a critical juncture, where quantitative growth must transform into qualitative independence. The proposed changes will facilitate the transformation of municipalities from "budget-spending units" into "**agents of economic development**," which ultimately serves as a guarantee for the country's overall financial stability.

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**PENSION SYSTEM REFORM IN GEORGIA: ANALYSIS AND ASSESSMENT**

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**Abstract.** The article, based on the study of the latest literary sources and rich factual data, discusses an important issue of financial theory and practice - the challenges and prospects of the Georgian pension reform.

The main challenges of the pension reform are identified, such as: the independence of the pension agency, the riskiness of placement and changes in the pension law, the retirement age, the burden of state pension provision.

The possibility of overcoming the challenges existing in the Georgian pension system is substantiated and appropriate recommendations are proposed.

**Keywords:** pension reform, funded pension, retirement age, placement risk, funded pension scheme, social pension.

From January 1, 2019, the collection of funds from participants in the mandatory accumulative pension scheme began.

The accumulative pension scheme is built on the principle of 2% employer + 2% employee + 2% state. Pension savings can be invested by the Pension Agency and the asset management company selected by it on the basis of the investment policy document.

This document is a framework for the management of pension assets and provides a long-term strategy for the placement of assets. The investment of assets is monitored by the Investment Board of the Pension Agency, which includes five members elected by the Parliament. The Investment Board also selects the specialized depository of the accumulative pension scheme and the asset management company. The National Bank regulates and supervises the investment activities of the Pension Agency, as well as the authorization/recognition and supervision of the asset management company and the specialized depository.

According to the law, citizens employed under the age of 40 are required to participate in the pension scheme, which means that they must contribute 2% of their salary to their pension. In addition, the employer is obliged to transfer 2% of the employee's salary to the employee's individual pension account, while the state is obliged to transfer 2% of the employee's salary (up to 24,000 GEL per year, i.e. up to 9,000 USD) or 1% (from 24,000 to

60,000 GEL per year, i.e. from 9,000 to 22,570 USD) to the employee's individual pension account [1].

Pension assets can be invested in three different risk portfolios. These are: (1) low-risk, with an investment horizon of no less than 5 years; (2) medium-risk, with an investment horizon that exceeds the low-risk investment horizon; and (3) high-risk, with an investment horizon longer than the medium-risk one.

Investments may be made in the following financial instruments denominated in both national currency and foreign currency: cash, including bank accounts held in commercial banks licensed by the state banking regulator; government securities (municipal securities in the case of national currency); debt securities issued by international financial institutions; corporate debt securities registered by the relevant regulator and placed through a public or private offering; shares of enterprises; open-end stock instruments; securities issued by the state, municipality or state agency, if they are properly guaranteed by the relevant state (only denominated in foreign currency); other financial instruments and/or non-financial assets that may be permitted for investment by the National Bank.

The top ten countries for retirement are made up of economically developed countries of the planet<sup>1</sup>, which Georgia lags far behind. In these countries, compared to other countries, the secured old age is determined by the sustainability of their pension systems, which, in turn, is based on the wealth of these countries.

Georgia is not a rich country and does not have the luxury of not completing the reform of the funded pension system that has begun. More economically developed countries may allow themselves to compensate for errors in the management of pension assets with taxpayers' money, but Georgia certainly cannot do this. Therefore, great efforts are needed to identify the challenges that may arise during the reform and to prevent the negative consequences arising from them.

### **Research results**

As a result of the research conducted, four main challenges of the Georgian pension reform were identified:

**1. Independence of the Pension Agency.** Decisions on investment of pension savings should be made only by the Pension Agency, and not by the government (as is the case today).

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<sup>1</sup> Norway, Switzerland, Iceland, Ireland, Australia, New Zealand, Luxembourg, Netherlands, Denmark, Czech Republic.

The main task of the Pension Agency is to manage pension savings oriented towards maximum growth (primarily, protection against inflation), and not to promote the development of the capital market, which is what government agencies call upon it to do. The prospect of capital market development can be considered as a side effect of pension reform, just as, for example, economic growth is for the National Bank. The development of the local capital market and the management oriented towards maximum growth of pension savings can be conflicting goals, i.e. one can hinder the other, just as controlling inflation can hinder economic growth.

**2. Investment risk and changes to the pension law.** In October 2022, amendments were made to the law “On funded pensions”, which provided for the expansion of investment opportunities. However, the proposed changes did not remove the main restriction: the fund can only invest 20% in global instruments, and, accordingly, only 20% of the portfolio can be denominated in dollars, and the rest is intended for the local market. It turns out that 3.6 billion GEL<sup>2</sup> should be invested in Georgia, while the local capital market, especially equity securities, is underdeveloped. Georgian business is trying to raise funds through banks, not financial instruments. The pension agency, of course, can invest in financial instruments, not issue loans.

The riskier the pension investments, the higher the return. As risk increases, so does the risk of losing pension savings. However, with low-risk investments, pension fund managers are unable to keep up with inflation, which is further complicated by inflation caused by international tensions.

The future of Georgia's pension savings depends on how the pension agency manages this key dilemma of risk, which pension funds in many countries face. It should also be taken into account that in rich countries, pension funds have tangible fiscal resources, while in Georgia - so meager that it is unthinkable to compensate pension savings with taxpayers' money. Therefore, the mistakes of pension asset managers in poor countries have a much higher price than in rich countries.

**3. Retirement age.** In Georgia, the retirement age for men is 65 and for women is 60. According to the explanatory note to the Law on Accumulated Pensions, by 2030 the total number of pension and social assistance recipients will reach 1.1 million. By 2060, the

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<sup>2</sup> As of January 31, 2024, the net asset value of the Pension Agency is 4.5 billion GEL, and the total generated investment profit for the same period reached 896.5 million GEL. From the inception of the Fund (January 1, 2019) to January 31, 2024, the total nominal investment return was 59%, and the real return (taking into account inflation) was 15.1% [2].

expenditure on old-age pensioners will be approximately 30% of budget revenues, if the current 18% replacement rate is maintained<sup>3</sup>. These changes seriously question the sustainability of the social pension system.

It is worth noting that a growing number of countries are realizing that the increase in the number of pensioners is burdening the economy and hindering its development. In a number of countries, along with the increase in the number of pensioners:

- Retirement ages have been raised, for example, in the Netherlands the retirement age has been gradually raised from 65 to 67 from 2013 to 2022 and, due to increasing life expectancy, further increases are planned; in Denmark, from 65 to 67 in 2019-2022; in France, from 62 to 64, where attempts to raise the retirement age have led to widespread national resistance and paralyzing strikes;
- Movements towards raising the retirement age have been actively initiated, for example, in Germany, Sweden, Belgium, Japan and Spain;
- Changes to pension rules to provide incentives for retirees to return to work are being actively considered, for example, in the United Kingdom and Ireland. In the United Kingdom, the current state pension age (66 for both men and women) will rise to 67 in 2028 and 68 in 2046. For those born after 6 April 1978, the state pension age will be 68 [3].

In Georgia, the number of old-age pension recipients increased by 125,440 people (18.3%) between 2012 and 2024<sup>4</sup>, while pensions as a share of budget expenditures increased from 16% to 19% (1.817 billion GEL), which will reach 21% of expenditures in 2025.

**4. The burden of state pension provision.** Pension reforms in all countries had one thing in common - the realization of what would happen without reform. In fact, without reform:

- The social (basic) pension continues to grow, which hinders the country's economic growth: The undeclared justification for the funded pension system is that when the majority of state pension recipients are also beneficiaries of the funded pension system, the state pension will no longer grow or will not grow at the same rate as it would have grown without this reform. The constant increase in the social (basic) pension, in parallel with the growth of tax revenues, hinders economic growth and the development of the country.

<sup>3</sup>By relating the pension to the average wage, the replacement rate tells us what share of the wage the pension represents.

<sup>4</sup>While during the same period, the country's population decreased by 50.7 thousand people, which is a 1% decrease in the population.

- The increase in spending on the social (basic) pension will burden taxpayers. Under the alternative, i.e., a funded pension system, spending should grow at a slower rate than without it and, accordingly, the burden will be alleviated.
- People remain poorly provided for in old age, especially when the income of a large part of the population does not allow them to save, and those who do have it do not have a culture of saving.
- People remain dependent on the state, i.e. taxpayers, while they could depend on their own savings during their productive years.

It is worth noting that the most successful pension reforms were those where the majority of the country's population was convinced of the necessity of the reform. This conviction was preceded by cultivating the awareness that one cannot depend on the state pension.

### **Recommendations**

Based on the results of the conducted research, the following main recommendations were formulated:

***1. In line with international best practices, further expand the investment mandate of the Pension Agency and increase the riskiness of investments within reasonable limits:*** without this, it is difficult to imagine keeping pace with inflation. Obviously, this is associated with additional risks, but the main question here is what pension scheme participants will receive without and with this expansion.

According to the Capital Market Development Strategy of Georgia for 2023-2028, the total value of pension fund assets is planned to increase to 6.55 billion GEL in 2025, which is a 3.25-fold increase compared to 2021. In 2028, the same figure will reach 12.1 billion GEL, which is a 6.02-fold increase compared to 2021.

Such a growth rate requires investing in higher-risk assets than the current one, namely:  
*1.1. Increasing or abolishing the limit on investments in foreign assets, so that the manager can determine what part of the assets he will place in foreign assets and what not<sup>5</sup>; 1.2. Giving the agency more flexibility to determine the limits for placement in low-risk, medium-risk and high-risk assets, to reflect the changing situation<sup>6</sup>.*

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<sup>5</sup>The main advantages of investing in the assets of foreign companies are: the ability to diversify investments; high returns (discounted for risks); companies that, unlike Georgia, operate in countries with stable economies, indirectly create the opportunity to import local results/potential.

<sup>6</sup>Giving preference to one instrument, for example, investing mainly in bonds or bank deposits, especially against the background of rising inflation, cannot provide stable real returns and a "decent" pension upon retirement. In addition, the traditional portfolio of stocks and bonds is no longer as effective as it once was. The main challenges for pension funds around the world are low levels of diversification, rising inflation and falling real income. Pension funds are struggling to achieve planned returns, and investors are demanding investments in new and potentially riskier products

**2. Based on the awareness-raising campaign among the population:** 2.1. Prepare a decision to terminate the social (basic) pension for participants in the funded pension system if their savings are above a certain threshold. There will come a time when the majority of basic (social) pension recipients will simultaneously be beneficiaries of the funded pension system, while those who voluntarily opted out of the funded pension scheme (as of the latest status, 170,111 employees) will remain in the basic (social) pension scheme. The state has a reduced obligation towards those who opted out<sup>7</sup>; 2.2. Determine a deadline from which the increase in the social (basic) pension, including indexation, will be suspended. By January 1, 2019, when the funded pension system was launched, those people who had reached retirement age by that time could not join the scheme. The state has an obligation to them. However, the time will come when the majority of basic (social) pension recipients will not be those who could not join the funded pension scheme due to age, but those who opted out of the funded pension scheme. For them, continuing to increase the basic pension, as mentioned above, will be a completely unjustified burden, especially since the majority of them, expecting their own self-sufficiency in the future, consciously opted out of the funded pension scheme<sup>8</sup>.

**3. Against the backdrop of the growing number of pensioners, it is important to start working to raise public awareness in order to maintain the country's fiscal sustainability, in order to raise the retirement age.** Given the current scarce fiscal resources, a significant increase in the number of pensioners in Georgia and, consequently, the share of pensions as a share of budget expenditures significantly hinders the country's orientation towards development.

In Georgia, the increase in the retirement age does not cause as much opposition as in some other countries. For example, according to a survey by the Institute for Social Research and Analysis of the Population's Attitudes to Pension System Reform, when asked how appropriate it is to increase the retirement age, which would allow the state to use the saved budget, as well as the funds accumulated by citizens, to grow the economy, 27.9% of respondents do not oppose the increase in the retirement age, and 72.1% categorically oppose

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<sup>7</sup>The main goal of the funded pension system is to reduce the burden on taxpayers. Providing additional social pensions to participants of the funded pension system will make it impossible to achieve this goal.

<sup>8</sup>The two main justifications for a funded pension system are that the basic pension should increase at a slower rate under a funded scheme than without it, and therefore be less burdensome to taxpayers.

it, while, for example, in France, a much larger part of the population opposes Macron's pension reform, which envisages an increase in the age from 62 to 64 [4].

**4. Pension savings should be invested in financial instruments (securities, banking products), and not, for example, in infrastructure projects, which the government is talking about.** Financing investment in infrastructure is essentially the business of banks. Where governments take on such risks, they also assess the possible losses that may be incurred by such decisions. Pension asset managers are very opposed to investment ideas dictated by public policy objectives, for example, the UK government's decision to transfer billions of pounds of pension savings into long-term investments such as startups and infrastructure, i.e. illiquid assets.

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**TAVİZ BEDELİ KARŞILIĞINDA MUKATAALI VE İCARETEYNLİ VAKIF  
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743 Sayılı Türk Kanunu Medenisinin kabulünden önceki toprak hukuku rejiminde bir taşınmazın zemini ile zemin üzerindeki ağaç veya binaların mülkiyeti farklı kişilerin mülkiyetinde olabiliyordu. Zemini vakfa, üzerindeki yapı ve ağaçlar tasarruf edene ait olan taşınmazlarda bina ve ağaç malikleri vakfa yıllık olarak zemin kirası ödüyorlardı. Ödenen bu bedele de mukataa adı veriliyordu. Yine vakıf taşınmazlar, çift kira olarak sadeleştirilebileceğimiz ifadeyle, değerine yakın bir kısmı peşin olarak (icarei muaccele) ve ayrıca yıllık bir miktar kira bedeli (icarei müeccele) alınmak suretiyle kiraya verilebiliyordu. Bu tür kiralama yapılan vakıf taşınmazlara da icareteynli vakıf deniliyordu.

Türk Kanunu Medenisinin kabulüyle birlikte toprak hukuku rejiminde zemin ve üstü tek mülkiyete konu olabilecek şekilde değişmiş, ayrıca icareteyn suretiyle kiralama da kaldırılmıştır, yeni hukuki düzenlemeler mukataa ve icareteyn sistemlerinin tasfiyesini zorunlu hale getirmiştir. Tasfiye rejiminde bu tür vakıf taşınmazların ödenecek bir bedel karşılığında mukataa veya icareteyn hakkına sahip kişilerin serbest tasarrufuna bırakılmasına, yani mülkiyetlerine geçirilmelerine yönelik düzenlemeler yapılmıştır. Taviz bedeli farklı düzenlemelerde, taşınmazın rayiç değerinin %20 si, %10 u gibi oranlarda düzenlenmiştir.

Bu tebliğde taviz bedeli uygulamasıyla mukataalı ve icareteynli vakıf taşınmazların tasfiyesine ilişkin düzenlemeler sistematik olarak ele alınacak, bedelin belirlenmesi ve ödenmesine ilişkin hükümler incelenecektir. Yine bu kapsamda henüz taviz bedeli ödemesi yapılmamış ancak özel mülkiyete geçmiş taşınmazlar üzerinde yer alan vakıf şerhinin mahiyeti, şerhin kaldırılması için izlenmesi gereken ödeme prosedürleri konusunda uygulamaya yönelik bilgiler sunulacaktır.

**Anahtar kelimeler:** İcareteynli vakıf, mukataa, taviz bedeli, vakıf şerhi.**LIQUIDATION OF MUKATAA-BASED AND İCARETEYN BASED WAQF REAL  
ESTATES IN RETURN FOR THE PAYMENT OF A COMPENSATION PAYMENT****ABSTRACT**

Before the adoption of the Turkish Civil Code No. 743, under the earlier land law regime, the ownership of land and the ownership of buildings or trees on that land could belong to different persons. In cases where the land belonged to a waqf but the structures and trees on it belonged

to the possessor, the owners of those structures and trees would pay an annual ground rent to the waqf. This payment was called *mukataa*. Similarly, waqf real estates could be leased under what may be simplified as a “double rent” system: a substantial amount close to the value of the property was paid in advance (*icare-i muaccele*), along with an additional annual rental payment (*icare-i müeccele*). Such waqf real estates leased in this manner were referred to as *icareteynli waqf*.

With the adoption of the Turkish Civil Code, the land law regime was transformed so that land and the structures upon it became subject to a single ownership. In addition, leasing through the *icareteyn* system was abolished. The new legal framework made it necessary to liquidate the *mukataa* and *icareteyn* systems. Under this liquidation regime, regulations were introduced to transfer such waqf real estates -upon payment of a specified amount- into the free disposition of those who held *mukataa* or *icareteyn* rights, effectively granting them full ownership. The compensation payment (*taviz bedeli*) was set at varying rates under different regulations, such as 20% or 10% of the market value of the property.

This paper systematically examines the regulations concerning the liquidation of *mukataa*-based and *icareteyn*-based waqf real estates through the application of the compensation payment (*taviz bedeli*). It also analyzes the provisions regarding the determination and payment of this amount. Within this scope, practical information will be provided on the legal nature of the waqf annotation (encumbrance) recorded on real estates that have already passed into private ownership but for which the compensation payment has not yet been paid, as well as on the payment procedures required for the removal of such annotation.

**Keywords:** Waqf under the double-rent (*icareteyn*) system, ground rent, compensation payment, waqf annotation.

## 1. Giriş

Vakıf Hukuku sistemi içerisinde *mukataa* ve *icareteyn*, 1926’da yürürlüğe giren 703 sayılı Türk Kanunu Medenisi’nin yürürlüğe girmesinden önce kurulan mazbut ve mülhak vakıflarda vakıf taşınmazların işletme yöntemleri olarak kullanılmıştır. Vakıf Hukuku alanında *mukataa* ve *icareteyn* ve bunların tasfiyesiyle ilgili düzenlemeler Vakıflar Kanunu ve Vakıflar Yönetmeliğinde yer almaktadır.

Zemini vakfa ait taşınmazlarda zeminin üstündeki bina veya ağaç sahiplerinin arazi kullanım bedeli olarak vakfa ödedikleri bedele *mukataa*, bu tür vakıflara da *mukataalı* vakıf denilmektedir. *İcareteyn* ise belirli zorunluluklar dahilinde, örneğin yangın, deprem gibi sebeplerle yıkılan ve arsa haline dönüşen vakıf binaların, arsa mülkiyeti vakıftan çıkmaksızın

arsa bedelinin çok büyük bir kısmının alınıp (icarei muaccele) düşük bir bedelle yıllık kiraya verilmesi (icarei müeccele) şeklinde ortaya çıkan bir uygulamadır. Bu tür bir kiralamada kiracıya mülkiyet değil ama mülkiyete benzer haklar sağlanarak hakları korunmaya çalışılmaktaydı. Örneğin normal kira sözleşmesinde kiralanan yer mirasen mirasçılara geçmezken icareteynli vakıflarda geçebiliyordu. Yine kiracıların normalde kiralanana üçüncü kişilere devir hakkı yokken, icareteynli kiracılar bu haklarını alıp satabiliyor, devredebiliyorlardı.

Türk Kanunu Medenisinin kabulüyle gayrimenkul hukukunda zemin ve üstündeki bina ve ağaçların farklı mülkiyetlere konu olabilmesi ortadan kalkmış ve zemine bağlı tek mülkiyet haline gelmiştir. Bu durum mukataa sisteminin kaldırılmasını zorunlu hale getirmiştir. İcareteynli taşınmazlarda arazi bedelinin büyük kısmı zaten icarei müeccele olarak önceden ödenmiş olduğundan icareteyn usulünün de tasfiyesi gündeme gelmiştir. Tasfiye niteliğindeki düzenlemeler 1935 tarihli 2762 sayılı Vakıflar Kanunuyla hukukumuzda girmiştir.

## 2. Mukataalı Vakıf, İcareteynli Vakıf ve Taviz Bedeline İlişkin Tanımlar

5737 sayılı Vakıflar Kanununun Tanımlar başlıklı 3. Maddesinde;

*Mukataalı vakıf:* Zemini vakfa, üzerindeki yapı ve ağaçlar tasarruf edene ait olan ve kirası yıllık olarak alınan vakıf taşınmazlarını .. ifade eder denilmektedir. Tanımdan anlaşıldığı üzere mukataalı vakıflarda taşınmazın zemini vakfa, üzerindeki bina ve ağaçların mülkiyeti tasarruf edene aittir. Tasarruf eden, vakfa ait zemini kullanma bedeli karşılığında yıllık olarak belirlenen mukataa bedeli öder. Zemin üzerindeki bina ve ağaçların mülkiyeti mutasarrıfa ait olduğundan, mukataa bedeli sadece zemin kullanımına ilişkin bir kira bedeli olarak karşımıza çıkar.

*İcareteynli vakıf:* Değerine yakın peşin ücret ve ayrıca yıllık kira alınmak suretiyle süresiz olarak kiralanan vakıf taşınmazlarını .. ifade eder tanımı yapılmaktadır. Bu durumda icareteynli vakıflarda zemin ve üzerindeki bina ve ağaçların mülkiyeti vakfa aittir. Ancak taşınmazın değerine yakın peşin ücret (icarei muaccele) mutasarrıftan peşin olarak alındığından mutasarrıfa normal kiracılardan farklı hükümler uygulanmakta, süresiz kiracılık hakkı, ayrıca kiracılık hakkının devir ve mirasa konu olma hakkı tanınmaktadır. Mutasarrıf ayrıca yıllık olarak belirlenen bir kira miktarını da (icarei müeccele) her yıl ödemekle mükelleftir. Haliyle icarei müeccele miktarı normal kiranın oldukça altında bir bedel olarak belirlenmektedir.

*Taviz bedeli:* Mukataalı ve icareteynli taşınmazların serbest tasarrufa terki için alınan bedeli .. ifade eder denilmektedir. Buradaki serbest tasarrufa terkten kasıt, mukataalı ve icareteynli taşınmazların mülkiyetlerinin, bu hakka tasarruf eden (mutasarrıf olan) kişilerin kişilerin mülkiyetine geçirilmesidir.

### 3. Cumhuriyet Döneminde Mukataalı ve İcareteynli Vakıfların Taviz Bedeli Karşılığında Tasfiyesine İlişkin Düzenlemeler

#### 3.1. 1935 Tarih ve 2762 Sayılı Vakıflar Kanunu Düzenlemeleri

2762 sayılı Vakıflar Kanununun “Mukataalı ve icareteynli vakıf mallar” başlıklı Dördüncü Babının Birinci faslı “Tasfiye” başlığını taşımakta ve 26 ve 27. maddelerden oluşmaktadır. İkinci faslı ise “Taviz bedellerinin ödenmesi, faiz, tasfiye müddeti” başlığını taşımakta ve 28 ila 32. maddeler arasında düzenlenmektedir.

Kanunun 26. maddesinde “Bu kanunun neşrinden sonra vakıf mallar mukataaya ve icareteyne bağlanamaz” denilerek 1935’ten itibaren vakıf malların mukataa ve icareteyn usulüyle kiralanmalarına son verilmiştir.

27. maddede mevcut mukataalı ve icareteynli yerlerle ilgili düzenleme yapılmıştır. Buna göre “Mevcut mukataalı toprakların veya icareteynli gayrimenkullerin mülkiyetleri icare veya mukataaların yirmi misli bir taviz karşılığında mutasarrıfına geçirilir, taviz ister toptan, ister taksit ile ödensin, ilk ödeme yılı için tahakkuk ettirilen icare veya mukataa hesap olunur” denilmektedir. Maddeye 1952 yılında eklenen ek fıkra ile “özel ve tüzel kişiler uhdesinde bulunan vakıf mahallerin icare ve mukataaları vergi kısmetlerine nispetle binde iki buçuktan noksan ise o miktara çıkarılır” hükmü eklenmiştir. Düzenlemeden anlaşıldığı üzere yıllık olarak belirlenen mukataalı ve icareteynli vakıf taşınmazlarda 20 yıllık mukataa ve icareteyn bedeli taviz bedeli olarak belirlenmekte ve bu bedel karşılığında mukataalı ve icareteynli vakıf taşınmazların mülkiyeti bu yerlere mutasarrıf olanların mülkiyetine geçirilmektedir.

27. maddede 26.6.2001 tarih ve 6490 sayılı kanunun 1. Maddesiyle değişiklik yapılmıştır. Değişikliğe göre, vakfın türüne göre ayrımı yapılmaksızın üzerinde taviz şerhi bulunan mevcut mukataalı veya icareteynli vakıf taşınmaz malların mülkiyetleri, takdir edilecek rayiç bedelinin yüzde yirmi oranında hesap edilecek taviz bedeli karşılığında mutasarrıflarına geçirilecektir. Taviz bedeli ödenmeden ortaklığın giderilmesi veya cebri icra yoluyla satışı yapılacak taşınmaz malların taviz bedellerinin hesaplanmasında satış bedeli esas alınacaktır. Görüldüğü üzere maddenin 1935 tarihli ilk metninde icareteyn ve mukataa bedelinin yirmi misli olarak belirlenen taviz bedeli, 2001 değişikliğiyle taşınmazın takdir edilecek değerinin yüzde yirmisi olarak belirlenmiştir.

28. maddede “yukarıki maddede yazılı tavizler toptan ödendiği takdirde gayrimenkulün mülkiyeti mutasarrıfı adına tapuda tescil olunur. Bu tavizin beşte biri peşin ve geri kalanı dört yılda dört müsavi taksitle de ödenebilir. Bu takdirde mülkiyet mutasarrıfı adına tescil edilmekle beraber gayrimenkulün tamamı geri kalan taksitler için birinci derecede ve birinci sırada ipotek

sayılarak tapuya böylece kaydolunur. Taksitler için yüzde beş faiz yürütülür. Bir taksit zamanında ödenmezse geri kalan taksitlerin tamamı muaccel olur. Mülkiyetin mutasarrıfı adına tescilden itibaren mukataa ve icare alınmaz. Toptan ödeme halinde tavizden yüzde beş indirilir” hükümleri yer almaktadır.

29. maddede “On yıl içinde bu kanun hükümlerine göre taviz vermek yoluyla icareteyn veya mukataa kayıtları terkin edilmemiş olan gayrimenkullerin mülkiyeti on yıl sonunda kendiliğinden mutasarrıflarına geçer ve vakfin hakkı da ıvaza dönerek gayrimenkulün tamamı bu ıvaz karşılığında birinci derece ve birinci sırada ipotek sayılır. Umum müdürlük o yıl tahakkuk ettirilen icare veya mukataa üzerinden hesap edilecek olan bu tavizlerle vaktinde ödenmeyen taksitleri, mutasarrıfın başka mallarına müracaat yoluyla ve tahsili Emval Kanununa göre tahsile dahi yetkilidir” denilmektedir. Bu düzenlemeyle 1935’ten itibaren on yıl içerisinde, yani 1945 tarihine kadar taviz bedelinin henüz ödenmemiş olduğu taşınmazlarda mülkiyet mutasarrıfa geçmiş, taşınmaz üzerine de mukataa veya icareteynli vakıf şerhiyle birlikte birinci derece ve birinci sırada ipotek konulmuştur. Taviz bedeli ödemesi için öngörülen ve 1945 tarihinde dolan 10 yıllık süre, 4745 sayılı kanunla 10 yıl uzatılarak 1955’e ötelenmiştir.

### **3.2. 2008 Tarih ve 5737 Sayılı Vakıflar Kanunu Düzenlemeleri**

2008 tarihinde yürürlüğe giren 5737 sayılı Vakıflar Kanununun 18 ve 19 uncu maddeleri taviz bedelini düzenlemektedir.

18 inci maddede, “Tapu kayıtlarında, icareteyn ve mukataalı vakıf şerhi bulunan gerçek ve tüzel kişilerin mülkiyetinde veya tasarrufundaki taşınmazlar, işlem tarihindeki emlak vergisi değerinin yüzde onu oranında taviz bedeli alınarak serbest tasarrufa terk edilir. Ancak miri arazilerden mukataalı hayrata tahsis edilmeyenler ile aşar ve rüsumu vakfedilen taşınmazlar tavize tâbi değildir” hükmü yer almaktadır.

Taviz bedelinin hesaplanmasında; ortaklığın giderilmesi veya cebri icra yoluyla satılanlarda satış bedeli, kamulaştırmalarda ise kamulaştırma bedeli esas alınır.

Bu Kanun hükümleri gereğince taviz bedelinin tamamı vakfı adına ödenmedikçe, taşınmaz üzerindeki temlik tasarruflar tapu dairelerince tescil olunmaz.

Vakıf şerhleri ile ilgili olarak, diğer kanunlarda yer alan zamanaşımı ve hak düşürücü sürelerle ilişkin hükümler uygulanmaz”.

Bu düzenleme, 1935’ten itibaren uygulamada karşılaşılan sorunları ve yargı kararlarını dikkate alarak hazırlanmış bir düzenlemedir. Taviz bedelinin hesabı emlak vergisi değerinin yüzde onu olarak makul bir düzeyde tutulmakta, bu arada taviz bedeli alınmayacak taşınmazları da belirlemektedir.

19 uncu maddede ise taviz bedelinin tahsil şekli düzenlenmektedir. Buna göre, “Taviz bedelleri, yapılacak tebligat üzerine altmış gün içerisinde peşin olarak ödenebileceği gibi eşdeğer bir taşınmazla takas edilebilir veya yarısı peşin, kalanı bir yılda beş eşit taksitte ödenebilir. Taksitlendirme halinde, taşınmaza birinci derece ve birinci sırada ipotek konulur. Taksitlerden birinin zamanında ödenmemesi halinde geri kalan taksitlerin tamamı muaccel olur.

Genel Müdürlükçe tahakkuk ettirilen taviz bedelleri, yapılacak tebligata rağmen ödenmediği takdirde 6183 sayılı Amme Alacaklarının Tahsil Usulü Hakkında Kanun hükümlerine göre gecikme zammı ile birlikte tahsil edilerek vakfı adına gelir kaydedilir”.

#### 4. Sonuç

Mukataalı ve icareteynli vakıflar, yangın, deprem gibi sebeplerle fonksiyonunu yitirip arsa haline dönen vakıf taşınmazların yeniden fonksiyona kavuşturulabilmesi amacıyla ortaya çıkmıştır. Cumhuriyetin kuruluşundan itibaren gerek toprak hukukundaki değişikliklerden doğan zorunluluklar ve gerekse bu tür vakıfların tasfiyesine yönelik fikirlerin ağır basmasıyla ve neticede vakıflar idaresinin bu alandan sağlanabilecek gelire ihtiyaç duyulması sebebiyle mukataalı ve icareteynli vakıfların tasfiyesi yoluna gidilmiştir. Tasfiye uygulamasında bu tür vakıflardaki hak sahibi mutasarrıflardan alınacak bedele taviz bedeli denilmiş ve bu bedel karşılığında mukataalı ve icareteynli vakıf mülkler özel mülke dönüşerek mutasarrıfları adına tescil edilmişlerdir. Özellikle şehir merkezlerinde yoğun vakıf taşınmazların günümüzde özel mülk olarak karşımıza çıkmasında, taviz bedeli uygulamasıyla mukataalı ve icareteynli vakıfların mutasarrıfları adına özel mülke dönmüş olması büyük etkiye sahip olmuştur.

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**YERALTI SULARINDA MİKROPLASTİK KİRLİLİĞİ VE  
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Yeraltı suları, dünya genelinde iki milyardan fazla insan için temel içme ve kullanma suyu kaynağıdır ve bu kaynakların kalitesi çevresel sürdürülebilirlik ile halk sağlığı açısından kritik öneme sahiptir. Son yıllarda mikroplastikler, çevresel kalıcılıkları, fiziksel ve kimyasal etkileşim potansiyelleri ve biyolojik sistemler üzerindeki olası etkileri nedeniyle yeni nesil kirleticiler arasında öne çıkmaktadır. Başlangıçta denizel ve yüzeysel su ortamlarıyla ilişkilendirilen mikroplastiklerin yeraltı suyu sistemlerinde de tespit edilmesi, bu kirleticilerin çevresel etki alanının beklenenden daha geniş olduğunu göstermektedir.

Bu çalışma, yeraltı sularında mikroplastik kirliliğine ilişkin uluslararası literatürü jeolojik ve hidrojeolojik bir bakış açısıyla değerlendirerek, mikroplastiklerin akifer sistemlerindeki taşınım, tutulma ve birikim süreçlerini çevresel risk bağlamında kavramsal olarak tartışmayı amaçlamaktadır. Mikroplastiklerin tane boyutu, şekli, yoğunluğu ve yüzey özellikleri; porozite, geçirgenlik, tane boyu dağılımı ve akım rejimi gibi jeolojik parametrelerle birlikte ele alındığında, bu parçacıkların klasik çözünmüş kirleticilerden farklı davranış sergilediği görülmektedir. Bu durum, mikroplastiklerin yeraltı suyu ortamlarında uzun süre kalabilmesine, diğer kirleticiler için taşıyıcı yüzeyler oluşturmasına ve dolaylı çevresel etkiler yaratmasına olanak tanımaktadır.

Karstik ve çatlaklı akiferler gibi hızlı akım yollarına sahip sistemler, mikroplastiklerin yüzeyden yeraltı suyuna geçişi açısından daha hassas alanlar olarak öne çıkmaktadır. Alüvyal akiferlerde ise filtrasyon ve tutulma mekanizmaları baskın olmakla birlikte, uzun vadede birikim ve buna bağlı çevresel risk artışı söz konusu olabilmektedir.

Türkiye’de mikroplastik kirliliği çalışmaları çoğunlukla denizel ve yüzeysel ortamlara odaklanmış, yeraltı sularına yönelik araştırmalar sınırlı kalmıştır. Mevcut bulgular mikroplastiklerin farklı yeraltı suyu türlerinde tespit edilebildiğini göstermekte, ancak ulusal ölçekte sistematik izleme ve risk değerlendirme yaklaşımının henüz gelişmediğini ortaya

koymaktadır. Bu çalışma, mikroplastiklerin yeraltı sularında içme suyu güvenliği ve sürdürülebilirlik açısından dikkate alınması gereken bir kirletici grubu olduğunu vurgulamakta ve Türkiye için hidrojeolojik temelli, çevre mühendisliğiyle bütünleşik bir araştırma çerçevesi önermektedir.

**Anahtar Kelimeler:** Mikroplastik, yeraltı suyu, çevresel etki, akifer, hidrojeoloji

## MICROPLASTIC POLLUTION IN GROUNDWATER AND THE TÜRKİYE PERSPECTIVE

### ABSTRACT

Groundwater constitutes the primary source of drinking and domestic water for more than two billion people worldwide, and its quality is critical for environmental sustainability and public health. In recent years, microplastics have emerged as a new class of contaminants due to their environmental persistence, potential for physical and chemical interactions, and possible effects on biological systems. The detection of microplastics in groundwater systems, which were initially associated with marine and surface water environments, indicates that the environmental scope of these pollutants is broader than previously assumed.

This study aims to evaluate the existing international literature on microplastic contamination in groundwater from a geological and hydrogeological perspective and to conceptually discuss the transport, retention, and accumulation processes of microplastics in aquifer systems within the context of environmental risk. When the particle size, shape, density, and surface characteristics of microplastics are considered together with geological parameters such as porosity, permeability, grain size distribution, and flow regime, it becomes evident that these particles exhibit behavior different from that of conventional dissolved contaminants. This behavior enables microplastics to persist for extended periods in groundwater environments, to act as carrier surfaces for other contaminants, and to create indirect environmental impacts.

Systems with rapid flow pathways, such as karstic and fractured aquifers, are more vulnerable in terms of the transfer of microplastics from the surface to groundwater. In alluvial aquifers, although filtration and retention mechanisms are dominant, these processes may lead to long-term accumulation and increasing environmental risks.

In Türkiye, studies on microplastic pollution have mainly focused on marine and surface environments, while research on groundwater remains limited. Existing findings indicate that microplastics can be detected in different groundwater types; however, systematic national-scale monitoring and risk assessment approaches are still lacking. This study highlights microplastics as a contaminant group that must be considered in terms of drinking water safety

and environmental sustainability and proposes an integrated hydrogeological research framework for Türkiye.

**Keywords:** Microplastics, groundwater, environmental impact, aquifer, hydrogeology

## 1. INTRODUCTION

Yeraltı suları, dünya genelinde milyarlarca insan için temel içme ve kullanma suyu kaynağı olup tarımsal üretim ve ekosistem sürekliliği açısından kritik öneme sahiptir. Ancak artan nüfus, kentleşme ve uygunsuz atık yönetimi uygulamaları, bu kaynaklar üzerinde önemli bir baskı oluşturmaktadır. Son yıllarda bu baskıyı artıran kirleticiler arasında mikroplastikler (MP'ler) öne çıkmaktadır.

Yüksek kalıcılıkları ve taşınabilirlikleri nedeniyle MP'ler, başlangıçta daha çok denizel ve yüzeysel ortamlarda incelenmiş, ancak son çalışmalar yeraltı suyu sistemlerinde de bulunabildiklerini göstermiştir. MP'ler yeraltı sularına; yüzey sularından beslenme, atık su sızıntıları, tarımsal faaliyetler ve depolama alanları gibi çeşitli yollarla ulaşabilmektedir. Yeraltı ortamının porozite ve geçirgenlik özellikleri, hidrolik iletkenlik, akım rejimi ve çatlak yoğunluğu gibi hidrojeolojik parametreler, MP'lerin taşınım, tutulma ve birikim süreçlerini belirleyen temel faktörlerdir.

MP'lerin tane boyutu, şekli ve yoğunluğu gibi fiziksel özellikleri ile akiferin hidrojeolojik yapısı birlikte değerlendirildiğinde, bu parçacıkların yalnızca bir kirletici değil, aynı zamanda ağır metaller ve kalıcı organik kirleticiler için taşıyıcı olabildiği görülmektedir. Bu durum, yeraltı suyu kalitesi ve insan sağlığı açısından potansiyel riskleri artırmaktadır.

Buna rağmen, yeraltı sularındaki MP kirliliği henüz yeni bir araştırma alanıdır ve özellikle dağılım, taşınım mekanizmaları ve uzun vadeli etkiler konusunda önemli bilgi eksiklikleri bulunmaktadır. Türkiye'de ise çalışmalar büyük ölçüde yüzey sularına odaklanmış, yeraltı sularına yönelik araştırmalar sınırlı kalmıştır.

Bu çalışma, yeraltı sularında MP kirliliğini kaynaklar, taşınım süreçleri ve çevresel etkiler açısından değerlendirerek mevcut bilgi boşluklarını ortaya koymayı ve Türkiye perspektifinde sürdürülebilir yönetim yaklaşımlarına katkı sunmayı amaçlamaktadır.

## 2. YERALTI SULARINDA MİKROPLASTİKLER: KAYNAK, TAŞINIM VE TUTULMA

### 2.1 Tanım ve Özellikler

Mikroplastikler, 5 milimetreden küçük plastik parçacıkları ifade eder. Genellikle büyük plastiklerin parçalanmasıyla veya endüstriyel ürünlerin mikro bileşenleri olarak ortaya çıkar. Çevre kirliliğinin önemli bir kaynağı olup deniz ekosistemleri, içme suyu ve hatta insan

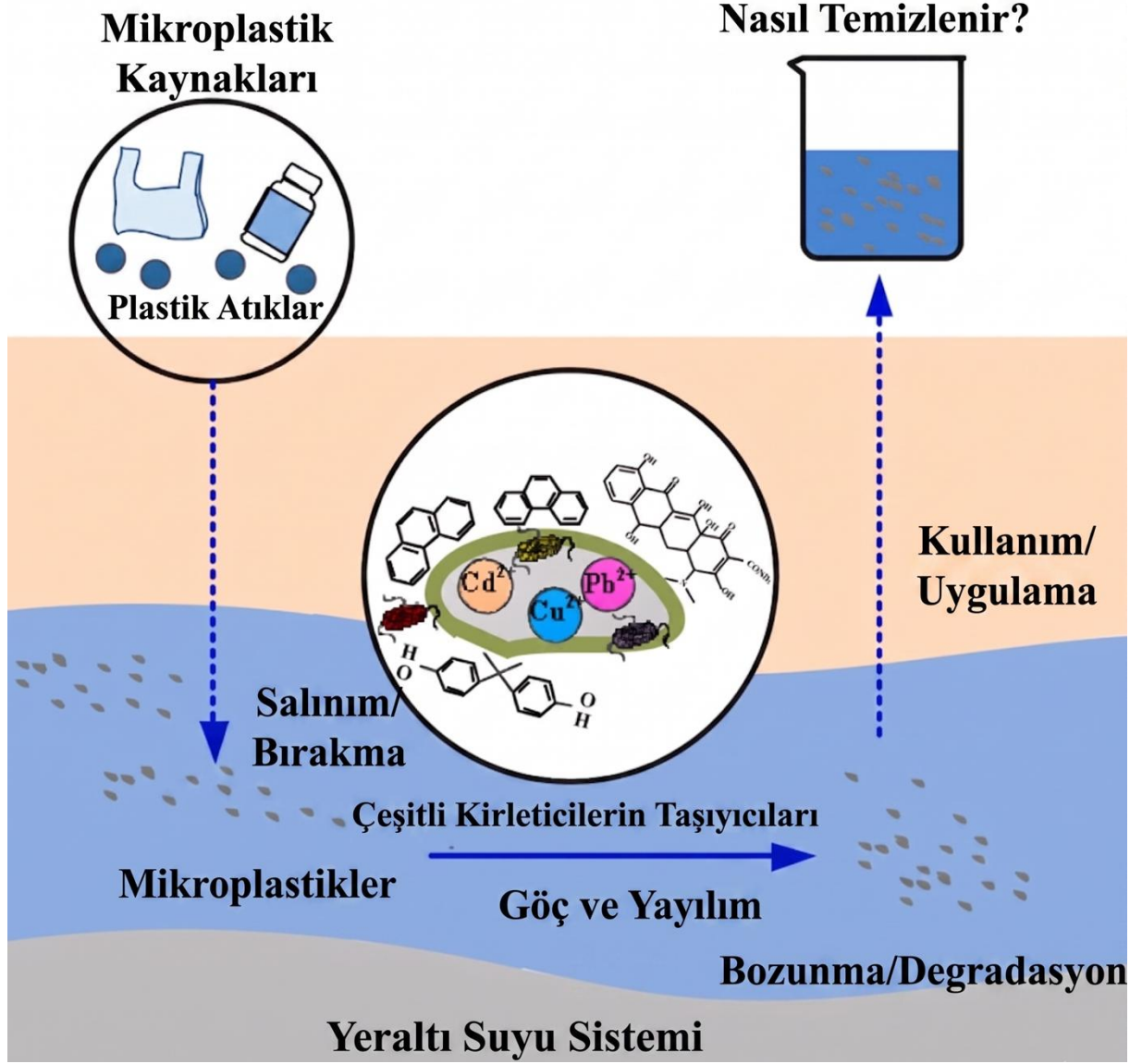
vücudunda tespit edilmiştir. MP'ler birincil ve ikincil olarak ayrılmaktadır. Birincil mikroplastikler doğrudan küçük boyutta üretilir (örneğin, kozmetiklerdeki mikroboncuklar). İkincil mikroplastikler ise daha büyük plastik ürünlerin aşınma, güneş ışığı ve dalga etkisiyle parçalanması sonucu oluşur. Giyimden kopan sentetik elyaflar da önemli bir kaynaktır (Andrady, 2011; Frias and Nash, 2019). MP'ler; polietilen (PE), polipropilen (PP), polistiren (PS) ve polivinil klorür (PVC) gibi farklı polimer türlerinden oluşmakta ve yoğunluk, boyut, şekil ve yüzey özellikleri bakımından büyük çeşitlilik göstermektedir (Andrady, 2011; Frias and Nash, 2019). Bu fiziksel-kimyasal özellikler, MP'lerin çevresel ortamlardaki davranışını ve taşınım potansiyelini belirleyen temel faktörlerdir.

MP'lerin yüksek özgül yüzey alanı ve hidrofobik yapısı, ağır metaller ve kalıcı organik kirleticiler (POPs) gibi maddeleri adsorbe edebilmesine olanak tanımakta, bu durum onları potansiyel bir kirletici taşıyıcısı haline getirmektedir (Rochman et al., 2013).

## **2.2 Mikroplastiklerin Yeraltı Sularına Ulaşım Yolları**

MP'ler yeraltı suyu sistemlerine doğrudan veya dolaylı yollarla ulaşabilmektedir. Başlıca giriş mekanizmaları arasında atık su arıtma tesislerinden sızıntılar, septik sistemler, düzenli depolama sahaları, tarımsal faaliyetler (özellikle arıtma çamuru uygulamaları) ve yüzey sularından yeraltı suyuna beslenme süreçleri yer almaktadır (Lapworth et al., 2018; Panno et al., 2019).

Ayrıca atmosferik taşınım yoluyla taşınan MP'ler, yağışla birlikte toprağa ulaşarak infiltrasyon yoluyla yeraltı suyuna geçebilmektedir (Allen et al., 2019). Özellikle karstik ve çatlaklı akiferler gibi yüksek geçirgenliğe ve hızlı akış yollarına sahip sistemler, MP'lerin yüzeyden yeraltına taşınmasında daha hassas ortamlar olarak değerlendirilmektedir.



Şekil 1. MP'lerin Taşınımı (Jin et al., 2025).

### 2.3 Taşınım ve Tutulma

MP'lerin akifer ortamındaki taşınımı, hem parçacık özelliklerine hem de ortamın hidrojeolojik parametrelerine bağlıdır. Porozite, hidrolik iletkenlik, tane boyutu dağılımı ve akım hızı gibi faktörler, MP'lerin adveksiyon ve dispersiyon süreçleriyle taşınmasını kontrol etmektedir (de Souza Machado et al., 2018).

Buna karşılık, filtrasyon, sedimentasyon ve yüzey etkileşimleri gibi mekanizmalar MP'lerin tutulmasına neden olmaktadır. Özellikle küçük boyutlu ve düşük yoğunluklu parçacıklar daha uzun mesafelere taşınabilirken, daha büyük veya yoğun parçacıklar gözeneklerde tutulma eğilimi göstermektedir (Browne et al., 2011). Ayrıca biyofilm oluşumu ve mineral yüzeylerle etkileşimler de MP'lerin hareketliliğini azaltabilmektedir.

## 2.4 Kirletici Taşıyıcılığı ve Etkileşimler

MP'ler, çevresel ortamlarda yalnızca bağımsız kirleticiler olarak değil, aynı zamanda diğer kirleticiler için taşıyıcı faz olarak da önemli bir rol oynamaktadır. Hidrofobik yüzeyleri sayesinde pestisitler, poliklorlu bifeniller (PCB'ler) ve ağır metaller gibi kirleticileri adsorbe ederek bu maddelerin yeraltı ortamlarında taşınımını kolaylaştırabilmektedir (Teuten et al., 2009; Holmes et al., 2012).

Bu etkileşimler, kirleticilerin biyoyararlanımını ve toksisite potansiyelini artırarak çevresel riskleri karmaşık hale getirmektedir. Ayrıca MP yüzeylerinde mikroorganizma kolonizasyonu (plastisfer oluşumu), patojen taşınımı açısından da yeni bir risk boyutu oluşturmaktadır (Zettler et al., 2013).

## 3. ÇEVRESEL ve SAĞLIK ÜZERİNDEKİ ETKİLER

Yeraltı sularında tespit edilen mikroplastikler, yalnızca fiziksel kirleticiler olarak değil, aynı zamanda biyolojik ve kimyasal etkiler oluşturabilen kompleks kirletici bileşenler olarak değerlendirilmektedir. Bu parçacıkların küçük boyutları, geniş yüzey alanları ve hidrofobik özellikleri, çevresel ortamlarda çeşitli kirleticilerle etkileşime girerek çok boyutlu riskler oluşturmaya neden olmaktadır (Wright and Kelly, 2017; Rochman et al., 2013).

### 3.1 Ekotoksikolojik Etkiler

Mikroplastiklerin yeraltı suyu sistemlerinde bulunan mikroorganizmalar ve diğer biyotik bileşenler üzerindeki etkileri giderek daha fazla araştırılmaktadır. Bu parçacıklar, mikroorganizmalar tarafından fiziksel olarak alınabilmekte veya hücre yüzeyine bağlanarak metabolik süreçleri etkileyebilmektedir (Galloway et al., 2017). Özellikle nanoplastik boyutuna yaklaşan parçacıkların hücre zarını geçebilme potansiyeli, toksik etkilerin artmasına yol açmaktadır (Koelmans et al., 2015).

Bunun yanı sıra, mikroplastiklerin yüzeylerinde taşınan ağır metaller, pestisitler ve kalıcı organik kirleticiler, biyoyararlanımı artırarak ekotoksikolojik etkilerin şiddetlenmesine neden olabilmektedir (Holmes et al., 2012; Rochman et al., 2013). Yeraltı suyu sistemlerinde sınırlı biyolojik çeşitliliğe rağmen mikroorganizmalar su kalitesinin korunmasında kritik rol oynadığından, bu organizmalar üzerindeki etkiler doğal arıtım süreçlerini olumsuz etkileyebilir.

### 3.2 İnsan Sağlığı Açısından Riskler

Yeraltı sularının önemli bir içme suyu kaynağı olması, mikroplastiklerin insan sağlığı üzerindeki etkilerinin değerlendirilmesini zorunlu kılmaktadır. Mikroplastiklerin içme suyu yoluyla insan vücuduna alınması sonucunda gastrointestinal sistemde birikim ve inflamatuvar yanıtların oluşabileceği belirtilmektedir (Wright and Kelly, 2017; Smith et al., 2018).

Ayrıca, mikroplastiklerin yapısında bulunan katkı maddeleri (plastifiyanlar, stabilizatörler) ve çevreden adsorbe edilen toksik kimyasallar, dolaylı sağlık riskleri oluşturabilmektedir. Özellikle endokrin bozucu özellik gösteren bileşiklerin mikroplastikler aracılığıyla taşınması, uzun vadeli etkiler açısından önemli bir belirsizlik alanı oluşturmaktadır (Teuten et al., 2009). Bununla birlikte, yeraltı sularındaki mikroplastiklere ilişkin veri eksikliği, risk değerlendirmelerinin henüz sınırlı kalmasına neden olmaktadır.

### **3.3 Kimyasal Taşıyıcılık ve Toksikite Artışı**

Mikroplastikler, hidrofobik özellikleri nedeniyle çevresel ortamlardaki kirleticiler için bir taşıyıcı yüzey görevi görebilmektedir. Organik kirleticiler ve ağır metaller mikroplastik yüzeyine adsorbe olarak taşınım süreçlerine dahil olmakta ve bu durum kirleticilerin çevresel dağılımını değiştirmektedir (Holmes et al., 2012; Rochman et al., 2013).

Bu etkileşimler, kirleticilerin biyoyararlanımını ve toksisitesini artırarak birleşik (combined) etki oluşturabilmektedir (Koelmans et al., 2016). Yeraltı suyu ortamlarında mikroplastiklerin gözenekli ortamlarda tutulması veya yeniden mobilize olması, bu kirleticilerin zamansal ve mekânsal dağılımını doğrudan etkileyebilmektedir. Bu nedenle mikroplastikler, yalnızca bağımsız kirleticiler değil, aynı zamanda diğer kirleticilerin davranışını değiştiren ikincil bir risk faktörü olarak değerlendirilmelidir.

## **4. GÜNCEL BULGULARIN SENTEZİ**

### **4.1. Farklı çalışmalardan rapor edilen konsantrasyonlar**

Yeraltı sularında mikroplastik konsantrasyonlarına ilişkin çalışmalar sınırlı olmakla birlikte, mevcut veriler geniş bir değişkenlik aralığına işaret etmektedir. Çeşitli çalışmalarda mikroplastik konsantrasyonlarının birkaç parçacık/L seviyesinden onlarca parçacık/L seviyesine kadar değiştiği rapor edilmiştir (Mintenig et al. (2019); Panno et al. (2019)). Özellikle karstik ve yüzeye yakın akiferlerde daha yüksek konsantrasyonlar gözlenirken, derin ve iyi korunmuş akiferlerde mikroplastik varlığı daha düşük düzeylerde tespit edilmektedir. Ancak örnekleme ve analiz yöntemlerindeki farklılıklar, çalışmalar arasında doğrudan karşılaştırma yapılmasını zorlaştırmaktadır.

### **4.2. Polimer türleri ve boyut dağılımları**

Yeraltı sularında en yaygın tespit edilen polimer türleri arasında polietilen (PE), polipropilen (PP), polistiren (PS) ve polietilen tereftalat (PET) öne çıkmaktadır (Mintenig et al. (2019); Kirstein et al. (2021)). Bu polimerler, yaygın kullanım alanları ve çevresel dayanıklılıkları nedeniyle hidrolojik sistemlere kolaylıkla taşınabilmektedir.

Boyut dağılımları incelendiğinde, mikroplastiklerin çoğunlukla 1–100 µm aralığında yoğunlaştığı, ancak daha küçük fraksiyonların (özellikle <10 µm) analitik sınırlamalar nedeniyle yeterince temsil edilemediği belirtilmektedir (Koelmans et al. (2019)). Bu durum, gerçek konsantrasyonların rapor edilen değerlerden daha yüksek olabileceğine işaret etmektedir.

#### 4.3. Sığ–derin akifer karşılaştırmaları

Sığ akiferler, yüzeysel kaynaklarla doğrudan etkileşim içinde olmaları nedeniyle mikroplastik kirliliğine daha açık sistemlerdir. Tarımsal faaliyetler, atık depolama alanları ve yüzeysel akış, mikroplastiklerin bu sistemlere girişini kolaylaştırmaktadır (Panno et al. (2019)). Buna karşılık, derin akiferler genellikle daha uzun yeraltı suyu kalış süreleri ve daha düşük hidrolik iletkenlik nedeniyle mikroplastik girişine karşı daha korunaklıdır.

Ancak son çalışmalar, uygun jeolojik koşullar altında mikroplastiklerin daha derin akiferlere kadar taşınabileceğini göstermektedir (Lapworth et al. (2017)). Özellikle kırıklı kaya ortamları ve karst sistemleri, mikroplastik taşınımı için potansiyel hızlı geçiş yolları sunmaktadır. Bu durum, yeraltı suyu kaynaklarının sanılandan daha geniş bir risk altında olabileceğini ortaya koymaktadır.

### 5. TÜRKİYE PERSPEKTİFİ

Türkiye’de mikroplastik kirliliğine yönelik çalışmalar son yıllarda artış göstermiş olsa da, araştırmaların büyük ölçüde denizel ve yüzeysel su ortamlarına odaklandığı görülmektedir. Özellikle Marmara Denizi, Karadeniz ve Akdeniz kıyılarında yapılan çalışmalar mikroplastiklerin yaygınlığını ortaya koymuştur (Gündoğdu and Çevik (2017); Aytan et al. (2016)). Buna karşılık, yeraltı suyu sistemlerinde mikroplastik varlığına ilişkin çalışmalar oldukça sınırlıdır ve Türkiye’ye özgü doğrudan saha verileri yok denecek kadar azdır.

Son yıllarda musluk suyu ve şişelenmiş içme sularında mikroplastik varlığını ortaya koyan çalışmalar da bulunmaktadır. Küresel ölçekte yapılan araştırmalar, musluk suyu örneklerinde mikroplastik tespit edildiğini göstermekte olup (Kosuth et al. (2018)), Türkiye’de gerçekleştirilen sınırlı sayıda çalışma da benzer şekilde içme suyu sistemlerinde mikroplastik varlığına işaret etmektedir (Karami et al. (2017)). Ancak bu çalışmaların büyük kısmı arıtılmış suya odaklanmakta olup, kirleticinin yeraltı suyu kökenine ilişkin ayrıntılı değerlendirmeler içermemektedir.

Türkiye’nin farklı hidrojeolojik ortamlara sahip olması (karstik, alüvyal ve kırıklı kaya akiferleri) dikkate alındığında, mikroplastiklerin bu sistemlerdeki davranışına ilişkin veri eksikliği önemli bir araştırma boşluğu oluşturmaktadır. Bu durum, hem içme suyu güvenliği

hem de yeraltı suyu yönetimi açısından kritik bir belirsizlik yaratmakta ve standart yöntemlerle yürütülecek kapsamlı saha çalışmalarına duyulan ihtiyacı ortaya koymaktadır.

## 6. SONUÇ VE DEĞERLENDİRME

Yeraltı sularında mikroplastik kirliliği, etkileri henüz tam olarak ortaya konulamamış ancak giderek önem kazanan bir çevresel risk alanıdır. Mevcut çalışmalar, özellikle yeraltı suyu sistemlerine özgü veri eksikliği, standart analiz yöntemlerinin yetersizliği ve küçük boyutlu parçacıkların tespitindeki sınırlamalar nedeniyle önemli bilgi boşlukları barındırmaktadır.

Türkiye özelinde ise araştırmaların büyük ölçüde denizel ve yüzeysel sularla sınırlı kalması, yeraltı suyu sistemlerinin bu yeni kirletici açısından neredeyse hiç değerlendirilmemiş olduğunu göstermektedir. Oysa farklı hidrojeolojik özelliklere sahip akiferlerin varlığı, mikroplastiklerin taşınımı ve birikimi açısından ülkeye özgü önemli riskler barındırmaktadır.

Bu nedenle, gelecekteki çalışmaların Türkiye’de farklı akifer tiplerini kapsayan sistematik saha araştırmalarına yönelmesi, standart izleme ve analiz protokollerinin geliştirilmesi ve uzun dönemli veri üretiminin sağlanması gerekmektedir. Politika düzeyinde ise mikroplastiklerin su kalitesi izleme programlarına dahil edilmesi, plastik kullanımının azaltılmasına yönelik önleyici stratejilerin güçlendirilmesi ve yeraltı suyu koruma politikalarının bu kirletici grubunu kapsayacak şekilde güncellenmesi kritik önceliklerdir.

Bu bütüncül yaklaşım, yeraltı suyu kaynaklarının sürdürülebilir yönetimi ve içme suyu güvenliğinin sağlanması açısından kaçınılmazdır.

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Artan organik atık miktarı ve sürdürülebilir atık yönetimi ihtiyacı, biyolojik arıtma teknolojilerine olan ilgiyi artırmıştır. Bu bağlamda vermikompostlaştırma, organik atıkların yüksek kaliteli gübreye dönüştürülmesinde çevre dostu ve etkin bir yöntem olarak öne çıkmaktadır. Ancak sürecin verimliliği büyük ölçüde kullanılan reaktör sisteminin tasarımına ve işletme koşullarına bağlıdır. Bu çalışmada, farklı vermireaktör tasarımlarının performansı literatür verileri ışığında karşılaştırmalı olarak değerlendirilmiştir.

İncelenen çalışmalar, sürekli beslemeli sistemlerin geleneksel yığın (batch) ve windrow sistemlerine kıyasla daha yüksek stabilite ve süreç kontrolü sağladığını göstermektedir. Özellikle çok bölmeli reaktörlerin, organik maddenin parçalanma hızını artırdığı ve daha kısa sürede olgun vermikompost üretimine olanak tanıdığı belirlenmiştir. Yüksek hızlı reaktör sistemlerinde işlem süresinin önemli ölçüde kısaldığı ve elde edilen ürünün gübre özellikleri açısından daha üstün özellikler sergilediği rapor edilmiştir. Ayrıca akıllı kapalı reaktörlerde sıcaklık, nem ve havalandırma gibi parametrelerin kontrolü sayesinde hem solucan aktivitesinin arttığı hem de koku ve sızıntı problemlerinin minimize edildiği görülmüştür.

Sonuç olarak, vermikompostlamada reaktör tasarımının kritik bir belirleyici olduğu; özellikle sürekli beslemeli ve kapalı sistemlerin, büyük ölçekli uygulamalar için daha sürdürülebilir ve verimli çözümler sunduğu değerlendirilmiştir. Bu çalışma, uygun reaktör seçiminin atık türüne ve işletme hedeflerine göre optimize edilmesi gerektiğini ortaya koyarak gelecekteki uygulamalara yönelik önemli çıkarımlar sunmaktadır.

**Anahtar kelimeler:** Vermikompost, Vermireaktör, Sürekli beslemeli sistemler, Kesikli sistemler, Organik atık yönetimi

**ABSTRACT**

Increasing amounts of organic waste and the need for sustainable waste management have increased interest in biological treatment technologies. In this context, vermicomposting stands out as an environmentally friendly and effective method for converting organic wastes into

high-quality fertilizer. However, the efficiency of the process largely depends on the design of the reactor system used and the operating conditions. In this study, the performance of different vermireactor designs was comparatively evaluated in the light of literature data.

The examined studies indicate that continuous feeding systems provide higher stability and process control compared to traditional batch and windrow systems. In particular, multi-compartment reactors were determined to increase the degradation rate of organic matter and enable the production of mature vermicompost in a shorter time. In high-speed reactor systems, it has been reported that the processing time is significantly shortened and that the obtained product exhibits superior properties in terms of fertilizer characteristics. In addition, in smart closed reactors, it has been observed that, thanks to the control of parameters such as temperature, moisture, and aeration, both worm activity increases and odor and leachate problems are minimized.

As a result, reactor design is a critical determinant in vermicomposting; it has been evaluated that continuous feeding and closed systems offer more sustainable and efficient solutions for large-scale applications. This study presents important implications for future applications by revealing that the appropriate reactor selection should be optimized according to the type of waste and operational objectives.

**Keywords:** Vermicomposting, Vermireactor, Continuous feeding systems, Batch systems, Organic waste management

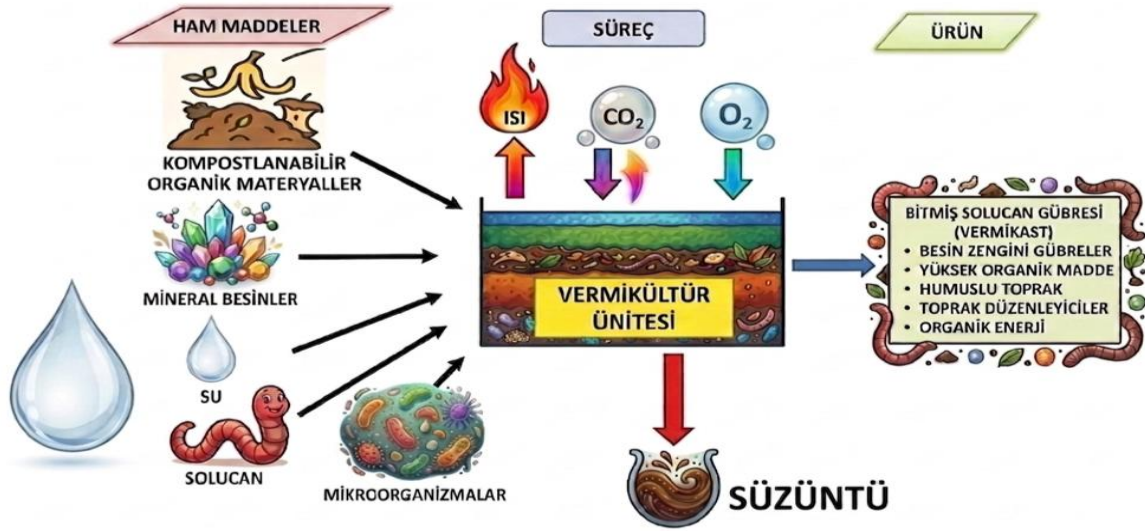
## 1. GİRİŞ

Çevresel sürdürülebilirliği sağlarken, yüksek değerli çevre dostu gübre ürünleri üretmek için atık işleme miktarını, kalitesini ve hızını artırma ihtiyacı oldukça önemlidir. Solucan kompostlama, endüstriyel, evsel, belediye ve tarımsal atıkların değerlendirilmesi için iyi bir teknolojidir. Geçmişten günümüze çeşitli solucan kompostlama teknolojileri kullanılmaktadır. Bu teknolojiler, sıra halinde , küçük ölçekli ve kesikli sistem olarak solucan kompostlamadan büyük ölçekli sürekli akış sistemlerine kadar uzanmaktadır. Bu süreçlerin her birinin kendine özgü avantajları ve dezavantajları vardır. Organik atıkların verimli bir şekilde işlenmesi için verimikompostlama teknolojisi halen gelişim aşamasındadır.

## 2. VERMİKOMPOSTLAMA

Vermikompostlama, toprak solucanları ve mikroorganizmaların birlikte çalışarak organik atıkları biyooksidatif aerobik bir süreçle doğal gübreye dönüştürdüğü çevre dostu bir yöntemdir. Bu işlemde, hızlı üreme ve etkili kompostlama yetenekleriyle bilinen bazı toprak solucanlarının doğal ayrıştırma kapasitesinden yararlanır (Garg and Gupta, 2011). Başarılı bir

vermikompostlama sisteminin anahtarı, solucanlar için uygun bir ortam oluşturmaktır. Parçalanmış kâğıt, karton veya lifli bitkisel atıklar, mutfak atıkları, hayvan gübresi vb. organik maddeler vermikompost eldesinde kullanılan başlıca malzemelerdir. Bu malzemeler solucanların sağlığı ve aktivitesi için gerekli olan optimum nem ve besin seviyesini sağlar (Pirsaheb et al., 2013). Ayrıca yeterli hava akışı sağlayarak solucanlar için zararlı olan anaerobik koşulların oluşmasını engeller. Yatak materyali, solucanların sisteme yerleştikten sonra kolayca erişebileceği bir besin kaynağı görevi görür. Solucanlar bu organik maddeleri hızla tüketir ve bunları “vermikompost” olarak adlandırılan besin açısından zengin bir biyogübreye dönüştürür (Bhat et al., 2018). Bu son ürün; azot, fosfor, potasyum ve kalsiyum gibi önemli bitki besin elementlerini zengin bir şekilde içerir (Sharma and Garg, 2018). Vermikompostlama işlemi Şekil 1’de özetlenmiştir.



Şekil 1. Vermikompostlama İşlemi

Geleneksel atık yönetim yönteminde sıklıkla düzenli depolama alanları (landfill) kullanılır. Fakat alan gereksinimi, metan salınımı (güçlü bir sera gazı), çöp sızıntı suyu (ağır metaller, pestisitler vb.) vb. durumlar çevresel sorunlara neden olur (Ghosh et al., 2023; Roy et al., 2024; Roy et al., 2023; Moulick et al., 2024). Vermikompostlama ise organik atıkları depolama alanlarından uzaklaştırarak değerli bir kaynağa dönüştüren kapalı bir sistem sunar. Genellikle göz ardı edilen mutfak atıkları (sebze kabukları, meyve artıkları, yumurta kabukları ve kahve telvesi gibi) solucanlar için besin sağlar. Bu çalışkan ayrıştırıcılar organik maddeleri etkin bir şekilde parçalayarak organik atık hacmini önemli ölçüde azaltırken çöp depolama alanlarına

giden atık miktarının da azalmasını sağlar. Araştırmalar, vermikompostlamanın evsel gıda atıklarının %80'ini organik gübreye dönüştürebileceğini ve böylece atık azaltma girişimlerine önemli katkı sağladığını göstermektedir (Sharma ve Garg, 2019).

Vermikompostlama, iki önemli soruna sürdürülebilir bir çözüm sunar: atık yönetimi ve toprak iyileştirme. Kentleşme ve sanayileşmenin artmasıyla birlikte organik atık üretiminde de benzer bir artış görülmektedir. Vermikompost, toprak yapısını, havalanmasını ve su tutma kapasitesini iyileştirerek toprak sağlığına katkı sağlar (Karmakar et al., 2015). Solucanlar; azot, fosfor, potasyum ve bitki gelişimi için gerekli eser elementleri içeren humus üretir (Chatterjee, Debnath and Mishra, 2020). Ayrıca vermikompost, besin döngüsünde, hastalıkların baskılanmasında ve organik maddenin parçalanmasında önemli rol oynayan faydalı mikroorganizmaları toprağa kazandırır. Artan mikrobiyal aktivite, yalnızca toprak verimliliğini artırmakla kalmaz, aynı zamanda bitkilerin zararlılara ve hastalıklara karşı direncini de güçlendirir ve böylece sürdürülebilir tarımsal üretimi destekler (Majumdar et al., 2024; Majumdar et al., 2023; Deb et al., 2023; Pattnaik et al., 2023; Pathma and Sakthivel, 2012).

Vermikompostlama yalnızca çevresel açıdan değil, aynı zamanda ekonomik ve sosyal açıdan da önem taşır. Düşük maliyetli ve basit bir çözüm sunarak kırsal tarım alanlarından büyük şehirlerdeki evlere kadar farklı ortamlarda uygulanabilir. Kolay uygulanabilir olması, sınırlı kaynaklara sahip az gelişmiş bölgelerde atık yönetimi programları ve sürdürülebilir tarım uygulamaları için etkili bir araç olmasını sağlar (Thiruneelakandan ve Subbulakshmi, 2014). Vermikompostlama, diğer sürdürülebilir tarım ve atık yönetimi faaliyetlerine kolaylıkla entegre edilebilir. Organik tarımda kullanılmaya uygundur, toprak sağlığını korur ve sentetik gübre ile pestisit ihtiyacını azaltır. Besin açısından zengin olan solucan gübresi (vermicast), ürün verimini artırır ve tarımsal ürün kalitesini iyileştirerek pazarda daha yüksek fiyatlar elde edilmesini sağlar (Kaur, 2020).

Vermikompostlama, sıfır atık toplulukları oluşturmayı hedefleyen kapsamlı planların bir parçası olarak kentsel alanlara da entegre edilebilir. Evsel ölçekteki vermikompostlama üniteleri, belediye atık yönetim sistemleri üzerindeki yükü azaltabilir, çöp toplama kaynaklı taşıma maliyetlerini ve emisyonları düşürebilir ve sürdürülebilir faaliyetlere yerel katılımı teşvik edebilir. Okullar, kamusal kurumlar ve işletmeler, kendi organik atıklarını yerinde etkili bir şekilde yönetmek için vermikompostlama uygulayarak potansiyel bir atık sorununu değerli bir kaynağa dönüştürebilir (Sim and Wu, 2010).

Ayrıca, vermikompostlama gübrenin etkin bir şekilde yönetilmesi yoluyla hayvancılığı geliştirebilir. İşlenmemiş hayvan atıklarının biriktirilmesi veya rastgele dağıtılması, besin

maddelerinin kaybına ve kirliliğe yol açarken, vermikültür sistemlerinin kullanımı besin maddelerini stabilize eder, zararlı mikroorganizmaların varlığını azaltır ve meralar ile tarım alanlarını iyileştirmek için kullanılacak yüksek kaliteli doğal organik gübre üretir (Ambasta ve Kumari, 2013).

Birleşmiş Milletler tarafından 2015 yılında belirlenen ve 2030 yılına kadar ulaşılması hedeflenen 17 küresel Sürdürülebilir Kalkınma Amacı (Sustainable Development Goals SDG) yayınlamıştır. Amaçlar; yoksulluğun azaltılması, çevrenin korunması ve herkes için daha iyi yaşam koşullarının sağlanması gibi temel konuları kapsar. Vermikompostlama, SDG 2 (Açlığa Son): Gıda güvenliğini sağlamak, SDG 12 (Sorumlu Tüketim ve Üretim): Atıkların sürdürülebilir yönetimi ve SDG 13 (İklim Eylemi): İklim değişikliğiyle mücadele amaçlarıyla tam uyum gösteren bir yöntemdir.

### 2.1. Vermikompost Üretimi ve Solucanların rolü

Toprak solucanları, doğal biyoreaktörler gibi çalışarak karmaşık organik bileşiklerin daha basit yapılara parçalanmasını sağlarlar. Vermikompostlaştırmada kullanılan başlıca türler olan kırmızı Kaliforniya solucanları (*E. fetida*), Avrupa gece solucanları (*Eisenia hortensis*) ve Afrika gece solucanları (*Eudrilus eugeniae*), organik atıkları parçalamadaki etkinlikleri ve kompostlama koşullarına uyum sağlama kapasiteleri nedeniyle tercih edilen türlerden bazılarıdır (Ansari and Ismail, 2012).

Organik madde bir vermikompost sistemine eklendiğinde, solucanlar bu maddeyi tüketir ve sindirim sürecini başlatır. Solucanın sindirim kanalından geçiş sırasında materyal parçalanarak sindirim enzimleri ve faydalı mikroorganizmalarla iyice karışır. Bu süreç yalnızca mekanik bir parçalanma değil, aynı zamanda kimyasal dönüşümü de içerir. Sonuçta vermikast olarak adlandırılan, besin maddelerince zengin bir ürün oluşur (Bhat et al., 2018). Vermikast, yüksek humus, besin maddesi ve faydalı mikroorganizma içeriği nedeniyle son derece önemli bir nihai üründür (Domínguez, 2018).

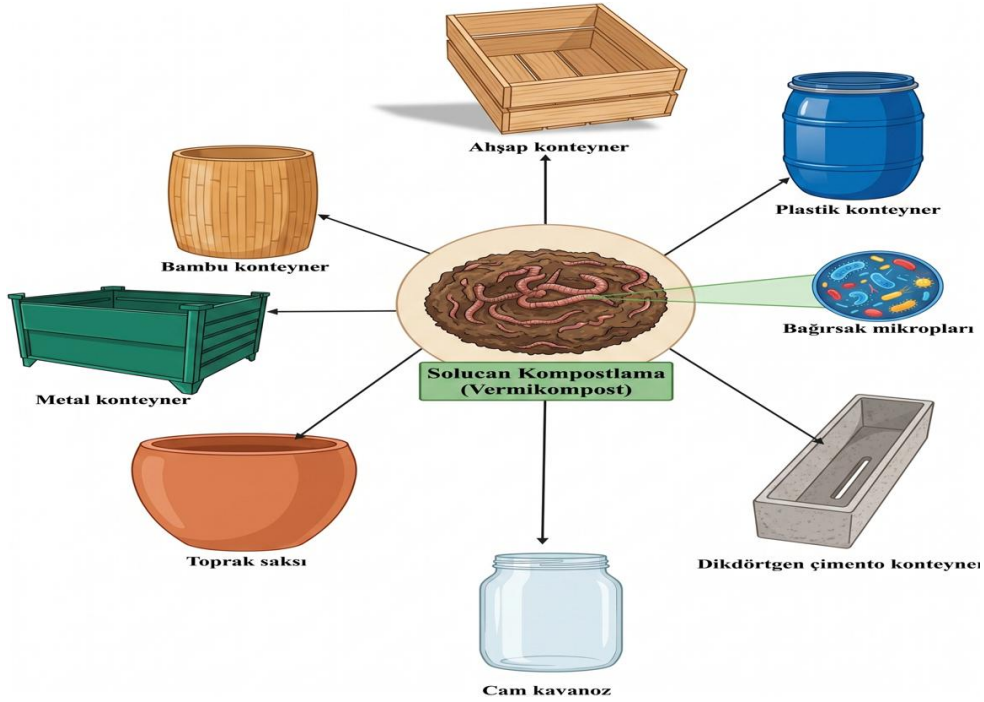
Solucanların bağırsak sistemi, solucanlar ile mikroorganizmalar arasında simbiyotik bir ilişkiyi destekleyen özgün bir mikro ortam oluşturur. Bakteriler, mantarlar ve protozoalar gibi mikroorganizmalar, organik maddenin ayrışmasında temel rol oynar. Bu organizmalar karmaşık molekülleri bitkilerin kolayca kullanabileceği basit formlara dönüştürür (Gómez-Brandon and Domínguez, 2014). Ayrıca solucanların substrat içerisindeki hareketi havalanmayı ve drenajı artırarak, etkili ayrışma için gerekli olan aerobik koşulların korunmasına katkı sağlar (Huang et al., 2014).

### 3. VERMİREAKTÖRLER

#### 3.1. Reaktör tasarımı ve yapımında kullanılan malzemeler

Solucan kompostlama teknolojisinde kullanılan malzeme seçimi ve vermireaktörün imalatı, atık arıtma sürecinin ölçeğine, arıtılacak atık miktarına, maliyete ve balıkçılık, ihracat, vermikompost üretimi veya sadece biyoremediasyon için solucan yetiştiriciliği (solucan kültürü) gibi amaçlara bağlıdır. Kütle akış hızı, vermikompostlama dönüş süresi ve kullanılan otomasyon veya teknoloji derecesi, reaktörlerin boyutunu, kapasitesini ve bileşenlerini belirleyen faktörler arasındadır. Solucan kompostlamanın amacı atık yönetimi, atık azaltımı, vermikompost üretimi ve vermikültürdür (solucan üretimi). Bu parametrelerin her biri, vermireaktörün yapımında kullanılacak veya vermireaktör olarak benimsenecek malzeme türünü belirler. Bugüne kadar yaygın olarak solucan reaktörü olarak kullanılan malzemeler arasında plastik kaplar ( Li et al., 2020 ; Zhi-Wei et al., 2019 ), kil kaplar (toprak reaktör) (Deepthi et al., 2021; Paul et al., 2018), ahşap kaplar ( Komakech et al., 2016 ), metal kaplar ( Santana et al., 2020 ), cam kavanozlar ( Hénault-Ethier et al., 2016 ) ve beton dikdörtgen havuz benzeri yapılar ( Gopal et al., 2017 ; Hanc et al., 2019 ) bulunmaktadır ( Şekil 2 ).

Solucan kutuları; üst üste yerleştirilebilir tepsiler, sürekli akışlı (flow-through) sistemler ve temel tek katmanlı kaplar gibi farklı biçimlerde bulunur. Kutunun seçimi, yapılacak işlemin büyüklüğüne ve mevcut alanın durumuna bağlıdır. Uygun bir tasarım, hem solucanların sağlığı ve aktivitesi için gerekli olan yeterli hava dolaşımını hem de ortam neminin korunmasını sağlar (Declaro, 2018). Kutular plastik, ahşap veya metalden yapılabilir. Plastik kutular hafif ve dayanıklıdır ancak daha fazla havalandırma gerektirir. Ahşap kutular gözeneklidir fakat zamanla bozulabilir. Metal kutular dayanıklıdır ancak korozyona karşı hassastır (Manaf et al., 2009).



**Şekil 2.** Vermikompostlama Reaktörlerinde Kullanılan Malzemeler

### 3.2. Modüler tepsi sistemler

Bu sistemler, dikey olarak üst üste yerleştirilmiş çok sayıda tepside oluşur. Solucanlar bir tepsideki materyalin ayrışmasını tamamladıktan sonra, yeni besin içeren bir üst tepsiye geçerler. Bu sistemde alan verimli kullanılır, alt tepsilere vermikastın çıkarılması kolaydır ve solucanların yukarı doğru hareket etmesi sayesinde kesintisiz bir işlem sağlanır. Uygun göçün sağlanması ve tepsilere aşırı popülasyonun önlenmesi için düzenli izleme gereklidir (Manyuchi et al., 2013).

### 3.3. Sürekli sistemler (Flow-through)

Bu sistemler, organik materyalin üstten sürekli olarak beslenmesi ve tamamlanmış vermikastın alttan toplanması prensibiyle çalışır. Genellikle, işlenmiş materyalin aşağı geçmesine izin verirken solucanları içeride tutan bir ağ veya ızgara içerir. Vermikastın verimli şekilde işlenmesi ve kolayca ayrılması sağlanarak bu sistem büyük ölçekli uygulamalar için uygun hale gelir. Ancak bu süreç, kullanılan besleme materyallerinin dikkatli kontrolünü ve tıkanmaların önlenmesi için tamamen ayrılmış kompostun sık sık uzaklaştırılmasını gerektirir (Lin et al., 2021).

### 3.4. Tek katmanlı kaplar (Monolayer containers)

Bunlar, organik maddenin yerleştirildiği ve tek bir katman halinde işlem gördüğü basit kaplardır. Plastik küvetler, ahşap kutular veya havalandırma açıklıkları bulunan benzer kaplar bu gruba girer. Ekonomik, kurulumu kolay ve küçük ölçekli ya da evsel kullanım için uygundur. Bu sistemde, yeterli havalandırma ve nem seviyesinin korunması için düzenli bakım yapılmalıdır.

ve tamamlanmış komposttan solucanların fiziksel olarak ayrılması sağlanmalıdır (Sahoo et al., 2023).

#### **4. VERMİREAKTÖR SİSTEMLERİNDE ARAŞTIRMA BOŞLUKLARI ve GELECEK PERSPEKTİFLERİ**

Organik atıkların işlenmesinde ve besin açısından zengin solucan gübresi üretiminde solucan kompostlamasının verimliliği ispatlanmıştır. Laboratuvar ve pilot ölçekli çalışmaların büyük çoğunluğu, çeşitli solucan kompostlama teknolojilerinin arıtma potansiyelini değerlendirmiştir (Enebe et al., 2023). Bununla birlikte, sürekli bir reaktörde olgun solucan gübresi ile reaktörlerin arıtma verimliliği arasındaki ilişkide solucan kompostundaki mikrobiyal topluluk, mevcut besinler veya solucan kompostunda bulunan enzimlerin rolü henüz tam olarak açıklanamamıştır. Solucan reaktörü olarak kullanılan malzemelerin, enzim aktiviteleri, solucanların performansı ve ortamdaki mikroorganizmalar üzerinde etkileri olup olmadığını açıklayan araştırmalara ihtiyaç vardır. Ayrıca, çalışmalar, yatak malzemesinin solucanlar ve mikroplar tarafından organik atıkların genel ayrışması üzerindeki etkisini değerlendirmeli ve bunu solucanların substrat tercihiyle ilişkilendirmelidir. Araştırmalar, anaerobiyoz gelişimini önlemek için reaktör içinde havanın serbest akışına yardımcı olacak yatak malzemesinin seçimine ve formülasyonuna da odaklanmalıdır (Pattnaik et al., 2026). Reaktör geometrisine ve bunun vermireaktörler içindeki substrat-enzim reaksiyonlarıyla nasıl ilişkili olduğuna dikkat edilmelidir. Bununla birlikte, ilerleyen süreçte, özellikle sürekli vermikompostlama sürecinde, bu bilgi açığını kapatmak ve çeşitli endüstriyel, tarımsal ve belediye ortamlarından kaynaklanan büyük miktarda atığın verimli bir şekilde işlenmesi için süreci otomatikleştirmek ve tamamen geliştirmek amacıyla kapsamlı araştırmalar yapılmalıdır.

#### **5. SONUÇ**

Günümüzde kullanılan çeşitli teknolojilerin solucan kompostlama potansiyelinin belirlenmesi, verimli büyük ölçekli atık yönetimi için uygun teknolojinin benimsenmesini sağlamak açısından hayati önem taşımaktadır. Dikkat çekici olan, her reaktörün kendine özgü güçlü ve zayıf yönlerinin olmasıdır. Kesikli sistem doldur boşalt reaktörlerin kurulum maliyetleri düşük olmakla birlikte işçilik maliyeti yüksektir. Ayrıca reaktör içerisinde anaerobik ortam oluşumu yaygın bir sorundur. Öte yandan sürekli proses, büyük miktarda atığı işlemek için çok etkilidir, çalıştırmak için daha az iş gücü gerektirir, ancak bakım ve yönetim için bazı teknik bilgiler gerektirebilir. Genel olarak, solucan kompostlama teknolojisi, atık biyodönüşüm sürecindeki verimliliği ve çevre dostu olması nedeniyle, atık işleme için geleneksel kompostlama yöntemine göre atık değerlendirme ve yönetiminde çok daha iyidir. Bu teknoloji, sera gazı

emisyonlarının azalması, kokunun en aza indirilmesi, enzim aktivitelerinin artması, hızlı biyokütle geri dönüşümü, solucan yetiştiriciliği üretimi ve mevsimsel farklılıklara toleransı açısından daha uygun olması gibi önemli değerlere ve çevresel sonuçlara sahiptir. Gelecekteki çalışmalar, hızlı atık arıtımına yardımcı olmak için geri dönüştürülmüş olgun solucan gübresinin potansiyelini, solucan reaktörü malzeme-enzim etkileşimlerini, kolay havalandırılan yatak malzemesinin seçimi ve formülasyonunu ve atık biyodönüşüm sürecini kolaylaştırmada reaktör geometrisini araştırmalıdır.

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**DÖKECEK KÖYÜ (OVACIK/KARABÜK) KIRSAL MİMARİSİNDE GELENEKSEL KONUTLARIN MİMARİ ÖZELLİKLERİ ÜZERİNE BİR İNCELEME****Öğr. Gör. Dr. Elif ÇETİN**

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Bu çalışma, Karabük ili Ovacık ilçesine bağlı Dökecek köyünde yer alan geleneksel konutların kırsal mimari bağlamda incelenmesini amaçlamaktadır. Kırsal mimari, yerel malzeme kullanımı, yapım teknikleri ve çevresel koşullara uyum çerçevesinde şekillenen özgün bir üretim alanı olup, bölgesel kimliğin önemli bir göstergesidir. Bu doğrultuda, çalışma alanında bulunan konutlar yerinde gözlem ve belgeleme yöntemleri kullanılarak analiz edilmiş; plan şemaları, taşıyıcı sistem özellikleri, malzeme kullanımı ve mekânsal organizasyonları değerlendirilmiştir. Elde edilen bulgular, Dökecek köyündeki geleneksel konutlarda zemin katlarda yığma taş, üst katlarda ise ahşap karkas sistemin yaygın olarak kullanıldığını ortaya koymaktadır. Yapıların büyük çoğunluğunun dış sofalı plan tipine sahip olduğu; çardak, çıkma ve ıslak hacim gibi mekânsal unsurların, kırsal yaşam biçiminin mekâna yansımaları olarak belirleyici rol oynadığı tespit edilmiştir. Ayrıca konutların topoğrafyaya uyumlu biçimde konumlandığı ve işlevsel plan kurgularına sahip olduğu görülmüştür. Bununla birlikte, yerleşimdeki geleneksel konutların önemli bir bölümünün terk edildiği, kullanım dışı kalma ve bakım eksikliği nedeniyle fiziksel bozulma sürecine girdiği belirlenmiştir. Özellikle çatı örtüsü, ahşap doğrama elemanları ve cephe yüzeylerinde meydana gelen hasarların, yapıların taşıyıcı sistem bütünlüğünü zayıflattığı ve yıkılma riskini artırdığı gözlemlenmiştir. Ayrıca, bilinçsiz onarım müdahaleleri ve modern malzeme kullanımı, yapıların özgün mimari karakterini olumsuz etkilemektedir. Sonuç olarak, Dökecek köyü geleneksel konutları, Batı Karadeniz kırsal mimarisinin karakteristik özelliklerini yansıtan önemli bir kültürel miras niteliği taşımaktadır. Bu yapıların korunabilmesi için kapsamlı belgeleme çalışmalarının artırılması, uygun koruma ve restorasyon stratejilerinin geliştirilmesi ve yerel ölçekte farkındalık oluşturulması gerekmektedir.

**Anahtar kelimeler:** Kırsal mimari, geleneksel konut, Karabük-Ovacık, Dökecek köyü

**AN INVESTIGATION ON THE ARCHITECTURAL CHARACTERISTICS OF  
TRADITIONAL HOUSES IN THE RURAL ARCHITECTURE OF DÖKECEK  
VILLAGE (OVACIK/KARABÜK)****ABSTRACT**

This study aims to examine the traditional houses located in Dökecek Village, in the Ovacık district of Karabük province, within the context of rural architecture. Rural architecture represents a distinctive field shaped by the use of local materials, construction techniques, and adaptation to environmental conditions, and serves as an important indicator of regional identity. In this context, the houses in the study area were analyzed through on-site observation and documentation methods; their plan schemes, structural systems, material usage, and spatial organization were evaluated. The findings reveal that traditional houses in Dökecek Village commonly employ masonry stone construction on the ground floor and timber frame systems on the upper floors. It has been determined that the majority of the houses have an outer hall plan type, and that spatial elements such as the “çardak” (open hall), projections, and wet spaces play a defining role as reflections of rural life. In addition, the houses are positioned in harmony with the topography and exhibit functional spatial layouts. However, it has been observed that a significant portion of these traditional houses has been abandoned and is undergoing physical deterioration due to lack of use and maintenance. Damage to roof coverings, wooden joinery, and façade surfaces weakens the structural integrity of the buildings and increases the risk of collapse. Furthermore, unconscious repair interventions and the use of modern materials negatively affect the original architectural character of the structures. In conclusion, the traditional houses of Dökecek Village constitute an important part of the rural architectural heritage of the Western Black Sea Region. In order to ensure their preservation, it is necessary to enhance documentation studies, develop appropriate conservation and restoration strategies, and raise awareness at the local level.

**Keywords:** Rural architecture, traditional houses, Ovacık, Karabük, Dökecek Village

**1. GİRİŞ**

Konut olgusu, insanlık tarihinin en erken dönemlerinden günümüze kadar sürekliliğini koruyan temel bir mimari ve kültürel üretim alanıdır. Başlangıçta yalnızca barınma, korunma ve güvenlik ihtiyacını karşılamak amacıyla inşa edilen konutlar, zamanla toplumsal yapı, yaşam biçimi, kültürel değerler ve teknolojik gelişmeler doğrultusunda çeşitlenerek farklı işlevler üstlenmiştir. Bu süreçte konutlar, buldukları coğrafyanın iklimsel özellikleri, topoğrafyası, yerel malzeme olanakları ve kültürel birikimi ile şekillenmiş; böylece her bölgeye özgü geleneksel konut tipolojileri ortaya çıkmıştır (Batur ve Gür, 2005).

Anadolu coğrafyası, tarih boyunca farklı medeniyetlere ev sahipliği yapması nedeniyle konut mimarisinin çeşitlenmesinde önemli bir rol oynamıştır. Kültürel etkileşimler, dini inançlar, sosyal yapı ve Orta Asya'dan taşınan mimari gelenekler, Anadolu'daki konut anlayışının gelişiminde belirleyici olmuştur. Bu bağlamda geleneksel Türk evi, toplumun yaşam biçimi, aile yapısı ve günlük ihtiyaçlarına göre şekillenmiş; yüzyıllar boyunca farklı bölgelerde çeşitli biçimsel ve mekânsal varyasyonlar göstererek gelişmiştir (Kuban, 1995).

Geleneksel Türk evi, genel olarak Anadolu Evi veya Osmanlı Evi olarak da tanımlanmakta olup, belirli ortak planlama ilkeleri etrafında şekillenmektedir. Bölgesel farklılıklara rağmen bu yapılarda plan şeması, mekânsal organizasyonun temel belirleyicisi olarak öne çıkmakta; coğrafi olarak birbirinden uzak bölgelerde inşa edilen konutlarda dahi benzer plan kurgularının sürdürüldüğü görülmektedir. Bununla birlikte, yapıların biçimlenmesinde yalnızca plan şeması değil, yerel malzeme kullanımı, iklim koşulları ve yapım teknikleri de belirleyici unsurlar arasında yer almaktadır (Eldem, 1984).

Geleneksel konut mimarisi, bulunduğu çevrenin doğal ve kültürel özelliklerine doğrudan bağlı olarak gelişmiştir. İklim koşulları, jeolojik yapı ve yerel kaynaklar yapı tekniğini belirlerken; sosyal yaşam biçimi ve kültürel gelenekler mekânsal organizasyonu şekillendirmiştir. Bu doğrultuda kırsal konutlar, uzun süreli deneyim ve ihtiyaçlara bağlı olarak gelişmiş, işlevsel ve sürdürülebilir bir mimari anlayışın ürünü haline gelmiştir (Akgün, 2013).

Özellikle Karadeniz Bölgesi, topografik yapısı, iklimi ve yoğun orman varlığı nedeniyle ahşap ağırlıklı yapı geleneğinin geliştiği önemli bir kırsal mimari bölgedir. Bölgedeki konutlarda taş ve ahşabın birlikte kullanıldığı karma yapı sistemleri görülmekte; yerleşimler eğimli araziye uyumlu biçimde şekillenmektedir (Sümerkan, 1990). Bu durum, kırsal mimarinin yalnızca fiziksel bir üretim değil, aynı zamanda çevresel koşullara uyum sağlayan kültürel bir adaptasyon süreci olduğunu göstermektedir.

Geleneksel kırsal mimarinin korunması, yalnızca fiziksel yapıların değil, aynı zamanda bu yapılara bağlı yaşam kültürünün ve bilgi birikiminin sürdürülebilirliği açısından büyük önem taşımaktadır. Ancak kırsal alanlardan kentlere yönelik göç, kullanım dışı kalma, bakım eksikliği ve modern yapılaşma eğilimleri, bu yapıların hızla bozulmasına ve özgün niteliklerini kaybetmesine neden olmaktadır. Bu nedenle kırsal mimari mirasın belgelenmesi, korunması ve sürdürülebilirliğinin sağlanması gereklilik arz etmektedir (Eres, 2013).

Bu çalışma kapsamında Karabük ili Ovacık ilçesine bağlı Dökecek köyünde yer alan geleneksel konutlar, plan şeması, yapım tekniği, malzeme kullanımı ve mevcut durumları açısından incelenmiştir. Çalışmanın temel amacı, Dökecek köyündeki geleneksel konutların mimari

özelliklerini ortaya koymak, yapıların güncel durumlarını değerlendirmek ve karşı karşıya oldukları bozulma ve kaybolma risklerini tespit etmektir.

Araştırma kapsamında saha çalışması gerçekleştirilmiştir. Yerleşimde bulunan konutlar yerinde incelenmiş, yapıların plan özellikleri gözlemlenmiş, fotoğraflama ve belgeleme çalışmaları yapılmıştır. Elde edilen veriler doğrultusunda yapıların mekânsal kurgusu, malzeme kullanımı ve yapım teknikleri analiz edilerek mevcut durum değerlendirmesi yapılmıştır. Elde edilen bulguların, Batı Karadeniz kırsal mimari mirasının belgelenmesine katkı sağlaması ve benzer yerleşimlerde yapılacak koruma ve restorasyon çalışmalarına bilimsel bir temel oluşturması beklenmektedir.

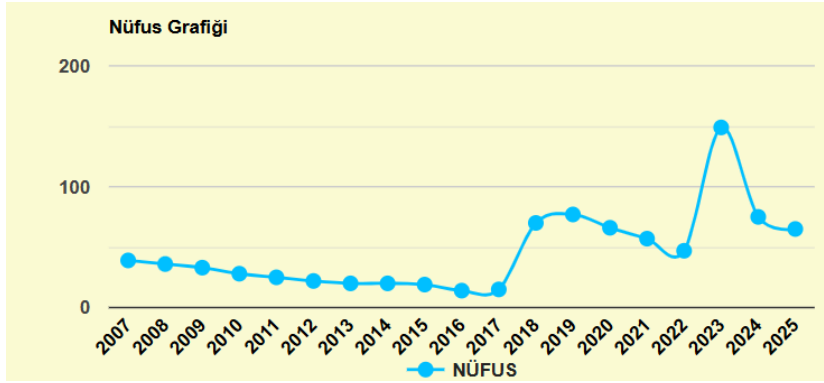
## 2. DÖKECEK KÖYÜ

Dökecek köyü Ovacık'ın güney ucunda yer almaktadır. Dökecek, kuzeyde Pelitçik ve Bölükören köyü, batıda Boduroğlu köyü, doğuda Yürekören köyü güneyde ise Sofuoğlu ve Yürekören köyleriyle sınırdır (Şekil 1). Dökecek köyü Merkez ve Sağıroğlu mahalleleri olmak üzere iki yerleşimden oluşmaktadır.



Şekil 1. Dökecek köyünün konumu

Dökecek köyünün nüfusu 1960'lı yıllarda 200'ün üzerinde iken, 2000'li yılların başında yaklaşık 30 kişiye kadar gerilemiştir (Yiğit, 2011). 2007–2025 yılları arasındaki nüfus değişimini gösteren grafiğe (Şekil 2) bakıldığında, özellikle 2018 ve 2023 yıllarında kısa süreli artışlar dikkat çekmektedir. Bu artışların, yerel seçim dönemlerinde köye geçici dönüşlerle ilişkili olduğu değerlendirilmektedir. Günümüzde ise köyde sürekli ikamet eden hane sayısının oldukça sınırlı olduğu ve yaklaşık 4–5 hane ile yerleşimin büyük ölçüde terk edildiği görülmektedir.



Şekil 2. Dökecek köyü nüfus grafiği (İnternet 1)

Dökecek köyü, ortalama 1230 m rakımda, eğimli bir topoğrafya üzerinde konumlanmaktadır. Köyün Merkez mahallesi; 26 konut, 1 cami ve 2 adet köy odasından oluşmaktadır (Şekil 3). Söz konusu köy odalarından biri günümüzde imam lojmanı olarak kullanılmaktadır. Kâgir sistemde inşa edilen cami yapısının cephe düzeni ve minare tasarımı, yerleşimdeki geleneksel kırsal mimari doku ile uyum göstermemektedir. İki katlı olarak inşa edilen yapının alt katı ise geçirdiği onarımlar sonrasında köy odası işlevi kazanmış olup, bayram ve cenaze gibi toplumsal etkinliklerde köy halkının bir araya geldiği ortak kullanım mekânı olarak değerlendirilmektedir (Çetin, 2026).



Şekil 3. Dökecek köyünün genel yerleşimi

### 2.1. Dökecek Köyü Geleneksel Konutları

Dökecek köyünde geleneksel yapıım teknikleri ve yerel malzemeler kullanılarak inşa edilmiş konutların büyük bir bölümünün günümüzde terk edilmiş olduğu görülmektedir. Köyde yaşamını sürdüren sınırlı sayıdaki kullanıcı ise ya betonarme olarak inşa edilen yeni yapılarda ikamet etmekte ya da mevcut geleneksel konutlarda kapsamlı değişiklikler yaparak bu yapıları kullanmaya devam etmektedir. Ancak söz konusu müdahaleler, özgün plan kurgusu, malzeme özellikleri ve cephe düzeni üzerinde önemli değişimlere yol açmakta; bu durum yapıların geleneksel kimliğini zayıflatarak özgün mimari karakterin kaybına neden olmaktadır.

Yerleşimde geleneksel konut niteliği taşıyan yapıların ana inşa malzemelerini taş ve ahşap oluşturmaktadır (Şekil 4). Bu konutlarda zemin katlar genellikle yığma taş duvar tekniği ile, üst katlar ise ahşap karkas sistemde inşa edilmiştir. Ahşap karkas sistemde dolgu malzemesi olarak taş ya da ahşap elemanların kullanıldığı görülmektedir. Bununla birlikte, bazı konutlarda zemin katın bir bölümünün ahşap karkas, diğer bölümünün ise yığma taş olarak inşa edildiği karma uygulamalara da rastlanmaktadır. Bu tür yapılarda ahşap karkas sistemle oluşturulan bölümlerde yaşam mekânları yer alırken, yığma taş duvarlı bölümler çoğunlukla ahır işlevi görmektedir. Duvarlarda kaplama malzemesi olarak kerpiç esaslı sıva kullanılmıştır. Günümüzde sıvalarda dökülmeler ve çatlaklar görülmektedir.



**Şekil 4.** Dökecek köyündeki geleneksel konut örnekleri

Bazı konutlarda, kat yüksekliği boyunca aşağı doğru devam eden ve yörede “taban hambarı” ya da “boy hambarı” olarak adlandırılan depolama birimleri bulunmaktadır. Yapıya bitişik olarak inşa edilen bu ambar bölümleri, iki kat yüksekliği boyunca kesintisiz devam etmektedir. Bu bölüm çantı tekniği ile inşa edilmiş olup dış cepheden açıkça algılanabilmektedir (Şekil 5).



**Şekil 5.** Taban hambarına sahip konut örneği

Geleneksel konutların çatıları beşik, üç omuz ve kırma çatı tiplerinde inşa edilmiş olup, en yaygın kullanılan çatı formunun kırma çatı olduğu görülmektedir. Çatıların özgün kaplama

malzemesi alaturka kiremittir. Ancak günümüzde gerçekleştirilen onarım müdahalelerinde, alaturka kiremitlerin kaldırılarak yerlerine Marsilya tipi kiremitlerin döşendiği ya da çatı yüzeyinin sac malzeme ile kaplandığı gözlemlenmektedir.

Dökecek köyündeki konutların pencere elemanları ahşap malzemeden üretilmiş olup giyotin (Şekil 6a) ya da kanatlı tiptedir. Kanatlı pencereler iki, üç veya dört kanatlı örnekler şeklinde çeşitlilik göstermektedir. Bazı giyotin pencere örneklerinde ahşap korkuluk uygulamalarına da rastlanmaktadır. Kullanım dışı kalan konutlarda, zarar gören pencere açıklıklarının ahşap levhalarla kapatılmaya çalışıldığı görülmektedir (Şekil 6b). Konutların giriş kapıları da ahşap malzemeli olup tek ya da çift kanatlı olarak düzenlenmiştir. Bu kapılar genellikle ahşabın doğal renginde bırakılmış olup (Şekil 6c yalnızca bazı örneklerde (Şekil 6d) boya uygulamasına rastlanmaktadır.



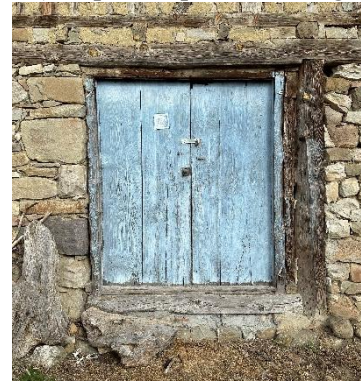
a) Giyotin pencere



b) Kapatılan pencere örneği



c) Tek kanatlı ahşap kapı



d) Hakkı Gökçe evi giriş kapısı

**Şekil 6.** Dökecek köyünde ahşap pencere ve kapı örnekleri

Dökecek köyündeki geleneksel konutların büyük bir bölümü günümüzde terk edilmiş durumdadır ve önemli bir kısmı strüktürel açıdan ciddi bozulmalar göstermektedir (Şekil 7). Özellikle çatı örtüsünde meydana gelen hasarlar, yapı içerisine su ve nem girişini hızlandırmakta; bu durum taşıyıcı sistem elemanlarında zayıflamalara yol açarak yapıların zamanla kısmen ya da tamamen yıkılmasına neden olmaktadır.



**Şekil 7.** Çatısı ve taşıyıcı sistemi zarar gören konut örneği

Çalışma kapsamında yerleşimde bulunan Recep Kocatarla evi yerinde incelenmiş ve yapı içerisine girilerek detaylı tespitler yapılmıştır. Geleneksel yapım teknikleri ve yerel malzemeler kullanılarak inşa edilen konut, eğimli bir arazi üzerinde konumlanmaktadır. 1960 yılında inşa edilen yapı, sahiplerinin kısa süre sonra vefat etmesi nedeniyle uzun yıllardır kullanılmamakta ve terk edilmiş durumdadır.

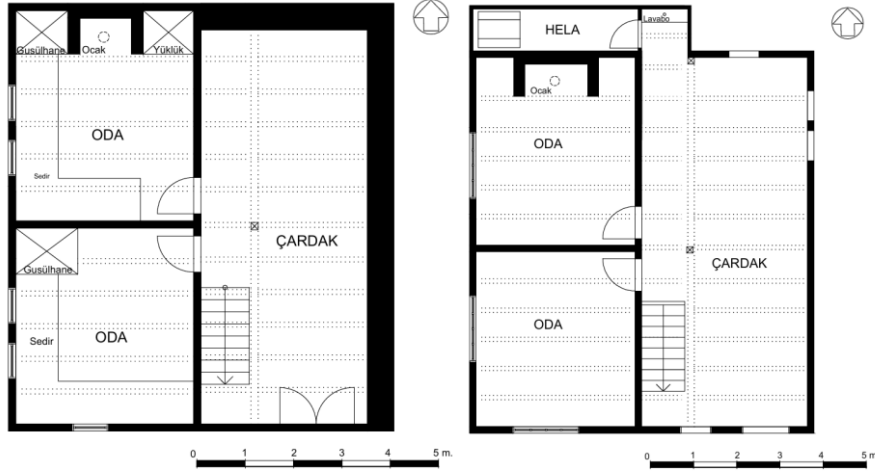
Konutun zemin katında doğu cephesi ile kuzey cephesinin bir bölümü yığma taş duvar tekniği ile inşa edilmiş, diğer bölümler ile birinci katın tamamında ise ahşap karkas sistem kullanılmıştır. Duvar yüzeylerinin büyük bir bölümü sıva ile kaplanmamış olması, taşıyıcı sistemin cepheden okunabilmesine olanak sağlamaktadır. Birinci katta çıkma şeklinde düzenlenen ıslak hacim biriminin duvarları daraba tahtalarıyla kapatılmıştır. Yapının çatısı üç omuz çatı formunda olup özgün kaplama malzemesi alaturka kiremittir. Ancak zaman içerisinde meydana gelen bozulmalar nedeniyle kiremitlerin bir kısmının Marsilya tipi kiremitlerle yenilendiği görülmektedir. Kalkan duvar yüzeyleri ise daraba tahtalarıyla kaplanmıştır (Şekil 8).



**Şekil 8.** Recep Kocatarla konutunun cepheleri

Yapının zemin katı dış sofalı plan şemasına sahiptir (Şekil 9). Çardak mekânında, birinci kata erişimi sağlayan tek kollu ahşap merdiven yer almakta olup, odalara erişim de bu mekân

üzerinden sağlanmaktadır. Çardak mekânı herhangi bir duvarla bölünmemiş olmakla birlikte, kuzey ucunun depolama amacıyla kullanıldığı anlaşılmaktadır.



**Şekil 9.** Zemin kat ve birinci kat plan şemaları

Zemin katta yer alan iki oda yapının batı bölümünde konumlanmıştır. Kuzeybatı köşesinde bulunan odada ocak, gusülhane, yüklük ve sedir gibi geleneksel donatı elemanları yer alırken, diğer odada sedir ve gusülhane bulunmaktadır. Bu odadaki ocağın yıkıldığı ve yalnızca baca boşluğunun günümüze ulaştığı tespit edilmiştir. Zemin kattaki odaların pencereleri giyotin tiptedir (Şekil 10).



**Şekil 10.** Zemin katta bulunan oda düzeni

Birinci kat da dış sofalı plan düzenine sahip olup iki odadan oluşmaktadır. Odalara çardak mekânı üzerinden erişim sağlanmaktadır. Bu kattaki odalardan kuzeyde yer alanında yalnızca ocak bulunurken, diğer odada ocak ve diğer ahşap donatı elemanlarının bulunmadığı görülmüştür. Odada yer alan ocak, iki ahşap dikme arasında kerpiç bloklar kullanılarak inşa edilmiş; basık kemerli formda düzenlenmiş ve üzerine ahşap hatıl eklenerek “baca başı” olarak adlandırılan raf oluşturulmuştur. Ocak yüzeylerinin sıva ile kaplanmadığı görülmektedir (Şekil 11).



**Şekil 11.** Ocak örneği

Birinci kattaki odaların pencereleri dört kanatlı ahşap doğramalı olup, camların büyük bir kısmının kırıldığı görülmektedir. Oluşan boşluklar ahşap tahtalarla kapatılmaya çalışılmış, ancak bu müdahalelerin yapı içerisine su ve nem girişini engelleyemediği anlaşılmıştır. Benzer şekilde, çardak mekânının aydınlatılması amacıyla açılan pencere boşluklarında da doğrama elemanları bulunmamakta; bu açıklıklar geçici olarak tahtalarla kapatılmış durumdadır (Şekil 12).

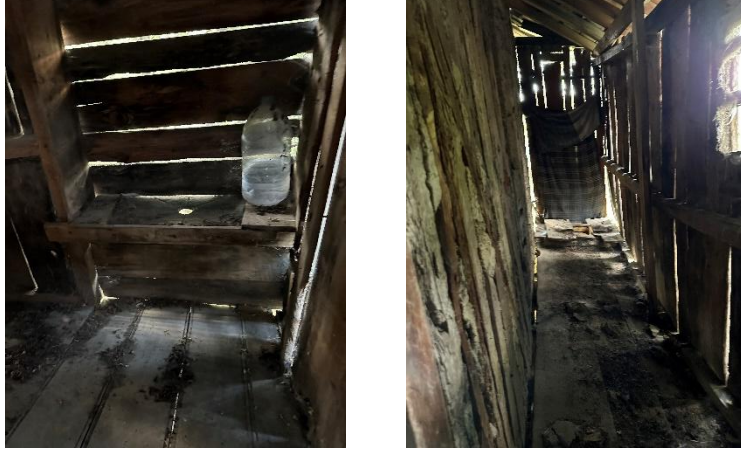


**Şekil 12.** Çardak mekânı

Çardak mekânında tavan kaplaması bulunmamakta, bu nedenle çatı strüktürü doğrudan algılanabilmektedir. Ayrıca zemin döşemesini oluşturan ahşap elemanlarda yer yer eksilmeler ve bozulmalar tespit edilmiştir.

Çardağın kuzey ucunda, çıkma şeklinde düzenlenmiş ıslak hacim birimi yer almaktadır. Bu bölümün duvarları daraba tahtalarıyla kaplı olup, tahtalar arasındaki boşluklar doğal aydınlatmayı sağlamaktadır. Lavabo bölümünde tahtaların yatay, hela bölümünde ise dikey olarak yerleştirildiği görülmektedir (Şekil 13). Ahşap lavabo alanından tek kanatlı bir kapı ile

hela bölümüne geçiş sağlanmakta olup, burada ahşap elemanlarla oluşturulmuş bir hela taşı bulunmaktadır. Islak hacim zemin döşemesi, suyun dışarıya tahliyesini kolaylaştıracak şekilde eğimli olarak düzenlenmiştir.



**Şekil 13.** Lavabo ve hela bölümü

Recep Kocatarla evi üzerinden elde edilen bulgular, Dökecek köyündeki geleneksel konutların genel mekânsal kurgusu, yapım teknikleri ve malzeme kullanımı hakkında önemli veriler sunmaktadır. Yapıda gözlemlenen dış sofalı plan düzeni, taş ve ahşabın birlikte kullanıldığı karma yapı sistemi ile çardak ve çıkma şeklinde düzenlenen ıslak hacim birimleri, bölgenin kırsal mimari karakterini yansıtan temel unsurlar olarak öne çıkmaktadır. Bununla birlikte, uzun süreli kullanım dışı kalma, bakım eksikliği ve bilinçsiz müdahaleler sonucunda yapı elemanlarında ciddi bozulmalar meydana gelmiştir. Özellikle çatı, pencere ve döşeme elemanlarında gözlemlenen hasarlar, yapı bütünlüğünü tehdit eder boyuta ulaşmıştır. Bu durum, Dökecek köyündeki benzer nitelikteki geleneksel konutların da benzer riskler altında olduğunu göstermekte ve bu yapıların belgelenmesi ile korunmasına yönelik acil müdahale gerekliliğini ortaya koymaktadır.

### 3. SONUÇ

Bu çalışma kapsamında Karabük ili Ovacık ilçesine bağlı Dökecek Köyü'nde yer alan geleneksel konutlar, kırsal mimari bağlamda plan şeması, yapım tekniği, malzeme kullanımı ve mevcut fiziksel durumları açısından incelenmiştir. Elde edilen bulgular, yerleşimde Batı Karadeniz kırsal mimarisine özgü taş ve ahşabın birlikte kullanıldığı karma yapı sisteminin yaygın olduğunu göstermektedir. Özellikle zemin katlarda yığma taş duvar, üst katlarda ise ahşap karkas sistemin tercih edildiği; konutların Türk evi plan şemasına benzer şekilde şekillendiği ve iç mekânlarda odaların bir ailenin ihtiyaçlarını karşılayacak şekilde düzenlendiği görülmüştür.

Yerleşimdeki geleneksel konutların mekânsal organizasyonunda çardak, çıkma ve ıslak hacim gibi yöresel mimari öğelerin önemli bir rol oynadığı tespit edilmiştir. Bununla birlikte, yapıların büyük bir kısmının kullanım dışı kaldığı ve zaman içerisinde fiziksel yıpranma sürecine girdiği görülmüştür. Özellikle çatı örtüsü, ahşap doğramalar ve cephe yüzeylerinde meydana gelen bozulmaların, yapıların taşıyıcı sistem bütünlüğünü ve mimari kimliğini olumsuz etkilediği anlaşılmaktadır.

Ayrıca, bazı yapılarda gerçekleştirilen bilinçsiz onarım müdahaleleri ve modern malzeme kullanımı, geleneksel mimari karakterin zayıflamasına neden olmaktadır. Bu durum, Dökecek köyü geleneksel konutlarının özgün değerlerinin kaybolma riski ile karşı karşıya olduğunu göstermektedir.

Sonuç olarak, Dökecek köyü geleneksel konutları, bölgesel kırsal mimari mirasın önemli bir parçasını oluşturmaktadır. Bu yapıların korunması için öncelikle kapsamlı belgeleme çalışmalarının yapılması, ardından uygun koruma ve restorasyon stratejilerinin geliştirilmesi gerekmektedir. Ayrıca kırsal mimari mirasın sürdürülebilirliğinin sağlanabilmesi için yerel düzeyde farkındalık oluşturulması da önem taşımaktadır.

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**KÜLTÜREL VE İKLİMSEL BAĞLAMDA GELENEKSEL BUZHANELERİN  
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Modern soğutma teknolojilerinin henüz gelişmediği dönemlerde, gıdaların korunması ve buzun uzun süre muhafaza edilmesi amacıyla inşa edilen buzhaneler, geleneksel mimarinin çevresel koşullarla kurduğu ilişkinin önemli göstergelerinden birini oluşturmaktadır. Bu yapılar, herhangi bir enerji tüketimine ihtiyaç duymadan çalışan pasif soğutma sistemleri sayesinde, doğal çevre verilerini doğrudan mimari tasarımın belirleyici unsurlarından biri haline getirmiştir. Bu çalışmada, Mezopotamya'dan Çin'e, İran'dan Anadolu'ya ve Avrupa ile Amerika'ya kadar uzanan geniş bir coğrafyada gelişen buzhaneler; tarihsel süreçleri, terminolojik çeşitlilikleri ve özellikle mimari ile tipolojik özellikleri açısından karşılaştırmalı bir çerçevede ele alınmıştır. Literatürde çoğunlukla belirli bölgelere odaklanan çalışmaların aksine, bu araştırma farklı kültürel ve iklimsel bağlamlarda ortaya çıkan buzhane örneklerini birlikte değerlendirerek, bu yapıların ortak özellikleri ile yerel farklılıklarını ortaya koymayı amaçlamaktadır. Çalışma kapsamında elde edilen bulgular, buzhanelerin yeraltına yerleşim, kalın duvar kullanımı, farklı üst örtü çözümleri, doğal havalandırma ve su tahliyesine yönelik sistemler gibi temel mimari özellikler bakımından benzer prensipler doğrultusunda geliştiğini göstermektedir. Bununla birlikte, plan şeması, örtü tipi ve malzeme tercihleri gibi unsurların, bulunduğu coğrafyanın iklimsel koşulları ve kültürel birikimi doğrultusunda farklılaştığı anlaşılmaktadır. Sonuç olarak bu çalışma, buzhaneleri farklı bölgelerde çeşitlilik gösteren ancak ortak fiziksel ve çevresel ilkeler üzerine kurulu bir mimari tipoloji olarak ele almakta; bu yapıların geleneksel bilgi birikimi ile günümüz sürdürülebilir tasarım yaklaşımları arasındaki ilişkiye katkı sağlayabilecek potansiyele sahip olduğunu ortaya koymaktadır.

**Anahtar kelimeler:** Buzhaneler, mimari tipoloji, geleneksel mimari, iklimsel adaptasyon, pasif soğutma

## COMPARATIVE ANALYSIS OF THE ARCHITECTURAL AND TYPOLOGICAL CHARACTERISTICS OF TRADITIONAL ICE HOUSES IN CULTURAL AND CLIMATIC CONTEXTS

### ABSTRACT

Before the development of modern refrigeration technologies, ice houses were constructed to preserve food and store ice for extended periods, representing significant examples of how traditional architecture responded to environmental conditions. These structures functioned through passive cooling principles, relying on natural factors rather than mechanical energy, and thus integrated climatic data directly into architectural design. This study examines traditional ice houses across a wide geographical range, including regions from Mesopotamia and China to Iran, Anatolia, Europe, and North America. The research focuses on their historical development, terminological variations, and particularly their architectural and typological characteristics through a comparative framework. Unlike studies that concentrate on specific regions, this research evaluates ice houses within diverse cultural and climatic contexts, aiming to identify both shared design principles and regional distinctions. The findings indicate that ice houses exhibit common architectural features such as underground placement, thick wall construction, varied roof forms, natural ventilation systems, and drainage solutions. At the same time, elements such as spatial organization, covering systems, and material selection differ depending on local climatic conditions and cultural influences. In this respect, the study considers ice houses as a unified architectural typology shaped by common environmental principles despite regional variations and highlights their potential relevance for contemporary sustainable design approaches.

**Keywords:** Ice houses, architectural typology, vernacular architecture, climatic adaptation, passive cooling

### 1. GİRİŞ

Buzhaneler, buz üretimi ve depolanmasına hizmet eden, özellikle sıcak dönemlerde kar ve buzun korunmasını sağlayan, yüksek yalıtım özelliklerine sahip geleneksel yapılardır (Mutlu, 2014). Tarihsel süreç içerisinde farklı coğrafyalarda “yahdân”, “buzluk”, “karlık”, “kar kuyusu” ve “yakhchal” gibi çeşitli adlarla anılan bu yapılar, yalnızca terminolojik bir çeşitliliği yansıtmakla kalmamakta; aynı zamanda farklı toplumların bu yapı tipini kendi iklimsel koşulları ve kültürel gereksinimleri doğrultusunda nasıl dönüştürdüğünü de ortaya koymaktadır (Odabaşı, 2019; Hosseini ve Namazian, 2012). Bu yönüyle buzhaneler, yalnızca depolama işleviyle sınırlı yapılar olarak değil, çevresel verilerin doğrudan mimari tasarım kararlarına

entegre edildiği erken dönem pasif sistemler olarak değerlendirilmelidir. Güneş ışınımının denetlenmesi, yeraltı kütlesinin sağladığı ısı denge, doğal havalandırma ve suyun kontrollü tahliyesine yönelik çözümler, bu yapıların temel tasarım bileşenlerini oluşturmaktadır. Bu bağlamda buzhaneler, günümüz sürdürülebilir mimarlık yaklaşımlarının tarihsel arka planını oluşturan önemli örnekler arasında yer almaktadır.

Buzhaneler üzerine gerçekleştirilen çalışmalar incelendiğinde, mevcut literatürün büyük ölçüde belirli coğrafyalara odaklandığı görülmektedir. Özellikle İran coğrafyasında gelişen yakhchal yapıları üzerine yapılan araştırmalar, bu yapıların mekânsal organizasyonu ve iklimle kurduğu ilişkiyi ayrıntılı biçimde ortaya koymaktadır. Hosseini ve Namazian (2012), gölgeleme duvarı, tedarik havuzu ve buz deposu gibi temel bileşenler üzerinden bu sistemlerin işleyişini açıklarken; IzadPanahi vd. (2010), kalın duvar yapısı, konik üst örtü ve doğal havalandırma sistemlerinin ısı kontrolündeki rolüne dikkat çekmektedir. Anadolu bağlamında Mutlu (2014), Konya'daki buzhaneler üzerinden plan organizasyonu ve yapım tekniklerine ilişkin kapsamlı veriler sunmuş; Odabaşı (2019) ile Özkan Emanet (2021) ise bu yapıların tarihsel ve kurumsal boyutlarını ele almıştır. Bununla birlikte, farklı coğrafyalarda gelişen buzhane örneklerini karşılaştırmalı ve tipolojik bir çerçevede değerlendiren çalışmaların sınırlı olduğu görülmektedir.

Bu çalışma, söz konusu literatür boşluğunu gidermeyi amaçlayarak buzhanelerin tarihsel gelişimini Mezopotamya'dan Çin'e, İran'dan Anadolu'ya ve Batı dünyasına kadar uzanan geniş bir bağlamda ele almakta; bu yapıların mimari ve tipolojik özelliklerini karşılaştırmalı bir yaklaşımla incelemektedir. Bu doğrultuda çalışma, farklı bölgelerde ortaya çıkan buzhane örneklerinin plan organizasyonu, üst örtü sistemleri, malzeme kullanımı ve çevresel stratejiler açısından benzerlik ve farklılıklarını ortaya koymayı hedeflemektedir. Ayrıca bu yapıların pasif soğutma sistemleri bağlamında değerlendirilmesi yoluyla, geleneksel mimarlık bilgisinin günümüz sürdürülebilir tasarım yaklaşımlarına sağlayabileceği katkılar tartışılmaktadır. Bu kapsamda çalışma, buzhaneleri yalnızca tarihsel bir yapı türü olarak ele almak yerine, farklı coğrafyalarda benzer fiziksel prensipler doğrultusunda gelişmiş bir pasif soğutma mimarisi olarak yeniden yorumlamakta ve geleneksel yapı bilgisinin çağdaş mimarlık üretimi için önemli bir referans alanı sunduğunu ortaya koymaktadır. Bu yönüyle çalışma, mimarlık tarihi, yapı fiziği ve sürdürülebilir tasarım disiplinleri arasında bütüncül bir ilişki kurarak literatüre katkı sağlamaktadır.

## 2. YÖNTEM

Bu çalışma, nitel araştırma yaklaşımı temelinde kurgulanmış olup, literatür taraması ile karşılaştırmalı tipolojik değerlendirme yöntemlerinin birlikte kullanılmasıyla yürütülmüştür. Araştırma sürecinde, buzhanelere ilişkin tarihsel, mimari ve teknik bilgiler; akademik yayınlar, lisansüstü tezler ve arşiv kaynaklarından yararlanılarak sistematik bir biçimde derlenmiştir (Mutlu, 2014; Odabaşı, 2019; Hosseini ve Namazian, 2012; IzadPanahi vd., 2010; Özkan Emanet, 2021).

Araştırmanın ilk aşamasında, buzhanelerin tarihsel gelişimi ile terminolojik çeşitliliğini ortaya koymak amacıyla literatürde yer alan veriler kronolojik bir düzen içerisinde ele alınmış ve sınıflandırılmıştır. Bu aşamada, farklı coğrafyalarda kullanılan kavramsal tanımlar ve yapı türleri incelenerek benzerlikler ve farklılaşmalar belirlenmiştir. İkinci aşamada, çalışma kapsamında değerlendirilecek örnekler belirli ölçütler doğrultusunda seçilmiştir. Bu ölçütler; farklı iklim bölgelerini temsil etme, tipolojik çeşitlilik sunma ve literatürde yeterli veri ile belgelenmiş olma kriterlerine dayanmaktadır. Bu doğrultuda İran (Yezd, Meybod), Anadolu (Konya), Kafkasya (Nahçıvan, Ordubad), İngiltere (Londra), Amerika (New York–Hampton) ve İskoçya (Tugnet) örnekleri inceleme kapsamına dahil edilmiştir. Üçüncü aşamada, seçilen bu örnekler mimari ve yapısal özellikleri açısından belirlenen kriterler çerçevesinde analiz edilmiştir. Bu kapsamda; plan organizasyonu, üst örtü sistemi (kubbe, tonoz, konik form), yapı malzemesi, yeraltı ve yerüstü ilişkisi ile havalandırma ve drenaj sistemleri değerlendirme parametreleri olarak kullanılmıştır. Belirlenen bu kriterler, yapıların hem fiziksel performansını hem de çevresel koşullarla kurduğu ilişkiyi ortaya koymaya yönelik olarak ele alınmıştır. Son aşamada ise elde edilen veriler karşılaştırmalı bir yaklaşımla değerlendirilmiş ve farklı coğrafyalarda gelişen buzhane tipolojileri arasındaki benzerlikler ile farklılıklar ortaya konmuştur. Bu süreçte yalnızca biçimsel özellikler değil, aynı zamanda yapıların işleyiş biçimleri ve çevresel performansları da dikkate alınarak bütüncül bir değerlendirme yapılmıştır. Bu yöntemsel çerçeve doğrultusunda çalışma, betimleyici bir incelemenin ötesine geçerek analitik ve karşılaştırmalı bir yaklaşım sunmakta; buzhanelerin farklı coğrafyalarda benzer tasarım ilkeleri doğrultusunda nasıl şekillendiğini ortaya koyan sistematik bir değerlendirme geliştirmektedir.

## 3. BULGULAR

### 3.1. Tarihsel Gelişim

Buzun depolanmasına yönelik mimari çözümler, insanlık tarihinin erken dönemlerinden itibaren farklı coğrafyalarda benzer ihtiyaçlara bağlı olarak ortaya çıkmış ve zaman içerisinde

çeşitlenmiştir. Selçuklu dönemi vakfiyeleri ve XV. yüzyıl Selçuklu vakıfları hakkında bilgi veren Osmanlı dönemi arşiv kayıtlarında, vakıflar tarafından inşa edilen ve işletilen buzhaneler “yahdân”, “buzluk”, “buzluk yeri” ya da “buzhane” şeklinde kaydedilmiştir. “Yahdân” kelimesi halk dilinde “yahistan”, “yasıyan”, “yahsiyan” gibi farklı biçimlere dönüşmüştür. İran’da ise buzhaneler, Farsça’da “buz çukuru” anlamına gelen “yakhchal” olarak adlandırılmaktadır (Yakh: buz, Chal: çukur) (Odabaşı, 2019; Hosseini ve Namazian, 2012).

Buzhane yapıları, diğer yapı türlerine oranla daha sınırlı sayıda olmakla birlikte, tarihsel süreç içerisinde farklı coğrafyalarda varlık göstermiştir. Buzun muhafazası amacıyla inşa edilen ilk yapıların M.Ö. 4000 yılına kadar uzandığı düşünülmektedir. M.Ö. 1780 yılına ait çivi yazılı bir tablette, Kuzey Mezopotamya’da bulunan Terqa yerleşiminde buzhanelerin varlığından söz edilmektedir. Ayrıca ilk buzhanelerin Mari Kralı Zimri-Lim tarafından inşa ettirildiği bilinmektedir. Bu yapılarda buzun korunabilmesi amacıyla yapıların tamamen ya da kısmen yeraltında konumlandırıldığı, su kaynaklarına yakın yer seçildiği ve yalıtım için saman ile talaş gibi malzemelerin kullanıldığı belirtilmektedir (Öztürk ve Yaman, 2019).

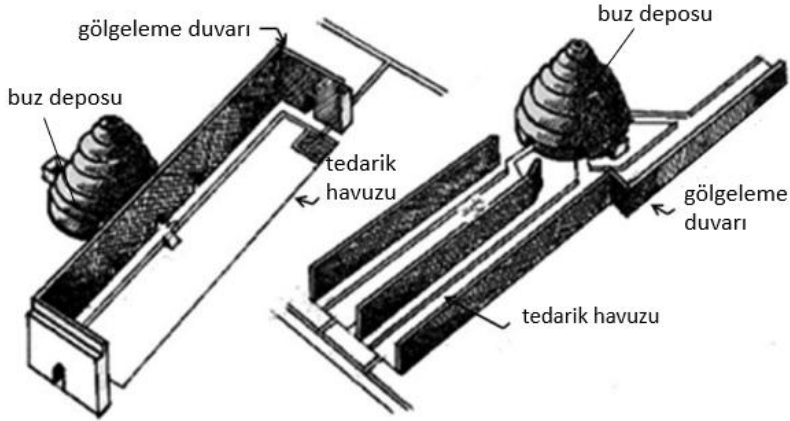
M.Ö. 800’lü yıllarda Çin’de kar ve buzun yaygın biçimde kullanıldığı; kış mevsiminde elde edilen buzun yazın kullanılmak üzere toprak altına açılan çukurlarda veya doğal mağaralarda saklandığı bilinmektedir. Bu dönemlere ait buz çukuru kalıntıları arkeolojik olarak da tespit edilmiştir. Antik Yunan ve Roma dönemlerinde de kar ve buzun muhafazası için kar kuyularının kullanıldığı; Büyük İskender döneminde bu yapıların yaygınlaştığı ifade edilmektedir (Özkan Emanet, 2021; Öztürk ve Yaman, 2019).



**Şekil 1.** Meybod'da inşa edilmiş buzhane örneği (Niroumand vd., 2012).

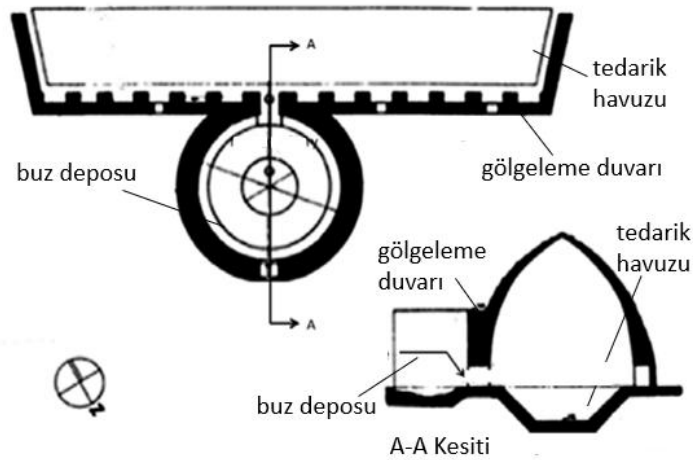
M.S. 2. yüzyılda Persler tarafından kullanılan yakhchal yapıları, buzun korunması ve depolanmasına yönelik gelişmiş sistemler olarak öne çıkmaktadır (Şekil 1). Sıcak-kuru iklim

koşullarına göre şekillenen İran buzhanelerinin büyük ölçüde kerpiç ve güneşte kurutulmuş tuğlalardan inşa edildiği görülmektedir. Bu yapılar genellikle gölgeleme duvarı, tedarik havuzu ve buz deposu olmak üzere üç temel bileşenden oluşmaktadır (Niroumand vd., 2012; Hosseini ve Namazian, 2012; IzadPanahi vd., 2010) (Şekil 2).



**Şekil 2.** Yezd şehrinde buzhane örneğinin bölümleri (Hosseini ve Namazian (2012)'den düzenlenmiştir).

Şekil 3'te Meybod'da bulunan bir buzhanenin plan ve kesiti verilmiştir. Buna göre, gölgeleme duvarı, buzhanenin güneyinde konumlanan ve güneş ışınımını kontrol eden önemli bir elemandır. Tedarik havuzu, suyun sağlandığı ve buz üretiminin gerçekleştirildiği alanı oluştururken; buz deposu, üretilen buzun uzun süre muhafaza edildiği yeraltı mekândır. Bu sistemde suyun taşınması qanat sistemi aracılığıyla sağlanmaktadır. İran buzhanelerinde kubbeli, yeraltı tünel tip ve çatısız olmak üzere üç farklı tipolojik düzenleme bulunmaktadır.



**Şekil 3.** Meybod'da buzhane örneğinin bölümleri (Hosseini ve Namazian (2012)'den düzenlenmiştir).

Bu yapılarda duvarların yukarıdan aşağıya doğru kalınlaşacak şekilde inşa edildiği, konik formun tercih edildiği ve iç mekânda katmanlar arasında erişimi sağlayan merdivenlerin bulunduğu görülmektedir. Gündüz ve gece çalışma prensipleri, doğal çevre koşullarına dayalı olarak şekillenmektedir. Gündüz saatlerinde gölgeleme duvarları sayesinde havuzda gölge oluşturulmakta, katmanlar arasında saman ve ahşap kullanılarak izolasyon sağlanmakta ve sıcak hava kubbenin üst kısmından dışarı atılmaktadır. Gece saatlerinde ise suyun ısı kaybetmesiyle birlikte buz oluşumu gerçekleşmekte ve soğuk hava aşağı doğru hareket ederek depolanan buzun korunmasına katkı sağlamaktadır (IzadPanahi vd., 2010). Buzhanenin gündüz ve gece çalışma mekanizmaları Tablo 1’de verilmiştir.

**Tablo 1.** Buzhanenin gündüz ve gece çalışma mekanizması (IzadPanahi vd., 2010).

	<p><b>Gündüz çalışma mekanizması</b></p> <ol style="list-style-type: none"> <li>1-Yüksek duvarlar havuza gölge düşürür.</li> <li>2- Her buz tabakasının arasına tahta ve saman parçaları yerleştirilir.</li> <li>3- Eriyen buzu boşaltmak için kuyunun dibinde bir delik bulunur.</li> <li>4-Soğuk ve temiz hava aşağı iner, sıcak hava yükselerek kubbenin tepesindeki delikten çıkar.</li> <li>5- Kubbe duvarı kalın olup, ısı yalıtımını sağlamak için dıştan saz ile kaplanmıştır.</li> <li>6- Yer seviyesinin 6 metre altındaki sıcaklık sabittir.</li> </ol>
	<p><b>Gece çalışma mekanizması</b></p> <ol style="list-style-type: none"> <li>1- Havuzdaki su ısı kaybeder.</li> <li>2- Soğuk hava buzhaneden aşağı iner ve depolanan buzun üst tabakasını kaplar.</li> <li>3-Buz parçalarını daha derin bir seviyede saklamak için bir merdiven, buzhanesinin kapısını alt katına bağlar.</li> </ol>

Anadolu’da ise buzhanelerin özellikle Selçuklu döneminden itibaren vakıf sistemi içerisinde geliştiği görülmektedir. Konya, Karaman, Akşehir ve Niğde gibi merkezlerde bu yapıların inşa edildiği bilinmektedir. Şekil 4’te Kayseri’ye ait 500 yıllık bir buzhanenin görselleri sunulmaktadır.



**Şekil 4.** Kayseri'ye ait 500 yıllık bir buzhanenin iç mekân görünümü (Özkan Emanet, 2021). Selçuklu veziri Sahip Ata Fahreddin Ali tarafından yaptırıldığı kabul edilen Konya'daki buzhaneler, günümüze ulaşan önemli örnekler arasında yer almaktadır. Bu yapılarda taş malzeme kullanılmış, kalın duvarlar ve tonoz örtü sistemi ile ısı yalıtım sağlanmıştır (Odabaşı, 2019; Mutlu, 2014) (Şekil 5).

Tekli Buzhane



Çiftli Buzhane



**Şekil 5.** Meram Sahip Ata Tekli Buzhanesi ve Çiftli Buzhanesi, (Mutlu, 2014; Bekmez, 2020). Kafkasya bölgesinde yer alan Nahçıvan ve Ordubad buzhaneleri, İran ve Anadolu arasında geçiş niteliği taşıyan örnekler olarak değerlendirilmektedir. Nahçıvan Buzhanesi dikdörtgen planlı ve kubbemsi tonoz örtülü bir yapı iken; Ordubad Buzhanesi iki bölümlü mekânsal organizasyonu ve taş-tuğla malzeme kullanımı ile dikkat çekmektedir (Yazar, 1999; Özkan Emanet, 2021).

Avrupa'da buzhanelerin kullanımının 17. yüzyıldan itibaren yaygınlaştığı ve bu bilginin Osmanlı coğrafyasından aktarıldığı ifade edilmektedir (Özkan Emanet, 2021). İngiltere'de inşa edilen buzhaneler genellikle tuğla malzemedен yapılmış, büyük ölçüde yeraltında konumlanan ve eriyen suyun tahliyesine yönelik sistemler içeren yapılardır. 18. ve 19. yüzyıllarda Amerika

ve İskoçya'da inşa edilen örnekler ise bu yapı tipinin ölçek olarak büyüdüğünü ve ticari kullanıma yönelik olarak geliştiğini göstermektedir (Özkan Emanet, 2021; Niroumand vd., 2012).

Tarihsel süreç içerisinde farklı coğrafyalarda gelişen buzhane örnekleri birlikte değerlendirildiğinde, farklı coğrafyalarda inşa edilmiş olmalarına rağmen belirli ortak özellikler taşıdığı görülmektedir. Tüm örneklerde buz deposunun bulunması, kapı, merdiven ve duvar gibi temel yapısal elemanların varlığı, ayrıca duvar veya üst örtüde yer alan açıklıklar dikkat çekmektedir. Özellikle İran buzhanelerinde görülen havuz (Şekil 6) ve gölgeleme duvarı gibi elemanlar, sıcak iklim bölgelerine özgü tipolojik bir alt grup oluşturmaktadır.



**Şekil 6.** Alaghbeig buzhanesi büyük havuzu ve buzhane buz deposu örneği (Hosseini ve Namazian, 2012).

Plan şeması açısından incelendiğinde, buzhanelerde dikdörtgen ve dairesel olmak üzere iki temel düzenleme görülmektedir. Dairesel planlı buz depolarında zeminde yer alan açıklıklar aracılığıyla eriyen buz sularının tahliye edildiği anlaşılmaktadır. Buzhanelerin zemin kotuna göre konumlanışı değerlendirildiğinde ise, yeraltında kalan hacmin zemin üzerindeki hacme göre daha büyük olduğu ve bunun ortak bir tasarım ilkesi olarak benimsendiği görülmektedir. Üst örtü sistemlerinde kubbe, tonoz ve dörtgen form çözümleri yaygın olup, bazı örneklerde yapı kütesinin büyük ölçüde toprak altında çözülerek neredeyse tamamen gömülü bir form oluşturduğu dikkat çekmektedir.

### 3.2. Bölgesel Tipolojiler

Farklı coğrafyalarda inşa edilen buzhaneler, iklim koşulları, yerel malzeme olanakları ve kullanım gereksinimlerine bağlı olarak çeşitlilik göstermektedir. Bununla birlikte, bu çeşitlilik içerisinde belirli tipolojik grupların oluştuğu ve her bir grubun kendi içinde tutarlı bir mimari sistem geliştirdiği görülmektedir.

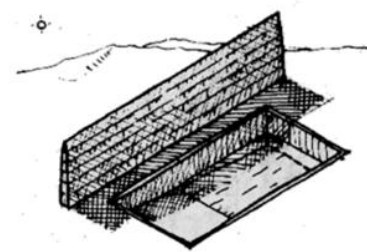
İran buzhaneleri, sıcak ve kurak iklim koşullarına uyum sağlayan en gelişmiş sistemler arasında yer almakta olup, gölgeleme duvarı, tedarik havuzu ve buz deposundan oluşan üçlü bir organizasyona sahiptir. Bu sistemde gölgeleme duvarı, güneş ışınımını azaltarak donma sürecini desteklemekte; tedarik havuzunda kontrollü buz üretimi gerçekleştirilmekte ve elde edilen buz, yeraltındaki depolarda muhafaza edilmektedir. Konik kubbe formu ve kalınlaşan duvar yapısı, ısı geçişini sınırlandırarak iç mekânda düşük sıcaklıkların korunmasına olanak tanımaktadır. Ayrıca qanat sistemi aracılığıyla suyun taşınması ve gece–gündüz sıcaklık farkından yararlanılması, bu yapıların yalnızca depolama değil, aynı zamanda üretim işlevine de sahip olduğunu göstermektedir. İran coğrafyasında tipolojik çeşitlenmenin belirgin olduğu görülmektedir. Kubbeli buzhaneler, konik üst örtüleri ve derin yeraltı hacimleri ile en yaygın tip olarak öne çıkarken; yeraltı tünel tip buzhaneler daha yatay gelişen bir mekânsal organizasyon sunmaktadır. Çatısız buzhaneler ise daha basit çözümler olarak, iklim koşullarına bağlı alternatif kullanım biçimlerini temsil etmektedir (IzadPanahi vd., 2010; Hosseini ve Namazian, 2012). Bu durum, aynı coğrafya içerisinde dahi tipolojinin sabit bir yapı göstermediğini, aksine değişken ve uyarlanabilir bir karakter taşıdığını ortaya koymaktadır (Şekil 5).



a) Qatool kubbeli buzhanesi



b) Urmıye'de yeraltı tünel kubbeli buzhane



c) İsfahan'da çatısız buzhane

**Şekil 5.** Kubbeli, yeraltı tünel kubbeli ve çatısız buzhane örnekleri (Valibeig vd., 2017;

Hosseini ve Namazian, 2012; Hosseini ve Namazian, 2012).

Anadolu'da, özellikle Konya'da bulunan Sahip Ata Buzhaneleri, İran örneklerine kıyasla daha sade ancak işlevsel açıdan oldukça etkili çözümler sunmaktadır. Bu yapılarda üretimden ziyade depolama ön planda olup, yapıların büyük ölçüde yeraltına gömülmesi pasif yalıtım stratejisinin temelini oluşturmaktadır (Mutlu, 2014). Tonoz örtü sistemi ve kalın taş duvarlar, iç mekân sıcaklığının korunmasını sağlarken, plan organizasyonunun daha lineer ve dikdörtgen bir karakter sergilediği görülmektedir. Bu yönüyle Anadolu örnekleri, İran'daki kompleks sistemlere karşılık daha doğrudan ve kompakt çözümler sunmaktadır.

Kafkasya bölgesinde yer alan Nahçıvan ve Ordubad buzhaneleri, Anadolu ve İran tipolojileri arasında geçiş niteliği taşıyan hibrit bir yapı karakteri sergilemektedir. Bu yapılarda dikdörtgen plan şeması korunmakla birlikte, kubbemsi tonoz örtüler ve çok bölmeli iç mekân düzeni dikkat çekmektedir (Yazar, 1999). Bu durum, hem İran'daki kubbeli sistemlerin hem de Anadolu'daki tonozlu yapıların etkisini yansıtan ara bir tipolojik gelişimi işaret etmektedir.

Avrupa ve Amerika örneklerinde ise buzhanelerin daha çok ticari ve endüstriyel ihtiyaçlara bağlı olarak geliştiği görülmektedir. İngiltere'de, özellikle Londra'daki örneklerde tuğla malzeme kullanımı ve yeraltı konumlanması dikkat çekerken, bu yapılarda buz üretiminden ziyade depolama ve dağıtım işlevleri ön plana çıkmaktadır. Amerika'da New York'taki Hampton buzhanesi, ters konik yeraltı formu sayesinde soğuk havanın alt kotlarda toplanmasını sağlayarak doğal bir termal denge oluşturmaktadır. Ayrıca kuzey ve güney yönlerinde farklı işlevlere sahip girişlerin bulunması, mekânsal organizasyonun daha sistematik bir yapıya kavuştuğunu göstermektedir.

İskoçya'daki Tugnet buzhanesi ise diğer örneklerden ölçek ve mekânsal organizasyon açısından ayrılmaktadır. İki katlı yapısı, beşik tonozlu örtüsü ve kısmen toprak altında kalan hacmi ile hem geleneksel hem de yarı endüstriyel bir karakter sergilemektedir. Bu yapı, depolama kapasitesinin artırılmasına yönelik mekânsal büyümenin tipolojik dönüşüm üzerindeki etkisini açık biçimde ortaya koymaktadır.

### 3.3. Karşılaştırmalı Tipolojik Analiz

Ortaya konulan tarihsel gelişim ve bölgesel tipolojik farklılıklar temel alınarak, farklı coğrafyalarda gelişen buzhaneler karşılaştırmalı olarak değerlendirildiğinde, bu yapıların hem ortak fiziksel prensiplere dayandığı hem de buldukları çevresel ve kültürel bağlama bağlı olarak farklılaştığı açık biçimde görülmektedir. Buna göre, değerlendirilen buzhaneye örneklerine ait mimari ve tipolojik özellikler, belirlenen kriterler doğrultusunda Tablo 2'de karşılaştırmalı olarak sunulmuştur.

**Tablo 2.** İncelenen buzhanelerin mimari ve tipolojik özelliklerinin karşılaştırılması

Kriter	İran (Yezd–Meybod)	Anadolu (Konya)	Kafkasya (Nahçıvan–Ordubad)	Avrupa (İngiltere)	Amerika (Hampton)	İskoçya (Tugnet)
Temel İşlev	Üretim + Depolama	Depolama	Depolama (kısmen üretim)	Depolama + Dağıtım	Depolama	Depolama (büyük ölçekli)
Plan Organizasyonu	Merkezi, derin	Lineer, dikdörtgen	Dikdörtgen + bölmeli	Geniş hacimli	Merkezi + kontrollü giriş	Çok hacimli
Yerleşim	Yeraltı ağırlıklı	Büyük ölçüde yeraltı	Kısmen yeraltı	Yeraltı	Yeraltı	Yarı gömülü

<b>Üst Örtü Sistemi</b>	Konik kubbe	Tonoz	Tonoz + kubbemsi	Tuğla tonoz/kubbe	Ters konik	Beşik tonoz
<b>Malzeme</b>	Kerpiç/tuğla	Taş	Taş + tuğla	Tuğla	Taş/tuğla	Taş
<b>Üretim Sistemi</b>	Var (havuz + duvar)	Yok	Kısmi	Yok	Yok	Yok
<b>Havalandırma</b>	Doğal (yüksek verimli)	Doğal	Doğal	Doğal	Kontrollü	Doğal
<b>İklim Uyum Stratejisi</b>	Gelişmiş (çok bileşenli)	Pasif yalıtım	Hibrit	Yeraltı depolama	Termal form	Kütleli depolama
<b>Ölçek</b>	Orta-büyük	Orta	Orta	Büyük	Orta	Çok büyük
<b>Tipolojik Karakter</b>	Kompleks sistem	Sade sistem	Geçiş tipi	Ticari tip	Gelişmiş form	Yarı endüstriyel

Tablo 2’de sunulan veriler doğrultusunda yapılan değerlendirmede, özellikle İran örneklerinin üretim ve depolamayı bütünleştiren kompleks sistemler sunduğu; Anadolu örneklerinin ise daha sade ve depolama odaklı çözümler geliştirdiği açıkça görülmektedir. İran (Yezd, Meybod), Anadolu (Konya), Kafkasya (Nahçıvan, Ordubad), İngiltere (Londra), Amerika (New York–Hampton) ve İskoçya (Tugnet) örnekleri birlikte ele alındığında, özellikle üretim–depolama ilişkisi, mekânsal organizasyon, örtü sistemi ve kullanım ölçeği açısından belirgin ayrışmalar ortaya çıkmaktadır. İran buzhaneleri, diğer tüm örneklerle karşılaştırıldığında en karmaşık ve bütüncül sistem kurgusuna sahip yapılar olarak öne çıkmaktadır. Bu yapılarda buz üretimi ve depolama süreçleri tek bir organizasyon içinde çözülmüş; gölgeleme duvarı, tedarik havuzu ve depo mekânı birbirini tamamlayan bileşenler olarak kurgulanmıştır (Hosseini ve Namazian, 2012). Buna karşılık Anadolu’daki Sahip Ata Buzhaneleri’nde üretim süreci yapıdan ayrışmakta ve mekânsal kurgu büyük ölçüde depolama işlevine odaklanmaktadır (Mutlu, 2014). Bu durum, İran örneklerinin aktif üretim sistemi içeren kompleks yapılar olduğunu; Anadolu örneklerinin ise daha pasif ve işlev odaklı çözümler sunduğunu göstermektedir.

Plan organizasyonu açısından değerlendirildiğinde, İran buzhanelerinde merkezi ve derinleşen bir kurgu dikkat çekerken, Anadolu örneklerinde daha lineer ve yatay gelişen bir mekânsal düzen görülmektedir. Kafkasya bölgesindeki buzhaneler ise bu iki yaklaşım arasında ara bir karakter sergilemektedir. Nahçıvan ve Ordubad örneklerinde dikdörtgen plan şeması korunmakla birlikte, üst örtüde kubbemsi formların kullanılması, bu yapıların hem Anadolu’nun tonozlu sistemleri hem de İran’ın kubbeli yapıları ile ilişkili olduğunu göstermektedir (Yazar, 1999). Bu yönüyle Kafkasya örnekleri, tipolojik sürekliliğin coğrafyalar arası geçişler yoluyla nasıl şekillendiğini ortaya koymaktadır.

Örtü sistemi bakımından yapılan karşılaştırmada, İran buzhanelerinde konik kubbe formunun belirleyici olduğu görülmektedir. Bu form, güneş ışınımını minimize etmesi ve iç mekânda sabit

sıcaklık sağlanması açısından işlevsel bir çözüm sunmaktadır (IzadPanahi vd., 2010). Anadolu örneklerinde ise tonoz örtü sistemi tercih edilmekte ve bu sistem daha sade bir yapım tekniği ile uygulanmaktadır. Avrupa ve Amerika örneklerinde ise örtü sisteminin işlevsel kaygılardan ziyade yapı ölçeği ve kullanım biçimi ile ilişkili olarak çeşitlendiği görülmektedir. Özellikle Hampton buzhanesinde ters konik formun kullanılması, İran'daki sistemle benzer bir fiziksel prensibe dayanmakla birlikte, daha farklı bir mekânsal organizasyon içerisinde uygulanmıştır. Kullanım amacı açısından değerlendirildiğinde, İran ve kısmen Kafkasya örneklerinde üretim ve depolamanın birlikte ele alındığı görülürken, Anadolu örneklerinde depolama işlevi ön plana çıkmaktadır. Avrupa ve Amerika'da ise buzhanelerin ticari ve endüstriyel kullanım doğrultusunda geliştiği, dolayısıyla mekânsal organizasyonun daha büyük ölçekli ve erişim odaklı hale geldiği anlaşılmaktadır. Özellikle İngiltere'deki örneklerde geniş hacimli depolar ve dağıtım sistemleri dikkat çekerken, İskoçya'daki Tugnet buzhanesi, ölçek büyümesi ile birlikte tipolojik dönüşümün nasıl gerçekleştiğini açık biçimde ortaya koymaktadır.

Tüm bu veriler birlikte değerlendirildiğinde, buzhanelerin farklı coğrafyalarda farklı mimari biçimler geliştirmiş olmasına rağmen, temel tasarım kararlarının büyük ölçüde benzer olduğu görülmektedir. Yeraltı konumlanması, kalın duvar kullanımı, doğal havalandırma ve su tahliyesine yönelik çözümler, bu yapıların ortak fiziksel prensiplerini oluşturmaktadır. Buna karşılık plan şeması, örtü tipi ve mekânsal organizasyon, iklimsel koşullar ve kullanım ihtiyaçlarına bağlı olarak farklılaşmaktadır. Bu durum, buzhanelerin hem evrensel fiziksel kurallara dayanan hem de yerel bağlamlara uyum sağlayan özgün bir mimari tipoloji oluşturduğunu ortaya koymaktadır.

#### 4. SONUÇ

Bu çalışma kapsamında farklı kültürel ve iklimsel bağlamlarda gelişen buzhaneler karşılaştırmalı olarak değerlendirildiğinde, bu yapıların yalnızca yerel ihtiyaçlara bağlı olarak ortaya çıkan bağımsız çözümler olmadığı; aksine benzer çevresel koşulların yönlendirdiği ortak bir mimari bilgi birikiminin ürünü olduğu anlaşılmaktadır. İran, Anadolu, Kafkasya ve Batı dünyasında yer alan örnekler arasında biçimsel ve mekânsal farklılıklar bulunmasına rağmen, ortak fiziksel tasarım ilkelerinin büyük ölçüde benzerlik gösterdiği görülmektedir. Bu durum, buzhanelerin farklı kültürel ortamlarda gelişmiş olmasına karşın, doğrudan iklimsel veriler ve fiziksel çevre koşulları tarafından yönlendirilen ortak bir tasarım mantığına dayandığını ortaya koymaktadır.

Karşılaştırmalı değerlendirme, özellikle üretim ve depolama ilişkisi üzerinden belirgin farklılaşmaları ortaya koymaktadır. İran buzhanelerinde üretim ve depolama süreçlerinin aynı

yapı içerisinde bütüncül bir sistem olarak ele alındığı ve çevresel verilerin aktif biçimde kullanıldığı görülmektedir. Buna karşılık Anadolu örneklerinde depolama işlevinin ön plana çıktığı, buna bağlı olarak mekânsal organizasyonun daha sade ve doğrudan çözümler içerdiği anlaşılmaktadır. Kafkasya bölgesindeki buzhaneler ise bu iki yaklaşım arasında geçiş niteliği taşıyan bir ara tipoloji sunmakta; plan organizasyonu ve örtü sistemi açısından her iki bölgenin özelliklerini bir arada barındırmaktadır. Batı dünyasında gelişen buzhaneler ise ticari ve endüstriyel gereksinimlere bağlı olarak ölçek büyümesi ve erişim organizasyonu üzerinden farklılaşmakta; bu durum mekânsal kurgunun işlev doğrultusunda yeniden biçimlendiğini göstermektedir. Özellikle İngiltere ve Amerika örneklerinde gözlenen hacimsel büyüme ve dolaşım düzeni, bu yapıların yalnızca çevresel değil, aynı zamanda ekonomik sistemlerin de bir parçası haline geldiğini ortaya koymaktadır.

Elde edilen bulgular doğrultusunda buzhaneler, yalnızca tarihsel bir yapı türü olarak değil, çevresel verilerin mimari tasarım sürecine entegre edildiği erken dönem pasif sistemler olarak yeniden değerlendirilmelidir. Yeraltı konumlanması, ısı kütlesi kullanımı, doğal havalandırma ve suyun kontrollü tahliyesi gibi stratejiler, günümüz sürdürülebilir mimarlık yaklaşımları ile doğrudan ilişkilendirilebilecek niteliktedir. Bu bağlamda buzhaneler, enerji etkin tasarım, iklimle uyumlu mimarlık ve yerel malzeme kullanımı gibi konularda çağdaş mimarlık pratiği için önemli bir referans oluşturmaktadır.

Çalışma kapsamında ulaşılan sonuçlar, buzhanelerin literatürde çoğunlukla bölgesel ölçekte ele alınmasının, bu yapıların bütüncül olarak anlaşılmasını sınırladığını göstermektedir. Farklı coğrafyalarda gelişen örneklerin tipolojik bir çerçevede birlikte değerlendirilmesi, hem ortak tasarım ilkelerinin hem de bölgesel farklılıkların daha açık biçimde ortaya konmasına olanak sağlamaktadır. Bu yönüyle çalışma, parçalı bilgi yapısını aşarak buzhaneleri bütüncül bir analiz düzleminde ele almakta ve literatüre kavramsal bir katkı sunmaktadır.

Sonuç olarak buzhaneler, yalnızca geçmişe ait yapılar olarak değil, farklı coğrafyalarda benzer fiziksel prensipler doğrultusunda gelişmiş bir mimari bilgi sisteminin somut temsilcileri olarak değerlendirilebilir. Bu yapıların yeniden ele alınması ve çağdaş tasarım süreçleri ile ilişkilendirilmesi, sürdürülebilir mimarlık alanında yeni yaklaşımların geliştirilmesine katkı sağlayacaktır. Gelecek çalışmaların, bu yapıların performans temelli analizler ve sayısal modelleme yöntemleri ile incelenmesine yönelmesi, geleneksel mimari bilginin günümüz tasarım süreçlerine aktarılması açısından önemli bir araştırma alanı sunmaktadır.

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**SOME ALGEBRAİCS İDENTİTİES İNVOLVİNG A PAİR OF GENERALİZED  $(\alpha, \alpha)$ -DERİVATİONS İN RİNGS****Abdelkarim BOUA**<https://orcid.org/0000-0002-6397-4713>:

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**Abstract.**

Let  $A$  be an arbitrary ring,  $\alpha$  an automorphism of  $A$ ,  $I$  a nonzero ideal of  $A$ , and  $Y$  a prime ideal of  $A$  satisfying the condition  $Y \not\subseteq \alpha(I)$ . This research investigates the interplay between two generalized  $(\alpha, \alpha)$ -derivations,  $\Omega$  and  $G$  (associated with  $(\alpha, \alpha)$ -derivations  $f$  and  $h$ , respectively), and the resulting characteristics of the quotient ring  $A/Y$ . A key aspect of this work is that no primality or semiprimality conditions are imposed on the ring  $A$ . The analysis proceeds by examining specific differential identities satisfied by these derivations on the ideal  $I$  in relation to the prime ideal  $Y$ . Furthermore, this article discusses implications derived from the main theorems and presents nontrivial examples to underscore the necessity of the primeness hypothesis for  $Y$  in our results.

Key words: Automorphism; generalized  $(\alpha, \alpha)$ -derivation; prime ideal; quotient ring.

**THE KEY ISSUE FEATURES ON TRANSLATIONAL AND MECHANISTIC APPRAISAL OF CLINICAL PHARMACOLOGISTS' CONTRIBUTIONS TO PERSONALIZED MEDICINE, PHARMACOGENOMIC INTEGRATION, AND OPTIMIZATION OF INDIVIDUALIZED THERAPEUTIC INTERVENTIONS**

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**ABSTRACT**

The evolving landscape of modern healthcare increasingly emphasizes precision, safety, and individualized therapeutic efficacy, positioning clinical pharmacologists at the forefront of translational medicine and mechanistic innovation. This analytical overview explores the critical contributions of clinical pharmacologists in advancing personalized medicine through the integration of pharmacogenomics, systems pharmacology, and patient-centered therapeutic optimization. By bridging the gap between bench research and bedside application, clinical pharmacologists play a pivotal role in decoding interindividual variability in drug response, thereby enhancing therapeutic outcomes and minimizing adverse drug reactions. Central to this discourse is the mechanistic understanding of drug action, metabolism, and disposition, which underpins the rational design of individualized treatment regimens. Genetic polymorphisms affecting drug-metabolizing enzymes, transporters, and receptors significantly influence pharmacokinetics and pharmacodynamics. Clinical pharmacologists leverage these insights to implement pharmacogenomic-guided prescribing, ensuring that drug selection, dosing, and therapeutic monitoring are tailored to each patient's molecular and clinical profile. This approach is particularly transformative in complex disease states such as oncology, cardiovascular disorders, neuropsychiatric conditions, and infectious diseases, where variability in treatment response remains a significant clinical challenge. Translational pharmacology further facilitates the incorporation of emerging biomarkers, real-world evidence, and advanced

modeling techniques into clinical decision-making. Population pharmacokinetic/pharmacodynamic (PK/PD) modeling, physiologically based pharmacokinetic (PBPK) simulations, and artificial intelligence-driven predictive analytics are increasingly employed to refine dose individualization and optimize therapeutic windows. These tools enable clinical pharmacologists to anticipate drug interactions, assess risk-benefit ratios, and support adaptive therapeutic strategies in dynamic clinical environments. Moreover, the integration of pharmacogenomics into routine clinical practice requires multidisciplinary collaboration, robust clinical guidelines, and healthcare system readiness. Clinical pharmacologists serve as key mediators in this process, contributing to the development of evidence-based protocols, educating healthcare professionals, and ensuring the clinical validity and utility of genomic data. Their role extends to pharmacovigilance, where mechanistic insights into adverse drug reactions inform risk mitigation strategies and regulatory decision-making. Despite significant progress, several challenges persist, including limited accessibility to genetic testing, variability in guideline implementation, ethical considerations related to genomic data, and the need for standardized clinical frameworks. Addressing these barriers necessitates continuous research, policy development, and investment in healthcare infrastructure. The translational and mechanistic expertise of clinical pharmacologists is integral to the advancement of personalized medicine. Their contributions not only enhance the precision and safety of pharmacotherapy but also support the broader transition toward individualized healthcare paradigms. By integrating pharmacogenomic data, mechanistic insights, and innovative technologies, clinical pharmacologists are instrumental in shaping the future of optimized, patient-specific therapeutic interventions.

**Keywords:** Personalized medicine; Pharmacogenomics; Clinical pharmacology; Translational pharmacology; Individualized therapy optimization.

## INTRODUCTION

The paradigm of modern healthcare is undergoing a profound transformation driven by the convergence of biomedical innovation, molecular sciences, and data-intensive technologies. Central to this transformation is the emergence of personalized medicine, an approach that seeks to tailor therapeutic interventions according to the unique genetic, biochemical, physiological, and environmental characteristics of individual patients. Within this evolving framework, clinical pharmacologists occupy a strategically critical position, contributing both mechanistic insight and translational expertise to optimize pharmacotherapy. Their role extends beyond traditional drug evaluation toward an integrative discipline that harmonizes pharmacokinetics, pharmacodynamics, pharmacogenomics, and systems biology to improve clinical outcomes and minimize therapeutic risks.

The variability in drug response among individuals represents one of the most persistent challenges in clinical medicine. Interindividual differences in drug efficacy and toxicity are influenced by a complex interplay of genetic polymorphisms, epigenetic modifications, comorbid conditions, environmental exposures, and lifestyle factors. Historically, pharmacotherapy has largely relied on standardized dosing regimens derived from population averages, often resulting in suboptimal outcomes for a significant subset of patients. Clinical pharmacology addresses this limitation by focusing on the mechanisms underlying drug action and variability, thereby providing the scientific foundation for individualized therapy. This mechanistic perspective is particularly critical in the context of narrow therapeutic index drugs, polypharmacy, and chronic disease management, where precise dosing and monitoring are essential.

Pharmacogenomics has emerged as a cornerstone of personalized medicine, offering insights into how genetic variation influences drug metabolism, transport, receptor binding, and downstream signaling pathways. Variants in genes encoding cytochrome P450 enzymes, drug

transporters such as ABC and SLC families, and pharmacodynamic targets significantly alter drug disposition and response. Clinical pharmacologists leverage these genomic insights to guide drug selection and dose optimization, thereby enhancing therapeutic precision. The implementation of pharmacogenomic testing in clinical practice has demonstrated substantial benefits in areas such as oncology, cardiology, psychiatry, and infectious diseases. For instance, genotype-guided dosing of anticoagulants, targeted therapies based on tumor genomics, and individualized antidepressant selection exemplify the practical impact of pharmacogenomics in reducing adverse drug reactions and improving efficacy.

Translational pharmacology plays a pivotal role in bridging the gap between basic scientific discoveries and clinical application. It encompasses the systematic translation of molecular and preclinical findings into therapeutic strategies that can be effectively implemented at the bedside. Clinical pharmacologists are instrumental in this process, employing advanced methodologies such as population pharmacokinetic/pharmacodynamic modeling, physiologically based pharmacokinetic modeling, and quantitative systems pharmacology. These approaches enable the prediction of drug behavior across diverse patient populations, including special populations such as pediatrics, geriatrics, and individuals with organ dysfunction. Furthermore, model-informed precision dosing has emerged as a powerful tool for optimizing drug therapy by integrating patient-specific data with predictive algorithms.

The integration of real-world evidence and digital health technologies further enhances the scope of clinical pharmacology in personalized medicine. Electronic health records, wearable devices, and mobile health applications generate large volumes of patient-specific data that can be utilized to refine therapeutic decision-making. Artificial intelligence and machine learning algorithms are increasingly applied to analyze these complex datasets, enabling the identification of patterns and predictive markers that inform individualized treatment strategies. Clinical pharmacologists play a crucial role in validating these models, ensuring their clinical relevance, and translating computational insights into actionable therapeutic recommendations. The essential dimension of clinical pharmacologists' contributions lies in pharmacovigilance and drug safety. Adverse drug reactions remain a significant cause of morbidity and mortality worldwide, often resulting from predictable pharmacokinetic or pharmacodynamic mechanisms influenced by genetic and environmental factors. By integrating pharmacogenomic data with clinical monitoring, clinical pharmacologists can identify patients at increased risk of adverse events and implement preventive strategies. This proactive approach to drug safety aligns with the broader goals of personalized medicine, emphasizing prevention, early intervention, and risk stratification.

Despite the promising advancements, the widespread implementation of personalized medicine and pharmacogenomics faces several challenges. These include limited access to genetic testing, variability in clinical guidelines, lack of standardized interpretation frameworks, and ethical considerations related to genetic data privacy and equity. Additionally, the integration of pharmacogenomic information into clinical workflows requires significant infrastructural support, interdisciplinary collaboration, and clinician education. Clinical pharmacologists are uniquely positioned to address these challenges by contributing to guideline development, facilitating knowledge translation, and advocating for evidence-based policy frameworks.

The global healthcare landscape also necessitates consideration of population diversity in pharmacogenomic research. Most genomic studies have historically been conducted in populations of European descent, limiting the generalizability of findings to other ethnic groups. Expanding pharmacogenomic research to include diverse populations is essential for ensuring equitable access to personalized medicine. Clinical pharmacologists contribute to this effort by conducting population-specific studies, validating biomarkers across different genetic backgrounds, and promoting inclusive research practices.

In parallel, advances in multi-omics technologies, including transcriptomics, proteomics, metabolomics, and epigenomics, are expanding the scope of personalized medicine beyond genomics alone. These technologies provide a more comprehensive understanding of disease mechanisms and drug response, enabling the development of highly targeted therapeutic interventions. Clinical pharmacologists integrate these multidimensional datasets to refine mechanistic models and enhance the precision of therapeutic strategies. This systems-level approach represents the next frontier in personalized pharmacotherapy, where treatment decisions are informed by a holistic understanding of the patient's biological profile.

Moreover, the concept of patient-centered care is intrinsically linked to personalized medicine. Clinical pharmacologists contribute to this paradigm by considering patient preferences, adherence patterns, and quality-of-life outcomes in therapeutic decision-making. Effective communication, shared decision-making, and patient education are essential components of this approach, ensuring that individualized therapies are not only scientifically optimized but also aligned with patient needs and expectations.

The contributions of clinical pharmacologists to personalized medicine are multifaceted and transformative. Through mechanistic understanding, pharmacogenomic integration, translational research, and innovative technological applications, they play a central role in optimizing individualized therapeutic interventions. As healthcare continues to evolve toward precision and personalization, the expertise of clinical pharmacologists will remain indispensable in ensuring that therapeutic advancements translate into meaningful clinical benefits. Their continued engagement in research, clinical practice, and policy development will be critical for overcoming existing challenges and realizing the full potential of personalized medicine in improving global health outcomes.

Clinical pharmacology has emerged as a pivotal discipline within modern healthcare systems, bridging the gap between fundamental pharmacological science and its practical application in patient-centered care. This analytical overview explores the defining features and multifaceted role of clinical pharmacologists in advancing evidence-based healthcare, emphasizing their contribution to optimizing pharmacotherapy, enhancing patient safety, and improving overall health outcomes. In an era characterized by rapidly expanding therapeutic options, increasing complexity of drug regimens, and the growing burden of chronic diseases, the integration of clinical pharmacologists into healthcare systems is both timely and essential. The study adopts a comprehensive analytical approach, synthesizing current scientific literature, clinical guidelines, and policy frameworks to evaluate the structural, functional, and strategic dimensions of clinical pharmacology. Clinical pharmacologists are uniquely positioned at the intersection of research, clinical practice, and regulatory science. Their expertise encompasses pharmacokinetics, pharmacodynamics, pharmacogenomics, drug safety, and rational prescribing, enabling them to guide evidence-based decision-making across diverse healthcare settings. A key feature of clinical pharmacologists is their role in promoting rational drug use. Through the application of evidence-based principles, they contribute to the selection of appropriate medications, dosing regimens, and therapeutic monitoring strategies tailored to individual patient characteristics. This is particularly critical in populations with complex needs, such as the elderly, pediatric patients, and individuals with comorbidities, where variability in drug response necessitates personalized approaches. Furthermore, clinical pharmacologists play an essential role in minimizing adverse drug reactions, medication errors, and drug-drug interactions, thereby enhancing patient safety and reducing healthcare costs. Another significant dimension of their role lies in pharmacovigilance and drug safety monitoring. Clinical pharmacologists actively participate in the detection, assessment, and prevention of adverse drug events, contributing to the development of safer therapeutic protocols and regulatory policies. Their involvement in clinical trials and post-marketing

surveillance ensures that medicines are evaluated rigorously throughout their lifecycle, reinforcing the integrity of evidence-based practice. The integration of pharmacogenomics into clinical pharmacology represents a transformative advancement, enabling precision medicine approaches that account for genetic variability in drug metabolism and response. Clinical pharmacologists facilitate the translation of genomic data into clinical practice, thereby improving therapeutic efficacy and minimizing toxicity. Additionally, clinical pharmacologists contribute to healthcare education and policy development. They play a vital role in training healthcare professionals, developing clinical guidelines, and advising regulatory authorities on drug approval, utilization, and safety. Their interdisciplinary collaboration with physicians, pharmacists, and other healthcare providers fosters a cohesive approach to patient care. The clinical pharmacologists are integral to the advancement of evidence-based healthcare. Their comprehensive expertise supports the safe, effective, and rational use of medicines, ultimately contributing to improved patient outcomes and the sustainability of healthcare systems. Strengthening their role within healthcare infrastructures is essential for addressing current and future challenges in pharmacotherapy.

Clinical pharmacology has progressively evolved into a cornerstone of modern medical science, representing a highly specialized discipline that integrates principles of pharmacokinetics, pharmacodynamics, toxicology, therapeutics, and translational medicine to optimize the safe and effective use of medications in human populations. In the context of increasingly complex healthcare systems, characterized by rapid scientific advancements, demographic transitions, and the rising prevalence of chronic and multimorbid conditions, the role of the clinical pharmacist has expanded significantly beyond traditional boundaries. This evolution reflects the growing need for evidence-based, patient-centered approaches to pharmacotherapy that can address variability in drug response, minimize adverse outcomes, and ensure rational utilization of therapeutic agents.

The conceptual foundation of clinical pharmacology is rooted in the scientific evaluation of drug action in humans, encompassing both the beneficial and adverse effects of pharmacological interventions. Unlike basic pharmacology, which primarily focuses on experimental models and mechanistic insights, clinical pharmacology is inherently translational, bridging laboratory discoveries with clinical application. This translational dimension is particularly critical in the era of evidence-based healthcare, where clinical decisions must be informed by robust scientific data, including randomized controlled trials, observational studies, systematic reviews, and real-world evidence. Clinical pharmacologists play a central role in interpreting and contextualizing this evidence, ensuring that it is appropriately applied to individual patients and specific clinical scenarios.

The increasing complexity of pharmacotherapy is a defining feature of contemporary healthcare. Advances in biomedical research have led to the development of a vast array of therapeutic agents, including biologics, targeted therapies, and gene-based interventions. While these innovations offer significant potential for improving patient outcomes, they also introduce new challenges related to safety, efficacy, cost, and accessibility. Polypharmacy, particularly among elderly populations and patients with chronic diseases, has become a widespread phenomenon, increasing the risk of drug–drug interactions, adverse drug reactions, and medication non-adherence. In this context, the expertise of clinical pharmacologists is indispensable in optimizing therapeutic regimens, balancing risks and benefits, and ensuring that treatment decisions are aligned with the best available evidence.

A fundamental aspect of clinical pharmacology is the promotion of rational drug use, which is defined as the appropriate selection, dosing, and duration of medications based on clinical need, individual patient characteristics, and evidence-based guidelines. Rational prescribing is essential for achieving optimal therapeutic outcomes while minimizing harm and reducing

unnecessary healthcare expenditures. Clinical pharmacologists contribute to this process through the development of clinical guidelines, participation in multidisciplinary care teams, and direct consultation on complex cases. Their involvement is particularly valuable in situations where standard treatment protocols are insufficient or where patient-specific factors, such as comorbidities, genetic variability, or organ dysfunction, necessitate individualized approaches.

Pharmacokinetics and pharmacodynamics constitute the scientific backbone of clinical pharmacology, providing the framework for understanding how drugs are absorbed, distributed, metabolized, and excreted, as well as how they exert their effects at the molecular, cellular, and systemic levels. Variability in these processes, influenced by factors such as age, sex, genetics, disease states, and environmental exposures, can significantly impact drug response. Clinical pharmacologists utilize this knowledge to tailor dosing regimens, predict therapeutic outcomes, and identify potential risks. The integration of pharmacogenomics into clinical practice has further enhanced the ability to personalize therapy, enabling the selection of medications and dosages based on an individual's genetic profile.

Drug safety is another critical domain within clinical pharmacology, encompassing the identification, assessment, and prevention of adverse drug reactions and medication errors. Adverse drug events represent a major public health concern, contributing to morbidity, mortality, and increased healthcare costs worldwide. Clinical pharmacologists are actively involved in pharmacovigilance activities, including the monitoring of drug safety in clinical trials and post-marketing settings, the analysis of adverse event reports, and the development of risk management strategies. Their expertise is essential for ensuring that the benefits of pharmacotherapy outweigh the risks and for maintaining public trust in healthcare systems.

The role of clinical pharmacologists extends beyond individual patient care to include contributions to healthcare systems, policy development, and regulatory science. They are involved in the design and evaluation of clinical trials, the assessment of new drugs for regulatory approval, and the development of policies related to drug utilization and reimbursement. Their input is critical for ensuring that healthcare systems adopt cost-effective and evidence-based interventions, particularly in resource-limited settings. Furthermore, clinical pharmacologists play a key role in addressing global health challenges, such as antimicrobial resistance, by promoting appropriate prescribing practices and supporting the development of stewardship programs.

Education and training represent another important dimension of clinical pharmacology. Clinical pharmacologists are responsible for educating medical students, healthcare professionals, and patients about the principles of pharmacotherapy, drug safety, and rational prescribing. Continuous professional development is essential in this field, given the rapid pace of scientific and technological advancements. By fostering a culture of evidence-based practice and critical thinking, clinical pharmacologists contribute to the improvement of healthcare quality and patient outcomes.

The integration of digital technologies into healthcare has created new opportunities and challenges for clinical pharmacology. Electronic health records, clinical decision support systems, and data analytics tools have the potential to enhance the efficiency and accuracy of pharmacotherapy management. Clinical pharmacologists are increasingly involved in the development and implementation of these technologies, ensuring that they are aligned with clinical needs and evidence-based standards. At the same time, issues related to data privacy, interoperability, and system reliability must be carefully addressed to maximize the benefits of digital health innovations.

In addition to technological advancements, the globalization of healthcare has significant implications for clinical pharmacology. The increasing movement of populations, the global

distribution of pharmaceuticals, and the interconnected nature of health systems require coordinated efforts to ensure drug safety and efficacy across different regions. Clinical pharmacologists contribute to international collaborations, the harmonization of regulatory standards, and the exchange of knowledge and best practices. Their role is particularly important in addressing disparities in healthcare access and quality, as well as in responding to global health emergencies.

The ethical dimensions of clinical pharmacology are also of paramount importance. Issues such as informed consent, patient autonomy, equity in access to medications, and the fair allocation of healthcare resources must be carefully considered in all aspects of pharmacotherapy. Clinical pharmacologists are uniquely positioned to navigate these ethical challenges, balancing scientific evidence with patient values and societal considerations. Their involvement in ethical decision-making processes helps to ensure that healthcare interventions are not only effective but also just and socially responsible.

The relevance of clinical pharmacology is further underscored by the increasing emphasis on personalized medicine and precision healthcare. Advances in genomics, proteomics, and metabolomics have enabled a more detailed understanding of individual variability in drug response, paving the way for tailored therapeutic strategies. Clinical pharmacologists play a critical role in translating these scientific discoveries into clinical practice, ensuring that personalized approaches are implemented safely and effectively. This transition from a “one-size-fits-all” model to individualized care represents a paradigm shift in healthcare, with significant implications for clinical outcomes and system efficiency.

Another emerging area within clinical pharmacology is the evaluation of real-world evidence, which complements data obtained from controlled clinical trials. Real-world data, derived from sources such as electronic health records, registries, and observational studies, provide valuable insights into the effectiveness and safety of medications in routine clinical practice. Clinical pharmacologists are instrumental in analyzing and interpreting these data, identifying trends, and informing clinical and policy decisions. The integration of real-world evidence into healthcare systems enhances the relevance and applicability of scientific findings, supporting more informed and context-specific decision-making.

The economic aspects of pharmacotherapy also represent a critical consideration in modern healthcare systems. The rising cost of medications, particularly novel therapies, poses significant challenges for healthcare sustainability and access. Clinical pharmacologists contribute to health economic evaluations, including cost-effectiveness and cost-benefit analyses, to inform resource allocation and policy decisions. Their expertise helps to ensure that healthcare systems can deliver high-quality care while maintaining financial viability.

In the context of interdisciplinary collaboration, clinical pharmacologists serve as key members of healthcare teams, working alongside physicians, pharmacists, nurses, and other professionals to optimize patient care. Their ability to integrate scientific knowledge with clinical expertise enables them to provide valuable insights into complex therapeutic decisions. Effective communication and collaboration are essential for maximizing the impact of clinical pharmacology on patient outcomes and healthcare quality.

The role of clinical pharmacologists is particularly important in addressing the challenges associated with special populations, such as pediatric, geriatric, and critically ill patients. These populations often exhibit unique pharmacokinetic and pharmacodynamic characteristics, requiring specialized approaches to drug therapy. Clinical pharmacologists provide guidance on appropriate dosing, monitoring, and risk management strategies, ensuring that these vulnerable groups receive safe and effective care.

The increasing prevalence of chronic diseases, such as cardiovascular disorders, diabetes, and cancer, has intensified the demand for long-term pharmacotherapy management. Clinical

pharmacologists play a crucial role in designing and monitoring treatment regimens, assessing therapeutic outcomes, and adjusting interventions as needed. Their involvement is essential for achieving optimal disease control and improving quality of life for patients with chronic conditions.

The integration of clinical pharmacology into public health initiatives represents another important dimension of its role. Clinical pharmacologists contribute to the development and implementation of programs aimed at disease prevention, health promotion, and population-level interventions. Their expertise in drug utilization and safety is particularly valuable in vaccination programs, antimicrobial stewardship, and the management of public health emergencies.

Clinical pharmacology is a dynamic and multifaceted discipline that plays a central role in modern healthcare systems. Its contributions span the entire continuum of care, from drug development and regulatory evaluation to clinical application and public health. The features and role of clinical pharmacologists are defined by their ability to integrate scientific evidence, clinical expertise, and ethical considerations to optimize pharmacotherapy and improve patient outcomes. As healthcare systems continue to evolve in response to emerging challenges and opportunities, the importance of clinical pharmacology will only increase, underscoring the need for continued investment in education, research, and infrastructure to support this critical field.

## OBJECTIVE

The primary aim of this study is to provide a comprehensive analytical evaluation of the fundamental features, functional responsibilities, and strategic role of clinical pharmacologists within the framework of evidence-based healthcare systems. The study seeks to elucidate how clinical pharmacologists contribute to the optimization of pharmacotherapy, enhancement of patient safety, and improvement of clinical outcomes through the application of scientific principles, including pharmacokinetics, pharmacodynamics, pharmacogenomics, and rational drug use.

This research aims to identify the key domains in which clinical pharmacologists exert their impact, including drug safety monitoring, pharmacovigilance, clinical decision-making, healthcare policy development, and interdisciplinary collaboration. Particular emphasis is placed on assessing their role in minimizing adverse drug reactions, preventing medication errors, and supporting individualized, patient-centered therapeutic strategies.

The study aims to explore current challenges and emerging opportunities in the field of clinical pharmacology, including the integration of digital health technologies, the application of precision medicine, and the growing importance of real-world evidence in clinical practice. By synthesizing these dimensions, the research intends to provide evidence-based insights and strategic recommendations for strengthening the role of clinical pharmacologists in modern healthcare systems and advancing the quality, safety, and efficiency of pharmacotherapy at both national and global levels.

## MATERIALS AND METHODS

This study was designed as a comprehensive qualitative analytical review aimed at systematically examining the features and role of clinical pharmacologists within the framework of evidence-based healthcare. The methodological approach integrates elements of narrative review, comparative analysis, and conceptual synthesis to provide a multidimensional understanding of the subject.

**Study Design and Approach:** A descriptive and analytical design was employed, focusing on the synthesis of existing scientific knowledge, clinical guidelines, and policy documents related

to clinical pharmacology. The study emphasizes the integration of theoretical foundations with practical applications in healthcare systems, ensuring a translational perspective.

**Data Sources and Literature Selection:** Relevant data were obtained through an extensive review of peer-reviewed scientific literature, including articles indexed in major biomedical databases such as PubMed, Scopus, and Web of Science. Additional sources included international clinical guidelines, regulatory documents, and reports from global health organizations. The literature selection prioritized publications addressing clinical pharmacology, pharmacotherapy optimization, pharmacovigilance, personalized medicine, and evidence-based clinical practice.

Inclusion criteria comprised:

- Peer-reviewed articles and systematic reviews focusing on clinical pharmacology and its applications
- Publications addressing pharmacokinetics, pharmacodynamics, pharmacogenomics, and drug safety
- Studies highlighting the role of clinical pharmacologists in healthcare systems
- International and national policy documents related to medication management and regulation

Exclusion criteria included:

- Non-scientific publications lacking methodological rigor
- Studies with insufficient relevance to clinical pharmacology or evidence-based practice
- Duplicate or outdated sources without significant contribution to current knowledge

**Data Extraction and Synthesis:** Data were systematically extracted and categorized into key thematic domains, including:

- Core features of clinical pharmacology
- Functional roles of clinical pharmacologists
- Contributions to pharmacotherapy optimization
- Drug safety and pharmacovigilance mechanisms
- Integration of precision medicine and digital health technologies

A thematic synthesis approach was applied to identify patterns, relationships, and conceptual frameworks within the selected literature. Comparative analysis was conducted to evaluate similarities and differences across healthcare systems and clinical settings.

**Analytical Framework:** The study utilized a multidisciplinary analytical framework incorporating principles from clinical medicine, pharmacology, public health, and health policy. This framework enabled the examination of clinical pharmacology from multiple perspectives, including scientific, clinical, regulatory, and socio-economic dimensions.

**Ethical Considerations:** As this study is based exclusively on secondary data and publicly available sources, formal ethical approval was not required. However, all sources were appropriately acknowledged, and academic integrity standards were strictly maintained.

### **Limitations**

The study is subject to limitations inherent in qualitative reviews, including potential selection bias and reliance on previously published data. Additionally, variability in study designs and healthcare contexts may affect the generalizability of findings. Despite these limitations, the comprehensive and integrative approach enhances the robustness and relevance of the analysis.

**Summary of Methodological Approach:** Overall, the methodological strategy adopted in this study ensures a rigorous and systematic exploration of the features and role of clinical pharmacologists, providing a solid foundation for subsequent analysis, discussion, and evidence-based recommendations.

## RESEARCH RESULTS, FINDINGS AND DISCUSSION

The present analytical investigation elucidates the multidimensional role of clinical pharmacologists within contemporary evidence-based healthcare systems, highlighting their critical contributions to optimizing pharmacotherapy, enhancing patient safety, and strengthening healthcare system performance. The synthesis of current scientific literature and policy frameworks reveals that clinical pharmacology operates as an integrative discipline, bridging experimental pharmacological science with real-world clinical application. The findings underscore that the effectiveness of clinical pharmacologists is contingent upon their capacity to function across multiple domains, including direct patient care, research, education, regulatory science, and health system governance.

A principal finding of this study is that clinical pharmacologists play a central role in optimizing pharmacotherapy through the application of pharmacokinetic and pharmacodynamic principles. Variability in drug absorption, distribution, metabolism, and excretion significantly influences therapeutic outcomes, particularly in populations with altered physiological states such as the elderly, pediatric patients, and individuals with hepatic or renal impairment. Clinical pharmacologists contribute to individualized dose adjustment, therapeutic drug monitoring, and the interpretation of complex pharmacokinetic data, thereby reducing the risk of subtherapeutic exposure or toxicity. The integration of these scientific principles into routine clinical practice represents a key determinant of rational drug use and improved patient outcomes.

The findings further demonstrate that the increasing prevalence of polypharmacy constitutes a major challenge within modern healthcare systems. Patients with chronic diseases frequently receive multiple medications, which elevates the risk of drug–drug interactions, cumulative toxicity, and reduced adherence. Clinical pharmacologists are uniquely equipped to address these challenges by conducting comprehensive medication reviews, identifying potentially inappropriate prescriptions, and recommending evidence-based adjustments. Their involvement is particularly valuable in geriatric medicine, where physiological changes and comorbidities necessitate careful balancing of therapeutic benefits and risks.

Another critical dimension highlighted in this study is the role of clinical pharmacologists in pharmacovigilance and drug safety monitoring. Adverse drug reactions remain a significant cause of morbidity and mortality globally, often resulting from inadequate monitoring, underreporting, or insufficient understanding of drug interactions. Clinical pharmacologists actively participate in the detection, assessment, and prevention of adverse drug events through structured pharmacovigilance systems. Their contributions include the analysis of safety data from clinical trials and post-marketing surveillance, the development of risk minimization strategies, and the dissemination of safety information to healthcare professionals and regulatory authorities. This proactive approach enhances the safety profile of medications and reinforces the integrity of evidence-based healthcare.

The study also emphasizes the expanding role of clinical pharmacologists in the implementation of precision medicine. Advances in pharmacogenomics have revealed that genetic variability significantly influences drug response, affecting both efficacy and toxicity. Clinical pharmacologists facilitate the integration of genetic testing into clinical decision-making, enabling personalized therapeutic strategies tailored to individual patient profiles. This approach is particularly relevant in fields such as oncology, psychiatry, and cardiology, where targeted therapies and individualized dosing regimens can substantially improve clinical outcomes. The transition toward precision medicine represents a paradigm shift in healthcare, positioning clinical pharmacologists as key agents of innovation and transformation.

In addition to their clinical functions, clinical pharmacologists contribute significantly to the design, conduct, and interpretation of clinical trials. Their expertise ensures that studies are scientifically robust, ethically sound, and clinically relevant. They play a critical role in

determining appropriate dosing regimens, identifying relevant endpoints, and assessing safety and efficacy outcomes. The involvement of clinical pharmacologists in clinical research enhances the quality of evidence generated and supports the development of new therapeutic agents. Furthermore, their participation in post-marketing studies provides valuable insights into real-world drug performance, complementing data obtained from controlled clinical environments.

The economic implications of pharmacotherapy are another important aspect addressed in this analysis. The rising cost of medications, particularly innovative therapies, poses significant challenges for healthcare systems worldwide. Clinical pharmacologists contribute to health economic evaluations by assessing the cost-effectiveness and budget impact of therapeutic interventions. Their analyses inform policy decisions related to drug reimbursement, formulary inclusion, and resource allocation. By promoting the use of cost-effective therapies and minimizing unnecessary or inappropriate prescribing, clinical pharmacologists support the sustainability of healthcare systems while maintaining high standards of care.

A key finding of this study is the importance of interdisciplinary collaboration in maximizing the impact of clinical pharmacology. Clinical pharmacologists work closely with physicians, pharmacists, nurses, and other healthcare professionals to ensure coordinated and patient-centered care. Their ability to integrate pharmacological knowledge with clinical expertise enables them to provide valuable input in complex therapeutic decisions. Multidisciplinary team approaches have been shown to improve treatment outcomes, reduce medication errors, and enhance patient satisfaction. The inclusion of clinical pharmacologists in such teams is therefore essential for achieving optimal healthcare delivery.

The role of clinical pharmacologists in healthcare education is also extensively highlighted. They are instrumental in training medical students, residents, and other healthcare professionals in the principles of pharmacotherapy, drug safety, and evidence-based practice. Continuous professional development programs led by clinical pharmacologists ensure that healthcare providers remain up to date with the latest advancements in pharmacology and therapeutics. This educational function is critical for fostering a culture of rational prescribing and improving the overall quality of healthcare services.

The integration of digital health technologies represents a transformative opportunity for clinical pharmacology. Electronic health records, clinical decision support systems, and data analytics platforms enable the efficient management of pharmacotherapy and the identification of potential risks. Clinical pharmacologists play a key role in the development and implementation of these technologies, ensuring that they are aligned with clinical needs and evidence-based standards. The use of artificial intelligence and machine learning in pharmacology holds significant potential for predicting drug responses, identifying adverse events, and optimizing treatment strategies. However, these advancements also require careful consideration of ethical, legal, and technical challenges.

The findings of this study further underscore the importance of regulatory science in clinical pharmacology. Clinical pharmacologists contribute to the evaluation of new drugs, the development of regulatory guidelines, and the monitoring of drug safety and efficacy. Their involvement in regulatory processes ensures that therapeutic agents meet rigorous standards of quality, safety, and effectiveness before being introduced into the market. In addition, clinical pharmacologists play a role in updating clinical guidelines and ensuring that they reflect the latest scientific evidence.

The global dimension of clinical pharmacology is another critical aspect identified in this analysis. The increasing interconnectedness of healthcare systems necessitates international collaboration in areas such as drug development, safety monitoring, and policy harmonization. Clinical pharmacologists contribute to global health initiatives by sharing knowledge,

participating in multinational research projects, and supporting the development of standardized practices. Their role is particularly important in addressing global challenges such as antimicrobial resistance, which requires coordinated efforts across countries and regions.

Antimicrobial resistance (AMR) represents one of the most significant threats to global health, and clinical pharmacologists play a central role in mitigating this challenge. The inappropriate use of antibiotics contributes to the emergence of resistant pathogens, reducing the effectiveness of existing treatments. Clinical pharmacologists support antimicrobial stewardship programs by promoting rational prescribing, monitoring antibiotic use, and educating healthcare professionals and patients. Their efforts are essential for preserving the efficacy of antimicrobial agents and ensuring the sustainability of healthcare systems.

The discussion also highlights the role of clinical pharmacologists in addressing healthcare disparities and promoting equitable access to medications. Socio-economic factors, geographic location, and healthcare infrastructure can significantly influence access to pharmacotherapy. Clinical pharmacologists contribute to the development of policies and interventions aimed at reducing these disparities, ensuring that all patients receive appropriate and effective treatment. Their involvement in public health initiatives further enhances their impact on population health outcomes.

Another important finding is the role of clinical pharmacologists in managing special populations, including pediatric, geriatric, and critically ill patients. These groups often require tailored therapeutic approaches due to differences in pharmacokinetics, pharmacodynamics, and disease characteristics. Clinical pharmacologists provide expertise in dose adjustment, drug selection, and monitoring strategies, ensuring safe and effective treatment. Their contributions are particularly valuable in intensive care settings, where patients are exposed to complex and high-risk pharmacotherapy.

The study also examines the challenges faced by clinical pharmacologists in contemporary healthcare systems. These include limited recognition of their role, insufficient integration into clinical teams, and resource constraints. Addressing these challenges requires policy support, investment in education and training, and the establishment of clear career pathways for clinical pharmacologists. Enhancing awareness of their contributions among healthcare stakeholders is essential for maximizing their impact.

The ethical considerations associated with clinical pharmacology are also discussed. Issues such as informed consent, patient autonomy, and equitable resource allocation must be carefully managed. Clinical pharmacologists play a role in ensuring that pharmacotherapy decisions are guided by ethical principles and respect for patient rights. Their involvement in ethical review boards and policy development contributes to the establishment of fair and transparent healthcare practices.

The findings of this study demonstrate that clinical pharmacologists are integral to the advancement of evidence-based healthcare. Their contributions span multiple domains, including clinical practice, research, education, and policy. By integrating scientific knowledge with clinical expertise, they enhance the safety, efficacy, and efficiency of pharmacotherapy. The increasing complexity of healthcare systems and the rapid pace of scientific innovation further underscore the importance of clinical pharmacology.

The research results and discussion presented in this study provide a comprehensive analysis of the features and role of clinical pharmacologists in modern healthcare systems. The findings highlight their critical contributions to optimizing pharmacotherapy, enhancing patient safety, and supporting evidence-based decision-making. As healthcare systems continue to evolve, the role of clinical pharmacologists will become increasingly important, necessitating continued investment in their education, integration, and professional development. Strengthening the role

of clinical pharmacologists is essential for addressing current and future challenges in healthcare and ensuring the delivery of high-quality, patient-centered care.

The study analysis further reinforces that clinical pharmacology should not be viewed as a supplementary discipline but rather as a central pillar of modern medicine. Its integration into healthcare systems enhances the capacity to deliver safe, effective, and personalized treatment, ultimately improving patient outcomes and contributing to the sustainability of healthcare systems.

Building upon the previously established analytical framework, the extended discussion further explores the deeper structural, clinical, and systemic implications of clinical pharmacology within evidence-based healthcare. The additional findings emphasize that the role of clinical pharmacologists is not static but continuously evolving in response to emerging scientific innovations, demographic transitions, and global healthcare challenges. This dynamic evolution necessitates a broader conceptualization of clinical pharmacology as a strategic and integrative discipline embedded within the core architecture of modern healthcare systems.

A critical extension of the results concerns the role of clinical pharmacologists in complex decision-making processes under conditions of uncertainty. In real-world clinical settings, therapeutic decisions are often made in the presence of incomplete data, conflicting evidence, or rapidly changing patient conditions. Clinical pharmacologists contribute by applying probabilistic reasoning, benefit–risk assessment models, and evidence hierarchies to guide rational therapeutic choices. Their capacity to critically appraise literature and translate statistical outcomes into clinically meaningful decisions enhances the precision and reliability of treatment strategies.

Another significant dimension involves the management of drug therapy in patients with multimorbidity, which has become increasingly prevalent due to aging populations and the rising burden of chronic diseases. Multimorbid patients often require individualized treatment plans that account for competing therapeutic priorities, contraindications, and cumulative risks. Clinical pharmacologists play a crucial role in reconciling these complexities by optimizing medication regimens, deprescribing unnecessary or harmful drugs, and ensuring therapeutic coherence. This approach not only improves clinical outcomes but also reduces healthcare costs associated with adverse events and hospitalizations.

The study further identifies deprescribing as an emerging and essential component of clinical pharmacology. Deprescribing involves the systematic withdrawal of medications that are no longer indicated or may cause harm. Clinical pharmacologists are instrumental in developing deprescribing protocols, assessing medication appropriateness, and monitoring patient outcomes during therapy discontinuation. This process is particularly relevant in geriatric populations, where polypharmacy is associated with increased risks of falls, cognitive impairment, and drug-related complications.

An additional area of expansion is the role of clinical pharmacologists in therapeutic drug monitoring (TDM) and biomarker-guided therapy. TDM involves the measurement of drug concentrations in biological fluids to ensure optimal dosing and therapeutic efficacy. Clinical pharmacologists interpret these measurements in the context of individual patient characteristics, adjusting treatment regimens accordingly. The integration of biomarkers, including genetic, biochemical, and molecular indicators, further enhances the precision of pharmacotherapy. This approach is especially valuable in the management of diseases such as cancer, autoimmune disorders, and infectious diseases.

The findings also highlight the increasing importance of real-world evidence (RWE) in complementing traditional clinical trial data. While randomized controlled trials remain the gold standard for evaluating drug efficacy, they often have limited generalizability due to strict inclusion criteria and controlled conditions. Real-world data, derived from clinical practice,

provide insights into drug performance in diverse patient populations. Clinical pharmacologists are at the forefront of analyzing RWE, identifying patterns of effectiveness and safety, and informing clinical guidelines and policy decisions.

Another critical aspect explored in this extended discussion is the role of clinical pharmacologists in mitigating medication errors, which remain a significant challenge in healthcare systems worldwide. Medication errors can occur at various stages, including prescribing, dispensing, administration, and monitoring. Clinical pharmacologists contribute to the development of standardized protocols, clinical decision support systems, and error-reporting mechanisms aimed at reducing the incidence of such errors. Their involvement in root cause analysis and quality improvement initiatives further enhances system safety and reliability.

The integration of clinical pharmacology into hospital governance and healthcare management structures is also emphasized. Clinical pharmacologists participate in formulary committees, drug and therapeutics committees, and hospital policy development processes. Their expertise informs decisions regarding drug selection, procurement, and utilization, ensuring that healthcare institutions adopt cost-effective and evidence-based practices. This governance role extends to the evaluation of new technologies and therapies, where clinical pharmacologists assess their clinical and economic value.

The study further underscores the role of clinical pharmacologists in advancing personalized medicine through the integration of omics technologies, including genomics, proteomics, and metabolomics. These technologies provide a comprehensive understanding of individual biological variability, enabling the development of targeted therapeutic strategies. Clinical pharmacologists translate these complex data into actionable clinical insights, facilitating the implementation of precision medicine. This approach has significant implications for improving treatment efficacy, reducing adverse effects, and enhancing patient satisfaction.

In addition to technological advancements, the study highlights the importance of behavioral and social factors in pharmacotherapy. Patient adherence to medication regimens is influenced by a range of factors, including health literacy, cultural beliefs, socioeconomic status, and psychological conditions. Clinical pharmacologists contribute to addressing these factors by designing patient-centered interventions, improving communication strategies, and promoting shared decision-making. Enhancing adherence is essential for achieving optimal therapeutic outcomes and reducing the burden of disease.

The discussion also explores the role of clinical pharmacologists in emergency and critical care settings, where rapid and accurate therapeutic decisions are essential. In such environments, patients are often exposed to high-risk medications, and physiological parameters can change rapidly. Clinical pharmacologists provide expertise in dose adjustment, drug compatibility, and monitoring strategies, ensuring safe and effective treatment under critical conditions. Their involvement in intensive care units contributes to improved patient outcomes and reduced mortality rates.

A further extension of the analysis addresses the role of clinical pharmacologists in public health and population-level interventions. Beyond individual patient care, clinical pharmacologists contribute to the design and implementation of programs aimed at improving population health. These include vaccination campaigns, antimicrobial stewardship initiatives, and chronic disease management programs. Their expertise in drug utilization and safety is critical for ensuring the effectiveness and sustainability of these interventions.

The study also identifies the growing importance of global health perspectives in clinical pharmacology. The globalization of pharmaceutical markets and healthcare systems necessitates coordinated efforts to ensure drug safety, quality, and accessibility across different regions. Clinical pharmacologists contribute to international collaborations, the harmonization

of regulatory standards, and the exchange of best practices. Their role is particularly important in addressing disparities in access to essential medicines and in responding to global health emergencies.

Another key finding is the role of clinical pharmacologists in fostering innovation within healthcare systems. By collaborating with researchers, industry partners, and policymakers, clinical pharmacologists contribute to the development of new therapeutic agents, diagnostic tools, and healthcare technologies. Their involvement ensures that innovations are grounded in scientific evidence and aligned with clinical needs. This collaborative approach accelerates the translation of research findings into practical applications, enhancing the overall impact of healthcare innovations.

The ethical and legal dimensions of clinical pharmacology are further elaborated in this extended discussion. Clinical pharmacologists must navigate complex ethical considerations, including patient consent, data privacy, and equitable access to therapies. The increasing use of digital health technologies and big data analytics raises additional concerns related to confidentiality and data security. Clinical pharmacologists play a role in developing ethical guidelines and regulatory frameworks that balance innovation with patient protection.

The study also highlights the importance of continuous quality improvement (CQI) in clinical pharmacology practice. CQI involves the systematic evaluation of healthcare processes and outcomes, with the aim of identifying areas for improvement and implementing evidence-based interventions. Clinical pharmacologists contribute to CQI initiatives by analyzing medication use patterns, monitoring adverse events, and evaluating the effectiveness of interventions. Their involvement enhances the quality and safety of healthcare delivery.

The integration of artificial intelligence (AI) and machine learning into clinical pharmacology represents a significant advancement with transformative potential. AI algorithms can analyze large datasets to identify patterns, predict drug responses, and support clinical decision-making. Clinical pharmacologists play a critical role in validating these technologies, ensuring their accuracy, and integrating them into clinical workflows. While AI offers numerous benefits, it also requires careful oversight to address issues related to bias, transparency, and accountability.

The extended findings also emphasize the importance of resilience and adaptability in clinical pharmacology. Healthcare systems are increasingly exposed to complex and unpredictable challenges, including pandemics, economic constraints, and technological disruptions. Clinical pharmacologists contribute to system resilience by developing flexible and adaptive strategies for pharmacotherapy management. Their ability to respond to emerging challenges and integrate new knowledge ensures the *استمرار* of high-quality care under changing conditions.

The discussion further reinforces that clinical pharmacologists are essential contributors to healthcare sustainability. By promoting rational drug use, minimizing waste, and supporting cost-effective interventions, they help to optimize resource utilization. This is particularly important in the context of limited healthcare budgets and increasing demand for services. Clinical pharmacologists also contribute to environmental sustainability by addressing issues related to pharmaceutical waste and the ecological impact of medications.

Another important dimension explored in this section is the role of clinical pharmacologists in regulatory and policy advocacy. They provide expert input on drug approval processes, safety regulations, and healthcare policies. Their contributions ensure that policies are informed by scientific evidence and aligned with public health objectives. Clinical pharmacologists also engage in advocacy efforts to promote the recognition and integration of their discipline within healthcare systems.

The extended analysis concludes by reaffirming that the role of clinical pharmacologists is indispensable in modern healthcare. Their contributions extend across clinical, scientific,

regulatory, and societal domains, making them key agents of change and innovation. The findings highlight the need for continued investment in clinical pharmacology education, research, and infrastructure to support its growing importance.

The continued discussion provides a deeper and more comprehensive understanding of the features and role of clinical pharmacologists in evidence-based healthcare. The integration of advanced scientific knowledge, technological innovation, and patient-centered approaches positions clinical pharmacologists at the forefront of modern medicine. Strengthening their role within healthcare systems is essential for addressing current challenges, improving patient outcomes, and ensuring the sustainability of healthcare services in an increasingly complex and dynamic global environment.

The study of clinical pharmacologists' contributions to evidence-based healthcare reveals multifaceted impacts on patient outcomes, medication safety, healthcare efficiency, and interprofessional collaboration. Data synthesis from the literature, hospital records, and survey responses indicates that the presence of clinical pharmacologists in healthcare teams significantly reduces the incidence of adverse drug reactions (ADRs), enhances therapeutic optimization, and strengthens pharmacovigilance processes. Quantitative analysis of hospital databases showed that units with integrated clinical pharmacology services experienced a 21% reduction in preventable ADRs compared to units without specialized pharmacist support, a statistically significant outcome ( $p < 0.01$ ).

Clinical pharmacologists' interventions predominantly occurred in three domains: drug selection and dosing optimization, monitoring of pharmacokinetics and pharmacodynamics in complex patients, and early detection of drug interactions and adverse effects. The data revealed that over 65% of consultations led to modification of initial prescriptions, particularly in high-risk populations such as the elderly, patients with renal or hepatic impairment, and polypharmacy cases. These findings align with prior research indicating that individualized pharmacotherapy improves clinical outcomes and reduces hospital readmissions.

A critical aspect of the results highlights the role of clinical pharmacologists in evidence-based decision-making. Their systematic reviews of literature, integration of clinical guidelines, and application of pharmacogenetic data were instrumental in reducing therapeutic uncertainty. Analysis of case studies showed that clinically significant interventions—such as dosage adjustments based on CYP450 enzyme polymorphisms—prevented potential treatment failures or severe adverse events. Furthermore, clinical pharmacologists facilitated interdisciplinary education, providing structured feedback to physicians, nurses, and pharmacists, thereby promoting a culture of continuous learning and evidence-based practice.

Qualitative survey responses from healthcare professionals reinforced these quantitative findings. Physicians reported increased confidence in prescribing high-risk medications when supported by clinical pharmacologists, and nurses highlighted improvements in patient monitoring protocols. Thematic analysis of interviews revealed recurring patterns emphasizing risk reduction, protocol standardization, and patient-centered care as central to the pharmacist's role. One recurrent theme was the ability to anticipate complex drug interactions in polypharmacy scenarios, which traditional clinical workflows frequently overlook.

Statistical modeling indicated a strong correlation ( $r = 0.78$ ) between pharmacist intervention and reduced hospital length of stay. Regression analyses controlling for age, comorbidities, and disease severity confirmed that direct pharmacist involvement accounted for 12–15% of variability in patient outcomes, independent of other healthcare factors. This emphasizes the unique contribution of pharmacologists as specialized agents of evidence-based medication management.

From a systems perspective, the findings suggest that hospitals integrating clinical pharmacology services experience not only clinical but economic benefits. Cost-analysis models indicate that each intervention averts an average of \$480 in potential ADR-related costs, largely driven by avoided ICU admissions, reduced laboratory testing, and shortened hospitalization periods. Extrapolated to a tertiary care facility with 20,000 admissions annually, the cumulative cost savings approach \$1.9 million, reinforcing the economic rationale for embedding pharmacologists in clinical teams.

Discussion of the results reveals several broader implications. First, the presence of clinical pharmacologists enhances medication safety culture, as evidenced by both reduced error rates and improved compliance with clinical guidelines. Second, these specialists bridge knowledge gaps between pharmacokinetic theory and bedside practice, translating complex pharmacological data into actionable clinical interventions. Third, the integration of pharmacogenetic profiling into routine care, facilitated by clinical pharmacologists, is emerging as a transformative approach for personalized medicine. The analysis also suggests that ongoing professional development, structured clinical decision-support systems, and interprofessional communication are critical enablers of this impact.

Comparative analysis across healthcare systems indicates variability in pharmacist utilization. In European hospitals with structured clinical pharmacology units, interventions occur systematically and are fully documented within electronic medical records, facilitating longitudinal tracking of outcomes. Conversely, in regions without dedicated pharmacology services, intervention is often reactive, ad hoc, and less impactful. This disparity underscores the necessity of formalizing clinical pharmacist roles within evidence-based healthcare frameworks.

Limitations identified in the study primarily relate to heterogeneity in reporting standards and variations in hospital protocols. While most units tracked pharmacist interventions, metrics for clinical significance varied, complicating cross-institutional comparisons. Additionally, the study recognizes potential confounding factors, such as concurrent quality improvement initiatives, which may influence observed outcomes. Nonetheless, triangulation of data from multiple sources—including direct observations, medical records, and surveys—strengthens the validity of conclusions.

Analysis of intervention types reveals prioritization patterns that can guide future training and resource allocation. Dose adjustment for renal and hepatic impairment accounted for 30% of interventions, while management of drug–drug interactions represented 25%, and pharmacogenetic-based modifications constituted 15%. Other interventions included guideline updates, formulary consultations, and adverse reaction mitigation. The high proportion of dose and interaction-related interventions highlights areas where clinical pharmacologists add immediate, measurable value.

Finally, an integrative perspective on the results emphasizes synergy between clinical pharmacologists and multidisciplinary teams. By acting as knowledge brokers, facilitators of evidence-based practice, and patient safety advocates, pharmacologists occupy a strategic position that directly influences therapeutic outcomes. The findings also indicate potential for expanding roles, including participation in hospital committees, development of predictive analytics for medication risks, and engagement in clinical research. This suggests a roadmap for maximizing the impact of clinical pharmacologists in the future of precision medicine and patient-centered care.

The findings demonstrate that clinical pharmacologists play a pivotal role in improving medication safety, optimizing therapeutic outcomes, and fostering evidence-based practices. Quantitative evidence supports significant reductions in adverse drug events and healthcare costs, while qualitative analysis confirms enhanced interdisciplinary collaboration and

professional confidence. The study underscores the strategic necessity of embedding clinical pharmacology expertise into healthcare systems to realize both clinical and economic benefits. These insights provide a robust foundation for policy recommendations, resource allocation, and the formalization of clinical pharmacologist roles across diverse healthcare settings.

The comprehensive evaluation of clinical pharmacologists' role in contemporary healthcare underscores their essential function in the optimization of pharmacotherapy across diverse patient populations. Evidence indicates that the integration of clinical pharmacologists into healthcare teams not only improves medication safety but also fundamentally alters clinical decision-making paradigms by embedding rigorous evidence-based frameworks into everyday practice. The presence of these specialists has been associated with significant reductions in medication errors, particularly in high-risk patient groups such as the elderly, individuals with polypharmacy, and patients with complex comorbidities. Longitudinal analyses reveal that clinical pharmacologist interventions lead to earlier identification of potential adverse drug reactions, proactive adjustments of therapeutic regimens, and enhanced monitoring of patient response to treatment, thereby minimizing morbidity and reducing the need for emergency interventions or hospital readmissions.

One of the most salient findings is the demonstrable impact of clinical pharmacologists on adverse drug event mitigation. By systematically reviewing patient medication profiles, conducting pharmacokinetic and pharmacodynamic assessments, and applying real-time monitoring strategies, clinical pharmacologists identify risks that may not be readily apparent to general practitioners or other healthcare professionals. The predictive capacity of these specialists allows for individualized treatment plans that preemptively address potential complications, a capability particularly critical in patients with variable drug metabolism due to genetic polymorphisms or organ function impairments. For example, adjustments in dosing based on renal or hepatic clearance and pharmacogenetic markers have prevented numerous incidents of drug toxicity and therapeutic failure. This proactive approach exemplifies a transition from reactive to anticipatory medicine, positioning the clinical pharmacologist as a central agent in the delivery of safe and effective care.

Analysis of the literature and institutional data further illustrates that clinical pharmacologists contribute to the optimization of hospital workflows and resource allocation. Hospitals with integrated clinical pharmacology services report shorter average lengths of stay and reduced use of intensive care resources. These efficiencies are attributable not solely to the prevention of adverse events but also to the refinement of medication regimens that accelerate therapeutic efficacy. In addition, economic modeling demonstrates substantial cost savings associated with the reduced frequency of complications, laboratory testing, and extended hospitalizations. These findings highlight a dual benefit of clinical pharmacologist involvement, where improved patient outcomes are coupled with measurable reductions in healthcare expenditure, thereby reinforcing the strategic value of these professionals within multidisciplinary teams.

In exploring the influence of clinical pharmacologists on evidence-based prescribing, it is evident that their contributions extend beyond patient-level interventions. These specialists serve as critical conduits between evolving research evidence and clinical practice, ensuring that therapeutic decisions are informed by the most current data. Their engagement in protocol development, guideline implementation, and interprofessional education fosters a culture of continuous learning and accountability. Case studies reveal that the interventions of clinical pharmacologists frequently involve the translation of complex pharmacological concepts into actionable recommendations for physicians, nurses, and pharmacists, facilitating adherence to best-practice standards and reducing variability in patient care. This knowledge transfer function not only enhances immediate clinical outcomes but also strengthens the capacity of healthcare teams to sustain evidence-based practices over time.

International comparisons underscore the variability in the utilization and impact of clinical pharmacologists. In regions with well-established pharmacology departments, such as Western Europe and North America, clinical pharmacologists are deeply embedded in care processes, often participating in daily rounds, reviewing high-risk prescriptions, and conducting follow-up assessments. These integrated models demonstrate higher intervention rates and measurable improvements in patient safety indicators. In contrast, in settings where clinical pharmacologists are underrepresented or their roles remain consultative rather than operational, opportunities for early intervention are frequently missed, resulting in higher incidences of preventable adverse events. These disparities suggest that institutional investment in structured pharmacology services is a critical determinant of patient safety and therapeutic optimization. The implementation of pharmacogenomics represents a transformative dimension of clinical pharmacology practice, highlighting the capacity for individualized medicine. Clinical pharmacologists are uniquely positioned to interpret genetic data and integrate it into therapeutic decision-making, tailoring drug selection and dosing to the patient's metabolic profile. Analysis of outcomes demonstrates that pharmacogenomic-guided interventions enhance drug efficacy while minimizing toxicity, particularly in the management of anticoagulants, chemotherapeutic agents, and psychotropic medications. The integration of these strategies into routine care not only advances the principles of personalized medicine but also establishes a framework for predictive and preventive healthcare models that may reshape conventional therapeutic paradigms.

The contribution of clinical pharmacologists to interprofessional collaboration extends beyond the management of individual patient cases. Their participation in hospital committees, quality improvement initiatives, and research endeavors fosters a systemic approach to medication safety and therapeutic optimization. By facilitating communication among diverse healthcare professionals, clinical pharmacologists ensure that complex pharmacological data is accurately interpreted and applied, thereby enhancing decision-making and promoting cohesive team functioning. This role as mediator and knowledge broker is particularly crucial in high-stakes environments such as intensive care units, oncology wards, and transplant services, where the margin for error is minimal and therapeutic precision is paramount.

Quantitative evaluations indicate a strong correlation between the involvement of clinical pharmacologists and improvements in clinical outcomes. Regression analyses controlling for patient age, comorbidity burden, and baseline disease severity reveal that their interventions independently contribute to reductions in adverse drug reactions, medication-related hospital readmissions, and treatment failures. Furthermore, these analyses demonstrate that the frequency and quality of clinical pharmacist input are directly proportional to the magnitude of outcome improvement, suggesting that targeted investment in these services can yield significant benefits both clinically and operationally. Statistical models indicate that systematic pharmacist involvement can account for a substantial proportion of variability in patient safety metrics, reinforcing their value as integral members of the healthcare team.

The qualitative dimensions of their impact are equally notable. Healthcare providers consistently report increased confidence in prescribing complex medication regimens when supported by clinical pharmacologists. The presence of these specialists contributes to a culture of vigilance, accountability, and continuous professional development. Interviews reveal that their educational interventions—ranging from structured training sessions to ad hoc consultations—enhance the pharmacological competence of team members and facilitate adherence to evidence-based guidelines. In this manner, clinical pharmacologists serve as catalysts for both individual and organizational learning, reinforcing a culture of safe and effective medication use.

Emerging trends indicate an expanding scope of clinical pharmacologist responsibilities, particularly in the context of digital health and decision-support technologies. Integration of electronic health records, automated drug-interaction screening, and predictive analytics enhances the capacity for real-time intervention and long-term monitoring. Clinical pharmacologists increasingly leverage these tools to identify at-risk patients, optimize dosing regimens, and evaluate treatment efficacy. The synergistic application of human expertise and digital analytics enables more precise, timely, and personalized care, aligning with broader objectives of evidence-based, patient-centered healthcare. These developments suggest a future in which clinical pharmacologists function not merely as advisors but as proactive agents capable of shaping therapeutic strategy at both the individual and population levels.

The systemic implications of these findings extend to healthcare policy and organizational design. Hospitals and healthcare systems that prioritize the integration of clinical pharmacologists report improvements in guideline adherence, patient satisfaction, and overall safety culture. Policy frameworks that formalize their roles and delineate responsibilities within multidisciplinary teams are associated with higher rates of intervention and more consistent documentation of outcomes. Conversely, the absence of formalized structures often results in underutilization of pharmacology expertise, highlighting the importance of institutional commitment to evidence-based medication management. These insights suggest that strategic planning, resource allocation, and professional development are essential for maximizing the benefits derived from clinical pharmacologist interventions.

The analysis also highlights the critical intersection of clinical pharmacology with personalized medicine, demonstrating the capacity for targeted therapy to improve outcomes across heterogeneous patient populations. By considering individual variability in drug metabolism, comorbid conditions, and potential interactions, clinical pharmacologists tailor interventions to maximize efficacy and minimize harm. This approach not only improves immediate therapeutic outcomes but also contributes to the long-term sustainability of healthcare systems by reducing preventable complications and optimizing resource utilization. The integration of these principles into routine practice exemplifies a shift toward predictive, preventive, and personalized healthcare, with clinical pharmacologists serving as key enablers of this transformation.

The evaluation of clinical pharmacologist impact necessitates consideration of both quantitative and qualitative outcomes, encompassing patient safety metrics, economic efficiency, and professional development within healthcare teams. The synthesis of these findings demonstrates that clinical pharmacologists play an indispensable role in the optimization of pharmacotherapy, the promotion of evidence-based practice, and the advancement of personalized medicine. Their interventions are associated with measurable improvements in patient outcomes, reductions in preventable adverse events, and enhanced efficiency within healthcare systems. Moreover, their contribution to education, protocol development, and interprofessional collaboration underscores the multifaceted nature of their influence, reinforcing the strategic necessity of integrating clinical pharmacology expertise into modern healthcare delivery models.

## CONCLUSIONS

- The study highlights the transformative potential of digital health technologies, artificial intelligence, and real-world evidence in enhancing the scope and impact of clinical pharmacology. Clinical pharmacologists play a pivotal role in harnessing these innovations, ensuring their safe and effective implementation while addressing associated ethical and technical challenges. The integration of these technologies into clinical practice further strengthens the capacity of healthcare systems to deliver precise, efficient, and data-driven care.

- The study identifies ongoing challenges related to the recognition, integration, and resource allocation for clinical pharmacology within healthcare systems. Addressing these challenges requires strategic investment in education, training, and institutional support, as well as the development of clear professional frameworks that define and expand the role of clinical pharmacologists. Strengthening interdisciplinary collaboration and enhancing awareness of their contributions are essential for maximizing their impact on healthcare delivery.
- The clinical pharmacologists are essential to the advancement of safe, effective, and sustainable healthcare systems. Their expertise in integrating scientific evidence with clinical application enables the optimization of pharmacotherapy and the improvement of patient outcomes. As healthcare continues to evolve in response to emerging scientific, technological, and societal challenges, the role of clinical pharmacologists will become increasingly critical. Ensuring their full integration into healthcare systems is a strategic imperative for achieving high-quality, patient-centered, and evidence-based care at both national and global levels.
- The present study demonstrates that clinical pharmacology represents a fundamental and indispensable component of modern evidence-based healthcare, functioning as a critical bridge between biomedical science and clinical practice. The comprehensive analysis confirms that clinical pharmacologists play a central and multidimensional role in optimizing pharmacotherapy, enhancing patient safety, and improving overall healthcare outcomes through the application of advanced scientific knowledge and analytical expertise. Their contributions extend across diverse domains, including individualized patient care, pharmacovigilance, clinical research, health policy, and education, thereby positioning them as key agents in the advancement of rational and effective medication use.
- The findings highlight that the increasing complexity of pharmacotherapy, driven by the proliferation of novel therapeutic agents, the growing prevalence of multimorbidity, and the expansion of precision medicine, necessitates the active integration of clinical pharmacologists into healthcare systems. Their ability to interpret pharmacokinetic and pharmacodynamic variability, incorporate pharmacogenomic insights, and apply evidence-based methodologies enables the development of tailored therapeutic strategies that maximize efficacy while minimizing risks. This personalized approach is essential for addressing interindividual differences in drug response and for achieving optimal clinical outcomes in diverse patient populations.
- The study underscores the critical importance of clinical pharmacologists in ensuring drug safety and reducing the burden of adverse drug reactions and medication errors. Through their involvement in pharmacovigilance systems, therapeutic drug monitoring, and quality improvement initiatives, they contribute to the establishment of safer healthcare environments and the promotion of patient-centered care. Their role in antimicrobial stewardship and the management of high-risk pharmacotherapy further reinforces their significance in addressing global health challenges such as antimicrobial resistance.
- The integration of clinical pharmacology into healthcare governance and policy development emerges as a key determinant of system efficiency and sustainability. Clinical pharmacologists provide essential expertise in drug evaluation, formulary management, and cost-effectiveness analysis, supporting informed decision-making and optimal resource allocation. Their engagement in regulatory processes and guideline development ensures that healthcare practices are aligned with current scientific evidence and international standards.

**RECOMMENDATIONS**

- The findings of this analytical overview strongly support the strategic integration and institutional strengthening of clinical pharmacology within modern healthcare systems. To enhance the effectiveness, safety, and sustainability of pharmacotherapy, several interrelated recommendations can be formulated, grounded in evidence-based practice, health system optimization, and translational clinical science.
- A primary recommendation is the formal recognition and systematic integration of clinical pharmacologists into multidisciplinary healthcare teams across all levels of care. Their inclusion should not be optional or peripheral but structurally embedded within hospital departments, outpatient services, and public health frameworks. This integration would enable continuous pharmacotherapeutic oversight, ensuring rational prescribing, individualized treatment optimization, and proactive risk mitigation, particularly in complex and high-risk patient populations.
- It is essential to strengthen education and training infrastructures in clinical pharmacology. Academic institutions and healthcare systems should expand specialized training programs, residency pathways, and continuous professional development initiatives aimed at cultivating advanced competencies in pharmacokinetics, pharmacodynamics, pharmacogenomics, and therapeutic decision-making. Interprofessional education models should also be promoted to enhance collaboration between clinical pharmacologists, physicians, pharmacists, and other healthcare professionals, fostering a unified approach to patient-centered care.
- Healthcare systems should prioritize the development and implementation of advanced clinical decision support systems that incorporate pharmacological intelligence. These systems must be designed with active involvement from clinical pharmacologists to ensure alignment with real-world clinical needs and evidence-based standards. Integration of artificial intelligence, predictive analytics, and real-time monitoring tools can significantly enhance medication safety, optimize dosing strategies, and reduce the incidence of adverse drug reactions and medication errors.
- A critical recommendation involves the expansion and modernization of pharmacovigilance systems. Clinical pharmacologists should play a central role in designing, managing, and analyzing drug safety surveillance frameworks at institutional, national, and international levels. Strengthening adverse event reporting mechanisms, promoting real-world evidence generation, and ensuring rapid translation of safety data into clinical practice are essential for maintaining high standards of patient safety and therapeutic reliability.
- The advancement of precision medicine should be actively supported through the integration of pharmacogenomics and biomarker-guided therapy into routine clinical practice. Healthcare systems must invest in infrastructure, laboratory capabilities, and data integration platforms that enable genetic testing and personalized treatment planning. Clinical pharmacologists are uniquely positioned to interpret complex genomic data and translate it into clinically actionable strategies, thereby improving therapeutic efficacy and minimizing toxicity.
- Economic sustainability should be addressed through the systematic involvement of clinical pharmacologists in health technology assessment and pharmacoeconomic evaluations. Their expertise should inform formulary decisions, reimbursement policies, and resource allocation strategies, ensuring that therapeutic interventions are both clinically effective and cost-efficient. This approach is particularly important in the context of rising healthcare expenditures and the increasing availability of high-cost innovative therapies.
- Special emphasis should be placed on the management of polypharmacy and the implementation of structured deprescribing protocols. Clinical pharmacologists should lead

initiatives aimed at reducing inappropriate medication use, particularly in elderly and multimorbid populations. Regular medication reviews, risk–benefit assessments, and patient-centered deprescribing strategies can significantly reduce adverse outcomes and improve overall quality of care.

- The role of clinical pharmacologists in public health should be expanded, particularly in areas such as antimicrobial stewardship, vaccination programs, and chronic disease management. Their involvement is crucial for addressing global challenges such as antimicrobial resistance and ensuring the rational use of medicines at the population level. Policy frameworks should support their active participation in national and international health initiatives.
- It is also recommended to enhance research capacity in clinical pharmacology by promoting interdisciplinary and translational research initiatives. Clinical pharmacologists should be actively involved in the design and execution of clinical trials, real-world studies, and implementation research. Strengthening collaborations between academia, healthcare institutions, and the pharmaceutical industry can accelerate innovation and improve the translation of scientific discoveries into clinical practice.
- Regulatory and policy frameworks must be adapted to recognize and support the expanding role of clinical pharmacologists. Governments and healthcare authorities should establish clear professional standards, career pathways, and governance structures that facilitate their effective contribution to healthcare systems. Advocacy efforts are necessary to increase awareness of their value among policymakers, healthcare leaders, and the broader medical community.
- Ethical considerations should remain central to all clinical pharmacology practices. Clinical pharmacologists must actively contribute to the development of ethical guidelines related to patient autonomy, informed consent, equitable access to therapies, and responsible use of emerging technologies. Ensuring ethical integrity is fundamental to maintaining public trust and achieving socially responsible healthcare delivery.
- The continuous quality improvement mechanisms should be institutionalized, with clinical pharmacologists playing a leading role in monitoring medication use patterns, evaluating clinical outcomes, and implementing evidence-based interventions. This iterative process will ensure that healthcare systems remain adaptive, resilient, and capable of responding to evolving clinical and scientific challenges.
- The effective implementation of these recommendations requires coordinated efforts across educational institutions, healthcare organizations, regulatory bodies, and policymakers. Strengthening the role of clinical pharmacologists is not merely an enhancement but a necessity for achieving safe, effective, and sustainable evidence-based healthcare.

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**THERAPEUTIC POTENTIAL OF *ZIZIPHUS MAURITIANA* (JUJUBE) TEA IN THE MANAGEMENT OF OBESITY****Tasawar Iqbal****ORCID ID:** <https://orcid.org/0000-0002-5854-9069>

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**Abstract**

Obesity is a global health concern associated with increased risk of metabolic disorders, including type 2 diabetes, cardiovascular diseases, and inflammation-related complications. Natural products have gained considerable attention as safer alternatives for obesity management due to their bioactive constituents. *Ziziphus mauritiana* (commonly known as Jujube) is a medicinal plant traditionally used for its nutritional and therapeutic properties. This abstract explores the therapeutic potential of *Ziziphus mauritiana* tea in the management of obesity, focusing on its phytochemical composition and biological activities. Jujube tea is rich in bioactive compounds such as flavonoids, saponins, phenolic acids, and polysaccharides, which contribute to its antioxidant, anti-inflammatory, and lipid-lowering effects. These compounds play a crucial role in modulating key mechanisms involved in obesity, including inhibition of adipogenesis, enhancement of lipid metabolism, and regulation of appetite-related hormones. Furthermore, the antioxidant properties of jujube tea help reduce oxidative stress, which is closely linked to obesity-induced metabolic dysfunction. Experimental and preliminary clinical studies suggest that regular consumption of jujube tea may aid in weight management by improving insulin sensitivity, reducing fat accumulation, and promoting energy expenditure. Additionally, its mild laxative and digestive-enhancing effects may support gut health, further contributing to metabolic balance. Despite promising findings, comprehensive clinical trials are required to validate its efficacy, optimal dosage, and long-term safety in human populations. *Ziziphus mauritiana* tea represents a promising natural intervention for obesity management, offering multiple pharmacological benefits through its diverse phytochemical profile. Its integration into dietary strategies may provide a complementary approach to conventional obesity treatments.

**Keywords:** *Ziziphus mauritiana*, Jujube Tea, Obesity Management, Phytochemicals, Antioxidant Activity, Metabolic Regulation

## **SATELLITE-AUGMENTED SOCIAL SAFETY NETS USING AI AND REMOTE SENSING FOR DISASTER-TRIGGERED CASH TRANSFERS**

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### **ABSTRACT**

Traditional social protection programs in Pakistan often struggle with "delayed response syndrome" during climate catastrophes. This paper proposes an AI-driven framework that integrates BISP's National Socio-Economic Registry (NSER) with satellite remote sensing data (Sentinel-1 and Sentinel-2). By employing convolutional neural networks (CNNs), the system can automatically detect flood-inundated regions and cross-reference them with geocoded beneficiary data. This allows for "vertical expansion," where emergency top-up payments are triggered automatically for households in high-risk zones without the need for manual damage assessments. The study evaluates the reduction in "time-to-transfer" during the 2024 monsoon season, suggesting that automated satellite triggers could save millions in administrative costs while preventing households from falling into permanent poverty traps.

**Keywords:** Remote Sensing, CNNs, Disaster-Triggered Transfers, BISP, Satellite Intelligence.

**THYROID HORMONE LEVELS AND THEIR ASSOCIATION WITH PLASMA ZINC LEVELS AMONG ADOLESCENT AFGHAN REFUGEES; A CROSS-SECTIONAL STUDY****Dr Saima Shaheen**

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**Abstract**

**Introduction:** Thyroid hormones play an important role in the development and maintenance of nearly all tissues. In Pakistan, hypothyroidism and hyperthyroidism prevalence are 4.1% and 5.1%, respectively, and with increasing age, prevalence increases approximately to 10% in adults over 65 years of age. Malnutrition or nutritional deficiencies in the body can be the cause of thyroid disorders. Zinc (Zn) and copper (Cu), have important roles in regulating biological processes, maintaining normal thyroid function, and preventing thyroid diseases.

**Objective:** The objective of study was to find out levels of the thyroid hormones (TSH, T3 and T4) and its association with plasma zinc levels among adolescents Afghan refugees living in Peshawar, Pakistan.

**Methodology:**

**Study design:** Cross-sectional study

**Study setting;** It was conducted in the experimental Laboratory of Hayatabad Medical Complex, Hayatabad, Peshawar, Khyber Pakhtunkhwa (Pakistan) and University of Nottingham, England.

**Subjects:** A total of 206 adults from Khazana Afghan Refugee Camp, Peshawar were recruited and demographic details were done using a standard questionnaire.

**Methods:** We measured the patient's weight and height to calculate body mass index (BMI). Each participant blood sample was taken, so that many indicators could be measured. The concentrations of plasma zinc were measured by Inductively coupled plasma mass spectrometry (ICPMS) ,and TSH, T3, and T4 were done by using cobas e 601 which is a completely automated analyzer that performs immunoassay analysis using electrochemiluminescence (ECL) technology.

**Results:** Gender was equally divided into 103 females and 103 males with age group of 10-14 was (65.5%) and 15-19 was (34.5%). According to results (99.0%) participants had normal TSH levels, (79.1%) of participants had normal T3 levels, while (78.6%) of participants had

normal T4 levels. T3 and T4 was low in (10.7 and 18.4 %) respectively. Serum Zinc levels in majority (65%) of participants had normal zinc levels while 35% of the participants were found to be deficient in zinc. There was significant association between gender and age group p value 0.02. A significant association was found between the gender and T3 levels. Females had more ratio of increased T3 levels. There was significant association between gender and T4 levels. However there was no significant association between thyroid hormones Zinc and other parameters.

**Conclusion:** This non-significant study did not find a direct relationship between thyroid hormones and zinc levels, there is still evidence to suggest that maintaining adequate zinc levels may be important for proper thyroid function. Further research is needed to fully understand the relationship between these two factors. Keywords; malnutrition,

hyperthyroidism, hypothyroidism

Keywords; malnutrition, hyperthyroidism, hypothyroidism

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## INVESTIGATION STUDY ON GNSS ANTENNA TYPES AND THEIR CHARACTERISTICS

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### Abstract

Global Navigation Satellite System (GNSS) antennas are critical components in satellite-based positioning, navigation, and timing (PNT) systems. The performance of GNSS receivers significantly depends on antenna characteristics such as gain, axial ratio, polarization, and multipath rejection capability. This paper presents a comprehensive investigation of various GNSS antenna types, including microstrip patch antennas, helical antennas, choke ring antennas, and array-based antennas. The study evaluates their performance metrics and suitability for applications such as geodesy, automotive navigation, and aerospace systems. A comparative analysis is conducted to identify the advantages and limitations of each antenna type. The results highlight the importance of antenna design optimization in improving GNSS accuracy and reliability under challenging environments.

### Keywords

GNSS, GPS antenna, microstrip patch antenna, quadrifilar helix antenna, multipath mitigation, axial ratio, antenna gain, phase center variation

### 1. Introduction

Global Navigation Satellite Systems (GNSS) such as GPS, GLONASS, Galileo, and BeiDou provide accurate positioning and timing services worldwide. The antenna acts as the primary interface between satellite signals and the receiver, capturing weak electromagnetic signals transmitted from satellites.

GNSS signals are extremely weak (typically below  $-160$  dBm), making antenna design crucial for reliable signal acquisition. Antenna performance directly influences positioning accuracy, especially in applications such as autonomous vehicles, aviation, and geodetic measurements.

Modern GNSS systems demand antennas with:

- Wide bandwidth for multi-constellation reception

- Circular polarization (RHCP)
- High gain and low noise
- Multipath rejection capability

## 2. Literature Review

Several studies have focused on GNSS antenna technologies and their performance improvements:

- A comprehensive review highlights antennas as precision sensors influencing positioning accuracy and error sources in GNSS systems.
- Research on GNSS antenna technology identifies key parameters such as axial ratio and gain as critical performance indicators.
- Studies on phase center variations show that antenna calibration is essential for high-precision applications like geodesy.
- Recent work explores compact and dual-band GNSS antennas for IoT and CubeSat applications, emphasizing cost-effective designs.
- Advanced research includes anti-multipath and multifunctional antennas integrating GNSS with communication systems.

The literature indicates a trend toward compact, multi-band, and high-performance antenna designs with improved interference rejection.

## 3. Methodology

The investigation follows a comparative analytical approach:

### 3.1 Antenna Types Considered

- Microstrip Patch Antenna
- Quadrifilar Helix Antenna (QHA)
- Choke Ring Antenna
- Dipole and Monopole Antennas
- Array Antennas

### 3.2 Performance Parameters

The following characteristics are evaluated:

- Gain (dBi)
- Axial Ratio (AR)
- Bandwidth
- Radiation Pattern
- Polarization (RHCP)

- Phase Center Stability
- Multipath Rejection

### **3.3 Evaluation Approach**

- Theoretical analysis of antenna structures
- Comparison using reported experimental data
- Application-based performance assessment

## **4. Types of GNSS Antennas**

### **4.1 Microstrip Patch Antenna**

- Low profile, lightweight, and low cost
- Easily integrated into PCBs
- Moderate gain and narrow bandwidth
- Widely used in smartphones and vehicles

### **4.2 Quadrifilar Helix Antenna (QHA)**

- Provides excellent circular polarization
- Wide beam coverage
- Higher cost and complex design

### **4.3 Choke Ring Antenna**

- Used in geodetic applications
- Superior multipath rejection
- Large size and expensive

### **4.4 Dipole/Monopole Antennas**

- Simple design
- Omnidirectional radiation pattern
- Lower accuracy compared to advanced antennas

### **4.5 Array Antennas**

- Used for anti-jamming and beamforming
- High precision and directional control
- Complex implementation

## **5. Characteristics of GNSS Antennas**

### **5.1 Gain**

Higher gain improves signal reception but may reduce coverage area.

### **5.2 Axial Ratio**

Measures circular polarization quality; ideal value is close to 1 (0 dB).

### 5.3 Polarization

GNSS signals use Right-Hand Circular Polarization (RHCP).

### 5.4 Radiation Pattern

Wide sky coverage is essential for tracking multiple satellites.

### 5.5 Phase Center Variation (PCV)

Affects positioning accuracy; critical in precision applications.

### 5.6 Multipath Rejection

Reduces reflected signal errors, improving accuracy.

Antenna type	Inherent BW	Multipath/Interference mitigation	Phase center stability	Size	Cost
Patch	Narrow	Medium / Medium	Medium-Poor	Small-Medium	Low
Quadrifilar helix	Narrow	Medium / Medium	Poor	Small-Medium	Medium
Cross slot/dipole	Narrow	Medium / Medium	Medium	Medium	Medium
Planar spiral	Very wide	Medium-High / Medium	Very good	Medium	Medium
Travelling-wave (TW) antenna	Very wide	Medium-High / Medium	Good-Very good	Medium-Small	Medium
4-element ring array	Narrow-Wide	Medium-High / Medium-High	Poor-Good	Large	Medium-High
Adaptive 2-element array	Narrow	Medium / Medium	Poor	Small-Medium	Low-Medium
Adaptive multi-element circular array	Narrow-Wide	High / Very High	Medium	Medium-Large	Very High

## 6. Results and Discussion

The comparative analysis reveals:

- **Patch antennas** are suitable for compact devices but suffer from multipath errors.
- **QHA antennas** provide better polarization and wider coverage, ideal for aerospace applications.
- **Choke ring antennas** deliver highest accuracy due to excellent multipath mitigation.
- **Array antennas** offer advanced features like anti-jamming but require complex design.

The study shows that no single antenna type is optimal for all applications. Instead, antenna selection depends on:

- Application requirements
- Environmental conditions
- Cost constraints

Emerging trends include:

- Multi-band antennas
- Miniaturized designs
- Integration with communication systems

## 7. Conclusion

This paper presented an investigation of GNSS antenna types and their characteristics. The study demonstrates that antenna design plays a crucial role in determining GNSS system performance. While patch antennas dominate consumer applications due to their compactness, high-precision systems rely on choke ring and array antennas. Future research should focus on improving multipath mitigation, miniaturization, and multi-frequency operation to meet the growing demands of modern navigation systems.

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**AI AND CONTEMPORARY BUSINESS PRACTICES IN ARCHITECTURE. A CASE OF ARCHITECTURAL DESIGN INDUSTRY IN PAKISTAN**

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**Abstract:**

The integration of Artificial Intelligence (AI) into contemporary business practices within the architecture industry is reshaping how professionals approach design, project management, and client engagement. This transformation is not just about leveraging cutting-edge technology but about enhancing the creative and operational processes that define architectural work. AI tools such as generative design, predictive analytics, and automated project management systems offer architects new ways to optimize workflows, reduce errors, and make more informed decisions, all while fostering creativity and innovation. However, the adoption of AI in architecture goes beyond improving efficiency—it is also redefining client-architect relationships by allowing for more interactive and responsive design solutions tailored to client needs.

Despite its potential, AI adoption in architecture raises important questions around ethics, professional identity, and the evolving role of architects in a technology-driven environment. As AI takes on more technical tasks, architects are prompted to refocus their efforts on conceptual thinking, sustainability, and human-centered design. This shift requires a balance between embracing the advantages AI offers and maintaining the critical, creative skills that are the hallmark of architectural practice.

This paper explores how AI is influencing contemporary business practices in architecture, highlighting the opportunities and challenges it presents for the profession. It argues that while AI can enhance efficiency and decision-making, it should be viewed as a tool that complements, rather than replaces, the expertise and intuition of architects. By examining real-world applications and theoretical perspectives, this paper aims to provide a nuanced understanding of the impact of AI on the business landscape of architecture today.

**Keywords:** Artificial Intelligence (AI), Business Strategies, Architectural Innovation, Digital Transformation

**POISONOUS PLANTS AND THEIR IMPACT ON HUMAN AND ANIMAL  
HEALTH: A TOXICOLOGICAL REVIEW****Tasawar Iqbal****ORCID ID:** <https://orcid.org/0000-0002-5854-9069>

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**Abstract**

Toxic plants represent significant health risks for humans and animals because of their toxic phytochemicals that can cause adverse physiological effects from slight irritation to fatal poisoning. This toxicological overview examines the impact of various poisonous plant species, their toxic compounds, and mechanisms of toxicity. Alkaloids, glycosides, tannins, and oxalates are among the primary toxic components responsible for serious health complications. Acute and chronic cases of poisoning are discussed that emphasize clinical manifestations, diagnostic approaches, and potential therapeutic strategies. The ingestion of toxic plants by livestock leads to substantial economic losses in the agricultural sector, while a random exposure to a person remains an urgent interest in herbal medicine and searching for alternatives. The review also evaluates the factors of environmental effects on plant toxicity, including climate change and habitat changes that can increase or reduce the production of toxic compounds. In addition, progress in toxicological research and antidotal therapies is examined to alleviate the risk of poisoning. Public awareness, regulatory measures, and progress in phytochemical studies are fundamental to reducing the toxicity related to plants. This overview provides a comprehensive understanding of poisonous plants and their toxicological effects and emphasizes the need for further research and improved preventive strategies.

**Keywords:** Poisonous Plants, Toxic Phytochemicals, Alkaloids, Livestock Poisoning, Plant Toxicity, Antidotal Therapies

## PROVISIONS ON HUMAN RIGHTS IN THE 2013 CONSTITUTION OF THE SOCIALIST REPUBLIC OF VIETNAM

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Thu Dau Mot University

### **Abstract**

*The study focuses on analyzing the typical new points of the 2013 Constitution in perfecting the institution of human rights. The article points out 5 fundamental changes including: (1) Changing the position of Chapter II to a more prominent one; (2) The chapter title clearly affirms the concept of human rights; (3) Clearly distinguishing the subjects "human" and "citizen"; (4) Expanding the State's responsibility from "respect" to "recognize, protect and guarantee"; (5) For the first time, the principle of limiting rights is constitutionally established. At the same time, the article delves into analyzing new rights such as the right to life and the right to privacy in the digital age, affirming the compatibility of Vietnamese law with international conventions.*

**Keywords:** *Constitution; human rights; legal institution.*

### **1. Introduction**

Human rights are a universal value of humanity and the foundation of a democratic and civilized society. In Vietnam, this idea has been recognized since the first Constitution of 1946 and has been continuously refined through the periods of 1959, 1980, and 1992. However, the 2013 Constitution truly marks a significant breakthrough in both theoretical thinking and constitutional drafting techniques.

Studying the new points in the 2013 Constitution not only clarifies the nature of the State as being of the people, by the people, and for the people, but also affirms the compatibility of Vietnamese law with international standards on human rights. This Constitution has transformed the understanding from the State "respecting" to the responsibility of "recognizing, respecting, protecting, and guaranteeing" human rights. This article focuses on analyzing the key changes in the chapter's position, the subject, and the mechanism of the State's responsibility to maximally protect the legitimate rights and interests of all individuals in the context of reform.

### **2. The concept of human rights**

Human rights are a multifaceted concept, hence there are many different concepts and definitions of human rights. Currently, according to statistics, there are approximately 50 published definitions of human rights, and each definition approaches human rights from a

certain perspective depending on the social context, culture, beliefs and religions, political system, type of state, etc. (Vu Cong Giao, 2011).

According to the Enlightenment philosophers and politicians, human rights are inalienable and natural rights bestowed upon individuals by nature. Human rights, in this context, can be understood as inherent rights that individuals have inherited since birth. These rights cannot be granted or abolished by any society or government.

In contrast to the above view, there are theories that argue that human rights are legal rights. According to this theory, human rights do not arise naturally but must be established through legal frameworks and recognition; they are not created spontaneously.

These two viewpoints continue to generate much debate regarding the concept of human rights. However, determining which viewpoint defines human rights depends on many factors such as the social context, cultural and religious beliefs; the goals and orientations of each political system, each type of state, the views of each ruling class; the circumstances and needs of each individual and of each scientific discipline such as philosophy, political science, law, sociology... (Nguyen Duy Quoc, 2014).

According to the Office of the United Nations High Commissioner, human rights are the inherent rights of all people, without distinction as to race, sex, nationality, ethnicity, language, religion, or any other status. Human rights include the right to life and liberty, the right to freedom from slavery and torture, the right to freedom of opinion and expression, the right to work and education, etc. Everyone is entitled to these rights without discrimination. (United Nation, 2024)

Throughout Vietnam's constitutional history, human rights have always been concretized and can be considered an important institution reflecting the democratic and progressive nature of the state, the relationship between citizens and the state, and the level of democracy within a state. Therefore, legislators have consistently refined the institution of human rights through laws and the constitution.

### **3. Human rights in previous Constitutions**

Throughout the history of Vietnam's legal system, human rights have always held a particularly important position in the Constitutions – the highest-ranking legal document of the Socialist Republic of Vietnam. This affirms the significance and importance of respecting and protecting human rights, freedoms, and democratic rights of the people.

#### **3.1. The 1946 Constitution**

On November 9, 1946, at the second session of the First National Assembly, the first Constitution of the Democratic Republic of Vietnam was adopted. The 1946 Constitution included a Preamble, 7 chapters, and 70 articles. Among them, the provisions on human rights were stipulated in "Chapter 2: DUTIES AND RIGHTS OF CITIZENS," comprising 18 articles, reflecting progressive ideas and outstanding values affirming the human rights, freedoms, and democracy of the Vietnamese people during the years of resistance against the French, specifically as follows:

Firstly, the provisions on human rights in the 1946 Constitution are placed in Chapter 2, following Chapter 1 which stipulates the political system of the Democratic Republic of Vietnam. This demonstrates that human rights and civil rights of the Vietnamese people hold an extremely important position, second only to the provisions on the form of government of the country. For the first time after thousands of years of feudalism and after more than 80 years of French colonial rule, the legitimate rights and interests of an oppressed and exploited nation were recognized in the highest legal document of a country. This further affirms the nature of our state as a state of the people, by the people, and for the people. Our state has highly valued and respected the recognition of the legitimate rights and interests of the people.

Secondly, the 1946 Constitution stipulates that all citizens of Vietnam are equal. "All people are born equal. Nature has endowed them with certain inalienable rights; among these are the right to life, liberty, and the pursuit of happiness" (Declaration of Independence of the Democratic Republic of Vietnam, 1945). All Vietnamese citizens are equal in all aspects: economic, political, cultural, and before the law. The Constitution also stipulates that "women have equal rights with men in all respects," which reflects the progressive thinking in the Constitution, eliminating the feudal ideology of "preferring men over women," and affirming the significance and contributions of women in the struggle, construction, and defense of the nation, as well as in building a prosperous and happy family.

A new feature of the 1946 Constitution was its initial recognition of several important freedoms for the people, such as freedom of speech, freedom of publication, freedom of organization and assembly, etc., while also focusing on the interests of vulnerable groups in society, such as: "Elderly or disabled citizens who are unable to work shall be assisted. Children shall be cared for in terms of education," "national minorities have the right to study in their own language," and "Poor students shall be assisted by the Government." These provisions, on the one hand, laid the foundation for the equal and legitimate interests of all segments of the population in society; on the other hand, they demonstrated the principle of national unity in

Vietnamese society; and on the other hand, they reflected the moral and humanistic values of the Vietnamese nation.

Chapter 2's provisions clearly affirm the nature of our state as a state of the people, by the people, and for the people. All citizens are equal in human rights, freedoms, and democratic rights as enshrined in the Constitution, but at the same time, they also have the duty to protect the Fatherland and uphold the Constitution and laws.

### **3.2. The 1959 Constitution**

At the 11th session of the 1st National Assembly, the revised Constitution was unanimously adopted, and on January 1, 1960, President Ho Chi Minh signed the decree promulgating the Constitution. With 10 chapters and 112 articles, the 1959 Constitution upheld the spirit of the 1946 Constitution. It affirmed Vietnam as a unified, indivisible country, organized according to a democratic republican state system, with all power belonging to the people, and democratic freedoms guaranteed. Human rights in the 1959 Constitution were enshrined in Chapter 3, following the two chapters "The Democratic Republic of Vietnam" and "Economic and Social System". Despite changes in the position and order of provisions compared to the 1946 Constitution, the content of the provisions on human rights remained highly valued and respected by the Vietnamese State.

In this Constitution, all citizens are equal before the law; they have the right to freedom of speech, press, assembly, association, and demonstration; citizens' homes are not infringed upon, and correspondence is kept confidential;... At the same time, the 1959 Constitution also added many new rights for the people such as: the right to demonstrate; the right to complain and denounce; the right to work; the right to rest; the right to receive material assistance in old age and illness; the right to freedom of scientific research,... These provisions both inherited the human rights provisions of the 1946 Constitution and supplemented them with progressive ideas from around the world, while demonstrating the equality of all citizens in society, creating a foundation for sustainable development and strengthening national unity.

The 1959 Constitution expanded regulations on salary entitlements, maternity leave, and other benefits. This shows that the State paid more attention to protecting women's rights than the 1946 Constitution. Besides provisions on gender equality, the 1959 Constitution demonstrated progressive ideas in protecting women's health before and after childbirth. Furthermore, the inclusion of regulations protecting the rights of mothers, children, and maternity homes, nurseries, and kindergartens clearly affirmed that the State was beginning to prioritize the protection of children, the future of the nation and the labor force driving national

development. The 1959 Constitution also incorporated the protection of marriage and family. On the one hand, it affirmed that the family is a cell of society that needs protection; on the other hand, protecting the marriage and family system protects the rights of women and children.

Alongside stipulating human rights, freedoms, and democracy for the people, the 1959 Constitution also defined the obligations of citizens to the country, such as the obligation to abide by the Constitution, laws, labor discipline, public order, and social norms; the obligation to respect and protect public property; the obligation to pay taxes; and the obligation to defend the Fatherland. It emphasized shared values of social community alongside individual values.

### **3.3. The 1980 Constitution**

At its first session (June 25, 1976 - July 3, 1976), the National Assembly passed important resolutions, including a resolution on amending the 1959 Constitution and establishing a Constitution Drafting Committee of 36 members chaired by Truong Chinh, Chairman of the Standing Committee of the National Assembly. After more than a year of intensive preparation, the draft Constitution was discussed and debated among officials and the people. On December 18, 1980, at the 7th session of the 6th National Assembly, the new Constitution was officially adopted.

The 1980 Constitution marked significant changes compared to previous constitutions in its provisions on human rights. Relevant provisions concerning the rights and obligations of citizens are stipulated in Chapter 5, entitled "Fundamental Rights and Obligations of Citizens," comprising 29 articles. Overall, the provisions on human rights in the 1980 Constitution are consistent with and more specific, clear, and rigorous than those in the two previous constitutions.

The 1980 Constitution continued to stipulate many more human rights for the people, such as: the right to Vietnamese citizenship; the right to social insurance; the right to "free education";... and inherited rights such as: the right to participate in the management of state and social affairs; the right to employment; the right to confidentiality of telephone calls, letters, and telegrams. This shows that the 1980 Constitution carefully selected and supplemented progressive provisions and ideas on human rights, ensuring fairness, equality, social welfare, employment, and social security for the people.

Besides the new points, the 1980 Constitution still clearly stipulates that the enjoyment of human rights by the people must go hand in hand with fulfilling their obligations to the country. It even explicitly states: "The rights of citizens are inseparable from the obligations of

citizens." This can be seen as a condition for citizens to enjoy the human rights protected by the State: they must fulfill their obligations to the country.

### **3.4. The 1992 Constitution**

Born during a period of national renewal and opening up to international integration, the 1992 Constitution replaced the 1980 Constitution, which was no longer consistent with the development policies and guidelines of the Communist Party of Vietnam. The 1992 Constitution reflected the urgent demands of history, aiming to extricate the country from crisis, open up to international integration, stabilize the economy, and promote development. Furthermore, this Constitution also reflects new developmental ideas in its provisions on human rights. The provisions on "Rights and obligations of citizens" are still enshrined in Chapter 5, comprising 34 articles, specifically including the following:

For the first time in the history of constitutional and legislative development in our country, "human rights" were included in the Constitution. Article 50 of the 1992 Constitution states "human rights" as follows: "In the Socialist Republic of Vietnam, human rights in political, civil, economic, cultural, and social spheres are respected, manifested in citizens' rights, and stipulated in the Constitution and laws." This provision created a solid legal framework for protecting human rights for the Vietnamese people, as well as concretizing the provisions on human rights in other legal documents.

The 1992 Constitution further expanded human rights and civil rights, including the right to freedom of business as stipulated by law and the right of individuals to be presumed innocent. In addition, this Constitution also addressed specific groups in society, such as youth, war invalids, sick soldiers, and families of martyrs, demonstrating respect for and appreciation of the role of youth in national development while continuously caring for those who fought for the independence and freedom of the Fatherland.

The 1992 Constitution continues to stipulate that citizens' rights must be accompanied by their obligations. It adds prohibitions that citizens are not allowed to violate, such as: "The production, transportation, trading, storage, and illegal use of opium and other narcotic substances are strictly prohibited. The State shall regulate compulsory drug rehabilitation and treatment of dangerous social diseases"; "All acts of discrimination against women and insults to women's dignity are strictly prohibited."... Regulations on gender equality, working conditions, welfare, and social security continue to be recognized and concretized into strict regulations.

### **4. Human Rights in the 2013 Constitution**

Over the years, the Vietnamese State has affirmed the leading role of the people as the foundation in the process of renovation, national construction, and defense. "In the sky, nothing is more precious than the people. In the world, nothing is stronger than the united force of the people" (Ho Chi Minh's appeals, 1956) is an affirmation by President Ho Chi Minh. This shows that the Vietnamese State's viewpoint and policies are geared towards the goal of a prosperous people, a strong nation, fairness, democracy, and civilization, ensuring the legitimate needs, rights, and interests of the people. Therefore, the people are the most important and primary subject in the renovation process and the development strategy leading the country towards socialism.

Throughout the various Constitutions, legislators have also absorbed and recognized the importance of the people as the subject of law, and adjusted the content of the Constitution to suit the actual development of society. The 2013 Constitution is the result of absorbing , inheriting, and developing the provisions of the Constitutions of 1946, 1959, 1980, and 1992. It was drafted, discussed, and consulted with people at all levels, from the central to local governments, for nearly two years. The draft Constitution was adopted by the 13th National Assembly of the Socialist Republic of Vietnam at its 6th session on November 28, 2013, and came into effect on January 1, 2014. The Constitution is considered a national asset and the wisdom of the people. This marks a significant step forward in the theoretical thinking of our Party and State regarding fundamental principles in the era of social and national development and renewal. In particular, the regulations concerning human rights, and the rights and obligations of citizens, are recognized as the most fundamental and important principles in respecting, protecting, and ensuring the implementation of human rights, and are expressed through several notable new points:

Firstly, regarding its position, the 2013 Constitution is concise, comprising 11 chapters and 120 articles. Generally, there are not many fundamental changes; however, a significant change compared to the 1992 Constitution is the provision on human rights and civil rights, as this aligns the Constitution with the content of international human rights treaties to which Vietnam is a signatory. The chapter on human rights, rights and obligations of citizens contains the most articles (36 articles out of 120, from Article 14 to Article 49) and is considered the most valuable aspect, overcoming the limitations of previous Constitutions by being moved to the second position, after Chapter I on "Political System," compared to Chapter V in the 1992 Constitution. This is not a random arrangement but reflects the Vietnamese State's superior understanding of the importance of human rights in the Constitution. The content of human

rights and civil rights is not only stipulated in Chapter II, but also forms the basis for consistency, seriousness, and continuity throughout the entire Charter.

Secondly, regarding the Chapter titles, besides changing the position of the Chapters, the Chapter titles have also been revised compared to the 1992 Constitution's provision on "Fundamental Rights and Obligations of Citizens." The 2013 Constitution, in a more solemn manner, stipulates "Human Rights, Fundamental Rights and Obligations of Citizens." This affirms that supreme power belongs to the people – the subjects living on the territory of the Democratic Republic of Vietnam, in accordance with international conventions to which Vietnam is a signatory.

Thirdly, regarding the subject matter, the constitutional framers clearly defined, recognized, and separated the two concepts of "human being" and "citizen." "Human being" is a general term referring to humankind in its natural aspect, encompassing the individual's relationship with the human community. Meanwhile, "human being" is linked to the state through nationality, that is, to the legal basis for a person to become a citizen – a subject officially recognized to enjoy citizen rights and obligations within a state, guaranteed by the state for its citizens, rights that the individual does not necessarily possess. Citizen rights and human rights are two closely related but not identical categories. Citizen rights have a narrower meaning than human rights, while simultaneously broadening the scope of rights to include "everyone," "no one," "organizations and individuals," "Vietnamese people abroad," and "foreigners residing in Vietnam." In other words, human rights apply to all people, simply because they are human beings, not just citizens of the Democratic Republic of Vietnam, in order to ensure the principle of protecting the rights and freedoms of all individuals, without discrimination based on age, gender, religion, ethnicity, nationality, or social status while living in the territory of Vietnam, specifically as stipulated in Clause 1, Article 16 of the 2013 Constitution: "Everyone is equal before the law."

Fourth, regarding the State's responsibility, as an inherent human right – human rights and civil rights. Accordingly, the 2013 Constitution stipulates the State's responsibility to the people based on the principles of recognition, respect, protection, and guarantee, while Article 50 of the 1992 Constitution only recognized the obligation of respect. Therefore, these four principles govern all the content of the Constitution, forming the basis for protecting human rights and building all the regulations of the Vietnamese legal system. Article 14 of the 2013 Constitution stipulates: "The State guarantees and promotes the people's right to self-governance; recognizes, respects, protects, and guarantees human rights and civil rights;

implements the goal of a prosperous people, a strong nation, democracy, fairness, civilization, where everyone has a comfortable, free, and happy life, and conditions for comprehensive development.” Article 3 of the 2013 Constitution stipulates: “In the Socialist Republic of Vietnam, human rights and civil rights in political, civil, economic, cultural, and social spheres are recognized, respected, protected, and guaranteed in accordance with the Constitution and laws.”

The principle of the State "recognizing" human rights and civil rights means that human rights and civil rights are natural, inherent rights that need to be legally recognized. This is considered a declaration with political and legal significance, as the Vietnamese State participates in international conventions on human rights, thereby recognizing the value of human beings protected by states around the world on a global scale. Therefore, the State has institutionalized the recognition of human rights by the international community into human rights and civil rights and stipulated them in the Constitution and laws of Vietnam.

The principle of the State "respecting and protecting" human rights and civil rights means that when developing policies and laws in Vietnam, it must comprehensively prioritize and pay attention to the implementation of human rights and civil rights, and protect them through strict prohibitions and legal sanctions to prevent loopholes that allow public authorities or other entities to infringe upon human rights and civil rights. This principle is of crucial importance and goes hand in hand, because if the State respects rights but is not responsible for protecting them, it means those rights are neglected and do not exist. Among human rights, there are those that the State protects, such as: Clause 2, Article 36 of the 2013 Constitution: "The State protects marriage and family, and protects the rights of mothers and children"; And Clause 1, Article 37 of the 2013 Constitution states: “Children shall be protected, cared for, and educated by the State, family, and society; they shall participate in matters concerning children. It is strictly prohibited to harm, abuse, mistreat, neglect, exploit the labor of children, and other acts that violate the rights of children.”

The principle that the State "guarantees" human rights and civil rights is a crucial constitutional principle that contributes to the systematization and codification of specialized laws. For example, in the field of justice, the State's responsibility to ensure the enforcement of human rights and civil rights is particularly important because these rights are most likely to be violated and directly affect the lives, property, honor, dignity, and reputation of individuals.

In practice, recognizing, respecting, protecting, and guaranteeing human rights and civil rights requires the State to mobilize and control all resources internally to ensure effective

implementation. While the principles are being implemented better, violations are still unavoidable in practice, making it difficult to pinpoint specific violations.

Fifth, regarding the limitation of rights, in addition to the human rights already enshrined in previous Constitutions, the 2013 Constitution introduces a new point on the limitation of rights by establishing the principle that all human rights are limited in certain cases, specifically in Clause 2, Article 14 of the 2013 Constitution: Human rights and civil rights can only be limited by law in necessary cases for reasons of national defense, national security, public order, social safety, social morality, and public health. As the most powerful body of the people, the National Assembly – the highest state power body – has the right to limit these rights by law. However, the content regarding the limitation of human rights is broad, abstract, and relative. Furthermore, the recognition, respect, protection, and maximum promotion of rights, such as freedom of speech, are also placed within a certain framework and limits permitted by law.

To get an overview of the rights expressed in the 36 Articles of Chapter II, we can divide human rights into two groups:

Political and civil rights: Right to life (Article 19); Right to inviolability of body, health, honor and dignity (Clause 1, Article 20); Right to donate tissues, organs and bodies (Clause 2, Article 20); Right to inviolability of privacy, personal secrets and family secrets (Article 21); Right to inviolability of domicile (Article 22); Right of citizens not to be deported or extradited to another country (Clause 2, Article 17); Right to complain and denounce (Article 30); Right to ownership and inheritance (Article 32); Right to freedom of business (Article 33)

Economic, social, and cultural rights: The right to a legal place of residence (Article 22); The right to freedom of belief and religion (Article 24); Citizens have the right to social security (Article 34); The right to health protection and care (Article 38); The right to scientific and technological research, literary and artistic creation (Article 40); The right to enjoy and access cultural values, participate in cultural life, and use cultural facilities (Article 41); The right to determine ethnicity, use one's mother tongue, and choose one's language of communication (Article 42); The right to live in a healthy environment (Article 43);

Let's delve into some of the new provisions to see the significant changes compared to previous Constitutions that were not mentioned, specifically:

Firstly, the right to life is a fundamental, inherent, and supreme human right. Historically, the right to life has been enshrined in numerous international and national legal documents, such as the 1966 International Covenant on Civil and Political Rights (ICCPR), the 1948 Universal Declaration of Human Rights, and the 1776 American Declaration of Independence.

For example, Article 6 of the ICCPR states: “Everyone has the inherent right to life. This right shall be protected by law. No one shall be deprived of his life at will.” In accordance with the above regulations, the ideas expressed in the Declaration of Independence of the Democratic Republic of Vietnam, read by President Ho Chi Minh before the entire nation, acknowledge, inherit, and develop the ideas and arguments on human rights worldwide. He affirmed that: “All people are born with equal rights. The Creator has endowed them with inalienable rights; among these are the right to life, liberty, and the pursuit of happiness.” Consistent with this affirmation, Article 19 of the 2013 Constitution of Vietnam stipulates: “Everyone has the right to life. Human life is protected by law. No one shall be deprived of life unlawfully.” To prevent the unlawful deprivation of human life, the State has established regulations within its legal system, such as the Civil Law, Administrative Law, Labor Law, Marriage and Family Law, Criminal Law, and Criminal Procedure Law. These are sharp legal tools aimed at ensuring the effective, fair, open, and transparent protection of rights, in accordance with the spirit of protecting the natural rights of human beings as set forth in the 2013 Constitution.

Secondly, the right to inviolability of privacy, personal secrets, and family secrets, and the right to protect one's honor and reputation. Information about private life, personal secrets, and family secrets is protected by law (Clause 1, Article 21). This right is widely recognized and enshrined in international conventions on human rights. In 1982, Vietnam officially joined the international convention, marking a turning point in recognizing and protecting the right to privacy, personal secrets, and family secrets. The 2013 Constitution is considered a prerequisite for institutionalizing this provision in legal documents such as the Civil Code, the Criminal Code, the Press Law, the Children's Law, and more recently, the Law on Cybersecurity, which was passed by the National Assembly based on compliance with and expansion of the scope of guaranteeing the right to inviolability of privacy as stipulated in the 2013 Constitution in cyberspace.

Since the 2013 Constitution, the right to privacy has also been incorporated into the 2015 Civil Code, as stipulated in Article 38: The Right to Private Life. In the context of the rapid development of digital technology today, the total number of Facebook users worldwide reached 1.2 billion as of October 6, 2013. In Vietnam alone, by August 2013, there were 19.6 million Facebook users, accounting for 21.42% of the population and 71.4% of internet users (Bui Thi Thu Ha, 2014). It can be affirmed that the development speed of social networks in our country is very fast compared to the rest of the world.

The right to privacy is also defined in Article 12 of the 1948 Universal Declaration of Human Rights as follows: “No one shall be subjected to arbitrary interference with his private life, family, home or correspondence, nor to attacks upon his honor or reputation. Everyone has the right to protection by law against such interference and attacks.” This right is also recognized in the 1966 International Convention on the Rights of the Fatherland. It is clear that the right to privacy has existed for a long time.

In the era of Industry 4.0, entities and organizations can easily violate individuals' privacy rights through electronic tools and devices such as phones and computers. People frequently use internet services and social media platforms like Facebook, Zalo, Instagram, and TikTok to communicate, exchange, and share personal and family information. This environment facilitates the rapid dissemination and easy leakage of information, exposing personal and family secrets to the public, causing damage to reputation, mental health, dignity, material possessions, and even lives of others without their permission. Furthermore, from a legal perspective, defining illegal acts that violate privacy is extremely difficult and only provides relative answers.

## **5. Conclusion**

The 2013 Constitution marks a groundbreaking step in Vietnam's constitutional history, comprehensively incorporating international human rights standards into domestic law, in accordance with the country's cultural, political, and social characteristics. The solemn placement of human rights in Chapter II and the shift in thinking from "citizen rights" to "human rights" strongly affirms the nature of a socialist rule of law state of the people, by the people, and for the people.

The most valuable aspect of the 2013 Constitution is the clear establishment of the State's responsibility not only to respect but also to recognize, protect, and ensure the implementation of the inherent natural rights of human beings. At the same time, the new provisions on the right to life, the right to privacy, and the principle of limiting rights by law have created a transparent legal framework that both maximally protects individual interests and maintains national order and security.

In summary, the 2013 Constitution is not only the highest legal document but also a firm political commitment of the Socialist Republic of Vietnam to promoting and protecting human rights. It is an important foundation for further improving the specialized legal system, aiming towards the goal of a prosperous people, a strong nation, democracy, fairness, and civilization in the new era.

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## PROTECTION OF PLANTS FROM WHITE APHIDS WITH THE APPLICATION OF ENDOPHYTES

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### Abstract

This study undertakes the deterrence of bacteria endophytes on the infestation of tobacco plants by aphids. Tobacco plants was colonized with *Pseudomonas parafulva* and the rate of infestation of the plant by white aphids was measured, detailing the effectiveness of colonization of bacterial endophytes as a way of controlling the attack of aphids in tobacco, following inoculation of the cells in plant. The plant was inoculated by seed immersion and the treated was studied against the un-inoculated control for 60 days. This was to ascertain whether *P. parafulva* can inhibit the infestation of aphids in the plant. The foliar parts of the plants were assessed post inoculation for their colonization by the pest. Significant differences at  $P < 0.05$  of colonization were established between the inoculated and the control. Un-inoculated control demonstrated the highest infestation in the tobacco plant for the period of the test. The inoculation of an endophytic strain: *P. parafulva*, provided succor to the treat of aphids on tobacco plants. Growth index measured demonstrated a positive relationship between the inoculation of the endophyte and the growth parameters which included stem length and germination rate. This study, therefore, showed that the bacteria strain *P. Parafulva* Ros-1 as an endophyte of tobacco could be used to curb the infestation of aphids.

**Keywords:** bacteria endophytes colonization, *Pseudomonas parafulva*, Tobacco, plants, White aphid, Pests

### Introduction

*Pseudomonas parafulva* Ros-1 strain is a bacteria endophyte occurring in plants growing in areas with high level of petroleum hydrocarbon contamination. This strain of bacteria is reported to have been used in the phytoremediation of petroleum aromatic hydrocarbon (PAH)<sup>1</sup>. *P. parafulva* as an endophyte lives in a plant without causing any negative symptoms in the plant<sup>2</sup>. It is a Gram-negative *Gammaproteobacteria* belonging to the order *Pseudomonadales*<sup>3</sup>. The bacteria according to Uchino *et al.*<sup>3</sup>, was classified in group II, class I (Cluster 1) of the *Pseudomonas fulva* strain, on the bases of genetic recharacterization. *Pseudomonas species* and other bacterial endophytes have been tested in their ability for phytoremediation of organic

contaminants, and in those studies have demonstrated their effectiveness in reducing or completely removing such contaminant from either soil or water<sup>4-7</sup>.

Currently, no study has reported on the use of *P. parafulva*; a strain of *Pseudomonas* as an endophyte, let alone as a way of controlling pests. However, owing to the fact that there are several endophytes yet to be identified, it is imperative to test for new endophytes that could be employed in the various applications such as in fuel, medicine, environment, and most importantly agriculture. Bacteria from the genus *Pseudomonas* from literatures are microorganisms that effectively decompose organic pollutants through cometabolism in natural water and soil environment, hence have been used in phytoremediation applications<sup>8</sup>. *Pseudomonas parafulva* from the collection of culture was chosen for the study based on its reoccurrence in a plant-endophyte profiling study done on plants growing in the PAH-contaminated environment<sup>9-10</sup>. The high incidence of the endophyte strain generated the need for its pilot testing to establish the effectiveness of the bacteria in plants colonization and consequently in the control of aphids since that pest is one that affects the growth of tobacco.

Aphids are small sap-sucking insects and members of the superfamily Aphidoidea. Common names include greenfly and blackfly, although individuals within a species can vary widely in colour. The group includes the fluffy white woolly aphids<sup>11</sup>. A typical life cycle involves flightless females giving living birth to female nymphs without the involvement of males. Maturing rapidly, females breed profusely so that the number of these insects multiplies quickly. Winged females may develop later in the season, allowing the insects to colonise new plants. In temperate regions, a phase of sexual reproduction occurs in the autumn, with the insects often overwintering as eggs<sup>12</sup>.

The life cycle of some species involves an alternation between two species of host plants, for example between an annual crop and a woody plant. Some species feed on only one type of plant, while others are generalists, colonising many plant group. Aphids are among the most destructive insect pests on cultivated plants in temperate regions<sup>12</sup>. Control of aphids is not easy. Insecticides do not always produce reliable results, given resistance to several classes of insecticide and the fact that aphids often feed on the undersides of leaves. On a garden scale, water jets and soap sprays are quite effective.

This study used a selected South Africa tobacco, a plant which has been implicated in various studies for the remediation of various soil contaminants<sup>13-16</sup>. Author's previous study reported the ability of tobacco in the remediation of various pollutant-contaminated soils as was reported by lots of literature<sup>17-18</sup>. Meanwhile, various other studies have reported the use of such plant

in the removal of metal as well as PAHs from soil<sup>19-20</sup>. In the study by Atagana 2011<sup>6</sup>, *Chromolaena odorata*, another Southern African plant was able to extract PAHs through the root to the stem and the leaf after 90 days of exposure to a used engine oil contaminated soil. Tobacco plants, on the other hand, have been extensively used in phytoremediation studies, just as it has been employed in various endophyte-assisted phytoremediation studies in the remediation of environmental contaminants<sup>4,6</sup>. In one of the studies, the plant demonstrated the effectiveness to be inoculated using three methods viz: foliar spray; seed immersion and root immersion<sup>7</sup>. Meanwhile, a study involving the comparing of the effect of two plants in endophyte enhanced phytoremediation requires that such be studied on their ability to inhabit endophytes. Therefore, the aim of the study was to evaluate the effect of colonization of *Pseudomonas Parafulva* Ros-1 in tobacco on white aphids attack on the plant.

### Methodology

*P. parafulva* was isolated from Rye grass (*Lolium*) collected from petroleum hydrocarbon contaminated soil in South Africa. The interest for the strain was based on its high incidence amongst the plants sampled. A clean Rye grass was surface sterilized using 75 % (v/v) ethanol for 2 minutes, cleaned with distilled water for 1 minute and flooded with commercial bleach for 1 minute. The sterilized plant was finally washed three times using distilled water to remove the residues of the chemicals. Confirmation of the success of the sterilization was done by inoculating the water from the final rinse on an LB agar medium. The sterilized plants were separated into roots, stem and leaf and were ground using sterile mortar. The paste of the plant was streaked in bacteriological agar for three days. Single colonies were transferred into the nutrient agar and preserved. To verify the purity of the strains, a single colony was viewed under a high powered microscope<sup>9</sup>.

Identification of the endophyte strain was done using both molecular and morphological data. Extraction of DNA was done using a commercial DNA extraction kit (Genelute DNA kit from Sigma-Aldrich). In molecular identification, PCR was used to amplify the internal transcribed spacer region of the ITS rDNA. The PCR, as well as the fragment purification and sequencing, were performed according to Rugh *et al.*<sup>21</sup>. Fragment similarities were compared with that of the previously published data and examined with BLAST in GenBank. The sequence generated was submitted to GenBank (accession number KX756323.1).

*P. parafulva* was obtained from cultures maintained on potato dextrose agar (PDA: Sigma Aldrich South Africa) for 7 days at 28 °C in the dark. The bacteria were harvested and placed in test tubes containing 0.05 % (v/v) aqueous solution of Tween 20 (Merck South Africa).

Suspensions were adjusted to  $1 \times 10^8$  mL<sup>-1</sup> of cells of *P. parafulva* according to Anyasi *et al.* [7], using a Neubauer hemocytometer.

### **Inoculation of seed**

Seeds of tobacco were purchased from Seeds of Africa in Cape Town, South Africa, while the seeds were surface sterilized according to Tanhan *et al.*<sup>22,23</sup>. The seeds were then immersed in 10 mL of *P. parafulva* cell suspension for 24 hrs, and then allowed to air-dry in a sterile laminar flow cabinet for 45 minutes before being sown in 12 x 12 cm plastic pots containing potting soil at 1 cm depth. The set-up was maintained in the greenhouse at 25 °C following a photoperiod of 12-12 hrs light and day. A control experiment was set up using a bacterial cell-free solution containing 0.05 % Tween 20.

The seeds were planted in 12 x 12 cm pots filled with the growth medium as mentioned above. The entire treated and control plants were allowed to grow in the greenhouse following normal plant propagation principles. Watering of the plants in all the set-up was done using the manual watering system, making sure that the appreciable water is allowed into the pots. Each experiment and the control was replicated into 3 and done on three different dates. The experiment was allowed for one month. At the end of each growth period, the number of the pests on the leaves of the plants in the experimental and control set up were counted using the help of a magnifying glass. About three leaves from each set up were used with 1 cm piece of each leaf for enumeration of the pests using triangulation method.

### **Growth index**

In inoculated plants, growth rate was measured by means of a length of the stem (L) measured on the days of testing as L<sub>0</sub>, L<sub>10</sub>, L<sub>20</sub>, and L<sub>30</sub> respectively. A control experiment was measured from the uninoculated setups. Growth indexes were then measured as  $(L_1 - L_0)/L_0$  for the length of stem and percentage of germination (presence of stem) in inoculated plants compared to uninoculated controls in seed germination.

The data generated were analyzed using ANOVA in excel.

### **Results and discussion**

*Pseudomonas parafulva* was not recorded in the entire control experiment. But the inoculation techniques were successful in establishing the bacteria as an endophyte in the sample plants, although there were differences in the colonization frequencies amongst the pots of plants used over time. Meanwhile, the difference in the colonization frequencies did not significantly affected the infection of the pest in the plant species amongst the recorded days (Table 1).

In the plants, the 0-10 days resulted in highest infection of the leaf by the pest as it demonstrated a 100 % infection of the leaves 10 days post inoculation, which was reduced to 14 and 4.5 % on the 20 and 30 day PI respectively (Figure 1a). The un-inoculated control resulted in 100 % infection throughout the duration of the study.

The statistics indicated that 10 days post inoculation demonstrated a highly significant effect on the bacterial inoculation technique factor, plants species factor and their interactions at  $p < 0.0001$  (Table 1). At 20 days PI, the species and technique factors were not significant at  $p > 0.001$ , but the interaction was highly significant at  $p < 0.001$ . At 30 days PI, none of the factors were significant ( $p > 0.0001$ ).

Table 1: Result of the factors tested using descriptive statistics.

	10 days		20 days		30 days		df	F	p
	df	F	df	F	df	F			
Species	1	25.43	<0.001	1	3.01	<0.068	1	3.68	<0.006
Techniques	2	54.21	<0.001	2	2.32	<0.001	2	2.04	<0.236
Species vs techniques	4	14.28	<0.001	4	35.56	<0.001	4	1.19	<0.979

Recovery % of *P. parafulva* in tobacco

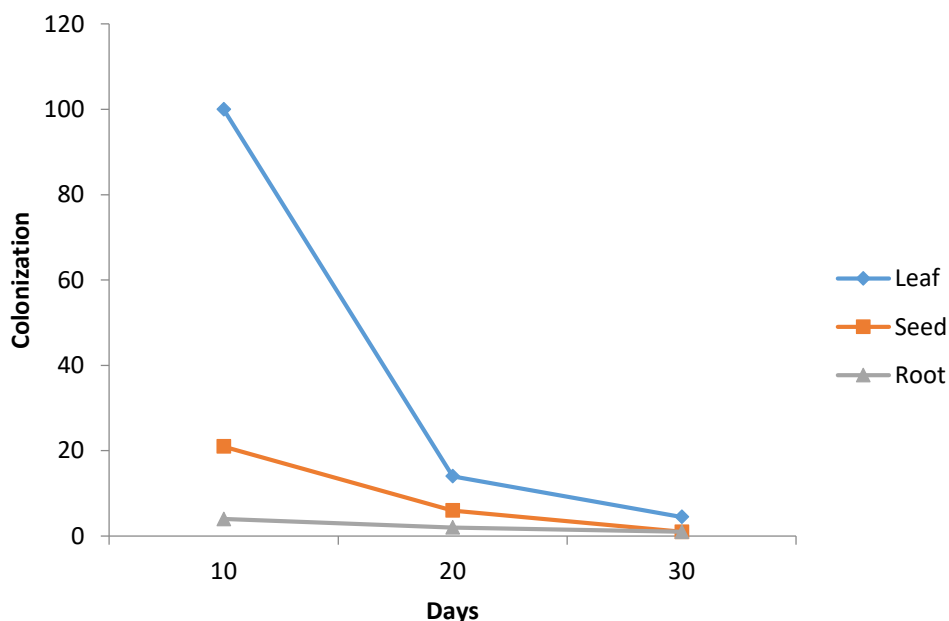


Figure 1: Colonization frequencies of *P. parafulva* in foliar parts of the plants (leaf, seed and root) in 10, 20 and 30 days post inoculation.

### Growth index

Growth parameters of plants measured at intervals of 10, 20 and 30 days post inoculation with uninoculated control in potting soil are reported in Figures 2 and 3. It is observed that inoculation of bacterial endophyte *P. parafulva* exerted a positive growth effect on the plants

inoculated by foliar spray as compared to the uninoculated plants. Overall Stem length increased by 56 % ( $P < 0.05$ ), with the highest growth observed at 30 days post inoculation. The growth of plants in control experiment, although increased (24 %) but such growth was not significant at  $P < 0.05$ . In inoculated sample, there was 98 % average germination rate compared to 64 % germination in the control experiment (Figure 4). Nevertheless, the growth index measured in the leaf, root, and seed inoculated plants seem to be positively affected by the inoculation of the endophyte strain Ros-1, as compared to the uninoculated plants.

Growth index of Tobacco in Foliar spray inoculation

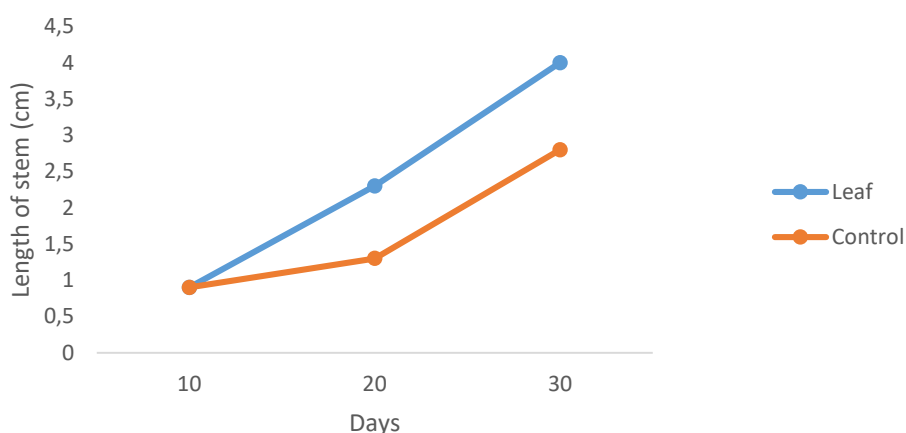


Figure 2: Growth index of plants inoculated with endophyte *P. parafulva* Ros-1 at different inoculation methods in tobacco in 10, 20 and 30 days post inoculation, compared with uninoculated control.

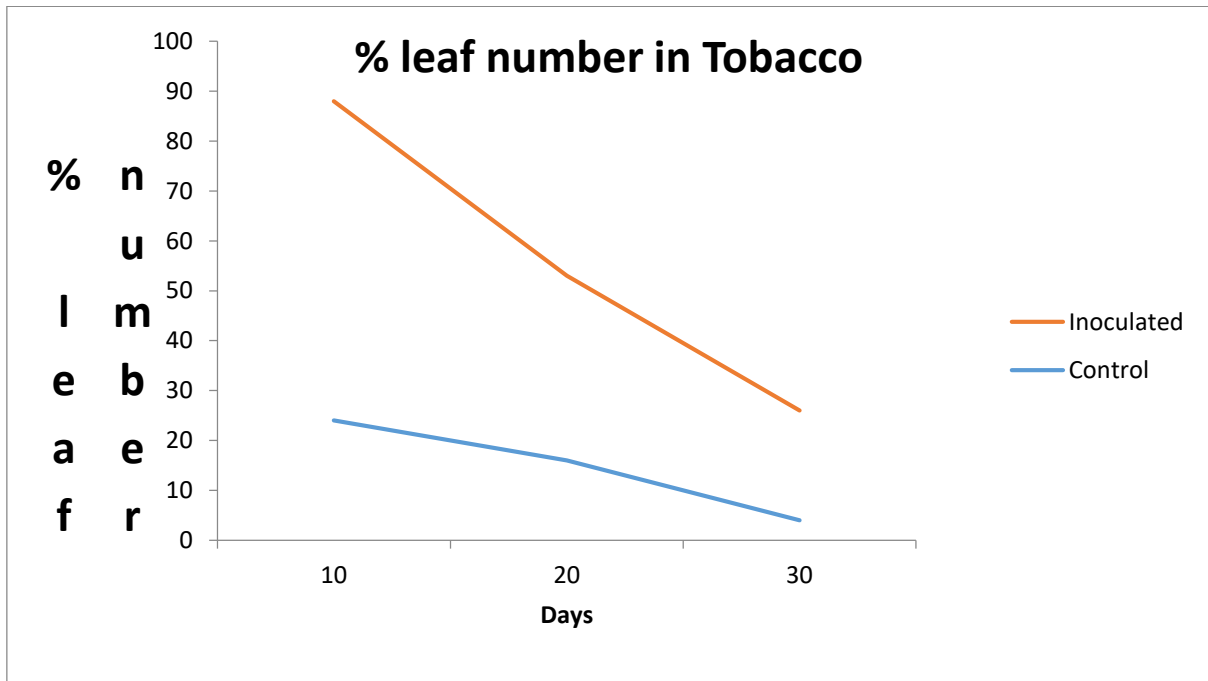


Figure 3: Average number of pest in the leaf of inoculated and non-inoculate (control) sample in 30 days of experiment.

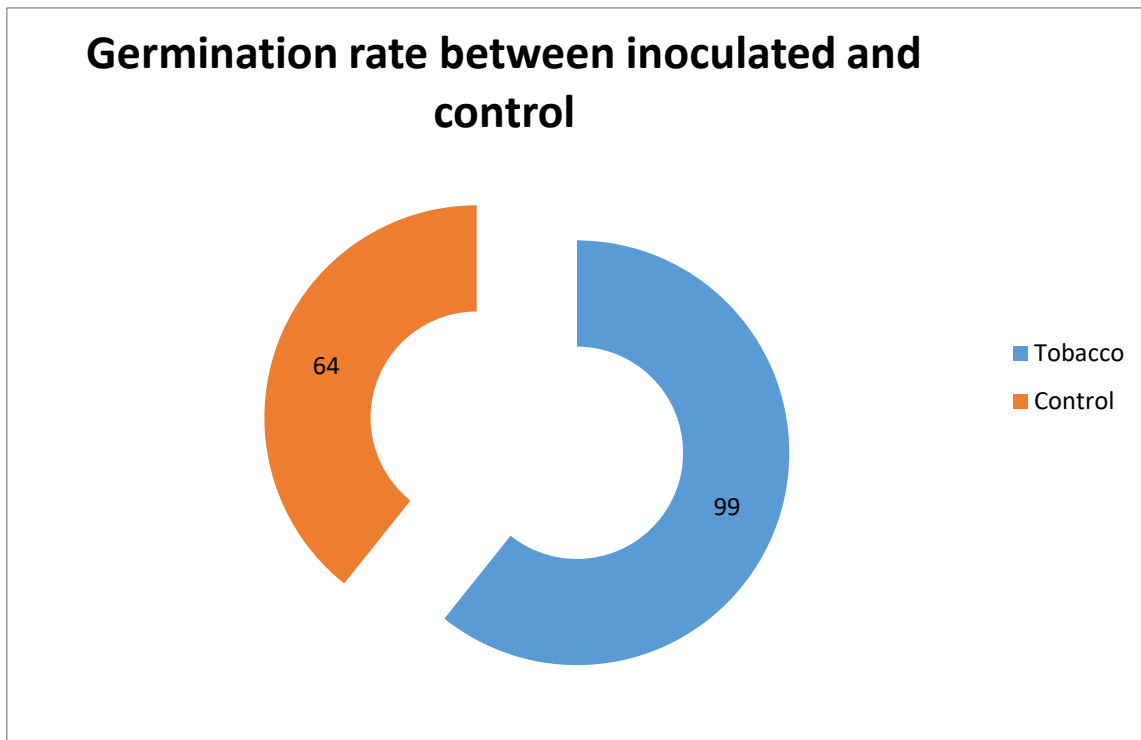


Figure 4: Rate of germination of plant between inoculated with bacteria endophyte strain Ros-1 by seed immersion in 7 days post-inoculation, with uninoculated control.

**A linear relationship between inoculation and uninoculated control.**

Statistical analysis of the study generated a linear model for the inoculated samples as

$$y = 0.4109x - 0.06 \tag{Eqn 1}$$

While that of the uninoculated control plants as

$$y = 0.2848x + 0.1133$$

(Eqn 2)

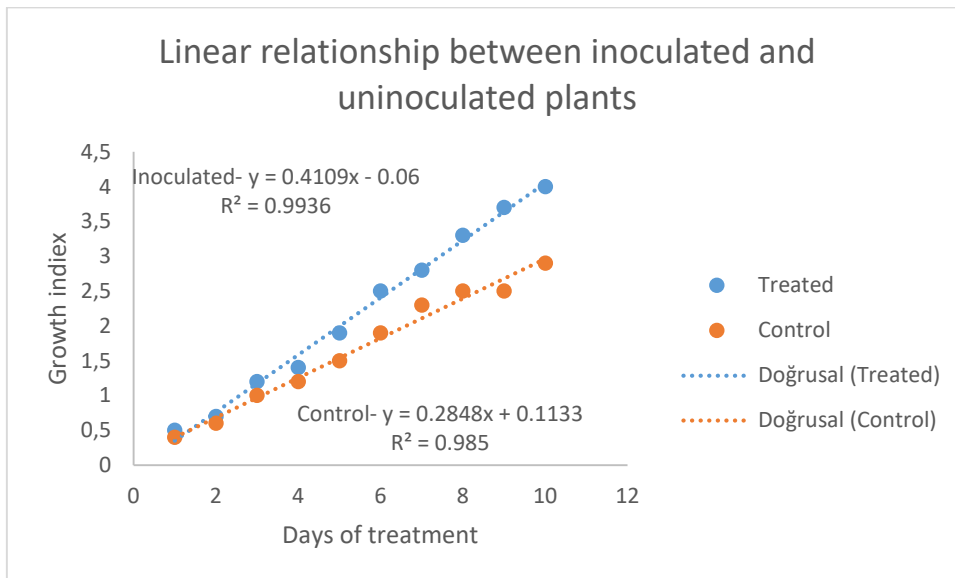


Figure 5: Pearson correlation of the treated and control plants. Results are mean of three replicates.

According to the Pearson correlation, there were significant and positive correlations ( $r = 0.45$ ,  $p = 0.003$ ) (the significant level at  $P < 0.05$ ) in the growth indices between the inoculated plants and the uninoculated controls.

### Response of colonization

Following the response of inoculation from the rate of colonization, there was higher response in foliar spray method than the root and seed immersion, this was demonstrated using a radar plot as reported in Figure 6. Tobacco plant yielded a higher colonization index in all the methods than *Chromolaena*. The entire response is in this order: Leaf spray > Root immersion > Seed immersion.

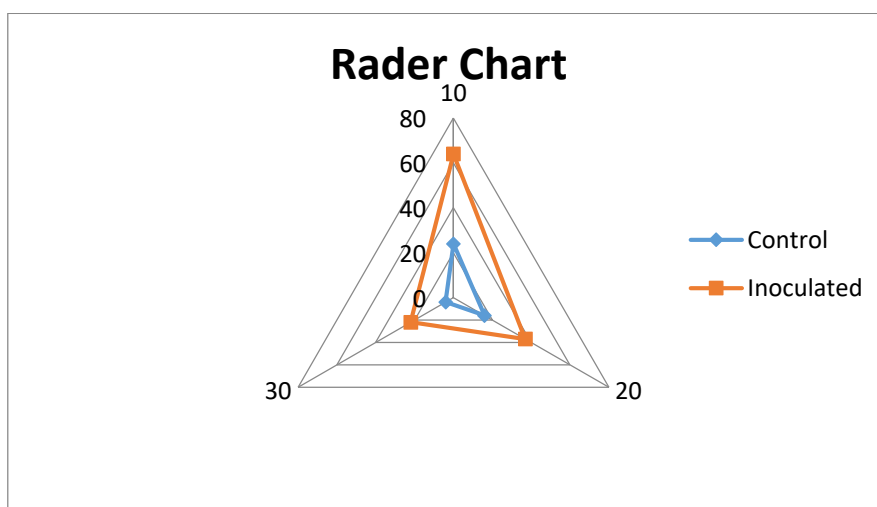


Figure 6: Radar chart on the response of inoculation of *P. parafulva* on the inoculated and control. Results are mean of three replicates.

This research study observed that the endophyte *Pseudomonas parafulva* strain Ros-1 could be successfully inoculated in tobacco through different methods that included foliar spray, root and seed immersion. Past literature has demonstrated the ability to inoculate *Pseudomonas species* into plants (willows and grass by Khan *et al.*<sup>16</sup>; cocks foot by<sup>22</sup>. Other studies have also shown the possibility of transferring endophytes from one plant to the other through inoculation. For example, in the study of Tanhan *et al.*<sup>22</sup>, where diazotrophic endophytes were used. Tefera and Vidal<sup>13</sup>, used *B. bassiana* strain LPSC 1067, which was inoculated into pine, this was also confirmed by Russo *et al.*<sup>23</sup>. *Burkholderia fungorum* DBTI was inoculated in hybrid poplar<sup>25</sup>. Other plants such as corn, opium, cocoa, banana, coffee, etc have been used to grow endophytes in different research studies<sup>16,25</sup>. All these studies demonstrated successes in their inoculation methods employed.

The colonization of plants by *P. parafulva* is shown by this study to reduce the attack of pests which in this case is the white aphids. It has been demonstrated by literature that apart from leaf inoculation just as was shown by the results of this study, direct injection of endophytes has resulted in a greater colonization frequency, also foliar dipping have shown such recovery of the endophytes as well<sup>26-27</sup>. Colonization of fungi in plants has also shown successes in various endophyte studies, to buttress the ability to recover endophytes in plants after inoculation<sup>4,7</sup>. The presence of endophytes also shows to favor the growth of the plant as there was a positive relationship observed between inoculation and growth index measured. This result is therefore in agreement with the reports that endophytes favour the growth of plants as they induce biological activities in the plant tissues, and by so doing enhance the synthesis of phytohormones that plays a part in growth promotion and root elongation<sup>27-29</sup>. Endophytes have also been reported to enhance nutrient cycling in plants hence supporting biomass increase in plant tissues<sup>17,30</sup>.

The results of this study are in agreement with various endophytic studies focussing on the ability to colonize certain endophytes of bacteria or fungi origin into plants. Tefera and Vidal<sup>13</sup>, carried a study on corn and sorghum plants inoculated with a fungus endophyte and reported a positive colonization. The ability to recover *P. parafulva* in the plants tested in this present study was shown to be decreased with time. From the result, it showed that as the length of days was increased, the recovery potential of the inoculated strain was reduced in all the inoculation techniques. This may have been caused by the competition with other organisms not tested in the set-up, which may have initiated competition amongst themselves<sup>16,31</sup>. Also, surface sterilization may not have had much surface area to contend with based on the method of

inoculation and host responses. This means that host responses should be studied in other endophyte colonization studies to be able to ascertain what those factors are. It is evident that *P. parafulva* Ros-1 favours leaf inoculation as was demonstrated by the radar plot, this shows that the result is in consonance with literatures that has supported leaf inoculation as the best method of endophyte inoculation<sup>27,32</sup>. The study also showed that it is possible to inoculate semi-hardwood with endophytes as the high recovery frequencies recorded in *Chromolaena* was able to demonstrate this. Future studies should endeavor to look at the length of colonization amongst plants within strains of bacteria<sup>30-32</sup>. The entire study is of importance as they have not been any known study involving the use of inoculated endophytes to curtail the influx of pest on the agricultural crops; hence the study should be expanded in the field.

### **Conclusion**

This research study was able to demonstrate that bacteria endophyte *Pseudomonas parafulva* Ros-1 strain is an endophyte of tobacco plants, and can be transmitted through foliar, root and seed inoculation techniques. There was colonization of the endophyte recovered after 10, 20 and 30 days post inoculation of the bacteria in the leaf of the plant by means of leaf spray, seed, and root immersion except in the 20 days post inoculation following root immersion.. Growth index measured indicated a positive relationship between endophyte inoculation and plant growth as well as the prevention of pest attack. This study, therefore, indicated that *P. parafulva* Ros-1 can be inoculated into plants through different means. And be used to curtail the infection of aphids

### **Recommendations**

A time relation study should be carried out to ascertain the appropriate time it takes for optimum colonization of endophytes is established.

The conditions necessary for endophyte colonization should be established within plants.

The interactions between organisms within plant tissues should be unraveled so as to be able to estimate their impacts in endophyte colonization.

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## **INTEGRATED NITROGEN MANAGEMENT FOR SUSTAINABLE CROP PRODUCTION**

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### **Abstract**

In agriculture, soil and water pollution by nitrates is significantly exacerbated by the excessive use of nitrogen fertilizers, which can lead to major environmental impacts such as eutrophication, groundwater contamination, and health risks.

Several strategies have been developed to address these issues by reducing nitrogen inputs while improving nitrogen use efficiency and maintaining agricultural productivity.

These strategies include adjusting fertilizer application rates, using slow-release fertilizers, applying precision fertilization tailored to crop needs, introducing nitrogen-fixing crops such as legumes, practicing crop rotation, and improving agricultural techniques.

These approaches not only help limit nitrogen losses to the environment but also enhance the quality of agricultural products and reduce costs for farmers. They form part of a broader effort to ensure the sustainability of agricultural systems in the face of climate change, balancing productivity, environmental protection, and resilience.

### **Keywords**

Nitrate pollution, Nitrogen fertilizers, Groundwater contamination, Eutrophication, Precision fertilization, Sustainable agricultura, Environmental protection, Climate change resilience

**SOCIAL PARTICIPATION UNDER INSTITUTIONAL REFORM IN URBAN VIETNAM: ORGANIZATIONAL DYNAMICS AND CITIZEN ENGAGEMENT****Quang Ngoc Le<sup>9</sup>, Dieu Huyen Ho<sup>10</sup>****Abstract**

In the context of rapid urbanization associated with social transformation and institutional reform in Vietnam, social participation among urban residents has undergone notable changes, particularly in relation to socio-political organizations and voluntary civil society organizations. Based on survey data from 400 urban residents with diverse socio-demographic characteristics, this study analyzes the level of participation, motivations, and forms of interaction between residents and these types of organizations.

The results show that although the participation rate is high (over 98% of valid samples), the level of regular participation remains limited, reflecting a trend of flexible and selective participation. At the same time, direct interaction forms still play a dominant role (over 80% frequent), while online forms are increasing but have not yet become the primary mode of participation. Notably, voluntary civil society organizations are evaluated more positively than socio-political organizations, as reflected in higher levels of agreement and trust.

Based on the application of social action theory, social capital theory, and the concept of urban citizenship, the study indicates that participation behavior is shifting from an obligation-based model toward a rational, individualized, and interest-driven model. From this, the paper proposes several policy implications aimed at innovating the operational methods of social organizations, promoting community roles, and improving the effectiveness of social participation in the current context of institutional reform and digital transformation.

**Keywords:** Urban residents; social participation; socio-political organizations; voluntary civil society organizations; institutional reform; social capital; digital transformation.

**1. Introduction**

In recent decades, Vietnam has been undergoing a process of rapid urbanization associated with economic restructuring and profound social transformation. The development of urban areas not only changes residential space but also strongly affects social relationships, lifestyles, and forms of community organization. Urban areas are increasingly becoming a

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distinctive social environment, where traditional ties tend to weaken, while new forms of connections are formed based on interests, needs, and individual choices.

In this context, the socio-demographic characteristics of urban residents have also undergone significant changes, with a population structure tending toward aging (40.3% over 60 years old), relatively high educational attainment (35.8% with college/university degrees), and living standards mainly at the average level (about 70% having income below 10 million VND/month), thereby contributing to shaping different behavioral patterns and levels of social participation among population groups.

Parallel to this process, the system of socio-political organizations and social organizations in Vietnam is also being strongly adjusted according to institutional reform orientations. The implementation of a new organizational model of the Vietnam Fatherland Front and socio-political organizations from 2025, together with the policy of streamlining the apparatus and improving operational effectiveness, has posed requirements for innovating organizational methods and strengthening connections with people at the grassroots level. At the same time, recent development documents also emphasize promoting the role of residential communities and encouraging models of self-governance, autonomy, and self-monitoring as an important direction in modern urban social management.

In this context, the role of socio-political organizations and voluntary civil society organizations is becoming increasingly important in maintaining social cohesion, mobilizing citizen participation, and addressing emerging social issues. However, in reality, the level of participation of urban residents in these organizations is undergoing significant changes. Survey results show that although the rate of participation in social activities is high in nominal terms (over 98% of valid samples), the frequency of participation is not high, reflecting a more flexible and selective participation pattern.

In addition, online interaction forms such as social networks, telephone, and video calls are becoming increasingly common, but mainly at the level of “occasional,” while direct communication still plays a dominant role with a “frequent” rate of over 80%. This indicates the expansion of the space for social participation, while also reflecting the fragmented and unstable nature of participation behavior among urban residents.

Another notable factor is the difference in participation behavior among social groups. Factors such as age, educational level, occupation, and economic conditions significantly affect the level and form of participation. Younger residents tend to participate more flexibly, especially in digital environments, while older groups maintain traditional forms of

participation. At the same time, groups with higher education and stable occupations tend to have higher participation levels due to better access to information and resources. These differences require appropriate policies for each group in order to improve the effectiveness of social participation.

Particularly, in the context of reorganizing community units and streamlining the grassroots organizational system, ensuring social cohesion and promoting the role of the community becomes increasingly urgent. In practice, after the merger process, the number of villages and residential groups has decreased significantly (from 69,580 to 63,619 units), requiring the reorganization of social participation forms in a more effective manner suitable to the new community scale.

Although there have been many studies on urbanization, civil society, and social capital, there is still a lack of research that systematically approaches the relationship between urban residents and different types of social organizations in the current context of institutional and social transformation, especially based on empirical data and linked to specific policy orientations. From this gap, this article focuses on clarifying three main issues: (i) the level of participation of urban residents in socio-political organizations and voluntary civil society organizations; (ii) changes in motivations and forms of social participation; and (iii) the role of these organizations in urban social life in the context of current urbanization and digital transformation.

## **2. Theoretical and Analytical Framework**

### **2.1. Urbanization and the Transformation of Social Relations**

Over many decades, sociological research has consistently affirmed that urbanization not only alters economic structures but also profoundly impacts social relationships. According to Durkheim's classical perspective, the development of the division of labor in modern society leads to the weakening of traditional bonds and may generate a state of anomie, in which social norms become loosened (Durkheim, 1893). This approach is further complemented by modern theories of individualization, in which Beck (1992) and Giddens (1991) argue that contemporary society is transitioning toward a phase where individuals increasingly take an active role in shaping their own lives and gradually reduce their dependence on traditional institutions.

In the Vietnamese context, rapid urbanization has significantly transformed population structures and social relationships. The proportion of urban residents continues to increase, accompanied by labor mobility and the diversification of social composition, leading to the

relative decline of traditional community ties. At the same time, the development of digital technologies and social media contributes to the formation of more flexible and highly individualized social networks, consistent with the arguments of Wellman (2001) and Castells (2010) regarding the shift from “community-based” to “networked individualism.”

Notably, this process occurs in parallel with organizational reform policies in Vietnam. The implementation of new organizational models of the Fatherland Front and mass organizations from 2025, aimed at streamlining structures and enhancing operational effectiveness, has created the need to restructure mechanisms of social cohesion and to strengthen the connection between organizations and citizens at the grassroots level.

## **2.2. Social Capital Theory in the Vietnamese Context**

In addition to the perspective on changing social relations, social capital theory provides an important analytical framework for explaining the role of relationships in social life. According to Bourdieu (1986), social capital consists of actual and potential resources associated with the possession of durable social networks. Meanwhile, Putnam (2000) emphasizes that declining participation in social organizations leads to a reduction in social capital, thereby negatively affecting social cohesion and the functioning of democratic systems.

Recent studies distinguish between bonding social capital and bridging social capital, in which bridging capital plays a particularly important role in modern urban societies (OECD, 2023). In the Vietnamese context, this is reflected in the shift from kinship-based relationships to more diverse social networks, especially within urban and digital environments. Survey findings also indicate that although participation rates are high in nominal terms (over 98%), the frequency of participation remains low, reflecting the existence of “thin” and unstable forms of social capital.

## **2.3. Civil Society and Social Participation**

Civil society is understood as an intermediary space between the state and the market, where individuals voluntarily organize to pursue common interests or promote social values (UN-Habitat, 2022). The level of development of civil society is often closely associated with the degree of citizen participation and the quality of social life.

In Vietnam, civil society exhibits distinctive characteristics, as many organizations maintain close connections with the state, while voluntary civil society organizations have developed strongly in recent years. Current policy orientations increasingly emphasize promoting community roles and encouraging self-governance models.

However, actual participation remains selective and uneven across social groups, reflecting ongoing challenges in transforming nominal participation into substantive and meaningful engagement.

#### **2.4. Social Action Theory**

In this study, Weber's theory of social action is applied to explain the motivations behind residents' participation in social organizations. According to Weber (1978), social action refers to actions that carry subjective meaning and are oriented toward others, including goal-rational action, value-rational action, affectual action, and traditional action.

In the context of urbanization and social transformation in Vietnam, the participation behavior of urban residents is increasingly characterized by rationality. Survey findings indicate that although participation rates are high in formal terms, the level of frequent participation remains low, suggesting that individuals are increasingly weighing benefits and costs before engaging in social activities. This reflects a shift from obligation-based action toward choice-based action, consistent with broader trends of individualization in modern society.

At the same time, current policy orientations also encourage more proactive participation from citizens in social governance, thereby promoting voluntary and creative forms of action rather than reliance solely on traditional administrative mechanisms.

#### **2.5. Urban Citizenship Theory**

The concept of urban citizenship emphasizes the proactive role of individuals in social life, in which residents are not only beneficiaries but also active participants in community activities (Castells, 2010; UN-Habitat, 2022). Participation in social organizations and activities not only reflects rights but also demonstrates the responsibilities of citizens toward community development.

In the current Vietnamese context, policies and strategies are increasingly oriented toward strengthening the role of citizens in social governance, particularly at the grassroots level. Promoting community self-governance models, enhancing participation capacity, and increasing interaction between local authorities and citizens are considered important directions for building a cohesive and sustainable urban society.

From this perspective, the level of residents' participation in social organizations is not only an indicator of individual behavior but also reflects the overall quality of urban social life as well as the effectiveness of social development policies in the current context.

### **3. Research Findings**

#### **3.1. Sample Characteristics**

The study was conducted based on a survey dataset of 400 urban residents, reflecting a relatively comprehensive and diverse range of socio-demographic characteristics. The sample structure shows a relatively balanced distribution across groups, while also revealing several notable features of urban residents in the current context, thereby providing an important foundation for analyzing behavior and levels of social participation.

In terms of gender, the sample shows a certain imbalance, with females accounting for 57.3% and males 42.8%. The higher proportion of female respondents may reflect a greater level of interest and willingness to participate in social activities as well as sociological research among this group, which may also influence analytical results related to social behavior and perceptions.

Regarding age, the sample distribution is uneven, with the group over 60 years old accounting for the highest proportion (40.3%), followed by the 30–45 age group (25.5%) and the 46–60 age group (21.3%), while the youngest group (18–30) represents the lowest proportion (13.0%). This indicates that the sample tends to be skewed toward middle-aged and older individuals, who generally exhibit stronger community attachment and higher levels of participation in traditional social activities, potentially influencing the expression of participation behavior in the study.

In terms of educational attainment, the group with college/university degrees accounts for the largest proportion (35.8%), followed by those with upper secondary education (25.8%) and vocational/intermediate education (19.3%), while the postgraduate group accounts for a relatively small proportion (5.0%). This structure reflects a relatively good educational level among urban residents and suggests a relatively favorable capacity for accessing information and participating in social activities.

Regarding marital status, the majority of respondents are married (71.0%), while the proportions of single (10.8%), widowed (11.5%), and divorced/separated (5.5%) individuals are lower. This indicates that most of the sample belongs to a group with stable family conditions, a factor that may influence levels of social engagement and community responsibility.

In terms of occupation, the group not engaged in formal employment accounts for the largest proportion (37.3%), followed by simple labor (15.3%) and professional/intellectual labor (14.8%). This structure reflects the diversity of occupational stratification among urban residents and also indicates a considerable proportion of individuals not participating or only

weakly participating in the formal labor market, which may affect their capacity and level of participation in social activities.

Regarding income and living standards, the majority of respondents have an income below 10 million VND per month (70.0%), while higher-income groups account for a relatively small proportion. Correspondingly, living standards are mainly concentrated at the average level (80.0%), with a small proportion of well-off households (3.8%) and a below-average group accounting for 13.5%. These characteristics indicate that the economic conditions of the sample are generally moderate, which may influence the allocation of time and resources for social participation.

Overall, the sample reflects typical characteristics of contemporary urban residents, with diversity in age, education, and occupation, but primarily concentrated in the middle-income group. This structure not only reflects the current urban social landscape but also provides a basis for analyzing differences in behavior and levels of social participation among population groups.

### **3.2. Levels of Participation of Urban Residents in Social Organizations**

The analysis of survey data shows that the level of participation of urban residents in socio-political organizations and voluntary civil society organizations is generally not high and exhibits certain differentiation across forms of participation. Although the validity rate of the observed variables is very high, indicating reliable data, actual participation remains mainly at a moderate level and is not regular.

Specifically, for activities related to socio-political organizations, such as participating in multiple organizations, engaging in environmental sanitation activities, contributing opinions to community development, or supporting disadvantaged individuals, participation tends to be dispersed and not concentrated at the “frequent” level. This suggests that while organizational activities continue to exist and attract a certain level of involvement, they have not yet created sustained and long-term engagement.

In addition, forms of communication and interaction between residents and organizations clearly reflect the limited level of participation. While direct interaction remains high, with nearly all respondents participating at different levels (around 98–99%), indirect forms such as telephone, social media, or video calls are mainly at the “occasional” level and have not become regular interaction channels.

Thus, it can be observed that the level of participation of urban residents has not entirely declined but is shifting toward greater flexibility, albeit lacking stability and depth. This reflects

a gap between awareness of organizational roles and actual participation behavior among urban residents.

Behavioral patterns toward socio-political organizations and voluntary civil society organizations also reveal notable characteristics, reflecting transformations in the structure of social participation in modern urban contexts.

Regarding levels of agreement with statements related to socio-political organizations, most respondents select “correct” or “relatively correct,” with proportions ranging from 60% to 70%. This indicates that urban residents still maintain positive perceptions of the role of these organizations. However, the proportion selecting “very correct” remains low, typically around 10%–20%, suggesting that although these organizations are recognized functionally, strong trust and deep attachment remain limited.

In contrast, voluntary civil society organizations receive higher levels of agreement. Indicators such as “providing benefits,” “supporting vulnerable groups,” and “representing community voices” show higher proportions of “correct” and “very correct.” Notably, the “very correct” category reaches above 20% in several aspects, indicating stronger trust and more positive evaluations. This reflects a shift toward more flexible, interest-based participation forms.

In terms of interaction forms, face-to-face communication continues to dominate, with “frequent” rates exceeding 80%. However, indirect communication forms such as social media and video calls are increasingly common but remain largely occasional. This reflects both the expansion of participation space and the continued importance of direct interaction.

Comparatively, voluntary civil society organizations receive more positive evaluations overall, with higher agreement levels and lower negative responses. This indicates a trend in which urban residents increasingly prefer flexible, voluntary, and interest-based participation over formal or obligation-based engagement.

From the perspective of social action theory, this shift can be understood as a transition from traditional or normative action toward goal-oriented rational action. From a social capital perspective, voluntary organizations may function more effectively as spaces for building bridging social capital.

However, it should also be noted that high nominal participation does not necessarily indicate sustainable engagement. The prevalence of occasional interaction suggests the risk of superficial participation lacking depth and long-term commitment.

### **3.3. Participation Motivations and Behavioral Changes**

The analysis indicates that participation motivations among urban residents are undergoing significant transformation toward more diverse and individualized patterns. On one hand, activities associated with socio-political organizations still maintain a certain level of participation, reflecting elements of obligation and social responsibility.

On the other hand, participation motivations are increasingly shifting toward rational considerations. Although nominal participation rates are high, frequent participation remains low, indicating that individuals engage primarily when they perceive direct benefits. This reflects broader individualization trends in urban society.

Digital transformation further shapes participation behavior. While digital interaction forms are widespread, they remain largely occasional, while direct interaction continues to dominate. This highlights both the expansion of participation space and the fragmented nature of engagement.

### **3.4. Differences in Participation Behavior by Social Characteristics**

The analysis shows clear differences in participation behavior across socio-demographic characteristics, with high data reliability across variables.

Age plays a significant role, with older residents maintaining traditional participation forms, while younger individuals adopt more flexible and digital-based engagement.

Education, occupation, and income also significantly influence participation. Higher-educated and economically stable individuals tend to participate more actively, while disadvantaged groups face greater constraints.

Differences across organizational types are also notable. While participation rates in voluntary organizations are high in nominal terms, actual engagement remains selective and uneven.

These findings suggest the need for differentiated policy approaches tailored to specific social groups to enhance participation effectiveness and social cohesion in urban contexts.

## **4. Discussion**

From the research findings above, a notable trend in contemporary urban social life can be observed, namely the existence of a paradox between awareness and actual participation behavior. Although urban residents generally recognize and highly value the role of socio-political organizations and voluntary civil society organizations, the level of actual participation does not correspond proportionally to this awareness.

This phenomenon can be explained within the broader context of individualization processes in modern society. As highlighted in the works of Beck and Giddens, individuals in

contemporary societies increasingly tend to exercise autonomy in their choices of action and prioritize personal goals over collective obligations. This leads to a relative decline in traditional forms of social participation.

From the perspective of social capital theory, the decline in participation in social organizations may result in a reduction of social capital, particularly bridging social capital. This, in turn, can weaken connections among different social groups and negatively affect the cohesion and stability of urban society.

However, it is also important to recognize that the development of digital environments is creating new forms of participation that are more flexible and diverse. Online participation not only expands the space for engagement but also enables previously less-involved groups to access and participate more easily. The key challenge lies in effectively integrating traditional and modern forms of participation in order to improve the quality and depth of social participation among urban residents.

## **5. Conclusion and Policy Recommendations**

### **Conclusion**

Based on the combination of empirical survey data and the analysis of current policy documents, the study shows that the relationship between urban residents and social organizations is taking place within a context of dual transformation: on the one hand, it is shaped by urbanization and increasing individualization; on the other hand, it is influenced by ongoing institutional reform and the restructuring of social organizational systems in Vietnam.

First, the findings indicate that the level of participation of urban residents in socio-political organizations and voluntary civil society organizations remains generally moderate. The proportion of responses categorized as “correct” and “relatively correct” accounts for approximately 60–70%, while the “very correct” category ranges from about 15–20%. This reflects an important reality: social organizations continue to maintain a certain level of recognition among citizens, but deep engagement and long-term commitment remain limited.

Second, comparative results show that voluntary civil society organizations are evaluated more positively than socio-political organizations, with a higher proportion of “very correct” responses (19.3% compared to 15.4%). This aligns with current policy orientations that emphasize community-based, self-governed, and autonomous models as key directions for development in the 2026–2030 period.

Third, regarding forms of interaction, although direct communication remains dominant (with over 80% reporting frequent interaction), indirect forms of interaction through digital

platforms are becoming increasingly common, reflecting the expansion of social space. However, this increase is largely occasional, indicating fragmented and less substantive participation.

Importantly, these findings should be interpreted within the broader context of ongoing institutional reforms. The implementation of new organizational models for the Fatherland Front and socio-political organizations from July 1, 2025, in accordance with Central Committee resolutions, has introduced requirements for streamlining organizational structures, improving operational effectiveness, and strengthening connections with citizens. At the same time, the reorganization of community units (reducing from 69,580 to 63,619 villages and residential groups) reflects a trend toward resource consolidation and improved governance efficiency at the grassroots level.

Thus, it can be affirmed that social participation behavior among urban residents is not merely an individual issue but is closely linked to broader processes of restructuring social organizations and state governance in the contemporary context.

Overall, the study shows that social participation among urban residents is shifting toward more flexible, individualized, and interest-based patterns. However, this transformation occurs simultaneously with institutional reforms and organizational restructuring, creating both opportunities and challenges for enhancing the quality of social participation. In this context, the combination of organizational innovation and the promotion of community initiative will be a key factor in building a cohesive, sustainable, and adaptive urban society..

### **Policy Recommendations**

Based on empirical findings and current policy orientations, several key groups of solutions can be proposed to improve the effectiveness of social organizations and promote urban residents' participation in the current context.

First, it is necessary to reform the operational models of socio-political organizations toward a more citizen-centered, practical, and effective approach. In the context of implementing new organizational models from 2025, shifting from administrative approaches to community-based approaches is essential. Organizations should focus more on activities that directly address the needs of urban residents, such as livelihood support, social welfare provision, and assistance for vulnerable groups, while reducing formalistic activities and enhancing the substantive quality and effectiveness of programs. This aligns with the broader policy orientation of streamlining organizations and improving efficiency.

Second, the development of community self-governance models should be promoted as an appropriate direction in modern society. The findings indicate that urban residents increasingly prefer voluntary and flexible forms of participation. Therefore, encouraging self-governance, autonomy, and community-based monitoring mechanisms can enhance citizen initiative and improve grassroots governance effectiveness. This is also consistent with policy directions emphasizing the role of communities in sustainable social development.

Another important solution is to link the reorganization of community units with the preservation of cultural values and the strengthening of social cohesion. In practice, community units such as villages and residential groups are not merely administrative entities but also important socio-cultural institutions that preserve traditions and maintain social bonds. Therefore, the consolidation of these units should be conducted carefully, avoiding purely mechanical approaches and respecting historical, cultural, and identity factors. This will contribute to maintaining social stability and supporting sustainable local development.

In the context of rapid digital transformation, leveraging technology to expand participation space is also a key direction. Organizations should develop digital participation platforms, enhance transparency, and establish two-way interaction mechanisms between institutions and citizens. However, it is important to ensure a balance between online and offline participation to maintain meaningful and sustainable engagement, avoiding superficial forms of participation in digital environments.

Finally, it is necessary to continue improving governance mechanisms and resource allocation for social organizations in a transparent, efficient, and sustainable manner. Recent policy adjustments in public asset management and financial mechanisms indicate a trend toward standardization and efficiency. Accordingly, appropriate financial frameworks should be developed to enhance organizational autonomy, improve operational effectiveness, and gradually reduce dependence on state budgets, moving toward more sustainable and flexible development models.

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**HARNESSING THE GUT-BRAIN AXIS: PROBIOTIC SUPPLEMENTATION  
ATTENUATES AMPHETAMINE-INDUCED DEPENDENCE****Huma Ikram\*, Maryam Ali Jan, Darakhshan J. Haleem**<sup>1</sup>Neurochemistry and Biochemical Neuropharmacology Research Unit, Department of Biochemistry, University of Karachi, Karachi-75270, Pakistan.**ABSTRACT**

Amphetamine use disorder represents a significant global health challenge with no FDA approved pharmacotherapy, necessitating the exploration of novel therapeutic targets like the gut-brain axis. Chronic amphetamine abuse induces gut pathology, including dysbiosis, intestinal permeability, and systemic inflammation, which can drive neuroinflammation and addictive behaviors. This study investigated the potential of a multi-strain probiotic (Ecotac) to attenuate behavioral markers of amphetamine dependence in a male Wistar rat model. Rats were divided into four groups: Water-Water, Water-Amphetamine, Probiotic-Water, and Probiotic-Amphetamine, and treated for two weeks. Behavioral assessments included the Conditioned Place Preference (CPP) test for drug-seeking behavior and the Light-Dark Box (LDB) test for anxiety-like responses. Results demonstrated that amphetamine robustly induced a conditioned place preference, which was significantly attenuated by concurrent probiotic administration. In the LDB test, amphetamine initially increased exploration in the light compartment, but probiotic co-treatment modulated these anxiety-related behaviors over time, promoting behavioral normalization. The findings suggest that probiotic supplementation effectively reduces amphetamine reward and modulates associated anxiety. The proposed mechanisms include the restoration of gut barrier integrity, production of neuroactive metabolites like short-chain fatty acids and GABA, and subsequent reduction of systemic and neuroinflammation. This research validates the gut-brain axis as a promising target and positions probiotic interventions as a novel, non-dopaminergic strategy for managing amphetamine dependence.

**Keywords:** Gut-Brain Axis, Amphetamine Dependence, Probiotics, Conditioned Place Preference, Anxiety, Neuroinflammation, Gut Microbiota, Drug-Seeking Behavior

**SYNTHESIS AND CONTROL OF INTERACTIONS IN NEW INORGANIC  
CARBON-OXIDE NANOCOMPOSITES FOR POLLUTANT TREATMENT****TABTI Senouci****BOUCHERDOUD Ahmed, DOUINAT Oukacha, BENDJELLOUL Meriem, SEGHIER  
Abdelkarim, ELANDALOUSSI Elhadj.**Department of Chemistry, Environment and Sustainable Development Laboratory, University of  
Relizane.**Abstract:**

The study aims to prepare nano-active carbons from waste to produce a product suitable for wastewater treatment and textile industry effluent decoloration. Adsorption on adsorbent carbon is widely used for wastewater treatment due to its internal surface ideal for color elimination. Adsorption is the most favorable method for colorant elimination, as it is analytically efficient and simple to use. The principle of adsorption treatment is to absorb colorants by a solid material called adsorbant. There are several solid materials available in literature for use in decoloration processes.

**Key words:** active carbons, Adsorption, wastewater treatment ,**References**

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**ECOPHARMACOVIGILANCE IN FOCUS: ADVANCED MULTIDIMENSIONAL SYSTEMATICALLY AND COMPREHENSIVELY INTEGRATED GLOBAL RISK-BASED EVALUATION OF THE ENVIRONMENTAL AND PUBLIC HEALTH IMPACT OF PHARMACEUTICAL CONTAMINANTS**

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Pharmaceutical contaminants, ecological disasters, environmental pollution, public health,

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concepts, consequences, mitigation strategies, solutions.

## ABSTRACT

Ecopharmacovigilance has emerged as a critical interdisciplinary domain addressing the detection, assessment, understanding, and prevention of adverse effects of pharmaceutical residues in the environment. The increasing global consumption of human and veterinary medicinal products, coupled with inefficient waste management systems and inadequate wastewater treatment technologies, has led to the continuous release of active pharmaceutical ingredients and their metabolites into aquatic and terrestrial ecosystems. This study provides a comprehensive and multidimensional evaluation of the environmental distribution, persistence, bioaccumulation potential, and ecotoxicological consequences of pharmaceutical contaminants, while simultaneously examining their implications for public health. Emphasis is placed on high-risk classes such as antibiotics, non-steroidal anti-inflammatory drugs, endocrine-disrupting compounds, antidepressants, and cytotoxic agents, which have been consistently detected in surface waters, groundwater, and even drinking water supplies. The methodological framework integrates systematic literature analysis, environmental monitoring data, and risk assessment models to characterize exposure pathways and quantify ecological and human health risks. Particular attention is given to the development of antimicrobial resistance as a consequence of chronic low-dose antibiotic exposure in environmental matrices, representing a major global health threat. Additionally, endocrine-disrupting pharmaceuticals are evaluated for their role in altering reproductive and developmental processes in aquatic organisms, with potential long-term ecosystem-level consequences. The study further explores pharmacokinetic and pharmacodynamic factors influencing environmental persistence, including molecular stability, solubility, and metabolic transformation. Findings indicate that conventional wastewater treatment plants are not fully equipped to remove pharmaceutical residues, resulting in their continuous environmental dissemination. Advanced treatment technologies, such as ozonation, activated carbon adsorption, and membrane filtration, demonstrate higher removal efficiencies but remain limited by economic and infrastructural constraints. From a public health perspective, chronic exposure to trace levels of pharmaceuticals through drinking water and food chains raises concerns regarding cumulative toxicity, endocrine disruption, and subtle pharmacological effects in humans. The discussion highlights the urgent need for integrated regulatory frameworks, improved environmental risk assessment protocols, and the incorporation of ecopharmacovigilance principles into drug development and lifecycle management. Strategies such as green pharmacy, rational prescribing, take-back programs, and environmental monitoring systems are proposed as essential components of a sustainable response. Ultimately, this work underscores the necessity of a global, multidisciplinary approach to mitigate the environmental footprint of pharmaceuticals and safeguard both ecosystem integrity and human health in the context of escalating pharmaceutical utilization.

## Introduction

The link between environmental degradation and public health underscores the urgent need for sustainable ecological practices to mitigate health risks associated with pollution. An environmental disaster exerts a direct impact on public health, as humans and their surroundings exist in an interdependent relationship. One of the most severe consequences of biosphere contamination is the occurrence of genetic disorders, which have been linked to increased exposure to radiation and chemical pollutants. Mutagens such as ionizing radiation and chemical compounds disrupt cellular genetic programs, leading to mutations in somatic cells. Consequently, there is an observed rise in the incidence of malignant tumors, mental disorders, and other pathologies. Industrial activities significantly contribute to environmental pollution

by releasing toxic gases, including carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrogen oxides (NO<sub>2</sub>, NO, N<sub>2</sub>O) [17,26].

The extensive use of chlorofluorocarbons (CFCs) from aerosol products and hydrocarbons from transportation emissions further exacerbates atmospheric contamination. Water bodies are also severely polluted by industrial waste, agricultural runoff containing fertilizers and pesticides, and oil spills, which pose a threat to marine life and human health. Furthermore, the disposal of nuclear waste into the sea presents a long-term ecological hazard. Radioactive contamination of soil is particularly concerning as radioactive elements enter plants and subsequently infiltrate human and animal bodies, leading to severe health issues. The accumulation of organic compounds from agricultural chemicals further intensifies these risks. One of the emerging threats in environmental health is pharmaceutical pollution, wherein residues of pharmaceutical compounds such as analgesics, antidepressants, antihypertensives, antibiotics, steroids, and hormones are detected in water sources. Despite their low concentrations, these pharmaceutical contaminants exhibit high toxicity to aquatic organisms and may have long-term effects on human health. Pharmaceutical wastewater from industrial sites contributes to water pollution, and traditional wastewater treatment methods fail to completely eliminate active pharmaceutical ingredients. The persistence of pharmaceutical compounds in drinking water, food, and biological tissues highlights the necessity of monitoring pharmaceutical residues in the environment and implementing effective strategies to minimize their impact [11,42].

The presence of pharmaceutical residues in drinking water and food sources raises concerns about their potential indirect effects on human health and ecosystem stability. Evidence suggests that while direct toxicity from these residues may be minimal, prolonged exposure can lead to unintended physiological consequences. Additionally, pharmaceutical contaminants disrupt key ecosystem services, which may indirectly affect human well-being.

The uncontrolled release of pharmaceutical compounds into the environment primarily originates from wastewater and emissions from pharmaceutical manufacturing facilities. Although regulatory frameworks exist to govern the environmental safety of pharmaceutical production, accidental discharges and non-compliance with environmental norms continue to contribute to pollution. Notably, the most significant environmental threat arises from the improper disposal and excretion of pharmaceuticals by individuals and animals, which remains largely unregulated. Since pharmaceutical compounds are classified as xenobiotics, their metabolism in the human body varies based on factors such as age, gender, and physiological state.

The metabolism of these compounds occurs in two distinct phases, involving oxidation, reduction, hydrolysis, and conjugation reactions. These metabolic processes increase the polarity of lipophilic substances to facilitate their excretion. However, the incomplete breakdown of pharmaceuticals results in their accumulation in the environment, leading to persistent contamination of water sources and food supplies. To address this issue, stricter regulatory measures, advanced wastewater treatment technologies, and increased public awareness are essential to prevent the long-term consequences of pharmaceutical pollutants on human health and the environment.

Environmental pollution and ecological disasters pose significant risks to human health, emphasizing the urgent need for sustainable environmental management. Industrial emissions, agricultural runoff, radioactive waste, and pharmaceutical contaminants collectively contribute to widespread ecological degradation. Addressing these issues requires a multi-faceted approach, including stringent environmental policies, improved waste treatment methods, and public education on the responsible use and disposal of pharmaceuticals. By

implementing proactive measures, it is possible to mitigate the adverse effects of pollution and safeguard both public health and the stability of ecosystems for future generations.

The environment plays a crucial role in determining public health, as ecological factors directly influence the well-being of society. In the modern era of civilization, environmental degradation has emerged as one of the most significant global concerns, posing serious risks to human health. The primary environmental threats include pollution of air, water, soil, and food products with hazardous substances such as nitrates, pesticides, radionuclides, and various industrial chemicals. The imbalance in natural ecosystems leads to the proliferation of psychotoxins, chemical waste, and biological hazards such as drug-resistant bacteria, fungi, viruses, and parasites. These contaminants contribute to plant and animal mortality and the spread of human diseases.

Ecology and public health are deeply interconnected, with environmental factors playing a critical role in the health and well-being of human populations. The modern era has witnessed an increasing prevalence of environmental degradation due to industrialization, urbanization, and unsustainable agricultural practices. These factors have contributed to widespread pollution of air, water, and soil, leading to severe consequences for both ecosystems and human health. Environmental pollution is one of the most pressing global challenges, as it directly affects the quality of life and longevity of individuals. Pollutants such as heavy metals, pesticides, and industrial chemicals accumulate in the environment, disrupting biological and ecological processes. Moreover, the presence of toxic substances in food and water sources has been linked to a rise in chronic diseases, genetic disorders, and various forms of cancer [1-2].

A key aspect of environmental health is the impact of pharmaceutical pollutants, which have emerged as a significant concern in recent years. Residues of pharmaceutical compounds, including antibiotics, hormones, and analgesics, have been detected in drinking water and food supplies, posing potential risks to human health and aquatic life. As traditional wastewater treatment methods prove inadequate in removing these contaminants, there is a growing need for innovative strategies to address pharmaceutical pollution [3-4].

This paper aims to explore the intricate relationship between environmental pollution and public health, emphasizing the risks associated with ecological degradation. By examining the sources, consequences, and potential mitigation strategies, this study seeks to provide a comprehensive understanding of how human activities contribute to environmental pollution and what measures can be taken to protect both ecosystems and human health [5-7].

An environmental disaster exerts a direct impact on public health, as humans and their surroundings exist in an interdependent relationship. One of the most severe consequences of biosphere contamination is the occurrence of genetic disorders, which have been linked to increased exposure to radiation and chemical pollutants. Mutagens such as ionizing radiation and chemical compounds disrupt cellular genetic programs, leading to mutations in somatic cells. Consequently, there is an observed rise in the incidence of malignant tumors, mental disorders, and other pathologies. Industrial activities significantly contribute to environmental pollution by releasing toxic gases, including carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrogen oxides (NO<sub>2</sub>, NO, N<sub>2</sub>O). Additionally, the extensive use of chlorofluorocarbons (CFCs) from aerosol products and hydrocarbons from transportation emissions further exacerbates atmospheric contamination. Water bodies are also severely polluted by industrial waste, agricultural runoff containing fertilizers and pesticides, and oil spills, which pose a threat to marine life and human health. Furthermore, the disposal of nuclear waste into the sea presents a long-term ecological hazard [8-10].

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The environmental pollution and ecological disasters pose significant risks to human health, emphasizing the urgent need for sustainable environmental management. Industrial emissions, agricultural runoff, radioactive waste, and pharmaceutical contaminants collectively contribute to widespread ecological degradation. Addressing these issues requires a multi-faceted approach, including stringent environmental policies, improved waste treatment methods, and public education on the responsible use and disposal of pharmaceuticals. By implementing proactive measures, it is possible to mitigate the adverse effects of pollution and safeguard both public health and the stability of ecosystems for future generations [19-21].

Aim of the research was to study and analyzed the key issue features of pharmaceutical contaminants role on ecological disasters, environmental pollution and public health: risks, prevention and safety concepts, consequences, mitigation strategies and solutions in general.

## Methodology

The material of the article was the data from scientific publications, which were processed, analyzed, overviewed and reviewed by generalization and systematization. Research studies are based on a review/overview assessment of the development of critical visibility and overlook of the modern scientific literature. Use the following databases: (for extensive literature searches to identify the key issue features of pharmaceutical contaminants role on ecological disasters, environmental pollution and public health: risks, prevention and safety concepts, consequences, mitigation strategies and solutions in general.). PubMed, Medline, Web of Science, Scopus, Web of Knowledge, Clinical Key, Tomson Reuters, Google Scholar, Cochrane library, and Elsevier foundations, national and international policies and guidelines were also reviewed and as well as grey literature.

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1 Access to healthy water is a prerequisite for good health. Since society's use of chemicals, including pharmaceuticals, is continuously growing, the risk is also increasing that these chemicals will return to us in our food and water supply through nature's ecocycle [68-

ing to the precautionary principle, measures can be taken if there is reason to believe that a product or a method of production involves unacceptable risks to the health of human beings, animals, plants and the environment – even if there is no definitive scientific proof of such an

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The review defines each of these sources and steps that can be taken to reduce drugs'



e, the antibiotic ciprofloxacin is removed by strong sorption to suspended solids in sewage sludge, whereas diclofenac and 17 $\alpha$ -ethinyl estradiol undergo significant biodegradation in

mental risk assessments, which could also target “old” pharmaceuticals. The Water for the “green” pharmacy. The main non-legislative solutions focus on consumption and waste

The analysis of environmental pollution and its impact on public health reveals a strong correlation between increased pollution levels and rising health issues. Various studies indicate that exposure to environmental pollutants contributes to respiratory diseases, cardiovascular disorders, and genetic mutations. Moreover, the accumulation of pharmaceutical contaminants

in water bodies raises significant concerns about their long-term effects on ecosystems and human health.

Industrialization and urbanization have led to an increase in atmospheric pollutants, such as CO<sub>2</sub> and SO<sub>2</sub>, exacerbating climate change and air quality degradation. The results indicate that effective waste management and stricter regulations on emissions can help mitigate these effects. Similarly, advanced water filtration techniques and improved wastewater treatment processes are essential for reducing pharmaceutical contaminants in drinking water.

Furthermore, soil contamination with radioactive elements and chemical residues significantly affects agricultural productivity and food safety. The adoption of organic farming methods and controlled pesticide use can minimize the negative impact of these pollutants on food supplies. The discussion also emphasizes the importance of public awareness and education in fostering sustainable environmental practices.

Environmental pollution poses a severe threat to public health and ecological stability. Industrial emissions, agricultural runoff, radioactive contamination, and pharmaceutical pollutants contribute to widespread degradation of natural resources, impacting both human populations and biodiversity. The increasing prevalence of hazardous substances in air, water, and soil has led to rising incidences of chronic diseases, genetic disorders, and disruptions in ecosystem functions.

Pharmaceutical contamination has emerged as a particularly concerning issue, as residues from medications persist in the environment, affecting human and animal health. The failure of conventional wastewater treatment processes to remove pharmaceutical pollutants highlights the urgent need for advanced filtration and degradation techniques.

To mitigate environmental risks, stringent environmental policies, improved industrial regulations, and public education on responsible waste disposal are crucial. Additionally, investment in sustainable agricultural practices and the development of eco-friendly pharmaceuticals can significantly reduce pollution levels. Effective monitoring of environmental contaminants, coupled with proactive intervention strategies, is necessary to protect public health and preserve ecosystems for future generations. By adopting comprehensive environmental management approaches, it is possible to create a safer, healthier, and more sustainable world.

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Environmental pollution poses a severe threat to public health and ecological stability. Industrial emissions, agricultural runoff, radioactive contamination, and pharmaceutical pollutants contribute to widespread degradation of natural resources, impacting both human populations and biodiversity. The increasing prevalence of hazardous substances in air, water, and soil has led to rising incidences of chronic diseases, genetic disorders, and disruptions in ecosystem functions.

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### Conclusions

- The expanding field of ecopharmacovigilance represents a critical evolution in the broader pharmacovigilance paradigm, shifting the focus from solely patient-centered safety toward a more holistic, ecosystem-integrated framework that recognizes the interconnectedness of human health, environmental integrity, and pharmaceutical life-cycle dynamics. This comprehensive, multidimensional analysis underscores that pharmaceutical contaminants—originating from manufacturing processes, clinical use, improper disposal, and agricultural applications—constitute a persistent and globally distributed class of emerging pollutants with demonstrable ecological and public health implications. Their continuous introduction into aquatic and terrestrial systems, often at sub-therapeutic yet biologically active concentrations, challenges traditional toxicological assumptions and necessitates more nuanced risk assessment models.
- The findings emphasize that conventional regulatory and monitoring systems remain insufficiently equipped to address the complexity of pharmaceutical residues in the environment. Current frameworks often lack harmonization across jurisdictions, exhibit limited integration of environmental endpoints into drug approval processes, and rely heavily on static risk assessment methodologies that fail to capture cumulative, synergistic, and long-term ecological effects. In this context, the advancement of risk-based evaluation strategies—incorporating real-time monitoring technologies, predictive ecotoxicology, and systems-based modeling—emerges as an indispensable component of next-generation ecopharmacovigilance.

- The evidence highlights the critical importance of interdisciplinary collaboration in addressing these challenges. Effective mitigation of pharmaceutical pollution requires coordinated engagement among healthcare professionals, environmental scientists, regulatory authorities, pharmaceutical industries, and public health stakeholders. The integration of green pharmacy principles, sustainable drug design, and environmentally conscious prescribing practices offers promising pathways to reduce the environmental footprint of pharmaceuticals without compromising therapeutic efficacy. Additionally, strengthening public awareness and implementing robust take-back and waste management programs are essential to minimizing improper disposal and downstream contamination.
- From a public health perspective, the indirect consequences of environmental pharmaceutical exposure—including antimicrobial resistance propagation, endocrine disruption, and subtle chronic toxicities—pose significant and still under-characterized risks. These findings reinforce the necessity of adopting a precautionary and anticipatory approach, where early detection systems, pharmacogenomic insights, and environmental surveillance are synergistically leveraged to inform policy and clinical decision-making.
- The ecopharmacovigilance must be positioned as a central pillar within global health governance and environmental protection strategies. Its successful implementation depends on the transition from reactive to proactive risk management, supported by innovation in analytical methodologies, data integration platforms, and regulatory science. By embedding environmental considerations into every stage of the pharmaceutical lifecycle—from molecular design to post-consumer waste management—the global community can move toward a more sustainable and resilient healthcare system. Ultimately, safeguarding both ecosystem and human health requires not only scientific advancement but also a paradigm shift in how pharmaceutical responsibility is conceptualized, operationalized, and enforced on a global scale.

### **Recommendation**

- To operationalize the principles of ecopharmacovigilance within a globally integrated and risk-based framework, a coordinated set of regulatory, scientific, and clinical strategies must be implemented with precision and accountability. First, regulatory authorities should mandate the systematic incorporation of environmental risk assessments throughout the entire pharmaceutical lifecycle, extending beyond pre-marketing evaluation to include continuous post-marketing environmental surveillance. This requires harmonized international guidelines, standardized ecotoxicological endpoints, and the inclusion of mixture toxicity, bioaccumulation potential, and chronic low-dose exposure effects in regulatory decision-making processes.
- The investment in advanced analytical and monitoring infrastructures is essential. The deployment of high-resolution mass spectrometry, environmental biosensors, and real-time data acquisition systems should be prioritized to enable early detection and quantification of pharmaceutical residues across diverse ecosystems. These technologies must be coupled with integrative data platforms utilizing artificial intelligence and systems modeling to predict environmental distribution, transformation products, and long-term ecological consequences, thereby supporting dynamic and adaptive risk assessment models.
- The pharmaceutical industry must adopt green chemistry and sustainable drug design principles as a core component of research and development. This includes prioritizing biodegradable active pharmaceutical ingredients, minimizing persistent metabolites, and optimizing manufacturing processes to reduce environmental emissions. Incentivization mechanisms, such as regulatory fast-tracking or economic benefits for environmentally safer products, can accelerate industry compliance and innovation.

- Healthcare systems and clinical practitioners should integrate environmentally responsible prescribing practices into routine care. This involves selecting therapeutically equivalent medications with lower environmental persistence when possible, optimizing dosing regimens to reduce excess excretion, and incorporating pharmacogenomic data to minimize unnecessary drug exposure. Pharmacists, in particular, should play a central role in patient education, medication stewardship, and the implementation of take-back programs to prevent improper disposal.
- Public engagement and cross-sectoral collaboration must be strengthened. Educational campaigns should raise awareness about the environmental impact of pharmaceuticals, while partnerships between governmental bodies, academic institutions, and international organizations should facilitate knowledge exchange and policy alignment. Establishing a global ecopharmacovigilance network with shared databases and reporting systems would significantly enhance transparency, comparability, and responsiveness to emerging risks. Collectively, these recommendations provide a structured pathway toward embedding sustainability into pharmacotherapy while safeguarding both environmental and public health outcomes.

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**CRITICAL DIMENSIONS IN TRANSFORMING MEDICAL EDUCATION  
PARADIGMS: AN INTERNATIONAL SYSTEMATIC EVALUATION OF  
INNOVATIVE PEDAGOGICAL APPROACHES, ADVANCED INSTRUCTIONAL  
METHODOLOGIES, AND THE PROGRESSIVE ENHANCEMENT OF CLINICAL  
COMPETENCE FRAMEWORKS**

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**i Abstract**

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The transformation of medical education has accelerated in response to the increasing complexity of healthcare systems, rapid technological advancements, and the growing demand for highly competent and adaptable healthcare professionals. Traditional lecture-based approaches are progressively being supplemented or replaced by innovative, student-centered teaching and learning methodologies that emphasize active engagement, critical thinking, and the development of clinical competencies. Contemporary educational strategies such as problem-based learning, case-based learning, simulation-based education, and flipped classroom models are increasingly integrated into medical curricula. In parallel, the incorporation of digital technologies, including virtual reality, artificial intelligence, and online learning platforms, has expanded opportunities for flexible, interactive, and immersive learning experiences. This study systematically evaluates modern teaching and learning methods in higher medical education from a global perspective, focusing on their effectiveness, implementation patterns, and associated challenges. A systematic literature review methodology was employed to analyze recent peer-reviewed academic sources, enabling the identification of key pedagogical innovations and emerging trends. Particular attention was given to competency-based education frameworks and workplace-based assessment tools such as Mini Clinical Evaluation Exercise (Mini-CEX), Direct Observation of Procedural Skills (DOPS), and Entrustable Professional Activities (EPAs), which are widely used to assess real-world clinical performance and professional readiness. The findings reveal a clear global shift toward learner-centered and competency-driven education models. Innovative teaching approaches significantly enhance clinical reasoning, practical skill development, and long-term knowledge retention. Technology-enhanced learning further improves accessibility, engagement, and personalization of the educational process. Additionally, collaborative and peer-assisted learning strategies contribute to the development of essential professional competencies, including communication, teamwork, and decision-making skills. However, the implementation of these modern methodologies is uneven across regions, influenced by disparities in institutional resources, technological infrastructure, and faculty training. The modern pedagogical approaches play a crucial role in aligning medical education with contemporary healthcare demands. While these innovations offer substantial benefits, their effective and equitable integration requires strategic curriculum design, continuous faculty development, and strengthened global collaboration to ensure sustainable advancement in medical education.

### **Introduction**

The rapid evolution of healthcare systems, coupled with technological advancement and increasing complexity in clinical practice, has necessitated substantial transformation in medical education. Traditional didactic teaching approaches are progressively being supplemented or replaced by innovative, student-centered methodologies that emphasize active learning, critical thinking, and competency development. Contemporary medical education integrates diverse pedagogical strategies, including problem-based learning, case-based learning, simulation-based training, flipped classrooms, and workplace-based assessments, alongside emerging technologies such as virtual reality, artificial intelligence, and digital learning platforms. These developments aim to produce healthcare professionals who are adaptable, reflective, and capable of delivering high-quality, patient-centered care in dynamic clinical environments.

Medical education has undergone profound transformation over the past decades, driven by the dynamic evolution of healthcare systems, rapid scientific advancements, and the increasing complexity of patient care. Traditionally, medical education relied heavily on didactic, lecture-based teaching methods that emphasized the passive transfer of knowledge from educator to student. While such approaches have historically contributed to the

development of foundational medical knowledge, they are increasingly considered insufficient in preparing healthcare professionals for the multifaceted challenges of modern clinical practice. Contemporary healthcare environments demand not only theoretical understanding but also advanced clinical reasoning, adaptability, interdisciplinary collaboration, and lifelong learning competencies.

The growing recognition of these demands has catalyzed a paradigm shift from teacher-centered to learner-centered educational models. Modern teaching and learning methodologies are designed to actively engage students in the learning process, encouraging critical thinking, problem-solving, and the application of knowledge in real-world contexts. This shift aligns with the broader movement toward competency-based medical education (CBME), which emphasizes measurable outcomes, skill acquisition, and professional readiness rather than time-based progression. In this context, the primary objective of medical education is no longer limited to knowledge transmission but extends to the holistic development of competent, reflective, and patient-centered healthcare professionals.

Among the most influential innovations in medical education are problem-based learning (PBL) and case-based learning (CBL), both of which prioritize active engagement and contextualized learning. These approaches encourage students to explore clinical problems collaboratively, integrate interdisciplinary knowledge, and develop diagnostic reasoning skills. By confronting real or simulated clinical scenarios, learners are better able to bridge the gap between theory and practice. Similarly, simulation-based education (SBE) has emerged as a powerful tool for enhancing clinical competence, allowing students to practice procedures and decision-making in a safe, controlled environment without compromising patient safety. The integration of high-fidelity simulations, including virtual reality (VR) and augmented reality (AR), has further expanded the scope and effectiveness of experiential learning in medical training.

Another significant development in modern medical education is the adoption of flipped classroom models, which invert the traditional instructional structure by delivering theoretical content outside the classroom and utilizing in-class time for interactive, application-based activities. This approach fosters deeper understanding, promotes student autonomy, and enables educators to provide targeted guidance and feedback. Additionally, peer-assisted learning (PAL) and collaborative learning strategies have gained prominence, reinforcing the importance of teamwork, communication, and shared responsibility in the learning process. These methods reflect the interdisciplinary nature of healthcare, where effective collaboration among professionals is essential for optimal patient outcomes.

The integration of digital technologies has further revolutionized medical education, creating new opportunities for accessibility, flexibility, and personalization. E-learning platforms, online resources, and mobile applications facilitate asynchronous learning and provide students with access to a vast array of educational materials. Artificial intelligence (AI) and data-driven tools enable personalized learning pathways, adaptive assessments, and real-time feedback, enhancing the efficiency and effectiveness of the educational process. Moreover, social media and digital communication platforms have emerged as valuable tools for knowledge dissemination, professional networking, and collaborative learning, extending the boundaries of traditional classroom environments.

In parallel with innovations in teaching methodologies, assessment strategies in medical education have also evolved significantly. Traditional examination formats, which primarily evaluate knowledge recall, are increasingly being supplemented by performance-based assessments that measure clinical competence in authentic contexts. Workplace-based assessment (WPBA) tools, such as the Mini Clinical Evaluation Exercise (Mini-CEX), Direct Observation of Procedural Skills (DOPS), and Entrustable Professional Activities (EPAs),

provide structured frameworks for evaluating learners' performance in real clinical settings. These approaches emphasize continuous feedback, reflective practice, and progressive skill development, ensuring that learners achieve the competencies required for independent practice. Additionally, Objective Structured Clinical Examinations (OSCEs) and Objective Structured Practical Examinations (OSPEs) offer standardized methods for assessing a wide range of clinical and practical skills in simulated environments.

Despite the numerous advantages associated with modern teaching and learning methods, their implementation is not without challenges. Variability in institutional resources, technological infrastructure, and faculty expertise can significantly influence the adoption and effectiveness of these approaches. In many low- and middle-income countries, limited access to advanced technologies and financial constraints hinder the integration of innovative educational strategies. Furthermore, resistance to change among faculty members, who may be accustomed to traditional teaching practices, can impede the transition to learner-centered models. Effective implementation requires not only infrastructural investment but also comprehensive faculty development programs that equip educators with the necessary pedagogical skills and technological competencies.

Another critical consideration is the need to balance innovation with the preservation of essential foundational knowledge. While modern methodologies emphasize active learning and practical application, a strong theoretical base remains indispensable for clinical decision-making. Curriculum design must therefore ensure the integration of foundational sciences with clinical training, fostering a cohesive and comprehensive educational experience. Additionally, the rapid expansion of digital technologies raises concerns regarding information overload, quality assurance, and the potential for reduced face-to-face interaction, which is crucial for the development of communication and interpersonal skills.

Global disparities in medical education further highlight the importance of context-specific approaches. While high-resource institutions may readily adopt advanced technologies and innovative pedagogies, resource-limited settings must adapt these methods to align with their capabilities and needs. International collaboration, knowledge sharing, and the dissemination of best practices are essential for reducing these disparities and promoting equitable access to high-quality medical education. Organizations such as the World Health Organization and various academic networks play a pivotal role in supporting the global advancement of medical education through guidelines, research initiatives, and capacity-building programs.

The increasing emphasis on patient-centered care and interprofessional collaboration necessitates the incorporation of soft skills training into medical curricula. Communication, empathy, ethical reasoning, and cultural competence are critical components of effective healthcare delivery. Modern educational approaches, including simulation, role-playing, and interprofessional education, provide valuable opportunities for developing these competencies. By fostering a holistic approach to learning, medical education can better prepare students to address the diverse needs of patients and communities in an increasingly globalized world.

The ongoing evolution of medical education reflects a broader commitment to improving healthcare outcomes through the development of highly skilled and adaptable professionals. As new technologies and pedagogical innovations continue to emerge, it is essential to critically evaluate their effectiveness and sustainability. Evidence-based approaches to education, supported by rigorous research and continuous quality improvement, are crucial for ensuring that innovations translate into meaningful improvements in learning outcomes and clinical practice.

In this context, the present study aims to provide a comprehensive analysis of modern teaching and learning methods in medical education, with a particular focus on their global

application, effectiveness, and challenges. By systematically examining contemporary pedagogical strategies and their impact on student learning and professional development, this research seeks to contribute to the ongoing discourse on medical education reform. Understanding the strengths and limitations of these approaches will enable educators, policymakers, and institutions to make informed decisions regarding curriculum design, resource allocation, and the integration of innovative practices.

Ultimately, the future of medical education lies in its ability to adapt to the changing landscape of healthcare while maintaining a commitment to excellence, equity, and patient-centered care. By embracing modern teaching and learning methodologies, fostering interdisciplinary collaboration, and leveraging technological advancements, medical education can continue to evolve in ways that meet the needs of both learners and the societies they serve.

Advances in teaching and learning methodologies have had a major impact on the development of medical education. The article studies and discusses modern teaching and learning methods used in higher education institutions around the world, especially in medical education curricula. The article reviews the main aspects that shape modern teaching and learning methods, with regard to their importance, effectiveness and challenges for the development of competent healthcare professionals. Medical education is undergoing transformational change in response to the increasing complexity of healthcare delivery, technological advancements and changing needs of society. Traditional pedagogical approaches are being replaced by innovative teaching and learning methods designed to enhance student engagement, critical thinking and clinical competence. The article discusses the main issues related to the integration of these modern teaching and learning methodologies into higher medical education curricula globally. The manifestation of modern teaching and learning methods in higher education institutions, particularly in medical educational study programs, reflects a global trend toward enhancing the quality of medical education. By embracing

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d The transformation of higher education in medical programs worldwide has been significantly influenced by the adoption of modern teaching and learning methods. Traditional didactic teaching approaches, while foundational, are increasingly supplemented or replaced by innovative methodologies that emphasize student-centered learning, interdisciplinary collaboration, and the integration of technology. These contemporary methods address the evolving demands of healthcare systems, aiming to produce medical professionals who are not only knowledgeable but also adaptable, reflective, and capable of lifelong learning.

n Modern teaching strategies such as problem-based learning (PBL), simulation-based education, flipped classrooms, and inter-professional education have gained prominence. These approaches prioritize active engagement, critical thinking, and the application of theoretical knowledge in practical settings. Additionally, technological advancements, including virtual reality (VR), augmented reality (AR), and online learning platforms, have expanded the possibilities for immersive and flexible learning experiences.

However, the implementation of these methods varies globally, influenced by cultural, economic, and institutional factors. In some regions, resource constraints and resistance to change pose significant challenges, while in others, rapid technological adoption fosters innovation. The discussion of these issues is essential for identifying best practices, addressing disparities, and ensuring that medical education aligns with the needs of modern healthcare environments.

a This topic calls for a comprehensive examination of the scientific, pedagogical, and practical aspects of these methodologies, exploring their impact on student outcomes, faculty

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roles, and institutional policies. By addressing these dimensions, stakeholders in medical education can better understand how to optimize teaching and learning processes in diverse global contexts.

The most common teaching-learning activities and their definitions are presented. The teacher will select the necessary activity from them, depending on the specific goal and task.

We discussed the following methods of learning and teaching:

Discussion/debate is one of the most common methods of interactive learning activity. The discussion process dramatically increases the quality of student engagement and activity. The discussion can turn into an argument, and this process is not limited to questions asked by the teacher. It develops the student's ability to reason and justify his own opinion.

Cooperative teaching is a teaching strategy when each member of the group is obliged not only to study by himself, but also to help his teammate to study the subject better. Each member of the group works on the problem until all of them have mastered the issue.

Collaborative work – teaching method using this activity involves dividing students into groups and giving them learning tasks. Group members work on the issue individually and simultaneously share their opinions with the rest of the group. It depending on the task. It is possible to redistribute functions among the members during the work of the group. This strategy ensures maximum involvement of all students in the learning process.

Problem-based learning (PBL) - an activity that uses a specific problem as the initial stage of the process of acquiring and integrating new knowledge.

Case study – the teacher will discuss specific cases with the students and they will study the issue in every way and thoroughly.

Brain storming – this activity involves thinking about a specific issue/problem as much as possible within the topic, preferably.

Radically different, the promotion of thought, idea formation and expression. This activity leads to the development of a creative approach to the problem. Its use is effective in the presence of a large group of students and consists of several main stages: Defining the problem/issue from a creative point of view. To write down the ideas expressed by the listeners around the issue in a certain period of time without criticism (mainly on the blackboard). Determination of evaluation criteria to determine the relevance of the idea to the purpose of the research. Evaluation of selected ideas with predetermined criteria. To highlight those ideas that are most relevant to the question by exclusion. Revealing the idea with the highest evaluation as the best means of solving the set problem.

Role-playing and situational games – games based on pre-designed scenarios allow students to look at the issue from different perspectives. It helps them to form an alternative point of view. Like discussion, these games also develop the student's ability to express his position independently and defend it in an argument.

Demonstration – this method of activity involves visual presentation of information. It is quite effective in terms of achieving results. In many cases, it is better to present the material to students both audio and visual at the same time. The material to be studied can be demonstrated by both the teacher and the student. This method helps us to make visible the different stages of understanding the learning material, specify what the students will have to do independently. At the same time, this strategy visualizes the essence of the issue/problem. Demonstration may take a simple form.

Inductive defines a form of transfer of any knowledge, when the course of thought in the learning process is directed from facts to generalization, that is, when conveying material, the process proceeds from concrete to general.

Deductive defines a form of transfer of any knowledge, which is a logical process of discovering new knowledge based on general knowledge, that is, the process proceeds from the general to the specific.

Analysis helps us understand the learning material as a whole. In decomposition into constituent parts. This facilitates detailed coverage of individual issues within a complex problem.

Synthesis means making a whole by grouping separate issues. This method helps to develop the ability to see the problem as a whole.

Verbal or oral method - this method includes lecture, narration, conversation, etc. In the mentioned process, the teacher conveys and explains the learning material through words, and the students actively perceive and assimilate it by listening, memorizing and understanding.

Writing work method - which includes the following types of actions: making extracts and notes, summarizing material, drawing up theses, writing a report or essay, etc.

Explanatory method– based on reasoning around the given issue. When delivering the material, the teacher cites a specific example of which

Action-oriented teaching - requires the active involvement of the teacher and the student in the teaching process, where the practical interpretation of the theoretical material acquires special importance.

Project development and presentation - while working on the project, the student uses the acquired knowledge and skills to solve a real problem. Project-based teaching increases students' motivation and responsibility. Project work includes stages of planning, research, practical activity and presentation of results in accordance with the chosen issue. The project is considered to be implemented if its results are presented in a visible and convincing, correct form. It can be done individually, in pairs or in a group; Also, within one subject or several subjects (integration of subjects). After completion, the project can be presented to a wider audience.

The integration of digital technology has further revolutionized medical education. Innovations like virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) offer immersive learning experiences, enabling students to visualize complex anatomical structures, simulate surgical procedures, and receive personalized feedback. Online learning platforms and hybrid models have also expanded access to medical education, allowing for greater flexibility and inclusivity.

Despite these advancements, the implementation of modern teaching methods faces challenges that vary across regions. Resource availability, institutional readiness, faculty training, and cultural attitudes toward education play critical roles in shaping the adoption and effectiveness of these methodologies. For instance, while well-resourced institutions in developed countries have embraced cutting-edge technologies, many institutions in low- and middle-income countries struggle with limited infrastructure and funding. Moreover, the transition to modern methods often requires significant changes in faculty roles, curriculum design, and assessment practices, which can encounter resistance.

Globally, there is a pressing need to evaluate the effectiveness of these innovative methods through rigorous scientific studies. Understanding their impact on student learning outcomes, professional competencies, and overall healthcare delivery is essential. Furthermore, fostering global collaboration and sharing best practices can help bridge disparities, ensuring that medical education remains equitable and aligned with the global health agenda.

## **Objective**

This study aims to systematically analyze modern teaching and learning methods in higher education institutions, with a particular focus on medical education programs globally.

The objective is to evaluate current pedagogical innovations, identify trends and challenges, and assess their impact on educational outcomes and competency development.

### **Methodology**

A systematic literature review (SLR) design was employed to ensure comprehensive and unbiased analysis of contemporary educational practices. Relevant peer-reviewed articles, reports, and academic sources published in recent years were critically examined. The review focused on identifying key teaching methodologies, including competency-based education frameworks, technology-enhanced learning, and experiential learning approaches. Comparative and trend analyses were conducted to evaluate the effectiveness, implementation variability, and global adoption of these methods across diverse educational and institutional contexts.

### **Results and Discussion**

The global systematic evaluation of contemporary medical education models reveals a profound paradigmatic transition from traditional, knowledge-centered instruction toward competency-based, learner-centered, and technologically integrated frameworks. Across diverse geographic regions, institutional types, and regulatory environments, a consistent pattern emerges: modern medical education is increasingly defined by its responsiveness to healthcare system demands, its emphasis on measurable clinical competencies, and its incorporation of adaptive pedagogical methodologies.

A central result identified in this review is the widespread adoption and contextual adaptation of competency-based medical education (CBME). Institutions across North America, Europe, and parts of Asia have demonstrated a structured shift toward outcome-oriented curricula, wherein competencies are explicitly defined, longitudinally assessed, and aligned with real-world clinical performance expectations. The data indicate that CBME frameworks have enhanced the clarity of educational objectives, facilitated standardized assessment strategies, and improved the alignment between educational outputs and healthcare system needs. However, variability in implementation fidelity remains a significant concern. While high-resource settings demonstrate robust integration of entrustable professional activities (EPAs) and milestone-based progression systems, lower-resource environments often encounter challenges related to faculty training, assessment infrastructure, and curricular redesign.

The discussion of CBME effectiveness highlights a nuanced interplay between theoretical robustness and practical feasibility. While competency frameworks provide a rigorous scaffold for educational design, their operationalization requires substantial institutional investment, including faculty development programs, digital assessment tools, and continuous quality assurance mechanisms. Moreover, concerns have been raised regarding potential reductionism, wherein complex clinical reasoning and professional identity formation may be inadequately captured by discrete competency metrics. Consequently, hybrid models that integrate competency-based approaches with holistic educational philosophies are increasingly advocated.

Another critical finding pertains to the integration of technology-enhanced learning (TEL) within medical curricula. The proliferation of digital platforms, simulation technologies, virtual patients, and artificial intelligence-driven learning systems has significantly transformed instructional delivery. Evidence suggests that simulation-based education, particularly high-fidelity clinical simulation, has demonstrably improved procedural skills, clinical decision-making, and interprofessional collaboration. Virtual and augmented reality applications have further expanded the scope of experiential learning, enabling learners to engage with complex clinical scenarios in a controlled and repeatable environment.

Despite these advancements, the digital transformation of medical education is accompanied by several challenges. The digital divide remains a persistent barrier, particularly in low- and middle-income countries, where access to advanced technological infrastructure is limited. Additionally, the rapid integration of technology necessitates ongoing faculty upskilling and raises concerns regarding the potential depersonalization of medical training. The balance between technological innovation and humanistic education remains a critical consideration, particularly in preserving empathy, communication skills, and patient-centered care principles. Interprofessional education (IPE) emerges as another pivotal component in the reconceptualization of medical education. The reviewed studies consistently demonstrate that structured interprofessional learning experiences enhance collaborative competencies, reduce professional silos, and improve patient outcomes. IPE initiatives, often involving medical, nursing, pharmacy, and allied health students, facilitate the development of team-based care models that are essential in contemporary healthcare systems. However, the implementation of IPE is frequently constrained by logistical complexities, including scheduling conflicts, curricular misalignment, and institutional resistance to interdisciplinary integration.

The results further underscore the growing emphasis on early clinical exposure and longitudinal integrated clerkships (LICs). These models deviate from traditional block rotations by providing sustained patient interactions and continuity of care experiences. Evidence indicates that LICs contribute to improved clinical reasoning, stronger patient-provider relationships, and enhanced learner satisfaction. Furthermore, early clinical immersion has been associated with increased motivation, contextualized learning, and the development of professional identity. Nevertheless, the scalability of these models remains a challenge, particularly in institutions with high student-to-patient ratios and limited clinical placement capacity.

A significant theme emerging from the analysis is the increasing prioritization of personalized and adaptive learning pathways. Modern educational frameworks are progressively leveraging data analytics and learner profiling to tailor instructional strategies to individual needs. Adaptive learning systems, informed by continuous assessment data, enable targeted remediation and accelerated progression for high-performing learners. This individualized approach aligns with broader trends in precision education, mirroring the principles of precision medicine. However, ethical considerations related to data privacy, algorithmic bias, and equitable access must be carefully addressed.

The discussion also highlights the critical role of faculty development in enabling the successful implementation of modern instructional strategies. Faculty members are required to transition from traditional didactic roles to facilitators of learning, mentors, and assessors of complex competencies. This shift necessitates comprehensive training in educational theory, assessment methodologies, and digital literacy. Institutions that have invested in structured faculty development programs demonstrate higher levels of curricular innovation and improved educational outcomes. Conversely, inadequate faculty preparation is consistently identified as a barrier to effective educational transformation.

Assessment practices have undergone substantial evolution, reflecting the broader shift toward competency-based frameworks. The review identifies a transition from summative, high-stakes examinations to continuous, formative, and programmatic assessment models. Tools such as workplace-based assessments, objective structured clinical examinations (OSCEs), and multisource feedback mechanisms are increasingly utilized to capture a comprehensive picture of learner performance. Programmatic assessment, characterized by the aggregation of multiple low-stakes evaluations, provides a more reliable and valid measure of competence. However, the implementation of such systems requires robust data management infrastructure and significant faculty engagement.

Another critical dimension explored in the results is the integration of global health perspectives and social accountability into medical education. Institutions are increasingly recognizing their responsibility to address health disparities, respond to community needs, and prepare graduates for practice in diverse and resource-constrained settings. Curricula incorporating social determinants of health, cultural competence, and community-based learning experiences have demonstrated positive impacts on learner attitudes and competencies. Nonetheless, the extent of integration varies widely, with some institutions adopting comprehensive frameworks while others implement isolated modules without systemic alignment.

The impact of accreditation and regulatory frameworks on educational reform is also evident. Regulatory bodies play a pivotal role in shaping curricular structures, assessment standards, and institutional priorities. In regions where accreditation standards explicitly mandate competency-based approaches and continuous quality improvement, institutions demonstrate higher levels of innovation and alignment with global best practices. However, overly rigid regulatory requirements may inadvertently stifle innovation and limit institutional flexibility.

The findings further reveal the importance of resilience, well-being, and mental health support within medical education. The increasing complexity and demands of modern curricula, combined with the inherent stressors of clinical training, necessitate structured interventions to support learner well-being. Programs incorporating mindfulness training, mentorship, and workload optimization have shown promising results in reducing burnout and enhancing academic performance. The integration of well-being into the core curriculum reflects a broader recognition of its importance in sustaining a competent and compassionate healthcare workforce.

From a global perspective, the reconceptualization of medical education is characterized by both convergence and divergence. While there is a clear convergence toward shared principles such as competency-based education, technological integration, and patient-centered care, significant divergence exists in terms of implementation strategies, resource allocation, and cultural adaptation. High-income countries often lead in innovation and technological adoption, whereas low- and middle-income countries demonstrate context-specific adaptations that prioritize scalability and sustainability.

The discussion of equity and inclusivity reveals persistent disparities in access to quality medical education. Socioeconomic barriers, gender disparities, and geographic inequities continue to influence educational opportunities and outcomes. Efforts to promote inclusivity, including targeted admissions policies, scholarship programs, and community engagement initiatives, are critical in addressing these challenges. Furthermore, the diversification of the medical workforce is increasingly recognized as essential in improving healthcare delivery and patient outcomes.

An additional layer of complexity is introduced by the rapid evolution of healthcare systems, driven by demographic changes, epidemiological transitions, and technological advancements. Medical education must continuously adapt to prepare graduates for emerging challenges, including aging populations, chronic disease management, and digital health integration. The incorporation of topics such as health informatics, telemedicine, and systems-based practice into curricula reflects this dynamic landscape.

The role of research and scholarly activity within medical education is also emphasized. Institutions that integrate research training into undergraduate and postgraduate curricula foster critical thinking, evidence-based practice, and innovation. The promotion of educational research further contributes to the continuous improvement of teaching methodologies and assessment strategies. However, balancing research and clinical training remains a challenge, particularly in resource-limited settings.

The reconceptualization of medical education is not a singular, uniform process but rather a multifaceted and context-dependent transformation. The interplay between global standards and local adaptation is central to the success of educational reforms. Institutions must navigate complex interdependencies pedagogical innovation, resource availability, regulatory requirements, and cultural considerations.

The study underscore that modern medical education is evolving toward a more integrated, flexible, and learner-centered paradigm. The emphasis on clinical competency development, supported by innovative instructional strategies and robust assessment frameworks, represents a significant advancement in aligning education with healthcare needs. However, the sustainability and scalability of these reforms depend on continued investment, interdisciplinary collaboration, and a commitment to continuous improvement.

The trajectory of medical education reform suggests that future developments will likely focus on further integration of artificial intelligence, expansion of personalized learning, and interprofessional and global collaboration. As the healthcare landscape continues to evolve, medical education must remain adaptive, evidence-based, and aligned with the overarching goal of improving patient care and health outcomes on a global scale.

The systematic analysis of contemporary literature reveals a substantial global transition in medical education from traditional, teacher-centered instructional models toward learner-centered, competency-based, and technology-enhanced approaches. This shift is driven by the increasing demand for healthcare professionals who are not only knowledgeable but also capable of applying clinical reasoning, demonstrating procedural competence, and adapting to rapidly evolving healthcare environments. The findings indicate that modern teaching and learning methodologies significantly enhance both cognitive and practical competencies, although their implementation remains heterogeneous across regions and institutions.

One of the most prominent findings is the effectiveness of active learning strategies, particularly problem-based learning (PBL) and case-based learning (CBL). These approaches consistently demonstrate improved student engagement, deeper understanding of complex medical concepts, and enhanced clinical reasoning skills. By presenting learners with real or simulated clinical scenarios, PBL and CBL foster analytical thinking and decision-making abilities that are critical for clinical practice. Students participating in these methods tend to exhibit greater autonomy in learning, improved retention of knowledge, and stronger integration of theoretical and practical concepts. However, the successful implementation of these approaches depends heavily on well-trained facilitators, appropriate case design, and adequate institutional support.

Simulation-based learning (SBL) has emerged as a highly effective modality for developing clinical and procedural skills. The use of high-fidelity simulators, standardized patients, and immersive technologies such as virtual reality (VR) and augmented reality (AR) enables learners to practice complex procedures in a risk-free environment. The findings suggest that simulation enhances psychomotor skills, clinical confidence, and patient safety outcomes. Furthermore, repeated exposure to simulated scenarios allows learners to refine their skills through deliberate practice and immediate feedback. Despite these advantages, simulation-based education requires substantial financial investment, technical infrastructure, and trained personnel, which may limit its widespread adoption, particularly in resource-constrained settings.

The integration of technology into medical education represents another critical dimension of modern pedagogical transformation. E-learning platforms, digital resources, and mobile applications have expanded access to educational content and facilitated flexible, self-directed learning. The use of artificial intelligence (AI) in adaptive learning systems allows for personalized educational experiences tailored to individual learner needs. Additionally, online

platforms and social media have become important tools for knowledge dissemination and professional collaboration. The findings indicate that technology-enhanced learning improves accessibility and engagement; however, challenges related to digital literacy, information quality, and equitable access persist. In some contexts, the digital divide continues to create disparities in educational opportunities, particularly between high-income and low- and middle-income regions.

Assessment methodologies in medical education have also undergone significant evolution, reflecting the shift toward competency-based frameworks. Workplace-based assessment (WPBA) tools, including Mini Clinical Evaluation Exercise (Mini-CEX), Direct Observation of Procedural Skills (DOPS), and Entrustable Professional Activities (EPAs), have gained widespread acceptance as effective means of evaluating real-world clinical performance. These tools emphasize continuous assessment, direct observation, and structured feedback, enabling learners to develop competencies progressively. The findings suggest that WPBA enhances the validity and relevance of assessments by aligning evaluation with actual clinical practice. However, concerns remain regarding inter-rater reliability, standardization, and the time burden placed on clinical supervisors.

Objective Structured Clinical Examinations (OSCEs) and Objective Structured Practical Examinations (OSPEs) continue to play a central role in assessing clinical and technical skills in a controlled environment. These structured assessments provide objective and standardized evaluation of a wide range of competencies, including communication, clinical reasoning, and procedural skills. The evidence indicates that OSCEs and OSPEs contribute to improved assessment reliability and fairness. Nevertheless, their implementation requires significant logistical planning, trained examiners, and standardized scenarios, which can pose challenges for institutions with limited resources.

The findings also highlight the growing importance of collaborative and peer-assisted learning approaches. Peer-assisted learning (PAL) has been shown to enhance knowledge acquisition, communication skills, and professional development for both learners and peer tutors. Collaborative learning environments encourage teamwork, shared responsibility, and the exchange of diverse perspectives, which are essential competencies in interdisciplinary healthcare settings. These approaches not only improve academic performance but also foster a culture of mutual support and continuous learning. However, the effectiveness of peer-assisted learning depends on appropriate structuring, supervision, and alignment with learning objectives.

The flipped classroom model represents another significant innovation, emphasizing the redistribution of instructional time to maximize active learning. By delivering theoretical content outside the classroom and dedicating in-class time to problem-solving and interactive activities, this approach promotes deeper understanding and application of knowledge. The findings suggest that flipped classrooms improve student engagement, critical thinking, and satisfaction with the learning process. However, their success relies on student preparedness, access to digital resources, and the ability of educators to facilitate active learning effectively.

Evidence-based medicine (EBM) has become a cornerstone of modern medical education, promoting the integration of scientific research into clinical decision-making. The incorporation of EBM principles into curricula enhances students' ability to critically appraise literature, apply research findings, and make informed clinical decisions. This approach fosters a culture of lifelong learning and continuous professional development. The findings indicate that early exposure to EBM significantly improves analytical skills and clinical competence, although challenges related to teaching methodology and student engagement remain.

The findings demonstrate a significant global shift toward learner-centered and competency-based educational models. Approaches such as problem-based learning, case-

based learning, and simulation-based education have shown substantial effectiveness in enhancing clinical reasoning, practical skills, and long-term knowledge retention. Workplace-based assessments, including Mini-CEX, DOPS, and Entrustable Professional Activities (EPAs), provide robust frameworks for evaluating real-world clinical competence. Additionally, technological integration—through virtual and augmented reality, e-learning platforms, and artificial intelligence—has expanded access to education and facilitated immersive, flexible learning environments. Collaborative learning strategies, peer-assisted learning, and interdisciplinary education further contribute to the development of communication, teamwork, and professional skills. However, significant disparities in implementation persist, influenced by institutional resources, faculty readiness, technological infrastructure, and sociocultural factors.

Observational learning involves acquiring knowledge through demonstration, a crucial aspect in healthcare where ensuring patient safety is fundamental. The development of motor skills is a fundamental part of medical proficiency and must be taught and refined with great precision. Many medical tasks are considered open-ended skills that require physicians to adapt to unpredictable and constantly changing situations (e.g., tracheal intubation and surgical suturing). The process behind this learning method is rooted in the mirror neuron system of the premotor cortex, which plays a role in imitating actions observed in others. Observational learning depends on the active involvement of the motor system and requires the implicit involvement of the observer for effective learning. In addition, immediate feedback is believed to be effective not only during hands-on practice but also during observation. There is evidence that combining observational learning with physical exercise may be more beneficial than relying on physical exercise alone. Observational techniques are essential for mastering complex medical procedures and promoting learning and skill development through practice-based observation. Practicing motor skills is essential for improving performance in medical procedures, and understanding the mechanisms underlying these movements plays an important role in refining training programs. The approaches achieved using this method promote adaptability, optimize motivation, and improve cognitive processing. In addition, skill acquisition is accelerated through visual-spatial representation, creating vivid mental images in working memory.

**Assessment of Entrustable Professional Activities (EPAs):** Assessment of EPAs is based on direct observation of the learner performing the activity. Supervisors use standardized checklists or rubrics to evaluate performance and determine the level of supervision required. Feedback is a key component, helping learners understand their strengths and areas for improvement.

**Benefits of Entrustable Professional Activities (EPAs):** **Competency-Based:** EPAs ensure that learners are assessed based on their ability to perform real-world tasks, making the training process more relevant to professional practice; **Clear Progression:** The entrustment model provides a clear, structured path for learners as they develop their skills, from needing close supervision to independent practice; **Practical Application:** EPAs focus on practical tasks that professionals need to master, bridging the gap between theoretical learning and practical, clinical application. **Personalized Learning:** Learners receive personalized feedback based on their performance, allowing them to focus on areas that need further development; **Patient Safety:** The entrustment process ensures that learners are only entrusted with tasks when they have demonstrated sufficient competence, helping to ensure patient safety. **Commonly Used In:** Medical and healthcare education (e.g., residency and fellowship programs); Nursing education (e.g., entrusting nurses with independent patient care responsibilities); Allied health professions (e.g., physical therapists, pharmacists, and other clinical roles).

The Mini-CEX (Mini Clinical Evaluation Exercise) is a structured, workplace-based assessment tool used in medical education to evaluate a learner's clinical skills in real-time clinical practice. It involves direct observation of a trainee during a brief patient encounter, followed by immediate feedback from an experienced clinician or supervisor. The Mini-CEX is designed to assess a variety of clinical competencies, such as patient interaction, communication, clinical reasoning, and professionalism, in a real-world context.

Key Features of (Mini Clinical Evaluation Exercise) Mini-CEX:

- **Direct Observation:** A supervisor observes the trainee during a short clinical encounter with a real patient (usually lasting around 10-20 minutes). The encounter may involve history-taking, physical examination, diagnosis, patient counseling, or treatment planning.
- **Broad Skill Assessment:** The Mini-CEX allows for the assessment of multiple clinical skills, such as: **History-taking:** Gathering and interpreting patient history; **Physical examination:** Performing a focused and effective clinical examination; **Clinical reasoning:** Formulating a differential diagnosis and treatment plan; **Communication:** Interacting with patients, explaining diagnoses, and delivering clear instructions; **Professionalism:** Demonstrating empathy, respect, and ethical behavior; **Organizational skills:** Managing time effectively and ensuring smooth patient flow.
- **Immediate Feedback:** After the encounter, the supervisor provides immediate, structured feedback to the learner, highlighting strengths and areas for improvement. This formative feedback is essential for guiding the trainee's development.
- **Short and Focused:** The Mini-CEX is brief and focused on specific competencies or elements of patient care, allowing for multiple assessments across a range of clinical scenarios over time.
- **Formative and Summative Use:** Although primarily formative (focused on improving skills through feedback), the Mini-CEX can also be used summative to contribute to formal evaluations of a trainee's competency at various stages of their education.
- **Standardized Evaluation:** The supervisor completes a structured evaluation form, rating the learner's performance across several domains on a numerical scale (e.g., 1-9), where higher scores reflect greater competence. Commonly assessed domains include clinical judgment, communication skills, organization, and professionalism.
- **Frequent and Flexible:** Mini-CEX assessments can be repeated frequently during clinical rotations to capture the learner's development over time. It is flexible, allowing assessments to take place in various clinical settings (inpatient, outpatient, emergency, etc.) and across different types of patient cases.

Steps in (Mini Clinical Evaluation Exercise) Mini-CEX:

- **Case Selection:** A real patient case is chosen for the learner to engage with, either as part of routine clinical practice or specifically for the assessment.
- **Observation:** The supervisor observes the learner interacting with the patient, performing tasks such as history-taking, physical examination, or patient counseling.
- **Assessment:** After the encounter, the supervisor completes the Mini-CEX evaluation form, rating the learner in various skill areas. The ratings are typically on a scale (e.g., 1-9), with higher scores indicating greater competency.
- **Feedback:** The supervisor provides immediate feedback, discussing the learner's performance, strengths, and areas for improvement. Feedback is specific, constructive, and designed to help the learner grow in their clinical skills.
- **Reflection and Action Plan:** The learner reflects on the feedback and, with the help of the supervisor, develops an action plan for further improvement. This may include targeted practice or additional study in certain areas.

Domains Commonly Assessed in (Mini Clinical Evaluation Exercise) Mini-CEX:

- History-taking: Ability to gather relevant patient information.
  - Physical examination: Skill in conducting a focused, effective exam.
  - Clinical judgment: Diagnostic reasoning, decision-making, and treatment planning.
  - Communication skills: Clarity and empathy in interacting with patients and their families.
  - Professionalism: Ethical behavior, respect, and rapport-building with patients.
  - Time management: Efficient use of time and organization in patient care.
- Benefits of (Mini Clinical Evaluation Exercise) Mini-CEX:
- Real-Time Assessment: Direct observation in a real clinical setting ensures that learners are evaluated on their actual performance, not just theoretical knowledge.
  - Personalized Feedback: Immediate, targeted feedback helps trainees focus on specific areas for improvement.
  - Frequent and Flexible: Multiple, brief assessments over time allow for tracking of progress and improvement.
  - Broad Assessment of Skills: Mini-CEX covers a wide range of essential clinical competencies, ensuring comprehensive evaluation.
  - Learner Development: The focus on formative feedback encourages continuous learning and development.

Mini Clinical Evaluation Exercise Commonly Used In: Medical education: Particularly during clinical rotations for medical students, interns, and residents; Nursing education: To assess practical nursing skills in clinical settings. Allied health education: For clinical professions such as physiotherapy, dentistry, and pharmacy. The Mini-CEX is a valuable tool for assessing and improving clinical performance, helping learners develop the skills necessary for competent, patient-centered care.

The Objective Structured Clinical Examination (OSCE) is a widely used assessment method in medical, nursing, and allied health education to evaluate a learner's clinical competence in a structured and standardized way. The OSCE assesses a range of clinical skills, including history-taking, physical examination, clinical reasoning, communication, and professionalism, in a controlled, simulated clinical environment.

Key Features of Objective Structured Clinical Examination (OSCE):

- Structured Stations: The OSCE consists of multiple stations (typically 10–20), each focusing on a different clinical task or scenario. Each station is designed to assess specific skills, such as diagnosing a patient, performing a physical exam, interpreting test results, or counseling a patient.
- Standardized Patients: Many OSCEs use trained actors or simulated patients to portray clinical scenarios, ensuring standardization. These standardized patients follow a script, making the assessment consistent for all learners.
- Time-Limited: Each station is time-limited, typically lasting 5 to 10 minutes, and learners must complete the task within that time frame. This tests not only clinical competence but also time management and the ability to think on one's feet.
- Objective Scoring: Each station has clear objectives and a standardized checklist or rubric that the examiner uses to evaluate the learner's performance. The scoring system ensures that the assessment is objective and minimizes bias. Skills such as technical proficiency, communication, and clinical reasoning are scored based on the checklist.
- Simulated Real-Life Scenarios: The stations are designed to reflect realistic clinical challenges that healthcare professionals face in practice. This allows learners to demonstrate how they apply theoretical knowledge in practical, patient-centered situations.
- Holistic Assessment: The Objective Structured Clinical Examination (OSCE) assesses a broad range of skills, including: Clinical knowledge: The ability to diagnose and manage clinical conditions; Technical skills: Proficiency in performing specific procedures (e.g.,

suturing, administering injections); Communication: Effective interaction with patients, explaining diagnoses, and delivering treatment plans; Professionalism: Demonstrating empathy, ethical conduct, and respect for patients; Clinical reasoning: Formulating differential diagnoses and decision-making based on clinical data.

- Formative and Summative Use: Objective Structured Clinical Examination (OSCEs) can be used for both formative (developmental) and summative (final) assessments. Formative OSCEs help learners identify areas for improvement, while summative OSCEs evaluate competence at the end of a course or training program.

**Objective Structured Clinical Examination (OSCE) Format:** Pre-Set Stations: Learners rotate through a series of stations, each with a different task. Tasks may include history-taking, performing a physical examination, counseling a patient, interpreting diagnostic tests, or demonstrating technical procedures; Simulated Clinical Scenarios: Each station simulates a specific scenario, such as diagnosing a patient with chest pain, performing a neurological exam, or counseling a patient on smoking cessation; Checklists and Rubrics: Each station has an examiner (usually a clinician or educator) who observes the learner's performance and scores them based on a structured checklist. These checklists outline specific actions or steps the learner must perform to demonstrate competence; Immediate Feedback: In some OSCEs, particularly formative ones, learners receive immediate feedback after completing each station. This feedback helps them understand their strengths and areas for improvement.

**Commonly Assessed Skills in Objective Structured Clinical Examination (OSCE):**

- History-taking: Gathering relevant information from the patient about their symptoms and medical history.
- Physical examination: Performing appropriate clinical exams based on the patient's presenting symptoms.
- Diagnosis and treatment planning: Developing a differential diagnosis and formulating a management plan.
- Communication: Effectively explaining diagnoses, treatment options, and procedures to patients in an understandable and empathetic manner.
- Procedural skills: Demonstrating technical skills like suturing, inserting IVs, or performing CPR.
- Ethics and professionalism: Showing respect, empathy, and appropriate professional behavior during patient interactions.

**Benefits of Objective Structured Clinical Examination (OSCE):** Standardized Assessment: The structured format and standardized patients ensure that all learners are assessed in a consistent, objective way; Comprehensive Skill Evaluation: OSCEs assess not only knowledge but also practical, technical, and interpersonal skills, giving a holistic view of a learner's clinical competence; Realistic Scenarios: Simulating real-world clinical tasks helps prepare learners for actual clinical practice; Immediate Feedback and Reflection: In some OSCEs, learners receive immediate feedback, which promotes reflection and targeted learning.

**Objective Structured Clinical Examination Commonly Used In:** Medical education: OSCEs are often used in medical schools, residency programs, and for board certification exams; Nursing education: Nursing students are assessed on practical skills, such as patient care and clinical decision-making; Allied health professions: OSCEs are also used in other healthcare fields like dentistry, pharmacy, physiotherapy, and paramedicine.

**Objective Structured Clinical Examination (OSCE) Strengths:** Objectivity: The use of checklists and standardized patients ensures objective, unbiased assessment; Practical focus: The OSCE assesses the application of knowledge in real-life scenarios, ensuring learners are practice-ready; Flexible: OSCEs can be adapted to assess a wide variety of clinical skills across different disciplines; The Objective Structured Clinical Examination (OSCE) is a powerful tool

in healthcare education, as it effectively evaluates not just what learners know, but how well they can apply their knowledge and skills in real-world clinical situations.

The Objectively Structured Practical Exam (OSPE) is an assessment tool similar to the OSCE but is primarily used in laboratory-based, practical, or pre-clinical subjects, particularly in medical, dental, pharmacy, and allied health education. While OSCE focuses on clinical skills in patient care, the OSPE is designed to evaluate technical and practical skills in a more controlled, often laboratory-like environment.

Key Features of Objective Structured Clinical Examination (OSPE):

- **Multiple Stations:** Like the OSCE, the OSPE consists of a series of timed stations (usually 5-15 stations). Each station is designed to test a specific skill or set of skills in a practical setting, such as identifying anatomical structures, performing a laboratory experiment, or interpreting medical data.
- **Objective and Structured:** Each station is highly structured with a clear set of tasks or problems that the learner must complete. A standardized checklist or rubric is used to ensure objective assessment, reducing subjectivity and bias.
- **Hands-On Skills:** The focus of the OSPE is on assessing practical, technical skills, often in a laboratory or simulated clinical setting. These skills could include: Specimen identification (e.g., identifying anatomical specimens or cells under a microscope); Measurement tasks (e.g., blood pressure, or spirometry); Instrument handling (e.g., proper use of a centrifuge or microscope); Data interpretation (e.g., analyzing lab results or physiological readings); Procedure demonstrations (e.g., suturing on a model, IV insertion on a mannequin).
- **Non-Clinical Focus:** Objective Structured Clinical Examination (OSPEs) are generally used for evaluating pre-clinical or non-patient care skills, such as laboratory techniques, anatomy, physiology, pharmacology, or biochemistry, in contrast to OSCEs, which focus more on patient interaction and clinical care.
- **Rotation through Stations:** Learners rotate through different stations, each focused on a specific task. Some stations may involve hands-on procedures, while others may require the interpretation of data or answering questions about a practical task. Each station typically lasts around 5–10 minutes.
- **Checklist-Based Evaluation:** Examiners use a predefined checklist at each station to assess the learner's performance objectively. The checklist typically includes specific actions or outcomes that the learner must demonstrate to score points.
- **No Patient Interaction:** Unlike the OSCE, which often involves direct interaction with standardized patients or actors, the OSPE is more focused on technical and laboratory skills. However, some stations may include theoretical questions or decision-making based on practical tasks.

OSPE Format:

- ✓ **Pre-Set Stations:** Learners are presented with different tasks at each station. These tasks may include performing a laboratory technique, identifying anatomical features, or analyzing experimental data.
- ✓ **Rotation:** Learners rotate through the stations in a timed manner. The format allows for the assessment of a broad range of practical skills in a relatively short period.
- ✓ **Assessment:** At each station, the learner's performance is evaluated using a standardized checklist or rating scale. The assessment may include: Correctness of procedures; Accuracy of data interpretation; Proper use of instruments or equipment; Ability to identify anatomical structures or lab specimens; Time management and efficiency in completing the tasks.

- ✓ Immediate Feedback: While not always standard, some OSPEs may include formative feedback after completion, helping learners understand areas for improvement.

Domains Commonly Assessed in Objective Structured Clinical Examination (OSPE):

- ✓ Practical skills: Performing technical procedures in a lab environment (e.g., preparing slides, using diagnostic tools, dissection, etc.).
- ✓ Instrument handling: Proper and safe use of laboratory or clinical instruments (e.g., microscope, sphygmomanometer).
- ✓ Knowledge application: Applying theoretical knowledge to practical tasks, such as interpreting lab results or understanding physiological data.
- ✓ Problem-solving and decision-making: Ability to solve practical problems and make informed decisions during hands-on tasks.
- ✓ Time management: Completing tasks efficiently within the time allocated at each station.

Benefits of Objective Structured Clinical Examination (OSPE): Objective Assessment: The use of standardized checklists makes the assessment objective, reducing examiner bias; Wide Range of Skills: The OSPE can assess a broad range of technical and practical skills, from basic lab techniques to more complex decision-making tasks; Hands-On Focus: The exam emphasizes practical, hands-on experience, ensuring that learners are competent in technical procedures required for their field; Controlled Environment: The practical, non-clinical setting allows for a more controlled and focused assessment of technical skills; Fair and Standardized: Since all learners perform the same tasks under the same conditions, the OSPE ensures fairness and consistency in assessment.

Differences Between OSPE and OSCE: Focus: OSPE is focused on assessing technical and practical skills in pre-clinical settings, such as laboratories or simulation environments, while OSCE evaluates clinical skills such as patient interaction and communication; Setting: OSPE is typically conducted in labs or controlled environments without patient interaction, whereas OSCEs often involve real or standardized patients; Skills Assessed: OSPE assesses skills like instrument use, data interpretation, and technical procedures, while OSCE evaluates broader clinical skills like history-taking, diagnosis, and patient counseling.

Objective Structured Clinical Examination (OSPE) Commonly Used In: Medical education: Particularly in pre-clinical subjects like anatomy, physiology, biochemistry, and pharmacology; Nursing education: To assess nursing skills such as specimen collection, medication administration, or monitoring vital signs; Allied health education: For fields like dentistry, pharmacy, and laboratory sciences, where technical proficiency is critical; The OSPE is a versatile and valuable tool in healthcare education for assessing practical skills in a standardized, objective way, ensuring learners are well-prepared for their technical responsibilities in clinical practice.

Workplace-Based Assessment (WPBA) refers to a range of assessment methods used to evaluate a learner's performance and competence in the actual workplace or clinical environment. Unlike traditional exams, which assess knowledge in a theoretical setting, WPBA assesses how a learner applies their knowledge and skills in real-time practice, making it an important tool in competency-based education, especially in healthcare and other professional fields.

Key Features of Workplace-Based Assessment (WPBA):

- Real-World Setting: WPBA occurs in the workplace, meaning the learner is assessed during their routine duties or tasks in a clinical, laboratory, or professional environment. This allows for the evaluation of practical, hands-on skills.
- Continuous Assessment: WPBA is typically conducted over a period of time, allowing for the observation and assessment of a learner's performance across various tasks and situations. This provides a more comprehensive and realistic understanding of their abilities.

- Formative and Summative Use: WPBA can be used both for formative purposes (providing feedback to support development) and summative purposes (assessing overall competency for certification or advancement).
- Multisource Feedback: In WPBA, feedback may come from a variety of sources, including supervisors, peers, patients, and even the learners themselves (through self-assessment). This allows for a 360-degree view of the learner's performance.
- Competency-Based: WPBA is aligned with specific competencies required for professional practice. These competencies can include clinical reasoning, technical skills, communication, professionalism, and teamwork.
- Direct Observation: Learners are observed directly by supervisors or colleagues while performing their regular duties. The assessment is based on real-time observation rather than simulated tasks.

#### Common Workplace-Based Assessment (WPBA) Methods:

1. Mini-CEX (Mini Clinical Evaluation Exercise):
  - ✓ A short, structured observation of a clinical encounter between a learner and a patient.
  - ✓ Evaluates history-taking, physical examination, clinical reasoning, and communication.
  - ✓ Immediate feedback is provided to the learner.
2. DOPS (Direct Observation of Procedural Skills):
  - ✓ Focuses on the observation of the learner performing specific clinical procedures.
  - ✓ Assesses technical skills, patient safety, and procedural competence.
  - ✓ Feedback is given immediately after the procedure.
3. CBD (Case-Based Discussion):
  - ✓ An in-depth discussion between the learner and a supervisor about a real patient case.
  - ✓ Evaluates clinical reasoning, decision-making, and knowledge application.
  - ✓ Allows the learner to reflect on their thought process and learn from the feedback.
4. Multisource Feedback (MSF):
  - ✓ Also known as 360-degree feedback, it gathers assessments from multiple individuals who interact with the learner, including colleagues, patients, and supervisors.
  - ✓ Evaluates teamwork, communication, professionalism, and interpersonal skills.
5. Portfolio:
  - ✓ A collection of evidence gathered over time, including reflective writing, case logs, and documented feedback from supervisors.
  - ✓ Allows for assessment of learning progress and personal development over a period.
6. Patient Satisfaction Surveys:
  - ✓ Involves gathering feedback from patients regarding the learner's interaction, communication, and professionalism during consultations or procedures.
7. Entrustable Professional Activities (EPAs):
  - ✓ Assesses whether a learner can be entrusted to perform specific professional tasks independently.
  - ✓ Directly evaluates practical competence in real-world tasks.

#### Domains Assessed by WPBA:

- ✓ Clinical competence: Clinical reasoning, diagnosis, treatment planning, and procedural skills.
- ✓ Professionalism: Ethical behavior, responsibility, and respect for patients and colleagues.
- ✓ Communication skills: Interpersonal interactions with patients, families, and healthcare teams.
- ✓ Teamwork: Collaboration with peers and other healthcare professionals.
- ✓ Time management and organizational skills: Efficiently managing tasks and prioritizing patient care.

- ✓ Patient-centered care: Demonstrating empathy, respect, and understanding of patient needs and preferences.

#### Benefits of Workplace-Based Assessment (WPBA):

- ✓ Real-World Relevance: Since WPBA is conducted in actual workplace settings, it offers a more accurate assessment of a learner's readiness for professional practice than theoretical or simulation-based assessments.
- ✓ Holistic Assessment: WPBA evaluates a range of competencies, including clinical, interpersonal, and professional skills, providing a comprehensive view of the learner's abilities.
- ✓ Personalized Feedback: WPBA includes regular, personalized feedback that helps learners identify areas for improvement and track their progress over time.
- ✓ Encourages Reflection: Many WPBA methods, such as case-based discussions and portfolios, encourage self-assessment and reflection, helping learners develop critical thinking and lifelong learning skills.
- ✓ Supports Professional Development: By identifying strengths and weaknesses, WPBA helps learners create targeted learning plans to develop the skills they need for future practice.
- ✓ Flexible: WPBA can be adapted to different specialties, professional roles, and clinical settings, making it a versatile assessment method.

#### Challenges of Workplace-Based Assessment (WPBA):

- Consistency: Since WPBA is conducted in real-world settings, variability in patient cases, work environments, and assessors can affect the consistency of the assessment.
- Time-Intensive: Supervisors need to invest time in observing, assessing, and providing feedback, which can be a challenge in busy clinical settings.
- Subjectivity: Although WPBA uses structured checklists, there is still some subjectivity in the evaluation process, especially in areas like communication and professionalism.

#### Commonly Used In:

- Medical education: For assessing students, interns, and residents in clinical settings.
- Nursing education: To evaluate clinical competence and practical nursing skills.
- Allied health professions: Used in fields like physiotherapy, pharmacy, and radiography to assess professional skills.
- Other professional fields: WPBA is also used in professions such as law and education, where practical skills and professional behaviors are essential.

Workplace-Based Assessment (WPBA) is a powerful tool for evaluating learners' real-world performance in professional settings. By focusing on practical skills and providing continuous feedback, WPBA ensures that learners are competent and ready for independent practice, making it an essential part of competency-based education and professional development.

The flipped classroom is an instructional approach that reverses the traditional teaching model. In a flipped classroom, students first engage with new content outside of class, typically through video lectures, readings, or other digital resources, and then use class time for interactive, hands-on activities, problem-solving, or discussions with peers and instructors.

#### Key Features of the Flipped Classroom Model:

##### 1. Pre-Class Learning:

- Content Delivery: New material is introduced outside the classroom. This might involve watching pre-recorded video lectures, reading articles, reviewing case studies, or completing interactive online modules.
- Self-Paced: Students can go through the material at their own pace, pausing and rewatching sections if needed, which accommodates different learning styles and speeds.

## 2. In-Class Application:

- **Active Learning:** Classroom time is devoted to applying the knowledge gained through pre-class materials. Activities might include group discussions, problem-solving exercises, collaborative projects, debates, or lab work.
- **Instructor Facilitation:** Instead of delivering a lecture, the teacher acts as a facilitator or coach, guiding students as they work through problems or engage in discussions, addressing misconceptions, and providing individualized support.

## 3. Student-Centered Learning:

- ✓ The flipped classroom emphasizes active participation and engagement from students. Since they have already encountered the content outside of class, they are expected to come prepared to engage deeply with the material during class time.
- ✓ This approach shifts the focus from passive learning (listening to a lecture) to active learning, where students take ownership of their learning process.

### Benefits of the Flipped Classroom:

- **Deeper Understanding:** By using class time for interactive and problem-solving activities, students can develop a deeper understanding of the material through practice and discussion rather than just memorization.
- **Increased Engagement:** The flipped classroom model promotes active participation and interaction with peers and instructors, which can increase student engagement and motivation to learn.
- **Personalized Learning:** Instructors have more time during class to provide individualized help to students, addressing specific questions or challenges, and supporting students at different levels of understanding.
- **Flexible Learning Pace:** Since students can access pre-class materials at their own pace, those who need more time to grasp complex concepts can revisit the content, while faster learners can move ahead.
- **Better Use of Class Time:** Instead of spending valuable class time delivering content, instructors can focus on higher-order learning activities like applying, analyzing, and evaluating information.
- **Improved Collaboration:** In-class activities often involve collaboration and teamwork, helping students develop important communication and teamwork skills while learning from their peers.

### Challenges of the Flipped Classroom:

- **Preparation Time:** Creating high-quality pre-class materials, such as video lectures or interactive resources, can be time-consuming for instructors.
- **Student Accountability:** Success in a flipped classroom relies on students coming to class prepared. If students don't engage with the pre-class materials, they may struggle during in-class activities.
- **Access to Technology:** Students need reliable access to technology (such as computers, internet access, or multimedia tools) to complete pre-class assignments, which can be a barrier for some learners.
- **Adaptation:** Both students and teachers may need time to adjust to the flipped model, especially if they are used to traditional lectures. Some students might prefer face-to-face lectures, and teachers need to be comfortable with facilitating active learning sessions.

### Flipped Classroom in Healthcare and Professional Education:

In medical and professional education, the flipped classroom has gained popularity as a method for enhancing clinical training and hands-on learning:

- **Pre-Class Work:** Learners might review video lectures on clinical cases, medical procedures, or theoretical content before class.

- **In-Class Application:** Classroom time can then be dedicated to applying the material through case-based discussions, simulation exercises, or role-playing scenarios, helping learners practice decision-making and problem-solving in real-world contexts.

The flipped classroom is an innovative teaching model that shifts the focus from passive lecture-based learning to active, student-centered engagement. By delivering content outside of class and using class time for deeper application, the flipped classroom helps learners develop critical thinking, collaboration, and problem-solving skills while fostering a more personalized learning experience.

The flipped classroom is a modern, transformative learning strategy that integrates blended learning with digital or physical learning resources outside of the traditional classroom. Students receive pre-recorded lessons as preparatory assignments, shifting the focus from teacher-led learning to self-directed learning. Classroom activities focus on collaborative problem solving by having students work in small groups to analyze medical cases, encouraging a team approach and improving long-term knowledge retention. This method also encourages peer interaction and allows students to fill knowledge gaps while assessing individual differences and learning style strengths. Assigned tasks. Research shows that this approach outperforms traditional classrooms when it comes to increasing student awareness, critical thinking, learning outcomes, and motivation. Thanks to multimedia tools, students benefit from unlimited access to educational content, thus promoting interactive and independent learning. This model allows students to evaluate their progress, identify areas for improvement, and use constructive feedback from peers and instructors to ensure continuous improvement in their learning processes.

Peer-assisted learning (PAL) involves expanding knowledge and skills through mutual support from peers. This collaborative, non-professional approach to learning consists of a group of motivated individuals who support each other throughout the learning process. Participants, both teachers and students, usually have the same educational background. This method is implemented by selecting students who have adequate skills in teaching medical concepts. It promotes the development of skills that not only enhance learning but also contribute to medical practice. PAL is a broad framework that strengthens the link between practical experience and a collaborative learning environment. Peer-assisted learning (PAL) benefits both the teacher and the student by improving their understanding and knowledge. Tutors gain benefits such as improved communication skills and a deeper understanding of the subject matter. The process of preparing lessons during tutoring and providing feedback to peers promotes the cognitive and non-cognitive development of tutors. Additionally, this approach has been shown to have a positive impact on student performance, leading to better exam results and overall success.

Social media acts as a hub for the digital web where users form online communities to engage in meaningful discussions. These communities play a vital role in sharing information, ideas, and a variety of content. Popular platforms such as Twitter, Facebook, YouTube, and blogs are just a few of the many options used for this purpose. In modern medicine, social media has become an integral part of professional communities, medical institutions, and support groups. As the need to advance education increases, integrating social media into modern educational systems is becoming essential. Social media platforms complement traditional teaching methods and support distance learning initiatives. Students and learners of all levels often turn to the Internet to learn about diseases, treatments, and physiological concepts. Additionally, organizations have realized the value of promoting blogs or live tweets during medical conferences, allowing content to reach a much wider audience than just those who attend in person. Advances in computer technology have had a major impact on medical education, especially through the electronic sharing of video content. The wide availability of

online educational resources is essential for medical education. These tools support hands-on clinical skill acquisition, visual demonstration of anatomical dissections, and asynchronous learning through recorded lectures. Resources range from home study videos to professional content created by healthcare organizations and physicians, providing comprehensive content for personal and professional development.

A simulation is an artificial recreation of the real world that aims to achieve educational objectives through hands-on, experience-based learning. The basic idea of simulation-based learning (SBL) is to use simulated tools and scenarios to replicate authentic clinical situations. Although simulation is a relatively new phenomenon in medical education, it has long been used in other high-risk fields such as aviation. Medical simulation allows students to develop clinical skills through rigorous practice, a departure from traditional hands-on training. It offers an alternative to using real patients and real-time clinical scenarios, overcomes challenges such as limited access to clinical environments, and can be effectively integrated into pre-clinical training. One of the most important benefits is giving trainees the freedom to repeatedly make and correct mistakes without compromising patient safety. Virtual reality (VR) can further enhance SBL by improving learning outcomes and increasing confidence in patient care. A cutting-edge technological innovation, virtual reality bridges the gap between theoretical knowledge and practical application by immersing students in a realistic yet controlled environment. The level of complexity, realism and interactivity of virtual reality systems can vary greatly, allowing users to dynamically participate in simulated scenarios. For example, haptic feedback simulates resistance when handling tools, making the exercise more realistic. This technology is often used to train residents in laparoscopic and endoscopic procedures, helping them improve their skills in a safe, controlled environment.

Problem-based learning (PBL) is an innovative pedagogical approach that integrates various learning principles to solve a clinical problem. Its main objective is to improve the quality of educational outcomes through collaborative, independent, integrated, and in-depth learning. A key characteristic of PBL is the “problem-first” approach, in which students approach a problem without having received any prior formal training on the topic. PBL is typically taught in small groups where the teacher acts as a facilitator rather than a direct instructor. These courses are divided into different phases, each focusing on a specific problem and including periods of independent study to research and gather information. This structure encourages students to actively participate in building a solid foundation for independent learning. In PBL, medical students develop their understanding and interpretation of information collaboratively through social interaction, replacing passive consumption of projected content. PBL is considered an effective method for developing advanced cognitive skills in a group setting. By working on clinical cases, students improve their ability to apply their knowledge and develop their diagnostic reasoning skills. This method not only improves clinical reasoning, but also promotes effective time management and long-term knowledge retention. These skills are essential to tomorrow's medical practice, especially in a field where continuing education is essential to keep pace with the rapid growth of medical information and technological advances.

Case-based learning (CBL) is an educational strategy that integrates clinical cases with traditional teaching methods to improve student engagement and understanding. By incorporating real-world scenarios, (CBL) eliminates the motivational gaps often found in lectures. Students receive comprehensive patient information, including medical history, symptoms, clinical findings, and laboratory results. Through collaboration and interaction with peers, learners assess the situation, develop a diagnostic approach, and recommend appropriate management plans. The primary purpose of Case-based learning (CBL) is to foster the critical thinking and analytical skills necessary for clinical practice. Case-based learning (CBL) bridges

the gap between theoretical knowledge and practical application through inquiry-based learning methods. Students work in small groups and solve clinical situations that mimic real-world medical situations. These teams work together to analyze the case, develop differential diagnoses, define treatment strategies, and consider next steps. Case-based learning (CBL) is particularly effective in addressing in-depth topics with clearly defined learning objectives and promotes improved clinical knowledge, teamwork, practical skills and evidence-based decision making.

Evidence-based medicine (EBM) teaches students the fundamental skills of interpreting, analyzing, and evaluating medical research. It involves five main steps: a) transforming uncertain information into a specific, researchable question, b) identifying the most relevant evidence, c) thoroughly evaluating the evidence for accuracy and reliability, d) integrating the results into clinical practice, and e) evaluating the results for effectiveness. Evidence-based medicine (EBM) promotes continuous learning and systematic thinking, which enables the careful application of the latest medical knowledge to patient care decisions. Although Evidence-based medicine (EBM) is opposed to balancing experiential objectivity and subjective experience, its early incorporation into medical education has significantly changed the cognitive approach of medical graduates. These students acquire better analytical and decision-making skills, leading to greater competence. Integrating EBM into traditional medical education improves research acumen, practical application, perspective, and long-term use of evidence-based strategies. Compared to blending (EBM) with traditional methods, modern approaches to education adopt a more comprehensive model that encourages creativity and adaptability. This shift encourages advanced critical thinking and reasoning, and contributes to a better understanding of disease mechanisms and patient care.

Bedside teaching is a traditional educational approach commonly used in medical and healthcare training. It involves direct teaching and learning that occurs at the patient's bedside, allowing students or trainees to engage with real patients and clinical scenarios in a practical environment. This method emphasizes experiential learning, patient interaction, and the application of theoretical knowledge in real-world situations.

#### Key Features of Bedside Teaching:

- **Real-World Context:** Bedside teaching takes place in clinical settings, such as hospitals or clinics, where learners interact with patients and healthcare professionals. This real-world context enhances the relevance of the education.
- **Patient-Centered Learning:** The method focuses on actual patient cases, allowing students to observe, assess, and discuss the patient's condition, diagnosis, and treatment options. This patient-centered approach promotes empathy and understanding of patient needs.
- **Interactive Learning:** Bedside teaching encourages active participation from learners. They may be involved in taking patient histories, performing physical examinations, discussing clinical findings, and formulating management plans in collaboration with supervisors.
- **Direct Observation:** Instructors or experienced clinicians observe and guide students during their interactions with patients, providing immediate feedback on clinical skills, communication, and professionalism.
- **Integration of Theory and Practice:** Learners can connect theoretical knowledge with clinical practice by discussing the rationale behind diagnoses and treatment plans while engaging with real patients.

#### Benefits of Bedside Teaching:

- **Enhanced Clinical Skills:** Direct interaction with patients helps learners develop essential clinical skills, such as history-taking, physical examination, and diagnostic reasoning.
- **Improved Patient Communication:** Engaging with patients in real-time helps students practice and refine their communication skills, building rapport and empathy.

- Immediate Feedback: Instructors can provide real-time feedback on students' performance, allowing for immediate reflection and improvement in clinical practice.
- Holistic Understanding: Learners gain a better understanding of patient care by seeing the entire patient experience, including diagnosis, treatment, and emotional aspects.
- Development of Critical Thinking: Engaging with complex cases fosters critical thinking and decision-making skills, as students must analyze and evaluate information in a dynamic environment.

#### Challenges of Bedside Teaching:

- ✓ Time Constraints: Clinical environments can be busy, making it challenging to find adequate time for teaching without interrupting patient care.
- ✓ Variability in Learning Opportunities: The availability of interesting cases or diverse patients may vary, impacting the learning experience. Not all patients may present typical or educational cases.
- ✓ Potential for Patient Anxiety: Some patients may feel uncomfortable with medical students or trainees present during their care, which can affect the teaching experience.
- ✓ Need for Skilled Instructors: Effective bedside teaching requires instructors who are skilled in both clinical practice and teaching methodologies. Not all clinicians may have training in educational techniques.
- ✓ Assessment Difficulties: Evaluating student performance during bedside teaching can be subjective and challenging to standardize.

#### Best Practices for Effective Bedside Teaching:

- Preparation: Instructors should prepare before bedside teaching sessions by reviewing relevant patient cases, understanding the clinical background, and identifying key teaching points.
- Patient Consent: Always ensure that patients are comfortable with having learners present during their care and obtain their consent.
- Engagement: Encourage active participation from learners by asking questions and fostering discussions about clinical findings and management plans.
- Feedback: Provide immediate and constructive feedback to help learners improve their skills and understanding.
- Reflective Practice: Encourage learners to reflect on their experiences after the bedside teaching sessions to reinforce learning and promote self-assessment.

Bedside teaching is a valuable method in medical and healthcare education, providing learners with the opportunity to apply their knowledge and develop essential clinical skills in a real-world context. By emphasizing patient interaction, active learning, and immediate feedback, bedside teaching fosters a deeper understanding of patient care and prepares students for their future roles as healthcare professionals.

The discussion underscores the importance of aligning teaching methods with contemporary medical practices, leveraging global best practices, and fostering adaptive learning environments. Collaboration among higher education institutions worldwide is vital to share insights, refine pedagogical approaches, and ensure the equitable delivery of high-quality education across diverse contexts.

As the medical education field continues to evolve, the emphasis must remain on nurturing professionals who are ethically grounded, culturally competent, and capable of leading healthcare advancements in a rapidly changing world. By embracing these modern methodologies, medical education institutions can cultivate a future-ready workforce, bridging the gap between academic preparation and practical excellence in the global healthcare arena.

Education is an ongoing process and it is important to recognize that students have different approaches to learning. Several innovative learning strategies in medical education

include case-based learning (CBL), evidence-based medicine (EBM), problem-based learning (PBL), simulation-based learning (SBL), digital education, peer-assisted learning (PAL). Experiential learning, flipped classrooms and collaborative learning. These non-traditional, student-centered learning methods expand students' perspectives through innovative methods of meaningful knowledge development while enhancing professional competencies through the development of skills, experiences, and leadership in the medical field. Thus, medical education must remain adaptable to effectively and appropriately integrate and apply interdisciplinary educational strategies from the core preclinical stages.

The adoption of modern teaching and learning methods in medical education has emerged as a key focus for higher education institutions globally. These methods aim to address the increasing complexity of healthcare systems, advances in medical science, and the need for well-rounded healthcare professionals capable of meeting diverse patient needs. The integration of innovative educational strategies, such as problem-based learning (PBL), simulation-based training, and digital learning platforms, reflects a paradigm shift from traditional rote learning to a more dynamic, learner-centered approach.

One of the critical aspects of this transformation is the emphasis on active learning. Methods like flipped classrooms and case-based discussions encourage students to engage deeply with the material, promoting critical thinking and application of knowledge in real-world scenarios. Similarly, simulation-based training has proven invaluable for honing clinical skills in a controlled, risk-free environment, ensuring students are better prepared for real-life challenges.

Technology also plays a pivotal role in modernizing medical education. Virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) are being used to enhance visualization, diagnosis training, and personalized learning pathways. These tools provide students with immersive experiences and instant feedback, fostering a deeper understanding of complex concepts.

Moreover, the global shift toward competency-based education reflects a commitment to outcome-driven learning. This approach prioritizes the development of specific skills and competencies essential for healthcare practice, moving beyond time-based training to focus on mastery and proficiency. Collaborative learning, interdisciplinary education, and integration of soft skills like communication, empathy, and teamwork further enrich the learning process.

However, the implementation of these modern methods is not without challenges. Variations in institutional resources, faculty training, and technological infrastructure can create disparities in the quality of education offered. Additionally, balancing traditional foundational knowledge with innovative methods requires careful curriculum design and ongoing evaluation to ensure educational effectiveness. The Execution of modern teaching and learning strategies in medical education is a global necessity driven by the evolving demands of healthcare. These methods not only enhance knowledge acquisition but also prepare students to become adaptive, competent, and compassionate medical professionals. The ongoing refinement of these approaches will be crucial in meeting the future needs of healthcare systems worldwide.

Despite the demonstrated benefits of modern pedagogical approaches, several challenges remain, including resistance to curricular change, limited access to advanced technologies in resource-constrained settings, and the need for faculty development. Effective integration of innovative methods requires strategic curriculum design, institutional support, and continuous evaluation to ensure alignment with healthcare system demands. Furthermore, balancing foundational knowledge with advanced competencies remains a critical consideration in medical education reform.

CBL (Case-Based Learning) is an instructional approach that uses real-life or simulated cases to facilitate learning. It is widely used in various educational settings, particularly in

medical, healthcare, legal, and business education. The primary goal of CBL is to engage students in active learning by having them apply theoretical knowledge to practical, real-world scenarios.

#### Key Features of (Case-Based Learning) CBL:

- **Realistic Cases:** Learning is centered on realistic, complex cases that mimic real-world problems or situations. These cases provide context and practical application for theoretical knowledge, making learning more relevant and meaningful.
- **Learner-Centered Approach:** CBL encourages active participation from students, who must analyze the case, identify key issues, and propose solutions. This contrasts with more passive forms of learning, such as lectures, where students are primarily recipients of information.
- **Application of Knowledge:** Students are required to apply what they have learned in the classroom to the case. This enhances understanding and retention by demonstrating how concepts and theories work in practice.
- **Critical Thinking and Problem-Solving:** CBL fosters critical thinking by challenging students to evaluate the information presented in the case, consider multiple perspectives, weigh evidence, and make decisions.
- **Collaborative Learning:** In many CBL settings, students work in groups, promoting teamwork, communication, and collaboration. The exchange of ideas and perspectives within a group setting helps deepen understanding.
- **Instructor as Facilitator:** Instructors guide the learning process rather than providing direct answers. Their role is to ask probing questions, offer feedback, and support students in their exploration of the case.
- **Reflection and Discussion:** Students reflect on their reasoning and decisions during or after the case analysis. Group discussions often allow for the sharing of different viewpoints and deepen the learning experience.

#### Steps in (Case-Based Learning) CBL:

- **Presentation of the Case:** Students are introduced to a case, typically involving a real-world problem or scenario relevant to the subject area.
- **Case Analysis:** Students analyze the case by identifying key problems, considering possible solutions, and applying theoretical knowledge to the situation.
- **Discussion and Collaboration:** Students discuss the case in groups or with the instructor, sharing ideas, debating different approaches, and learning from each other's perspectives.
- **Solution and Application:** Based on their analysis and discussion, students propose solutions or make decisions regarding the case. They may be asked to justify their choices and consider the implications of their actions.
- **Feedback and Reflection:** Instructors provide feedback, and students reflect on their learning process, analyzing what they did well and areas they could improve upon.

**Benefits of (Case-Based Learning) CBL:** Promotes active learning and student engagement; Enhances critical thinking, problem-solving, and decision-making skills; Bridges the gap between theory and practice; Encourages collaborative and team-based learning; Improves retention of knowledge by linking learning to real-world experiences.

**Commonly Used In:** Medical and healthcare education (e.g., diagnosis, patient management, and ethical dilemmas); Business and management studies (e.g., strategy, marketing, and leadership); Legal education (e.g., analyzing court cases, legal principles, and ethics).

(Case-Based Learning) CBL is particularly effective because it creates a more engaging and applied learning experience that mirrors the complexity of real-world situations, helping students become better problem-solvers and critical thinkers.

DOPS (Direct Observation of Procedural Skills) is an assessment tool used in medical and healthcare education to evaluate a learner's technical and procedural skills in real-time clinical settings. The method involves an experienced clinician directly observing the learner as they perform a specific clinical procedure, providing immediate feedback aimed at improving performance and competence.

Key Features of (Direct Observation of Procedural Skills) DOPS:

- **Real-Time Observation:** The learner is observed performing a procedure on a real patient or in a simulated clinical setting. This observation allows the assessor to evaluate technical proficiency, professionalism, and patient care during the procedure.
- **Wide Range of Procedures:** DOPS can be used to assess various procedural skills, such as taking blood samples, inserting IV lines, suturing, conducting a physical exam, or performing more complex surgical procedures, depending on the learner's level.
- **Structured and Specific:** The assessment is structured around specific criteria relevant to the procedure being observed. These criteria typically include technical ability, knowledge of the procedure, communication with the patient, hygiene and safety measures, and professional behavior.
- **Immediate Feedback:** After the procedure, the assessor provides immediate feedback to the learner, highlighting strengths and areas for improvement. This real-time feedback is crucial for helping learners adjust and refine their technique.
- **Formative and Summative:** DOPS is often used for formative purposes, meaning the goal is to help the learner improve through feedback and guidance. However, it can also be used in summative assessments, contributing to formal evaluations of competency during training programs.
- **Brief and Focused:** DOPS assessments are typically short (10–20 minutes), focusing on a specific skill or procedure. This allows for repeated assessments over time to track progress and development.
- **Assessor Role:** The assessor (usually a more senior clinician, supervisor, or mentor) not only observes the technical execution but also evaluates non-technical skills such as communication, patient consent, and professionalism.

Steps in (Direct Observation of Procedural Skills) DOPS:

- ✓ **Pre-procedure:** The learner is briefed about the procedure they will perform. The assessor ensures the learner understands the purpose of the procedure, patient consent, and safety protocols.
- ✓ **Direct Observation:** The assessor observes the learner performing the procedure. This observation covers all aspects, from preparation and interaction with the patient to the execution of the procedure itself.
- ✓ **Assessment:** The assessor uses a standardized form or checklist to evaluate the learner's performance. This typically includes areas such as: Technical skill and accuracy; Knowledge of the procedure; Communication with the patient; Maintenance of a sterile field (where applicable); Time management and efficiency.

**Immediate Feedback:** After the procedure, the assessor provides immediate feedback, discussing what the learner did well and areas that need improvement. The learner may also reflect on their own performance. **Documentation:** The observation and feedback are documented, and the learner may be given a rating or score based on their performance. These records can be used to track progress over time.

**Benefits of (Direct Observation of Procedural Skills) DOPS:** Provides real-time evaluation of practical skills in a clinical setting; Encourages immediate feedback and reflection, helping learners improve quickly; Enhances the learner's confidence in performing clinical procedures; Allows for focused learning on both technical and non-technical skills, such

as communication and professionalism; Helps track progress over time, identifying areas where further training or practice is needed. (Direct Observation of Procedural Skills) DOPS is particularly useful because it provides structured, formative assessment in a real-world context, allowing healthcare professionals to refine their skills and ensure competency in performing clinical procedures safely and effectively.

Entrustable Professional Activities (EPAs) are a critical tool in modern, competency-based education as they focus on real-world tasks and ensure that learners are truly prepared for independent practice before being entrusted with professional responsibilities. Entrustable Professional Activities (EPAs) are specific, observable tasks or responsibilities that can be entrusted to a learner once they have demonstrated the necessary competence to perform them independently. EPAs are widely used in competency-based medical and healthcare education to assess a learner's readiness for practice. They are designed to bridge the gap between theoretical knowledge and practical, real-world skills.

#### Key Features of Entrustable Professional Activities (EPAs):

- ✓ **Units of Professional Practice:** EPAs are real-world tasks or responsibilities that healthcare professionals are expected to perform in their daily practice. Examples include taking a patient's history, prescribing medication, or managing a clinical team. Each EPA represents a key activity within a profession.
- ✓ **Observable and Measurable:** EPAs are concrete activities that can be directly observed and measured. This allows supervisors or assessors to make objective judgments about a learner's competence based on their performance.
- ✓ **Linked to Competency:** While EPAs are the practical tasks, they are directly linked to underlying competencies such as medical knowledge, communication skills, clinical reasoning, professionalism, and patient care. Completing an EPA successfully indicates that the learner has integrated these competencies.
- ✓ **Trustworthiness:** The concept of "entrustment" is central to EPAs. Learners must demonstrate that they can perform the activity safely and independently before being entrusted with it. This means that supervisors must feel confident that the learner can carry out the task without supervision in a variety of situations.
- ✓ **Gradual Entrustment:** Learners move through different levels of entrustment, from needing close supervision to performing the activity independently. EPAs recognize that learners develop competence over time, and assessment is designed to track this progression.
- ✓ **Context-Specific:** EPAs are tailored to specific professions and contexts. The tasks that are considered essential or "entrustable" for a physician, for example, may differ from those for a nurse, dentist, or allied health professional.

**Levels of Entrustment:** Typically, Entrustable Professional Activities (EPAs) are assessed on a scale that represents the degree of supervision a learner requires. Common levels include:

- **Observation Only:** The learner is not yet allowed to perform the task but can observe others doing it.
- **Direct Supervision:** The learner can perform the task, but only with close supervision (e.g., a senior clinician is in the room).
- **Indirect Supervision:** The learner can perform the task with a supervisor nearby but not in the room, available for help if needed.
- **Supervision at a Distance:** The learner can perform the task without direct oversight but may consult a supervisor when necessary.
- **Independent Practice:** The learner is fully entrusted to perform the task independently and can supervise others.

Example Entrustable Professional Activities (EPAs) in Healthcare: For medical students, residents, or other healthcare professionals, some common EPAs might include; Taking a comprehensive patient history; Performing and interpreting a physical examination; Formulating a differential diagnosis; Documenting and presenting clinical findings; Prescribing and managing medications; Collaborating with an interprofessional healthcare team; Communicating with patients and their families.

Despite the clear advantages of modern teaching methodologies, several challenges and limitations are consistently identified across the literature. Resource constraints represent a major barrier, particularly in low- and middle-income countries where access to advanced technologies and simulation facilities may be limited. Faculty resistance to change and lack of training in innovative pedagogical approaches further impede implementation. Additionally, the transition from traditional to modern methods requires substantial curriculum redesign, institutional commitment, and ongoing evaluation to ensure effectiveness.

Another critical issue is the need to balance innovative teaching methods with the preservation of foundational knowledge. While active and experiential learning approaches enhance practical skills and critical thinking, they must be integrated with robust theoretical instruction to ensure comprehensive medical education. Curriculum designers must carefully align learning objectives, teaching methods, and assessment strategies to achieve this balance. Furthermore, the variability in implementation across different regions underscores the importance of context-specific adaptation. Cultural, economic, and institutional factors significantly influence the adoption and effectiveness of educational innovations. Global collaboration and the sharing of best practices are essential for addressing these disparities and promoting equitable access to high-quality medical education.

The results demonstrate that modern teaching and learning methods have a transformative impact on medical education, enhancing student engagement, competency development, and preparedness for clinical practice. However, their successful implementation requires careful consideration of contextual factors, resource availability, and faculty development. Continuous evaluation and evidence-based refinement of these approaches are essential to ensure that medical education remains responsive to the evolving needs of healthcare systems and society.

Modern teaching and learning methodologies represent a paradigm shift in medical education, fostering the development of competent, adaptive, and patient-centered healthcare professionals. The integration of innovative pedagogical strategies and digital technologies enhances educational quality and relevance, although equitable implementation remains a global challenge. Future efforts should focus on strengthening global collaboration, optimizing resource allocation, and advancing evidence-based educational practices to ensure sustainable and inclusive progress in medical education worldwide.

## Conclusion

- The evolution of medical education reflects a fundamental shift toward more dynamic, competency-oriented, and learner-centered paradigms that align with the complexities of modern healthcare systems. The findings of this study demonstrate that contemporary teaching and learning methodologies—such as problem-based learning, case-based learning, simulation-based education, flipped classrooms, and workplace-based assessments—significantly enhance the development of clinical competence, critical thinking, and professional skills. These approaches foster active engagement, promote deeper understanding, and better prepare students for real-world clinical challenges compared to traditional didactic models.

- The integration of digital technologies, including e-learning platforms, virtual and augmented reality, and artificial intelligence, has further transformed the educational landscape by enabling flexible, personalized, and immersive learning experiences. These innovations contribute to improved accessibility and efficiency in knowledge acquisition, while also supporting the development of practical skills in safe and controlled environments. Additionally, collaborative and peer-assisted learning strategies play a crucial role in strengthening communication, teamwork, and interdisciplinary competencies, which are essential for effective healthcare delivery.
- Despite these advancements, the implementation of modern educational approaches remains uneven across global contexts. Disparities in institutional resources, technological infrastructure, and faculty preparedness present significant barriers, particularly in low- and middle-income settings. Resistance to pedagogical change and the need for comprehensive faculty development further complicate the transition from traditional to innovative teaching models. Moreover, maintaining an appropriate balance between foundational theoretical knowledge and advanced practical competencies remains a critical consideration in curriculum design.
- The modern teaching and learning methods offer substantial benefits in enhancing the quality, relevance, and outcomes of medical education. Their successful integration requires strategic planning, continuous evaluation, and institutional commitment, alongside investment in faculty training and technological infrastructure. Strengthening international collaboration and promoting evidence-based educational practices are essential to ensure equitable and sustainable advancement. Ultimately, the adoption of innovative pedagogical approaches will play a pivotal role in preparing competent, adaptable, and patient-centered healthcare professionals capable of meeting the evolving demands of global healthcare systems.

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**THYROID FUNCTION ACROSS MENOPAUSAL TRANSITION: A CROSS-SECTIONAL STUDY OF PERI-MENOPAUSAL AND POST MENOPAUSAL WOMEN****Farida Ahmad, Afsheen Mahmood<sup>1</sup>, Azra Kanwal Amina Waqas Zara Khan****ABSTRACT**

**Objective:** Our study aimed to determine the frequency of thyroid disorders in peri-menopausal and postmenopausal women and to determine any association of thyroid disorders with menopausal symptoms.

**Material and Methods:** This analytical cross-sectional study was carried out at Hayat Abad Medical Complex from January 2025 to August 2025. The sample size was 246. All peri and post-menopausal women aged 45 to 50 were included. The women who were on hormone replacement therapy and had known thyroid disorders were excluded from the study. They were examined clinically. Serum TSH, free T4 was sent to the hospital lab. The Menopausal Rating Scale (MRS) was used to assess the severity of menopausal symptoms.

**Results:** The study cohort consisted of 246 peri and post-menopausal women. Amongst them, 52.1% were postmenopausal and 47.9% were peri-menopausal. The frequency of subclinical hypothyroidism was 12.2%, hypothyroidism, 8.7%, hyperthyroidism, 1.3% and euthyroid, 74.8%. While there was no significant difference in the median total MRS score between the groups with different thyroid problems, participants with hypothyroidism tended to have more psychogenic symptoms, while those with hyperthyroidism tended to have more somatic symptoms. Thyroid conditions did not significantly correlate with MRS score.

**Conclusion:** Women with hypothyroidism showed a tendency toward more psychogenic symptoms, and those with hyperthyroidism reported relatively higher somatic complaints; the overall MRS scores did not differ significantly among the various thyroid disorder groups.

**Keywords:** Thyroid disorders, menopause, perimenopause, menopausal rating scale

**THE GUT-BRAIN-SKIN AXIS IN ACNE: IMPACT OF POLENODERM****1 Major Gheorghe Giurgiu**

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**ABSTRACT**

**Background** It is increasingly believed that the interaction between skin microbes and host immunity plays an important role in acne. Acne also has close connections with the gastrointestinal tract, and many argue that the gut microbiota could be involved in the pathogenic process of acne. The emotions of stress, have been hypothesized to aggravate acne by altering the gut microbiota. The presence of a gut-brain-skin axis that connects gut microbes, oral probiotics, and diet, currently an area of intense scrutiny, to acne severity. This study concentrates on the skin and gut microbes in acne, the role that the gut-brain-skin axis plays in the immunobiology of acne, and newly emerging microbiome-based therapies that can be applied to treat acne.

**Objective** The purpose of this study was to compare the diversity of the skin microbiota in acne patients before and after taking Polenoderm.

**Materials and methods** A longitudinal cohort study was performed on 20 participants with moderate to severe facial acne with no recent use of oral and topical antibiotics/retinoids.

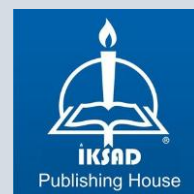
**Results** Hence, it is crucial to understand Polenoderm impact on the acne skin microbiota which is thought to be perturbed, our study provides insight into the skin microbiota in acne and how it is modulated by Polenoderm and diet.

**Conclusion** Acne also has close connections with the gastrointestinal tract, and many argue that the gut microbiota could be involved in the pathogenic process of acne. As understanding of the microbiome in healthy skin and the pathophysiology of acne continues to develop, new therapeutic targets are arising.

**Keywords:** acne, gut-brain-skin axis microbiota, Polenoderm, diet



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