ICONFOOD'26

5TH INTERNATIONAL CONGRESS ON FOOD RESEARCHES

Food Right for Future

October 16-18, 2026
Baku, Azerbaijan
Azerbaijan Cooperation University



ABSTRACT BOOK

Editors
Prof. Dr. Özlem Pelin CAN
Prof. Dr. Fatih TÖRNÜK
Assoc. Prof. Dr. Tuğba DEMİR
Assoc. Prof. Dr. Tuğba DEDEBAŞ

ISBN: 979-8-89695-591-7

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adopted by Mariam Rasulan

ISBN: 979-8-89695-591-7

CONGRESS ID

TITLE OF CONGRESS

ICONFOOD'26
5th INTERNATIONAL CONGRESS on FOOD RESEARCHES

PARTICIPATION

Keynote & Invited

DATE - PLACE

October 16-18, 2026
Baku, Azerbaijan

ORGANIZATION

Azerbaijan Cooperation University
&
Sivas Cumhuriyet University Food Studies Application and Research Center
&
İKSAD-Institute of Economic Development and Social Researches

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Azerbaijan, Türkiye, Pakistan, Bangladesh, Romania, Egypt, Nigeria, India, Morocco, Greece, Albania, Indonesia, Hungary, Iran, North Macedonia, Serbia, Montenegro, Kazakhstan, Algeria, Germany, Croatia, Mexico, Italy, Ukraine, Afghanistan

TOTAL PAPERS: 212

The number of papers from foreign countries: **109**

The number of papers from Türkiye: **103**

LANGUAGES

Turkish, English

5. ULUSLARARASI GIDA ARAŞTIRMALARI KONGRESİ (ICONFOOD'26)

Kongre Başkanı Açılış Konuşması

Sayın Rektörüm, değerli protokol üyeleri, kıymetli akademisyenler, değerli bilim insanları, sevgili araştırmacılar ve saygıdeğer konuklarımız;

Hepinizi şahsım ve kongre düzenleme kurulumuz adına saygı, sevgi ve muhabbetle selamlıyorum.

Kardeş ülke Azerbaycan'ın güzel şehri Bakü'de, 5. Uluslararası Gıda Araştırmaları Kongresi ICONFOOD'26 vesilesiyle sizlerle bir arada bulunmaktan büyük bir mutluluk ve onur duyuyorum. Kongremize hoş geldiniz, sefalar getirdiniz.

Öncelikle kongremize ev sahipliği yapan Azerbaycan Kooperasiya Üniversitesi yönetimine, değerli Rektör Yardımcımız Prof. Dr. Anar Ataşov'a, kongremizin gerçekleştirilmesine katkı sunan bütün kurumlara, bilimsel paydaşlarımıza, düzenleme ve bilim kurullarımıza, oturum başkanlarımıza ve bildirileriyle kongremizi zenginleştiren tüm araştırmacılarımıza içtenlikle teşekkür ediyorum.

Bu kongreyi Sivas Cumhuriyet Üniversitesi Gıda Çalışmaları Uygulama ve Araştırma Merkezi öncülüğünde, değerli paydaşlarımızla birlikte gerçekleştirmenin mutluluğunu yaşıyoruz. Farklı üniversitelerden, farklı disiplinlerden ve farklı ülkelerden bilim insanlarını ortak bir amaç etrafında buluşturan bu organizasyonun, yeni bilimsel iş birliklerine ve kalıcı dostluklara vesile olmasını diliyorum.

Değerli konuklarımız,

Gıda, insan yaşamının devamı için temel bir gereksinim olmanın çok ötesinde bir anlam taşımaktadır. Gıda; sağlığın, toplumsal refahın, ekonomik kalkınmanın, kültürel mirasın ve sürdürülebilir bir geleceğin temel unsurlarından biridir.

Bugün dünya, birbirini etkileyen çok sayıda gıda sorunuyla karşı karşıyadır. İklim değişikliği, doğal kaynakların giderek artan baskı altında olması, gıda kayıpları ve israfı, gıda güvenliği riskleri, beslenme eşitsizlikleri ve güvenilir gıdaya erişimde yaşanan güçlükler, bilim dünyasının ortak sorumluluk üstlenmesini gerektirmektedir.

Bu sorunlar bize önemli bir gerçeği hatırlatmaktadır: Geleceğin gıda sistemlerini oluşturmak, yalnızca daha fazla üretmekle değil; daha güvenli, daha sağlıklı, daha verimli, daha adil ve çevresel açıdan daha sürdürülebilir üretim ve tüketim modelleri geliştirmekle mümkündür.

İşte bu nedenle gıda alanında yürütülen bilimsel araştırmaların, disiplinler arası çalışmaların ve uluslararası akademik iş birliklerinin önemi her geçen gün artmaktadır.

Kıymetli bilim insanları,

Kongremizin 16 Ekim Dünya Gıda Günü ile aynı dönemde gerçekleştirilmesi, etkinliğimize ayrıca anlam kazandırmaktadır.

FAO tarafından 2026 Dünya Gıda Günü için belirlenen *"Innovate today. Nourish tomorrow."* teması, Türkçeye **"Bugün yenilik yap, yarını besle"** şeklinde aktarılabilir.

Bu mesaj, geleceğin gıda sorunlarına çözüm üretmek için bugünden bilimsel bilgiye, yenilikçi teknolojilere ve sürdürülebilir uygulamalara yatırım yapmamız gerektiğini vurgulamaktadır.

Gıda bilimi ve teknolojisinden gıda güvenliğine, mikrobiyolojiden beslenmeye, sürdürülebilir üretim sistemlerinden yapay zekâ uygulamalarına kadar pek çok alanda gerçekleştirilen araştırmalar, geleceğin gıda sistemlerinin şekillenmesinde belirleyici olacaktır.

Ancak yenilikçilik yalnızca yeni teknolojiler geliştirmek değildir. Aynı zamanda geleneksel bilgi birikimini bilimsel yöntemlerle değerlendirmek, yerel kaynakları korumak, gıda kayıplarını azaltmak ve bilimsel bulguları toplum yararına dönüştürmektir.

Biz akademisyenlere düşen görev, yalnızca bilgi üretmek değil; ürettiğimiz bilgiyi paylaşmak, genç araştırmacıları desteklemek ve bilimin toplumsal sorunlara çözüm sunmasını sağlamaktır.

ICONFOOD'26'nın bu yönde yeni fikirlerin doğmasına, araştırmaların paylaşılmasına ve ortak projelerin geliştirilmesine katkı sağlayacağına yürekten inanıyorum.

Değerli konuklarımız,

Bugün burada yalnızca bilimsel bildirileri dinlemek ve araştırma sonuçlarını paylaşmak için bulunmuyoruz. Aynı zamanda ülkelerimiz, üniversitelerimiz ve araştırma topluluklarımız arasında yeni bağlar kurmak için bir aradayız.

Türkiye ile Azerbaycan arasındaki tarihî ve kültürel kardeşlik, bilimsel iş birliklerimiz için de güçlü bir temel oluşturmaktadır. Bu kardeşliğin üniversiteler arasında geliştirilecek ortak araştırmalarla, akademik hareketlilikle, bilgi paylaşımıyla ve genç bilim insanlarının katılımıyla daha da güçleneceğine inanıyorum.

Bakü'de gerçekleştirdiğimiz bu kongreyi, Sivas'tan Azerbaycan'a uzanan bir bilim köprüsü olarak görüyorum. Bu köprünün yalnızca iki ülke arasında değil, farklı ülkelerden araştırmacılar arasında da yeni iş birliklerine kapı açmasını diliyorum.

Çünkü bilim, paylaşıldıkça gelişir; bilgi, ortak çalışmalarla değer kazanır ve uluslararası iş birlikleriyle insanlığın ortak geleceğine katkı sunar.

Bu üç gün boyunca gerçekleştirilecek bilimsel sunumların, tartışmaların ve fikir alışverişlerinin yeni araştırmalara, ortak yayınlara, projelere ve uzun soluklu akademik dostluklara zemin hazırlamasını temenni ediyorum.

Kongremize katkı sunan, zaman ayıran, bilgi ve deneyimlerini bizlerle paylaşan tüm katılımcılarımıza bir kez daha teşekkür ediyorum.

Ev sahipliği ve destekleri için Azerbaycan Kooperasiya Üniversitesi yönetimine, kongrenin hazırlanmasında emeği geçen bütün kurul üyelerimize, paydaş kurumlarımıza ve çalışma arkadaşlarımıza; ayrıca ortaklığımız ve değerli katkıları için İKSAD Enstitüsüne şükranlarımı sunuyorum.

Sözlerimi tamamlarken, 16 Ekim Dünya Gıda Günü'nün hepimiz için daha güvenli, daha sağlıklı ve daha sürdürülebilir bir gıda geleceğine yönelik sorumluluklarımızı yeniden hatırlatmasını diliyorum.

Bilim için, gıda için, gelecek için birlikte çalışmaya devam edelim.

ICONFOOD'26'nın verimli, başarılı ve yeni iş birliklerine kapı açan bir kongre olmasını temenni ediyor; hepinizi saygı ve sevgiyle selamlıyorum.

5. Uluslararası Gıda Araştırmaları Kongresi ICONFOOD'26'nın açılışını yapmaktan büyük bir onur duyuyorum. Hepinize hoş geldiniz diyor, kongremizin başarılı geçmesini diliyorum.

Teşekkür ederim.

“Bakü’de gerçekleştirdiğimiz bu kongreyi, Sivas’tan Azerbaycan’a uzanan bir bilim köprüsü olarak görüyorum.”

Prof. Dr. Özlem Pelin CAN

PHOTO GALLERY









ABSTRACT BOOK


ONFOOD'26
RNATIONAL CONGRESS ON FOOD RESEARCHES
ICONFOOD'26
5. ULUSLARARASI GIDA ARAŞTIRMALARI KONG


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CONGRESS ON FOOD RESEARCHES
ICONFOOD'26
5. ULUSLARARASI GIDA ARAŞTIRMA




2. Understanding Cancer and Genetic Diseases
Molecules that interact with dsDNA:
• Replication (DNA multiplication) or Transcription (RNA synthesis) can affect these processes. Disruption of these processes underlies diseases such as cancer. Therefore, understanding the mechanism of these interactions is important for solving disease biology.






ICONFOOD'26
5TH INTERNATIONAL CONGRESS ON FOOD RESEARCHES
From Past to Future: Food Systems
5. ULUSLARARASI GIDA ARAŞTIRMALAR
Geçmişten Geleceğe: Gıda Sistemleri


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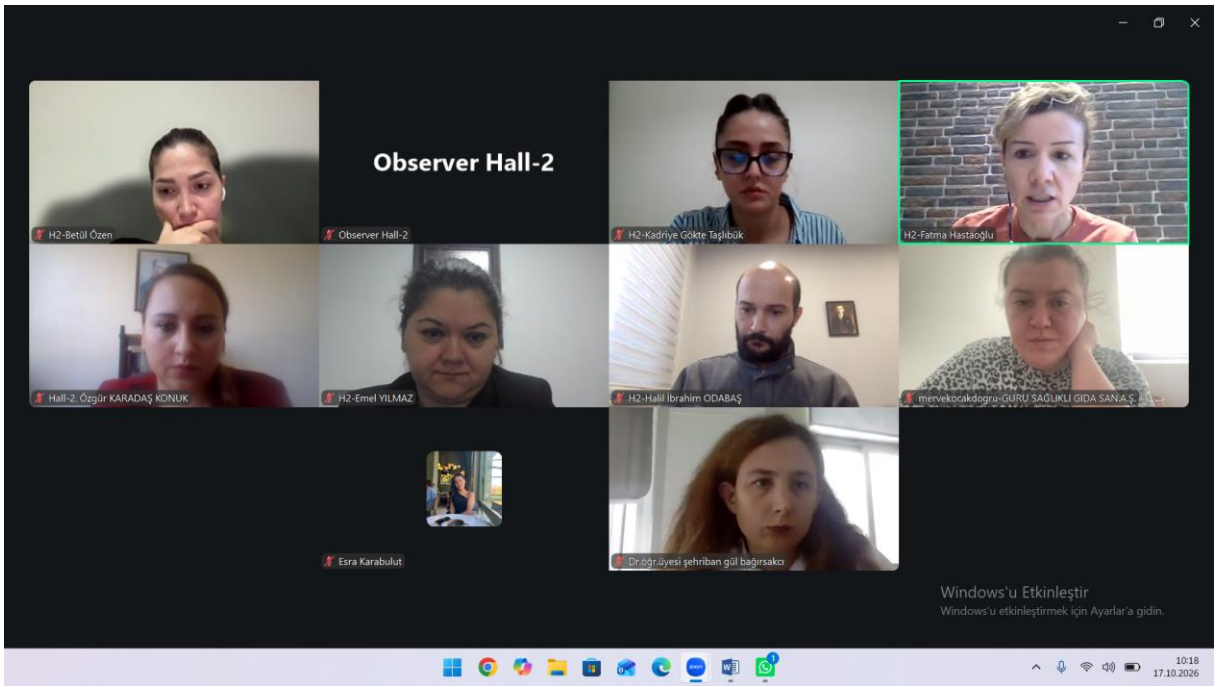
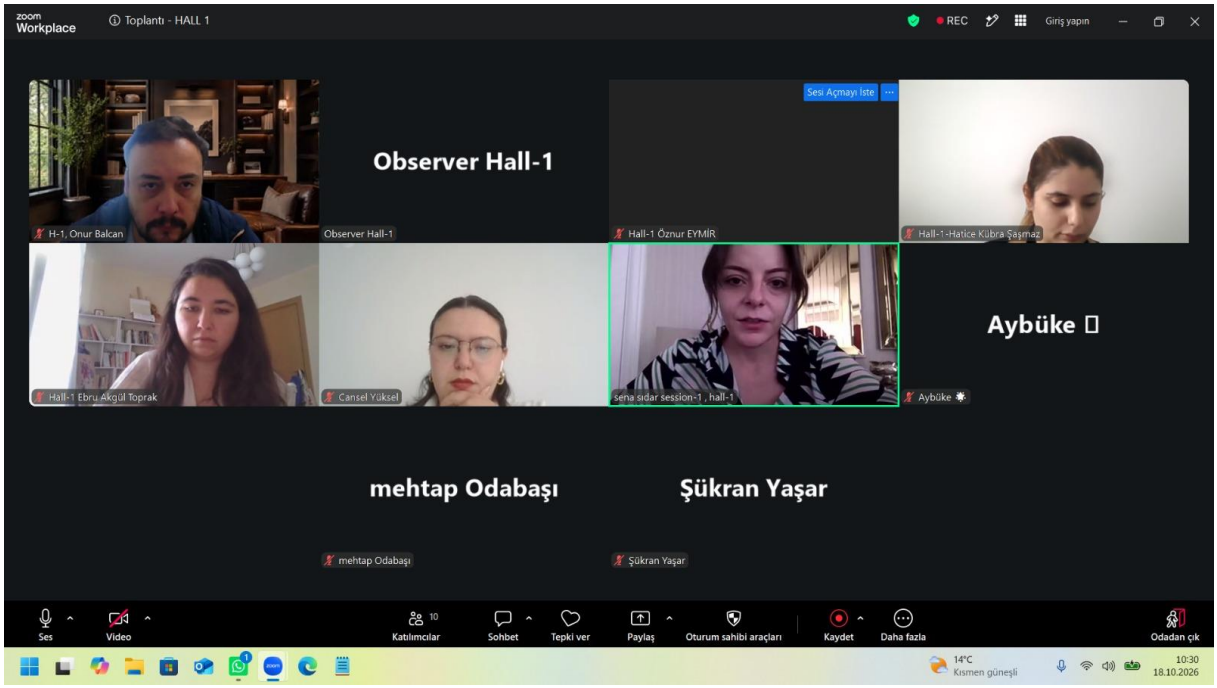
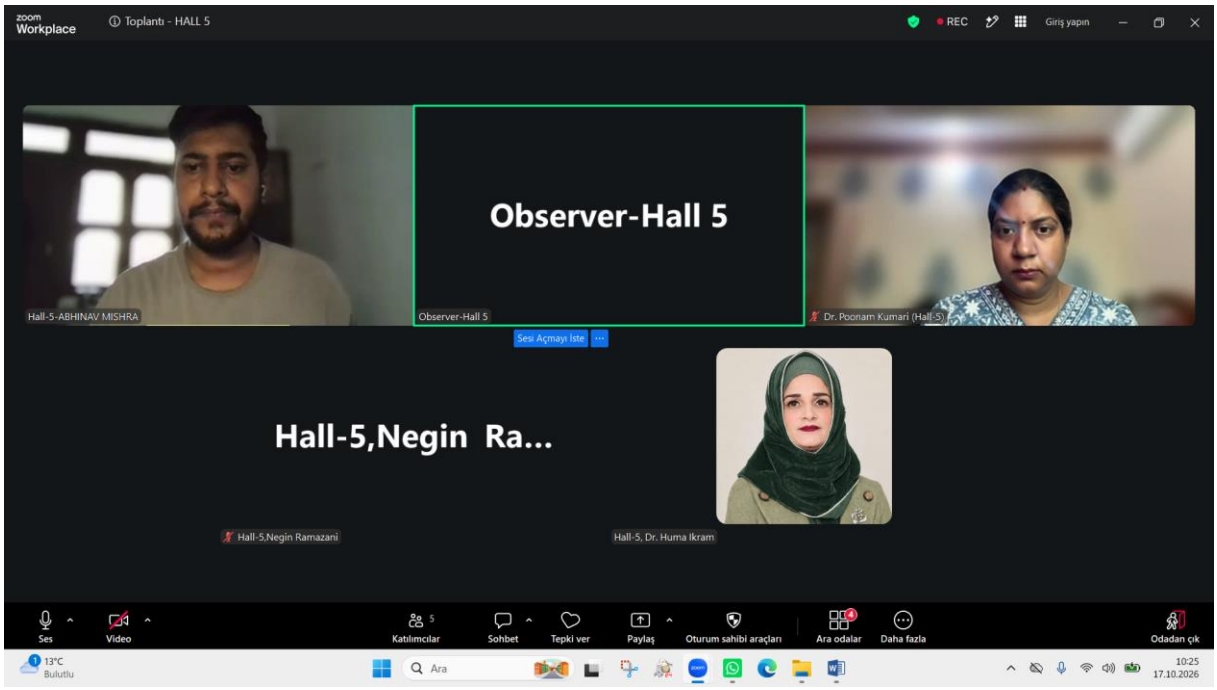
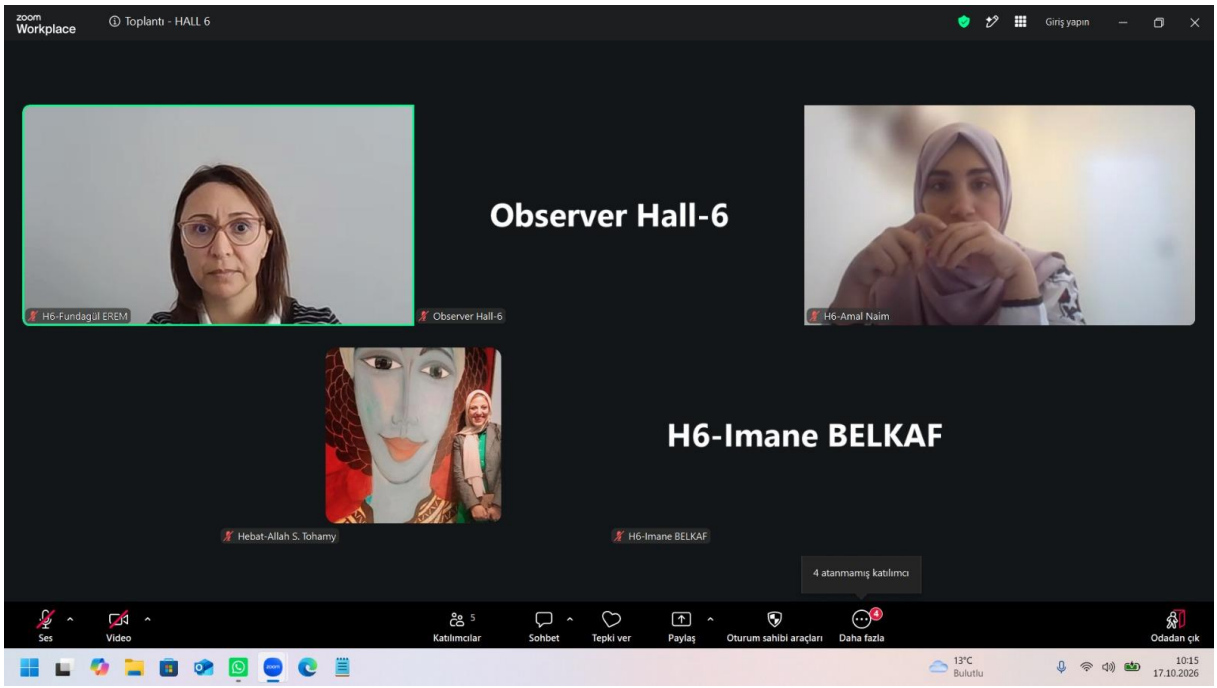


ABSTRACT BOOK

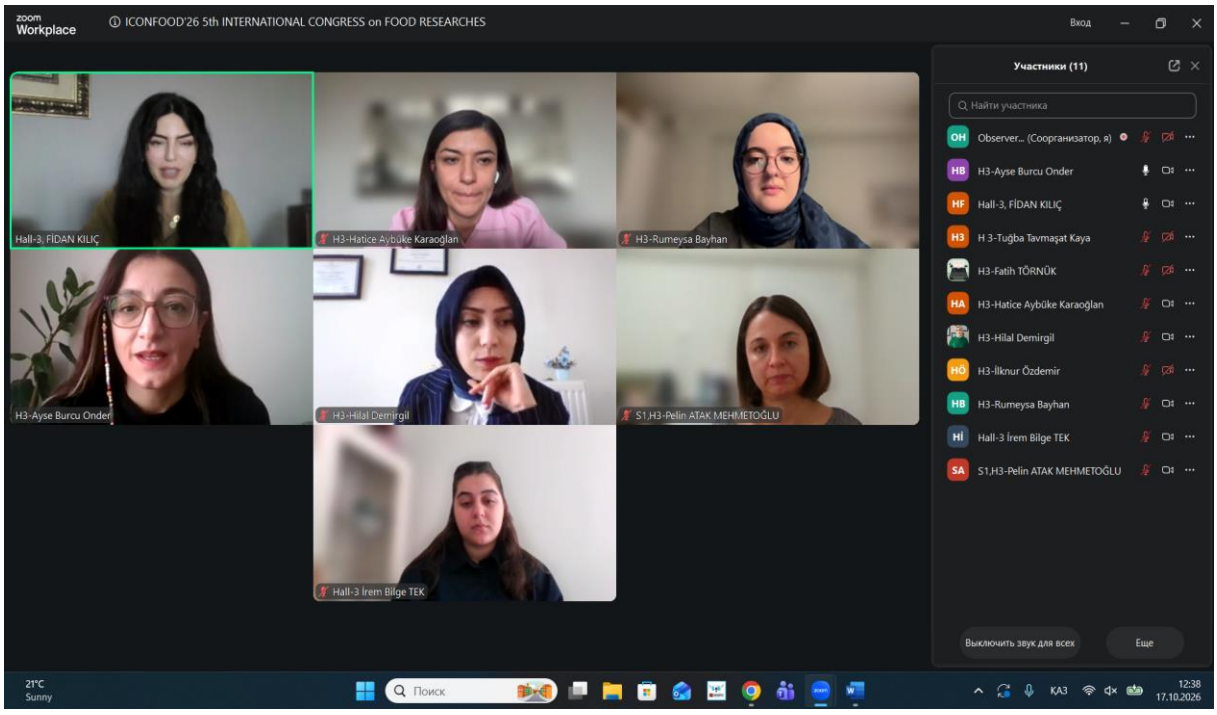

Toplantı - HALL 1
Observer Hall-1
Aybüke
mehtap Odabaşı
Şükran Yaşar


Toplantı - HALL 2
Observer hall-2


Toplantı - HALL 5
Observer-Hall 5
Hall-5-ABHINAV MISHRA
Dr. Poonam Kumari (Hall-5)
Hall-5,Negin Ra...
Hall-5,Negin Ramazani
Hall-5, Dr. Huma Ikram


Toplantı - HALL 6
Observer Hall-6
H6-Fundagül EREM
H6-Amal Naim
H6-Imane BELKAF
Hebat-Allah S. Tohamy


Toplantı - HALL 5
Hamidah
Observer-Hall 5
Observer-Hall 5
Purwati Purwati
Purwati Purwati
Katılımcılar
Sohbet
Tepki ver
Paylaş
Oturum sahibi araçları
Ara odalar
Daha fazla
Odadan çık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Вход
Участники (11)
Найти участника
Hall-3, FİDAN KILIÇ
H3-Hatice Aybüke Karaoğlan
H3-Rumeysa Bayhan
H3-Ayse Burcu Onder
H3-Hilal Demirgil
S1,H3-Pelin ATAK MEHMETOĞLU
Hall-3 İrem Bilge TEK
Выключить звук для всех
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ICONFOOD'26

5th INTERNATIONAL CONGRESS on FOOD RESEARCHES

October 16-18, 2026 / Baku, Azerbaijan

CONGRESS IN-PERSON PROGRAM

Azerbaijan Cooperation University

- Opening Ceremony-

16.10.2026 / Baku Time: 11.00-11.30

Adress: 93 Najaf Narimanov Street, Baku, Azerbaijan
Azerbaijan Cooperation University, Azerbaijan

Prof. Dr. Eldar Allahyar oğlu Quliyev
Rector of Azerbaijan Cooperative University

Prof. Dr. Bəyalı Xanalı oğlu Ataşov
Azerbaijan Cooperative University, Vice Rector for International Relations and Academic Affairs

Prof. Dr. Özlem Pelin CAN
Director of the Center for Applied Research in Food Studies, Sivas Cumhuriyet University

Dr. Elvan CAFEROV
Head of IKSAD Azerbaijan

- Keynote Speaker-

16.10.2026 / Baku Time: 11.30-12.00

Prof. Dr. Ayşegül GÖLCÜ
Istanbul Technical University
'The Future of Food Safety: Green, Intelligent and Portable Analytical Technologies for a Sustainable Food System'

IN-PERSON PRESENTATIONS (HALL-1)

Baku Local Time: 12.00-14.00

Address: Azerbaijan Cooperation University, Azerbaijan

HEAD OF SESSION: Assist. Prof. Dr. Hatice Aybüke KARAOĞLAN

AUTHOR(S)	TITLE	AFFILIATION
Uğur ŞEN Hasan ÖNDER Mustafa BOĞA	EFFECTS OF DIFFERENT FATTENING PERIODS ON CARCASS AND MEAT QUALITY TRAITS IN GERZE MALE CHICKS	Ondokuz Mayıs University, Türkiye Niğde Ömer Halisdemir University, Türkiye
Hasan ÖNDER Uğur ŞEN Mustafa BOĞA	GENDER EFFECT ON TEXTURE CHARACTERISTICS OF BREAST MEAT FOR PEKIN DUCKS	Ondokuz Mayıs University, Türkiye Niğde Ömer Halisdemir University, Türkiye
Ahmet YAKIN Halil DURAK	EXHAUST EMISSIONS OF AGRICULTURAL BIOMASS-DERIVED GAMMA-VALEROLACTONE (GVL) BLENDS AND ENVIRONMENTAL SAFETY EVALUATION IN FOOD LOGISTICS	Van Yüzüncü Yıl University, Türkiye
Özlem Pelin CAN Betül YÜCEL	INVESTIGATION OF CHEESE WHEY FERMENTATION WITH *LACTOBACILLUS CASEI* AND ITS EFFECT ON *C. ALBICANS*	Sivas Cumhuriyet University, Türkiye Sivas University of Science and Technology, Türkiye
Engin ÇAKIR Özlem ERDOĞDU Eray Rüştü TAKA	IDENTIFYING THE ELEMENTS THAT ASSOCIATE A PRODUCT WITH ITS LOCALITY: A STUDY ON NAZİLLİ DRIED EGGPLANT	Aydın Adnan Menderes University, Türkiye Nazilli Chamber of Commerce, Nazilli, Aydın, Türkiye
Ibrahim CAN	A COMBINED ASSESSMENT OF ENERGY CONSUMPTION, CARBON FOOTPRINT, AND FOOD LOSSES IN ARTIFICIAL INTELLIGENCE-BASED ELECTRIC REFRIGERATED TRUCKS	Sivas Cumhuriyet University, Türkiye
Ibrahim CAN	A COMPARISON OF SOLAR, NATURAL GAS, AND ELECTRIC ENERGY IN TERMS OF EFFICIENCY IN FRUIT AND VEGETABLE DRYING SYSTEMS: A REVIEW OF THE LITERATURE FROM THE PAST FIVE YEARS	Sivas Cumhuriyet University, Türkiye
Şövkət Abuzər qızı Yusufova	QUALITY INDICATORS OF WILD FRUITS GROWN IN AZERBAIJAN AND THEIR ROLE IN FOOD SECURITY	Azerbaijan Cooperation University, Azerbaijan
Kəmalə Haqverdiyeva Əziz	THE ROLE OF INNOVATIVE TECHNOLOGIES AND WASTE RECYCLING IN ENSURING SUSTAINABLE DEVELOPMENT IN THE FOOD INDUSTRY	Azerbaijan Cooperation University, Azerbaijan
Qədimova Natəvan Səfər qızı	ŞƏRAB ISTEHSALI TULLANTILARININ BIOLOJI POTENSIALI VƏ ONLARIN FUNKSIONAL QIDA MƏHSULLARININ ISTEHSALINDA ISTIFADƏ PERSPEKTIVLƏRI	Azerbaijan Cooperation University, Azerbaijan

IN-PERSON PRESENTATIONS (HALL-2)

Baku Local Time: 12.00-14.00

Address: Azerbaijan Cooperation University, Azerbaijan

HEAD OF SESSION: Prof. Dr. Fatih TÖRNÜK

AUTHOR(S)	TITLE	AFFILIATION
Yeliz KAYA Sena TIRAŞ Nazlı ERCAN Tevhide SEL	INVESTIGATION OF THE EFFECT OF CARDAMOM (ELETTARIA CARDAMOMUM) OIL ON CELL VIABILITY IN HT-29 AND MDA-MB-231 CANCER CELL LINES	Ankara University, Türkiye
Semanur BAYBURTLU Sena TIRAŞ Yeliz KAYA	INVESTIGATION OF THE MULLEIN PLANT (VERBASCUM SP.) IN TERMS OF ANTIOXIDANT CONTENT	Ankara University, Türkiye Sivas Cumhuriyet University, Türkiye
Kibar GÜLTEKİN KURT Özlem Pelin CAN	EFFECT OF YELLOW MUSTARD (*SINAPIS ALBA* L.) SEEDS ON THE MICROBIAL QUALITY OF CHEESE	Sivas Cumhuriyet University, Türkiye
Sena TIRAŞ Soner TUTUN Sema Nur BAYBURTLU Yeliz KAYA	THE HIDDEN TREASURE OF ANATOLIA: THE EFFECT ON PHENOLIC, FLAVONOID CONTENT, AND DPPH ANTIOXIDANT ACTIVITY OF MADIMAK (*POLYGONUM COGNATUM*) PLANT: A PRELIMINARY STUDY	Sivas Cumhuriyet University, Türkiye Ankara University, Türkiye
Sena TIRAŞ Soner TUTUN Yeliz KAYA	BIOCHEMISTRY OF POSTBIOTIC MOLECULES	Sivas Cumhuriyet University, Türkiye Ankara University, Türkiye
Ayşegül GÖLCÜ	INTERACTIONS OF BIOACTIVE POLYPHENOL MOLECULES FOUND IN PLANTS WITH DOUBLE HELIX DNA USING SPECTROSCOPIC METHODS	İstanbul Technical University, Türkiye
Vilayət Abbas oğlu Əliyev	RESEARCH ON THE BEEF MATURATION PROCESS	Azerbaijan Cooperation University, Azerbaijan
Kamil Arif oğlu İsmayılov	EMAL EDİLMİŞ BALIQ MƏHSULLARININ TƏHLÜKƏSİZLİK VƏ MİKROBİOLOJİ GÖSTƏRİCİLƏRİ	Azerbaijan Cooperation University, Azerbaijan
Sevda Adıgözəlova	QİDA SƏNAYESİNDƏ YARANAN QABLAŞDIRMA TULLANTILARININ ƏTRAF MÜHİTƏ MƏNFİ TƏSİRİ	Azerbaijan Cooperation University, Azerbaijan
Rauf Əsədullayev	YARPAQ SEYRƏLDİLMƏSİNİN ÜZÜM SALXIMININ BƏZİ GÖSTƏRİCİLƏRİNƏ TƏSİRİ	Azerbaijan Cooperation University, Azerbaijan
A.M. Labazanova L.Ü. Həsənova	ARPA SORT NÜMUNƏLƏRİNDƏ DƏNİN KEYFİYYƏT GÖSTƏRİCİLƏRİNİN QİYMƏTLƏNDİRİLMƏSİ	Əkinçilik Elmi-Tədqiqat İnstitutu, Bakı ş. AZ 1098, Sovxoz № 2
İmanova Könül Fikrət qızı	ÇƏHRAYI ŞƏRABLARIN SAXLANMA ŞƏRAİTİNİN FİZİKİ-KİMYƏVİ VƏ ORQANOLEPTİKİ GÖSTƏRİCİLƏRƏ TƏSİRİ	Azerbaijan Cooperation University, Azerbaijan

ICONFOOD'26

5th INTERNATIONAL CONGRESS on FOOD RESEARCHES

October 16-18, 2026

CONGRESS ONLINE PROGRAM

Azerbaijan Cooperation University, Azerbaijan

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Meeting ID: 884 2447 8604

Passcode: 161718

- Invited Speakers-

17.10.2026 / Baku Time: 10.00-10.30 / AnkaraTime: 09.00-09.30

Prof. Dr. Behiç Mert
Middle East Technical University
'Beyond Puree: Reshaped and Sensorially Enhanced Foods for Individuals with Dysphagia'

17.10.2026 / Baku Time: 10.30-11.00 / AnkaraTime: 09.30-10.00

Prof. Dr. Nevzat Konar
Ankara University
'Shelf Life and Stability Behavior in Food Technology'

Session-1, Hall-1
17.10.2026
Moderator: Assoc. Prof. Dr. Tuğba DEMİR
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Betül KARAPINAR Tuğba DEMİR	POLYCHLORINATED BIPHENYL (PCB) CONTAMINATION IN ANIMAL-ORIGIN FOODS: CURRENT STATUS AND ASSESSMENT OF CONSUMER EXPOSURE	Sivas Cumhuriyet University, Türkiye
Umar Murad Khan Hatice Sadiye Gezgin Khan Ahmet GÜNER	SHEWANELLA PUTREFACIENS AND ITS IMPORTANCE IN FOOD MICROBIOLOGY	Selçuk University, Türkiye
Neslihan ARSLAN	THE EVOLUTION OF FOOD ADDITIVES: FROM TRADITIONAL PRESERVATION PRACTICES TO BIOPROTECTION AND THE CLEAN LABEL APPROACH	Sivas Cumhuriyet University, Türkiye
Neslihan ARSLAN	MICROBIOLOGICAL SAFETY IN PLANT-BASED ALTERNATIVES: PATHOGEN DYNAMICS AND CONTROL STRATEGIES	Sivas Cumhuriyet University, Türkiye
Neşe KEKLİKCİOĞLU ÇAKMAK Tuğba DEMİR	ENGINEERING NANO/MICRO-ENCAPSULATED ENZYMES FOR FOOD PROCESSING: FROM MOLECULAR PROTECTION TO INTELLIGENT BIOCATALYST DELIVERY	Sivas Cumhuriyet University, Türkiye
Neşe KEKLİKCİOĞLU ÇAKMAK Tuğba DEMİR	MICRO AND NANOPLASTICS IN FOOD: DETECTION, PHOTOCATALYTIC MITIGATION, AND HEALTH RISKS	Sivas Cumhuriyet University, Türkiye
Zeynep DEMİR Tuğba DEMİR	NEXT-GENERATION ANALYTICAL METHODS FOR FOODS OF ANIMAL ORIGIN	Sivas Cumhuriyet University, Türkiye

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Session-1, Hall-2
17.10.2026
Moderator: Assoc. Prof. Dr. Fatma HASTAOĞLU
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Kübra Feyza EROL Gözde KUTLU Fatih TÖRNÜK	EFFECTS OF HIGH-INTENSITY ULTRASOUND ON THE PHENOLIC CONTENT, ANTIOXIDANT ACTIVITY, AND AMINO ACID PROFILE OF PUMPKIN SEED PROTEIN ISOLATE	University of Health Sciences, Türkiye Ankara Medipol University, Türkiye Sivas Cumhuriyet University, Türkiye
Kadriye Gökte TAŞLIBÜK Fatih TÖRNÜK	FUTURE PROTEIN SOURCES: EDIBLE INSECTS AND ALGAE-BASED INGREDIENTS	Sivas Cumhuriyet University, Türkiye
Esra KARABULUT Halil İbrahim ODABAŞ İlyas ATALAR	TECHNO-FUNCTIONAL PROPERTIES OF PEA PROTEIN-GUM ARABIC CONJUGATES PREPARED BY OHMIC HEATING-ASSISTED GLYCATION	Eskişehir Osmangazi University, Türkiye
Fatma Gul AKYOL Sehriban Gul BAGIRSAKCI	EVALUATION of THE SENSORY CHARACTERISTICS of ASHURA MODERNIZED with FOREST FRUITS PUREE	Antalya Belek University, Türkiye
Betül ÖZEN İlyas ATALAR Asena TÜRK Esra KARABULUT Nevzat KONAR M. İrfan AKSU Ömer Said TOKER Ceren ELMACI	ULTRASOUND-ASSISTED PRE-CRYSTALLIZATION AS AN ALTERNATIVE TEMPERING METHOD FOR MILK CHOCOLATE	Eskisehır Osmangazi University, Türkiye Ankara University, Türkiye Ataturk University, Türkiye Yıldız Technical University, Türkiye Eti Food R&D Center, Eskişehir, Turkey
Emel YILMAZ	TIME-DEPENDENT RECOVERY OF BIOACTIVE COMPOUNDS FROM GRAPE POMACE: EFFECTS OF EXTRACTION METHOD	Trakya University, Türkiye
Özgür KARADAŞ KONUK Berkay KOPUK Başak Ebru ÖZCAN Harun URAN Hatice ŞANLIDERE ALOĞLU Raşit BAKAN	COMPREHENSIVE CHARACTERIZATION OF KIRKLARELI MEATBALLS: EVALUATION OF CHEMICAL, TEXTURAL, AROMA, STRUCTURAL, AND SENSORY PROPERTIES	Kırklareli University, Türkiye

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Session-1, Hall-3
17.10.2026
Moderator: Assoc. Prof. Dr. Ayşe Burcu ÖNDER
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
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Author(s)	Title	Affiliation
Özlem Pelin CAN Fidan KILIÇ	DETERMINATION OF THE ANTIMICROBIAL EFFECTS OF DIFFERENT POSTBIOTICS ON *CANDIDA ALBICANS* USING THE DISK DIFFUSION METHOD	Sivas Cumhuriyet University, Türkiye
Özlem Pelin CAN	SUSTAINABLE FOOD SUPPLY CHAINS AND FOOD SAFETY	Sivas Cumhuriyet University, Türkiye
Rumeysa BAYHAN Büşra YUSUFOĞLU Rukiye GÜNDOĞAN	WHEATGRASS PROTEIN–*ARONIA MELANOCARPA* JUICE COMPLEXES: STRUCTURAL CHARACTERIZATION, MOLECULAR DOCKING, AND ENHANCED BIOACCESSIBILITY	İstanbul Technical University, Türkiye
Pelin ATAK MEHMETOĞLU Ayşe Burcu ÖNDER	OLIVE OIL, BIOACTIVE COMPONENTS OF OLIVE OIL AND ITS EFFECTS ON HEALTH	Sivas Cumhuriyet University, Türkiye
Hilal Demirgil Zeynep Mine Şenol	NUTRITIONAL EVALUATION OF *CHLORELLA VULGARIS* MICROALGAE AS A FOOD SUBSTITUTE	Sivas Cumhuriyet University, Türkiye
İrem Bilge TEK Hatice Aybüke KARAOĞLAN	INTEGRATION OF FUNCTIONAL FOODS INTO MASS CATERING SYSTEMS	Sivas Cumhuriyet University, Türkiye
Kibar GÜLTEKİN KURT İrem Bilge TEK Kübra Feyza EROL Hatice Aybüke KARAOĞLAN Gözde KUTLU Fatih TÖRNÜK	DETERMINATION OF THE EFFECTS OF PELEMIR EXTRACT ADDITION ON THE PHYSICOCHEMICAL PROPERTIES AND IN VITRO STARCH DIGESTION KINETICS	Sivas Cumhuriyet University, Türkiye University of Health Sciences, Türkiye Ankara Medipol University, Türkiye

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Session-1, Hall-4
17.10.2026
Moderator: Monika Stojanova
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
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Author(s)	Title	Affiliation
Muhammad Salman Sadid Shahriyar Methila Farjana Md Tazwar Rahman Ashir Humaira Shabbir Sadaf Saeed Ullah	INTERACTIVE EFFECT OF WATER POTENTIAL AND TEMPERATURE ON GERMATION AND AGRONOMIC PARAMETERES OF TRITICIUM AESTIVUM L.	Abdul Wali Khan University Mardan, Pakistan Sher-e-Bangla Agricultural University, Bangladesh Govt. Edward college, Bangladesh University of Kotli AJK Government College University ,Lahore
Onwubiko Emmanuel Chidiadi	A SYSTEMATIC REVIEW OF LITERATURE ON THE EFFECT OF AGROCHEMICALS ON CROP YIELDS, SOIL AND HUMAN HEALTH	Michael Okpara Federal University of Agriculture, Umudike, Nigeria
Marina S.T. Stojanova Dragutin A. Djukic Monika Stojanova Milos Rabrenovic	FOLIAR APPLICATION OF NANOFERTILIZERS IN AGRICULTURAL CROPS: UPTAKE MECHANISMS, EFFICIENCY, AND FACTORS AFFECTING ABSORPTION	University of Ss. Cyril and Methodius, Faculty of Agricultural Sciences and Food, Skopje, North Macedonia University of Kragujevac, Faculty of Agronomy, Čačak, Serbia Mother Teresa University, Faculty of Technological Sciences, Skopje, North Macedonia Montenegro Dance Sport Federation, Podgorica, Montenegro
Monika Stojanova Sani Demiri Olga Popovska Arita Sabriu Haxhijaha	PLANT-BASED BIOACTIVE EXTRACTS FROM FOOD BY-PRODUCTS: OPPORTUNITIES FOR CIRCULAR ECONOMY AND SUSTAINABLE FOOD PRODUCTION	Mother Teresa University, Faculty of Technological Sciences, Skopje, North Macedonia
K Boudjema R Laoufi I Amerane F Boughelaf	PHYTOCHEMICAL SCREENING AND EVALUATION OF ANTIOXYDANT AND ANTIBACTERIAL ACTIVITIES OF ESSENTIAL OILS OBTAINED FROM ORIGANUM VULGARE L. HARVESTED IN ALGERIA	University M'hamed Bougara of Boumerdès (UMBB) in Algeria University of M'Hamed, Boumerdes
Tayyaba Shaheen Muhammad Qamar Ashfaq Anjuman Arif	ASSESSING SUPERIOR AGRONOMIC TRAITS IN LOCAL WHEAT GERMPLASM USING FUNCTIONAL MARKERS	Government College University Faisalabad, Pakistan Nuclear Institute for Agriculture and Biology, Pakistan
Meknassia DEBBAL Tarık Mohammed CHAOUCHE Farah HADDOUCHI	FROM AGRO-INDUSTRIAL RESIDUES TO NEXT-GENERATION FOOD TECHNOLOGIES: A CRITICAL REVIEW ON EMERGING NANOTECHNOLOGICAL, BIOMOLECULAR, AND ADVANCED STRUCTURING PARADIGMS FOR DATE PALM (PHOENIX DACTYLIFERA L.) SEED BIOMASS	Abou-Bekr Belkaïd University, Algeria
Prof. Gabrijel ONDRASEK Asst. Prof. Jelena HORVATINEC ISAKOVIĆ Asst. Prof. Ema Kostešić	BIOASH AS A CIRCULAR AMENDMENT FOR METAL-CONTAMINATED SOILS: TRADE-OFFS BETWEEN METAL IMMOBILIZATION AND RHIZOSPHERE MICROBIOME FOOTPRINT	University of Zagreb, Croatia

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Session-1, Hall-5

17.10.2026
Moderator: Major Gheorghe GIURGIU
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
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Author(s)	Title	Affiliation
Major Gheorghe GIURGIU Prof. dr. Manole COJOCARU	THE ASSOCIATION BETWEEN THE CUTANEOUS MICROBIOME AND HIDRADENITIS SUPPURATIVA	Deniplant-Aide Sante Medical Center, Romania Titu Maiorescu University, Romania
Tasawar Iqbal Sidra Altaf	OIL AND WATER EMULSIONS FOR POSTHARVEST PRESERVATION AND QUALITY MAINTENANCE OF FRUITS	University of Agriculture, Faisalabad, Pakistan
Neha Berma Abhinav Mishra Dr. Poonam Kumari	VETERINARY GOVERNANCE AT THE HUMAN-ANIMAL HEALTH INTERFACE: A ONE HEALTH APPROACH TO GLOBAL HEALTH SECURITY	Central University of South Bihar, Gaya Jee, India. Advocate, Allahabad High Court, India
Msc. Hermis MELE Dr. Marcela MELE	SUSTAINABLE UNDERGROUND AGROTOURISM DEVELOPMENT THROUGH PERMACULTURE PRINCIPLES: A CASE STUDY KORÇA REGION, ALBANIA	Agricultural University of Tirana, Albania University Aleksandër Moisiu of Durrës, Albania
Huma Ikram Rumaisa Zakir Darakhshan J. Haleem	NEUROPROTECTIVE EFFECTS OF GREEN TEA EXTRACT ON AGE-RELATED COGNITIVE DECLINE IN A RAT MODEL	University of Karachi, Karachi-75270, Pakistan
Andrea Lehoczki Diána Görög Vince Fazekas-Pongor Mónika Fekete	FOOD-DERIVED BIOACTIVE COMPOUNDS AND BRAIN AGING: THE ROLE OF OMEGA-3 FATTY ACIDS, POLYPHENOLS, AND THE MEDITERRANEAN DIET	Budapest University of Economics and Business, Hungary Semmelweis University, Hungary
Dr. Asma Kheirollahi Dr. Akram Vatannejad Dr. Maryam Shabani Nashtaei	EGG AND DIETARY CHOLESTEROL INTAKE AND SEMEN QUALITY AMONG IRANIAN MEN UNDERGOING INFERTILITY EVALUATION	University of Tehran, Tehran, Iran Tehran University of Medical Sciences, Tehran, Iran
Dr. Akram Vatannejad Dr. Maryam Shabani Nashtaei Dr. Asma Kheirollahi	LOW-FAT DIETARY PATTERN IS ASSOCIATED WITH LOWER ODDS OF ABNORMAL SEMEN QUALITY AMONG IRANIAN MEN UNDERGOING INFERTILITY EVALUATION	University of Tehran, Tehran, Iran Tehran University of Medical Sciences, Tehran, Iran

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Session-1, Hall-6
17.10.2026
Moderator: Umar Baba Shaaba
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
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Author(s)	Title	Affiliation
Hebat-Allah S. Tohamy	POMEGRANATE-DERIVEDPHOSPHORUS,NITROGEN-DOPED CARBON NANOFLOWER/NANOFIBER HYBRIDS AND QUASI SPHERICAL DOT STABILIZED PICKERING EMULSIONS WITH LOW-DS AMPHIPHILIC CMC FOR DUAL-MODE DETECTION OF PATHOGENIC BACTERIA AND THEIR METABOLIC pH SIGNATURES	Cellulose and Paper Department, Egypt
Umar Baba Shaaba	BOOKKEEPING PRACTICES AND FINANCIAL SUSTAINABILITY AMONG SMALLHOLDER AGRICULTURAL AND FOOD PROCESSING ENTERPRISES IN NORTH CENTRAL NIGERIA	Ahman Pategi University, Patigi, Kwara State, Nigeria
Umar Baba Shaaba	DIGITAL TAX ADMINISTRATION AND COMPLIANCE BEHAVIOR IN THE AGRICULTURAL AND FOOD SUPPLY CHAIN SECTOR: EVIDENCE FROM NIGERIA	Ahman Pategi University, Patigi, Kwara State, Nigeria
Amal NAIM Fundagül EREM	THE HIDDEN SIDE OF THE GLUTEN-FREE DIET TREND: INCREASED GLYCEMIC INDEX, CROSS-CONTAMINATION RISKS, AND NUTRITIONAL INADEQUACIES	Zonguldak Bülent Ecevit University, Türkiye
Imane BELKAF Mustapha HASNAOUI	INDIGENOUS PRACTICES FOR AGRICULTURAL WATER MANAGEMENT IN ARID AND SEMI-ARID REGIONS	Sultan Moulay Slimane University, Morocco
Amany, M. Basuny Hossam E. F. Abdel-Rahea Maha, A. Zayed	EVALUATE THE ANTIOXIDANT AND ANTIMICROBIAL EFFECT OF MARJORAM, PURSLANE AND SOWTHISTLE LEAVES TO BE USED AS NATURAL PRESERVATIVE IN MEAT PRODUCT	Beni –Suef University, Egypt
Loubna Jrhaider Hassan Mabrak El mostafa Tace Youssef Naimi	SYNERGISTIC ANTIOXIDANT AND ANTIMICROBIAL EFFICACY OF BOTANICAL EXTRACTS AS NATURAL ALTERNATIVES TO SYNTHETIC PRESERVATIVES IN FUNCTIONAL FOOD MATRICES	Hassan II University of Casablanca, Morocco
M Annish Shabiya S. Hemalatha Ranjani S	GREEN-SYNTHESIZED TRIDECA-HERBAL SILVER NANOFORMULATIONS AS ANTIMICROBIAL AGENTS TO COMBAT POLYMICROBIAL DENTAL PATHOGENS	B. S. Abdur Rahman Crescent Institute of Science and Technology, Vandalur, Chennai, Tamil Nadu, India

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Session-2, Hall-1
17.10.2026
Moderator: Assoc. Prof. Dr. Handan GÜLER
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 13:30 – 15:30
Ankara Local Time: 12:30 – 14:30

Author(s)	Title	Affiliation
Aybüke ÇITAK Fatma MERT BİBEROĞLU	ARE PACKAGED FOODS MARKETED WITH SPECIAL ATTRIBUTES HEALTHIER? A COMPARATIVE EVALUATION BASED ON NUTRIENT PROFILE AND NUTRI-SCORE	Bahçeşehir University, Türkiye
Bilge ÖZDEMİR	SAFE NUTRITION OF CHILDREN WITH CELIAC DISEASE IN SCHOOL CANTEENS AND CAFETERIAS: CROSS-CONTAMINATION RISK, CURRENT REGULATIONS AND THE ROLE OF NURSING	Istanbul Gedik University, Türkiye
Ağayeva Tamilla Hüseyn qızı	IMPROVING EATING BEHAVIOR IN CHILDREN WITH AUTISM	Azerbaijan State Pegagogy University, Türkiye
Şimşek ÇELİK Pelin ÇELİK	EMERGENCY DEPARTMENT APPROACH TO FOODBORNE POISONING: FROM TOXIDROMES TO CRITICAL PATIENT MANAGEMENT	Sivas Cumhuriyet University, Türkiye
Şimşek ÇELİK Pelin ÇELİK	EMERGENCY DEPARTMENT APPROACH TO FOODBORNE INFECTIONS: RISK STRATIFICATION, EARLY RECOGNITION OF COMPLICATIONS, AND RATIONAL ANTIMICROBIAL THERAPY	Sivas Cumhuriyet University, Türkiye

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Session-2, Hall-2
17.10.2026
Moderator: Assoc. Prof. Dr. Tuğba DEDEBAŞ
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 13:30 – 15:30
Ankara Local Time: 12:30 – 14:30

Author(s)	Title	Affiliation
Soner TUTUN Tuğba DEMİR	LEAD AND CADMIUM LEVELS IN COMMERCIAL HONEY PRODUCTS MARKETED IN TÜRKİYE: A MULTI-BRAND ICP-MS STUDY	Sivas Cumhuriyet University, Türkiye
Merve KOÇAK DOĞRU Fatih BOZKURT	HYDROGEL PRODUCTION AND CHARACTERIZATION USING PROTEIN HYDROLYSATES FROM DIFFERENT SOURCES AND CONCENTRATIONS	Yıldız Technical University, Türkiye
Müge HENDEK Seda ÖZGEN	INCORPORATION OF ENCAPSULATED HONEY-BASED PROPOLIS EXTRACT INTO DIFFERENT FOOD MODELS: SENSORY CHARACTERISTICS AND ANTIOXIDANT ACTIVITY	Kastamonu University, Türkiye Çankırı Karatekin University, Türkiye
Eyyüp ALTEN Seda Dicle Korkmaz Özlem KÜPLÜLÜ	CHITOSAN-BASED ACTIVE AND INTELLIGENT PACKAGING SYSTEMS: FILM AND COATING APPLICATIONS	Ankara University, Türkiye Giresun University, Türkiye
Seda Dicle Korkmaz Elif Tuğçe AKSUN TÜMERKAN Eyyüp ALTEN Özlem KÜPLÜLÜ	AN ASSESSMENT OF MICROPLASTIC CONTAMINATION IN PLASTIC-PACKAGED DRINKING WATER	Giresun University, Türkiye Ankara Yıldırım Beyazıt University, Türkiye Ankara University, Türkiye
Adıgözəlova Sevda Həsən qızı Adıgözəlov Məcid Bilal oğlu	FUNCTIONAL PROPERTIES OF SPECIES OF THE FOREGROUND SECTION USED AS VEGETABLES	"Vegetable Growing Scientific Research Institute", Azerbaijan

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Session-2, Hall-3
17.10.2026
Moderator: Assoc. Prof. Dr. Emre HASTAOĞLU
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 13:30 – 15:30
Ankara Local Time: 12:30 – 14:30

Author(s)	Title	Affiliation
Emre HASTAOĞLU	THE GASTRONOMIC DIVERSITY OF TRADITIONAL SNACKS IN EUROPE: A COMPARATIVE REVIEW OF SELECTED COUNTRIES	Sivas Cumhuriyet University, Türkiye
Emre HASTAOĞLU	THE NATIONAL AND INTERNATIONAL SIGNIFICANCE OF GEOGRAPHICAL INDICATIONS FOR FOOD PRODUCTS: A COMPARATIVE REVIEW OF REGISTRATION SYSTEMS IN THE EUROPEAN UNION AND SELECTED CANDIDATE COUNTRIES	Sivas Cumhuriyet University, Türkiye
Barış ŞEN Buse ACAR Merve TEZCAN Özlem GÜNCAN	DIGITAL TRANSFORMATION IN RESTAURANTS AND SMART RESTAURANTS: A SYSTEMATIC LITERATURE REVIEW	Bilecik Şeyh Edebali University, Türkiye Burdur Mehmet Akif Ersoy University, Türkiye
Kerem İLASLAN Nazlı Gülse TASLI	CONSUMER ACCEPTANCE OF GLUTEN-FREE COOKIES PRODUCED BY 3D FOOD PRINTING AND CONVENTIONAL SHAPING	Bahçeşehir University, Türkiye
Fulya Harp Çelik	SUSTAINABILITY PARADIGMS IN TABLE OLIVE PACKAGING SYSTEMS: LIFE CYCLE ANALYSIS OF TRADITIONAL PACKAGING AND THE FUTURE OF BIODEGRADABLE ALTERNATIVES	Hasan Kalyoncu University, Türkiye
Sinan AKBAL	POSTBIOTICS PRODUCED BY YEASTS: FUNCTIONAL PROPERTIES AND FOOD APPLICATIONS	Pamukkale University, Türkiye
Sinan AKBAL	USE OF FAT REPLACERS IN LOW-FAT ICE CREAM PRODUCTION	Pamukkale University, Türkiye

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Session-2, Hall-4
17.10.2026
Moderator: Dr. Sándor FÖLDVÁRI
Meeting ID: 884 2447 8604/ Passcode: 161718
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Ankara Local Time: 12:30 – 14:30

Author(s)	Title	Affiliation
Blerina Xhaferaj Anila Kopali Kapllan Sulaj Maria Irakli Ekaterini Grigoriadou Aurel Nuro	HARVEST-PERIOD VARIATION IN THE PHENOLIC PROFILE AND ANTIOXIDANT CAPACITY OF SUPERCRITICAL CO_2 EXTRACTS OF CULTIVATED ROSMARINUS OFFICINALIS L. FROM ALBANIA	University of Medicine, Tirana, Albania Agricultural University of Tirana, Albania Institute of Plant Breeding & Genetic Resources, Greece
Rhessa Maulida Indah Naela Zulfa Nabilati Naela Makhasin Himmatul Aliyah Mahya Akmelia	PACKAGING INNOVATION FOR PEMALANG HERITAGE CULINARY PRODUCTS	Islamic State University of K.H. Abdurrahman Wahid Pekalongan, Indonesia
Mahya Akmelia Indah Naela Zulfa Nabilati Naela Makhasin Rhessa Maulida Himmatul Aliyah	COASTAL CULINARY HERITAGE OF THE PANTURA REGION: CULTURAL IDENTITY, ECONOMIC POTENTIAL, AND PRESERVATION CHALLENGES	Islamic State University of K.H. Abdurrahman Wahid Pekalongan, Indonesia
Indah Naela Zulfa Nabilati Naela Makhasin Rhessa Maulida Himmatul Aliyah Mahya Akmelia	CULINARY TOURISM VILLAGES AS A STRATEGY FOR LOCAL TOURISM AND CREATIVE ECONOMIC DEVELOPMENT IN PEMALANG REGENCY	Islamic State University of K.H. Abdurrahman Wahid Pekalongan, Indonesia
Muhammad Hidayatullah Ghathfaan Alhamda Rahman M.Abdul Latif Tabik Asghar Ramadhani Muhammad Haikal Adzimil Anam	UMKM IN THE HALAL FOOD INDUSTRIAL AREA OF PEMALANG	Islamic State University of K.H. Abdurrahman Wahid Pekalongan, Indonesia
Mustafa Nijat Nasrullah Amini Mehdi Rezai Sara Safdari Ali Sina Mohammadi Shah Wali Rezaie Sayed Ali Reza Balkhi Nesar Hussain Mohammadi	FOOD SECURITY AND INTERNATIONAL COOPERATION: BUILDING RESILIENT AGRICULTURAL SYSTEMS IN A CHANGING WORLD	Ghazi Amanullah Boys, Afghanistan
Ibrahim Umar Ahmed Yusuf Mundi Mamman Rashidu Idris Mohammed Jika Ahmed Saidu Avuya	TRANSFORMING FOOD AND AGRICULTURAL SYSTEMS FOR SUSTAINABLE DEVELOPMENT IN AFRICA: INNOVATION, CLIMATE RESILIENCE, FOOD SECURITY AND EMERGING OPPORTUNITIES	Umaru Sanda Ahmadu College of Education, Nigeria College of Education, Nigeria
Dr. Sándor FÖLDVÁRI	TURKISH GASTRONOMY HERITAGE IN HUNGARY: STUFFED VEGETABLES, RICE DISHES, SWEETS OF TURKISH ORIGIN AND TURKISH SPICES: PEPPER, PARSLEY, CUMIN, ANISE	Debrecen University, Hungary

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Session-2, Hall-5

17.10.2026
Moderator: Dr. Aasia Akbar Panhwar
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 13:30 – 15:30
Ankara Local Time: 12:30 – 14:30

Author(s)	Title	Affiliation
Negin Ramazani Damla Arslan-Acaröz Ulas Acaroz	MOLECULAR AND IMMUNOLOGICAL APPROACHES FOR DETECTING FOODBORNE PARASITES IN MEAT AND ANIMAL-DERIVED PRODUCTS: A REVIEW	General Directorate of Veterinary Medicine of West Azerbaijan Province, Khoy County, Iran. Islamic Azad University, Iran. ACR Bio Food and Biochemistry Research and Development, Turkey Afyon Kocatepe University, Turkey
Negin Ramazani	DETECTION OF HONEY BEE PARASITES AND THEIR DNA TRACES IN HONEY AND HIVE PRODUCTS: MOLECULAR METHODS FOR COLONY HEALTH SURVEILLANCE AND FOOD SAFETY ASSURANCE	General Directorate of Veterinary Medicine of West Azerbaijan Province, Khoy County, Iran. Islamic Azad University, Iran
Parkash MEGHWAR Saghir Ahmed SHEIKH Aasia Akbar PANHWAR Tuğba DEMİR	ELECTROLYZED WATER AS AN EMERGING SUSTAINABLE TECHNOLOGY FOR FOOD PROCESSING, SAFETY, AND QUALITY PRESERVATION	Hamdard University, Department of Applied Sciences, Karachi, Pakistan Sindh Agriculture University, Institute of Food Sciences and Technology, Tandojam, Pakistan Sivas Cumhuriyet University, Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, Sivas, Türkiye
Parkash MEGHWAR Tuğba DEMİR	VALORIZATION OF AGRO-INDUSTRIAL BY-PRODUCTS INTO VALUE-ADDED FUNCTIONAL FOOD FORMULATIONS: OVERCOMING TECHNOLOGICAL BARRIERS AND MICRONUTRIENT DEFICITS	Hamdard University, Department of Applied Sciences, Karachi, Pakistan Sivas Cumhuriyet University, Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, Sivas, Türkiye
Saimon islam Jihad Islam Chowdhury	RETHINKING AGRICULTURAL SUSTAINABILITY THROUGH THE WATER–ENERGY–FOOD NEXUS: A REVIEW OF TECHNOLOGIES, MODELS, AND POLICY PATHWAYS	University of Rajshahi,Rajshahi-6205, Bangladesh
U.H. Muhammad B. Abdullahi I. I. Ahmad	LEVERAGING DIGITAL AGRICULTURAL EXTENSION SERVICES TO STRENGTHEN HOUSEHOLD FOOD SECURITY AMONG SMALLHOLDER FARMERS IN NORTH CENTRAL NIGERIA	Federal University of Technology, Minna, Nigeria
Barizomdu Tina PII Christiana Chinenye Aniobi Ajibulu Kehinde Ezekiel Abimbola Deola Olanipekun Mobolaji Omiye Aduloju Moridiyah Jadesola Sheu Oyebade Adewale Tosin	EFFECT OF PRESERVATION METHODS ON THE NUTRITIONAL STABILITY OF ZOBO (HIBISCUS SABDARIFFA) BEVERAGE DURING STORAGE	Bamidele Olumilua University of Education Science and Technology, Nigeria

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Session-2, Hall-6
17.10.2026
Moderator: Dr. Iram Liaqat
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 13:30 – 15:30
Ankara Local Time: 12:30 – 14:30

Author(s)	Title	Affiliation
Iram Liaqat	INHIBITORY EFFICACY OF HONEY AGAINST MULTISPECIES BACTERIAL BIOFILM	Government College University, Lahore
Iram Liaqat	QUORUM SENSING CONTROLS BIOFILM FORMATION IN MARINE ISOLATES	Government College University, Lahore
Dr. Chaimaa jazi Prof. Dr. Chadia Ouazzani Prof. Dr. Abdellah Moustaghfir	FROM CHEMICAL BREAKDOWN TO HEALTH IMPACT: PHYSICOCHEMICAL EVALUATION OF COOKING OILS FROM VARIOUS FOOD MATRICES IN MOROCCO	University Mohammed V in Rabat, Morrocco
Opeyemi Gbenga Joshua Ojoajogwu Emmanuel Owoyemi Julius Olugbenga	GENDER VARIATION IN THE PERCEPTION OF CLIMATE CHANGE AND ADPTATION STRATEGIES AMONG CROP FARMERS IN AGROECOLOGICAL ZONE B OF KOGI STATE, NIGERIA	Prince Abubakar Audu University, Nigeria
Hebat-Allah S. Tohamy Ilaria Cacciotti	AMPHIPHILIC EMULGELS LOADED WITH POMEGRANATE CARBON DOTS AND ROSEMARY OIL FOR METABOLIC pH MONITORING	National Research Centre, Egypt University of Rome "Niccolò Cusano", 0Italy
Fatima DAOUDI Fatima BOULANOUAR Dr. Reda MEDIOUNI Dr. KADDOUR HAKIM Prof. Dr. ILIAS FAIZA	GEOGRAPHICAL DISTRIBUTION AND DIVERSITY OF TABLE GRAPE CULTIVARS IN THE AÏN TÉMOUCHENT REGION (ALGERIA)	University of Ain Temouchent, Ain Temouchent, Algeria; University of Tlemcen, Algeria
Amir Nikakhtar	OPTIMAL NITROGEN MANAGEMENT IN IRRIGATED WHEAT UNDER SOUTH OF IRAN	Agricultural and Natural Resources Research and Education Center, AREEO. Bandar Abbas, Iran
Salawu M.O. Prof. I.S. Umar Dr. Sallahu H.	EFFECTS OF CLIMATE CHANGE ON MAIZE FARMERS' PRODUCTION	Federal University of Technology Minna
Dapas Afiniki Emmanuel Prof. Larai A.. Keswet Dr. Gavou T. Pam	SOCIOECONOMIC CHARACTERISTICS, CULTURAL NORMS, AND MATERNAL FOOD SELECTION PRACTICES OF PRE-SCHOOL CHILDREN IN PLATEAU STATE, NIGERIA	Plateau State College of Agriculture, Garkawa, Nigeria University of Jos, Nigeria

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Session-3, Hall-1
17.10.2026
Moderator: Assoc. Prof. Dr. Fatma HASTAOĞLU
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 16:00 – 18:00
Ankara Local Time: 15:00 – 17:00

Author(s)	Title	Affiliation
Fatma HASTAOĞLU	THE ROLE OF SNACKS IN HEALTHY EATING: EVALUATING NUTRITIONAL QUALITY, PORTION SIZE, AND CONSUMPTION CONTEXT	Sivas Cumhuriyet University, Türkiye
Fatma HASTAOĞLU	THE ROLE OF DIETARY SUPPLEMENTS IN OLDER ADULTS' NUTRITION: NEEDS-BASED USE, CLINICAL EVIDENCE, AND SAFETY	Sivas Cumhuriyet University, Türkiye
Mehtap ODABASI Ebru BARDAS OZKAN Cebrail GÜRSUL	THE ROLE OF FUNCTIONAL FOODS IN NEUROINFLAMMATORY AND NEUROTOXIC PROCESSES MEDIATED BY THE GUT-BRAIN AXIS. A REVIEW OF PUBLISHED RESEARCH	Republic of Turkey Ministry of Agriculture and Forestry, Türkiye Erzincan Binali Yildirim University, Türkiye
Mehtap ODABASI Ebru BARDAS OZKAN Cebrail GÜRSUL	PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN FOODS OF ANIMAL ORIGIN: EXPOSURE AND EFFECTS ON OXIDATION AND THE IMMUNE SYSTEM AS WELL AS POTENTIAL NEUROLOGICAL EFFECTS	Republic of Turkey Ministry of Agriculture and Forestry, Türkiye Erzincan Binali Yildirim University, Türkiye
Nazife YILMAZ	DIETARY OPIOID PEPTIDES: NATURAL SOURCES, BIOLOGICAL ACTIVITIES, AND POTENTIAL APPLICATIONS	Erzincan Binali Yıldırım University, Türkiye
Seda Nur YETER Nazife YILMAZ	PERSONALİZED NUTRİTİON: CURRENT APPROACHES AND THEİR EFFECTS ON HEALTH	Erzincan Binali Yıldırım University, Türkiye
Halenur YILDIZ Esra DEMİRATA Burak DEMİRHAN Buket ER DEMİRHAN	DETERMINATION OF TOTAL PHENOLIC COMPOUND, ANTIOXIDANT CAPACITY AND MICROBIOLOGICAL QUALITY IN TURKISH COFFEE VARIETIES	Ankara Bilim University, Türkiye Ankara University, Türkiye Gazi University, Türkiye
Esra DEMİRATA Burak DEMİRHAN Buket ER DEMİRHAN	INVESTIGATION OF SOME BIOCHEMICAL AND PHYSICOCHEMICAL PROPERTIES OF ORGANIC AND CONVENTIONAL FLORAL HONEYS	Gazi University, Türkiye

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Session-3, Hall-2
17.10.2026
Moderator: Assoc. Prof. Dr. Meryem GÖKSEL SARAÇ
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 16:00 – 18:00
Ankara Local Time: 15:00 – 17:00

Author(s)	Title	Affiliation
Meryem GÖKSEL SARAÇ	NEW FOOD DESIGN IN GLUTEN-FREE, VEGAN, AND VEGETARIAN PRODUCTS: CURRENT APPROACHES FROM NUTRITIONAL, TECHNOLOGICAL, AND SENSORY ACCEPTANCE PERSPECTIVES	Sivas Cumhuriyet University, Türkiye
Meryem GÖKSEL SARAÇ	HYBRID MEAT ANALOGUES IN THE TRANSITION TOWARD SUSTAINABLE MEAT ALTERNATIVES: A BIBLIOMETRIC ANALYSIS BASED ON WEB OF SCIENCE DATA	Sivas Cumhuriyet University, Türkiye
Kürşat KÖŞKEROĞLU	CURRENT METHODS FOR SPECIES AUTHENTICATION AND ADULTERATION DETECTION IN HALAL FOODS	Erciyes University, Türkiye
Gaye MUDRİŞLER ŞAMA Okan KURTULDU	DEVELOPMENT OF AN ALTERNATIVE FORMULATION FOR COCOA POWDER SUBSTITUTION IN WAFER PRODUCTS	Nestle Türkiye Gıda Sanayi A.Ş.
İlknur ÖZDEMİR Ayşe Burcu ÖNDER	DIFFERENT SESAME VARIETIES GROWN IN TURKEY AND THEIR USES IN THE FOOD INDUSTRY	Sivas Cumhuriyet University, Türkiye
Elshan Penjaliyev Yavuz Yüksel	DETERMINATION OF HEAVY METAL LEVELS IN STURGEON FISH AND CAVIAR FOUND IN THE CASPIAN SEA IN AZERBAIJAN	Balıkesir University, Türkiye
Muhammet Ali ÇAKIR	POTENTIAL USE OF BEE BREAD IN FOOD SYSTEMS: COMPOSITION, TECHNOLOGICAL APPLICATIONS, SAFETY AND STANDARDISATION	Kırklareli University, Türkiye

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Session-3, Hall-3
17.10.2026
Moderator: Assoc. Prof. Dr. Tuğba DEDEBAŞ
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 16:00 – 18:00
Ankara Local Time: 15:00 – 17:00

Author(s)	Title	Affiliation
Özlem AKPINAR	ENZYME-ASSISTED EXTRACTION FOR SUSTAINABLE UTILIZATION OF FOOD WASTE	Tokat Gaziosmanpaşa University, Türkiye
Burcu ÖZTÜRK KERİMOĞLU Muge URGU ÖZTÜRK	PLANT-BASED BEVERAGE BY-PRODUCTS AS MULTIFUNCTIONAL INGREDIENTS FOR CLEANER-LABEL AND SUSTAINABLE MEAT PRODUCTS	Ege University, Türkiye
Muge URGU ÖZTÜRK Burcu ÖZTÜRK KERİMOĞLU	VALORIZATION OF PLANT-BASED BEVERAGE PROCESSING BY-PRODUCTS AS VALUE-ADDED FOOD INGREDIENTS	Ege University, Türkiye
Tuğba DEDEBAŞ	ENHANCING THE FUNCTIONAL FOOD POTENTIAL OF MICROGREENS: CULTIVATION, BIOACTIVE COMPOUNDS, PROCESSING, AND BIOAVAILABILITY	Afyon Kocatepe University, Türkiye
Tuğba DEDEBAŞ	ARTIFICIAL INTELLIGENCE-ASSISTED ANALYTICAL APPROACHES FOR ADULTERATION DETECTION IN EDIBLE OILS	Afyon Kocatepe University, Türkiye
Zeynep AKŞİT	GIDALARDA DİYET LİFLER VE FİZYOLOJİK ETKİLERİ	Erzincan Binali Yıldırım University, Türkiye
Zeynep AKŞİT Fatma YENİCE	GIDALARDA RAF ÖMRÜ TESTLERİ	Erzincan Binali Yıldırım University, Türkiye
Fırat ÇINAR	EFFECTS OF HOT-AIR, FREEZE, AND MICROWAVE-VACUUM DRYING ON THE PHYSICAL, TEXTURAL, AND THERMAL PROPERTIES OF BLUEBERRIES (*VACCINIUM CORYMBOSUM* L.)	Mersin University, Türkiye

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Session-3, Hall-4
17.10.2026
Moderator: Akbar Soliemanzadeh
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 16:00 – 18:00
Ankara Local Time: 15:00 – 17:00

Author(s)	Title	Affiliation
Arypzhan ABEN Dinmukhammed GABDULLAULY	CLASSIFYING MUSHROOM EDIBILITY FROM CATEGORICAL MORPHOLOGICAL FEATURES: A COMPARATIVE RE-EVALUATION AND METHODOLOGICAL AUDIT OF MACHINE LEARNING MODELS	Khoja Akhmet Yassawi International Kazakh-Turkish University, Kazakhstan,
Muhammad Abdul Jabbar.K.K. Dr.Gowhar Ahmad Wan	ARTIFICIAL INTELLIGENCE IN AGRICULTURE AND FOOD SECURITY	B.S.AbdurRahman Crescent Institute of Science and Technology, Chennai
Aliza Naeem Bushra Niaz Farhan Saeed Muhammad Afzaal Ali Imran	SUSTAINABLE VALORIZATION OF RED BEETROOT POMACE BIOACTIVES THROUGH NANOENCAPSULATION FOR ENHANCED QUALITY OF FRESH PLUM JUICE	Government College University Faisalabad, Faisalabad, Pakistan
Bahareh Rafiei Pooya Shahinkhoo	CLIMATE-DRIVEN PEST OUTBREAKS AND PESTICIDE RESIDUES: SUSTAINABLE PEST MANAGEMENT FOR SAFER FRESH PRODUCE	Gilan Agricultural and Natural Resources Research and Education Center, AREEO, Rasht, Iran, University of Hohenheim, Stuttgart, Germany
SALEY, Sanoussi and Abdullahi, Abdulazeez	CROSS-BORDER GRAIN MARKETING AND FOOD SECURITY STATUS OF MARKETERS IN NIGERIA AND NIGER REPUBLIC	Federal University of Technology Minna, Niger State, Nigeria
Temilade, A. O. Akinlade O. O. Sogunle, O. M. Odutayo, O. J. Sanda, A. J. Irivboje, O. A. Okusanya, P. O. Akinlade O. O. Akinyode, A.	INFLUENCE OF CASSAVA ROOT SIEVATE FORTIFIED WITH PALM OLEIN ON SERUM BIOCHEMISTRY OF ABOR ACRES BROILER CHICKEN	Federal University of Technology, Ilaro, Ogun State. 2Federal University of Agriculture, Abeokuta.
G. O. Tona	MITIGATING THE EFFECTS OF CLIMATE CHANGE IN RUMINANT LIVESTOCK PRODUCTION TO IMPROVE FOOD SECURITY AND LIVELIHOODS IN NIGERIA	Ladoke Akintola University of Technology, Ogbomoso, Nigeria
Akbar Soliemanzadeh	OPTIMIZING POTASSIUM FERTILIZATION FOR WHEAT UNDER SALINE AND WATER-SCARCE CONDITIONS IN THE MIDDLE EAST	Hormozgan Agricultural and Natural Resources Research and Education Center, AREEO, Bandar Abbas, Iran

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Session-3, Hall-5
17.10.2026
Moderator: Akpan, Christopher Aniekan
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 16:00 – 18:00
Ankara Local Time: 15:00 – 17:00

Author(s)	Title	Affiliation
Wissem MAHNANE Mountaha MAHNANE	PRECISION METABOLIC NUTRITION IN CANCER THERAPY: SYNCHRONIZING GLUCOSE CONTROL AND METHIONINE MODULATION TO EXPLOIT TUMOR VULNERABILITIES	University Abou-Bekr Belkaïd, Tlemcen 13000, Algeria University Djillali Liabes, Algeria
Akpan, Christopher Aniekan	AGRICULTURE'S POTENTIALS TO MITIGATE YOUTH MIGRATION IN SUB-SAHARAN AFRICA: A CASE STUDY OF EDO STATE, SOUTH-SOUTH NIGERIA	Federal College of Education (Technical) Ekiadolor Benin City, Edo State Nigeria
Akpan, Christopher Aniekan	REDOUBLING EFFORTS TO ADDRESS FOOD INSECURITY IN DEVELOPING COMMUNITIES: A CASE STUDY OF GUMA LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA	Federal College of Education (Technical) Ekiadolor Benin City, Edo State Nigeria
Manoj-Kumar Arthikala Yalpi Karthik Pavithra Narendran	STRUCTURAL AND COMPARATIVE DOCKING ANALYSIS OF HUMAN GUT-DERIVED AKKERMANSIA MUCINIPHILA AMUC_1100 WITH INNATE IMMUNE RECEPTORS	Universidad Nacional Autónoma de México (UNAM), Mexico The University of Trans-Disciplinary Health Sciences and Technology (TDU), India
Sadia Bakhtawar	GENOME EDITING OF WHEAT STARCH BIOSYNTHESIS FOR THE DEVELOPMENT OF LOW-GLYCEMIC WHEAT	University of Sargodha, Sargodha, Pakistan
Hari Nandhini . A Meenatchi.S Swathi.R	DRUG REPURPOSING: AN INNOVATIVE APPROACH TO ACCELERATING DRUG DISCOVERY AND THERAPEUTIC DEVELOPMENT	Bharath Institute of Higher Education and Research, Selaiyur, Chennai ,Tamil Nadu, India
Purwati, Siti Mutmainah Edrivo Pandapotan Tumanggor	THE EFFECT OF PLANTING MEDIA COMPOSITION AND TRICHODERMA SP. DOSAGE ON THE GROWTH OF COCOA SEEDLINGS (THEOBROMA CACAO L.)	University of Widya Gama Mahakam Samarinda, Indonesia
Hamidah Rustam Baraq Noor Mikael.T	THE EFFECT OF PROVIDING HOUSE HOLD WASTE TRICHOCOMPOST AND PELANGI NPK ON THE GROWTH OF OIL PALM (ELAEIS GUINEENSIS JACQ.) SEEDLINGS IN PRE – NURSERIES	University of Widya Gama Mahakam Samarinda, Indonesia
Ouassila Riouchi Khalid Elkalay	FOOD CONTAMINATION BY MICROPLASTICS	Cadi Ayyad University, Essaouira, Morocco

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Session-3, Hall-6
17.10.2026
Moderator: Aghja Valiyeva
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 16:00 – 18:00
Ankara Local Time: 15:00 – 17:00

Author(s)	Title	Affiliation
IGERE, Bright E Oluwafemi D. Yinka	OCCURRENCE OF CRONOBACTER SPP IN LOCALLY FERMENTED RAW COW MILK PRODUCTS IN SOUTHERN DELTA SENATORIAL REGIONS OF DELTA STATE, NIGERIA	Delta State University, Abraka, Delta State, Nigeria
Aghja Valiyeva	VARIATIONS IN ACIDIFICATION AND MICROBIAL RECOVERY AMONG YOGURT FORMULATIONS DURING REFRIGERATED STORAGE	Baku State University, Baku, Azerbaijan
Elkhatir Mohcin Talhaoui Abdeljalil Elkhatir Abdelkarim Itto rahou Abdessamad Elmadkouri Mohammed Louragli Ismail Chaker Lamrani Anass Youssef Aboussaleh	PRINCIPAL COMPONENT ANALYSIS OF TRADITIONAL MOROCCAN FOOD INTAKE AND ITS ASSOCIATION WITH ATTENTIONAL OUTCOMES IN MOROCCAN SCHOOL-AGED CHILDREN AND ADOLESCENTS	Ibn Tofail University, Morocco
Babita Gupta	THERMAL-SENSITIVE FOOD PRODUCTS FOR THERAPEUTIC APPLICATIONS	Institute of technology and Management Gida Gorakhpur
Salihu, I. A. Gado, A. A. Abubakar, A. L. Mariam, I. Asiyah, A. B. Silver, A. E.	COMPARATIVE EVALUATION OF AGRO-MORPHOLOGICAL PERFORMANCE IN SELECTED NACGRAB COWPEA GERMPLASM	Federal University of Technology, Minna, Niger State, Nigeria Federal College of Freshwater Fisheries Technology New-Bussa, Niger State, Nigeria
Ekanem, Moses Columba	COMPARATIVE EVALUATION OF WATER YAM (Dioscorea alata), COCOYAM (Colocasia esculenta) AND COWPEA (Vigna unguiculata) FLOURS AND THEIR COMPOSITE FLOUR BLENDS	Akwa Ibom State Polytechnic, Nigeria
Hamisu W.; Bilkisu MI	HONEYBEE PEST AWARENESS AND PERCEPTIONS AMONG TRADITIONAL BEEKEEPERS IN KATSINA STATE, NIGERIA	Alqalam University, Katsina, Katsina State, Nigeria
Ahmed Osmane Khadija Zidan Hasnae Sabri Moustapha Belmouden	ASSESSMENT OF THE HEALTH AND NUTRITIONAL IMPACTS OF MILLET IRRIGATED WITH TRICKLING FILTER EFFLUENT UNDER ARID NORTH AFRICAN CONDITIONS	Agadir University Ibn Zohr University Cadi Ayyad, Marrakech, Morocco.
Muhammad Naziih Haniif Adhi Wira Pradana S Irfandi Rizqullah Miftakhudin Sauqi Masda Kama	THE ROLE OF HALAL FOOD AND HOSPITALITY IN SUPPORTING MUSLIM-FRIENDLY TOURISM DEVELOPMENT IN PEMALANG, INDONESIA	Islamic State University of K.H. Abdurrahman Wahid Pekalongan
Fika DEALOVA Dwi Tika Wulan SARI Cahya AMELIA	FROM TRADITIONAL CUISINE TO CREATIVE HALAL CUISINE: INNOVATION, BRANDING,	Islamic State University of K.H. Abdurrahman Wahid Pekalongan

Ismi NURHANIFAH Nindi AULIA	AND CULINARY TOURISM IN BATANG REGENCY	

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Session-1, Hall-1
18.10.2026
Moderator: Assoc. Prof. Dr. Tekmile CANKURTARAN KÖMÜRCÜ
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Öznur EYMİR Tekmile CANKURTARAN KÖMÜRCÜ	EFFECT OF UNRIPE BANANA FLOUR SUBSTITUTION ON THE PHYSICAL, COLOR, TEXTURAL, AND SENSORY PROPERTIES OF GLUTEN-FREE BISCUITS	Necmettin Erbakan University, Türkiye
Öznur EYMİR Tekmile CANKURTARAN KÖMÜRCÜ	EFFECT OF WHITE, YELLOW, AND RED ONION PEEL POWDER SUBSTITUTION ON THE PHYSICAL, COLOR, TEXTURAL, AND SENSORY PROPERTIES OF CRACKERS	Necmettin Erbakan University, Türkiye
Ruşanov Asəf Əyyub Mustafayeva Samirə Müslüm Elxan Rəşad Əhmədli	SÜD VƏ ƏT MƏHSULLARINDA EKOLOJİ TƏMİZLİYİN BİOKİMYƏVİ GÖSTƏRİCİLƏRLƏ QİYMƏTLƏNDİRİLMƏSİ	Naxçıvan Dövlət Universiteti
Sena SIDAR Hasan YALÇIN	EFFECT OF CORNELIAN CHERRY EXTRACT ADDITION ON THE PHYSICAL AND PHENOLIC PROPERRTIES OF SODIUM ALGINATE-BASED EDIBLE FILMS	Erciyes University, Türkiye
Ebru Akgül Toprak Hatice Kubra Sasmaz Yildiz Pınar Kadiroglu Kelebek Hasim Kelebek	COMPARISON OF BLACKBERRY (RUBUS FRUTICOSUS L.) EXTRACTS OBTAINED BY CONVENTIONAL AND ULTRASOUND-ASSISTED EXTRACTION METHODS	Adana Alparslan Türkeş Science and Technology University, Türkiye
Hatice Kübra Şaşmaz Yıldız Ebru Akgül Toprak Pınar Kadiroğlu Kelebek Haşim Kelebek	THE EFFECT OF DIFFERENT INFUSION TIMES ON THE TOTAL PHENOLIC CONTENT AND ANTIOXIDANT CAPACITY OF UBE (*DIOSCOREA ALATA* L.) POWDER INFUSIONS	Adana Alparslan Türkeş Science and Technology University, Türkiye
Meltem Sarıoğlu CEBECİ Onur BALCAN	TREATABILITY of SUGAR INDUSTRY WASTEWATER BY ADVANCED TREATMENT: SUGAR INDUSTRY WASTE AND ADSORPTION	Sivas Cumhuriyet University, Türkiye
Cansel YÜKSEL Nihan AKDEMİR	A QUALITATIVE STUDY ON THE ROLE OF FOOD NAMES IN TASTE EXPECTATIONS AND CULTURAL MEANING-MAKING IN TURKISH CUISINE	Gedik University, Türkiye Kocaeli University, Türkiye

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Session-1, Hall-2
18.10.2026
Moderator: Lecturer Dr. Fatma ŞEKER
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Neslihan AYAĞ Elif DAĞDEMİR	THE ROLE OF ARTIFICIAL INTELLIGENCE IN CHEESE PRODUCTION AND QUALITY CONTROL	Atatürk University, Türkiye
Feyza TOPALOĞLU Ahmet DURSUN	RESPONSE SURFACE OPTIMIZATION OF TEMPERATURE AND VOLTAGE FOR THE CAPILLARY ELECTROPHORETIC SEPARATION OF NITRATE AND NITRITE	Hatay Mustafa Kemal University, Türkiye
Kamile BAYRAK AKAY	RELEASE BEHAVIOUR OF BIOLOGICAL GROUPS IN CAKES ENRICHED WITH SPRAY-DRIED BLUEBERRY JUICE DURING IN VITRO DIGESTION	Harran University, Türkiye
Muhammet Murat DURMAZ Merve AKALAN Kamile BAYRAK AKAY Mehmet Şükrü KARAKUŞ Mehmet KARAASLAN Bülent BAŞYİĞİT	SIMULTANEOUS MICROWAVE-ASSISTED ENZYMATIC EXTRACTION OF THYME ESSENTIAL OIL: OPTIMIZATION THROUGH RESPONSE SURFACE METHODOLOGY AND A COMPARATIVE ASSESSMENT WITH CONVENTIONAL HYDRODISTILLATION	Harran University, Türkiye
Eda Elgin KILIÇ Mahmut KILIÇLI	EFFECTS OF CHICKPEA AQUAFABA POWDER ON LACTIC ACID BACTERIA VIABILITY, ANTIOXIDANT ACTIVITY, AND QUALITY CHARACTERISTICS OF YOGURT	Gaziantep University, Türkiye
Gökçe ÖZDEMİR	FROM SMART FARMS TO SAFE FOOD: SMART FARM MANAGEMENT CENTRED ON PRECISION LIVESTOCK FARMING AND BIO-DIGITAL TRACEABILITY SUPPORTED BY BIOMARKERS IN ANIMAL PRODUCTION	Sivas Cumhuriyet University, Türkiye
Fatma ŞEKER	A FOOD SAFETY REGULATION IN THE 2ND MILLENNIUM BC? THE HYGIENE CLAUSES OF THE HITTITE INSTRUCTIONS FOR TEMPLE PERSONNEL	Sivas Cumhuriyet University, Türkiye
Fatma ŞEKER	FOOD STORAGE AMONG THE HITTITES: FROM VESSELS TO SILOS AN ARCHAEOLOGICAL, PHILOLOGICAL AND ADMINISTRATIVE ASSESSMENT	Sivas Cumhuriyet University, Türkiye

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Session-1, Hall-3

18.10.2026
Moderator: Assoc. Prof. Dr. Tuğba DEMİR
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Nursel SÖYLEMEZ MİLLİ Pelin ERTÜRKMEN	IDENTIFICATION OF *CBH* GENES ASSOCIATED WITH BILE SALT HYDROLASE ACTIVITY IN *LACTOBACILLUS ACIDOPHILUS* STRAIN L2	Bolu Abant İzzet Baysal University, Türkiye
Koray KOŞAR Gonca ALAK	NANOPARTICLE APPLICATION IN RAINBOW TROUT FILLETS: CHANGES IN WATER-HOLDING CAPACITY IN FROZEN PRODUCTS	Atatürk University, Türkiye
Fadime KARABULUT	PHYSIOLOGICAL BASIS OF STRESS MEMORY IN PLANTS: HOW TRANSIENT STRESS SHAPES FUTURE STRESS TOLERANCE	Bitlis Eren University, Türkiye
Fadime KARABULUT	PHOTOSYNTHETIC PLASTICITY IN PLANTS: A NEW INDICATOR OF RAPID PHYSIOLOGICAL ACCLIMATION TO ENVIRONMENTAL FLUCTUATIONS	Bitlis Eren University, Türkiye
Busra Baspinar	CHRONOTYPE, MEDITERRANEAN DIET ADHERENCE, AND FINDRISK SCORE IN ADULTS: A CROSS-SECTIONAL MEDIATION ANALYSIS	Erzincan Binali Yıldırım University, Türkiye
Shaymaa Jasım Shakor ALOBAİDİ Ulker AVDILLAZ Hakan USLU	ESCHERİCHİA COLİ VE STAPHYLOCOCCUS AUREUS İZOLATLARI ÜZERİNDE FARKLI SİRKELERİN "ANTİBAKTERİYEL ETKİNLİĞİNİN" ARAŞTIRILMASI	Atatürk University, Türkiye
Ulker AVDILLAZ Hakan USLU	KAFKASLARDAN ANADOLUYA; ALVEOLEAR EKİNEKOKKOZİS VE GIDA BULAŞI	Atatürk University, Türkiye
Handan GÜLER	SUSTAINABLE MATERNAL NUTRITION: ORGANIC FOOD CONSUMPTION DURING PREGNANCY AND HEALTH OUTCOMES	Sivas Cumhuriyet University, Türkiye
Handan GÜLER	FROM TRADITION TO SCIENCE: FUNCTIONAL AND LACTOGENIC PROPERTIES OF REGIONAL ANATOLIAN FOODS USED TO STIMULATE BREAST MILK PRODUCTION	Sivas Cumhuriyet University, Türkiye
Tuğba DEMİR	ENDOCRINE DISRUPTORS IN FOOD: COMBINED EXPOSURE AND METABOLIC EFFECTS	Sivas Cumhuriyet University, Türkiye
Tuğba DEMİR	PFAS IN FOODS OF ANIMAL ORIGIN: OCCURRENCE, DIETARY EXPOSURE AND FOOD SAFETY	Sivas Cumhuriyet University, Türkiye

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Session-1, Hall-4

18.10.2026
Moderator: Bogdan-Catalin SERBAN
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Bogdan-Catalin SERBAN Maria Ruxandra SALAGEAN Matei-Gabriel URSACHESCU Vlad DİACONESCU Caterina ZETU Diana DUMITRAŞCU Maria Ruxandra DİMA Marius BUMBAC	WHY CAN GRAPEFRUIT TURN A SAFE MEDICINE INTO A DANGEROUS ONE? CHEMISTRY AND BIOCHEMISTRY OF A CLASSIC FOOD–DRUG INTERACTION	National Institute for Research and Development in Microtechnologies–IMT Bucharest, Voluntari, Romania National College "Saint Sava", Bucharest, Romania National College "B. P. Hasdeu", Buzau, Romania University of Medicine and Pharmacy "Carol Davila", Bucharest, Romania International Theoretical High School of Computer Science, Bucharest, Romania International Theoretical High School of Computer Science, Bucharest, Romania Sciences and Advanced Technologies Department, Faculty of Sciences and Arts, Valahia University of Targoviste, Romania
Bogdan-Catalin SERBAN Maria Ruxandra SALAGEAN Matei-Gabriel URSACHESCU Vlad DİACONESCU Caterina ZETU Diana DUMITRAŞCU Maria Ruxandra DİMA Marius BUMBAC	THE CHEMISTRY OF HUMAN BODY ODOR: WHY DO WE SMELL AND WHY DOES OUR SMELL CHANGE WITH AGE?	///
Bogdan-Catalin SERBAN Maria Ruxandra SALAGEAN Matei-Gabriel URSACHESCU Vlad DİACONESCU Caterina ZETU Diana DUMITRAŞCU Maria Ruxandra DİMA Marius BUMBAC	HYDROGEN SULFIDE IN THE HUMAN BODY: FROM A TOXIC GAS TO AN ESSENTIAL BIOLOGICAL MESSENGER	///
Mahdalena Asiah Wati Lubis	THE EFFECTIVENESS OF LIQUID ORGANIC FERTILISER MADE FROM BANANA PEEL WASTE AND UREA FERTILISER ON THE GROWTH OF OIL	University of Widya Gama Mahakam Samarinda, Indonesia

	PALM SEEDLINGS (ELAEIS GUINEENSIS JACQ) IN A PRE-NURSERY	
Novel Reonald Laila Maghfirah Dian Irma Aprianti	GREEN BUSINESS AND GREEN INNOVATION: SMALL AND MEDIUM-SIZED ENTERPRISES AND MICRO-ENTERPRISES IN EAST KALIMANTAN	University of Widya Gama Mahakam Samarinda, Indonesia
Purbawati Mad Yusup Diyaa Aaisyah Salmaa Putri Atmaja	COCONUT SHELL CHARCOAL EXTRACTION AS A SUBSTITUTE FOR SYNTHETIC PIGMENTS ON THE PHYSICAL AND MECHANICAL PROPERTIES OF COMPOSITE MATERIALS	University of Widya Gama Mahakam Samarinda, Indonesia
Muhammad Riyzan Anggra Hidayat Rolly Yulianthy Akas Pinaringan Sujalu	EFFECT OF SEED DRYING ON THE QUALITY OF GERMINATION OF CHILLI (CAPSICUM ANNUM L.)	University of Widya Gama Mahakam Samarinda, Indonesia
Rudy Aliri	YIELD TEST OF TWO VARIETIES OF WELSHAW RICE WITH NITROGEN FERTILIZER APPLICATION FOLLOWING THE SRI METHOD	Agricultural College of Kutai Timur, Indonesia
M Sheeraz	AI-POWERED CROP DISEASE DETECTION FOR SMALLHOLDER FARMERS IN PAKISTAN: A REVIEW AND DEPLOYMENT ROADMAP	MNS University of Agriculture Multan, Pakistan
Hassan Daghagheleh Ali Azogh	A GLOBAL OUTLOOK ON THE FUTURE OF NANOCHEMICAL AND BIOLOGICAL FERTILIZERS IN AGRICULTURAL PRODUCTION	Shahid Chamran University of Ahvaz, Ahvaz, Iran

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Session-1, Hall-5

18.10.2026
Moderator: Fatima-ezzahra Jaayefar
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Fatima-ezzahra Jaayefar Jamila Dahman	VALORIZATION OF GLADIOLUS SEGETUM KER-GAWL: A REVIEW OF ITS PHYTOCHEMICAL DIVERSITY AND ANTIPROLIFERATIVE POTENTIAL	Ibn Tofail University, Kenitra, Morocco
Saimon islam Jihad Islam Chowdhury	INTEGRATED AGRICULTURE-AQUACULTURE SYSTEMS: IMPLICATIONS ON FOOD AND NUTRITION SECURITY	University of Rajshahi, Bangladesh
Fatima-ezzahra Jaayefar Jamila Dahmani	VALORIZATION OF LUPINUS PILOSUS MURR.: A REVIEW OF ITS AGRONOMIC POTENTIAL AND TOLERANCE TO CALCAREOUS SOILS FOR SUSTAINABLE AGRICULTURE	Ibn Tofail University, Kenitra, Morocco
Aygun Musayeva	MOLECULAR AND BIOTECHNOLOGICAL APPROACHES TO IMPROVING FRUIT CROP RESILIENCE TO CLIMATE CHANGE	Ministry of Agriculture, Guba, Azerbaijan
Fatima-ezzahra Jaayefar Jamila Dahmani	NEPETA TUBEROSA L. SSP. TUBEROSA: A REVIEW OF ITS ESSENTIAL OIL COMPOSITION AND POTENTIAL APPLICATIONS	Ibn Tofail University, Kenitra, Morocco
Mrs. Bornare Ashwini C. Mr. Rohan Kherud Mr. Vikas shinde Dr. Amol Gayke	POLYHERBAL ORAL DISSOLVING FILMS : FORMULATION STRATEGIES & THERAPEUTIC POTENTIAL OF BOUGAINVILLEA & CILTORIA TERNATEA EXTRACT	Department of Herbal Drug technology, Department of pharmacognosy, Environmental Biotechnology.
Fatima-ezzahra Jaayefar Jamila Dahmani	RESEDA LUTEOLA L. (WELD): A REVIEW OF ITS AGRONOMIC POTENTIAL AND NATURAL DYEING PROPERTIES FOR SUSTAINABLE TEXTILE PRODUCTION	Ibn Tofail University, Kenitra, Morocco

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Session-1, Hall-6

18.10.2026
Moderator: Wilson Okaka
Meeting ID: 884 2447 8604/ Passcode: 161718
Baku Local Time: 11:00 – 13:00
Ankara Local Time: 10:00 – 12:00

Author(s)	Title	Affiliation
Wilson Okaka Celia Amanya	EFFECTIVENESS OF DIGITAL AGRICULTURAL COMMUNITY OUTREACH INFORMATION SERVICES IN MITIGATING ADVERSE CLIMATE CHANGE EFFECTS ON AGRICULTURAL PRODUCTIVITY FOR FOOD SECURITY AMONG SMALLHOLDER FARMERS IN UGANDA	Kyambogo University, School of Education, Uganda
Wilson Okaka Sylvanus Twinomugisha Rwobusiisi	THE ROLE OF SCIENCE JOURNALISM IN STRENGTHENING PUBLIC AWARENESS COMMUNICATION CAMPAIGN STRATEGY FOR AGRICULTURAL VALUE CHAIN EMPLOYMENT INNOVATION OPTIONS FOR THE YOUTH AND WOMEN IN UGANDA	Kyambogo University, School of Education, Uganda
Wilson Okaka Leticia Komba Rwakijuma	ACCELERATING THE PROSPECTS OF BLENDING MODERN SCIENTIFIC BIOMEDICAL RESEARCH WITH TRADITIONAL MEDICINE THROUGH COMMUNITY HERBAL FARMING INFORMATION SERVICES IN UGANDA	Kyambogo University, School of Education, Uganda
Daud, S.A Omotoso, A.B Ayodele, M.A Adejumo, D.R	DETERMINANT OF FOOD INSECURITY DYNAMICS AMONG RURAL FARMING HOUSEHOLDS IN SOUTHWEST NIGERIA	Ministry of Agriculture, Guba, Azerbaijan
Maryem Arraji Mohamed Khalis Mohamed Chahboune	USE OF ARTIFICIAL INTELLIGENCE FOR MEDICATION ADHERENCE ASSESSMENT IN PATIENTS WITH TYPE 2 DIABETES: AN EXPLORATORY STUDY IN MOROCCO USING CHATGPT AND THE VALIDATED GENERAL MEDICATION ADHERENCE SCALE	Hassan First University of Settat, Settat, Morocco Mohammed VI Center of Research and Innovation, Rabat, Morocco Mohammed VI University of Health Sciences, Casablanca, Morocco
Olena A. Lykholat Tetyana Y. Lykholat Maksim O. Kvitko Yuriy V. Lykholat	PSYCHOPHYSIOLOGICAL ASPECTS OF IMPLEMENTING SHORT FOOD SUPPLY CHAINS AS AN ELEMENT OF PSYCHOLOGYOF HEALTH	University of Customs and Finance, Dnipro, Ukraine Oles Honchar Dnipro National University, Dnipro, Ukraine Kryvyi Rih State Pedagogical University, Kryvyi Rih, Ukraine

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ÜZÜM POSASINDAN BİYOAKTİF BİLEŞİKLERİN ZAMANA BAĞLI OLARAK GERİ KAZANIMI: EKSTRAKSİYON YÖNTEMİNİN ETKİSİ

TIME-DEPENDENT RECOVERY OF BIOACTIVE COMPOUNDS FROM GRAPE POMACE: EFFECTS OF EXTRACTION METHOD

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ÖZET

Üzüm posası, biyoaktif bileşikler açısından değerli bir kaynak olmakla birlikte, bu bileşiklerin etkin bir şekilde geri kazanımı ekstraksiyon yöntemi ve işlem süresine önemli ölçüde bağlıdır. Bu çalışmada, manyetik karıştırma ekstraksiyonu (MSE) ve ultrasonik banyo destekli ekstraksiyon (UAE-B) kullanılarak üzüm posasından biyoaktif bileşiklerin zamana bağlı geri kazanımı araştırılmıştır. Ekstraksiyonlar, %50 (v/v) etanol kullanılarak 1:20 (g/mL) katı/çözücü oranında ve 40 °C'de 150 dakika süreyle gerçekleştirilmiş ve 15 dakikalık aralıklarla örnekleme yapılmıştır. Toplam fenolik madde (TPC), toplam flavonoid madde (TFC), toplam monomerik antosiyanin (TMAC) ve ABTS antioksidan kapasitesi belirlenmiştir. UAE-B, tüm ekstraksiyon süresi boyunca MS'ye kıyasla daha hızlı ve daha yüksek geri kazanım sağlamıştır. UAE-B ile yalnızca 15 dakikada elde edilen TPC, 150 dakikalık MSE sonucunda elde edilenden %18,1 daha yüksek bulunmuştur. Bu artış, ultrason uygulamasıyla üzüm posası matriksinden kütle transferinin iyileşmesine bağlanabilir. UAE-B ile maksimum TPC, 105. dakikada 14.155,79 mg GAE/kg liyofilize ağırlık (LA) düzeyine ulaşmış ve MSE ile 135. dakikada elde edilen maksimum değerden %33,8 daha yüksek bulunmuştur. UAE-B ayrıca MSE ile elde edilen karşılık gelen maksimum değerlere kıyasla maksimum TFC, TMAC ve ABTS antioksidan kapasitesini sırasıyla %51,9, %35,1 ve %57,2 artırmıştır. Maksimum geri kazanıma ulaşma süresi incelenen parametreye bağlı olarak değişmiş; UAE-B ile maksimum değerlere TPC ve TFC için 105. ABTS için 90. ve TMAC için 135. dakikada ulaşılmıştır. Bu sürelerin ötesinde ekstraksiyonun uzatılması genel olarak ilave bir iyileşme sağlamamış ve bazı parametrelerde azalmaya neden olmuştur. Bu bulgular, ekstraksiyon süresinin uzatılmasının biyoaktif bileşiklerin geri kazanımını her zaman artırmadığını ve uygun işlem süresinin seçilmesinin önemini göstermektedir. Sonuç olarak, hem ekstraksiyon yönteminin hem de işlem süresinin biyoaktif bileşiklerin geri kazanımında kritik faktörler olduğu ve UAE-B'nin geleneksel MSE'ye kıyasla daha hızlı ve etkili bir ekstraksiyon sağladığı belirlenmiştir.

Anahtar Kelimeler: Ultrasonik banyo ekstraksiyonu; Manyetik karıştırma ekstraksiyonu; Ekstraksiyon süresi; Biyoaktif bileşikler

ABSTRACT

Grape pomace is a valuable source of bioactive compounds, although their efficient recovery depends strongly on extraction method and treatment time. This study investigated the time-dependent recovery of bioactive compounds from grape pomace using magnetic stirring extraction (MSE) and ultrasound bath extraction (UAE-B). Extractions were performed with 50% (v/v) ethanol at a solid-to-solvent ratio of 1:20 (g/mL) and 40 °C for 150 min, with sampling at 15-min intervals. Total phenolic content (TPC), total flavonoid content (TFC), total monomeric anthocyanin content (TMAC), and ABTS antioxidant capacity were evaluated. UAE-B showed faster and greater recovery than MSE throughout the extraction period. After only 15 min, UAE-B yielded a TPC 18.1% higher than that

obtained after 150 min of MSE. This enhancement may be attributed to improved mass transfer from the grape pomace matrix under ultrasound treatment. The maximum TPC reached 14,155.79 mg GAE/kg lyophilized weight (LW) at 105 min with UAE-B, 33.8% higher than the maximum obtained with MSE at 135 min. UAE-B also increased the maximum TFC, TMAC, and ABTS antioxidant capacity by 51.9%, 35.1%, and 57.2%, respectively, compared with their corresponding maxima obtained by MSE. The time required to reach maximum recovery was response-dependent: UAE-B maxima occurred at 105 min for TPC and TFC, 90 min for ABTS, and 135 min for TMAC. Beyond these points, extended extraction generally provided no further improvement and, in several responses, resulted in decreases. These findings suggest that extending the extraction time does not necessarily improve bioactive compound recovery, emphasizing the importance of selecting an appropriate treatment duration. Overall, the results demonstrate that both extraction method and treatment time are critical factors affecting bioactive compound recovery, with UAE-B providing faster and more effective extraction than conventional MSE.

Keywords: Ultrasound bath extraction; Magnetic stirring extraction; Extraction time; Bioactive compounds

KIRKLARELİ KÖFTESİNİN KAPSAMLI KARAKTERİZASYONU: KİMYASAL, TEKSTÜREL, AROMA, YAPISAL VE DUYUSAL ÖZELLİKLERİN DEĞERLENDİRİLMESİ

COMPREHENSIVE CHARACTERIZATION OF KIRKLARELI MEATBALLS: EVALUATION OF CHEMICAL, TEXTURAL, AROMA, STRUCTURAL, AND SENSORY PROPERTIES

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ÖZET

Kırklareli köftesi, yöreye özgü üretim özellikleriyle öne çıkan geleneksel bir et ürünüdür. Bu çalışmada, Kırklareli Merkez'de faaliyet gösteren ve ilde yaşayan tüketicilerin en çok tercih ettikleri üç farklı üreticiye ait köfte örneklerinin kimyasal, tekstürel, yapısal, aroma ve duyusal özelliklerinin karşılaştırılması amaçlanmıştır. Aynı gün ve yeni üretilmiş olarak temin edilen köfte örnekleri KL1, KL2 ve KL3 olarak kodlanmış ve soğuk zincir koşullarında laboratuvara ulaştırılmıştır. Örneklerde nem, protein, toplam yağ ve tuz içerikleri belirlenmiş; tekstürel özellikler tekstür profil analizi (TPA),

yapısal özellikler Fourier dönüşümlü kızılötesi spektroskopisi (FTIR) ve aroma profili headspace gaz kromatografisi-kütle spektrometrisi (HS-GC-MS) ile incelenmiştir. Ayrıca örneklerin duyusal değerlendirmesi de yapılmış ve bu amaçla da örnekler tat, koku, tekstür ve genel beğeni açısından puanlanmıştır. Elde edilen verilere göre örneklerin nem, protein, toplam yağ ve tuz içerikleri sırasıyla %46,66-54,68, %14,70-17,23, %19,14-24,65 ve %1,46-1,68 aralığında belirlenmiştir. TPA sonuçlarında en yüksek sertlik değeri KL3 örneğinde belirlenirken, elastikiyet, koheziflik, sakızımsılık, çiğnenebilirlik ve esneklik parametrelerinde en yüksek ortalama değerler KL2 örneğinde elde edilmiştir. FTIR bulguları, KL3 örneğinde daha güçlü moleküller arası hidrojen bağları nedeniyle daha kompakt ve organize bir protein ağı olduğunu göstermiştir. Örneklerin aroma profile değerlendirildiğinde KL1 örneğinde terpen ve sülfür bileşiklerinin, KL2 örneğinde protein bozunması ve Strecker reaksiyon ürünleri olan amin bileşiklerinin, KL3 örneğinde ise 2,3-butanedione bileşiğinin öne çıktığı gözlenmiştir. Duyusal değerlendirmede KL2 örneğinin tüm kriterler bakımından en yüksek ortalama puanları aldığı tespit edilmiştir.

Sonuç olarak, incelenen köfte örneklerinin kimyasal bileşim, tekstürel yapı, protein ağı, aroma profili ve duyusal özellikler bakımından farklı profiller sergilediği belirlenmiştir. Elde edilen bulgular KL2 örneğinin yapılan bir çok analiz bakımından öne çıktığını ve bu durumun duyusal değerlendirme verileri ile desteklendiğini ortaya koymuştur. Bu çalışmada elde edilen bulguların, Kırklareli köftesinin kalite özelliklerinin tanımlanmasına yardımcı olacağı ve üründe yapılacak sonraki çalışmalara temel oluşturabileceği düşünülmektedir.

Anahtar Kelimeler: Kırklareli köftesi, kalite özellikleri, tekstür profil analizi, aroma profili, duyusal değerlendirme

ABSTRACT

Kirklareli meatball is a traditional meat product distinguished by its region-specific production characteristics. This study aimed to compare the chemical, textural, structural, aroma, and sensory properties of meatball samples obtained from three different producers operating in Kirklareli city center and most preferred by consumers residing in the province. Freshly produced samples obtained on the same day were coded as KL1, KL2, and KL3 and transported to the laboratory under cold-chain conditions. Moisture, protein, total fat, and salt content of the samples were determined, while their textural properties were analyzed using texture profile analysis (TPA), structural properties using Fourier-transform infrared spectroscopy (FTIR), and aroma profiles using headspace gas chromatography-mass spectrometry (HS-GC-MS). In addition, sensory evaluation was performed, and the samples were scored in terms of taste, odor, texture, and overall acceptability. According to the results, the moisture, protein, total fat, and salt contents of the samples ranged from 46.66-54.68%, 14.70-17.23%, 19.14-24.65%, and 1.46-1.68%, respectively. The highest hardness value was determined in the KL3 sample in the TPA analysis, whereas the highest mean values for springiness, cohesiveness, gumminess, chewiness, and resilience were obtained for KL2. The FTIR findings indicated that the KL3 sample had a more compact and organized protein network, which was attributed to stronger intermolecular hydrogen bonding. Evaluation of the aroma profiles revealed that terpenes and sulfur compounds were prominent in KL1, amine compounds associated with protein degradation and Strecker reaction products were predominant in KL2, while 2,3-butanedione was particularly prominent in KL3. In the sensory evaluation, the KL2 sample received the highest mean scores for all evaluated criteria.

In conclusion, the examined meatball samples exhibited distinct profiles in terms of chemical composition, textural properties, protein structure, aroma profile, and sensory characteristics. The

findings demonstrated that the KL2 sample was prominent across several analytical parameters, and this was supported by the sensory evaluation results. The findings obtained in this study may contribute to the characterization of the quality attributes of Kirklareli meatballs and provide a basis for future studies on this traditional product.

Keywords: Kirklareli meatballs, quality characteristics, texture profile analysis, aroma profile, sensory evaluation

GIDA KAYNAKLI ZEHİRLENMELERDE ACİL SERVİS YAKLAŞIMI: TOKSİDROMLARDAN KRİTİK HASTA YÖNETİMİNE

EMERGENCY DEPARTMENT APPROACH TO FOODBORNE POISONING: FROM TOXIDROMES TO CRITICAL PATIENT MANAGEMENT

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ÖZET

Gıda kaynaklı zehirlenmeler, hafif ve kendini sınırlayan gastrointestinal yakınmalardan ciddi nörolojik ve çoklu organ tutulumuna kadar değişen geniş bir klinik spektrumda ortaya çıkabilmektedir. Acil serviste özellikle yaşamı tehdit edebilecek toksik sendromların erken tanınması, uygun destek tedavisinin başlanması ve ağır hastaların erken dönemde belirlenmesi hasta yönetiminin temelini oluşturmaktadır.

Gıda kaynaklı botulizm, tipik olarak akut başlangıçlı, simetrik ve inen flask paralizi ile karakterize ciddi bir nöroparalitik sendromdur. Botulizm tanısı esas olarak klinik değerlendirmeye dayanmakta; laboratuvar incelemeleri klinik şüphenin doğrulanması, sorumlu botulinum nörotoksininin ve zehirlenme kaynağının belirlenmesinde kullanılmaktadır. Tedavi; uygun olgularda dekontaminasyon, spesifik antitoksin uygulanması ve solunum yetmezliği gelişen hastalarda solunum desteğini içermektedir.

Yabani mantar zehirlenmeleri, kendini sınırlayan gastrointestinal sendromlardan ciddi hepatik veya renal hasar ve ilerleyici organ yetmezliğine kadar değişen klinik tablolarla seyredebilir. Özellikle amatoksin zehirlenmelerinde erken tanı, doğru risk sınıflaması ve tedavinin zamanında başlanması klinik sonuç açısından önem taşımaktadır.

Deniz ürünleri kaynaklı toksikolojik tablolar arasında yer alan ciguatera zehirlenmesinde gastrointestinal ve nörolojik belirtilere kardiyovasküler bulgular eşlik edebilmekte; kardiyotoksisite gelişen olgularda bradikardi ve hipotansiyon sık görülen bulgular arasında yer almaktadır. Scombroid zehirlenmesi ise uygun koşullarda saklanmamış balıklarda histidinin histamine dönüşmesi sonucu gelişmekte ve kutanöz, gastrointestinal ve anafilaktoid belirtilerle balık alerjisini taklit edebilmektedir.

Sonuç olarak, gıda kaynaklı zehirlenmelerde acil servis yaklaşımı yalnızca gastrointestinal semptomların kontrolü ile sınırlı olmamalı; nörolojik, kardiyovasküler, hepatik ve renal toksisite bulguları açısından sistematik değerlendirme yapılmalıdır. Tüketilen gıdanın türü ve ortaya çıkan klinik sendromun birlikte değerlendirilmesi, olası toksik etkenin belirlenmesine ve uygun tedavinin erken başlanmasına katkı sağlayabilir. Bu derlemede başlıca gıda kaynaklı toksikolojik acillerin klinik özelliklerinin, tanısal yaklaşımının ve güncel tedavi seçeneklerinin acil servis perspektifinden değerlendirilmesi amaçlanmıştır.

Anahtar Kelimeler: Gıda zehirlenmesi, acil servis, toksidrom, botulizm, mantar zehirlenmesi, deniz ürünü toksinleri.

ABSTRACT

Foodborne poisoning can present with a broad clinical spectrum, ranging from mild and self-limiting gastrointestinal symptoms to severe neurological manifestations and multiorgan involvement. In the emergency department, early recognition of potentially life-threatening toxic syndromes, prompt initiation of appropriate supportive care, and early identification of critically ill patients are fundamental components of patient management.

Foodborne botulism is a severe neuroparalytic syndrome typically characterized by acute-onset, symmetric, descending flaccid paralysis. The diagnosis of botulism is primarily based on clinical assessment, while laboratory investigations are used to confirm clinical suspicion and identify the responsible botulinum neurotoxin and the source of poisoning. Treatment includes decontamination in appropriate cases, administration of specific antitoxin, and respiratory support in patients who develop respiratory failure.

Wild mushroom poisoning may present with clinical manifestations ranging from self-limiting gastrointestinal syndromes to severe hepatic or renal injury and progressive organ failure. Particularly in amatoxin poisoning, early diagnosis, appropriate risk stratification, and timely initiation of treatment are important for clinical outcomes.

Among seafood-related toxic syndromes, ciguatera poisoning may present with gastrointestinal and neurological symptoms accompanied by cardiovascular manifestations; bradycardia and hypotension are common findings in patients who develop cardiotoxicity. Scombroid poisoning results from the conversion of histidine to histamine in improperly stored fish and may mimic fish allergy, presenting with cutaneous, gastrointestinal, and anaphylactoid manifestations.

In conclusion, the emergency department approach to foodborne poisoning should not be limited to the management of gastrointestinal symptoms; patients should be systematically evaluated for signs of neurological, cardiovascular, hepatic, and renal toxicity. Combined assessment of the type of food consumed and the resulting clinical syndrome may facilitate identification of the likely toxic agent and early initiation of appropriate treatment. This review aims to evaluate the clinical characteristics, diagnostic approaches, and current treatment options for major foodborne toxicological emergencies from an emergency medicine perspective.

Keywords: Food poisoning, emergency department, toxidrome, botulism, mushroom poisoning, marine toxins.

GIDA KAYNAKLI ENFEKSİYONLARDA ACİL SERVİS YAKLAŞIMI: RİSK SINIFLAMASI, KOMPLİKASYONLARIN ERKEN TANINMASI VE AKILCI ANTİMİKROBİYAL TEDAVİ

EMERGENCY DEPARTMENT APPROACH TO FOODBORNE INFECTIONS: RISK STRATIFICATION, EARLY RECOGNITION OF COMPLICATIONS, AND RATIONAL ANTIMICROBIAL THERAPY

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ÖZET

Gıda kaynaklı enfeksiyonlar, çoğunlukla kendini sınırlayan gastrointestinal hastalık şeklinde seyretmekle birlikte, bakteriyel gastroenteritler önemli bir sağlık hizmeti yükü oluşturmakta ve bazı hastalarda ciddi klinik tablolara yol açabilmektedir. Acil serviste değerlendirmede hastalığın şiddetinin ve dehidratasyonun belirlenmesi, sıvı-elektrolit kayıplarının yerine konması ve ileri inceleme veya tedavi gerektiren hastaların ayırt edilmesi temel yaklaşımı oluşturmaktadır. Tedavinin temelini destekleyici bakım ve rehidrasyon oluştururken, antimikrobiyal tedavi özellikle ağır seyreden seçilmiş bakteriyel enfeksiyonlarda ve yüksek riskli hastalarda düşünülmelidir.

Gıda kaynaklı hastalıkların başlıca enfeksiyöz etkenleri arasında norovirüs, *Campylobacter* spp., tifoidal olmayan *Salmonella*, Shiga toksin üreten *Escherichia coli* (STEC) ve *Listeria monocytogenes* yer almaktadır. Özellikle kanlı ishal ile başvuran hastalarda STEC enfeksiyonunun erken dönemde düşünülmesi önemlidir; bu hastalar hemolitik üremik sendrom (HUS) gelişimi açısından yakından değerlendirilmelidir. STEC ile ilişkili HUS; mikroanjiyopatik hemolitik anemi, trombositopeni ve akut böbrek hasarı ile karakterize olup ağır olgularda nörolojik ve diğer sistemik komplikasyonlara neden olabilmektedir. *Listeria monocytogenes* ise özellikle gebeler, ileri yaştaki bireyler ve immünsüprese hastalarda invaziv enfeksiyonlara yol açabilmesi nedeniyle risk değerlendirmesinde önem taşıyan gıda kaynaklı patojenlerden biridir.

Gıda kaynaklı enfeksiyonların yönetiminde antimikrobiyal tedavi her hastada gerekli değildir; tedavi kararı hastalığın şiddeti, olası etken ve hastaya ait risk faktörleri dikkate alınarak verilmelidir. Acil servislerde gereksiz veya uygunsuz antibiyotik kullanımının azaltılması, antimikrobiyal yönetim programlarının temel hedefleri arasında yer almaktadır. Özellikle STEC şüphesi bulunan kanlı ishalli hastalarda antimikrobiyal tedavi kararı, HUS gelişimiyle olası ilişkisi nedeniyle dikkatle değerlendirilmelidir.

Sonuç olarak, gıda kaynaklı enfeksiyonlarda acil servis yaklaşımının temel amacı yalnızca etken mikroorganizmanın belirlenmesi değil, ciddi hastalık ve komplikasyon riski taşıyan hastaların erken tanınmasıdır. Sistematik risk değerlendirmesi, uygun rehidrasyon ve destek tedavisinin erken başlanması, HUS ve invaziv enfeksiyon gibi ciddi komplikasyonların zamanında fark edilmesi ve antimikrobiyal tedavinin uygun hastalarda kullanılması etkin acil servis yönetiminin temel bileşenleridir. Bu derlemede gıda kaynaklı enfeksiyonların acil serviste risk sınıflaması, önemli

komplikasyonlarının erken tanınması ve akılcı antimikrobiyal tedavi ilkelerinin güncel literatür doğrultusunda değerlendirilmesi amaçlanmıştır.

Anahtar Kelimeler: Gıda kaynaklı enfeksiyon, acil servis, risk sınıflaması, akut gastroenterit, hemolitik üremik sendrom, antimikrobiyal tedavi.

ABSTRACT

Foodborne infections are generally self-limiting gastrointestinal illnesses; however, bacterial gastroenteritis represents a substantial healthcare burden and may lead to severe clinical conditions in some patients. In the emergency department, the primary approach involves assessing disease severity and the degree of dehydration, correcting fluid and electrolyte losses, and identifying patients who require further diagnostic evaluation or treatment. Supportive care and rehydration constitute the mainstay of treatment, whereas antimicrobial therapy should be considered particularly in selected severe bacterial infections and high-risk patients.

The major infectious causes of foodborne illness include norovirus, *Campylobacter* spp., non-typhoidal *Salmonella*, Shiga toxin-producing *Escherichia coli* (STEC), and *Listeria monocytogenes*. Early consideration of STEC infection is particularly important in patients presenting with bloody diarrhea, and these patients should be closely evaluated for the development of hemolytic uremic syndrome (HUS). STEC-associated HUS is characterized by microangiopathic hemolytic anemia, thrombocytopenia, and acute kidney injury and may lead to neurological and other systemic complications in severe cases. *Listeria monocytogenes* is an important foodborne pathogen in risk assessment because of its potential to cause invasive infections, particularly in pregnant women, older adults, and immunocompromised patients.

Antimicrobial therapy is not required in all patients with foodborne infections; treatment decisions should be based on disease severity, the suspected causative pathogen, and patient-specific risk factors. Reducing unnecessary or inappropriate antibiotic use in emergency departments is one of the primary goals of antimicrobial stewardship programs. In particular, antimicrobial treatment in patients with bloody diarrhea and suspected STEC infection should be carefully considered because of its potential association with the development of HUS.

In conclusion, the primary objective of the emergency department approach to foodborne infections is not merely to identify the causative microorganism but also to recognize patients at risk of severe disease and complications at an early stage. Systematic risk assessment, early initiation of appropriate rehydration and supportive care, timely recognition of serious complications such as HUS and invasive infection, and appropriate use of antimicrobial therapy are key components of effective emergency department management. This review aims to evaluate risk stratification, early recognition of major complications, and principles of rational antimicrobial therapy for foodborne infections in the emergency department in light of the current literature.

Keywords: Foodborne infection, emergency department, risk stratification, acute gastroenteritis, hemolytic uremic syndrome, antimicrobial therapy.

SUSTAINABLE FOOD SUPPLY CHAINS AND FOOD SAFETY

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ABSTRACT

Three major global drivers influencing sustainable food systems and food safety. Firstly, population growth and rapid urbanization are increasing global food demand while simultaneously placing significant pressure on production, processing, and distribution systems. Urban consumption patterns further intensify the need for safe and processed food products. Secondly, climate change has a profound impact on food systems by increasing the frequency of extreme weather events such as droughts, floods, and temperature variability. These conditions not only affect agricultural productivity but also elevate food safety risks, particularly through the proliferation of pathogens and contaminants. Thirdly, food security and food safety pressures are becoming increasingly complex. Ensuring both the availability and safety of food is a critical global challenge, especially in the context of supply chain disruptions and environmental stressors.

Global food systems are under increasing pressure due to rapid population growth and accelerating urbanization. The world population is expected to exceed 9 billion by 2050, significantly increasing the demand for food production. At the same time, urbanization is reshaping consumption patterns, food distribution systems, and dietary habits. Urban populations tend to consume more processed and resource-intensive foods, which increases the burden on food supply chains. Additionally, the expansion of cities leads to the loss of agricultural land and creates logistical challenges in food distribution. These changes not only affect food availability but also have important implications for food safety and sustainability. Ensuring a stable, safe, and sustainable food supply under these conditions requires innovative approaches, including improved supply chain management, reduction of food loss and waste, and integration of advanced technologies such as artificial intelligence.

Climate change leads to significant physical changes such as increasing temperatures and more frequent extreme weather events. These changes directly affect agricultural production and food systems. Climate change creates new risks for food safety. For example, higher temperatures can increase microbial growth and toxin production. At the same time, disruptions in the cold chain may lead to unsafe food conditions. Food safety is becoming one of the most critical dimensions of climate change.

Food security and food safety are increasingly under pressure due to multiple global challenges. First, the growing global population is significantly increasing the demand for safe and nutritious food. At the same time, urbanization is changing dietary habits, leading to higher demand for processed and ready-to-eat foods. Secondly, climate change plays a major role. Extreme weather events such as droughts and floods not only reduce agricultural productivity but also increase food safety risks, including contamination with toxins and pathogens. Another important factor is the increasing complexity of food supply chains. As food systems become more globalized, products travel longer distances, increasing the risk of contamination, spoilage, and even food fraud. Additionally, food safety risks such as microbial contamination, chemical hazards, and antimicrobial resistance are becoming more significant. Finally, economic and social pressures, including rising food prices and unequal access to safe food, further complicate the issue. Food loss and waste also remain major

global challenges. Therefore, ensuring both food security and food safety requires integrated and sustainable approaches.

Keywords: food safety, food supply, enverioment factory

BİTKİ BAZLI ALTERNATİFLERDE MİKROBİYOLOJİK GÜVENLİK: PATOJEN DİNAMİKLERİ VE KONTROL STRATEJİLERİ

MICROBIOLOGICAL SAFETY IN PLANT-BASED ALTERNATIVES: PATHOGEN DYNAMICS AND CONTROL STRATEGIES

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ÖZET

Çevresel sürdürülebilirlik hedefleri, hayvan refahı, bireysel sağlık kaygıları ve sosyo-kültürel tüketim kalıplarındaki değişim, alternatif protein kaynaklarına ve özellikle bitki bazlı gıdalara yönelik küresel talebi artırmaktadır. Tüketiciler tarafından çoğunlukla "bitkisel" ve "sağlıklı" olarak algılanan bu ürünler, mikrobiyolojik açıdan geleneksel hayvansal ürünlerden farklılaşan ve hammadde, formülasyon, üretim prosesi ve depolama koşullarına bağlı olarak değişen bir risk profiline sahip olabilmektedir. Özellikle yüksek nem içeren, yüksek su aktiviteli ve nötre yakın pH'ya sahip bitki bazlı et ve süt alternatifleri, mikroorganizmaların gelişimi için uygun koşullar sağlayabilmektedir. Buna karşılık düşük su aktiviteli kuru hammaddeler ve protein izolatları, mikrobiyal gelişimi sınırlamakla birlikte bazı patojenlerin uzun süre canlı kalmasına olanak tanıyabilmektedir. Baklagil, tahıl ve bitkisel protein kaynaklı hammaddelerde bulunabilen spor oluşturan bakteriler, özellikle *Bacillus cereus*, ısıl işlem sonrasında canlılığını sürdürebilmektedir. Ayrıca *Salmonella* spp. kuru bitkisel hammaddelerde canlılığını koruyabilirken, proses sonrası bulaşma ve yetersiz sıcaklık kontrolü durumunda *Listeria monocytogenes* soğutma koşullarında gelişimini sürdürebilmektedir. Koliformlar ve *E. coli* hijyen koşullarının değerlendirilmesinde indikatör olarak kullanılabilmekte; Shiga toksin üreten *E. coli* suşları ise patojenik açıdan önem taşımaktadır. Bununla birlikte, mikrobiyolojik risklerin düzeyi ürünün bileşimi, su aktivitesi, pH'sı, ambalajlama sistemi, proses koşulları ve raf ömrüne bağlı olarak değişmektedir. Ürün matrisindeki yüksek protein ve yağ içeriği ile düşük su aktivitesi, bazı mikroorganizmaların ısıl inaktivasyon kinetiğini etkileyebilmekte ve termal proseslerin ürün bazında doğrulanmasını gerekli kılmaktadır. Ayrıca temiz etiket eğilimi doğrultusunda sentetik koruyucuların azaltılması, raf ömrü ve mikrobiyolojik güvenlik açısından yeni kontrol yaklaşımlarına duyulan gereksinimi artırmaktadır. Koruyucu kültürler, bakteriyosinler, bitkisel ekstraktlar ve diğer doğal antimikrobiyal bileşenler; yüksek basınç ve soğuk plazma gibi ısıl olmayan teknolojilerle birlikte, uygunlukları doğrulandığı takdirde tamamlayıcı biyokoruma stratejileri olarak değerlendirilebilmektedir. Sonuç olarak, bitki bazlı alternatiflerde mikrobiyolojik güvenliğin sağlanması için hammadde tedarikinden tüketime kadar uzanan süreçte ürüne özgü risk analizlerinin yürütülmesi gerekmektedir. Mevcut gıda güvenliği ilkeleri temel alınarak, formülasyon, proses, ambalajlama, depolama ve tüketim koşullarını dikkate alan HACCP planlarının geliştirilmesi; proses validasyonu, çevresel izleme, raf ömrü doğrulaması ve uygun mikrobiyolojik kriterlerle desteklenmelidir. Bu yaklaşım hem tüketici sağlığının korunmasına hem de bitki bazlı gıda sektörünün güvenli ve sürdürülebilir biçimde gelişmesine katkı sağlayabilmektedir.

Anahtar Kelimeler: Bitki bazlı alternatifler, gıda güvenliği, *Bacillus cereus*, *Salmonella* spp., *Listeria monocytogenes*, biyokoruma, HACCP.

ABSTRACT

Environmental sustainability targets, animal welfare concerns, individual health considerations, and changes in sociocultural consumption patterns are driving global demand for alternative protein sources, particularly plant-based foods. These products, which consumers largely perceive as "plant-based" and "healthy," may exhibit a microbiological risk profile that differs from that of conventional animal-based products and varies depending on the raw materials, formulation, processing conditions, and storage conditions. Plant-based meat and dairy alternatives with high moisture content, high water activity, and a pH close to neutral may provide favorable conditions for microbial growth. Conversely, dry raw materials and protein isolates with low water activity may restrict microbial growth while allowing certain pathogens to remain viable for extended periods. Spore-forming bacteria, particularly *Bacillus cereus*, may be present in raw materials derived from pulses, cereals, and plant-based proteins and can remain viable following heat treatment. Furthermore, while *Salmonella* spp. can remain viable in dry plant-based raw materials, *Listeria monocytogenes* can continue to grow under refrigeration conditions in the event of post-processing contamination or inadequate temperature control. Coliforms and *E. coli* can be used as indicators for assessing hygienic conditions; however, Shiga toxin-producing *E. coli* strains are of pathogenic significance. Moreover, the level of microbiological risk varies with product composition, water activity, pH, packaging system, processing conditions, and shelf life. High protein and fat contents, combined with low water activity in the product matrix, can affect the thermal inactivation kinetics of certain microorganisms, thereby necessitating product-by-product validation of thermal processes. Furthermore, the trend towards "clean labelling" and the reduced use of synthetic preservatives are increasing the need for novel control approaches to ensure adequate shelf life and microbiological safety. Protective cultures, bacteriocins, plant extracts, and other natural antimicrobial compounds may be considered complementary bio-preservation strategies in combination with non-thermal technologies such as high-pressure processing and cold plasma, provided that their suitability and efficacy are appropriately validated. Consequently, ensuring microbiological safety in plant-based alternatives requires product-specific risk analyses throughout the entire food chain, from raw material sourcing to consumption. Based on current food safety principles, the development of HACCP plans that account for formulation, processing, packaging, storage, and consumption conditions must be supported by process validation, environmental monitoring, shelf-life verification, and appropriate microbiological criteria. This approach may contribute to both the protection of consumer health and the safe and sustainable development of the plant-based food sector.

Keywords: Plant-based alternatives, food safety, *Bacillus cereus*, *Salmonella* spp., *Listeria monocytogenes*, biopreservation, HACCP.

FONKSİYONEL GIDALARIN TOPLU BESLENME SİSTEMLERİNE ENTEGRASYONU

INTEGRATION OF FUNCTIONAL FOODS INTO MASS CATERING SYSTEMS

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ÖZET

Genel ifadesiyle fonksiyonel gıdalar, temel beslenmenin ötesinde sağlık faydaları olabilecek herhangi bir yiyecek veya gıda bileşenini içeren gıdalar olarak kabul edilir. Fonksiyonel gıdalar; doğal olarak biyoaktif bileşen içeren **geleneksel gıdalar,** mevcut bir bileşenin miktarı artırılmış **zenginleştirilmiş gıdalar**, normalde bulunmayan veya yetersiz bulunan bir besin öğesinin eklendiği **güçlendirilmiş gıdalar** ve belirli bileşenleri azaltılmış, uzaklaştırılmış veya başka bir bileşenle değiştirilmiş **modifiye gıdalar** şeklinde sınıflandırılabilir.

Toplu yemek hizmeti sunan okul, hastane, yaşlı bakım evleri gibi kurumların yemek planlarına fonksiyonel gıdaların entegre etmeleri hem hedef kitlenin ihtiyaç duyduğu besinlere daha iyi ulaşabilmesini sağlayacak hem de kişilerin sağlıklı beslenme alışkanlıkları kazanmasına yardımcı olacaktır. Ancak bu entegrasyonun başarılı olabilmesi için maliyet, tüketici kabulü, ürün standardizasyonu, personel eğitimi ve raf ömrünün korunmasına yönelik stratejilerin geliştirilmesi gerekmektedir.

Bu çalışmada, fonksiyonel gıdaların toplu beslenme sistemlerine entegrasyonu; farklı uygulama alanları, menü planlama stratejileri, işleme ve pişirme yöntemleri, tüketici tercihleri ve uygulamayı etkileyen teknolojik ve operasyonel faktörler açısından değerlendirilmiştir. Bu kapsamda hastane ve yaşlı bakım kurumlarında enerji ve protein yoğunluğunun artırılması, okul ve işyeri yemekhanelerinde tam tahıl, meyve, sebze, kuruyemiş ve baklagil çeşitlerine erişilebilirliğinin artırılması önerilebilir. Fonksiyonel bileşenlerin kullanımında gıda matriksi, işlem koşulları, bileşen stabilitesi ve duyusal özelliklerin dikkate alınması gerekmektedir. Uygulamalar kurumun olanakları ve hedef grubun beslenme gereksinimlerine göre planlanmalıdır. Mevcut çalışmalar, uygun şekilde planlanan fonksiyonel ve sağlığı destekleyici uygulamaların toplu beslenme hizmetlerinde beslenme kalitesinin geliştirilmesine katkı sağlayabileceğini göstermektedir.

Anahtar Kelimeler: Sürdürülebilir beslenme, zenginleştirilmiş gıdalar, menü planlama, fonksiyonel gıdalar

ABSTRACT

In general terms, functional foods are considered to be foods containing any food or food component that may have health benefits beyond basic nutrition. Functional foods can be classified as traditional foods that naturally contain bioactive components, enriched foods in which the amount of an existing component has been increased, fortified foods to which a nutrient that is normally absent or

insufficient has been added, and modified foods in which certain components have been reduced, removed, or replaced with another component.

The greater integration of functional foods into the meal plans of institutions providing mass catering services, such as schools, hospitals, and nursing homes, will both enable the target population to have better access to the nutrients they need and help individuals develop healthy eating habits. However, for this integration to be successful, strategies for cost, consumer acceptance, product standardization, staff training, and the preservation of shelf life need to be developed.

In this study, the integration of functional foods into mass catering systems was evaluated in terms of different application areas, menu planning strategies, processing and cooking methods, consumer preferences, and technological and operational factors affecting implementation. In this context, increasing energy and protein density in hospitals and elderly care institutions, and increasing accessibility to whole grains, fruits, vegetables, nuts, and legumes in school and workplace cafeterias can be recommended. When using functional components, the food matrix, processing conditions, component stability, and sensory properties should be taken into consideration. Applications should be planned according to the capabilities of the institution and the nutritional requirements of the target group. Existing studies indicate that appropriately planned functional and health-supportive practices can contribute to improving nutritional quality in mass catering services.

Keywords: Sustainable nutrition, enriched foods, menu planning, functional foods

ANADOLU'NUN SAKLI HAZİNESİ MADIMAK (POLYGONUM COGNATUM) BİTKİSİNİN FENOLİK, FLAVONOİD İÇERİĞİ VE DPPH ANTİOKSİDAN AKTİVİTESİ ÜZERİNE ETKİSİ: ÖN ÇALIŞMA

THE HIDDEN TREASURE OF ANATOLIA: THE EFFECT ON PHENOLIC, FLAVONOID CONTENT, AND DPPH ANTIOXIDANT ACTIVITY OF MADIMAK (POLYGONUM COGNATUM) PLANT: A PRELIMINARY STUDY

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ÖZET

Tarihsel olarak, bitkiler geleneksel tedavi uygulamalarında yaygın olarak kullanılmıştır. Son yıllarda, tıbbi bitkilerin kullanımı, diğer tedavilerle birlikte tamamlayıcı ve alternatif bir tedavi yöntemi olarak kabul görmektedir. Hastalıkların büyük çoğunluğu serbest radikallerin oluşumuyla ilişkilidir. Serbest radikaller aerobik yaşamın ve metabolizmanın önemli bir parçasıdır. Bitkiler, serbest radikallerin neden olduğu hastalıklara karşı koruma sağlayan çok sayıda antioksidan moleküller içermektedir. Tıbbi öneme ve antioksidan özelliklere sahip bitkilerin ana bileşenleri genellikle fenoller ve flavonoidlerdir. Yapıları nedeniyle serbest radikalleri temizleme yeteneğine sahiptir. Bu bağlamda, geleneksel olarak tüketilen ve zengin bir fitokimyasal profiline sahip olan madımak (*Polygonum cognatum*) bitkisinin etki mekanizmalarının ve biyolojik aktivitelerinin incelenmesi önem arz etmektedir. Madımak (*Polygonum cognatum*), *Polygonaceae* (Kuzukulağıgiller) ailesinden gövdesi toprak üstüne yatık, pembe çiçekli, yaprak kını gövdeyi saran ve zarımsı yapıda olan çok yıllık otsu yabani bir bitkidir. Bitki örtüsü zenginliği açısından Anadolu, dünyanın en önemli coğrafyalarından biridir. Madımak (*Polygonum cognatum*) Türkiye'de Orta Anadolu'da yol ve tarla kenarlarında doğal olarak yetişen bir bitki türüdür. Bu ön çalışmanın amacı, farklı çözücüler kullanılarak hazırlanan madımak ekstraksiyonlarının total fenolik madde miktarı, total flavonoid içerikleri ve DPPH* radikal süpürücü aktivitelerinin karşılaştırılmalı olarak değerlendirilmesidir. Çalışma kapsamında, kurutulmuş ve öğütülmüş madımak bitkisinin etanol, metanol ve su ekstraksiyonları

gerçekleştirilmiştir. Elde edilen ekstraksiyonların total fenolik madde miktarı, total flavonoid içerik ve DPPH* radikal süpürücü aktivite analizleri yürütülmüştür. Kurutulmuş ve öğütülmüş madımak bitkisi üzerinde yapılan analizler; metanol, etanol ve su ekstraktları için toplam fenolik içeriği sırasıyla 41,35, 37,31 ve 25,98 mg GAE/g bulunmuştur. Aynı ekstraktlar için toplam flavonoid içeriği ise sırasıyla 112,50, 109,50 ve 64,16 mg RE/g olarak belirlenmiştir. DPPH* radikal süpürücü aktiviteleri ise sırasıyla 8,95, 8,31 ve 9,36 mg/g GAE olarak ölçülmüştür. Yürütülen analizler sonucunda, madımak bitkisinin farklı çözücü ekstraksiyonlarındaki biyoaktif bileşen profilleri arasında farklılıklar görülürken, antioksidan aktivitelerinin birbirine yakın ve benzer seviyelerde olduğu tespit edilmiştir. Metanolik ekstraktların fenolik ve flavonoid içeriği daha yüksek bulunmuştur. Bu ön çalışma bulguları, madımak bitkisinin önemli düzeyde biyoaktif bileşenler barındırdığını ve güçlü bir antioksidan potansiyele sahip olduğunu ortaya koymaktadır. Sonuç olarak, bu bulgular madımak bitkisinin gelecekteki fonksiyonel gıda ürünleri, diyet takviyeleri ve farmasötik uygulamalardaki potansiyeline ışık tutabilir. Elde edilen bu ön çalışma sonuçlarının; *in vitro* ve *in vivo* biyolojik aktivite uygulamaları ile toksikoloji ve ileri düzey kromatografik içerik analizleriyle desteklenmesiyle, bitkinin endüstriyel ve tıbbi alanda katma değer yaratan ürünlere dönüştürülmesine sağlam bir temel oluşturacağı değerlendirilmektedir.

Anahtar Kelimeler: doğal ürün, DPPH*, fenolik, flavonoid, madımak, *Polygonum cognatum*.

ABSTRACT

Plants have been utilized extensively in conventional medicine throughout history. The use of medicinal plants has become more widely accepted in recent years as an alternative and supplemental therapeutic approach to traditional medicines. The majority of diseases are associated with the generation of free radicals. A vital aspect of aerobic life and metabolism are free radicals. Plants contain numerous antioxidant molecules that provide protection against diseases induced by free radicals. The primary active constituents of plants with medicinal significance and antioxidant properties are generally phenols and flavonoids, which possess the capability to scavenge free radicals due to their chemical structures. In this context, it is of significant importance to investigate the mechanisms of action and biological activities of madımak (*Polygonum cognatum*), a traditionally consumed plant with a rich phytochemical profile. The perennial herbaceous wild plant *Polygonum cognatum* is a member of the *Polygonaceae* family. It has a horizontal stem, pink flowers, and a membrane ochrea (leaf sheath) that surrounds the stem. Anatolia is one of the world's most prominent regions in terms of floral diversity. *Polygonum cognatum* naturally grows along roadsides and field edges, particularly in Central Anatolia, Türkiye. This preliminary study aimed to comparatively evaluate the total phenolic content, total flavonoid content, and DPPH* radical scavenging activities of *Polygonum cognatum* extracts prepared using different solvents. Within the scope of the study, ethanol, methanol, and aqueous extractions of dried and powdered plant material were performed. Analyses of total phenolic content, total flavonoid content, and DPPH* radical scavenging activity were subsequently conducted. The total phenolic contents of the methanol, ethanol, and aqueous extracts of the dried and ground plant were found to be 41.35, 37.31, and 25.98 mg GAE/g, respectively. The total flavonoid contents were determined as 112.50, 109.50, and 64.16 mg RE/g, respectively. Furthermore, the DPPH* radical scavenging activities were measured as 8.95, 8.31, and 9.36 mg GAE/g, respectively. The analyses revealed notable differences among the bioactive component profiles of the plant across different solvent extractions, whereas their antioxidant activities were found to be close and at comparable levels. Notably, methanolic extracts exhibited higher phenolic and flavonoid contents. These preliminary findings demonstrate that *Polygonum*

cognatum harbors significant levels of bioactive components and possesses a strong antioxidant potential. In conclusion, these results may provide insight into Polygonum cognatum's potential for use in dietary supplements, pharmaceuticals, and functional food products in the future. It is considered that supporting these preliminary results with *in vitro* and *in vivo* biological activity assays, toxicology studies, and advanced chromatographic analyses will provide a robust foundation for transforming the plant into value-added products in industrial and medical fields.

Keywords: DPPH*, flavonoid, madımak, natural product, phenolic, *Polygonum cognatum*.

GÖKKUŞAĞI ALABALIĞI FİLETOLARINDA NANOPARTİKÜL UYGULAMASI: DONDURULMUŞ ÜRÜNLERDE SU TUTMA KAPASİTESİNİN DEĞİŞİMİ

NANOPARTICLE APPLICATION IN RAINBOW TROUT FILLETS: CHANGES IN WATER-HOLDING CAPACITY IN FROZEN PRODUCT

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ÖZET

Et işleme araştırmalarının odağı koruma/yumuşatma merkezli işlemlerden, koordineli kontrole doğru kaymaktadır. Bu yeni eğilimde su tutma kapasitesi (WHC) dikkat çeken bir parametre olarak gösterilmektedir. Bu sebeple mevcut çalışmada, dondurulmuş gökkuşağı alabalık filetolarında nanopartikül uygulamalarının etkinliği su tutma kapasitesi üzerinden değerlendirilmiştir. Bu amaçla tüm uygulamalarda alabalık filetoları daldırma tekniği ile kaplanmıştır. Uygulama grupları negatif kontrol (C; saf suya daldırıldı), pozitif kontrol sadece kitosan (Ch), nanopartikül (PG-ZnO) ve *Punica granatum* özütü (PG) olarak dizayn edilmiş ve kaplama işlemi tamamlanan filetolar plastik tabaklara yerleştirilerek -18 °C'de sekiz hafta boyunca depolanmıştır. Depolamanın belirli aralıklarında (2 haftada bir) her uygulama grubuna ait çiğ filetoların sırt bölgesinden ve yan çizginin (lateral hat) üzerindeki beyaz kas dokusundan alınan tekrarlı örneklerde WHC ölçülmüştür. Elde edilen bulgular, WHC'nin depolamanın ilk dönemlerinde (onbes ve otuzuncu günlerde) gruplar üzerinde ayrıştırıcı bir etki yaratmadığını, ancak depolamanın son dönemlerinde (kırkbes ve altmışındı günler) çok güçlü ve belirgin farklar ortaya çıkardığını göstermiştir. Grup bazlı değerlendirmelerde ise özellikle depolamanın son dönemlerinde bile Ch ve PG-ZnO uygulamalarına ait filetolarda su tutma kapasitesi kontrole göre yüksek bulunmuştur ($p<0,05$). Elde edilen bulgular, PG-ZnO uygulamasının -18 °C'de depolama koşullarında gökkuşağı alabalığı filetolarının depolama kalitesini korumak için umut verici bir yöntem olmasının yanı sıra su ürünleri işleme endüstrisinde geniş bir uygulama potansiyeline sahip olabileceğini ortaya koymuştur.

Anahtar Kelimeler: su tutma kapasitesi, gökkuşağı alabalığı, raf ömrü

ABSTRACT

The focus of meat processing research is shifting from preservation/tenderization-oriented treatments towards coordinated control. Within this emerging trend, water-holding capacity (WHC) is highlighted

as a notable parameter. Therefore, the present study evaluated the effectiveness of nanoparticle (NPs) treatments in frozen rainbow trout fillets through water-holding capacity. For this purpose, rainbow trout fillets in all treatment groups were coated using the dipping technique. The treatment groups were designed as a negative control (C; immersed in distilled water), a positive control consisting of chitosan alone (Ch), nanoparticles (PG-ZnO), and *Punica granatum* extract (PG). Following coating, the fillets were placed on plastic trays and stored at −18 °C for eight weeks. At specified intervals during storage (every two weeks), WHC was measured in replicate samples collected from the dorsal region and the white muscle tissue above the lateral line of raw fillets from each treatment group. The findings showed that WHC did not distinguish between the groups during the early stages of storage (days fifteen and thirty), whereas very strong and marked differences emerged during the later stages (days forty-five and sixty). Group-level evaluations further revealed that, even during the later stages of storage, fillets treated with Ch and PG-ZnO exhibited higher water-holding capacity than the control ($p < 0.05$). These findings demonstrated that PG-ZnO treatment may be a promising method for maintaining the storage quality of rainbow trout fillets at −18 °C and may also have broad application potential in the seafood processing industry.

Keywords: water-holding capacity, rainbow trout, shelf life

KIZILCIK EKSTRAKTI İLAVESİNİN SODYUM ALJİNAT BAZLI YENİLEBİLİR FİLMLERİN FİZİKSEL VE FENOLİK ÖZELLİKLERİ ÜZERİNE ETKİSİ

EFFECTS OF CORNELIAN CHERRY EXTRACT ADDITION ON THE PHYSICAL AND PHENOLIC PROPERTIE OF SODIUM ALGINATE-BASED EDIBLE FILMS

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ÖZET

Gıda ambalajlama endüstrisindeki gelişmelere paralel olarak, gıda kalitesinin korunması ve raf ömrünün uzatılmasına yönelik yenilebilir film ve kaplamaların kullanımı önem kazanmıştır. Bu çalışmada, farklı oranlarda kızılcık ekstraktı ilavesinin sodyum aljinat bazlı yenilebilir filmlerin fiziksel ve fenolik özellikleri üzerine etkisinin belirlenmesi amaçlanmıştır. Film oluşturucu çözeltiler %2 sodyum aljinat, %2 gliserol, %2 lesitin kullanılarak hazırlanmış, formülasyonlara %0 (kontrol), %5 ve %10 oranlarında kızılcık ekstraktı ilave edilmiştir. Hazırlanan film çözeltilerinden 25 mL alınarak döküm yöntemiyle filmler elde edilmiştir. Elde edilen filmlerde kalınlık, nem, renk, (L*, a*, b*) ve toplam fenolik madde analizleri gerçekleştirilmiştir. Kontrol, %5 ve %10 gruplarında film kalınlıkları sırasıyla 0,091±0,008, 0,117±0,019 ve 0,114±0,009 mm, nem içerikleri ise %44,68±2,01, %45,03±0,57, %46,23±0,80 olarak belirlenmiş, gruplar arasındaki farklılıklar anlamlı bulunmamıştır (p>0,05). Renk analizinde L*(p=0,928) ve a*(p=0,886) değerlerinde anlamlı farklılık görülmezken, b* değerinde anlamlı farklılık belirlenmiştir (p=0,018). Toplam fenolik madde miktarları sırasıyla 0,11395±0,00787, 0,27160±0,01822 ve 0,3602±0,01950 mg GAE/g film olarak belirlenmiş ve kızılcık ekstraktı ilavesinin toplam fenolik madde miktarını anlamlı düzeyde arttığı saptanmıştır.

Anahtar Kelimeler: Gıda Ambalajı, Yenilebilir Film, Kızılcık, Sodyum Aljinat

ABSTRACT

In parallel with developments in the food packaging industry, the use of edible films and coating has gained increasing importance for preserving food quality and extending shelf life. This study aimed to determine the effects of different concentrations of cranberry extract on the physical and phenolic properties of sodium alginate-based edible films. Film-forming solutions were prepared using 2% sodium alginate, 2% glycerol, and 2% lecithin, and cranberry extract was incorporated into the formulations at concentrations of 0% (control), 5% and %10. Films were produced by the casting method using 25 mL of each film-forming solution. The resulting films were analyzed for thickness, moisture content, color (L*, a*, b*) and total phenolic content. Film thickness for the control, 5% and %10 groups were 0.091±0.008, 0.117±0.019 and 0.114±0.009 mm, respectively while moisture contents were 44.68±2.01%, 45.03±0.57%, 46.23±0.80% respectively. No significant differences were observed among the groups for these parameters (p> 0.05). Color analysis revealed no significant differences in L*(p=0.928) and a*(p=0.886) values, wheras a significant difference was observed in b* values (p=0.018). Total phenolic contents were determined as 0.11395±0.00787, 0.27160±0.01822

and 0.3602±0.01950 mg GAE/g film for the control 5% and%10 groups, respectively. The addition of cranberry extract significantly increased the total phenolic content of the films

Keywords: Food packaging, Edible film, Cranberry, Sodium Algınate

KAKULE (ELETTARİA CARDAMOMUM) YAĞININ HT-29 VE MDA-MB-231 KANSER HÜCRELERİNDEKİ HÜCRE CANLILIĞI ÜZERİNE ETKİSİNİN İNCELENMESİ

INVESTIGATION OF THE EFFECT OF CARDAMOM (ELETTARIA CARDAMOMUM) OIL ON CELL VIABILITY IN HT-29 AND MDA-MB-231 CANCER CELL LINES

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ÖZET

Uçucu yağlar; çeşitli yöntemlerle tek bir bitki türünden elde edilen, uçucu bileşiklerin oluşturduğu karmaşık karışımlardır. En çok aroma, koku ve kozmetik alanlarında kullanımlarıyla bilinseler de, tedavi edici ajanlar gibi farklı amaçlarla da kullanılmışlardır. Tedavi amaçlı kullanım biçimleri, söz konusu yağların biyolojik aktivitelerine yönelik ilginin artmasını sağlamıştır. Kakule (*Elettaria cardamomum*), kendine özgü aroması ve zengin biyoaktif bileşen içeriği nedeniyle hem farklı gıda ve içeceklerin hazırlanmasında hem de tıptaki iyileştirici özellikleri nedeniyle kullanılan, bilinen en eski baharatlardan biridir. Özellikle tohumlarında bulunan uçucu yağlar, fenolik bileşikler ve diğer fitokimyasallar, kakulenin aroma ve lezzet verici bir bileşen olarak değil, aynı zamanda fonksiyonel özellikleri açısından da dikkat çekmesini sağlamaktadır. Gıda sektöründe yapılan çalışmalarda kakulenin antibakteriyel etkinliği olduğu ve ayrıca gıda koruyucusu olarak da kullanılabileceği öngörülmektedir. Yapılan sağlık üzerindeki çalışmalar, kakulenin antikanser etkinliği olduğunu göstermektedir. Bu çalışmadaki amaç kakule yağının insan kolorektal adenokarsinom (HT-29) ve insan üçlü negatif meme adenokarsinom (MDA-MB-231) hücre hatları üzerindeki etkisini ortaya koymaktır. Kakule esansiyel yağı dimetilsülfoksitte (DMSO) çözündürüldükten sonra RPMI ile dilüe edilerek 80 mg/mL'lik stok çözelti hazırlanmıştır. İnsan kolorektal adenokarsinom (HT-29) ve insan üçlü negatif meme adenokarsinom (MDA-MB-231) hücre hatlarına 0 ve 80 mg/mL konsantrasyon aralığında uygulanmıştır. Her konsantrasyon için dört analiz gerçekleştirilmiştir (n=4). Hücre canlılık testi spektrofotometrik ölçüm prensibine dayanan dimetiltiyazol difeniltetrazolyum bromid (MTT) analizi yöntemiyle yapılmıştır. Kontrol grubu %100 canlı kabul edilerek, uygulanan konsantrasyonların canlılık yüzdeleri hesaplanmıştır. HT-29 ve MDA-MB-231 hücre hatlarında 48 saatlik MTT sonuçlarında doza bağlı olarak hücre canlılığında değişimler gözlenmiştir. Her iki hücre hattında da (HT-29: %70,31; MDA-MB-231: %55,27) en düşük canlılık 80 mg/mL konsantrasyonda

tespit edilmiştir. Ancak IC50 değeri belirlenememiştir. HT-29 hücre hattına kakule yağının 6,25 ve 50 mg/mL konsantrasyonlarındaki uygulaması hücrelerde proliferatif bir etkiye neden olmuştur. Elde edilen bulgular, kakule yağının yüksek konsantrasyonlarda her iki kanser hücre hattında hücre canlılığını azaltabildiğini, ancak 48 saatlik uygulama koşullarında IC50 değerine ulaşılmadığını göstermektedir. HT-29 hücrelerinde bazı konsantrasyonlarda gözlenen proliferatif etki ise kakule yağının hücre tipine ve konsantrasyona bağlı farklı biyolojik yanıtlar oluşturabileceğini düşündürmektedir. Bu sonuçlar, kakule yağının antikanser potansiyelinin değerlendirilmesinde hücre tipi gibi faktörlerin dikkate alınması gerektiğini ortaya koymakta ve geleneksel tedaviye tamamlayıcı bir tedavi arayışına yönelik daha kapsamlı çalışmalar için umut vadetmektedir. Kanser hücrelerinde inflamasyon, oksidatif stres, apoptoz ve hücre proliferasyonu ile ilişkili biyokimyasal yolakların ve bu süreçleri yansıtan belirteçlerin analiz edilmesi, kakule yağının hücresel metabolik süreçler üzerindeki etkilerinin ve olası antikanser mekanizmalarının daha kapsamlı şekilde ortaya konulmasına katkı sağlayacaktır.

Anahtar Kelimeler: doğal ürün, kakule yağı, kanser, hücre kültürü.

ABSTRACT

Essential oils are complex mixtures of volatile compounds obtained from a single plant species through various extraction methods. Although they are primarily known for their use in aroma, scent, and cosmetic applications, they have also been used for various purposes, including as therapeutic agents. Due to their therapeutic applications, interest in their biological activities has increased. Cardamom (*Elettaria cardamomum*) is one of the oldest known spices and is widely used in the preparation of various foods and beverages due to its distinctive aroma and rich content of bioactive compounds. It has also been traditionally used for medicinal purposes because of its potential therapeutic properties. Its seeds contain essential oils, phenolic compounds, and other phytochemicals that contribute to its characteristic aroma and flavor. These compounds have also attracted attention due to their potential functional properties. Studies conducted in the food sector have reported that cardamom exhibits antibacterial activity and may also have potential for use as a food preservative. Studies investigating its health-related effects have indicated that cardamom has anticancer activity. The aim of this study was to investigate the effects of cardamom oil on human colorectal adenocarcinoma (HT-29) and human triple-negative breast adenocarcinoma (MDA-MB-231) cell lines. Cardamom essential oil was dissolved in dimethyl sulfoxide (DMSO) and then diluted with RPMI to prepare an 80 mg/mL stock solution. Human colorectal adenocarcinoma (HT-29) and human triple-negative breast cancer (MDA-MB-231) cell lines were treated with cardamom essential oil at doses ranging from 0 to 80 mg/mL. For every concentration, four analyzes were carried out (n = 4). Cell viability was examined using the dimethylthiazol diphenyltetrazolium bromide (MTT) test, which is based on a spectrophotometric measurement method. The viability percentages of the cells treated with the various amounts were calculated using the control group, which was regarded as having 100% viability. The 48-hour MTT results showed dose-dependent changes in cell viability in both HT-29 and MDA-MB-231 cell lines. The lowest cell viability was detected at a concentration of 80 mg/mL in both cell lines (HT-29: 70.31%; MDA-MB-231: 55.27%). But an IC50 value could not be determined. Treatment of HT-29 cells with cardamom oil at concentrations of 6.25 and 50 mg/mL resulted in a proliferative effect. These findings indicate that cardamom oil can reduce cell viability in both cancer cell lines at higher concentrations; however, an IC50 value was not reached under the 48-hour treatment conditions. The proliferative effect observed at certain concentrations in HT-29 cells suggests that cardamom oil may induce different biological responses depending on cell type and concentration. Factors such as cell type should be considered when evaluating the anticancer potential of cardamom oil. Further comprehensive studies are needed to investigate its potential as a

complementary approach to conventional cancer treatment. Analysis of biochemical pathways associated with inflammation, oxidative stress, apoptosis, and cell proliferation, together with biomarkers reflecting these processes, may contribute to a more comprehensive understanding of the effects of cardamom oil on cellular metabolic processes and its potential anticancer mechanisms in cancer cells.

Keywords: natural product, cardamom oil, cancer, cell culture.

FARKLI KONSANTRASYONLARDAKİ PROTEİN HİDROLİZATLARI İLE HİDROJEL ÜRETİMİ VE KARAKTERİZASYONU

HYDROGEL PRODUCTION AND CHARACTERIZATION USING PROTEIN HYDROLYSATES FROM DIFFERENT CONCENTRATIONS

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ÖZET

Bu çalışmada whey, jelatin, kolajen ve gluten protein kaynaklarından %1.25, %2.5 ve %5 hidroliz derecelerinde enzimatik hidroliz ile elde edilen protein hidrolizatlarının %30 ve %40 konsantrasyonlarda hidrojel oluşturma kapasitelerinin belirlenmesi ve bu sistemlerin fonksiyonel gıda uygulamaları göz önünde bulundurularak potansiyelinin değerlendirilmesi amaçlanmıştır.

Hidrojellerin karakterizasyonu FTIR, renk ve zeta potansiyel analizleri ile gerçekleştirilmiştir. FTIR analizinde, whey pH ilaveli örneklerinde özellikle 3300 cm^{-1} (Amid A) ve 1635 cm^{-1} (Amid I) piklerini daha spesifik olarak işaretlediği görülüyor. Bu, PH değişiminin proteinlerin ikincil yapısındaki hidrojen bağlarında değişikliklere neden olabileceğini göstermektedir.Renk analizinde, jelatin grubunda b *değerinde $p<0,001$ düzeyinde anlamlı düşüş, whey %40 grubunda ise b*=9,13 ile $p=0,003$ düzeyinde anlamlı artış gözlenmiştir. Zeta potansiyel analizinde, ZP_kolajen değişkenine ilişkin yapılan tek yönlü varyans analizi (ANOVA) sonucunda gruplar arasında istatistiksel olarak anlamlı farklılık olduğu belirlenmiştir ($F = 20,846$; $p < 0,001$). Bu durum, deneysel uygulamaların ZP_kolajen değeri üzerinde güçlü bir etkiye sahip olduğunu göstermektedir. Tukey HSD post-hoc testi sonuçlarına göre gruplar iki homojen alt kümeye ayrılmıştır. Zeta kontrol, %30 kontrol, %2,5 ve %5 kolajen grupları birinci homojen grup (^{a}) içerisinde yer almış ve daha düşük ZP_kolajen değerleri göstermiştir. Buna karşılık %30 pH ilaveli, %40 kontrol ve %40 pH ilaveli grupları ikinci homojen grup (^{b}) içerisinde yer alarak daha yüksek ZP_kolajen değerleri sergilemiştir. Elde edilen sonuçlar, kolajen konsantrasyonu ve pH ilavesinin ZP_kolajen değeri üzerinde belirleyici bir etkiye sahip olduğunu göstermektedir.

Sonuç olarak, protein kaynağı, konsantrasyon ve pH uygulamasının hidrojel sistemlerinin yapısal özelliklerini etkilediği belirlenmiştir. Genel olarak, elde edilen bulgular protein hidrolizatlarından elde edilen hidrojellerin fonksiyonel gıda uygulamalarındaki kullanım potansiyelinin belirlenmesi için biyoaktif özelliklerinin ileri çalışmalarla değerlendirilmesi gerekmektedir.

Anahtar Kelimeler: Hidrojel, protein hidrolizatı, FTIR, zeta, renk

ABSTRACT

This study aimed to determine the hydrogel-forming capacity of protein hydrolysates obtained from whey, gelatin, collagen, and gluten protein sources through enzymatic hydrolysis at degrees of

hydrolysis of 1.25%, 2.5%, and 5%, at concentrations of 30% and 40%, and to evaluate the potential of these systems for functional food applications.

The hydrogels were characterized using Fourier-transform infrared spectroscopy (FTIR), color, and zeta potential analyses.FTIR analysis showed that the whey samples subjected to pH modification exhibited more pronounced peaks particularly at 3300 cm^{-1} (Amide A) and 1635 cm^{-1} (Amide I). These findings suggest that pH modification may induce changes in the hydrogen-bonding interactions associated with the secondary structure of proteins.Color analysis revealed a statistically significant decrease in the b* value in the gelatin group ($p<0.001$), whereas a statistically significant increase was observed in the 40% whey group, which exhibited a b* value of 9.13 ($p=0.003$).In the zeta potential analysis, one-way analysis of variance (ANOVA) revealed a statistically significant difference among the groups for the ZP_collagen variable ($F=20.846$; $p<0.001$), indicating a significant effect of the experimental treatments on ZP_collagen values. According to the Tukey HSD post-hoc test, the groups were classified into two homogeneous subsets. The zeta control, 30% control, 2.5% collagen, and 5% collagen groups were included in the first homogeneous subset (^{a}) and exhibited lower ZP_collagen values. In contrast, the 30% pH-modified, 40% control, and 40% pH-modified groups were included in the second homogeneous subset (^{b}), exhibiting higher ZP_collagen values.Overall, these findings demonstrate that collagen concentration and pH modification have significant effects on ZP_collagen values and, consequently, may influence the physicochemical and colloidal characteristics of the hydrogel systems. The observed differences in FTIR and zeta potential profiles indicate that both protein concentration and processing conditions should be considered when designing protein hydrolysate-based hydrogel systems for potential functional food applications.

In conclusion, protein source, concentration, and pH treatment were found to affect the structural properties of the hydrogel systems. The findings indicate that hydrogels obtained from protein hydrolysates have potential for use in functional food applications. However, further studies are required to evaluate their bioactive properties and to confirm their potential for functional food applications.

Keywords: Hydrogel, protein hydrolysate, FTIR, zeta, color

SIĞIRKUYRUĞU BİTKİSİNİN (*VERBASCUM* SP.) ANTİOKSİDAN İÇERİK YÖNÜNDEN İNCELENMESİ

INVESTIGATION OF THE ANTIOXIDANT CONTENT OF MULLEIN (*VERBASCUM* SP.)

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ÖZET

Gıda endüstrisinde sentetik antioksidanlara yönelik artan tüketici kaygıları, doğal alternatif arayışlarını hızlandırmıştır. Bitkilerde bulunan fitokimyasallar, sayısız sağlık yararı ve hastalık önleme özelliğine sahip kimyasal moleküllerdir. Fitokimyasallar besin takviyesi açısından önem taşır ve sağlığı koruyan, gıda ile ilaç endüstrileri arasında köprü görevi gören biyoaktif bileşenlerdir. Fenolik bileşikler, bitkilerdeki fitokimyasal içeriğin %45'lik kısmını oluşturarak bu alandaki en yaygın grubu temsil eder. Bitkiler doğal olarak antioksidan ve serbest radikal temizleme özelliklerine sahiptir. Geleneksel tıpta yüzyıllardır kullanılan, Scrophulariaceae familyasına ait, geniş bir coğrafi yayılım gösteren *Verbascum* sp. (Sığırkuyruğu), zengin fenolik ve flavonoid içeriğiyle dikkat çekmektedir. Bu çalışmada, Sığırkuyruğu'nun farklı çözücülerle elde edilen ekstraktları toplam fenolik ve flavonoid madde içeriği ile antioksidan kapasite açısından değerlendirilmiştir. Çalışmada *Verbascum* sp. (Sığırkuyruğu) bitkisinin su, etanol ve metanol çözücülerinde hazırlanmış ekstraktları kullanılmıştır. Her ekstraksiyon için üç ayrı tekrar yapılmış; DPPH radikal süpürücü aktivitesi, toplam polifenol ve flavonoid içeriği spektrofotometrik olarak analiz edilmiştir. Sığırkuyruğu fenolik madde içeriği metanolik, etanolik ve sulu ekstraksiyonlarında sırasıyla 14.14 ± 4.86, 6.65 ± 1.21, 4.25 ± 0.99 mg GAE/g; flavonoid içeriği metanolik, etanolik ve sulu ekstraksiyonları sırasıyla 39.62 ± 16.58, 13.85 ± 4.94, 8.83 ± 2.31 mg RE/g, olarak tespit edilmiştir. DPPH radikal süpürme aktivitesi metanolik, etanolik ve sulu ekstraksiyonlarında sırasıyla 5.77 ± 0.28, 4.38 ± 0.74, 0.72 ± 0.19 mg GAE/g bulunmuştur. Sığırkuyruğu bitkisinin, metanolik ekstraksiyonlarının su ve etanolik ekstraksiyonlarına oranla daha yüksek flavonoid ve fenolik madde ile antioksidan aktiviteye sahip olduğu belirlenmiştir. Bu çalışmada, *Verbascum* sp. ekstraktlarının biyoaktif bileşen içerikleri ve antioksidan potansiyellerinin kullanılan çözücüye bağlı olarak farklılık gösterdiği belirlenmiştir. Elde edilen bulgular, *Verbascum* sp. bitkisinin fenolik ve flavonoid bileşikler açısından zengin bir doğal kaynak olabileceğini ve özellikle antioksidan özellikleri bakımından gıda bileşeni veya fonksiyonel gıda geliştirme çalışmalarında değerlendirilme potansiyeli taşıdığını göstermektedir. Bununla birlikte, bitkinin gıda

formülasyonlarındaki nihai yerini alabilmesi için spesifik biyoaktif bileşenlerin profillenmesi, gıda matrisindeki stabilitelerinin incelenmesi ve ürün bazlı ileri çalışmaların yapılması gerekmektedir.

Anahtar Kelimeler: *Verbascum* sp., sığırkuyruğu, doğal antioksidan, gıda katkısı, fonksiyonel gıda, polifenol.

ABSTRACT

Increasing consumer concerns regarding synthetic antioxidants in the food industry have accelerated the search for natural alternatives. Phytochemicals found in plants are chemical compounds with numerous health benefits and disease-preventive properties. Phytochemicals are important as dietary supplements and constitute bioactive compounds that help maintain health and serve as a bridge between the food and pharmaceutical industries. Phenolic compounds constitute approximately 45% of the phytochemical content of plants and represent the most abundant group in this field. Plants naturally possess antioxidant and free radical-scavenging properties. *Verbascum* sp. (mullein), a member of the Scrophulariaceae family that has been used in traditional medicine for centuries and has a wide geographical distribution, has attracted attention due to its rich phenolic and flavonoid content. In this study, extracts of mullein obtained using different solvents were evaluated in terms of total phenolic and flavonoid contents and antioxidant capacity. Extracts of *Verbascum* sp. (mullein) prepared using water, ethanol, and methanol were used in the study. Three independent replicates were performed for each extraction, and DPPH radical-scavenging activity, total phenolic content, and total flavonoid content were analyzed spectrophotometrically. The phenolic contents of mullein extracts obtained by methanolic, ethanolic, and aqueous extraction were determined as 14.14 ± 4.86, 6.65 ± 1.21, and 4.25 ± 0.99 mg GAE/g, respectively. The flavonoid contents were determined as 39.62 ± 16.58, 13.85 ± 4.94, and 8.83 ± 2.31 mg RE/g, respectively. DPPH radical-scavenging activities were found to be 5.77 ± 0.28, 4.38 ± 0.74, and 0.72 ± 0.19 mg GAE/g for the methanolic, ethanolic, and aqueous extracts, respectively. The methanolic extracts of *Verbascum* sp. were found to have higher phenolic and flavonoid contents and antioxidant activity compared with the aqueous and ethanolic extracts. In this study, it was determined that the bioactive compound contents and antioxidant potentials of *Verbascum* sp. extracts varied depending on the solvent used. The findings indicate that *Verbascum* sp. may be a rich natural source of phenolic and flavonoid compounds and has potential for use in food ingredient or functional food development studies, particularly due to its antioxidant properties. However, further studies are required to establish the potential use of the plant in food formulations, including profiling of specific bioactive compounds, investigation of their stability within food matrices, and product-based studies.

Keywords: *Verbascum* sp., mullein, natural antioxidant, food additive, functional food, polyphenol.

SOFRALIK ZEYTİN AMBALAJLAMA SİSTEMLERİNDE SÜRDÜRÜLEBİLİRLİK PARADİGMALARI: GELENEKSEL AMBALAJLARIN YAŞAM DÖNGÜSÜ ANALİZİ VE BİYOBOZUNUR ALTERNATİFLERİN GELECEĞİ

SUSTAINABILITY PARADIGMS IN TABLE OLIVE PACKAGING SYSTEMS: LIFE CYCLE ANALYSIS OF TRADITIONAL PACKAGING AND THE FUTURE OF BIODEGRADABLE ALTERNATIVES

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ÖZET

Sofralık zeytin, Akdeniz havzası başta olmak üzere küresel gıda endüstrisinde yüksek katma değere ve yaygın tüketim ağına sahip stratejik bir fermente üründür. Yüksek tuz içeriği, asidik salamura ortamı ve oksidasyona duyarlı doymamış yağ asidi profili, zeytin ambalajlamasında yüksek gaz, nem ve mekanik bariyer dayanımı gerektirmektedir. Sektörde geleneksel olarak cam kavanozlar, kalay kaplı teneke kutular ve çok katmanlı sentetik plastik filmler (PET/PE/EVOH laminasyonları) baskın olarak kullanılmaktadır. Cam ve teneke, yüksek inertlik ve geri dönüştürülebilirlik avantajı sunuyor olsa da yüksek üretim enerjisi, taşımadaki ağırlık faktörü ve buna bağlı karbon ayak izi nedeniyle sürdürülebilirlik parametrelerini olumsuz etkilemektedir. Çok katmanlı plastikler ise düşük karbon ayak izi sağlamakla birlikte, katman ayrıştırma güçlüğü nedeniyle geri dönüşüm döngülerine dahil edilememekte ve kalıcı çevre kirliliğine yol açmaktadır. Sofralık zeytin ambalajlamasında kullanılan mevcut ambalaj materyalleri; ham madde eldesinden atık yönetimine kadar uzanan Yaşam Döngüsü Analizi (LCA) perspektifinden incelenmiştir. Mevcut ambalajların çevresel yüklerine karşın, zeytinin mikrobiyal stabilitesini (özellikle laktik asit bakterileri ve mayaların dengesi) ve fenolik madde kompozisyonunu koruma etkinliği karşılaştırmalı olarak değerlendirilmiştir. Ayrıca, tarımsal yan akımlardan (pirina selülozu, kitosan ve polilaktik asit bazlı biyopolimerler) üretilen biyobozunur ve kompostlanabilir alternatiflerin sofralık zeytin salamura matriksindeki bariyer performansları, migrasyon riskleri ve raf ömrü kinetiği üzerindeki etkileri tartışılmıştır. Sonuç olarak, döngüsel biyoekonomi hedefleri doğrultusunda, sofralık zeytin endüstrisinin geleneksel yüksek emisyonlu ambalajlardan biyo-tabanlı ve aktif fonksiyonel kaplamalara geçiş yapmasının zorunluluğunu ortaya koymaktadır. Yeşil Mutabakat regülasyonları çerçevesinde zeytinin kalitesini ödün vermeden koruyabilen ve endüstriyel kompostlanabilirlik kriterlerini karşılayan yeni nesil biyopolimer formülasyonlarının geliştirilmesi, sektörün sürdürülebilirlik dönüşümünde önemli bir noktadadır.

Anahtar Kelimeler: Sofralık zeytin, Sürdürülebilir ambalaj, Yaşam döngüsü analizi (LCA), Biyobozunur polimerler, Yeşil mutabakat, Raf ömrü.

ABSTRACT

Table olives are a strategic fermented product with high added value and a widespread consumption network in the global food industry, particularly in the Mediterranean basin. Their high salt content, acidic brine environment, and unsaturated fatty acid profile—which is sensitive to oxidation—require olive packaging to provide high resistance to gas, moisture, and mechanical stress. Traditionally, the industry has predominantly used glass jars, tin-plated steel cans, and multilayer synthetic plastic films (PET/PE/EVOH laminates). While glass and steel offer the advantages of high inertness and recyclability, they negatively impact sustainability metrics due to high production energy consumption, the weight factor during transportation, and the associated carbon footprint. Multilayer

plastics, on the other hand, while providing a low carbon footprint, cannot be incorporated into recycling loops due to the difficulty of separating the layers, leading to persistent environmental pollution. The current packaging materials used in table olive packaging have been examined from a Life Cycle Assessment (LCA) perspective, spanning from raw material extraction to waste management. Despite the environmental impact of current packaging materials, their effectiveness in preserving the microbial stability of olives (particularly the balance of lactic acid bacteria and yeasts) and their phenolic compound composition was evaluated comparatively. In addition, the effects of biodegradable and compostable alternatives produced from agricultural byproducts (olive pomace cellulose, chitosan, and polylactic acid-based biopolymers) on barrier performance, migration risks, and shelf-life kinetics in the table olive brine matrix were discussed. In conclusion, in line with the goals of the circular bioeconomy, this study highlights the necessity for the table olive industry to transition from traditional, high-emission packaging to bio-based and active functional coatings. Within the framework of the Green Deal regulations, the development of new-generation biopolymer formulations that can preserve olive quality without compromise and meet industrial compostability criteria is a key element in the sector's sustainability transformation.

Keywords: Table olives, Sustainable packaging, Life cycle assessment (LCA), Biodegradable polymers, Green Deal, Shelf life.

MAYALAR TARAFINDAN ÜRETİLEN POSTBİYOTİKLER; FONKSİYONEL ÖZELLİKLERİ VE GIDA UYGULAMALARI

POSTBIOTICS PRODUCED BY YEASTS: FUNCTIONAL PROPERTIES AND FOOD APPLICATIONS

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ÖZET

Postbiyotikler, hücre kültürlerinden elde edilen süpernatant (sıvı kısım) şeklindeki hücresiz karışımlarda toplanan ve probiyotik mikroorganizmaların metabolik faaliyetleri sonucunda ortaya çıkan çözünür moleküller olarak tanımlanmaktadır. Postbiyotiklerin doğal veya biyolojik koruyucular, gıda takviyeleri, postbiyotiklerle zenginleştirilmiş fonksiyonel gıdalar ve gıda formülasyonlarında biyoaktif bileşenler olarak kullanılması; tüketicilerin temiz etiketli ürünlere yönelik artan tercihi ve sektörün sürdürülebilir ve çevre dostu bileşen arayışıyla örtüşmektedir. Postbiyotikler; immünomodülatör, antikanser, antimikrobiyal, anti-enflamatuar, antioksidan, kolesterol düşürücü, antitoksik ve biyofilm oluşumunu engelleyici etkiler dahil olmak üzere pek çok sağlık yararına sahiptir. Maya fermantasyonundan elde edilen bu canlı olmayan mikrobiyal ürünler, gıda muhafazasını iyileştirebilen, bağırsak mikrobiyotası modülasyonu yoluyla insan sağlığını geliştirebilen ve hatta tarımsal uygulamaları optimize edebilen benzersiz biyoaktif bileşikler sunmaktadır. Çeşitli maya suşları kullanılarak elde edilen postbiyotiklerin içerisinde peptitler, antioksidanlar, enzimler, kısa zincirli yağ asitleri (SCFA'lar) ve organik asitler yer almaktadır. Hatta mayalardan elde edilen preparatlarla ilişkili birçok biyolojik aktivite, yalnızca çözünür metabolitler tarafından değil; aynı zamanda hücresel canlılığın yitirilmesinden sonra bile konak dokularla etkileşime girmeye elverişli kalan mannoproteinler, β-glukanlar ve kitin gibi yapısal bütünlüğünü koruyan hücre duvarı bileşenleri tarafından da gerçekleştirilmektedir. Laktik asit bakterileri ve ürettikleri metabolitlerden endüstriyel olarak birçok alanda yararlanılmakta ve araştırılmakta, fakat mayalar üzerine postbiyotik alanında yapılan çalışmalar sınırlı kalmaktadır. Bu araştırmada da farklı biyoaktif özelliklere sahip olan mayaların ürettiği postbiyotiklerin önemine, olası etkilerine ve kullanım alanlarına yer verilmiştir.

Anahtar Kelimeler: postbiyotik, maya, gıda uygulamaları, fonksiyonel özellikler

ABSTRACT

Postbiotics are defined as soluble molecules—derived from cell-free fractions such as the supernatant (liquid portion) of cell cultures—that are produced through the metabolic activities of probiotic microorganisms. The use of postbiotics as natural or biological preservatives, dietary supplements, functional foods enriched with postbiotics, and bioactive ingredients in food formulations aligns with the growing consumer preference for clean-label products and the industry's search for sustainable, eco-friendly ingredients. ostbiotics offer various health benefits, including immunomodulatory, anticancer, antimicrobial, anti-inflammatory, antioxidant, cholesterol-lowering, antitoxic, and antibiofilm effects. These non-viable microbial products derived from yeast fermentation offer unique bioactive compounds capable of improving food preservation, enhancing human health through gut microbiota modulation, and even optimizing agricultural practices. In fact, many biological activities associated with yeast-derived preparations are mediated not only by soluble metabolites but also by cell wall components such as mannoproteins, β-glucans, and chitin that retain their structural integrity and remain capable of interacting with host tissues even after the loss of cellular viability. While lactic acid bacteria and their metabolites are widely researched and utilized across various industrial sectors,

studies on postbiotics derived from yeasts remain limited. This research addresses the importance, potential effects, and application areas of postbiotics produced by yeasts possessing diverse bioactive properties.

Keywords: postbiotic, yeast, food applications, functional properties

AZ YAĞLI DONDURMA ÜRETİMİNDE YAĞ İKAME EDİCİLERİN KULLANIMI

USE OF FAT REPLACERS IN LOW-FAT ICE CREAM PRODUCTION

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ÖZET

Dondurma, kendine özgü tadı olan ve %10-15 oranında yağ içeren popüler bir süt ürünüdür. Süt ürünlerinde yağ, yapısal stabilite ve duyusal özelliklerin üzerinde önemli etkilere sahiptir. Nitekim dondurmanın bileşiminde bulunan yağ kümeleri kararlı mikroyapısının oluşmasında görev almaktadır. Tüketiciler tarafından yüksek yağ tüketiminin obezite ve kalp rahatsızlıkları üzerinde etkisi olduğu düşüncesi son yıllarda az yağlı ürünlere talebi artırmıştır. Fakat dondurmada yağ oranının azaltılması buzlanma, ufalanan yapı, büzülme ve lezzet üzerinde olumsuz etkilere sebep olduğundan kaliteyi etkilemektedir. Bu nedenle tekstürel ve duyusal özellikleri koruyabilmek için yağ yerine yağ ikame maddelerinin ürün üretiminde kullanılabilmektedir. Yağ ikame ediciler, üründeki yağın yerini alarak aynı zamanda yağınkine benzer fizyolojik özellikler sunan bir maddelerdir. Bu nedenle dondurmadaki süt yağının yerine karbonhidrat veya protein bazlı yağ ikamelerinin kullanımı, yağ içeriğini azaltmaya ve sağlıklı bir ürün üretmeye yönelik stratejilerden biridir. Dondurmada bu amaçla maltodekstrin, süt proteinleri (kazein ve serum proteinleri), inülin, soya proteinleri ve nişasta maddeleri yağ ikame maddeleri olarak genellikle kullanılmaktadır. Dondurmada yağın sertlik, erime hızı, reolojik özellikler gibi birden fazla fonksiyonel etkisi olduğu göz önünde bulundurulduğunda bu yağ ikame maddelerinin az yağlı dondurmada istenilen özelliklerin sağlanabilmesi için kombinasyon halinde kullanılabilmesi de mümkün olabilmektedir. Bu derleme, süt yağı ikamesi olarak kullanılabilen çeşitli maddeleri ele almakta ve bunların dondurma özellikleri üzerindeki fonksiyonel etkilerini incelemektedir.

Anahtar Kelimeler: Az yağlı dondurma, protein bazlı yağ ikame maddeleri, karbonhidrat bazlı yağ ikame maddeleri, duyusal özellikler, dokusal ve tekstürel özellikler

ABSTRACT

Ice cream is a popular dairy product characterized by its distinctive taste and a fat content of 10–15%. Fat plays a significant role in the structural stability and sensory characteristics of dairy products. Indeed, fat clusters within the composition of ice cream play a role in the formation of its stable microstructure. In recent years, the perception among consumers that high fat intake contributes to obesity and heart disease has driven up the demand for low-fat products. However, reducing the fat content of ice cream can adversely affect its quality by increasing iciness and causing a crumbly texture, shrinkage, and undesirable changes in flavor. Therefore, fat replacers can be used in product manufacturing instead of fat to preserve textural and sensory characteristics. Fat replacers are substances that substitute for fat in a product while offering physiological properties similar to those of fat. Therefore, the use of carbohydrate- or protein-based fat replacers instead of milk fat in ice cream is one of the strategies aimed at reducing fat content and producing a healthier product. Maltodextrin, milk proteins (casein and whey proteins), inulin, soy proteins, and starch-based ingredients are

commonly used as fat replacers in ice cream. Given that fat exerts multiple functional effects on ice cream—such as influencing hardness, melting rate, and rheological properties—it is possible to use these fat replacers in combination to achieve the desired characteristics in low-fat ice cream. This review discusses the various substances that can be used as milk fat replacers and examines their functional effects on ice cream properties.

Keywords: Low-fat ice cream, protein-based fat raplacer carbohydrate-based fat substitutes, sensory properties, textural and texture properties.

PLANT-BASED BEVERAGE BY-PRODUCTS AS MULTIFUNCTIONAL INGREDIENTS FOR CLEANER-LABEL AND SUSTAINABLE MEAT PRODUCTS

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ABSTRACT

Meat products are highly valued for their nutritional quality, particularly as important sources of high-quality protein, essential amino acids, vitamins, and minerals. However, concerns related to the environmental impact of meat production, together with the relatively high levels of animal fat and the use of certain synthetic additives in processed meat products, have increased interest in the development of healthier and more sustainable formulations. In this context, current reformulation strategies increasingly focus on reducing animal fat and synthetic additives while maintaining desirable technological, nutritional, and sensory properties. Plant-based beverage production by-products represent promising sources of multifunctional food ingredients for this purpose. These materials may be incorporated into meat formulations directly, either in their raw form or after drying, or further processed into protein concentrates, isolates, or protein hydrolysates, depending on the intended technological function. Plant-based beverage by-products may contain substantial amounts of proteins, dietary fiber, lipids, minerals, and bioactive compounds, while also exhibiting techno-functional properties such as water and oil binding, emulsification, gel formation, and textural modification. In addition, protein fractions and hydrolysates obtained from these by-products may provide further functionalities, including antioxidant and other bioactive effects, and may therefore contribute to reducing the need for certain synthetic additives. Their incorporation into meat systems may consequently offer a multifunctional strategy combining nutritional improvement, technological functionality, and ingredient simplification. Nevertheless, differences in botanical source, processing conditions, composition, sensory characteristics, and functional behavior should be considered, as these factors may influence product quality and consumer acceptance. Overall, valorizing plant-based beverage by-products in meat product formulations may simultaneously support cleaner-label, more sustainable products and circular economy principles by converting food-processing residues into value-added ingredients. Further studies on ingredient standardization, processing conditions, optimal incorporation levels, and sensory compatibility are needed to support broader application in meat product development.

Keywords: food upcycling, sustainable meat products, cleaner-label meat products, milk-like beverages, plant proteins, nuts

VALORIZATION OF PLANT-BASED BEVERAGE PROCESSING BY-PRODUCTS AS VALUE-ADDED FOOD INGREDIENTS

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ABSTRACT

The increasing production and consumption of plant-based beverages have led to the generation of considerable amounts of solid processing by-products, particularly after filtration and separation steps. Although these materials are often treated as low-value residues, they may retain substantial amounts of proteins, dietary fiber, lipids, minerals, and bioactive compounds, making them promising raw materials for food upcycling. This review discusses the valorization potential of by-products generated during the processing of commonly consumed plant-based beverages, including those produced from soybean, oat, almond, hazelnut, and other plant sources. Depending on their composition and intended application, these by-products may be incorporated directly into food formulations after appropriate stabilization or further processed into value-added fractions such as protein concentrates and isolates, protein hydrolysates, fiber-rich ingredients, or extracts containing bioactive compounds. Their technological properties, including water and oil binding, emulsification, gelation, foaming, and textural modification, can support their application in a wide range of food systems such as bakery products, snacks, cereal-based foods, beverages, meat analogues, hybrid products, and other reformulated foods. Beyond their technological functionality, the recovery of these materials may contribute to nutritional enrichment and the development of innovative food ingredients with additional bioactive potential. However, high initial moisture content, limited storage stability, compositional variability, and source-dependent color and flavor characteristics remain important challenges for their broader utilization. Appropriate drying, stabilization, fractionation, and formulation strategies are therefore required to improve their functionality and facilitate industrial application. Overall, the valorization of plant-based beverage processing by-products represents a promising approach for reducing food processing residues, improving resource efficiency, generating value-added food ingredients, and supporting circular economy principles and more sustainable food production systems.

Keywords: food upcycling, plant-based beverages, value-added ingredients, resource efficiency, circular economy, sustainable food production

HAYVANSAL KAYNAKLI GIDALARDA YENİ NESİL GIDA ANALİZ YÖNTEMLERİ

NEXT-GENERATION ANALYTICAL METHODS FOR FOODS OF ANIMAL ORIGIN

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ÖZET

Hayvansal kaynaklı gıdalar, yüksek besin değerleri nedeniyle insan beslenmesinde önemli bir yere sahiptir. Bununla birlikte süt ve süt ürünleri, et ve et ürünleri, yumurta ve su ürünleri; üretimden tüketime uzanan süreçte patojen kontaminasyonu, veteriner ilaç kalıntıları, kimyasal kontaminantlar ve tağşiş gibi risklerle karşı karşıyadır. Bu risklerin izlenmesi ve ürün özgünlüğünün doğrulanması, hızlı, duyarlı ve güvenilir analiz yöntemlerini gerekli kılmaktadır. Geleneksel analizler birçok amaç için geçerliliğini korusa da bazı uygulamalarda uzun numune hazırlama süreleri, sınırlı çoklu bileşen analizi ve yüksek numune sayısında uygulama güçlüğü söz konusudur. Bu derlemede, hayvansal kaynaklı gıdaların güvenilirlik, kalite ve özgünlük değerlendirmesinde kullanılan yeni nesil analitik yaklaşımlar ele alınmaktadır. Sıvı kromatografisi–tandem kütle spektrometrisi (LC-MS/MS) ve yüksek çözünürlüklü kütle spektrometrisi (HRMS), kalıntı ve kontaminantların hedefli analizi ile hedef dışı tarama açısından değerlendirilmektedir. Fourier dönüşümlü kızılötesi (FT-IR) ve Raman spektroskopisi ile hiperspektral görüntüleme, ürün bileşimi, kalite değişimleri ve tağşişin hızlı ve tahribatsız incelenmesine olanak sağlamaktadır. Biyosensörler yerinde ve hızlı tarama için potansiyel sunarken proteomik, metabolomik ve diğer omik yaklaşımlar tür, coğrafi köken ve üretim sistemiyle ilişkili moleküler belirteçlerin araştırılmasını desteklemektedir. Bu yöntemlerden elde edilen çok boyutlu verilerin kemometri ve makine öğrenmesiyle değerlendirilmesi, sınıflandırma ve özgünlük doğrulama çalışmalarına katkı sağlamaktadır. Bununla birlikte yöntemlerin rutin kullanıma aktarılmasında matriks etkisi, modellerin bağımsız örneklerle doğrulanması, standardizasyon ve cihaz maliyeti dikkate alınmalıdır. Farklı analitik yaklaşımların uygun biçimde birleştirilmesi, hayvansal kaynaklı gıdaların güvenilirliğinin ve kalitesinin daha kapsamlı değerlendirilmesine katkı sağlayabilir.

Anahtar Kelimeler: Hayvansal kaynaklı gıdalar; gıda güvenilirliği; özgünlük doğrulaması; kemometri; omik teknolojiler; biyosensörler; hiperspektral görüntüleme.

ABSTRACT

Foods of animal origin play an important role in human nutrition because of their high nutritional value. However, milk and dairy products, meat and meat products, eggs, and fishery products may be exposed to pathogenic contamination, veterinary drug residues, chemical contaminants, and adulteration throughout production, processing, storage, and distribution. Monitoring these hazards and verifying product authenticity require rapid, sensitive, and reliable analytical methods. Conventional methods remain valuable, but some applications involve lengthy sample preparation, limited simultaneous analysis of multiple compounds, or practical difficulties when large numbers of samples must be tested. This review discusses emerging analytical approaches for evaluating the

safety, quality, and authenticity of foods of animal origin. Liquid chromatography–tandem mass spectrometry (LC-MS/MS) and high-resolution mass spectrometry (HRMS) support targeted determination of residues and contaminants as well as non-targeted screening. Fourier-transform infrared (FT-IR) and Raman spectroscopy, together with hyperspectral imaging, enable rapid, nondestructive assessment of composition, quality changes, and adulteration. Biosensors offer potential for rapid on-site screening, while proteomics, metabolomics, and other omics approaches support the investigation of molecular markers associated with species, geographical origin, and production systems. Chemometrics and machine learning help interpret the multidimensional data generated by these techniques for classification and authenticity assessment. Their implementation in routine analysis nevertheless requires attention to matrix effects, validation using independent samples, standardization, and equipment costs. Appropriate integration of complementary analytical approaches may enable a more comprehensive evaluation of the safety and quality of foods of animal origin.

Keywords: Foods of animal origin; food safety; authenticity; chemometrics; omics technologies; biosensors; hyperspectral imaging.

FARKLI İNFÜZYON SÜRELERİNİN UBE (*DİOSCOREA ALATA* L.) TOZU İNFÜZYONLARININ TOPLAM FENOLİK İÇERİĞİ VE ANTİOKSİDAN KAPASİTESİ ÜZERİNE ETKİSİ

THE EFFECT OF DIFFERENT INFUSION TIMES ON THE TOTAL PHENOLIC CONTENT AND ANTIOXIDANT CAPACITY OF UBE (*DIOSCOREA ALATA* L.) POWDER INFUSIONS

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ÖZET

Ube (*Dioscorea alata* L.), tozu, mor tatlı patatesin kurutulup öğütülmesiyle elde edilen, doğal mor renkli bir tozdur. Tatlı, hafif cevizimsi ve vanilyaya yakın bir aroması vardır. Dondurma, pasta, latte ve makaron gibi ürünlerde hem renk hem tat vermek için kullanılır. Ube, mor renk oluşumundan sorumlu antosiyaninler başta olmak üzere fenolik bileşikler ve diğer biyoaktif bileşenler açısından zengin bir yumrulu bitkidir. Bu çalışmada, ube tozu kullanılarak hazırlanan infüzyonlarda farklı infüzyon sürelerinin renk özellikleri, toplam fenolik madde miktarı, antioksidan kapasite ve antimikrobiyal aktivite üzerine etkisinin belirlenmesi amaçlanmıştır. Bu kapsamda ube tozu kullanılarak 3, 6, 9 ve 12 dakikalık infüzyon sürelerinde örnekler hazırlanmıştır. Elde edilen infüzyonların toplam fenolik madde ve toplam flavonoid madde içerikleri belirlenmiş; antioksidan aktiviteleri DPPH ve ABTS radikal süpürme yöntemleri kullanılarak değerlendirilmiştir. İnfüzyon süresine bağlı olarak ube infüzyonlarının toplam fenolik madde ve toplam flavonoid madde içeriklerinde farklılıklar gözlenmiştir. Benzer şekilde, DPPH ve ABTS yöntemleriyle belirlenen antioksidan aktivitelerin de infüzyon süresinden etkilendiği belirlenmiştir. Sonuçlar, 6 dakikalık infüzyon süresinde toplam fenolik madde ve toplam flavonoid madde içeriği ile antioksidan kapasite açısından en yüksek değerlerin elde edildiğini göstermiştir. Elde edilen bulgular, ube tozundan hazırlanan infüzyonların biyoaktif özelliklerinin infüzyon süresine bağlı olarak değişebildiğini ve ube

tozunun farklı gıda uygulamalarında biyoaktif bileşen kaynağı olarak değerlendirilebilecek potansiyele sahip olduğunu göstermektedir.

Anahtar Kelimeler: *Dioscorea alata* L., ube tozu, infüzyon, toplam fenolik madde, toplam flavonoid, DPPH, ABTS,

ABSTRACT

Ube (*Dioscorea alata* L.) powder is a naturally purple-colored powder obtained by drying and grinding purple sweet potato. It has a sweet, mildly nutty, and vanilla-like aroma and is used in products such as ice cream, cakes, lattes, and macarons to provide both color and flavor. Ube is a tuberous plant rich in anthocyanins, which are primarily responsible for its purple color, as well as phenolic compounds and other bioactive components.This study aimed to determine the effects of different infusion times on the color properties, total phenolic content, antioxidant capacity, and antimicrobial activity of infusions prepared using ube powder. In this context, samples were prepared using ube powder at infusion times of 3, 6, 9, and 12 minutes. The total phenolic and total flavonoid contents of the resulting infusions were determined, and their antioxidant activities were evaluated using the DPPH and ABTS radical scavenging assays.Differences were observed in the total phenolic and total flavonoid contents of the ube infusions depending on the infusion time. Similarly, the antioxidant activities determined using the DPPH and ABTS assays were found to be affected by the infusion time. The results showed that the highest values for total phenolic content, total flavonoid content, and antioxidant capacity were obtained at an infusion time of 6 minutes.The findings indicate that the bioactive properties of infusions prepared from ube powder may vary depending on the infusion time, and that ube powder has the potential to be utilized as a source of bioactive compounds in various food applications.

Keywords: *Dioscorea alata* L., ube powder, infusion, total phenolic content, total flavonoid content, DPPH, ABTS,

BÖĞÜRTLEN (*RUBUS FRUTİCOSUS* L.) EKSTRAKTLARININ KLASİK VE ULTRASON DESTEKLİ EKSTRAKSİYON AÇISINDAN KARŞILAŞTIRILMASI

COMPARISON OF BLACKBERRY (RUBUS FRUTICOSUS L.) EXTRACTS OBTAINED BY CONVENTIONAL AND ULTRASOUND-ASSISTED EXTRACTION METHODS

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ÖZET

Böğürtlen (*Rubus fruticosus* L.), fenolik bileşikler ve flavonoidler başta olmak üzere çeşitli biyoaktif bileşenler içeren ve antioksidan özellikleriyle öne çıkan bir meyvedir. Bu çalışmada, böğürtlenin biyoaktif bileşenlerinin ekstraksiyonunda klasik ekstraksiyon ile ultrason destekli ekstraksiyon (UDE) yöntemlerinin karşılaştırılması amaçlanmıştır. Farklı örnek miktarlarından elde edilen ekstraktların toplam fenolik madde (TFM) ve toplam flavonoid madde (TFM) içerikleri ile DPPH ve ABTS radikal süpürme aktiviteleri belirlenmiştir. Ayrıca ekstraktların antimikrobiyal aktiviteleri incelenmiş ve FTIR analizleri gerçekleştirilmiştir. Elde edilen sonuçlara göre, UDE uygulanan örneklerde toplam fenolik madde içeriği 2,848–3,334 mg gallik asit eşdeğeri/g arasında değişirken, klasik ekstraksiyonda bu değerler 2,540–3,273 mg gallik asit eşdeğeri/g olarak belirlenmiştir. Toplam flavonoid madde içeriği UDE örneklerinde 2,852–4,892 mg kuersetin eşdeğeri/g, klasik ekstraksiyon örneklerinde ise 1,348–4,307 mg kuersetin eşdeğeri/g aralığında bulunmuştur. UDE ile elde edilen ekstraktlarda özellikle 3 g örnek miktarında toplam fenolik (3,334 mg GAE/g) ve toplam flavonoid (4,649 mg QE/g) içerikleri dikkat çekmiştir. ABTS radikal süpürme aktivitesi açısından da UDE örneklerinde genel olarak daha yüksek değerler elde edilmiş; en yüksek değer 39,50 olarak belirlenirken, klasik ekstraksiyonda en yüksek değer 35,52 olmuştur. Bu sonuçlar, ultrasonik uygulamanın böğürtlen örneklerinden fenolik ve flavonoid bileşiklerin ekstraksiyonunu destekleyebildiğini ve antioksidan aktivite üzerinde olumlu bir etki oluşturabildiğini göstermektedir. DPPH ve antimikrobiyal aktivite sonuçları ile FTIR analizleri de ekstraktların fonksiyonel özelliklerinin ve kimyasal karakteristiklerinin değerlendirilmesine katkı

sağlamıştır. Genel olarak, çalışma sonuçları UDE'nin klasik ekstraksiyona kıyasla daha kısa sürede böğürtlenin biyoaktif bileşenlerinin ekstraksiyonunda etkili bir alternatif yöntem olabileceğini göstermektedir. Elde edilen bulgular, böğürtlen ekstraktlarının antioksidan özellikleri açısından değerlendirilerek gıda ve fonksiyonel ürün uygulamalarında kullanılma potansiyeline sahip olduğunu ortaya koymaktadır.

Anahtar Kelimeler: *Rubus fruticosus* L., ultrason destekli ekstraksiyon, antioksidan aktivite, antimikrobiyal aktivite, FTIR

ABSTRACT

Blackberry (Rubus fruticosus L.) is a fruit rich in various bioactive compounds, particularly phenolic compounds and flavonoids, and is recognized for its antioxidant properties. This study aimed to compare conventional extraction and ultrasound-assisted extraction (UAE) methods for the extraction of bioactive compounds from blackberry. The total phenolic content (TPC) and total flavonoid content (TFC), as well as DPPH and ABTS radical-scavenging activities, were determined in extracts obtained using different sample amounts. In addition, the antimicrobial activities of the extracts were investigated, and FTIR analyses were performed.According to the results, the TPC of the UAE extracts ranged from 2.848 to 3.334 mg gallic acid equivalents (GAE)/g, whereas the values obtained by conventional extraction ranged from 2.540 to 3.273 mg GAE/g. The TFC ranged from 2.852 to 4.892 mg quercetin equivalents (QE)/g in the UAE extracts and from 1.348 to 4.307 mg QE/g in the conventional extraction extracts. Among the UAE extracts, the sample obtained using 3 g of blackberry exhibited the highest TPC (3.334 mg GAE/g) and a high TFC (4.649 mg QE/g). In terms of ABTS radical-scavenging activity, UAE extracts generally exhibited higher values, with the highest value being 39.50, compared with 35.52 obtained by conventional extraction. These findings indicate that ultrasound treatment may enhance the extraction of phenolic and flavonoid compounds from blackberry and may contribute to improved antioxidant activity. The DDPH and antimicrobial activity results, together with the FTIR analyses, further contributed to the evaluation of the functional properties and chemical characteristics of the extracts.Overall, the results demonstrate that UAE may serve as an effective alternative to conventional extraction for obtaining bioactive compounds from blackberry within a shorter extraction time. The findings also highlight the potential of blackberry extracts for evaluation in food and functional product applications due to their bioactive and antioxidant properties.

Keywords: *Rubus fruticosus* L., ultrasound-assisted extraction, antioxidant activity, antimicrobial activity, FTIR

SICAK HAVA, DONDURARAK VE MİKRODALGA-VAKUM KURUTMANIN YABAN MERSİNİNİN (*VACCİNİUM CORYMBOSUM* L.) FİZİKSEL, TEKSTÜREL VE TERMAL ÖZELLİKLERİ ÜZERİNE ETKİLERİ

EFFECTS OF HOT-AIR, FREEZE, AND MICROWAVE-VACUUM DRYING ON THE PHYSICAL, TEXTURAL, AND THERMAL PROPERTIES OF BLUEBERRIES (*VACCINIUM CORYMBOSUM* L.)

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ÖZET

Bu çalışmada, farklı kurutma yöntemlerinin yaban mersininin fiziksel, tekstürel ve termal özellikleri üzerindeki etkilerinin belirlenmesi amaçlanmıştır. Meyveler, nem içerikleri %10 veya daha düşük seviyeye ulaşıncaya kadar kurutma işlemlerine tabi tutulmuştur. Kullanılan yöntemler sıcak hava ile kurutma (HA-60 °C), dondurarak kurutma (FD) ve mikrodalga-vakum kurutmayı (MVD-180 ve MVD-360 W) içermektedir. Kurutulan meyveler daha sonra rehidrasyon oranı, büzülme (%), renk, tekstür ve termal özellikleri açısından değerlendirilmiştir. En düşük toplam renk değişimi MVD-180 W örneklerinde (ΔE = 13.53) belirlenirken, en yüksek değer FD örneklerinde (ΔE = 21.07) gözlenmiş ve HA-60 °C uygulamasıyla kırmızılık (a*) belirgin şekilde artmıştır. En yüksek sertlik, yapışkanlık, sakızımsılık ve çiğnenebilirlik değerleri HA-60 °C örneklerinde gözlenirken, FD örneklerinde daha düşük mekanik direnç belirlenmiştir. MVD-360 W uygulamasında yüksek sertlik ve yaylanma değerleri elde edilmiştir. En yüksek Tg (58.80 °C) ve entalpi değişimi (9.78 J g^{-1}) MVD-180 W örneklerinde belirlenmiştir. FD uygulamasından sonra daha düşük büzülme ve daha yüksek rehidrasyon oranı gözlenirken, HA-60 °C uygulamasından sonra daha yüksek büzülme ve daha düşük rehidrasyon oranı belirlenmiştir. Genel olarak, yaban mersininin renk, yapı, tekstür ve termal özelliklerinin kurutma yönteminden güçlü bir şekilde etkilendiği ve kalite özelliklerinin korunmasının uygulanan kurutma tekniğine bağlı olarak değiştiği belirlenmiştir.

Anahtar Kelimeler: kurutma yöntemleri, yaban mersini, rehidrasyon oranı, büzülme, termal özellikler, tekstür, renk

ABSTRACT

This study aimed to determine the effects of different drying methods on the physical, textural, and thermal properties of blueberries. Fruits were subjected to drying processes until their moisture content reached 10% or less. The methods used included hot-air drying (HA-60 °C), freeze-drying (FD), and microwave-vacuum drying (MVD-180 and MVD-360 W). These dried fruits were then assessed based on their rehydration ratio, shrinkage (%), color, texture, and thermal properties. The lowest total color difference was determined in MVD-180 W samples (ΔE = 13.53), whereas the highest was observed in FD samples (ΔE = 21.07), while redness (a*) was markedly increased by HA-60 °C. The highest hardness, adhesiveness, gumminess, and chewiness were observed in HA-60 °C samples, whereas lower mechanical resistance was determined in FD samples. High hardness and springiness values

were obtained with MVD-360 W. The highest Tg (58.80 °C) and enthalpy change (9.78 J g^{-1}) were determined in MVD-180 W samples. Lower shrinkage and a higher rehydration ratio were observed after FD, whereas higher shrinkage and a lower rehydration ratio were determined after HA-60 °C. Overall, the color, structure, texture, and thermal properties of blueberries were strongly influenced by the drying method, and the preservation of quality attributes varied depending on the drying technique applied.

Keywords: drying methods, blueberries, rehydration ratio, shrinkage, thermal properties, texture, color.

TÜRK KAHVESİ ÇEŞİTLERİNDE TOPLAM FENOLİK MADDE, ANTİOKSİDAN KAPASİTE VE MİKROBİYOLOJİK KALİTENİN BELİRLENMESİ

DETERMINATION OF TOTAL PHENOLIC COMPOUND, ANTIOXIDANT CAPACITY AND MICROBIOLOGICAL QUALITY IN TURKISH COFFEE VARIETIES

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ÖZET

Dünyada en çok tüketilen içecekler arasında yer alan kahve karbonhidratlar, lipitler, vitaminler, mineraller, alkaloitler ve fenolik maddeler gibi farklı kimyasal bileşikler içermektedir. Kahvenin hazırlanması ülkeler, kültürler ve bireyler arasında değişiklik göstermektedir. Türk kahvesi tadı ve hoş aroması nedeniyle Türkiye'de popüler bir içecektir. Bu çalışmada, sade, damla sakızlı, çikolatalı ve kafeinsiz olmak üzere öğütülmüş ve orta kavrulmuş Türk kahvesi çeşitlerinde mikrobiyolojik kalite (toplam aerobik mezofilik bakteri ve toplam koliform bakteri sayısı), toplam fenolik madde içeriği, toplam antioksidan durumu, toplam oksidan durumu ve oksidatif stres indeksi araştırılmıştır. Öğütülmüş ve orta kavrulmuş kahve örneklerinin kuru hallerinde yapılan mikrobiyolojik analizlerde klasik kültür yöntemi kullanılmıştır. Toplam fenolik madde içeriği, toplam antioksidan durumu ve toplam oksidan durumu değerleri ise öğütülmüş ve orta kavrulmuş Türk kahvesi çeşitlerinde kuru olarak ve pişirme işlemi uygulandıktan sonra kolorimetrik yöntem ile tespit edilmiştir. Sonuç olarak, tüm kuru kahve örneklerinde toplam aerobik mezofilik bakteri ve toplam koliform bakteri sayıları 10^2 KOB/g'dan az olarak tespit edilmiştir. Kuru kahvelerin en düşük ve en yüksek toplam antioksidan durumu ve toplam oksidan durumu değerleri ile oksidatif stres indeksi sırasıyla 3,31 mmol/L - 3,34 mmol/L, 63,44 µmol/L - 87,98 µmol/L ve 1,902 - 2,643 olarak bulunmuştur. Bununla birlikte, pişirme işlemi uygulandıktan sonra kahvelerin en düşük ve en yüksek toplam antioksidan durumu ve toplam oksidan durumu değerleri ile oksidatif stres indeksi sırasıyla 3,29 mmol/L - 3,33 mmol/L, 44,82 µmol/L - 73,16 µmol/L ve 1,352 - 2,217 olarak tespit edilmiştir. Kuru ve pişmiş kahvelerin en düşük ve en yüksek toplam fenolik madde içeriği ise sırasıyla 66,56 mg/L - 160,63 mg/L ve 138,58 mg/L -

166,56 mg/L olarak tespit edilmiştir. Geleneksel yöntemle pişirilen Türk kahvelerinin toplam fenolik içeriğinin kuru kahvelere kıyasla genel olarak arttığı bulunmuştur.

Anahtar Kelimeler: Türk kahvesi, Antioksidan, Mikrobiyolojik kalite.

ABSTRACT

Coffee, one of the most consumed beverages in the world, contains different chemical compounds including carbohydrates, lipids, vitamins, minerals, alkaloids and phenolic substances. Preparation of coffee varies between countries, cultures and individuals. Turkish coffee is a popular beverage in Türkiye due to its taste and pleasant aroma. In this study, microbiological quality (total aerobic mesophilic bacteria and total coliform bacteria count), total phenolic compound content, total antioxidant status, total oxidant status and oxidative stress index were investigated in ground and medium roasted Turkish coffee varieties, namely without sugar, mastic gum, chocolate and decaffeinated. Classical culture method was used in microbiological analyses of ground and medium roasted coffee samples in dry form. Total phenolic compound content, total antioxidant status and total oxidant status values were determined by colorimetric method in ground and medium roasted Turkish coffee varieties in dry form and after the cooking process. As a result, total aerobic mesophilic bacteria and total coliform bacteria counts were detected less than 10^2 CFU/g in all ground coffee samples. The lowest and highest total antioxidant status and total oxidant status values and oxidative stress index of ground coffees were found to be 3.31 mmol/L - 3.34 mmol/L, 63.44 µmol/L - 87.98 µmol/L and 1.902 - 2.643, respectively. Furthermore, after the cooking process, the lowest and highest total antioxidant status and total oxidant status values and oxidative stress index of the coffees were determined as 3.29 mmol/L - 3.33 mmol/L, 44.82 µmol/L - 73.16 µmol/L and 1.352 - 2.217, respectively. The lowest and highest total phenolic substance contents of ground and cooked coffees were determined as 66.56 mg/L - 160.63 mg/L and 138.58 mg/L - 166.56 mg/L, respectively. It has been found that the total phenolic content of Turkish coffee prepared using the traditional method generally increases compared to that of ground coffee.

Keywords: Turkish coffee, Antioxidant, Microbiological quality.

ORGANİK VE KONVANSİYONEL ÇİÇEK BALLARININ BAZI BİYOKİMYASAL VE FİZİKOKİMYASAL ÖZELLİKLERİNİN ARAŞTIRILMASI

INVESTIGATION OF SOME BIOCHEMICAL AND PHYSICOCHEMICAL PROPERTIES OF ORGANIC AND CONVENTIONAL FLORAL HONEYS

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ÖZET

Bal, içerdiği çeşitli biyoaktif bileşenler nedeniyle önemli bir gıda olarak kabul edilmektedir. Balın bileşimi ve kalite özellikleri; botanik köken, üretim koşulları ve coğrafik özellikler gibi çeşitli faktörlerden etkilenebilmektedir. Bu çalışmada, Türkiye'deki organik ve konvansiyonel bal üreten dört farklı firmadan temin edilen toplam 92 çiçek balı örneği incelenmiştir. Bal örnekleri; toplam antioksidan kapasite, toplam oksidan kapasite, toplam fenolik madde içeriği, pH, ºBrix değeri, renk, prolin içeriği, diastaz aktivitesi, hidroksimetilfurfural düzeyi, elektriksel iletkenlik ve nem içeriği yönünden analiz edilmiştir. Çiçek ballarında ortalama toplam antioksidan kapasite, toplam oksidan kapasite ve toplam fenolik madde içeriği değerleri sırasıyla 0,48–0,93 mmol Trolox eşdeğeri/L, 12,03–56,76 µmol H_2O_2 eşdeğeri/L ve 97,17–153,00 mg GAE/kg aralığında bulunmuştur. Ortalama pH ve ºBrix değerleri sırasıyla 3,85–4,23 ve %80,81–82,43 aralığında değişmiştir. Çiçek ballarının rengi beyaz ile açık kehribar arasında çeşitlilik göstermiştir. Ayrıca; prolin içeriği, diastaz sayısı, hidroksimetilfurfural düzeyi, elektriksel iletkenlik ve nem içeriğine ait ortalama değerler, Türk Gıda Kodeksi'nde belirtilen sınır değerler içerisinde yer almıştır. Yazarlar, bu çalışmaya yüksek lisans tez projesi (Proje No. TYL-2024-9820) kapsamında sağladığı finansal destekten dolayı Gazi Üniversitesi Bilimsel Araştırma Projeleri Birimi'ne teşekkür eder.

Anahtar Kelimeler: Bal, Organik, Konvansiyonel, Antioksidan, Fenolik içerik.

ABSTRACT

Honey is recognized as an important food due to its diverse bioactive constituents. The composition and quality characteristics of honey can be influenced by various factors, including botanical origin, production conditions, and geographical characteristics. In this study, a total of 92 floral honey samples obtained from four different firms of organic and conventional honey in Türkiye were investigated. The honey samples were analyzed for total antioxidant status, total oxidant status, total phenolic content, pH, ºBrix content, color, proline content, diastase activity, hydroxymethylfurfural

level, electrical conductivity, and moisture content. In floral honeys, the mean total antioxidant status, total oxidant status, and total phenolic content range from 0.48–0.93 mmol Trolox equivalent/L, 12.03–56.76 µmol H_2O_2 equivalent/L, and 97.17–153.00 mg GAE/kg, respectively. The mean pH and ◦Brix values ranged from 3.85 to 4.23 and 80.81 to 82.43%, respectively. The color of the floral honeys was ranged from white to light amber. Furthermore, the mean values of proline content, diastase number, hydroxymethylfurfural level, electrical conductivity, and moisture content were within the limits specified in the Turkish Food Codex. The authors gratefully acknowledge the Gazi University Scientific Research Projects Unit for its financial support of this study under the master's thesis project (Project No. TYL-2024-9820).

Keywords: Honey, Organic, Conventional, Antioxidant, Phenolic content.

SÜRDÜRÜLEBİLİR ET ALTERNATİFLERİNE GEÇİŞTE HİBRİT ET ANALOGLARI: WOS VERİLERİNE DAYALI BİR BİBLİYOMETRİK İNCELEME

HYBRID MEAT ANALOGUES IN THE TRANSITION TOWARD SUSTAINABLE MEAT ALTERNATIVES: A BIBLIOMETRIC ANALYSIS BASED ON WEB OF SCIENCE DATA

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ÖZET

Bu çalışma, sürdürülebilir et alternatiflerine geçiş sürecinde önemli bir araştırma alanı haline gelen hibrit et ve et analogları literatürünün bibliyometrik görünümünü ortaya koymayı amaçlamaktadır. Bu kapsamda, Web of Science (WoS) veri tabanında 2006–2026 yılları arasında 'Hybrid meat', 'Hybrid meat analogues' ve 'Plant based meat' anahtar kelimeleri kullanılarak belirlenen 1.568 makale bibliyometrik analiz yöntemiyle incelenmiştir. Verilerin analizinde ve bibliyometrik ağların oluşturulmasında VOSviewer programından yararlanılmış; yayınların yıllara göre dağılımı, ülkeler, yazarlar, kurumlar, kaynaklar, atıf ilişkileri ve anahtar kelimeler değerlendirilmiştir. Bulgular, hibrit et ve et analogları alanındaki araştırmaların uluslararası ve disiplinlerarası bir yapı gösterdiğini ortaya koymuştur. Ülke bazında Çin ve Amerika Birleşik Devletleri yayın ve atıf göstergelerinde öne çıkarken, Wageningen University & Research ve Jiangnan University gibi kurumların araştırma ağlarında belirgin bir konuma sahip olduğu görülmüştür. Yazar analizinde McClements ve Van der Goot öne çıkan araştırmacılar arasında yer almıştır. Kaynak analizi, özellikle Trends in Food Science & Technology, Food Research International ve Food Hydrocolloids gibi dergilerin alanın bilimsel bilgi üretiminde önemli bir konuma sahip olduğunu göstermiştir. Anahtar kelime analizinde ise 'plant-based meat', 'plant-based meat alternatives', 'meat analogues', 'sustainability', 'texture', 'plant protein', 'high-moisture extrusion' ve 'alternative proteins' gibi kavramların öne çıktığı belirlenmiştir. Sonuç olarak, hibrit et ve et analogları alanındaki araştırmaların sürdürülebilirlik, bitkisel proteinler, alternatif protein kaynakları, tekstür ve yenilikçi işleme teknolojileri ekseninde geliştiği belirlenmiş ve bu temalar arasındaki ilişkilerin gelecekteki araştırmalar açısından önem taşıdığı değerlendirilmiştir.

Anahtar Kelimeler: Hibrit et, et analogları, bitkisel et, sürdürülebilirlik, bibliyometrik analiz, alternatif proteinler

ABSTRACT

This study aimed to provide a bibliometric overview of the literature on hybrid meat and meat analogues, which has become an important research area in the transition toward sustainable meat alternatives. In this context, 1,568 articles identified in the Web of Science (WoS) database using the keywords 'Hybrid meat', 'Hybrid meat analogues', and 'Plant based meat' for the period 2006–2026 were analyzed using bibliometric methods. VOSviewer was used for data analysis and the visualization of bibliometric networks, and the distribution of publications by year, countries, authors, institutions, sources, citation relationships, and keywords was evaluated. The findings revealed that research in the field of hybrid meat and meat analogues has an international and interdisciplinary structure. China and the United States were prominent in terms of publication and citation indicators, while institutions such as Wageningen University & Research and Jiangnan University occupied notable positions within research networks. McClements and Van der Goot were among the prominent researchers identified in the author analysis. Source analysis indicated that journals such as Trends in Food Science & Technology, Food Research International, and Food Hydrocolloids play important roles in scientific knowledge production in this field. Keyword analysis showed that concepts such as

'plant-based meat', 'plant-based meat alternatives', 'meat analogues', 'sustainability', 'texture', 'plant protein', 'high-moisture extrusion', and 'alternative proteins' were prominent. Overall, research on hybrid meat and meat analogues has developed around sustainability, plant proteins, alternative protein sources, texture, and innovative processing technologies, and the relationships among these themes are expected to remain important for future research.

Keywords: Hybrid meat, meat analogues, plant-based meat, sustainability, bibliometric analysis, alternative proteins

GLÜTENSİZ, VEGAN VE VEJETARYEN ÜRÜNLERDE YENİ GIDA TASARIMI: BESLENME, TEKNOLOJİ VE DUYUSAL KABUL AÇISINDAN GÜNCEL YAKLAŞIMLAR

NEW FOOD DESIGN IN GLUTEN-FREE, VEGAN, AND VEGETARIAN PRODUCTS: CURRENT APPROACHES FROM NUTRITIONAL, TECHNOLOGICAL, AND SENSORY ACCEPTANCE PERSPECTIVES

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ÖZET

Glütensiz, vegan ve vejetaryen beslenme modellerine yönelik tüketici ilgisinin artması, farklı beslenme gereksinimlerini karşılayabilen, besleyici ve duyusal açıdan kabul edilebilir yeni gıda ürünlerinin geliştirilmesini önemli bir araştırma alanı haline getirmiştir. Özellikle çölyak hastalarında yaşam boyu uygulanması gereken glütensiz diyet, ürün geliştirme açısından yalnızca glutenin uzaklaştırılmasını değil, aynı zamanda ürünlerin besinsel yeterliliğinin ve teknolojik özelliklerinin korunmasını gerektirmektedir. Bununla birlikte, vegan ve vejetaryen ürünlerde hayvansal kaynaklı bileşenlerin sınırlandırılması veya tamamen çıkarılması; protein kalitesi, bazı vitamin ve minerallerin yeterliliği, yapı oluşumu ve duyusal özellikler açısından yeni formülasyon yaklaşımlarını gerekli kılmaktadır. Bu derlemede, glütensiz, vegan ve vejetaryen ürünlerin yeni gıda tasarımı perspektifinden değerlendirilmesi amaçlanmıştır. Bu kapsamda alternatif tahıl ve yalancı tahıllar, baklagiller, bitkisel proteinler, lif kaynakları, tohumlar, meyve ve sebze yan ürünleri, bitkisel hidrokolloidler ve diğer fonksiyonel bileşenlerin ürün geliştirmedeki potansiyelleri ele alınmıştır. Ayrıca glutenin teknolojik fonksiyonlarının ikame edilmesine yönelik hidrokolloidler, proteinler, enzimler, fermantasyon ve yeni işleme teknolojileri değerlendirilmiştir. Besinsel kalite, özellikle protein miktarı ve kalitesi, diyet lifi ve mikro besin ögeleri açısından incelenirken tekstür, renk, aroma, ağız hissi ve genel kabul gibi duyusal özelliklerin tüketici kabulündeki rolü tartışılmıştır. Son olarak, glütensiz ve bitkisel ürün tasarımında beslenme, teknolojik performans ve duyusal kabulün birlikte optimize edilmesine yönelik gelecek araştırma alanları değerlendirilmiştir. Yeni nesil glütensiz ve bitkisel ürünlerin başarılı biçimde geliştirilmesinin, tek bir bileşenin ikamesinden ziyade, besinsel kalite, gıda matriksi, proses koşulları ve tüketici beklentilerinin birlikte ele alındığı bütüncül bir tasarım yaklaşımına dayanması gerektiği sonucuna varılmıştır.

Anahtar Kelimeler: Glütensiz gıdalar, vegan ürünler, vejetaryen ürünler, yeni gıda tasarımı, bitkisel protein, duyusal kabul

ABSTRACT

The increasing consumer interest in gluten-free, vegan, and vegetarian dietary patterns has made the development of novel food products that can meet diverse nutritional requirements while providing adequate nutritional value and sensory acceptability an important area of research. Particularly for individuals with celiac disease, the lifelong adherence to a gluten-free diet requires not only the removal of gluten but also the preservation of nutritional adequacy and technological properties of food products. In vegan and vegetarian products, the restriction or complete elimination of animal-derived ingredients necessitates new formulation approaches to address challenges related to protein quality, the adequacy of certain vitamins and minerals, structure formation, and sensory properties. This review aimed to evaluate gluten-free, vegan, and vegetarian products from the perspective of novel food design. In this context, the potential of alternative cereals and pseudocereals, legumes, plant proteins, dietary fiber sources, seeds, fruit and vegetable by-products, plant-based hydrocolloids,

and other functional ingredients in product development was discussed. In addition, hydrocolloids, proteins, enzymes, fermentation, and emerging processing technologies used to compensate for the technological functions of gluten were evaluated. Nutritional quality was examined particularly in terms of protein content and quality, dietary fiber, and micronutrients, while the role of sensory attributes, including texture, color, aroma, mouthfeel, and overall acceptability, in consumer acceptance was discussed. Finally, future research directions for the simultaneous optimization of nutritional quality, technological performance, and sensory acceptance in gluten-free and plant-based product design were evaluated. It was concluded that the successful development of next-generation gluten-free and plant-based products should rely not on the substitution of a single ingredient, but on a holistic design approach that considers nutritional quality, food matrix structure, processing conditions, and consumer expectations together.

Keywords: Gluten-free foods, vegan products, vegetarian products, novel food design, plant proteins, sensory acceptance

YETİŞKİNLERDE KRONOTİP, AKDENİZ DİYETİNE UYUM VE FINDRISK PUANI: KESİTSEL BİR ARACILIK ANALİZİ

CHRONOTYPE, MEDITERRANEAN DIET ADHERENCE, AND FINDRISK SCORE IN ADULTS: A CROSS-SECTIONAL MEDIATION ANALYSIS

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ÖZET

Amaç: Bu çalışmada, yetişkinlerde kronotip, Akdeniz diyetine uyum ve Finlandiya Diyabet Risk Skoru (FINDRISK) arasındaki ilişkilerin ve Akdeniz diyetine uyum üzerinden gözlenen dolaylı ilişkinin incelenmesi amaçlanmıştır.

Yöntem: Kesitsel tasarımdaki bu çalışmaya kartopu örnekleme yöntemiyle ulaşılan 2.302 yetişkin dahil edilmiştir. Kronotip, 19 maddelik Sabahçıl–Akşamcıl Anketi (MEQ-19); Akdeniz diyetine uyum, 14 maddelik Akdeniz Diyetine Uyum Ölçeği (MEDAS-14); diyabet risk puanı ise FINDRISK kullanılarak değerlendirilmiştir. Değişkenler arasındaki ilişkiler, yaş, beden kütle indeksi ve cinsiyete göre düzeltilmiş çoklu doğrusal regresyon ve bootstrap aracılık analiziyle incelenmiştir. Yüksek MEQ-19 puanları sabahçıllık yönelimini, yüksek MEDAS-14 puanları ise Akdeniz diyetine daha yüksek uyumu göstermektedir. Ölçekler arasındaki beslenme içeriği örtüşmesini değerlendirmek amacıyla FINDRISK'in meyve–sebze tüketimi maddesi çıkarılarak duyarlılık analizi yapılmıştır.

Bulgular: Akşamcıl, ara ve sabahçıl kronotip gruplarında ortalama MEDAS-14 puanları sırasıyla 5,5 ± 1,4; 5,9 ± 1,5 ve 6,4 ± 1,5 bulunmuştur ($p < 0,001$). Düzeltilmiş analizlerde yüksek MEQ-19 puanı, yüksek MEDAS-14 puanı ($p < 0,001$) ve düşük FINDRISK puanı ($p = 0,033$) ile ilişkili bulunmuştur. Yüksek MEDAS-14 puanı da düşük FINDRISK puanı ile ilişkili bulunmuştur ($p < 0,001$). MEDAS-14 üzerinden küçük bir dolaylı ilişki gözlenmiş (tahmin = −0,005; %95 güven aralığı: −0,008 ile −0,002; $p = 0,002$), ancak duyarlılık analizinde bu ilişkinin güven aralığı sıfırı içermiştir.

Sonuç: Sabahçıllık yönelimi, Akdeniz diyetine daha yüksek uyum ve daha düşük FINDRISK puanı ile ilişkili bulunmuştur. Bulgular, kronotip ile beslenme örüntülerinin birlikte değerlendirilmesinin önemine işaret etmektedir. Diyet uyumu üzerinden gözlenen küçük dolaylı ilişkinin daha iyi anlaşılması için boylamsal çalışmalara ihtiyaç vardır.

Anahtar kelimeler: Kronotip; Akdeniz diyeti; FINDRISK; aracılık analizi; sirkadiyen ritim.

ABSTRACT

Objective: This study examined associations among chronotype, Mediterranean diet adherence, and the Finnish Diabetes Risk Score (FINDRISK) in adults, including the indirect association through Mediterranean diet adherence.

Methods: This cross-sectional study included 2,302 adults recruited through snowball sampling. Chronotype was assessed using the 19-item Morningness–Eveningness Questionnaire (MEQ-19), Mediterranean diet adherence using the 14-item Mediterranean Diet Adherence Screener (MEDAS-14), and diabetes risk score using FINDRISK. Associations were examined using multiple linear regression and bootstrapped mediation analysis, adjusting for age, body mass index, and sex. Higher MEQ-19 scores indicate greater morningness, whereas higher MEDAS-14 scores indicate greater

Mediterranean diet adherence. A sensitivity analysis excluding the fruit and vegetable consumption item from FINDRISK assessed the influence of overlapping dietary content between the instruments.

Results: Mean MEDAS-14 scores were 5.5 ± 1.4, 5.9 ± 1.5, and 6.4 ± 1.5 among evening-type, intermediate-type, and morning-type participants, respectively ($p < 0.001$). In adjusted analyses, higher MEQ-19 scores were associated with higher MEDAS-14 scores ($p < 0.001$) and lower FINDRISK scores ($p = 0.033$). Higher MEDAS-14 scores were also associated with lower FINDRISK scores ($p < 0.001$). A small indirect association through MEDAS-14 was observed (estimate = −0.005; 95% confidence interval: −0.008 to −0.002; $p = 0.002$), but its confidence interval included zero in the sensitivity analysis.

Conclusion: Greater morningness was associated with higher Mediterranean diet adherence and lower FINDRISK scores. These findings highlight the relevance of considering chronotype alongside dietary patterns. Longitudinal studies are needed to clarify the small indirect association observed through dietary adherence.

Keywords: Chronotype; Mediterranean diet; FINDRISK; mediation analysis; circadian rhythm.

HAYVANSAL GIDALARDA PFAS: VARLIĞI, DİYETLE MARUZİYET VE GIDA GÜVENLİĞİ

PFAS IN FOODS OF ANIMAL ORIGIN: OCCURRENCE, DIETARY EXPOSURE AND FOOD SAFETY

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ÖZET

Per- ve polifloroalkil maddeler (PFAS), karbon–flor bağının olağanüstü kararlılığı nedeniyle çevrede kalıcı olan ve besin zincirinde biriken sentetik kimyasallardır. Bu çalışmada, güncel sistematik derlemeler, uluslararası risk değerlendirmeleri ve insan biyoizleme verileri temelinde hayvansal gıdalarda PFAS varlığı, diyetle maruziyet ve halk sağlığı riskleri değerlendirilmiştir. PFAS'lar proteinlere bağlanma eğilimleri nedeniyle özellikle balık ve kabuklu su ürünlerinde, yumurta sarısında ve sakatatta yüksek düzeylerde bulunmakta; PFOS ve PFOA baskın bileşikler olarak öne çıkmaktadır. Uluslararası Kanser Araştırma Ajansı PFOA'yı insanlar için kanserojen (Grup 1), PFOS'u ise olası kanserojen (Grup 2B) olarak sınıflandırmıştır. Florokimya tesisleri çevresinde üretilen yumurtalarda PFOA düzeyinin 100 ng/g'ı aştığı bildirilmiştir. Avrupa Gıda Güvenliği Otoritesi (EFSA), PFOA, PFOS, PFNA ve PFHxS toplamı için bağışıklık sistemi etkilerine dayanarak 4,4 ng/kg vücut ağırlığı/hafta tolere edilebilir haftalık alım (TWI) belirlemiştir. Avrupa'da ortalama maruziyet 3–22, 95. persentil ise 9–70 ng/kg vücut ağırlığı/hafta olup küçük çocuklarda yaklaşık iki kat daha yüksektir. Avrupalı ergenlerin %12,7–14,3'ünde serum PFAS düzeyi sağlık temelli eşik değeri aşmaktadır. Karasal besin zincirinde tehlike oranının 1'i aştığı durumlar yalnızca hayvansal gıdalarda saptanmış, pişirmenin ise PFAS düzeylerini tutarlı biçimde azaltmadığı görülmüştür. Çocuklar, gebeler ve yoğun su ürünü tüketenler başta olmak üzere halk sağlığının korunması için kirlilik odaklarında yerel gıda izlemesi, yem kaynaklı kontaminasyonun kontrolü, kısa zincirli PFAS'ları kapsayan standart analitik yöntemler ve ulusal maruziyet verilerinin oluşturulması gerekmektedir.

Anahtar Kelimeler: PFAS, hayvansal gıdalar, diyetle maruziyet, risk değerlendirmesi, halk sağlığı

ABSTRACT

Per- and polyfluoroalkyl substances (PFAS) are synthetic chemicals that persist in the environment and accumulate in the food chain owing to the exceptional stability of the carbon–fluorine bond. In this study, the occurrence of PFAS in foods of animal origin, dietary exposure and the associated public health risks were evaluated on the basis of recent systematic reviews, international risk assessments and human biomonitoring data. Because of their tendency to bind to proteins, PFAS are found at high levels particularly in fish and shellfish, egg yolk and offal, with PFOS and PFOA as the dominant compounds. The International Agency for Research on Cancer has classified PFOA as carcinogenic to humans (Group 1) and PFOS as possibly carcinogenic (Group 2B). PFOA levels exceeding 100 ng/g have been reported in eggs produced near fluorochemical facilities. Based on immune effects, the European Food Safety Authority (EFSA) established a tolerable weekly intake (TWI) of 4.4 ng/kg body weight/week for the sum of PFOA, PFOS, PFNA and PFHxS. In Europe, mean exposure ranges from 3 to 22 and the 95th percentile from 9 to 70 ng/kg body weight/week, and exposure in toddlers is approximately twofold higher. Serum PFAS levels exceed the health-based threshold in 12.7–14.3% of European adolescents. Within the terrestrial food chain, hazard ratios above 1 were identified only for foods of animal origin, and cooking did not consistently reduce PFAS

levels. To protect public health, particularly children, pregnant women and high consumers of seafood, local food monitoring in contamination hotspots, control of feed-borne contamination, standardised analytical methods covering short-chain PFAS and the generation of national exposure data are required.

Keywords: PFAS, foods of animal origin, dietary exposure, risk assessment, public health

GIDALARDA ENDOKRİN BOZUCULAR: BİRLEŞİK MARUZİYET VE METABOLİK ETKİLER

ENDOCRINE DISRUPTORS IN FOOD: COMBINED EXPOSURE AND METABOLIC EFFECTS

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ÖZET

Gıda güvenliğinde kimyasal risklerin değerlendirilmesi, tüketicilerin birden fazla kirleticiye birlikte maruz kaldığını dikkate alan yaklaşımları gerektirmektedir. Bu anlatısal derleme, gıda kaynaklı endokrin bozuculara birleşik maruziyetin metabolik etkilerini; toksik metal ve metaloidler (Cd, Pb, As, Hg), bisfenoller (BPA, BPF, BPS) ve ftalatlar (DEHP, DBP) çerçevesinde ele almaktadır. Çevresel bulaşma ve gıda ile temas eden materyallerden migrasyon, bu bileşiklere diyetle maruziyetin başlıca kaynakları arasındadır. Deneysel araştırmalar, incelenen bileşik ve karışımların hormonal sinyal yolları, oksidatif stres, mitokondriyal işlevler, inflamasyon ve glukoz–lipit metabolizması üzerinde etkili olabileceğini göstermektedir. Bununla birlikte, birleşik etkilerin yönü ve büyüklüğü; bileşiklerin özelliklerine, doz oranlarına, maruziyet süresine ve gelişim dönemine bağlıdır. Birlikte maruziyetin mutlaka sinerji oluşturduğu varsayılamaz; additif, sinerjik ve antagonistik etkiler uygun referans modelleriyle ayırt edilmelidir. Güncel epidemiyolojik çalışmalar, bazı maruziyet örüntülerini obezite, insülin direnci ve metabolik disfonksiyonla ilişkili steatotik karaciğer hastalığıyla ilişkilendirmektedir. Ancak gözlemsel ilişkiler nedenselliği tek başına kanıtlamamakta; biyolojik izleme verilerinin gıda dışı kaynakları da yansıtması, diyet kaynaklı etkilerin ayrıştırılmasını güçleştirmektedir. Tehlike indeksi, ortak toksikolojik sonlanım ve uygun referans değerler temelinde bir tarama yaklaşımı sunarken sinerjiyi doğrudan ölçmemektedir. Bayesian kernel machine regression ve quantile g-computation gibi yöntemler, epidemiyolojik karışım ilişkilerinin incelenmesine katkı sağlayabilir. Sonuç olarak, gıda kaynaklı endokrin bozucuların metabolik etkilerinin değerlendirilmesinde mekanizma temelli gruplandırma, gerçekçi birleşik maruziyet senaryoları ve belirsizlik analiziyle desteklenen kademeli risk değerlendirmesi önem taşımaktadır.

Anahtar Kelimeler: Endokrin bozucular, birleşik maruziyet, kimyasal karışımlar, toksik metaller, bisfenoller, ftalatlar, metabolik etkiler

ABSTRACT

Chemical risk assessment in food safety requires approaches that account for consumers' combined exposure to multiple contaminants. This narrative review examines the metabolic effects of combined exposure to foodborne endocrine disruptors, focusing on toxic metals and metalloids (Cd, Pb, As, Hg), bisphenols (BPA, BPF, BPS), and phthalates (DEHP, DBP). Environmental contamination and migration from food contact materials are major sources of dietary exposure to these substances. Experimental research indicates that the investigated compounds and mixtures may affect hormonal signalling, oxidative stress, mitochondrial function, inflammation, and glucose and lipid metabolism. However, the direction and magnitude of combined effects depend on chemical properties, dose ratios, exposure duration, and developmental stage. Co-exposure cannot automatically be interpreted as synergism; additive, synergistic, and antagonistic effects must be distinguished using appropriate reference models. Recent epidemiological studies associate certain exposure patterns with obesity, insulin resistance, and metabolic dysfunction-associated steatotic liver disease. Nevertheless,

observational associations alone do not establish causality, and biomonitoring data also reflect nondietary sources, complicating the attribution of effects to dietary exposure. The hazard index provides a screening approach when based on a common toxicological endpoint and suitable reference values, but does not directly quantify synergism. Methods such as Bayesian kernel machine regression and quantile g-computation can support the investigation of epidemiological mixture associations. Overall, evaluating the metabolic effects of foodborne endocrine disruptors requires tiered risk assessment incorporating mechanism-based grouping, realistic combined exposure scenarios, and explicit uncertainty analysis.

Keywords: Endocrine disruptors, combined exposure, chemical mixtures, toxic metals, bisphenols, phthalates, metabolic effects

GIDA İŞLEME, GIDA GÜVENLİĞİ VE KALİTENİN KORUNMASINDA GELİŞMEKTE OLAN SÜRDÜRÜLEBİLİR BİR TEKNOLOJİ: ELEKTROLİZE SU

ELECTROLYZED WATER AS AN EMERGING SUSTAINABLE TECHNOLOGY FOR FOOD PROCESSING, SAFETY, AND QUALITY PRESERVATION

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ÖZET

Güvenli ve yüksek kaliteli gıdalara yönelik artan talep, gıda işleme ve muhafazasında sürdürülebilir teknolojilerin geliştirilmesini teşvik etmektedir. Seyreltik sulu elektrolit çözeltilerinin elektrolizi ile üretilen elektrolize su (ES), sanitasyonu iyileştirme ve gıda kalitesini koruma potansiyeli nedeniyle ilgi görmektedir. ES'nin asidik, nötr ve alkali formları farklı fizikokimyasal özellikler göstermekte; bu da temizlik, dezenfeksiyon ve işleme uygulamalarının geniş bir yelpazesinde kullanılmalarına olanak tanımaktadır. Bu derleme; mikrobiyal kontrol, ürün yıkama, gıda temas yüzeylerinin sanitasyonu ve kalitenin korunmasına odaklanarak ES'nin meyve-sebze, et, su ürünleri, süt, tahıl ve bitki bazlı gıda sistemlerindeki rolünü incelemektedir. Elektroliz parametreleri ile uygulama koşullarının antimikrobiyal etkinlik ve besinsel ile duyusal niteliklerin korunması üzerindeki etkileri ele alınmaktadır. ES'nin geleneksel kimyasal sanitasyon ajanlarına bağımlılığın azaltılması ve kaynak verimliliğinin artırılması gibi olası sürdürülebilirlik yararları eleştirel bir bakışla değerlendirilmektedir. Pratik sınırlılıklar arasında organik maddenin etkisi, çözelti stabilitesi, homojen olmayan uygulama, ekipman uyumluluğu ve uygulamaya özgü optimizasyon gerekliliği yer almaktadır. Korozyon, olası kalıntılar ve yan ürünler, endüstriyel ölçeğe geçiş, mevzuata uyum ve standart çalışma prosedürleri ise diğer güçlükler arasındadır. ES'nin tamamlayıcı muhafaza teknolojileriyle birlikte kullanılması, uygulama etkinliğini artırabilir ve gıda işleme operasyonlarındaki kullanım alanını genişletebilir. ES, gıda güvenliği ve kalitenin korunması için umut verici bir yaklaşım olmakla birlikte, çevresel ve ekonomik avantajlarının endüstriyel koşullarda daha fazla doğrulanması gerekmektedir. Gıda endüstrisinde etkin ve sürdürülebilir biçimde benimsenmesini desteklemek için pilot ölçekli araştırmalar, kapsamlı güvenlik değerlendirmeleri ve optimize edilmiş işleme protokolleri gereklidir.

Anahtar Kelimeler: Elektrolize su; sürdürülebilir gıda işleme; gıda güvenliği; mikrobiyal kontrol; kalitenin korunması.

ABSTRACT

Increasing demand for safe, high-quality foods has encouraged the development of sustainable technologies for food processing and preservation. Electrolyzed water (EW), generated by electrolyzing dilute aqueous electrolyte solutions, has attracted interest for its potential to improve sanitation and maintain food quality. Its acidic, neutral, and alkaline forms exhibit different physicochemical characteristics, allowing their use in a range of cleaning, disinfection, and processing applications. This review examines the role of EW in fruit and vegetable, meat, seafood, dairy, cereal, and plant-based food systems, focusing on microbial control, produce washing, food-contact surface sanitation, and quality preservation. It explores the effects of electrolysis parameters and treatment conditions on antimicrobial performance and the retention of nutritional and sensory attributes. The potential sustainability benefits of EW, including reduced dependence on conventional chemical sanitizers and improved resource efficiency, are critically considered. Practical limitations include the influence of organic matter, solution stability, uneven treatment, equipment compatibility, and the need for application-specific optimization. Additional challenges involve corrosion, potential residues and by-products, industrial scale-up, regulatory compliance, and standardized operating procedures. Combining EW with complementary preservation technologies may improve treatment efficacy and broaden its use across food processing operations. Although EW represents a promising approach to food safety and quality preservation, its environmental and economic advantages require further validation under industrial conditions. Pilot-scale investigations, comprehensive safety assessments, and optimized processing protocols are essential to support its effective and sustainable adoption by the food industry.

Keywords: Electrolyzed water; sustainable food processing; food safety; microbial control; quality preservation.

TARIMSAL-ENDÜSTRİYEL YAN ÜRÜNLERİN KATMA DEĞERLİ FONKSİYONEL GIDA FORMÜLASYONLARINA DÖNÜŞTÜRÜLMESİ: TEKNOLOJİK ENGELLERİN VE MİKROBESİN EKSİKLİKLERİNİN AŞILMASI

VALORIZATION OF AGRO-INDUSTRIAL BY-PRODUCTS INTO VALUE-ADDED FUNCTIONAL FOOD FORMULATIONS: OVERCOMING TECHNOLOGICAL BARRIERS AND MICRONUTRIENT DEFICITS

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ÖZET

Küresel tarım-gıda işleme endüstrisinin büyümesi her yıl milyarlarca ton organik atık oluşmasına yol açmakta; bu durum sera gazı emisyonları ve bertaraf sorunları bakımından ciddi ekolojik sonuçlar doğurmaktadır. Dikkat çekici biçimde, meyve kabukları, posalar, çekirdekler ve sebze kalıntıları gibi yan ürünler; diyet lifi, mineraller ve polifenoller, karotenoidler ve flavonoidler gibi sağlığa yararlı fitokimyasallar bakımından oldukça zengindir. Ancak bu materyaller geleneksel tarımsal atık yönetiminde çoğunlukla göz ardı edilmekte; böylece mikrobesin yetersizliğine bağlı malnütrisyonun azaltılması ve gıda sürdürülebilirliğinin artırılması yönündeki önemli bir fırsat kaçırılmaktadır. Bu çalışma, yeterince değerlendirilmeyen tarımsal kalıntıların fonksiyonel gıda geliştirmeye yönelik biyofonksiyonel bileşenlere dönüştürülmesini amaçlayan, hedefe yönelik bir yeşil biyorafineri yaklaşımını ele almaktadır. Bağlı fenolikleri ve yapısal polisakkaritleri antioksidan kinetiklerini değiştirmeden elde etmek amacıyla iki çevre dostu ekstraksiyon ve termal kurutma yöntemi test edilmiştir. Optimize edilmiş fonksiyonel tozlar model gıda sistemlerine eklenmiş; duyusal ve reolojik özellikler olumsuz etkilenmeden radikal süpürme aktivitesi, oksidatif stabilite ve diyet lifi yoğunluğu önemli ölçüde artmıştır. Bununla birlikte, matrise bağlı biyoyararlılık sorunlarının ve antibesinsel etkileşimlerin aşılması, ölçeklenebilir ticari uygulamaya geçiş için hâlâ kilit önemdedir. Sonuç olarak, tarımsal yan ürünlerin katma değerli fonksiyonel gıda ürünlerine dönüştürülmesi döngüsel biyoekonomi yaklaşımlarıyla uyumludur; hasat sonrası atıkların azaltılmasına katkı sağlamanın yanı sıra halk sağlığı beslenmesi için sürdürülebilir ve besin değeri yüksek seçenekler sunmaktadır.

Anahtar Kelimeler: Tarımsal atıkların değerlendirilmesi; fonksiyonel gıdalar; döngüsel biyoekonomi; polifenoller; sürdürülebilir gıda sistemleri; diyet lifi.

ABSTRACT

The growth of the world agri-food processing industry produces billions of tons of organic waste per year, which has serious ecological consequences in terms of greenhouse gas emissions and disposal problems. Interestingly, their by-products such as fruit peels, pomace, seeds and vegetable residues are very rich in dietary fibers, minerals and phytochemicals like polyphenols, carotenoids and flavonoids, which are beneficial to health. However, these are often neglected in conventional agro-waste management, missing a viable opportunity to reduce micronutrient malnutrition and improve food sustainability. It is a targeted green biorefinery approach for valorizing underutilized agro-residues

into bio-functional ingredients for functional food development. Two eco-friendly extraction and thermal dehydration methods were tested to extract bound phenolics and structural polysaccharides without altering their antioxidant kinetics. Optimized functional powders were incorporated into model food systems, and their radical scavenging activity, oxidative stability, and density of dietary fiber were significantly increased, without compromising the organoleptic and rheological properties. However, overcoming matrix-dependent bioavailability challenges and anti-nutritional interactions are still key for scalable commercial translation. Overall, the conversion of agricultural by-products into value-added functional food products is in line with circular bioeconomy approaches, and it not only helps to reduce post-harvest waste but also provides sustainable, nutrient-dense options for public health nutrition.

Keywords: Agro-waste valorization; functional foods; bio-circular economy; polyphenols; sustainable food systems; dietary fiber.

PHYSIOLOGICAL BASIS OF STRESS MEMORY IN PLANTS: HOW TRANSIENT STRESS SHAPES FUTURE STRESS TOLERANCE

BİTKİLERDE STRES HAFIZASININ FİZYOLOJİK TEMELLERİ: GEÇİCİ STRESLERİN GELECEKTEKİ STRES TOLERANSINI ŞEKİLLENDİRMESİ

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ÖZET

Bitkiler, çevresel streslere karşı yalnızca anlık fizyolojik yanıtlar geliştiren organizmalar değil, aynı zamanda daha önce karşılaştıkları stres koşullarının etkilerini sonraki yaşam dönemlerine taşıyabilen dinamik sistemlerdir. Son yıllarda "stres hafızası" olarak tanımlanan bu olgu, bitki fizyolojisi ve stres biyolojisinin dikkat çeken araştırma alanlarından biri hâline gelmiştir. Kısa süreli kuraklık, tuzluluk, sıcaklık değişimi, oksidatif stres veya besin yetersizliği gibi çevresel uyarıların, bitkinin daha sonraki streslere verdiği fizyolojik yanıtı değiştirebildiği bildirilmektedir. Bu süreçte reaktif oksijen türleri (ROS), kalsiyum sinyalleri, fitohormonlar, antioksidan sistemler, epigenetik düzenlemeler ve stresle ilişkili genlerin yeniden programlanması önemli rol oynamaktadır. Özellikle ilk stres deneyiminin ardından antioksidan enzimlerin daha hızlı aktive olması, stomatal davranışların değişmesi, fotosentetik aparatın korunması ve ozmotik düzenlemenin güçlenmesi, bitkinin ikinci stres döneminde daha yüksek tolerans göstermesine katkı sağlayabilmektedir. Bununla birlikte stres hafızasının kalıcı bir özellik olmadığı; stresin şiddeti, süresi, bitki türü, gelişim dönemi ve çevresel koşullara bağlı olarak değişebildiği görülmektedir. Bu derlemede, bitkilerde stres hafızasının fotosentez, su ilişkileri, stomatal düzenleme, oksidatif denge, antioksidan savunma ve hormon metabolizması üzerindeki fizyolojik etkileri bütüncül olarak değerlendirilecektir. Ayrıca "ön streslenme" (priming) yaklaşımının bitkilerin gelecekteki streslere hazırlanmasındaki potansiyeli ve sürdürülebilir tarım açısından uygulanabilirliği tartışılacaktır. Stres hafızasının fizyolojik mekanizmalarının daha iyi anlaşılması, değişken çevre koşullarına dayanıklı bitkilerin belirlenmesi ve geliştirilmesi açısından yeni araştırma perspektifleri sağlayabilir.

Anahtar Kelimeler: Bitki Fizyolojisi, Abiyotik Stres, Antioksidan Sistem, Fotosentez, Bitki Stres Toleransı.

ABSTRACT

Plants are not merely organisms that develop immediate physiological responses to environmental stresses; they are dynamic systems capable of retaining the effects of previous stress exposure and modifying their responses to subsequent challenges. This phenomenon, commonly referred to as stress memory, has emerged as an important research area in plant physiology and stress biology. Previous exposure to short-term drought, salinity, temperature fluctuations, oxidative stress, or nutrient limitation can alter the physiological responses of plants to subsequent stress events. This process involves a complex interaction among reactive oxygen species (ROS), calcium signaling, phytohormones, antioxidant defense systems, epigenetic regulation, and the reprogramming of stress-responsive genes. In particular, enhanced activation of antioxidant enzymes following a previous stress event, together with changes in stomatal behavior, protection of the photosynthetic apparatus, and improved osmotic adjustment, may contribute to greater tolerance during subsequent stress exposure. However, stress memory is not necessarily permanent and can vary depending on stress intensity and duration, plant species, developmental stage, and environmental conditions. This review

evaluates the physiological mechanisms underlying stress memory in plants, with particular emphasis on photosynthesis, plant water relations, stomatal regulation, redox homeostasis, antioxidant defense, and phytohormonal regulation. The potential role of stress priming as a physiological strategy for preparing plants for future environmental challenges is also discussed in the context of sustainable crop production. Understanding the physiological mechanisms underlying stress memory may provide new perspectives for identifying and developing plants with improved resilience to increasingly variable environmental conditions.

Keywords: Plant Physiology, Abiotic Stress, Antioxidant Defense, Photosynthesis, Stress Tolerance.

PHOTOSYNTHETIC PLASTICITY IN PLANTS: A NEW INDICATOR OF RAPID PHYSIOLOGICAL ACCLIMATION TO ENVIRONMENTAL FLUCTUATIONS

BİTKİLERDE FOTOSENTETİK ESNEKLİK: DEĞİŞKEN ÇEVRE KOŞULLARINDA HIZLI FİZYOLOJİK UYUMUN YENİ BİR GÖSTERGESİ

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ÖZET

Bitkiler doğal yaşamları boyunca sabit çevre koşullarından ziyade ışık, sıcaklık, su ve atmosferik CO_2 düzeylerinin sürekli değiştiği dinamik ortamlara maruz kalmaktadır. Buna karşın bitki fizyolojisi çalışmalarının önemli bir bölümü, bitkilerin sabit çevresel koşullara veya sürekli uygulanan streslere verdiği yanıtlar üzerinden yürütülmektedir. Oysa doğal koşullarda fotosentetik performans, çevresel değişimin yalnızca şiddetine değil, değişimin hızı, sıklığı, süresi ve öngörülebilirliğine bağlı olarak da yeniden düzenlenmektedir. Son yıllarda yapılan çalışmalar, özellikle dalgalanan ışık altında fotosentetik elektron taşınımı, stomatal davranış, fotokoruyucu mekanizmalar ve karbon kazanımının zamana bağlı olarak önemli ölçüde değişebildiğini ortaya koymuştur. Bu çalışmada, bitkilerin değişken çevre koşullarına uyum kapasitesinin "fotosentetik esneklik" kavramı üzerinden değerlendirilmesi önerilmektedir. Fotosentetik esneklik; çevresel bir değişim sonrasında net fotosentez, stomatal iletkenlik, PSII fotokimyasal verimi, elektron taşınım hızı ve fotokoruyucu mekanizmaların yeni koşullara ulaşma hızı ile mevcut fizyolojik durum arasındaki farkın birlikte değerlendirilmesi şeklinde ele alınabilir. Özellikle sabit ışık ile aynı günlük ışık integraline sahip ancak farklı frekans ve amplitüdlere sahip dalgalanan ışık rejimlerinin karşılaştırılması, bitkilerin çevresel değişimlere verdiği dinamik yanıtların ortaya çıkarılmasını sağlayabilir.

Çalışmanın özgün hipotezi, benzer günlük ışık miktarına maruz kalan bitkilerin çevresel değişimlerin frekansına ve amplitüdüne bağlı olarak farklı fotosentetik esneklik göstereceğidir. Bu kapsamda klorofil floresansı, gaz değişimi, stomatal davranış, fotosentetik pigmentler, membran stabilitesi ve oksidatif stres göstergelerinin zamana bağlı olarak izlenmesi önerilmektedir. Ayrıca ışık değişimleriyle birlikte yaprak sıcaklığındaki kısa süreli değişimlerin değerlendirilmesi, doğal çevrede eşzamanlı meydana gelen faktörlerin fizyolojik etkilerinin daha gerçekçi biçimde ortaya konulmasına olanak sağlayacaktır. Nitekim yakın tarihli çalışmalar, ışık ve yaprak sıcaklığındaki eşzamanlı dalgalanmaların stomatal iletkenlik ve net CO_2 asimilasyonu üzerinde tek başına ışık değişiminden farklı etkiler oluşturabileceğini göstermektedir.

Sonuç olarak, bitkilerin çevresel streslere verdiği yanıtın yalnızca stres toleransı ile değil, değişen koşullara ne kadar hızlı ve etkin uyum sağlayabildiği ile değerlendirilmesi önerilmektedir. Fotosentetik esnekliğin yeni bir fonksiyonel fizyolojik özellik olarak tanımlanması, iklim değişikliğine dayanıklı bitkilerin belirlenmesi ve kontrollü çevre tarımında dinamik yetiştirme stratejilerinin geliştirilmesi açısından yeni bir araştırma perspektifi sunabilir.

Anahtar Kelimeler: Fotosentetik Esneklik, Dinamik Fotosentez, Fizyolojik Plastisite, İklim Dayanıklılığı, Bitki Adaptasyonu.

ABSTRACT

Throughout their natural lifespans, plants are exposed to dynamic environments in which light, temperature, water and atmospheric CO_2 levels are constantly changing, rather than to static environmental conditions. Nevertheless, a significant proportion of research into plant physiology is conducted by examining plants' responses to static environmental conditions or to continuously applied stresses. In fact, under natural conditions, photosynthetic performance is modulated not only by the intensity of environmental change but also by the rate, frequency, duration and predictability of that change. Recent studies have demonstrated that, particularly under fluctuating light conditions, photosynthetic electron transport, stomatal behaviour, photoprotective mechanisms and carbon uptake can vary significantly over time. In this study, it is proposed that plants' capacity to adapt to variable environmental conditions be assessed through the concept of 'photosynthetic flexibility'. Photosynthetic flexibility can be defined as the combined assessment of the difference between the current physiological state and the rate at which net photosynthesis, stomatal conductance, PSII photochemical efficiency, electron transport rate and photoprotective mechanisms adapt to new conditions following an environmental change. In particular, comparing fluctuating light regimes—which have the same daily light integral as constant light but differ in frequency and amplitude—can help to reveal the dynamic responses of plants to environmental changes.

The study's original hypothesis is that plants exposed to similar daily light quantities will exhibit different levels of photosynthetic flexibility depending on the frequency and amplitude of environmental fluctuations. In this context, it is recommended that chlorophyll fluorescence, gas exchange, stomatal behaviour, photosynthetic pigments, membrane stability and oxidative stress indicators be monitored over time. Furthermore, the assessment of short-term changes in leaf temperature alongside light fluctuations will enable a more realistic understanding of the physiological effects of factors occurring simultaneously in the natural environment. Indeed, recent studies have shown that simultaneous fluctuations in light and leaf temperature can exert different effects on stomatal conductance and net CO_2 assimilation compared to light changes alone.

Consequently, it is recommended that the response of plants to environmental stresses be assessed not only in terms of stress tolerance but also in terms of how rapidly and effectively they can adapt to changing conditions. Defining photosynthetic flexibility as a new functional physiological trait may offer a new research perspective for identifying plants resilient to climate change and for developing dynamic cultivation strategies in controlled-environment agriculture.

Keywords: Photosynthetic Flexibility, Dynamic Photosynthesis, Environmental Fluctuations, Physiological Plasticity, Climate Resilience, Plant Adaptation.

THE HIDDEN SIDE OF THE GLUTEN-FREE DIET TREND: INCREASED GLYCEMIC INDEX, CROSS-CONTAMINATION RISKS, AND NUTRITIONAL INADEQUACIES

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ABSTRACT

Digestive problems are among the most widespread issues recently, and the multiplicity of potential causes, combined with the absence of a clear scientific consensus in many cases, has led people to increasingly follow the gluten-free diet as an attempt to get rid of the symptoms they experience. Notably, this diet remains the only recognized therapeutic approach for celiac disease, wheat allergy, dermatitis herpetiformis and gluten ataxia, representing a medical necessity rather than a lifestyle preference for affected individuals. However, a considerable proportion of consumers without medically diagnosed conditions have also adopted gluten avoidance, following misconceptions that link gluten to digestive problems. Therefore, this rising demand has driven food manufacturers to expand the variety of gluten free products available on the market, with formulation efforts frequently prioritizing gluten exclusion over nutritional quality. In fact, the majority of gluten free products rely on refined starch sources that are low in fiber and rapidly digested, resulting in an elevated glycemic index. Their low protein content also limits the moderating effect that is normally observed on postprandial blood glucose response. Due to the use of alternative ingredients to compensate for the absence of gluten, most gluten-free products are also considered poor sources of vitamins and minerals. Beyond these nutritional concerns, cross-contamination with gluten, particularly during the manufacturing process, represents a critical safety issue directly affecting celiac and gluten allergy patients, a problem that has been consistently documented across numerous studies worldwide. Recognizing these real concerns by healthy people, patients, and even manufacturers is essential to controlling and minimizing the negative effects of these products.

Keywords: Gluten-free diet, Glycemic index, Cross-contamination, Nutritional deficiency, Celiac disease.

CHLORELLA VULGARİS MİKROALGİNİN GIDA İKAMESİ OLARAK BESLENME PERSPEKTİFİNDEN DEĞERLENDİRİLMESİ

NUTRITIONAL EVALUATION OF CHLORELLA VULGARIS MICROALGAE AS A FOOD SUBSTITUTE

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ÖZET

Günümüzde temel beslenmenin ötesinde sağlığı destekleyici, bağışıklık sistemini güçlendirici ve kronik hastalık riskini azaltıcı etkiler sunan fonksiyonel gıdalara olan küresel ilgi hızla artmaktadır. Özellikle yüksek besin profilleri ve hızlı biyokütle üretim avantajlarıyla mikroalgler yenilikçi bir kaynak olarak öne çıkmaktadır. Mikroalgler, sucul ortamlarda gelişebilen, yüksek oranlarda protein, lipit, karbonhidrat, vitamin ve mineraller içeren fotosentetik mikroorganizmalardır. Bu mikroalg türleri arasında yer alan *Chlorella vulgaris*, kuru ağırlığının %43-58'ini oluşturan yüksek kaliteli protein yapısı, esansiyel amino asitleri, klorofil ve karotenoid pigmentleri, B ve E vitaminleri ile mineralleri sayesinde olağanüstü zengin bir biyoaktif profile sahiptir. Sahip olduğu işlevsel makro ve mikro besin öğeleri nedeniyle *C. vulgaris* gıda endüstrisinde gıda ürünlerinin besin değerini, dokusunu ve organoleptik niteliklerini geliştirmek amacıyla bir gıda ikamesi ve fonksiyonel biyoaktif takviye bileşeni olarak yaygın şekilde değerlendirilmektedir. Literatürde *C. vulgaris* mikroalginin fırıncılık ürünlerinde, makarnada ve yoğurtta gıda ikamesi olarak kullanılmasına rağmen, emülsiyon yapısı karmaşık ve duyusal dengesi oldukça hassas olan dondurma matrisinde bir gıda ikamesi olarak değerlendirilmesine yönelik herhangi bir çalışma bulunmamaktadır. Bu çalışmada, *C. vulgaris* mikroalgi ilave edilerek yenilikçi ve fonksiyonel bir dondurma geliştirildi. Geliştirilen ürünün organoleptik özelliklerini ve genel beğenisini değerlendirmek üzere, belirlenen dahil etme ve dışlama kriterleri çerçevesinde Sivas Cumhuriyet Üniversitesi Sağlık Bilimleri Fakültesi'nde öğrenim gören 287 öğrencinin katılımıyla 9 puanlık hedonik skala kullanılarak duyusal analiz gerçekleştirildi. Elde edilen anket verilerinin SPSS paket programı üzerinden istatistiksel değerlendirilmesi ve dondurma örneklerinin temel besin bileşimi ve biyoaktif özelliklerine ilişkin laboratuvar analizleri yapıldı. Bu çalışma ile *C. vulgaris* mikroalginin dondurulmuş süt ürünlerinde fonksiyonel bir gıda ikamesi, biyoaktif bileşen ve doğal renklendirici olarak kullanım potansiyeli ve sürdürebilir fonksiyonel gıda geliştirmeye katkısı ortaya konulmuştur.

Anahtar Kelimeler: *Chlorella vulgaris*, gıda ikamesi, fonksiyonel dondurma

ABSTARCT

There is currently rapidly growing global interest in functional foods that offer health-promoting, immune-boosting, and chronic disease risk-reducing effects beyond basic nutrition. Microalgae, in particular, stand out as an innovative resource due to their superior nutritional profiles and the advantage of rapid biomass production. Microalgae are photosynthetic microorganisms capable of

thriving in aquatic environments and contain high levels of proteins, lipids, carbohydrates, vitamins, and minerals. Among these species, *Chlorella vulgaris*, possesses an exceptionally rich bioactive profile, characterized by high-quality protein (comprising 43–58% of its dry weight), essential amino acids, chlorophyll and carotenoid pigments, vitamins B and E, and minerals. Due to its functional macro- and micronutrients, *C. vulgaris* is widely utilized in the food industry as a food substitute and a functional bioactive supplement to enhance the nutritional value, texture, and organoleptic properties of food products. Although the literature documents the use of *C. vulgaris* microalgae as a food substitute in bakery products, pasta, and yogurt, there are no studies evaluating its use as a food substitute in ice cream matrices, systems characterized by complex emulsion structures and highly sensitive sensory balances. In this study, an innovative and functional ice cream was developed through the addition of *C. vulgaris* microalgae. To evaluate the organoleptic properties and overall acceptability of the developed product, a sensory analysis using a 9-point hedonic scale was conducted with the participation of 287 students from the Faculty of Health Sciences at Sivas Cumhuriyet University, based on established inclusion and exclusion criteria. Statistical analysis of the survey data was performed using the SPSS software package, and laboratory analyses were conducted to determine the basic nutritional composition and bioactive properties of the ice cream samples. This study demonstrates the potential of the microalga *C. vulgaris* to serve as a functional food substitute, bioactive ingredient, and natural colorant in frozen dairy products, as well as its contribution to the development of sustainable functional foods.

Keywords: *Chlorella vulgaris*, food substitute, functional ice cream.

AUTİZMLİ UŞAQLARDA QİDA DAVRANIŞININ YAXŞILAŞDIRIMASI

IMPROVING EATING BEHAVIOR IN CHILDREN WITH AUTISM

УЛУЧШЕНИЕ ПИЩЕВОГО ПОВЕДЕНИЯ У ДЕТЕЙ С АУТИЗМОМ

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XÜLASƏ

Bu tədqiqatın məqsədi autizm spektr pozğunluğu olan uşaqların qidalanma xüsusiyyətlərini və qidalanma pozğunluqları ilə müşayiət olunan davranış çatışmazlıqlarını təhlil etməkdir.

ASD-li uşaqlarda qidalanma pozğunluqları uşağın qidalanma vəziyyətində mənfi dəyişikliklərə və bir sıra xəstəliklərin yaranmasına gətirib çıxarır. Autizm spektr pozğunluğu olan uşaqlada qida çatışmazlığı,təkcə əqli və fiziki inkişafın ləngiməsinə deyil, həmçinin qida davranışının pisləşməsi nə də səbəb olur.

Açar sözlər: autizmli uşaq,qidalanma, seçmə qidalanma, qidalanma davranışı

АННОТАЦИЯ

Цель данного исследования — проанализировать особенности питания детей с расстрой ствами аутистического спектра (PAC) и поведенческие нарушения, связанные с расстройст вами пищевого поведения.

Расстройства пищевого поведения у детей с PAC приводят к неблагоприятным изменениям нутритивного статуса и развитию различных заболеваний. У детей с PAC недостаточность питания влечет за собой не только задержку психического и физического развития, но и ухудшение пищевого поведения.

Заключение. Методы коррекции питания у детей с PAC могут способствовать улучшению пищевого поведения и уменьшению выраженности клинических проявлений аутизма.

Ключевые слова:ребенок с аутизмом, питание,избирательное питание, пищевое поведение

ABSTRACT

The aim of this study is to analyze the dietary characteristics of children with autism spectrum disorder (ASD) and the behavioral disturbances associated with eating disorders.

Eating disorders in children with ASD lead to adverse changes in nutritional status and the development of various medical conditions. In children with ASD, malnutrition results not only in delayed mental and physical development but also in a deterioration of eating behaviors.

Conclusion. Dietary intervention methods for children with ASD can lead to improved eating behaviors and a reduction in the clinical manifestations of autism.

Keywords: child with autism, nutrition, selective eating, eating behavior

GIDA KATKI MADDELERİNİN DÖNÜŞÜMÜ: GELENEKSEL MUHAFAZA UYGULAMALARINDAN BİYOKORUMA VE TEMİZ ETİKET YAKLAŞIMINA

THE EVOLUTION OF FOOD ADDITIVES: FROM TRADITIONAL PRESERVATION PRACTICES TO BIOPROTECTION AND THE CLEAN LABEL APPROACH

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ÖZET

Gıda maddelerinin bozulmasının önlenmesi, raf ömrünün uzatılması ve organoleptik özelliklerin korunması, insanlık tarihi boyunca gıda işlemenin temel hedefleri arasında yer almaktadır. Kurutma, tuzlama, tütsüleme ve fermentasyon gibi geleneksel yöntemler, Sanayi Devrimi ile sentetik katkı maddelerinin yaygınlaşmasıyla endüstriyel boyut kazanmaktadır. E-kodlama sistemi gıda güvenliğinde standart sağlasa da 21. yüzyılda artan tüketici farkındalığı ve sağlık kaygıları paradigma değişimini zorunlu kılmaktadır. Bu dönüşümle birlikte, sentetik koruyucu, antioksidan ve renklendiricilerin yerini "temiz etiket" anlayışı ve biyokoruma odaklı yaklaşımlar almaktadır. Biyokoruma, gıdaların raf ömrü ve güvenliğinin geliştirilmesinde yararlı mikroorganizmalar ve antimikrobiyal metabolitlerinden yararlanılmasına dayanan alternatif bir muhafaza yaklaşımı olarak değerlendirilmektedir. Bu kapsamda özellikle laktik asit bakterileri ve ürettikleri bakteriyosinler, organik asitler, antifungal metabolitler, koruyucu kültürler ve fermentatlar, sentetik koruyucuların kullanımının azaltılmasına yönelik önemli seçenekler arasında yer almaktadır. Bitkisel ekstraktlar, uçucu yağlar ve doğal biyoaktif bileşenler de temiz etiketli ürünlerin geliştirilmesini destekleyen alternatifler olarak kabul edilmektedir. Bu ajanlarla patojen ve bozulma mikroorganizmaları hedef alınarak gıdanın besinsel ve duyusal değeri korunmaktadır. Ayrıca enkapsülasyon, yenilebilir film ve kaplamalar, aktif ambalajlama ve engel teknolojileri gibi yeni nesil uygulamalar, doğal antimikrobiyal bileşenlerin etkinliğinin ve stabilitesinin geliştirilmesi açısından potansiyel taşımaktadır. Bununla birlikte, doğal veya mikrobiyal kökenli bileşenlerin sentetik koruyucuların yerine doğrudan kullanılması her zaman mümkün olmamaktadır. Antimikrobiyal etkinliğin gıda matriksinden etkilenmesi, duyusal değişiklikler, inaktivasyon riskleri, maliyetler ve mevzuat gereklilikleri başlıca sınırlamaları oluşturmaktadır. Bu nedenle gelecekte tek bir koruyucu ikamesinden ziyade; biyokoruyucu kültürler, doğal antimikrobiyaller, enkapsülasyon ve hedefe yönelik salım sistemleri ile farklı teknolojilerin bütünleşik kullanımının önem kazanacağı öngörülmektedir. Sonuç olarak, gıda katkı maddeleri pasif raf ömrü uzatıcı bileşenlerden doğal, biyoaktif ve fonksiyonel sistemlere evrilmektedir. Geleceğin gıda işleme teknolojilerinde, temiz etiket konseptine uygun olarak biyolojik kaynaklı koruyucuların ve yan ürünlerden ekstrakte edilen doğal katkıların kullanımının artacağı öngörülmektedir.

Anahtar Kelimeler: Gıda katkı maddeleri, biyokoruma, temiz etiket, laktik asit bakterileri, bakteriyosinler, doğal antimikrobiyaller, gıda güvenliği.

ABSTRACT

Preventing food spoilage, extending shelf life and preserving organoleptic properties have long been among the fundamental objectives of food processing throughout human history. Traditional methods such as drying, salting, smoking and fermentation gave way to industrial-scale processes with the Industrial Revolution and the widespread adoption of synthetic additives. While the E-number system provides standards for food safety, increasing consumer awareness and health concerns in the 21st

century have necessitated a paradigm shift. With this shift, the 'clean label' concept and biopreservation-focused approaches are replacing synthetic preservatives, antioxidants and colorings. Biopreservation is regarded as an alternative preservation approach that uses beneficial microorganisms and their antimicrobial metabolites to improve the shelf life and safety of food. In this context, lactic acid bacteria and their bacteriocins, organic acids, antifungal metabolites, preservative cultures, and fermentates are key options for reducing reliance on synthetic preservatives. Plant extracts, essential oils and natural bioactive compounds are also recognised as alternatives supporting the development of 'clean label' products. The use of these agents to target pathogens and spoilage microorganisms preserves the nutritional and sensory value of food. Furthermore, new-generation applications such as encapsulation, edible films and coatings, active packaging, and hurdle technologies show potential to enhance the efficacy and stability of natural antimicrobial agents. However, it is not always possible to use natural or microbial components directly as substitutes for synthetic preservatives. The main limitations include the influence of the food matrix on antimicrobial efficacy, sensory changes, inactivation risks, costs and regulatory requirements. Therefore, future food preservation is expected to rely not on single-preservative substitution but on the integrated use of bioprotective cultures, natural antimicrobials, encapsulation, targeted delivery systems, and complementary technologies. In conclusion, food additives are evolving from passive shelf-life extenders to natural, bioactive and functional systems. Future food processing technologies are predicted to increasingly incorporate biologically derived preservatives and natural additives extracted from by-products, in line with the clean label concept.

Keywords: Food additives, biopreservation, clean label, lactic acid bacteria, bacteriocins, natural antimicrobials, food safety.

POSTBİYOTİK MOLEKÜLLERİN BİYOKİMYASI

BIOCHEMISTRY OF POSTBIOTIC MOLECULES

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ÖZET

Sağlık; tam bir fiziksel, zihinsel ve sosyal iyilik hali olarak tanımlanmaktadır. Sağlıklı gıdalara yönelik artan tüketici talebi, fonksiyonel faydalar sunan biyoaktif bileşiklere olan ilgiyi artırmıştır. Bu bağlamda postbiyotikler, gelecek vaat eden fonksiyonel gıda bileşenleri olarak dikkat çekmektedir. Uluslararası Probiyotik ve Prebiyotik Bilimsel Derneği (ISAPP), postbiyotikleri "konakçıda sağlık yararı sağlayan cansız mikroorganizmalar ve/veya bunların bileşenlerinden oluşan preparatlar" olarak tanımlamaktadır. Postbiyotikler, geleneksel canlı probiyotik kullanımına kıyasla yüksek güvenlik profili, stabilite avantajı ve standartlaştırılabilirlik özellikleri sayesinde son yıllarda bilim dünyasının ilgi odağı haline gelmiştir. Postbiyotikler; probiyotik veya kommensal mikroorganizmaların ürettiği, son derece zengin ve heterojen bir biyokimyasal yapıya sahiptir. Bu karmaşık yapı; vitaminler ve enzimler gibi fonksiyonel moleküllerin yanı sıra poliaminler ve kısa zincirli yağ asitleri (SCFA'lar) gibi metabolik yan ürünleri de içeren geniş bir bileşik yelpazesini kapsamaktadır. Ayrıca peptidoglikan parçaları ve lipoteikoik asitler (LTA) gibi hücresel yapısal bileşenleri, hücre dışı polisakkaritler (EPS) gibi salgılanan polimerleri, antimikrobiyal peptitleri ve çeşitli diğer biyoaktif proteinleri de içermektedir. Postbiyotikler; anti-inflamatuar, antioksidan, antimikrobiyal, antihipertansif, antiproliferatif, hipokolesterolemik ve immünomodülatör aktiviteler sergilemektedir. Niteliksel ve niceliksel karakterizasyonlarında gaz kromatografisi (GC), yüksek performanslı sıvı kromatografisi (HPLC), ince tabaka kromatografisi (TLC) ve spektroskopik teknikler kullanılır; bu yöntemler, söz konusu bileşenlerin biyokimyasal özellikleri ile fonksiyonel gıdalar ve sağlığı geliştirici ürünlerdeki potansiyel kullanım alanlarına dair bilgiler sunmaktadır. Bu çalışmanın amacı; postbiyotiklerin karmaşık biyokimyasal bileşimini ve etki mekanizmalarını incelemektir. Ayrıca hücresel sinyal yolaklarındaki rolleri ile bu mekanizmaların fizyolojik ve terapötik etkilerini güncel literatür ışığında kapsamlı bir şekilde ortaya koymaktır. Bu kapsamda derlemede, postbiyotiklerin kimyasal yapıları, etki mekanizmaları ve hücresel reseptörlerle etkileşimleri kapsamlı bir şekilde ele alınmıştır.

Anahtar Kelimeler: Biyoaktif bileşikler, biyokimyasal karakterizasyon, fonksiyonel gıdalar, postbiyotikler,

ABSTRACT

Health is defined as a state of complete physical, mental, and social well-being. Growing consumer demand for healthy foods has increased interest in bioactive compounds that offer functional benefits. In this context, postbiotics are arising as promising functional food ingredients. The International Scientific Association for Probiotics and Prebiotics (ISAPP) defines postbiotics as "preparations of inanimate microorganisms and/or their components that improve the host's health." In recent years, postbiotics have become a focal point of scientific interest due to their high safety profile, stability advantages, and potential for standardization compared to traditional live probiotics. Postbiotics possess an exceptionally rich and heterogeneous biochemical composition produced by probiotic or commensal microorganisms. This complex composition contains a wide range of compounds, including functional molecules like vitamins and enzymes as well as metabolic byproducts including polyamines and short-chain fatty acids (SCFAs). It also contains structural cell components, such as peptidoglycan fragments and lipoteichoic acids (LTA), secreted polymers such as extracellular polysaccharides (EPS), and antimicrobial peptides and various other bioactive proteins. Postbiotics exhibit anti-inflammatory, antioxidant, antimicrobial, antihypertensive, antiproliferative, hypocholesterolemic, and immunomodulatory activities. Gas chromatography (GC), high-performance liquid chromatography (HPLC), thin-layer chromatography (TLC), and spectroscopic techniques are employed for their qualitative and quantitative characterization. These analytical approaches provide valuable insights into the biochemical properties of these constituents as well as their potential applications in functional foods and health-promoting products. The aim of this review is to examine the complex biochemical composition and mechanisms of action of postbiotics. It also aims to comprehensively elucidate their roles in cellular signaling pathways along with the physiological and therapeutic effects associated with these mechanisms, in light of current literature. Accordingly, this review addresses the chemical structures, mechanisms of action, and interactions of postbiotics with cellular receptors in detail.

Keywords: Bioactive compounds, biochemical characterization, functional foods, postbiotics

ENGINEERING NANO/MICRO-ENCAPSULATED ENZYMES FOR FOOD PROCESSING: FROM MOLECULAR PROTECTION TO INTELLIGENT BIOCATALYST DELIVERY

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ABSTRACT

Enzymes are increasingly recognized as precision biocatalysts for developing efficient, selective, and sustainable food-processing technologies; however, their practical performance is frequently limited by sensitivity to temperature, pH, ionic strength, oxidation, and other process-related stresses. Nano- and microencapsulation provide an engineering platform for transforming free enzymes into protected and functionally integrated biocatalysts with improved operational stability and controlled accessibility. This study examines encapsulated enzymes from a design-oriented perspective, emphasizing how carrier composition, structural architecture, particle size, and interfacial properties govern enzyme protection, activity retention, mass transfer, and release behavior. Conventional and emerging encapsulation strategies, including coacervation, spray drying, liposomal systems, sol–gel processing, supercritical CO_2-assisted methods, and metal–organic frameworks, are critically compared in terms of their suitability for food applications. Particular attention is given to polysaccharides, proteins, lipids, and other food-compatible biomolecules as functional carrier materials and to the mechanisms through which these matrices modulate enzyme–substrate interactions and environmental resistance. The potential of stimulus-responsive systems to regulate enzyme availability in response to pH, temperature, ionic conditions, or gastrointestinal environments is also discussed. Applications spanning dairy processing, baking, beverages, meat products, and functional foods are evaluated with emphasis on process efficiency and product quality. Finally, key challenges associated with scale-up, carrier safety, cost, regulatory acceptance, and reproducibility are identified. Future development should move beyond passive enzyme protection toward rationally engineered, food-compatible, and intelligent encapsulation platforms that integrate stability, controlled activity, and process-specific functionality.

Keywords: Nano/microencapsulation; Engineered biocatalysts; Enzyme stability; Food processing

MICRO AND NANOPLASTICS IN FOOD: DETECTION, PHOTOCATALYTIC MITIGATION, AND HEALTH RISKS

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ABSTRACT

The increasing occurrence of micro and nanoplastics (MNPs) in food has emerged as a growing concern because of their persistence, widespread environmental distribution, and potential implications for human health. Their small dimensions, diverse polymeric compositions, and complex interactions with food components make reliable separation and identification particularly challenging. Conventional food-processing and treatment approaches are generally not designed to effectively remove these persistent contaminants, highlighting the need for integrated analytical and mitigation strategies. This study provides a critical assessment of current approaches for the isolation, detection, characterization, and photocatalytic mitigation of MNPs in food matrices. Particular emphasis is placed on sample-preparation procedures that facilitate the recovery of plastic particles from complex food systems and on instrumental techniques used for their chemical and morphological characterization, including spectroscopic and microscopic approaches. The principles governing photocatalytic degradation of plastic polymers are subsequently discussed, with attention to catalyst properties, irradiation conditions, surface interactions, and the transformation of polymeric materials during treatment. The study also considers the extent to which photocatalytic processes can contribute to the reduction of MNP contamination while addressing the potential formation of intermediate degradation products. In parallel, possible human health implications associated with dietary exposure to MNPs, including particle–biomolecule interactions and their potential to act as carriers of other contaminants, are examined. Finally, current methodological limitations, uncertainties in risk evaluation, and critical research gaps are identified. Future efforts should focus on standardized analytical protocols, food-compatible mitigation technologies, and mechanistically validated photocatalytic systems to support effective management of MNP contamination across the food chain.

Keywords: Micro and nanoplastics; Engineered biocatalysts; Enzyme stability; Food processing.

YAPAY ZEKÂ TABANLI ELEKTRİKLİ FRİGORİFİK ARAÇLARDA GIDA SOĞUK ZİNCİRİNİN ENERJİ TÜKETİMİ, KARBON AYAK İZİ VE GIDA KAYIPLARININ BİRLİKTE DEĞERLENDİRİLMESİ

A COMBINED ASSESSMENT OF ENERGY CONSUMPTION, CARBON FOOTPRINT, AND FOOD LOSSES IN ARTIFICIAL INTELLIGENCE-BASED ELECTRIC REFRIGERATED TRUCKS

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ÖZET

Gıda ürünlerinin hasat veya üretim noktasından tüketiciye ulaştırılmasına kadar uygun sıcaklık koşullarında muhafaza edilmesi, ürün güvenliği ve kalite sürekliliği açısından kritik öneme sahiptir. Soğuk zincirin sürdürülebilmesi için kullanılan frigorifik taşıma sistemleri ilave enerji gereksinimi oluşturmakta ve özellikle geleneksel yakıtlı araçlarda sera gazı emisyonlarını artırabilmektedir. Elektrikli araç ve batarya teknolojilerindeki gelişmeler, taşıma kaynaklı doğrudan emisyonların azaltılması açısından önemli bir alternatif sunmaktadır. Bununla birlikte, elektrikli frigorifik araçların (EFA) enerji talebinin tahmin edilmesi; araç tahriki ve soğutma sistemlerinin dinamik çalışma koşullarında birlikte değerlendirilmesini gerektiren karmaşık bir problemdir.

Bu çalışmada, mevcut literatür gözden geçirilerek analitik, ölçüme dayalı, simülasyon ve normatif yaklaşımlar dâhil olmak üzere farklı enerji talebi tahmin yöntemleri ele alınmış; soğuk zincir uygulamalarında enerji tüketimi, emisyon ve gıda kayıpları arasındaki ilişkinin yapay zekâ tabanlı karar destek yaklaşımlarıyla nasıl optimize edilebileceği değerlendirilerek söz konusu bileşenlerin birlikte ele alınmasına yönelik bir yol haritası oluşturulması amaçlanmıştır.. Önerilen yaklaşımda; araç hızı, yol eğimi, taşıma mesafesi, araç yükü, dış ortam sıcaklığı, soğutucu bölme ve ürün sıcaklığı, batarya şarj durumu, soğutma sistemi enerji talebi ve taşıma süresi gibi değişkenlerin birlikte değerlendirilmesi incelenmiştir. Bu doğrultuda, EFA'ların enerji yönetimi ile gıda soğuk zincirinin sürdürülebilirliği arasında bir ilişki kurulması ve taşıma operasyonlarının yalnızca enerji verimliliği açısından değil, ürün kaybı ve çevresel etki açısından da optimize edilmesine yönelik bir metodoloji ortaya konulması hedeflenmektedir.

Sonuç olarak, yapay zekânın enerji ve emisyon tahmininin yanı sıra enerji tüketimi ile ürün kalitesi arasındaki dengeyi sağlayan çok amaçlı bir karar mekanizmasında kullanılması önerilmektedir. Çalışmanın, otomotiv ve gıda mühendisliği disiplinlerinin sürdürülebilir soğuk zincir yaklaşımı kapsamında bütünleştirilmesine katkı sağlaması beklenmektedir.

Anahtar Kelimeler: Yapay zekâ, elektrikli frigorifik araç, gıda soğuk zinciri, enerji tüketimi, karbon ayak izi, gıda kaybı, sürdürülebilir taşımacılık.

ABSTRACT

Maintaining food products at appropriate temperature conditions from the point of harvest or production until they reach the consumer is of critical importance for product safety and quality consistency. Refrigerated transport systems used to sustain the cold chain create additional energy requirements and can increase greenhouse gas emissions, particularly in traditional fuel-powered vehicles. Advances in electric vehicle and battery technologies offer a significant alternative for reducing direct emissions from transportation. However, estimating the energy demand of electric

refrigerated vehicles (EFVs) is a complex problem that requires a joint evaluation of the vehicle's propulsion and refrigeration systems under dynamic operating conditions.

In this study, the existing literature was reviewed to examine various energy demand forecasting methods, including analytical, measurement-based, simulation, and normative approaches; the aim was to assess how the relationship between energy consumption, emissions, and food losses in cold chain applications can be optimized using artificial intelligence-based decision support approaches, thereby establishing a roadmap for addressing these components collectively. In the proposed approach, the joint evaluation of variables such as vehicle speed, road gradient, transport distance, vehicle load, ambient temperature, refrigerated compartment and product temperature, battery charge status, cooling system energy demand, and transport duration was examined. Accordingly, the goal is to establish a relationship between the energy management of EFA vehicles and the sustainability of the food cold chain, and to develop a methodology for optimizing transport operations not only in terms of energy efficiency but also in terms of product loss and environmental impact.

In conclusion, it is recommended that artificial intelligence be used in a multipurpose decision-making mechanism that not only estimates energy and emissions but also balances energy consumption with product quality. This study is expected to contribute to the integration of the disciplines of automotive and food engineering within the framework of a sustainable cold chain approach.

Keywords: Artificial intelligence, electric refrigerated vehicle, food cold chain, energy consumption, carbon footprint, food loss, sustainable transportation.

MEYVE VE SEBZE KURUTMA SİSTEMLERİNDE GÜNEŞ, DOĞAL GAZ VE ELEKTRİK ENERJİSİNİN VERİMLİLİK AÇISINDAN KARŞILAŞTIRILMASI: SON BEŞ YILA AİT LİTERATÜRÜN DEĞERLENDİRİLMESİ

A COMPARISON OF SOLAR, NATURAL GAS, AND ELECTRIC ENERGY IN TERMS OF EFFICIENCY IN FRUIT AND VEGETABLE DRYING SYSTEMS: A REVIEW OF THE LITERATURE FROM THE PAST FIVE YEARS

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ÖZET

Meyve ve sebze kurutma işlemleri, ürünlerin raf ömrünü uzatmada ve hasat sonrası kayıpları azaltmada önemli bir uygulamadır. Bu süreçte kullanılan enerji kaynağı, hem kurutma performansını hem de işletme maliyetlerini doğrudan etkilemektedir. Bu çalışmada, son beş yılda TR Dizin ve SCI/SCIE kapsamındaki dergilerde yayımlanan araştırmalar esas alınarak güneş enerjisi, doğal gaz ve elektrik enerjisi ile çalışan kurutma sistemleri enerji verimliliği, kurutma süresi, ürün kalitesi ve çevresel etki bakımından karşılaştırmalı olarak değerlendirilmiştir. Literatür bulguları, güneş enerjili sistemlerin yenilenebilir ve düşük işletme maliyetli olmaları nedeniyle çevresel açıdan avantaj sağladığını; ancak iklim koşullarına bağımlılık nedeniyle kurutma süresi ve süreklilik açısından değişkenlik gösterebildiğini ortaya koymaktadır. Doğal gazlı sistemler, yüksek ve kontrol edilebilir ısı girdisi sayesinde daha kısa kurutma süreleri ve daha kararlı işletme koşulları sunmakta; buna karşın fosil yakıt kullanımı nedeniyle karbon salımı ve enerji maliyeti açısından dezavantaj oluşturmaktadır. Elektrikli sistemler ise sıcaklık ve hava akışı kontrolü açısından yüksek hassasiyet sağlamakla birlikte, özgül enerji tüketimi ve işletme maliyeti bakımından çoğu durumda daha az ekonomik görünmektedir. Genel olarak, literatür hibrit sistemlerin veya güneş destekli kurutma çözümlerinin, ürün kalitesi ile enerji verimliliği arasında en dengeli yaklaşımı sunduğunu göstermektedir. Sonuç olarak, kurutma sistemi seçiminde enerji kaynağı; ürün türü, hedef kalite parametreleri, iklim koşulları ve ölçek ekonomisi dikkate alınarak belirlenmelidir.

Anahtar kelimeler: Meyve kurutma, sebze kurutma, güneş enerjisi, doğal gaz, elektrik enerjisi, enerji verimliliği

ABSTRACT

Fruit and vegetable drying processes are an important method for extending the shelf life of products and reducing post-harvest losses. The energy source used in this process directly affects both drying performance and operating costs. In this study, based on research published in journals indexed in TR Index and SCI/SCIE over the past five years, drying systems powered by solar energy, natural gas, and electricity were comparatively evaluated in terms of energy efficiency, drying time, product quality, and environmental impact. Literature findings indicate that solar-powered systems offer environmental advantages due to their renewable nature and low operating costs; however, they may exhibit variability in drying time and continuity due to dependence on climatic conditions. Natural gas systems offer shorter drying times and more stable operating conditions thanks to their high and controllable heat input; however, they present disadvantages in terms of carbon emissions and energy costs due to the use of fossil fuels. Electric systems, on the other hand, provide high precision in terms of temperature and airflow control; however, in most cases, they appear less economical in terms of specific energy consumption and operating costs. In general, the literature indicates that hybrid systems or solar-assisted drying solutions offer the most balanced approach between product quality

and energy efficiency. Consequently, the choice of drying system should be determined by considering the energy source, product type, target quality parameters, climatic conditions, and economies of scale.

Keywords: Fruit drying, vegetable drying, solar energy, natural gas, electricity, energy efficiency

MÖ 2. BİNYILDA BİR GIDA GÜVENLİĞİ YÖNETMELİĞİ Mİ? HİTİT TAPINAK GÖREVLİLERİ TALİMATNAMESİNİN HİJYEN HÜKÜMLERİ

A FOOD SAFETY REGULATION IN THE 2ND MILLENNIUM BC? THE HYGIENE CLAUSES OF THE HITTITE INSTRUCTIONS FOR TEMPLE PERSONNEL

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ÖZET

Hitit kralları tarafından görevlilere verilen talimatnameler, yükümlülük ve yaptırım içeren ve Eski Önasya'da benzeri az bulunan düzenleyici metinlerdir. Bu bildiri, MÖ 15./14. yüzyıla tarihlenen "Rahipler ve Tapınak Görevlileri için Talimatlar" (CTH 264) metnindeki gıda hazırlamaya ilişkin hükümleri, Eski Krallık dönemine ait "Kralın Saflığına İlişkin Saray Hizmetkârları Talimatı" (CTH 265) ile birlikte gıda hijyeni perspektifinden incelemektedir. Metinler, kurban ekmeğini hazırlayanların yıkanmış olmasını, saç ve tırnaklarının kesilmesini ve temiz giysi giymesini; fırıncılar evinin süpürülüp ovulmasını, mutfak eşiğinden domuz ve köpeğin geçmemesini, bu hayvanların dokunduğu tahta ve kil kapların atılmasını ve kralın suyunun süzgeçten geçirilmesini şart koşar. Kuşaklı-Sarissa'daki tapınak yıkanma odaları ve natron, kül gibi temizlik maddelerine ilişkin veriler bu kuralların uygulamadaki karşılığına işaret eder. Kurallara uymamanın yaptırımı ilahi cezadan ölüm cezasına kadar uzanır; ihlali bilip gizleyenin de cezalandırılması ve kaplardan sorumlu görevlinin ayrıca tanımlanması, sorumluluğun belirli rollere bağlandığını gösterir. Bu hükümler Codex Alimentarius'un "Gıda Hijyeni Genel İlkeleri" ile karşılaştırıldığında personel hijyeni, tesis temizliği, hayvan kontrolü, kontamine ekipmanın uzaklaştırılması ve personel sorumluluğu başlıklarında güçlü işlevsel örtüşmeler görülür. Ancak hükümlerin gerekçesi mikrobiyolojik değil, tanrının "ruhunu" incitmeme kaygısına dayanan ritüel saflıktır; hastalıklı personelin gıdadan uzak tutulmasına ilişkin bir hükmün bulunmaması da bunu destekler. Bildiri, başlıktaki soruyu "işlev bakımından evet, gerekçe bakımından hayır" biçiminde yanıtlamaktadır. Bu bulgu, hijyen kurallarının tarihsel kökenlerinin yalnızca tıbbi bilgiyle değil, dinî ve kurumsal düzenlemelerle de şekillendiğini göstermektedir.

Anahtar Kelimeler: Hititler, CTH 264, tapınak görevlileri, gıda hijyeni, ritüel saflık, Codex Alimentarius.

ABSTRACT

The instructions issued by Hittite kings to their officials are regulatory texts that impose obligations and sanctions, a genre rarely attested elsewhere in the ancient Near East. This paper examines, from the perspective of food hygiene, the food-preparation clauses of the Instructions for Priests and Temple Personnel (CTH 264, 15th/14th century BC) together with the Old Kingdom Instructions for Royal Servants concerning the Purity of the King (CTH 265). The texts require those who bake the daily offering bread to be bathed and groomed, with hair and nails trimmed and wearing clean clothes; the bakers' house to be swept and scrubbed; pigs and dogs to be kept from the kitchen threshold; wooden and clay utensils touched by these animals to be discarded; and the king's water to be filtered through a sieve. Bathing rooms in the temple at Kuşaklı-Sarissa and textual references to cleaning agents such as natron and ash point to the practical side of these rules. Sanctions range from divine punishment to the death penalty; the punishment of anyone who knowingly conceals a violation, and the specific responsibility assigned to the official in charge of utensils, show that accountability was attached to defined roles. Compared with the Codex Alimentarius General Principles of Food

Hygiene, the clauses show strong functional parallels in personal hygiene, premises cleaning, animal control, removal of contaminated equipment and staff accountability. Their rationale, however, is ritual purity rather than microbiology, as the absence of any rule excluding sick personnel from food handling confirms. The paper therefore answers its title question: yes in function, no in rationale. This finding suggests that the historical roots of hygiene rules were shaped not only by medical knowledge but also by religious and institutional regulation.

Keywords: Hittites, CTH 264, temple personnel, food hygiene, ritual purity, Codex Alimentarius.

HİTİTLERDE GIDA DEPOLAMA: KAPLARDAN SİLOLARA ARKEOLOJİK, FİLOLOJİK VE YÖNETSEL BİR DEĞERLENDİRME

FOOD STORAGE AMONG THE HITTITES: FROM VESSELS TO SILOS AN ARCHAEOLOGICAL, PHILOLOGICAL AND ADMINISTRATIVE ASSESSMENT

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ÖZET

Hitit Devleti'nde (MÖ yak. 1650–1200) gıda depolama, hane küplerinden tapınak pithoslarına ve devlet ölçeğindeki yeraltı silolarına uzanan üç kademeli bir sistem olarak örgütlenmiştir. Bu bildiri, Hattuşa, Kuşaklı-Sarissa, Kaman-Kalehöyük ve Alaca Höyük'ten gelen arkeolojik ve arkeobotanik verileri, Hitit seramiğinin işlevsel tipolojisini ve çivi yazılı metinlerdeki depolama terimlerini birlikte değerlendirmektedir. Hane düzeyinde kulplu büyük küpler kısa vadeli, resmî depolarda zemine gömülü ve 2000 litreye varan pithoslar orta vadeli, hava geçirmez yeraltı siloları ise yıllarca sürebilen uzun vadeli depolama için kullanılmıştır. Hattuşa'daki Poternli Sur silosu, 32 odası ve 4000–5000 tonluk kapasitesiyle bu sistemin en büyük örneğidir; her odanın ayrı bir tarım topluluğundan gelen tahılla doldurulduğunu gösteren arkeobotanik bulgular, depolamayı doğrudan vergi sistemine bağlamaktadır. Çalışmanın özgün katkısı, depolamayı bir denetim sistemi olarak okumasıdır: mühürlenen kaplar ve hermetik silolar varlığın korunmasını, pithos ağızlarındaki kapasite ve içerik işaretleri kaydı, Karkamış mühür arşivinde "kralın deposunun yöneticisi" gibi ünvanlarla belgelenen mühür sahibi memurlar ise yetkilendirmeyi sağlamıştır. Sonbaharda arpa ile doldurulup mühürlenen ve ilkbaharda bir bayramla açılan *ḫarši* küpleri, mührün aynı zamanda zamansal bir denetim aracı olduğunu göstermektedir. Gıda bilimi açısından Hitit silolarının dayandığı oksijensiz ortam ilkesi, günümüz hermetik tahıl depolama teknolojisiyle aynı biyolojik süreçlere dayanır; modern deneyler, açılan bir silonun hızla tüketilmesi gerektiği yönündeki arkeolojik yorumu ve depolama öncesi kurutmanın belirleyiciliğini doğrulamaktadır. Bildiri, kap içeriklerine yönelik organik kalıntı analizlerinin ve kapasite işaretlerinin sistematik yayınının bu sistemin nicel boyutunu netleştireceğini önermektedir.

Anahtar Kelimeler: Hititler, gıda depolama, pithos, tahıl silosu, mühürleme, hermetik depolama.

ABSTRACT

Food storage in the Hittite state (c. 1650–1200 BC) was organised as a three-tier system extending from household jars to temple pithoi and state-scale underground silos. This paper combines archaeological and archaeobotanical evidence from Hattusa, Kuşaklı-Sarissa, Kaman-Kalehöyük and Alaca Höyük with the functional typology of Hittite pottery and the storage terminology of cuneiform texts. Large handled jars served short-term household needs, floor-sunk pithoi of up to 2,000 litres in official storerooms served medium-term institutional storage, and airtight underground silos preserved grain reserves for years. The silo beside the Postern Wall at Hattusa, with 32 chambers and an estimated capacity of 4,000–5,000 tonnes, is the largest example; archaeobotanical evidence that each chamber was filled with grain from a different farming community links storage directly to the taxation system. The main contribution of the paper is to read storage as a control system: sealed vessels and hermetic silos ensured asset protection, capacity and content marks on pithos rims served as records, and seal-holding officials, attested in the Karkemish sealing archive with titles such as "administrator of the king's storehouse", provided authorisation. *Ḫarši* jars, filled with barley and sealed in autumn and ceremonially opened in spring, show that the seal also functioned as a temporal

control device. From a food science perspective, the anoxic principle behind Hittite silos rests on the same biological processes as modern hermetic grain storage; experimental studies confirm the archaeological inference that an opened silo had to be consumed quickly, and underline the importance of drying grain before storage. The paper suggests that organic residue analysis and systematic publication of capacity marks will clarify the quantitative dimension of this system.

Keywords: Hittites, food storage, pithos, grain silo, sealing practice, hermetic storage.

ARI EKMEĞİNİN GIDA SİSTEMLERİNDE KULLANIM POTANSİYELİ: BİLEŞİM, TEKNOLOJİK UYGULAMALAR, GÜVENLİK VE STANDARDİZASYON

POTENTIAL USE OF BEE BREAD IN FOOD SYSTEMS: COMPOSITION, TECHNOLOGICAL APPLICATIONS, SAFETY AND STANDARDISATION

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ÖZET

Arı ekmeği, bal arılarının topladığı polenin nektar veya bal ve glandüler salgılarla birlikte petek gözlerinde depolanması ve bu süreçte asitlenme ile mikrobiyal ve biyokimyasal değişimlere uğraması sonucu oluşan doğal bir arı ürünüdür. Protein, lipit, mineral, organik asit ve çeşitli fenolik bileşenler içeren arı ekmeğinin gıda formülasyonlarında kullanımı araştırılmaktadır. Arı ekmeğinin gıda bileşeni olarak kullanım potansiyeli; bileşim, biyoerişilebilirlik, teknolojik uygulamalar, gıda güvenliği ve standardizasyon açısından güncel bilimsel kanıtlar ışığında eleştirel olarak değerlendirilmektedir. Mevcut bulgular, arı ekmeğinin bileşiminin botanik köken, arı türü, coğrafi bölge, hasat zamanı, depolama ve işleme koşullarına bağlı olarak önemli ölçüde değişebildiğini göstermektedir. Varsayımsal 10–20 g alım senaryolarında protein ve minerallerin çoğu için referans değerlere katkı sınırlı kalırken, bazı partilerde demir ve mangan katkısı dikkate değer düzeylere ulaşabilmektedir. Küçük ölçekli ve kısmen ekstraktlarla yürütülen in vitro sindirim çalışmaları, protein ve fenolik bileşiklerin arı ekmeğinden polene kıyasla sayısal olarak daha fazla açığa çıkabileceğine işaret etmektedir. Ancak mevcut kanıtlar insanlarda üstün biyoyararlılık veya klinik yararı desteklemek için yetersizdir. Arı ekmeği ekmek, bisküvi, fermente süt ürünleri ve içecek formülasyonlarında kullanılmıştır. Ekstraktları ise aktif ambalaj materyallerinde değerlendirilmiştir. Kullanım düzeyinin artırılması her zaman daha iyi ürün kalitesi sağlamamaktadır. Renk, tat, tekstür, proses performansı ve duyusal kabul üzerinde formülasyona bağlı değişiklikler ortaya çıkabilmektedir. Pirolizidin alkaloitleri, pestisit kalıntıları, mikotoksinler ve potansiyel toksik elementlerin bazı örneklerde saptanması, gıda güvenliğinin yalnızca ürünün doğal kökenine dayanarak varsayılamayacağını göstermektedir. Bir kontaminantın saptanması tek başına tüketici riskini göstermez; risk değerlendirmesi, kontaminant derişimi ve tüketim miktarına dayalı maruziyetin uygun toksikolojik veya düzenleyici referans noktalarıyla birlikte değerlendirilmesini gerektirir. Pirolizidin alkaloitleriyle yüksek düzeyde kirlenmiş bazı partiler için varsayımsal tüketim senaryolarında endişe göstergesi olan maruziyet marjları hesaplanmıştır. Arı ekmeği içeren ısıl işlem görmüş ürünlerde proses kontaminantları da dikkate alınmalıdır. Sonuç olarak arı ekmeği, yenilikçi gıda geliştirme açısından potansiyel taşıyan bir bileşendir. Ancak güvenilir kullanım ve tekrarlanabilir ürün kalitesi için parti bazında karakterizasyon, ürüne özgü kullanım düzeyinin belirlenmesi, risk temelli kontaminant kontrolü ve standardizasyon gereklidir.

Anahtar Kelimeler: arı ekmeği; gıda bileşeni; biyoerişilebilirlik; gıda güvenliği; standardizasyon; ürün geliştirme

ABSTRACT

Bee bread is a natural bee product formed when pollen collected by honey bees is stored in comb cells with nectar or honey and glandular secretions, where it undergoes acidification and microbial and biochemical changes. Bee bread contains proteins, lipids, minerals, organic acids and diverse phenolic compounds, and its use in food formulations is being investigated. The potential of bee bread as a food ingredient is critically evaluated in terms of composition, bioaccessibility, technological applications, food safety and standardisation in the light of current scientific evidence. Available findings show that its composition can vary considerably with botanical origin, bee species, geographical location, harvest period, storage and processing conditions. In illustrative intake scenarios of 10–20 g, contributions to reference values for protein and most minerals remain modest, whereas iron and manganese contributions can be appreciable in some batches. Small in vitro digestion studies, partly conducted with extracts, indicate that protein and phenolic compounds may be released to a numerically greater extent from bee bread than from bee pollen; however, current evidence is insufficient to support superior bioavailability or clinical benefit in humans. Bee bread has been incorporated into bread, cookies, fermented dairy products and beverages, and its extracts have been evaluated in active packaging materials. Increasing the inclusion level does not necessarily improve product quality, as formulation-dependent changes in colour, flavour, texture, processing performance and sensory acceptance can occur. The detection of pyrrolizidine alkaloids, pesticide residues, mycotoxins and potentially toxic elements in some samples shows that food safety cannot be assumed solely from the natural origin of the product. Detection of a contaminant alone does not indicate consumer risk; risk assessment requires exposure, based on contaminant concentration and consumption, to be evaluated against appropriate toxicological or regulatory reference points. For some highly pyrrolizidine-alkaloid-contaminated batches, margins of exposure indicative of concern were calculated under illustrative consumption scenarios. Process contaminants should also be considered in heat-treated products containing bee bread. Overall, bee bread is an ingredient with potential for innovative food development; however, reliable use and reproducible product quality require batch-specific characterisation, product-specific determination of inclusion levels, risk-based contaminant control and standardisation.

Keywords: bee bread; food ingredient; bioaccessibility; food safety; standardisation; product development

ÇİMLENDİRİLMİŞ SARI HARDAL (*SİNAPİS ALBA* L.) TOHUMLARININ BEYAZ PEYNİR MİKROBİYAL KALİTESİ ÜZERİNE ETKİSİ

EFFECT OF YELLOW MUSTARD (SINAPIS ALBA L.) SEEDS ON THE MICROBIAL QUALITY OF CHEESE

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ÖZET

Hardal (*Sinapis alba* L.), tarih boyunca hem gıda hem de tıbbi amaçlarla kullanılan önemli bitkilerden biri olmuştur. Hardal glukozinolatlar ve izotiyosiyanatlar gibi biyoaktif bileşikleri içermektedir. Çimlenme, tahılların biyolojik aktif bileşiklerinde ve besin kalitesinde dinamik ve karmaşık olumlu değişikliklere yol açan verimli ve ekonomik bir süreçtir. Bu çalışmada, çimlendirilmiş sarı hardal tohumlarının depolama boyunca beyaz peynir örneklerinde mikrobiyal kalite üzerine etkisi incelenmiştir.

Deneysel beyaz peynir örneklerinde toplam mezofilik aerob bakteri sayıları (TMB), toplam maya küf sayıları (TMK) ve koliform bakteri sayılarına bakılmıştır.

K (control), T (tohum), Ç (çimlendirilmiş), ÇK (çimlendirilip kuurutulmuş) olmak üzere dört deneysel grup oluşturulmuştur. Çimlendirme işlemi yıkanan sarı hardal tohumları 96 saat süreyle oda şartlarında bekletilerek yapılmıştır. Sarı hardal tohumları öğütülerek %1 oranında beyaz peynir yapım aşamasının enzim ilave edilmeden hemen öncesinde ilave edilmiştir.

Depolamanın 0. gününde toplam mezofilik bakteri (TMB) sayıları; sarı hardal tohumu eklenen peynir (T), çimlendirilmiş sarı hardal tohumu eklenen peynir (Ç), çimlendirilip kurutulmuş sarı hardal tohumu eklenen peynir (ÇK) ve hardal tohumu eklenmeden üretilen kontrol (K) örneklerinde sırasıyla 4,62; 3,83; 3,05 ve 3,85 log kob/g olarak belirlenmiştir. Depolamanın 7. gününde TMB sayıları T, Ç, ÇK ve K örneklerinde sırasıyla 5,91; 3,79; 4,51 ve 6,62 log kob/g'ye ulaşmıştır. Depolamanın 14. gününde ise bu değerler sırasıyla 5,86; 4,94; 5,86 ve 7,72 log kob/g olarak belirlenmiştir. Depolamanın 0. gününde TMK sayıları T, Ç, ÇK ve K örneklerinde sırasıyla 2,52; 2,67; 2,63 ve 2,75 log kob/g olarak belirlenmiştir. Depolamanın 7. gününde bu değerler sırasıyla 3,67; 3,91; 3,67 ve 5,74 log kob/g'ye ulaşırken, 14. günde 4,65; 5,52; 4,71 ve 4,91 log kob/g olarak belirlenmiştir. Depolama süresince TMB sayılarının genel olarak arttığı, 14. günde en yüksek değerin K örneğinde, en düşük değerin ise Ç örneğinde olduğu görülmüştür. TMK sayısının ise en düşük olduğu örneğin T olduğu belirlenmiştir. Ayrıca, depolama süresince tüm örneklerde toplam koliform sayısı tespit edilebilir limitlerin altında kalmıştır.

Anahtar Kelimeler: Sarı hardal, *Sinapis alba* L., çimlendirme, peynir, mikrobiyal kalite

ABSTRACT

Mustard (*Sinapis alba* L.) has been one of the important plants used throughout history for both food and medicinal purposes. Mustard contains bioactive compounds such as glucosinolates and isothiocyanates. Germination is an efficient and economical process that induces dynamic and complex beneficial changes in the bioactive compounds and nutritional quality of grains and seeds. In this study, the effect of germinated yellow mustard seeds on the microbiological quality of white cheese during storage was investigated.

The total mesophilic aerobic bacteria (TMB), total yeast and mold (TYM), and coliform bacteria counts were determined in experimental white cheese samples.

Four experimental groups were established: K (control), T (seed), Ç (germinated seed), and ÇK (germinated and dried seed). Germination was performed by washing the yellow mustard seeds and allowing them to germinate under room conditions for 96 h. The yellow mustard seeds were then ground and added to the cheese at a concentration of 1% immediately before the addition of the enzyme during cheese production.

On day 0 of storage, the total mesophilic aerobic bacteria (TMB) counts in the cheese samples containing yellow mustard seeds (T), germinated yellow mustard seeds (Ç), germinated and dried yellow mustard seeds (ÇK), and the control samples without mustard seeds (K) were 4.62, 3.83, 3.05, and 3.85 log CFU/g, respectively. On day 7 of storage, the TMB counts reached 5.91, 3.79, 4.51, and 6.62 log CFU/g in the T, Ç, ÇK, and K samples, respectively. On day 14, these values were 5.86, 4.94, 5.86, and 7.72 log CFU/g, respectively.

On day 0 of storage, the total yeast and mold (TYM) counts were 2.52, 2.67, 2.63, and 2.75 log CFU/g in the T, Ç, ÇK, and K samples, respectively. On day 7, these values increased to 3.67, 3.91, 3.67, and 5.74 log CFU/g, respectively, while on day 14, they were 4.65, 5.52, 4.71, and 4.91 log CFU/g, respectively. Overall, the TMB counts generally increased throughout storage, with the highest value observed in the K sample and the lowest value in the Ç sample on day 14. The lowest TYM count throughout storage was observed in the T sample. In addition, the total coliform counts remained below the detectable limits in all samples throughout the storage period.

Keywords: Yellow mustard, *Sinapis alba* L., germination, cheese, microbial quality

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BESİNSEL OPİOİD PEPTİTLER: DOĞAL KAYNAKLAR, BİYOLOJİK AKTİVİTELER VE POTANSİYEL UYGULAMALAR

DIETARY OPIOID PEPIDES: NATURAL SOURCES, BIOLOGICAL ACTIVITIES, AND POTENTIAL APPLICATIONS

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ÖZET

Son yirmi yılda, çeşitli gıda proteinlerinden türeyen peptitlerin farklı in vitro ve in vivo test sistemlerinde biyolojik etkiler gösterdiği ortaya konmuştur. Bu biyoaktif peptitlerin bir kısmının opioid benzeri aktivite gösterdiği ve bu nedenle opioid peptitler olarak adlandırıldığı bildirilmiştir. Gıda kaynaklı opioid peptitler; hayvansal ve bitkisel proteinler gibi doğal kaynaklardan elde edilmeleri nedeniyle, doğal ve potansiyel olarak güvenli biyoaktif bileşikler olarak değerlendirilmektedir. Opioid peptitler genel olarak endojen ve eksojen olmak üzere iki grupta incelenmektedir. Endojen opioid peptitler memeli organizmalarında doğal olarak sentezlenir ve hormon veya nöromodülatör olarak görev yaparak merkezi ve periferik sinir sisteminde çeşitli fizyolojik süreçlerin düzenlenmesine katkıda bulunur. Gıda kaynaklı eksojen opioid peptitler ise ekzorfinler olarak da adlandırılmakta ve vücut dışında bulunan proteinlerin sindirimi veya gıda işleme süreçleri sonucunda açığa çıkarak organizmaya besinler yoluyla alınmaktadır. Diyet proteinleri, endojen opioid peptitlerle yapısal benzerlikleri nedeniyle eksojen opioid peptitlerin önemli kaynakları arasında kabul edilmektedir. Gıda kaynaklı eksojen opioid peptitlerin çeşitli kaynaklardan elde edilebildiği bildirilmiştir. Bunlar arasında insan sütü, manda sütü, peynir, arpa, buğday, çavdar, pirinç albümini, sığır serum albümini ve hemoglobin gibi hayvansal ve bitkisel kaynaklar bulunmaktadır. Ayrıca ıspanak proteinlerinden elde edilen bazı peptitlerin de opioid reseptörlerine bağlanma ve opioid benzeri aktivite gösterme potansiyeline sahip olduğu belirlenmiştir. Gıda kaynaklı opioid peptitlerin, doğal kaynaklardan elde edilmeleri ve bazı durumlarda farmakolojik opioid bileşiklere alternatif oluşturabilme potansiyelleri nedeniyle, fonksiyonel gıda ve nutrasötiklerin geliştirilmesinde kullanılabilecek biyoaktif bileşikler olduğu düşünülmektedir. Bu derlemede, farklı gıda kaynaklarından elde edilen opioid peptitler ve bunların biyolojik aktiviteleri özetlenmiş; ayrıca opioid peptitlerin insan sağlığını desteklemeye yönelik terapötik ajanlar veya fonksiyonel gıda bileşenleri olarak potansiyel kullanım alanları ele alınmıştır.

Anahtar Kelimeler: Opioid Peptitler, Fonksiyonel Gıda, Terapötik Ajanlar

ABSTRACT

Over the past two decades, numerous studies have demonstrated that peptides derived from various food proteins exhibit biological activities in different in vitro and in vivo experimental systems. Some of these bioactive peptides have been reported to exert opioid-like activity and are therefore referred to as opioid peptides**.** Food-derived opioid peptides are considered natural and potentially safe bioactive compounds because they are obtained from natural sources, including animal and plant proteins. Opioid peptides are generally classified into two groups: endogenous and exogenous opioid peptides. Endogenous opioid peptides are naturally synthesized in mammals and function as hormones or neuromodulators, contributing to the regulation of various physiological processes in the central and peripheral nervous systems. Food-derived exogenous opioid peptides, also known as exorphins, are generated from proteins outside the body through processes such as digestion or food processing and

are subsequently introduced into the organism through dietary intake. Dietary proteins are considered important sources of exogenous opioid peptides due to their structural similarity to endogenous opioid peptides. Food-derived exogenous opioid peptides have been identified in a wide range of animal and plant sources. These include human milk, buffalo milk, cheese, barley, wheat, rye, rice albumin, bovine serum albumin, and hemoglobin. In addition, certain peptides derived from spinach proteins have been reported to possess the potential to bind to opioid receptors and exhibit opioid-like activity. Because of their natural origin and their potential to serve as alternatives to pharmacological opioid compounds in certain applications, food-derived opioid peptides are considered promising bioactive compounds for the development of functional foods and nutraceuticals**.** This review summarizes opioid peptides identified from different food sources and their reported biological activities. Furthermore, the potential applications of opioid peptides as therapeutic agents or functional food ingredients for promoting and supporting human health are discussed.

Keywords: Opioid Peptides, Functional Food, Therapeutic Agents

KİŞİSELLEŞTİRİLMİŞ BESLENME: GÜNCEL YAKLAŞIMLAR VE SAĞLIK ÜZERİNDEKİ ETKİLERİ

PERSONALIZED NUTRITION: CURRENT APPROACHES AND THEIR EFFECTS ON HEALTH

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ÖZET

Kişiselleştirilmiş beslenme, toplum temelli genel beslenme önerilerinden farklı olarak bireylerin biyolojik, fizyolojik ve yaşam tarzına ilişkin özelliklerini dikkate alarak kişiye özgü beslenme stratejileri geliştirmeyi amaçlayan yenilikçi bir yaklaşımdır. Güncel bilimsel kanıtlar, bireyler arasındaki farklılıkların besinlere verilen metabolik yanıtları etkilediğini ve bu nedenle geleneksel "herkese aynı beslenme önerisi" yaklaşımının tüm bireyler için eşit derecede etkili olmayabileceğini göstermektedir. Bu kapsamda yaş, cinsiyet, sağlık durumu, yaşam tarzı, metabolik özellikler, genetik yapı ve bağırsak mikrobiyotası gibi bireysel faktörlerin, kişiye özgü beslenme stratejilerinin geliştirilmesinde önemli rol oynadığı bildirilmektedir. Kişiye özel beslenme yaklaşımı yalnızca kronik hastalıkların önlenmesi ve/veya etkilerinin azaltılmasına odaklanmamakta; aynı zamanda ruh hali, dikkat, fiziksel dayanıklılık ve vücut ağırlığının kontrolü gibi iyilik halinin farklı boyutlarını da kapsamaktadır. Bunun yanı sıra glukoz düzeylerinin kontrol altında tutulması, normal kan basıncının sürdürülmesi, sağlıklı serum lipid profilinin korunması ve düşük yoğunluklu lipoprotein (LDL) ile yüksek yoğunluklu lipoprotein (HDL) kolesterol düzeylerinin dengelenmesi gibi sağlık göstergelerinin iyileştirilmesini hedeflemektedir. Son yıllarda obezite ve buna bağlı metabolik bozuklukların, özellikle tip 2 diyabet ve kardiyovasküler hastalıkların, küresel ölçekte artan prevalansı kişiye özel beslenme yaklaşımlarına olan ilgiyi artırmıştır. Bu nedenle kişiselleştirilmiş beslenme, bireylerin sağlık durumlarının iyileştirilmesi, kronik hastalıkların önlenmesi ve yönetilmesinde umut vadeden bir yaklaşım olarak değerlendirilmektedir. Ayrıca, bu yaklaşımın rutin sağlık hizmetlerine etkin bir şekilde entegre edilebilmesi için daha güçlü bilimsel kanıtların oluşturulmasına ve standardize edilmiş klinik uygulamaların geliştirilmesine ihtiyaç duyulmaktadır. Bu derlemede, kişiselleştirilmiş beslenmenin kavramsal çerçevesi, temel ilkeleri, sağlık üzerindeki etkileri, güncel uygulamaları, avantajları, sınırlılıkları ve geleceğe yönelik perspektifleri ele alınmıştır.

Anahtar Kelimeler: Kişiselleştirilmiş beslenme, kronik hastalıklar, metabolik sağlık, koruyucu sağlık

ABSTRACT

Personalized nutrition is an innovative approach that aims to develop individualized dietary strategies by taking into account individuals' biological, physiological, and lifestyle characteristics, in contrast to general population-based dietary recommendations. Current scientific evidence indicates that interindividual differences influence metabolic responses to nutrients and foods; therefore, the traditional "one-size-fits-all" approach to dietary recommendations may not be equally effective for all

individuals. In this context, individual factors such as age, sex, health status, lifestyle, metabolic characteristics, genetic background, and gut microbiota are reported to play important roles in the development of personalized nutrition strategies. Personalized nutrition focuses not only on the prevention and/or reduction of the effects of chronic diseases but also encompasses various dimensions of well-being, including mood, attention, physical resilience, and body weight management. In addition, it aims to improve health-related indicators such as maintaining glycemic control and normal blood pressure, preserving a healthy serum lipid profile, and maintaining balanced levels of low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol. In recent years, the increasing global prevalence of obesity and associated metabolic disorders, particularly type 2 diabetes and cardiovascular diseases, has increased interest in personalized nutrition approaches. Accordingly, personalized nutrition is considered a promising approach for improving individual health outcomes and preventing and managing chronic diseases. However, stronger scientific evidence and standardized clinical practices are needed to effectively integrate this approach into routine healthcare services. This review discusses the conceptual framework and fundamental principles of personalized nutrition, its effects on health, current applications, advantages, limitations, and future perspectives.

Keywords: Personalized nutrition, chronic diseases, metabolic health, preventive health.

THE ROLE OF FUNCTIONAL FOODS IN NEUROINFLAMMATORY AND NEUROTOXIC PROCESSES MEDIATED BY THE GUT-BRAIN AXIS. A REVIEW OF PUBLISHED RESEARCH

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ABSTRACT

Bidirectional interactions between the gut microbiota and central nervous system have emerged as important factors in neuroinflammation and other neurological disorders. Dietary factors play an important role in shaping gut microbiota composition and metabolic activity. Functional foods that affect communication between the gut and the brain may be beneficial for neurological health. This review summarizes the experimental and clinical evidence for the effects of polyphenols, omega-3 polyunsaturated fatty acids, prebiotic fibers, probiotics, and other fermented foods on the gut-brain axis. Experimental and clinical studies suggest that functional foods can affect gut microbiota composition and metabolism, including the production of bioactive metabolites like short-chain fatty acids. Other potential benefits of consuming functional foods include improved intestinal and blood-brain barrier function and reduced systemic inflammation. Mechanisms mediating these effects include inhibition of NF-κB and NLRP3 inflammasome pathways and activation of Nrf2 antioxidant pathways. Modulation of microglial and cytokine activity may be one mechanism by which functional foods affect neuroinflammation. Most of the evidence to date is derived from experimental studies with variable designs and characteristics of study participants and functional food exposures, including dose and duration of exposure and gut microbiota composition. Further clinical studies, including longer-term studies and assessment of biomarkers, are needed to determine how functional foods might be used to improve neurological health.

Keywords: Functional foods, gut-brain axis, microbiota, neuroinflammation, oxidative stress, Nrf2, NLRP3, neurodegeneration

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN FOODS OF ANIMAL ORIGIN: EXPOSURE AND EFFECTS ON OXIDATION AND THE IMMUNE SYSTEM AS WELL AS POTENTIAL NEUROLOGICAL EFFECTS

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ABSTRACT

Per- and polyfluoroalkyl substances (PFAS) are recognised as major food safety and public health challenges because of their persistence in the environment, bioaccumulative properties, and other health effects. Permanence and bioaccumulation in animal tissues are important considerations in assessing risks from dietary exposure to PFAS. This review summarises information on the occurrence of PFAS in foods of animal origin and other dietary exposure pathways and health effects, including oxidative stress and immune and neurotoxic effects, linked to PFAS exposure. PFAS exposure related to animal-derived foods, such as seafood and fish, meat and meat products, and dairy and egg products, has been studied. Many factors related to animal and food production affect PFAS concentrations in these foods. Adverse health effects associated with PFAS exposure include increased production of reactive oxygen species and other reactive substances and altered antioxidant and other defence mechanisms and mitochondrial and other cellular functions, as well as immune activation. Other health effects involving the immune and endocrine systems and the brain suggest that PFAS should be viewed as a public health rather than just a food safety concern. Research priorities for the nervous system include studies of neuroinflammation, the blood-brain barrier, and other neurotoxic effects, especially during development. Knowledge gaps related to individual differences and other factors limit understanding of the potential health impacts of PFAS in foods of animal origin. Testing and other measures to reduce PFAS contamination of foods of animal origin are important steps for maintaining a sustainable food supply. Strategies to reduce PFAS risks should follow a "One Health" approach that takes into account multiple health concerns affecting people, animals, and the environment.

Keywords: PFAS, animal-derived foods, food safety, dietary exposure, oxidative stress, immunotoxicity, neurotoxicity, One Health

THE GASTRONOMIC DIVERSITY OF TRADITIONAL SNACKS IN EUROPE: A COMPARATIVE REVIEW OF SELECTED COUNTRIES

AVRUPA'DA GELENEKSEL ATIŞTIRMALIKLARIN GASTRONOMİK ÇEŞİTLİLİĞİ: SEÇİLMİŞ ÜLKELER ÜZERİNDEN KARŞILAŞTIRMALI BİR İNCELEME

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ÖZET

Geleneksel atıştırmalıklar, yerel hammaddelerin, üretim bilgisinin ve tüketim alışkanlıklarının bir araya geldiği gastronomik ürünlerdir. Avrupa'daki atıştırmalık çeşitliliğinin incelenmesi, farklı toplumların gıda kültürlerinin anlaşılmasına ve ortak özelliklerin belirlenmesine katkı sağlayabilir. Bu çalışmanın amacı, seçilmiş Avrupa ülkelerindeki geleneksel atıştırmalıkları hammadde bileşimi, hazırlama yöntemi, sunum özellikleri ve tüketim bağlamı açısından karşılaştırmaktır.

Çalışma, İspanya, İtalya ve Almanya örnekleriyle sınırlandırılacak ve nitel araştırma yaklaşımı kapsamında karşılaştırmalı doküman analizi yöntemiyle yürütülecektir. İspanya'dan seçilmiş tapas ve pintxos örnekleri, İtalya'dan arancini ve panelle, Almanya'dan ise Brezel incelemeye dâhil edilecektir. Tapas ve pintxos, tek bir ürün yerine farklı yiyecekleri kapsayan sunum biçimleri olduğundan, karşılaştırmada içerikleri açıkça tanımlanan örnekler kullanılacaktır. Akademik yayınlar, resmî gastronomi ve turizm kaynakları ile güvenilir tarif kayıtları temel veri kaynaklarını oluşturacaktır.

İncelenen örnekler; tahıl, baklagil ve diğer temel hammaddelerin kullanımı, pişirme teknikleri, porsiyon yapısı, taşınabilirlik ve servis biçimi bakımından değerlendirilecektir. Ayrıca bu yiyeceklerin öğün arası tüketim, sokak yemeği ve sosyal paylaşım bağlamındaki kullanımına ilişkin kaynak bilgileri karşılaştırılacaktır. Ürünlerin bölgesel çeşitleri dikkate alınacak, seçilmiş örneklerden ülke mutfaklarının tamamına yönelik genellemeler yapılmayacaktır.

Çalışmanın, Avrupa'daki geleneksel atıştırmalıkların benzerliklerini ve farklılıklarını sistematik bir çerçevede ortaya koyması hedeflenmektedir. Elde edilecek değerlendirmenin, gastronomik mirasın belgelenmesine, gastronomi eğitimine ve yerel ürünlerden hareketle geliştirilecek atıştırmalık tasarımlarına katkı sunması beklenmektedir.

Anahtar Kelimeler: Geleneksel atıştırmalıklar, Avrupa mutfakları, gastronomik çeşitlilik, gıda kültürü, karşılaştırmalı inceleme.

ABSTRACT

Traditional snacks reflect the interaction of local ingredients, culinary knowledge, and consumption practices. Examining snack diversity across Europe can contribute to understanding different food cultures and identifying their shared characteristics. This study aims to compare traditional snacks from selected European countries in terms of ingredients, preparation methods, presentation, and consumption contexts.

The study will focus on Spain, Italy, and Germany, using comparative documentary analysis within a qualitative research framework. Selected tapas and pintxos from Spain, arancini and panelle from Italy, and Brezel from Germany will be examined. Since tapas and pintxos encompass various foods and serving styles rather than individual products, clearly defined examples will be selected for

comparison. Academic publications, official gastronomy and tourism resources, and reliable recipe documentation will constitute the principal data sources.

The selected examples will be evaluated according to their main ingredients, including cereals and legumes, cooking techniques, portion characteristics, portability, and serving styles. Documented consumption practices will also be compared, particularly in relation to between-meal eating, street food, and social sharing. Regional variations will be considered, and the selected examples will not be treated as representative of entire national cuisines.

The study seeks to provide a systematic account of similarities and differences among traditional European snacks. The resulting review is expected to contribute to the documentation of gastronomic heritage, gastronomy education, and the development of snack products inspired by local culinary traditions.

Keywords: Traditional snacks, European cuisines, gastronomic diversity, food culture, comparative review.

THE NATIONAL AND INTERNATIONAL SIGNIFICANCE OF GEOGRAPHICAL INDICATIONS FOR FOOD PRODUCTS: A COMPARATIVE REVIEW OF REGISTRATION SYSTEMS IN THE EUROPEAN UNION AND SELECTED CANDIDATE COUNTRIES

GIDA ÜRÜNLERİNDE COĞRAFİ İŞARETLERİN ULUSAL VE ULUSLARARASI ÖNEMİ: AVRUPA BİRLİĞİ VE SEÇİLMİŞ ADAY ÜLKELERDE TESCİL SİSTEMLERİNİN KARŞILAŞTIRILMASI

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ÖZET

Coğrafi işaretler, gıda ürünlerinin belirli bir yöreye bağlı niteliğini, ününü ve üretim bilgisini korumaya yönelik önemli araçlardır. Ulusal düzeyde yerel üretimin desteklenmesi, geleneksel gıda mirasının korunması ve tüketicinin ürünün kökeni hakkında bilgilendirilmesi açısından önem taşıyan bu işaretler, uluslararası düzeyde ürün adlarının korunması ve pazarda farklılaşma bakımından da değerlendirilmektedir. Bununla birlikte, coğrafi işaretlerin sağladığı korumanın kapsamı ve tescil koşulları hukuk sistemlerine göre değişebilmekte; ulusal tescil ile uluslararası koruma arasındaki ilişkinin ayrıca incelenmesi gerekmektedir.

Bu çalışmanın amacı, gıda ürünlerinde coğrafi işaretlerin ulusal ve uluslararası önemini değerlendirmek ve Avrupa Birliği ile seçilmiş aday ülkelerin tescil sistemlerini benzerlikler, farklılıklar ve mevzuat uyumu açısından karşılaştırmaktır. Çalışma, Türkiye, Arnavutluk ve Sırbistan örnekleriyle sınırlandırılarak nitel araştırma yaklaşımı kapsamında karşılaştırmalı doküman analizi yöntemiyle yürütülecektir. Avrupa Birliği'nin 2024/1143 sayılı Tüzüğü, seçilen ülkelerin ilgili ulusal mevzuatı, yetkili kurumların başvuru rehberleri ve resmî tescil belgeleri temel veri kaynaklarını oluşturacaktır.

Karşılaştırma; koruma kategorileri, ürün ile coğrafi alan arasındaki bağ, ürün şartnamesi, başvuru sahipleri, inceleme ve itiraz süreçleri, denetim düzenlemeleri ve korumanın kapsamı üzerinden gerçekleştirilecektir. Ayrıca ulusal tescilli ürünlerin Avrupa Birliği'nde korunmasına ilişkin başvuru koşulları ele alınacaktır. Ekonomik ve kültürel önem ise ilgili literatür çerçevesinde tartışılacaktır. Çalışmanın, tescil sistemlerindeki ortak ilkeleri ve uygulama farklılıklarını ortaya koyarak aday ülkelerin uyum süreçlerine, üretici örgütlerinin başvuru hazırlıklarına ve geleneksel gıdaların uluslararası korunmasına ilişkin değerlendirmelere katkı sunması hedeflenmektedir.

Anahtar Kelimeler: Coğrafi işaretler, geleneksel gıdalar, Avrupa Birliği, aday ülkeler, tescil sistemleri.

ABSTRACT

Geographical indications (GIs) are intellectual property instruments that protect the names of food products whose quality, reputation, or other characteristics are attributable to their geographical origin. This study examines the national and international significance of GIs and compares registration systems in the European Union (EU) and three selected candidate countries: Türkiye, Albania, and Serbia. A qualitative documentary review draws on official regulatory sources and guidance published by competent authorities. The comparison focuses on protection categories, the relationship between

products and geographical areas, applicant eligibility, product specifications, and arrangements governing the use of protected names.

The reviewed sources indicate that these systems share a fundamental emphasis on the link between product characteristics and geographical origin. However, differences exist in institutional arrangements, eligible applicants, and the recognition of authorised users. National registration does not automatically confer protection in the EU, highlighting the need for separate preparation for EU registration. Beyond legal protection, GIs may support product differentiation, the preservation of traditional food knowledge, and local economic development. These potential benefits depend on producer participation, workable production requirements, effective controls, and market access.

The study concludes that comparisons of registration systems should address both shared legal concepts and differences in implementation. It recommends strengthening producer involvement, documenting the geographical link through clear evidence, and coordinating registration with control and marketing strategies. As the review is limited to official documents, further empirical research is needed to assess enforcement effectiveness and economic outcomes.

Keywords: Geographical indications, traditional foods, European Union, candidate countries, registration systems

THE ROLE OF SNACKS IN HEALTHY EATING: EVALUATING NUTRITIONAL QUALITY, PORTION SIZE, AND CONSUMPTION CONTEXT

ATIŞTIRMALIKLARIN SAĞLIKLI BESLENMEDEKİ ROLÜ: BESİN KALİTESİ, PORSİYON VE TÜKETİM BAĞLAMININ DEĞERLENDİRİLMESİ

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ÖZET

Atıştırmalık tüketimi, günlük beslenme örüntüsünün bir parçasıdır ve toplam enerji ile besin ögesi alımına katkıda bulunabilir. Ancak atıştırmalıkların sağlık açısından değerlendirilmesi, yalnızca tüketim sıklığına değil, seçilen yiyeceklerin besin kalitesine, porsiyon büyüklüğüne ve genel beslenme düzenindeki yerine bağlıdır. Bu çalışmanın amacı, atıştırmalıkların sağlıklı beslenmedeki rolünü besin ögesi alımı, iştah, enerji dengesi ve tüketim bağlamı açısından incelemektir.

Çalışma, resmî sağlıklı beslenme rehberleri ve seçilmiş özgün araştırmalara dayanan anlatısal derleme olarak hazırlanmıştır. Atıştırmalık kavramı, ana öğünler arasında tüketilen yiyecek ve enerji içeren içecekleri kapsayacak biçimde ele alınmıştır. Kaynaklar; besin kalitesi, porsiyon, tüketim zamanı, iştah yanıtları ve genel diyetle ilişki başlıklarında değerlendirilmiştir.

İncelenen kaynaklar, besin ögesi bakımından zengin seçeneklerin günlük beslenmeye katkı sağlayabileceğini göstermektedir. Bununla birlikte, kısa süreli tokluk yanıtları uzun dönemli ağırlık kontrolüyle eşdeğer değildir. Gözlemsel araştırmalarda bildirilen metabolik ilişkiler de nedensellik olarak yorumlanmamalıdır. Atıştırmalığın mevcut yiyeceklerin yerine tüketilmesi veya günlük alıma eklenmesi, enerji dengesi açısından ayrıca değerlendirilmelidir.

Sonuç olarak atıştırmalıklar, bireyin gereksinimleri ve genel beslenme örüntüsü içinde ele alınmalıdır. Besin kalitesi yüksek seçeneklere erişimin artırılması, porsiyon farkındalığı ve etiket okuryazarlığı desteklenmelidir. Bu derleme, bütün bireyler için sabit sayıda ara öğün önermek yerine, seçimin niteliğine ve bireysel uygunluğa odaklanan bir değerlendirme çerçevesi sunmaktadır.

Anahtar Kelimeler: Atıştırmalıklar, sağlıklı beslenme, diyet kalitesi, porsiyon, enerji dengesi.

ABSTRACT

Snacking forms part of daily eating patterns and can contribute to total energy and nutrient intake. However, its health implications depend not only on consumption frequency but also on the nutritional quality of the foods selected, portion size, and their place within the overall diet. This study aims to examine the role of snacks in healthy eating, focusing on nutrient intake, appetite, energy balance, and consumption context.

A narrative review was conducted using official healthy eating guidance and selected original studies. Snacks were defined as foods and energy-containing beverages consumed between main meals. Sources were evaluated according to nutritional quality, portion size, timing, appetite responses, and their relationship with the overall dietary pattern.

The reviewed sources indicate that nutrient-rich choices can contribute to daily nutrition. Nevertheless, short-term improvements in satiety are not equivalent to long-term weight management. Similarly, metabolic associations reported in observational studies should not be interpreted as causal effects.

Whether a snack replaces other foods or adds to existing intake is an important consideration for energy balance.

Snacks should therefore be evaluated within individual nutritional needs and the overall dietary pattern. Improving access to nutritious options, increasing portion awareness, and supporting nutrition label literacy are relevant strategies. Rather than recommending a fixed number of snacks for everyone, this review provides a framework centred on food quality and individual suitability.

Keywords: Snacks, healthy eating, diet quality, portion size, energy balance.

THE ROLE OF DIETARY SUPPLEMENTS IN OLDER ADULTS' NUTRITION: NEEDS-BASED USE, CLINICAL EVIDENCE, AND SAFETY

YAŞLI BESLENMESİNDE TAKVİYE EDİCİ GIDALARIN ROLÜ: GEREKSİNİME DAYALI KULLANIM, KLİNİK KANITLAR VE GÜVENLİLİK

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ÖZET

Yaşlılık döneminde yetersiz besin alımı, emilim sorunları, kronik hastalıklar ve çoklu ilaç kullanımı, beslenme durumunun değerlendirilmesini önemli hâle getirmektedir. Takviye edici gıdalar belirli besin ögesi gereksinimlerinin karşılanmasına katkı sağlayabilmekle birlikte, yararları ve güvenlilikleri ürünün içeriğine, kullanım amacına ve bireyin klinik özelliklerine göre değişmektedir. Bu çalışmanın amacı, takviye edici gıdaların yaşlı beslenmesindeki rolünü gereksinime dayalı kullanım, klinik kanıtlar ve güvenlilik açısından değerlendirmektir.

Çalışma, geriatrik beslenme rehberleri, besin ögelerine ilişkin resmî bilimsel değerlendirmeler ve seçilmiş klinik araştırmalara dayanan anlatısal derleme olarak hazırlanmıştır. B12 vitamini, D vitamini, kalsiyum, demir, multivitamin-mineral ürünleri ve omega-3 yağ asitleri ele alınmıştır. Enerji ve protein yetersizliğinde kullanılan oral beslenme destekleri, takviye edici gıdalardan ayrı bir klinik beslenme yaklaşımı olarak değerlendirilmiştir.

İncelenen kaynaklar, besin ögesi eksikliğinin giderilmesi ile eksiklik bulunmayan bireylerde hastalıkların önlenmesi amacıyla takviye kullanımının farklı kanıt temellerine sahip olduğunu göstermektedir. Bazı ürünler ve sonuçlar için yarar bildirilmesine karşın, bu bulgular bütün yaşlı bireylere veya tüm ürünlere genellenememektedir. Güvenli kullanımda toplam alımın, ilaç etkileşimlerinin, böbrek işlevlerinin ve kullanım süresinin değerlendirilmesi önem taşımaktadır.

Sonuç olarak takviye seçimi, beslenme değerlendirmesi ve ilgili rehber önerileriyle ilişkilendirilmeli; kullanım hedefi ve izlem planı açıkça tanımlanmalıdır. Takviyeler, yeterli beslenmeyi destekleyen ve gerektiğinde klinik bakımın içinde değerlendirilen araçlar olarak ele alınmalıdır.

Anahtar Kelimeler: Yaşlı beslenmesi, takviye edici gıdalar, mikrobesinler, ilaç etkileşimleri, güvenlilik.

ABSTRACT

In older adulthood, inadequate dietary intake, impaired absorption, chronic diseases, and polypharmacy make nutritional assessment particularly important. Dietary supplements may help meet specific nutrient needs, but their benefits and safety depend on their composition, intended use, and the individual's clinical characteristics. This study aims to evaluate the role of dietary supplements in older adults' nutrition, focusing on needs-based use, clinical evidence, and safety.

An narrative review was conducted using geriatric nutrition guidelines, official scientific assessments of nutrients, and selected clinical studies. The review addresses vitamin B12, vitamin D, calcium, iron, multivitamin-mineral products, and omega-3 fatty acids. Oral nutritional supplements used to address inadequate energy and protein intake are considered separately as a clinical nutrition intervention.

The reviewed sources indicate that correcting nutrient deficiencies and using supplements to prevent disease in individuals without deficiencies rely on different evidence bases. Although benefits have been reported for certain products and outcomes, these findings cannot be generalised to all older adults or all supplement formulations. Safety assessment should consider total nutrient intake, medication interactions, renal function, and duration of use.

Supplement selection should therefore be guided by nutritional assessment and relevant guideline recommendations, with clearly defined goals and monitoring plans. Dietary supplements should be considered tools that support adequate nutrition and, where appropriate, form part of coordinated clinical care.

Keywords: Older adults' nutrition, dietary supplements, micronutrients, medication interactions, safety.

GIDA YAĞLARINDA TAĞŞİŞ TESPİTİNDE YAPAY ZEKÂ DESTEKLİ ANALİTİK YAKLAŞIMLAR

ARTIFICIAL INTELLIGENCE-ASSISTED ANALYTICAL APPROACHES FOR ADULTERATION DETECTION IN EDIBLE OILS

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ÖZET

Yüksek enerji değerine sahip olmaları nedeniyle, yenilebilir katı ve sıvı yağlar günlük beslenmemizde hayati bir öneme sahiptir. Gıda yağlarının özgünlüğünün belirlenmesi ve tağşişin tespit edilmesi, gıda kalite kontrolü ve tüketici güvenilirliği açısından önemli bir analitik gerekliliktir. Yağların kimyasal bileşimlerinin birbirine benzer olması, özellikle farklı bitkisel yağların karıştırılmasıyla gerçekleştirilen tağşişlerin belirlenmesini analitik açıdan güçleştirebilmektedir. Bu nedenle hızlı, güvenilir ve çok değişkenli verileri değerlendirebilen analitik yaklaşımlara yönelik çalışmalar önem kazanmaktadır. Fourier dönüşümlü kızılötesi spektroskopisi ve nükleer manyetik rezonans spektroskopisi, yağların kimyasal yapısına ilişkin karakteristik spektral bilgiler sağlayan ve yağ özgünlüğünün değerlendirilmesinde kullanılabilen analitik teknikler arasında yer almaktadır. Makine öğrenmesi ve örüntü tanıma gibi yapay zeka alanındaki gelişmelerle birlikte, katı ve sıvı yağların kalite kontrol süreçlerinde de yapay zeka teknikleri kullanılmaya başlanmıştır. Yapay zeka tekniklerinin bu alandaki uygulamaları; fizikokimyasal özelliklerin belirlenmesini, hidrolitik ve oksidatif kararlılıkların saptanmasını, yabancı bileşenlerin tespit edilmesini ve orijinallik doğrulama çalışmalarını kapsamaktadır. Nitekim, yapay zekanın diğer bilgisayar yazılımlarıyla entegre edilmesi sayesinde, yenilebilir katı ve sıvı yağların kalite kontrol süreçleri optimize edilebilir ve otomatikleştirilebilir. Bu çalışmada gıda yağlarında tağşiş ve özgünlük analizinde elde edilen verilerin yapay zekâ ve makine öğrenmesi yöntemleriyle değerlendirilmesine yönelik yaklaşımlar ele alınmıştır.

Anahtar Kelimeler: Gıda yağları, yapay zeka, tağsiş

ABSTRACT

Edible fats and oils are essential components of the human diet owing to their high energy content. Determining the authenticity of edible fats and oils and detecting adulteration are important analytical requirements for food quality control and consumer safety. The similarity of the chemical compositions of fats and oils can make the analytical detection of adulteration, particularly that involving the blending of different vegetable oils, challenging. Therefore, increasing attention has been paid to analytical approaches that are rapid, reliable, and capable of evaluating multivariate data. Fourier-transform infrared spectroscopy (FTIR) and nuclear magnetic resonance (NMR) spectroscopy are among the analytical techniques that provide characteristic spectral information on the chemical structure of fats and oils and can be used to assess oil authenticity. With advances in artificial intelligence, particularly in areas such as machine learning and pattern recognition, artificial intelligence techniques have increasingly been applied to the quality control of edible fats and oils.

Applications of artificial intelligence in this field include the determination of physicochemical properties, assessment of hydrolytic and oxidative stability, detection of foreign components, and authenticity verification. The integration of artificial intelligence with other computational tools can contribute to the optimization and automation of quality control processes for edible fats and oils. In this study, approaches for evaluating data obtained from adulteration and authenticity analyses of edible fats and oils using artificial intelligence and machine learning methods are discussed.

Keywords: Edible fats and oils, artificial intelligence, adulteration

MİKROFİLİZLERİN FONKSİYONEL GIDA POTANSİYELİNİN GELİŞTİRİLMESİ: YETİŞTİRME, BİYOAKTİF BİLEŞENLER, İŞLEME VE BİYOYARARLANIM

ENHANCING THE FUNCTIONAL FOOD POTENTIAL OF MICROGREENS: CULTIVATION, BIOACTIVE COMPOUNDS, PROCESSING, AND BIOAVAILABILITY

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ÖZET

Mikro yeşillikler; çimlenmeden sonraki takiben kısa süre içerisinde hasat edilen; merkezi bir gövde, çenek yaprakları ve gerçek yapraklardan oluşan, körpe ve yenilebilir fidelerdir. Düşük kalorili olmaları, yüksek miktarda mikro besin ve biyoaktif bileşen içermeleri ve çeşitli yemeklerin doku, tat, aroma, renk ve estetik görünüm gibi duyusal (organoleptik) özelliklerini geliştirmeleri nedeniyle tüketiciler arasındaki popülerlikleri giderek artmaktadır. Mikro yeşilliklerin çimlenme oranı, tat ve kimyasal bileşim bakımından farklılık gösteren çok çeşitli türleri yer almaktadır. Geleneksel sebzelere kıyasla kısa üretim süresine sahip olmaları, kontrollü üretim sistemlerinde yetiştirilebilmeleri ve farklı bitki türlerinden elde edilebilmeleri, mikrofilizleri gıda bileşeni olarak önemli bir alternatif haline getirmektedir. Taze ve tüketime hazır fonksiyonel gıdalar olarak bilinen bu bitkiler; kendilerine özgü tatları, renkleri ve dokularının yanı sıra vitaminler, antioksidanlar, biyoaktif bileşikler ve mineraller açısından da zengindir. Mikro filizlerin besin yoğunluğu ve fenolik asitler, flavonoidler ile glukozinolatlar gibi biyoaktif bileşikleri yüksek oranda içermeleri, onları potansiyel antienflamatuar ve antikanser özelliklere sahip güçlü antioksidanlar haline getirmektedir. Bunun yanısıra mikrofilizlerin fonksiyonel gıda potansiyeli yalnızca sahip oldukları biyoaktif bileşenlerin miktarı ile değil, bu bileşenlerin sindirim sürecindeki davranışları ile de ilişkilidir. Gıda matriksi, bileşiğin kimyasal yapısı, işleme koşulları ve gastrointestinal sindirim sırasında gerçekleşen dönüşümler biyoyararlanımı belirleyen önemli faktörlerdir. Bu derlemede mikrofilizlerin fonksiyonel gıda potansiyelinin geliştirilmesinde yetiştirme koşullarının rolü, başlıca biyoaktif bileşenleri, gıda işleme süreçleri ve biyoyararlanım açısından mevcut bilgiler derlenmiştir.

Anahtar Kelimeler: Microgreens, functional food, bioactive compounds, food processing, bioavailability

ABSTRACT

Microgreens are young and edible seedlings harvested shortly after germination, consisting of a central stem, cotyledon leaves, and true leaves. Their popularity among consumers has been steadily increasing due to their low-calorie content, high levels of micronutrients and bioactive compounds, and their ability to enhance the sensory (organoleptic) properties of various dishes, including texture, taste, aroma, color, and visual appeal. A wide variety of microgreen species are available, differing in germination rate, taste, and chemical composition. Their short production period compared with conventional vegetables, suitability for cultivation in controlled production systems, and availability from diverse plant species make microgreens an important alternative as food ingredients. Known as fresh and ready-to-eat functional foods, these plants are rich in vitamins, antioxidants, bioactive compounds, and minerals, in addition to their distinctive flavors, colors, and textures. The high nutrient density of microgreens and their considerable levels of bioactive compounds, such as phenolic acids, flavonoids, and glucosinolates, make them potent sources of antioxidants with potential anti-inflammatory and anticancer properties. Furthermore, the functional food potential of microgreens is

associated not only with the amount of bioactive compounds they contain but also with the behavior of these compounds during the digestive process. The food matrix, chemical structure of the compound, processing conditions, and transformations occurring during gastrointestinal digestion are important factors determining bioavailability. This review summarizes the current knowledge on the role of cultivation conditions in enhancing the functional food potential of microgreens, their major bioactive compounds, food processing practices, and bioavailability.

Keywords: Edible fats and oils, artificial intelligence, adulteration

GIDALARDA DİYET LİFLER VE FİZYOLOJİK ETKİLERİ

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ÖZET

Uluslararası platformda diyet lifler için kullanılan terimler çok karmaşık olup; plantix, complantix, bitkisel hücre duvarı kalıntısı, besleyici değeri olmayan lif, sindirilemeyen veya elverissiz karbonhidratlar, kısmen sindirilebilen bitki polimerleri gibi terimlerin kullanılması önerilmistir. İngilizcede yaygın olarak kullanılan terim "Dietary Fibre" veya "Dietary Fiber"dır (Köksel ve Özboy, 1993a). Türkçede ise "Diyet Lif", "Besinsel Lif" ve "Gıda Lifi" en yaygın kullanılan terimlerdir.

Tarım, işleme, dağıtım ve satış ile büyük miktarlarda bitki kaynaklı atıklar elde edilir. Bitkisel kaynaklı atıklar genellikle lignoselüloz, protein, yağ, şeker ve fitokimyasallar ile diğer değerli bileşikler açısından zengindir. Bu bileşiklerin gıda atıklarından değerlendirilmesi sadece çevresel kaygıları azaltmakla kalmaz, aynı zamanda tarım-gıda endüstrilerinin sürdürülebilirliğini ve ekonomik rekabet gücünü de artırır (Jin vd, 2018). Büyük miktarda üretilen tahıl, meyve ve sebze yan ürünleri değerli ürünler olarak geri döndürülebilir. Bu atıklar gıda, kozmetik ve ilaç sanayi için ekonomik fayda sağlayan diyet liflerle beraber polifenoller ve uçucu yağlar gibi biyoaktif bileşikler de içerirler. Lifce zengin yan ürünler, biyoaktif bileşikler ve diyet lifi açısından zengin olduklarından, özellikle de tüketicilerin doğal takviyeler tercih etmesi nedeniyle gıda işletmecileri için çok kıymetli ürünlerdir (Elleuch vd, 2011).

Diyet lifler, ham lifte bulunan selüloz ve ligninin yanısıra, hemiselüloz, pektik maddeler, gamlar ve diğer karbonhidratları içerir. Gıdalarda en çok bulunan ve metabolik fonksiyonlar açısından en önemli olanlar; selüloz, hemiselüloz, pektin ve lignindir. Selüloz β-(1-4) bağlı, düz zincirli bir glukoz polimeridir, çözünmez yapıdadır. Pektin α-(1-4) bağlı galakturonik asit polimeridir, çözünür yapıdadır. Hemiselülozlar düz veya dallanmış yapıdaki pentoz ve heksozlardan oluşan heterojen yapıdadır ve hem çözünen hem çözünmeyen formları vardır. Lignin ise inert özelliğe sahip, sindirime dirençli, çözünmeyen, koniferil, sinapil, p-kumaril alkol içeren fenil propan polimeridir, polisakkarit değildir. Bu nedenlerle besinsel lifler "insan sindirim salgılarına dirençli olan bitkisel kaynaklı polisakkaritler ve lignin" olarak da tanımlanmaktadır (Köksel ve Özboy, 1993a). Bir başka tanıma göre de diyet lif "nişasta olmayan polisakkarit" olarak bilinmektedir. Ancak, dirençli nişasta bu tanımın dışındadır (Burdurlu ve Karadeniz, 2003).

Diyet lifi, lignin ve diğer karbohidrat olmayan bileşenler ile ilişkili olabilen hem oligosakkarit ve polisakkaritleri içeren bitki karbohidrat polimerlerinin karışımını (selüloz, hemiselülozlar, pektik maddeler, zamklar, dirençli nişasta, inülin) ve karbonhidrat olmayan bileşenleri (polifenoller, mumlar, saponinler, kutin, fitatlar, dirençli protein) içerir (Elleuch vd, 2011). Bitkilerin hücre duvarında yer alan lignin ve lignin türevleri (kutin, mum, suberin), selüloz, hemi-selüloz, pektin gibi yapı polisakkaritleri, inülin ve oligofruktoz gibi oligosakkaritler, diyet lifi olarak tanımlanmaktadır. Bunlarla beraber yapı bileşiklerinden olmayan gum maddeleri (gum arabik ve guar gum gibi); karragenan, agar, aljinat gibi deniz yosunu polisakkaritlerinin de diyet lifi olduğu belirtilmiştir (Burdurlu ve Karadeniz, 2003).

Diyet lif ile ham lif birbirine eşit terimler değildir. Ham lif önce seyreltik asit sonra seyreltik baz ile muameleden kalan kısımdır ve lignin ile selüloz miktarını gösterir (Köksel ve Özboy, 1993a). Ham lif terimi çözünmeyen lif kısmını ifade etmekte olup çözünen lif miktarını kapsamamaktadır, toplam diyet lif miktarını belirlemek için çözünür ve çözünmeyen fraksiyonları belirlemek gerekir.

Meyve ve sebze atıkları beslenme açısından önemli olan diyet lifi, antioksidanlar, pektin, elzem yağ asitleri, vitaminler gibi birçok faydalı maddenin kayıplarına sebep olmaktadır. Meyve ve sebze atıkları, antioksidanların yanı sıra çözünür diyet lifi olan pektin içeriği bakımından da zengindirler. Pektin preparatları genellikle turunçgil meyve kabuklarından veya elma posasından ekstrakte edilerek değerlendirilmektedir. Günümüzde, meyve ve sebze atıklarından çok yönlü fonksiyonel katkı maddeleri elde etmek ve bu katkıların değişik gıda ürünlerinde uygulaması üzerine araştırmalar sürmektedir (Yağcı vd, 2006).

Pektin, mineral metabolizması için önemi olan diyet liflerinden biridir. Önemli diğer diyet lifler arasında selülozlar, hemiselülozlar, pektin ve müsilajlar bulunur. Bitki hücrelerinin iskelet kalıntıları olan bu diyet lifleri, insan sindirim enzimleri tarafından hidrolize edilmez, kolonik bakteri enzimleri tarafından hidrolize edilir ve dışkı ağırlığı ve sıklığı artar. Bir dizi kompleks pektik polisakaritin heterojen bir karışımı olan pektin, erken bitki hücre duvarı biyogenezi sırasında ortaya çıkar. Uygun yenilebilir bitki materyalinin, genellikle turunçgillerin veya elmaların sulu ekstraksiyonu ile elde edilir. Tüm yeşil bitkiler selülozla birlikte, pektik maddeleri içerir ve bu maddeler meyve ve sebzelerin yapısal özelliklerinden sorumludur (Cerda, 1988). Meyvelerdeki pektik bileşikler onların tekstürlerini, sertliğini ve ayrıca reolojik özelliklerini etkiler. Pektinler yağlılık hissiyle beraber su bazlı jeller oluşturdukları için doğal yağ ikame maddeleri olarak düşünülürler. Narenciye kabuklarından ve elma küspesinden elde edilen ticari pektin genellikle reçel, jelibon ve diğer kalınlaştırıcı ürünlerin üretiminde kullanılır (Sharma vd, 1997).

Pektinin iyi bir jelleşme ajanı olmasının yanı sıra, proteinlerle birlikte kullanıldığında emülgatör özelliği de gösterir. Bitkisel bir lif olan pektinin kalori içermediği, proteinlerle bir arada gösterdiği emülgatör etkisi sayesinde emülsiyon ürünlerinde rahatlıkla kullanılabileceği ve pektin ilavesinin proteinlerin emülsiyon özelliklerini geliştirdiği belirtilmiştir (Ketenoğlu ve Tekin, 2012). Pektinin metoksilasyon derecesi (DM) önemli bir parametredir. Düşük metoksillenen pektinler (LM) ve yüksek metoksillenen pektinler (HM) farklı jel oluşumu mekanizmalarına sahiptirler. Pektinin homogalakturonan kısımları, su ve çözünen maddelerin hapsedildiği üç boyutlu bir kristal ağı oluşturmak için çapraz bağlanarak jel oluşturur. LM pektinlerinde jel, özellikle Ca2+ olmak üzere divalent katyonlar varlığında ve geniş bir pH aralığında oluşur. Böylece, LM pektinleri çoğunlukla düşük şekerli veya şekersiz ve düşük asitli ürünlerde kullanılır. Diğer HM pektinlerindeki jelleşme mekanizması hidrofobik etkileşimler ve hidrojen bağları ile yönetilir. Bu hidrojen bağları homogalacturonan zincirleri arasındaki bağlantıyı arttırarak, içindeki suyu hapseden üç boyutlu katı bir ağ oluşturur. Genellikle yüksek DM arzu edilir, çünkü metil grupları tarafından korunan homogalacturonan bölgeleri, bitişik pektin molekülleri arasında hidrojen bağı ve hidrofobik etkileşimlere katılabilir (do Nascimento vd, 2016).

ŞEKER ENDÜSTRİSİ ATIKSULARININ İLERİ ARITIMLA ARITILABİLİRLİĞİ : ŞEKER ENDÜSTRİSİ ATIĞI VE ADSORPSİYON

TREATABILITY of SUGAR INDUSTRY WASTEWATER BY ADVANCED TREATMENT: SUGAR INDUSTRY WASTE AND ADSORPTION

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ÖZET

Dünya genelinde su kaynakları üzerindeki baskı, artan nüfus, iklim değişikliği ve endüstriyel faaliyetlerin hızla genişlemesiyle giderek artmaktadır. Özellikle su yoğun sektörlerden biri olan gıda endüstrisi, büyük hacimlerde ve yüksek organik kirlilik içeren atık su üretimiyle çevresel sürdürülebilirliği tehdit etmektedir. Şeker endüstrisine bakıldığında şeker, dünyadaki ikinci büyük gıda ürünüdür. Şeker endüstrisi, şeker pancarı ve şeker kamışından çeşitli işlemlerle ham şeker, beyaz şeker, pudra şekeri, esmer kandis, beyaz kandis, sıvı şeker, yemek ve imalat şurubu, şekerli şurup, yapma bal, melas ve ispirto gibi ürünlerin üretildiği bir sektördür. 1 ton şeker kamışının işlenmesi ile yaklaşık 1000 L atık su açığa çıkar. Bu atık suların uygun arıtılmadan doğrudan alıcı ortamlara deşarj edilmesi, sucul ekosistemlerde ciddi oksijen tükenmesine, biyoçeşitlilik kaybına ve su kalitesinin düşmesine yol açmaktadır. Dolayısıyla, şeker endüstrisi atık sularının etkin bir şekilde arıtılması ve geri kazanılması, hem çevresel sürdürülebilirlik hem de su yönetimi açısından kritik bir gerekliliktir. Şeker endüstrisi atık sularındaki yüksek KOİ seviyeleri, geleneksel biyolojik arıtma süreçlerinin tek başına yeterli olmamasına neden olmaktadır. Literatürde, şeker endüstrisi atık sularının arıtımında ileri oksidasyon prosesleri (İOP), membran teknolojileri, elektrokoagülasyon (EK) ve adsorpsiyon (AD) gibi ileri arıtım yöntemlerinin etkinliği üzerinde çalışmalar bulunmaktadır.

Bu çalışmada; ileri arıtma yöntemleri özetlenerek, seker endüstrisi atıksu arıtımında seker endüstrisi parametreleri dikkate alınarak atıklarından elde edilen adsorban malzemesiyle arıtım ile deşarj standartlarını sağlama durumu tartışılacaktır.

Anahtar Kelimeler: Atıksu, şeker endüstrisi, şeker endüstrisi atığı, ileri arıtım , adsorpsiyon

ABSTRACT

Pressure on water resources worldwide is steadily increasing due to population growth, climate change, and the rapid expansion of industrial activities. The food industry, in particular—being a water-intensive sector—threatens environmental sustainability by generating large volumes of wastewater with high organic pollution loads. In the context of the sugar industry, sugar ranks as the second-largest food product globally. It is a sector in which products such as raw sugar, white sugar, powdered sugar, brown rock sugar, white rock sugar, liquid sugar, culinary and manufacturing syrups, sugar syrup, artificial honey, molasses, and spirits are produced from sugar beet and sugarcane through various processes.Processing one ton of sugarcane generates approximately 1,000 liters of wastewater. Discharging this wastewater directly into receiving environments without proper

treatment leads to severe oxygen depletion in aquatic ecosystems, loss of biodiversity, and a decline in water quality. Therefore, the effective treatment and recovery of sugar industry wastewater is a critical necessity for both environmental sustainability and water management.Therefore, the effective treatment and recovery of sugar industry wastewater is a critical necessity for both environmental sustainability and water management. High COD levels in sugar industry wastewater render conventional biological treatment processes insufficient on their own. Studies in the literature examine the effectiveness of advanced treatment methods—such as advanced oxidation processes (AOPs), membrane technologies, electrocoagulation (EC), and adsorption (AD)—for the treatment of sugar industry wastewater.

This study summarizes advanced treatment methods and discusses the feasibility of meeting discharge standards in sugar industry wastewUater treatment—taking specific industry parameters into account—by using adsorbent materials derived from the industry's own waste.

Keywords: Wastewater, sugar industry, sugar industry waste, advanced treatment, adsorption

ENKAPSÜLE BAL BAZLI PROPOLİS EKSTRAKTININ FARKLI GIDA MODELLERİNE UYGULANMASI: DUYUSAL ÖZELLİKLER VE ANTİOKSİDAN AKTİVİTE

INCORPORATION OF ENCAPSULATED HONEY-BASED PROPOLIS EXTRACT INTO DIFFERENT FOOD MODELS: SENSORY CHARACTERISTICS AND ANTIOXIDANT ACTIVITY

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ÖZET

Propolis bir gıda takviyesi olarak tüketilebildiği gibi, başta zengin fenolik bileşimi olmak üzere sağlığı destekleyici çeşitli etkileri sayesinde farmasötik formülasyonlarda ve fonksiyonel gıdalarda aktif bir bileşen olarak önemli bir potansiyele sahiptir. Ancak, sudaki sınırlı çözünürlüğü, baskın tat ve aroması ve gıda işleme sırasında biyoaktif özelliklerinin bozulmaya yatkın olması, gıda modellerinde kullanımını sınırlamaktadır. Çeşitli enkapsülasyon teknikleri, biyoaktif bileşikleri korurken aynı zamanda propolisin karakteristik tadını maskelemek ve antioksidan özelliklerini muhafaza etmede etkili yaklaşımlar olarak değerlendirilmektedir. Dah önceki bir çalışmamızda, çözücü olarak etanol, bal ve gliserol kullanılarak propolis ekstraktları hazırlanmış ve ardından %0,5, %1,5 ve %2 konsantrasyonlarda sodyum aljinat (Na-Alg) ve $CaCl_2$ kullanılarak iyonik jelasyon tekniği ile enkapsüle edilmişlerdi. Sonuçlar, iyonik jelasyon tekniği ile enkapsülasyonda %1.5 Na-Alg ve bal bazlı propolis ekstraktı kombinasyonunun en uygun yaklaşım olduğunu göstermişti. Bu çalışmada ise, %1.5 Na-Alg enkapsüle bal bazlı propolis örnekleri, kek, bal karışımı, yoğurt ve beyaz çikolata gibi gıda modellerinde kullanılmıştır. Ön denemelere dayanarak, gıdaya ilave oranları %0, %0,5, %1,0 ve %2,0 olarak belirlenmiştir. Enkapsüle propolis ilaveli yoğurt örnekleri buzdolabı koşullarında 10 gün boyunca depolanırken, diğer gıda örnekleri laboratuvar ortamında muhafaza edilmiştir. Depolama süresinin sonunda, örneklerin duyusal özellikleri ve antioksidan aktiviteleri değerlendirilmiştir. Enkapsüle propolis ilavesinin, tüm gıda modellerinin biyoaktivitesini artırdığı tespit edilmiştir. Spesifik olarak, %1.5 oranında enkapsüle propolis ilavesi, çiçek balında antioksidan aktiviteyi %10.91'den %50.14'e, çikolatada %13.12'den %58.27'ye, kekte %6.36'dan %77.45'e ve yoğurtta %8.12'den %87.96' ya yükseltmiştir. Gıda modellerinin duyusal değerlendirmesi sonucunda, en yüksek puanların genellikle % 0.5' lik kullanım düzeyinde elde edildiği belirlenmiştir. Gıda modellerinde yapılan duyusal değerlendirmeler sonucunda ise genel olarak en yüksek skorların %0.5 kullanım oranında elde edildiği, ancak genel bir sonuç olarak enkapsüle propolisin gıda modellerinde kullanım oranının %0.5-1.0 düzeyinde olabileceği belirlenmiştir.

Anahtar Kelimeler: Propolis, enkapsülasyon, antioksidan aktivite, arı ürünleri, iyonik jelasyon

ABSTRACT

Propolis can be consumed as a dietary supplement and has considerable potential as an active ingredient in pharmaceutical formulations and functional foods, owing to its diverse health-promoting

effects, primarily attributed to its rich phenolic composition. However, its limited water solubility, pronounced taste and aroma, and susceptibility of its bioactive properties to degradation during food processing restrict its incorporation into food matrices. Various encapsulation techniques are considered effective approaches for protecting bioactive compounds, while simultaneously masking the characteristic taste of propolis and preserving its antioxidant properties. In our previous study, propolis extracts were prepared using ethanol, honey, and glycerol as solvents and subsequently encapsulated via ionic gelation using sodium alginate (Na-Alg) and $CaCl_2$ at concentrations of 0.5%, 1.5%, and 2%. The results demonstrated that the combination of honey-based propolis extract with 1.5% Na-Alg, applied as an ionic gelation coating, was the most suitable approach. In this study, honey-based propolis extract samples encapsulated with 1.5% Na-alginate were used in various food models, including cake, honey mix, yogurt, and white chocolate. In this study, honey-based propolis extract encapsulated with 1.5% Na-Alg was incorporated into various food models. Based on preliminary trials, the incorporation levels were determined as 0%, 0.5%, 1.0%, and 2.0%. Yogurt samples fortified with encapsulated propolis were stored under refrigerated conditions for 10 days, whereas the other food samples were stored at laboratory conditions. At the end of the storage period, the sensory characteristics and antioxidant activity of the samples were evaluated. The incorporation of encapsulated propolis was found to enhance the bioactivity of all food models. Specifically, the addition of 1.5% encapsulated propolis increased antioxidant activity in floral honey from 10.91% to 50.14%, in chocolate from 13.12% to 58.27%, in cake from 6.36% to 77.45%, and in yogurt from 8.12% to 87.96%. Sensory evaluation of the food models indicated that the highest sensory scores were generally obtained at an incorporation level of 0.5%. However, based on the overall sensory results, the optimal incorporation level of encapsulated propolis in these food models was determined to be 0.5% to 1.0%.

Keywords: Propolis, encapsulation, antioxidant activity, bee products, ionic gelation

AKILLI ÇİFTLİKTEN GÜVENLİ GIDAYA: HASSAS HAYVANCILIK EKSENİNDE AKILLI ÇİFTLİK YÖNETİMİ VE HAYVANSAL ÜRETİMDE BİYOBELİRTEÇ DESTEKLİ BİYO-DİJİTAL İZLENEBİLİRLİK

FROM SMART FARMS TO SAFE FOOD: SMART FARM MANAGEMENT CENTRED ON PRECISION LIVESTOCK FARMING AND BIO-DIGITAL TRACEABILITY SUPPORTED BY BIOMARKERS IN ANIMAL PRODUCTION

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ÖZET

Günümüzde ve gelecekte hızla artan nüfusa bağlı hayvansal ürüne olan talebin artışının yarattığı, hayvancılık sektöründe; çevre, güvenli gıda, etik, halk sağlığı ve refahı gibi konuların olumsuz yönlerine dair kaygılar her geçen gün artmaktadır. Hayvansal ürüne artan talebi küresel boyutta karşılamaya, tüm olumsuzlukları ve kaygıları gidermeye yönelik hayvancılık sektöründe yeni stratejiler geliştirilmektedir. Hayvansal üretim içerisinde hayvan verimliliğini artırmak, hayvan sağlığı ve refahı ile üretim koşullarında güvenli ve kaliteli gıda üretimini kontrol altında tutabilmeye olanak sağlayacak ve sınırlı kaynakları sürdürülebilir bir şekilde kullanıldığı bir üretim sistemleri geliştirilmektedir. Bu kapsamda; sürdürülebilirlik, gıda güvenliği ve halk sağlığını destekleyen dijital üretim sistemleri olarak Hassas Hayvancılık uygulamalarından (Precision Livestock Farming, PLF) faydalanılmaktadır. Hassas hayvancılık teknolojileri; hayvansal üretimde çiftçilerin ve araştırmacıların hayvan sağlığı ve refahı kaygılarını gidermekle birlikte; yapay zeka, nesnelerin interneti, büyük veri analitiği, blok zinciri teknolojileri gibi uygulamalar ile de tüketiciler için daha şeffaf, izlenebilir, kaliteli ve güvenli gıda üretim taleplerini karşılayacak çiftlikten sofraya kadar bir hayvanın ve ürünlerinin uçtan uca izlenebilirlik sağlayan en etkili çözümdür. Bu çalışmada, çiftlikten çatala güvenli gıda konseptinden hayvancılıkta yaygınlaştırılması ile hassas hayvancılık uygulamalarının durumu ve potansiyelinin incelemesi, akıllı çiftlik yönetimi ve hayvansal üretimde biyobelirteçlerden faydalanılarak, biyo-dijital izlenebilirlik yöntemleri hakkında genel bir bilgi sunuldu.

Anahtar Kelimeler: Akıllı Çiftlik, Biyobelirteç, Hassas Hayvancılık, Güvenli Gıda, İzlenebilirlik

ABSTRACT

There are concerns amongst consumers, farmers, experts, authorities and numerous organisations regarding the negative impacts on the environment, food safety, ethics, public health and welfare resulting from the rising demand for animal products, driven by the rapidly growing population both today and in the future. New strategies are being developed to meet the global rise in demand for animal products and to address all the associated negative impacts and concerns. Within a livestock production system that utilises limited resources sustainably, there is a need for production models that enable increased animal productivity whilst ensuring animal health and welfare, and maintaining control over the production of safe and high-quality food under controlled conditions. In this context, Precision Livestock Farming (PLF) is utilised as an approach that supports sustainability, food safety and public health. Precision livestock farming technologies not only address the concerns of farmers and researchers regarding animal health and welfare but also, through applications such as blockchain technology, provide the most effective solution to meet consumer demands for more transparent, traceable, high-quality and safe food production from farm to fork: digital production systems that ensure end-to-end traceability. This study examines the current status and potential of precision

livestock farming applications through the widespread adoption of the 'farm-to-fork' safe food concept in the livestock sector.

Key Words: Biomarkers, Food Safety, Precision Livestock Farming, Smart Farm, Traceability

AN ASSESSMENT OF MICROPLASTIC CONTAMINATION IN PLASTIC-PACKAGED DRINKING WATER

PLASTİK AMBALAJLI İÇME SULARINDA MİKROPLASTİK KONTAMİNASYONUNA İLİŞKİN BİR DEĞERLENDİRME

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ÖZET

Mikroplastikler, çevrede yaygın olarak bulunmaları ve gıda, içme suyu ile solunum yoluyla insan vücuduna alınabilmeleri nedeniyle giderek önem kazanan bir halk sağlığı sorunu olarak değerlendirilmektedir. İçme sularında da yaygın olarak tespit edilmeleri, özellikle ambalajlanmış suları mikroplastik maruziyeti açısından potansiyel bir kaynak hâline getirmektedir. Mikroplastik maruziyetinin oksidatif stres, inflamatuvar ve immünolojik yanıtlar, bağırsak mikrobiyotasında değişiklikler ve endokrin sistem bozuklukları gibi çeşitli olumsuz biyolojik etkilerle ilişkili olabileceği bildirilmektedir. Ayrıca mikroplastikler, yüksek yüzey adsorpsiyon kapasiteleri nedeniyle ağır metaller, kalıcı organik kirleticiler ve çeşitli mikroorganizmalar için taşıyıcı görevi görebilmektedir. Özellikle ambalajlanmış içme sularında muhafaza sıcaklığı ve süresinin, mikroplastik oluşumu veya ambalajdan geçişi üzerindeki etkilerinin belirlenmesi, ürün güvenliği ve halk sağlığının korunması açısından önem taşımaktadır. Çalışmada, Türkiye'de faaliyet gösteren bir su üretim tesisinden temin edilen, ambalajlanmış doğal kaynak sularında muhafaza koşullarının mikroplastik düzeyi üzerine etkisinin belirlenmesi amaçlanmıştır. Bu amaçla, aynı üretim partisine ait, 180 mL'lik tek kullanımlık plastik ambalajlarda bulunan toplam 60 L su örneği kullanılmıştır. Örnekler 4 °C, 24 ± 2 °C ve 35 °C sıcaklıklarda muhafaza edilmiş ve analizler depolamanın 1., 5. ve 7. günlerinde gerçekleştirilmiştir. Örneklerde mikroplastik tayini ve polimer karakterizasyonu Raman spektroskopisi kullanılarak yapılmıştır. Analiz sonuçlarına göre; başlangıçta (0. gün) 2,20 partikül/L olan mikroplastik düzeyi, 7. günde 4 °C, 24 ± 2 °C ve 35 °C'de sırasıyla **2,34; 2,89 ve 4,56 partikül/L** olarak belirlenmiş olup mikroplastik düzeyinin **depolama süresi ve sıcaklığındaki artışa bağlı olarak yükseldiği görülmüştür.** Ayrıca, başlangıçta baskın olan **1–5 mm boyutundaki partiküllerin**, sıcaklık ve depolama süresi arttıkça yerini **<0,5 mm ve 0,5–1 mm boyutundaki mikroplastiklere** bıraktığı

gözlenmiştir. Bu değişim, mikroplastiklerde **ısı ve zamana bağlı fragmentasyonun** önemli bir göstergesi olarak değerlendirilmiştir. Elde edilen bulgular, depolama sıcaklığı ve süresinin ambalajlanmış içme sularında mikroplastik migrasyonunu belirgin ölçüde artırdığını göstermektedir. İçme sularındaki mikroplastik varlığına ilişkin insan sağlığı odaklı uluslararası norm ve sınır değerlerin henüz belirlenmemiş olduğu dikkate alındığında; tedarik, depolama ve satış zincirinde uygun sıcaklık koşullarının sağlanması ve etkin biçimde kontrol edilmesi, mikroplastik maruziyetinin azaltılması ve halk sağlığının korunması açısından önem taşımaktadır. Bu durum, konunun hem metodolojik hem de mevzuat açısından öncelikli olarak ele alınması gerektiğini ortaya koymaktadır. Bu kapsamda, mikroplastiklerin belirlenmesine yönelik standart analiz yöntemlerinin geliştirilmesi ve ilgili mevzuat çalışmalarının sürdürülmesine ihtiyaç duyulmaktadır.

Anahtar Kelimeler: Ambalajlanmış doğal kaynak suyu, Halk sağlığı, Mikroplastik, Plastik ambalaj, Raman spektroskopisi

ABSTRACT

Microplastics are increasingly recognized as a public health concern due to their widespread occurrence in the environment and their potential to enter the human body through food, drinking water, and inhalation. Their frequent detection in drinking water has raised particular concern regarding packaged water as a potential source of microplastic exposure. Microplastic exposure has been reported to be associated with various adverse biological effects, including oxidative stress, inflammatory and immune responses, alterations in the gut microbiota, and endocrine disruption. In addition, owing to their high surface adsorption capacity, microplastics may act as carriers for heavy metals, persistent organic pollutants, and various microorganisms. In packaged drinking water, determining the effects of storage temperature and duration on microplastic formation and/or migration from packaging is therefore important for ensuring product safety and protecting public health. This study aimed to determine the effects of storage conditions on microplastic levels in packaged natural spring water obtained from a water production facility operating in Türkiye. A total of 60 L of water from the same production batch, packaged in 180 mL single-use plastic containers, was used. Samples were stored at 4 °C, 24 ± 2 °C, and 35 °C, and analyses were performed on days 1, 5, and 7 of storage. Microplastic identification and polymer characterization were carried out using Raman spectroscopy. The initial microplastic level (day 0) was 2.20 particles/L and increased with increasing storage duration and temperature. On day 7, microplastic levels were 2.34, 2.89, and 4.56 particles/L in samples stored at 4 °C, 24 ± 2 °C, and 35 °C, respectively. In addition, particles in the 1–5 mm size range, which were predominant at the beginning of storage, were gradually replaced by smaller microplastics (<0.5 mm and 0.5–1 mm) as storage temperature and duration increased. This shift in particle-size distribution was considered an important indicator of temperature- and time-dependent fragmentation of microplastics. The findings demonstrate that higher storage temperatures and prolonged storage significantly enhance microplastic migration from the packaging into the water, resulting in increased microplastic levels in packaged drinking water. Given the absence of internationally accepted health-based standards or regulatory limits for microplastics in drinking water, maintaining and effectively controlling appropriate temperature conditions throughout the supply, storage, and retail chain is important for reducing microplastic exposure and protecting public health. These findings highlight the need to address this issue as a priority from both methodological and regulatory perspectives. Accordingly, standardized analytical methods for the determination of microplastics should be developed, and further efforts toward establishing relevant regulatory frameworks are needed.

Keywords: Packaged natural spring water, Public health, Microplastic, Plastic packaging, Raman spectroscopy.

KİTOSAN BAZLI AKTİF VE AKILLI AMBALAJ SİSTEMLERİ: FİLM VE KAPLAMA UYGULAMALARI

CHITOSAN-BASED ACTIVE AND INTELLIGENT PACKAGING SYSTEMS: FILM AND COATING APPLICATIONS

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ÖZET

Gıda ambalajlama sistemlerinde çevresel sürdürülebilirlik, gıda güvenliği ve raf ömrünün uzatılması amacıyla biyobozunur ve fonksiyonel materyallere olan ilgi giderek artmaktadır. Kitinin deasetilasyonu sonucu elde edilen doğal bir biyopolimer olan kitosan; biyouyumluluk, biyobozunurluk, film oluşturma kapasitesi, antimikrobiyal ve antioksidan özellikleri nedeniyle aktif ve akıllı ambalaj sistemlerinin geliştirilmesinde önemli bir materyal olarak öne çıkmaktadır. Bu derlemede, kitosanın film ve kaplama materyali olarak yapısal ve fonksiyonel özellikleri ile gıda ambalajlama alanındaki aktif ve akıllı uygulamaları değerlendirilmiştir. Aktif ambalaj sistemleri kapsamında kitosanın, doğal antimikrobiyal etkisinin yanı sıra bitkisel ekstraktlar, uçucu yağlar, fenolik bileşikler, nanopartiküller ve diğer fonksiyonel ajanlarla birlikte kullanımıyla antimikrobiyal, antioksidan, etilen ve gaz düzenleyici özellikler açısından ele alınmıştır. Akıllı ambalaj sistemlerinde ise tazelik indikatörleri, gaz indikatörleri, zaman-sıcaklık indikatörleri ile sensör ve biyosensör uygulamaları incelenmiştir. Kitosan bazlı akıllı sistemlerin gıdalarda bozulma sırasında meydana gelen pH değişimleri, uçucu bazik bileşiklerin oluşumu ve diğer kalite parametrelerinin görsel veya ölçülebilir sinyallere dönüştürülmesine olanak sağlayabildiği görülmektedir. Bununla birlikte, kitosanın sınırlı mekanik ve bariyer özellikleri, nem duyarlılığı, doğal indikatörlerin stabilitesi, bileşenler arasındaki etkileşimler ve endüstriyel ölçekte üretim ve standardizasyon gereksinimleri bu sistemlerin yaygın kullanımını sınırlandırabilmektedir. Sonuç olarak, kitosan bazlı aktif ve akıllı film ve kaplamalar, gıdaların korunması ile kalite ve tazeliğinin izlenmesini aynı ambalaj sistemi içerisinde birleştirebilme potansiyeli nedeniyle yenilikçi gıda ambalajlama yaklaşımları arasında önemli bir yer tutmaktadır.

Anahtar Kelimeler: Kitosan, Aktif ambalaj, Akıllı ambalaj, Gıda ambalajlama.

ABSTRACT

The use of biodegradable and functional materials in food packaging systems has gained increasing attention due to concerns related to environmental sustainability, food safety, and shelf-life extension.

Chitosan, a natural biopolymer obtained by the deacetylation of chitin, is considered an important material in the development of active and intelligent packaging systems because of its biocompatibility, biodegradability, film-forming ability, and antimicrobial and antioxidant properties. In this review, the structural and functional properties of chitosan as a film and coating material, as well as its active and intelligent applications in food packaging, are evaluated. In active packaging systems, the natural antimicrobial activity of chitosan and its use together with plant extracts, essential oils, phenolic compounds, nanoparticles, and other functional agents are discussed in terms of antimicrobial, antioxidant, ethylene-regulating, and gas-regulating properties. In intelligent packaging systems, freshness indicators, gas indicators, time-temperature indicators, sensors, and biosensors are examined. Chitosan-based intelligent systems can allow changes occurring during food spoilage, including pH changes, the formation of volatile basic compounds, and changes in other quality parameters, to be converted into visual or measurable signals. However, the limited mechanical and barrier properties of chitosan, its sensitivity to moisture, the stability of natural indicators, interactions between components, and the requirements for industrial-scale production and standardization may limit the widespread use of these systems. In conclusion, chitosan-based active and intelligent films and coatings have an important place among innovative food packaging approaches because of their potential to combine food preservation with the monitoring of quality and freshness within the same packaging system.

Keywords: Chitosan, Active packaging, Intelligent packaging, Food packaging.

NEUROPROTECTIVE EFFECTS OF GREEN TEA EXTRACT ON AGE-RELATED COGNITIVE DECLINE IN A RAT MODEL

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ABSTRACT

The present study investigated the neuroprotective effects of standardized green tea extract (GTE) against age-related cognitive decline in a rat model. Twenty-four male Albino Wistar rats were divided into young (4 months) and aged (24 months) groups, receiving either water or GTE (30 mg/kg) daily for five weeks. Spatial learning and memory were assessed weekly using Morris water maze (MWM) and novel object recognition (NOR) tests. Hippocampal tissues were analyzed for antioxidant enzymes (superoxide dismutase, catalase, glutathione peroxidase), inflammatory markers (interleukin-6, interleukin-1β), brain-derived neurotrophic factor (BDNF), and monoamine neurotransmitters (serotonin, 5-HIAA). Aged rats exhibited significant cognitive impairments in MWM and NOR tests compared to young controls. Chronic GTE administration significantly improved spatial learning and recognition memory in aged rats from week three onwards. This was accompanied by enhanced antioxidant enzyme activities, reduced pro-inflammatory cytokine levels, increased BDNF expression, and restoration of hippocampal monoamine levels. Our findings demonstrate that GTE exerts multi-target neuroprotective effects, attenuating age-related cognitive decline through antioxidant, anti-inflammatory, and neurochemical mechanisms.

Key words: green tea, neuroprotection, cognitive decline, aging, rat model, oxidative stress, Morris water maze test, novel object recognition test

A SYSTEMATIC REVIEW OF LITERATURE ON THE EFFECT OF AGROCHEMICALS ON CROP YIELDS, SOIL AND HUMAN HEALTH

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ABSTRACT

From creation God designated that man shall eat through the tilling of the soil. This divine inclination, makes agricultural activities a vital means through which billions of global citizens are provided with food. However, with the dynamic nature of man, there arose the need for the provision of more crops and plants within a short frame of time. This has resulted in the discovering and adaptation of agrochemicals by farmers with the aim of increasing crop yields and by extension food. The incremental and wide use of these agrochemicals such as herbicides, pesticide and fertilizers no doubt has contributed immensely in protecting crops from pests and diseases as well as increasing crops' yields but, the excessive usage has raised global concerns as evidence has shown that these agrochemicals have also hazardous effect on agricultural soil and human health. This paper therefore is a systematic review of literature on the effect of agrochemicals on crop yields, soil and human health. To come up with the appropriate literature to suit the purpose of the paper, it adopted interpretive content and document analysis method which precipitated the application of scientific procedures and rationale for systematic literature review (SPAR-4-SLR) model. Apart from identifying that agrochemicals are playing critical role in contemporary agriculture in the areas of crop growth, yields and control of pest, excessive use has resulted to decline in soil fertility, soil contamination and soil acidification and has exposed man's health to danger as most crops produced are also contaminated by the same agrochemicals, as well as disruption of soil microorganisms. Other effects as identified through the review include that their prolonged usage can negatively affect soil, resulting to declining yields over time, creating pesticide-resistance species and disruption of microbial activities. The paper also ascertained that the way forward among others are that farmers should apply integrated pest management, use organic fertilizers which are eco-friendly as against inorganic fertilizers, and employ precision agriculture. The paper concludes that farmers should adopt eco-friendly farming solutions to safeguard the green environment in line with UN sustainable development goal of food for all, to promote global good human health and soil sustainability.

INHIBITORY EFFICACY OF HONEY AGAINST MULTISPECIES BACTERIAL BIOFILM

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ABSTRACT

Bacterial biofilms are a major worldwide healthcare problem (urinary tract infections) and are associated with decreasing quality of life and significant patient morbidity. This study is first to test Pakistani honey bess, *Apis dorsata* and *A. cerana* honey samples as anti biofilm, anti quorum sensing (QS) and biofilm dispersal agents honey against multispecies biofilm of bacteria (obtained from obese patients). Briefly, five previously identified isolates *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus*, *Morganella morganii* and *Klebsiella pneumoniae* (MT448672-MT448676) were selected. Antibiogram study of all five isolates was tested against three antibiotics *viz*., erythromycin (20 µg/mL), lincomycin (100 µg/mL) and rifampicin (100 µg/mL). In order to form multispecies biofilm, identified bacteria were grown in batch culture by mixing equal volumes (OD_{590nm}= 0.1) of 2, 3 and 5 bacterial isolates. In total 11 groups (g1-g11) were made. Crystal violet (CV) staining method was used to evaluate the antibiofilm potential and biofilm dispersal potential of both honey samples. QS inhibition in *P. aeruginosa* was measured following culture supernatant method. Antibiogram study showed significant ($p < 0.05$) resistance by *P. aeruginosa* against tested antibiotics. *E. coli*, *M. morganii* and *K. pneumoniae* were significantly susceptible to erythromycin and *S. aureus* to lincomycin. Minimum inhibitory concentrations (MIC) values of both honey samples showed 2 and 5% concentrations as having significant ($p < 0.05$) inhibition potential of multispecies biofilm by all test groups (g1-g11). Though *A. dorsata* honey significantly inhibited biofilm formation at 2 and 5% against all groups but 2% concentration was highly significant against g2-g4 groups. Regarding *A. cerana* honey, 2% concentration was significantly effective against g1, g4-g7 and g9-g11 groups. Both honey samples significantly inhibited QS at 2 and 5%. The 5% concentration of *A. dorsata* honey significantly dispersed biofilm by all groups compared to 2% which showed dispersal potential only by g2 and g3 groups. Collectively, honey samples showed significant antibiofilm, anti-QS and biofilm dispersal potentials thus can be considered as good alternative to antibiotics.

Keywords: Honey potential as antibiofilm, quorum sensing, antibiotic resistance, resistant isolates

INDIGENOUS PRACTICES FOR AGRICULTURAL WATER MANAGEMENT IN ARID AND SEMI-ARID REGIONS

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ABSTRACT

Historically, rural communities in arid and semi-arid regions have demonstrated remarkable ingenuity and cultural resilience in coping with water scarcity, particularly in securing water for agricultural production. Their nature-based and innovative approaches to water management have long been rooted in rainwater harvesting (RWH), which has played an important role in supporting agricultural activities in water-scarce environments. Although the fundamental objective of these practices remains the same, namely collecting, storing, and reusing rainwater for crop irrigation, the indigenous techniques developed across different regions vary considerably according to local environmental conditions, cultural practices, and available resources. Therefore, this study presents a comprehensive review and comparative analysis of 18 recent studies indexed in the Scopus database and published between 2021 and 2025. The review examines traditional RWH practices across several regions, including the Middle East, Asia, North Africa, and Sub-Saharan Africa, while emphasizing their significance, diversity, and cultural value. The reviewed studies collectively highlight the positive contribution of RWH to rural agriculture in enhancing water-use efficiency and strengthening the resilience of agricultural systems through the provision of water for crop production. In turn, these practices can contribute to improving the socio-economic conditions of rural communities in water-scarce areas. Furthermore, several of the reviewed studies provide evidence that the use of harvested rainwater for crop irrigation can positively influence agricultural productivity and crop yields. Overall, the findings highlight the continued relevance of traditional RWH practices and their potential to support more water-efficient and sustainable rural agricultural systems.

Keywords: Rainwater harvesting, water management, climate resilience, agriculture.

FOLIAR APPLICATION OF NANOFERTILIZERS IN AGRICULTURAL CROPS: UPTAKE MECHANISMS, EFFICIENCY, AND FACTORS AFFECTING ABSORPTION

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ABSTRACT

Foliar application of nanofertilizers has emerged as a promising approach for improving the efficiency of nutrient management in modern agricultural production. Compared with conventional foliar fertilizers, nanofertilizers possess unique physicochemical properties, including high specific surface area, enhanced solubility, and the potential for controlled nutrient release, which may facilitate more efficient nutrient delivery to plant tissues. This review summarizes current knowledge on the mechanisms underlying foliar uptake of nanofertilizers and evaluates the major factors determining their absorption, translocation, and utilization by crop plants. Particular attention is given to the penetration of nanoparticles through the leaf cuticle, stomatal pathways, and other potential routes of entry, as well as their subsequent transport within plant tissues. The review also considers the influence of nanoparticle size, morphology, surface charge, chemical composition, concentration, and formulation on foliar absorption and nutrient-use efficiency. In addition, plant-related factors, including leaf surface characteristics, cuticle properties, stomatal density, developmental stage, and physiological status, are discussed as important determinants of foliar uptake. Environmental conditions such as relative humidity, temperature, light intensity, and rainfall following application may further affect the retention and absorption of nanofertilizers. Evidence from recent studies indicates that foliar-applied nanofertilizers can improve nutrient availability, promote plant growth, and enhance yield and quality in several crop species; however, their effectiveness is strongly dependent on nanoparticle characteristics, application strategy, and crop-specific responses. Potential phytotoxicity, environmental persistence, and uncertainties regarding long-term effects also require further investigation. The objective of this review is to critically synthesize the available scientific evidence on foliar nanofertilization, with emphasis on uptake mechanisms, factors affecting absorption, agronomic efficiency, and current research gaps, thereby highlighting prospects for the development of more precise and sustainable nutrient-management strategies.

Keywords: Nanofertilizers; foliar application; nanoparticle uptake; nutrient-use efficiency; crop production

PLANT-BASED BIOACTIVE EXTRACTS FROM FOOD BY-PRODUCTS: OPPORTUNITIES FOR CIRCULAR ECONOMY AND SUSTAINABLE FOOD PRODUCTION

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ABSTRACT

The increasing generation of food-processing by-products represents both an environmental challenge and an opportunity for the development of sustainable and value-added food ingredients. Fruit and vegetable peels, seeds, pomace, pulp, and other plant-derived residues are often rich sources of biologically active compounds, including phenolic compounds, flavonoids, carotenoids, anthocyanins, vitamins, and other phytochemicals with potential technological and health-promoting properties. Their recovery through appropriate extraction strategies can contribute to the transition from a linear to a more circular food production system by transforming underutilized biomass into valuable resources. This review summarizes the current knowledge on the potential of plant-based bioactive extracts obtained from food-processing by-products and their applications within a circular economy framework. Particular attention is given to the major classes of bioactive compounds present in different plant-derived by-products and to extraction approaches used for their recovery, including conventional solvent extraction and emerging green extraction technologies such as ultrasound-assisted extraction, microwave-assisted extraction, enzyme-assisted extraction, and supercritical fluid extraction. The influence of extraction conditions, solvent characteristics, temperature, extraction time, and raw material composition on extract yield and bioactive compound recovery is also considered. Furthermore, the potential application of these extracts as natural antioxidants, colorants, preservatives, functional ingredients, and nutraceutical components in food products is discussed. The review also addresses important challenges associated with the practical utilization of plant-based extracts, including variability in raw material composition, extraction efficiency, stability of bioactive compounds, scalability, economic feasibility, and regulatory considerations. The objective of this review is to critically synthesize current scientific evidence on the recovery and utilization of bioactive compounds from food by-products, highlighting their potential to generate value-added ingredients while reducing food waste and supporting more sustainable and circular food production systems.

Keywords: Food by-products; bioactive compounds; plant extracts; green extraction; circular economy

FOOD-DERIVED BIOACTIVE COMPOUNDS AND BRAIN AGING: THE ROLE OF OMEGA-3 FATTY ACIDS, POLYPHENOLS, AND THE MEDITERRANEAN DIET

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ABSTRACT

Background: The increasing burden of cognitive decline and neurodegenerative disorders has intensified interest in nutritional factors that may influence biological processes involved in brain aging. Omega-3 fatty acids, polyphenols, and Mediterranean dietary patterns have been linked to several mechanisms relevant to the preservation of cognitive function.

Objective: This presentation summarizes human evidence on the associations of food-derived omega-3 fatty acids, plant polyphenols, and Mediterranean dietary patterns with brain aging and cognitive outcomes.

Methods: Evidence from epidemiological studies, clinical trials, systematic reviews, and meta-analyses was evaluated, with emphasis on inflammatory, oxidative, mitochondrial, synaptic, and cerebrovascular pathways.

Results: Omega-3 fatty acids and polyphenols have been associated with lower neuroinflammatory and oxidative activity and with mechanisms supporting mitochondrial function, synaptic plasticity, and endothelial homeostasis. The Mediterranean diet provides these compounds within a complex dietary matrix, and greater adherence has been associated with more favorable cognitive outcomes in several populations. However, intervention studies show substantial heterogeneity. Genetic background, baseline nutritional and cardiometabolic status, age, intervention duration, and the composition of the dietary exposure may modify the observed effects.

Conclusions: Current evidence indicates that dietary patterns and food-derived bioactive compounds may influence several biological pathways involved in brain aging. Future studies should focus on sources of interindividual variability and on identifying the timing and characteristics of nutritional interventions most relevant to cognitive health.

Keywords: brain aging; omega-3 fatty acids; polyphenols; Mediterranean diet; cognitive function

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CLASSIFYING MUSHROOM EDIBILITY FROM CATEGORICAL MORPHOLOGICAL FEATURES: A COMPARATIVE RE-EVALUATION AND METHODOLOGICAL AUDIT OF MACHINE LEARNING MODELS

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ABSTRACT

Mushroom poisoning remains a recurrent food-safety problem: poison centres in the United States logged 133,700 mushroom exposures in 1999–2016, and China recorded 10,036 mushroom-poisoning outbreaks with 788 deaths in 2010–2020. Machine learning (ML) classifiers trained on morphological descriptors are frequently reported to separate edible from poisonous mushrooms with near-perfect accuracy, yet such claims are rarely audited. This study re-evaluates a published comparative experiment on the UCI Mushroom dataset (8,124 records, 22 categorical features) and audits its methodology in order to establish which conclusions the reported evidence supports. Eleven model configurations, namely Logistic Regression (default, tuned and L2 repeat), Gaussian Naïve Bayes, Support Vector Classifiers with RBF and polynomial kernels, Random Forest and Decision Tree (default and tuned) and a Multilayer Perceptron, were evaluated on a single 80/20 hold-out split of 1,625 test records. Accuracy, precision, recall, F1 and macro-F1 were recomputed from the published confusion matrices, and ROC-AUC values, cross-validation scores and code were examined for leakage and reporting errors. Five configurations classified all test records correctly. Logistic Regression reached 95.815% (default) and 97.292% (tuned) accuracy and Gaussian Naïve Bayes 93.169%, with 37, 23 and 52 poisonous mushrooms labelled edible, respectively. Hyper-parameter tuning did not always help: tuned Random Forest and Decision Tree made one and five errors where their default versions made none. Ten methodological issues were identified, including feature scaling fitted before the train–test split, ROC curves computed from hard labels and a gap between hold-out (93.17%) and 10-fold cross-validation (84.63%) accuracy for Gaussian Naïve Bayes. The evidence therefore supports only a dataset-specific claim; a leakage-free pipeline, repeated validation, paired statistical tests and external data are required before any practical safety claim.

Keywords: Mushroom Classification, Machine Learning, Categorical Features, ROC Analysis, Data Leakage, Reproducibility.

EVALUATE THE ANTIOXIDANT AND ANTIMICROBIAL EFFECT OF MARJORAM, PURSLANE AND SOWTHISTLE LEAVES TO BE USED AS NATURAL PRESERVATIVE IN MEAT PRODUCT

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ABSTRACT

Lipid oxidation is one of the most important problems that decrease the shelf life of meat and meat products. Therefore, the aim of this study was to evaluate the antioxidant and antimicrobial effect of three plants Marjoram (Origanum majorana L.), Purslane (Portulaca oleracea L.) and Sowthistle (Sonchus oleraceus) leaves to be used as natural preservative in meat product (burger patties). Powders of Marjoram, Purslane and Sowthistle were incorporated into freshly minced beef meat at concentration (1%) and compared with negative control and positive control (BHT). antimicrobial activity of the leaves was studied. Chemical composition, physical characteristics, and sensory evaluation were evaluated for cooked burgers. The physical characteristics included (water holding capacity), cooking characteristics (shrinkage, cooking loss and cooking yield), shelf life limiting parameters (TBA, TVN and total plate count) and sensory evaluation test were all investigated, while the chemical characteristics included moisture, protein, fat contents and pH values of chilled prepared beef burgers stored at freezer (-18°C) for three months. Moisture, protein and water holding capacity increased in both additives (Marjoram, Purslane and Sowthistle leaves extracts) added to the burger recipe and these parameters decreased at the end of storage period while fat increased with additives and after storage. All cooking parameters improved as shrinkage and cooking loss decreased with marjoram addition while cooking yield increased. TBA, TVN and total plate count at all added marjoram Purslane and Sowthistle samples were showed less increase rate comparing to that of control. The sensory evaluation showed no significant differences ($p < 0.05$) between the control samples and the prepared beef burger samples with the added extracts. The findings of the current study recommend possible use of Marjoram, Purslane, and Sowthistle leaves as natural sources of antioxidants and preservatives to extend the burgers shelf life under chilling storage to provide consumers with save healthy beef burger.

Keywords: Beef Burger, preservatives, Antioxidant, Antimicrobial, Keeping Quality, Storage Period

PHYTOCHEMICAL SCREENING AND EVALUATION OF ANTIOXYDANT AND ANTIBACTERIAL ACTIVITIES OF ESSENTIAL OILS OBTAINED FROM *ORIGANUM VULGARE* L. HARVESTED IN ALGERIA

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ABSTRACT

Origanum vulgare L. is a medicinal plant widely distributed in the region of Jijel. It is used in

the pharmaceutical, cosmetic and preservation industries of several food products. The present work focused on a phytochemical screening and the evaluation of two biological activities (antioxidant and antibacterial) of the essential oils of the studied plant. The phytochemical screening study of the aerial part of *Origanum vulgare* revealed the presence of various secondary metabolites such as flavonoids, tannins, alkaloids and coumarins. Moreover, the extraction of essential oils by hydrodistillation allowed obtaining a yield of 1.033%.In addition, the evaluation of the antioxidant activity by the DPPH method showed that the essential oil has a good antioxidant activity with an IC_{50} value of 9.40 µg/ml. The antibacterial activity was also evaluated by the agar diffusion method, which demonstrated the effectiveness of the oil towards approximately all tested bacterial strains (*Staphylococcus aureus* 38.25 mm, *Bacillus substillis* 43 mm, *Escherichia coli* 39,25 mm) with the exception of *Pseudomonas aeruginosa* which presented low inhibition zone of 13 mm.

As conclusion, the oil of the studied plant has potent antioxidant and antibacterial properties.

Keywords: *Origanum vulgare* L., phytochemical screening, essential oils, antioxidant activity

antibacterial activity

EGG AND DIETARY CHOLESTEROL INTAKE AND SEMEN QUALITY AMONG IRANIAN MEN UNDERGOING INFERTILITY EVALUATION

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ABSTRACT

The relationship between egg intake, dietary cholesterol, and male reproductive health has not been clearly established, with previous findings being inconsistent. This study examined whether egg and dietary cholesterol consumption were related to semen quality in Iranian men undergoing infertility assessment.

In this cross-sectional study, 207 infertile men were evaluated. Dietary information was collected using a validated 168-item semi-quantitative food frequency questionnaire. Participants were classified into tertiles according to their egg consumption and dietary cholesterol intake. Semen quality was evaluated based on overall semen status and individual parameters, including sperm count, motility, and morphology. Multivariable logistic regression models were applied to calculate odds ratios (ORs) and 95% confidence intervals (CIs).

Men with greater egg consumption had higher odds of an abnormal overall semen status. Relative to those in the lowest tertile, participants in the highest tertile had more than twice the prevalence odds of overall abnormal semen status after adjustment for potential confounders (OR: 2.35; 95% CI: 1.03–5.39). Higher egg intake was also related to increased odds of abnormal sperm morphology (OR: 2.74; 95% CI: 1.17–6.43). However, no statistically significant associations were observed between egg consumption and sperm count or motility. Dietary cholesterol intake showed no significant association with either overall semen status or individual semen characteristics.

In men evaluated for infertility, greater egg consumption was associated with increased odds of overall abnormal semen status and abnormal sperm morphology, while dietary cholesterol intake was not associated with semen quality. Given the cross-sectional nature of the study and the possibility of residual confounding related to overall dietary patterns, these findings should be interpreted as hypothesis-generating and do not establish a causal relationship.

Keywords: Male infertility, Semen parameters, Egg intake; Cholesterol intake, FFQ

QUORUM SENSING CONTROLS BIOFILM FORMATION IN MARINE ISOLATES

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ABSTRACT

This study aims to test marine microorganism for their biofilm forming capability using the crystal violet *in vitro* microplate assay. We examined that whether patulin and penicillic acid, two well-known quorum sensing inhibitors (QSI) for human pathogen *Pseudomonas aeruginosa* PAO1, can prevent biofilm formation. This study reports, for the first time, the successful amplification of a putative *luxS* gene homologue in the marine microorganism *H. pacifica* ATCC 27122, as well as a log 3 fold expression of AI-2 during early and mid-exponential growth in marine nutrient broth batch cultures. Degenerated primers were designed based on the *luxS* protein sequence of ten gram-negative, □-, □- and □- proteobacteria, and used for *luxS* gene amplification in *H. pacifica*. AI-2 assays were carried out using the well-established *Vibrio harveyi* BB170 AI-2 bioluminescence assay. Effect of penicillic acid on AI-2 induction of *H. pacifica* showed strong inhibitory effect at non-growth inhibitory concentrations compared to patulin having adverse effect at the highest concentration (25 µM) tested in our study. QSIs effect on biofilm forming capability of marine isolates was isolate specific. Detection of bioluminescence in the autoinducer bioassay and the presence of a putative *luxS* gene orthologue are biochemical and genetic evidence for the production of a signalling molecule(s) and provide a first step in characterizing *H. pacifica* quorum sensing. Our study emphasize that QSI compounds must be selected in the specific system in which they are to function and they cannot easily be transferred from one QS system to another.

Key Words: *H. pacifica*, AI-2 assay, Patulin, Penicillic acid, *LuxS* gene

LOW-FAT DIETARY PATTERN IS ASSOCIATED WITH LOWER ODDS OF ABNORMAL SEMEN QUALITY AMONG IRANIAN MEN UNDERGOING INFERTILITY EVALUATION

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ABSTRACT

The relationship between macronutrient-based dietary patterns and semen quality has not been well established. This study examined whether low-carbohydrate, low-protein, and low-fat dietary patterns were associated with semen quality among Iranian men undergoing infertility evaluation.

A total of 207 Iranian men aged 20–40 years who were referred to a specialized infertility clinic for evaluation participated in this cross-sectional study. Dietary consumption was obtained using a validated 168-item food frequency questionnaire. Macronutrient-based dietary pattern scores were calculated from decile rankings of macronutrient energy contributions, with the target macronutrient reverse-scored and combined with the other two macronutrients, and then categorized into tertiles. Semen quality was evaluated according to sperm count, motility, and morphology. Logistic regression analyses were performed to determine crude and adjusted odds ratios (ORs) with corresponding 95% confidence intervals (CIs) for overall abnormal semen quality and abnormalities in individual semen parameters.

Neither the low-carbohydrate nor the low-protein dietary pattern showed a statistically significant relationship with overall semen quality or any individual semen parameter. Compared with the lowest tertile, the highest low-fat pattern score was associated with lower odds of overall abnormal semen quality in crude (OR, 0.40; 95% CI, 0.19–0.84), demographic- and lifestyle-adjusted (OR, 0.38; 95% CI, 0.18–0.82), and energy-adjusted models (OR, 0.43; 95% CI, 0.20–0.94). The low-fat dietary pattern was also inversely related to abnormal sperm morphology in both the crude and partially adjusted analyses. However, this association was reduced in magnitude and no longer statistically significant following additional adjustment for energy intake. No significant associations were detected between the low-fat pattern and sperm count or motility.

Greater adherence to the low-fat dietary pattern was associated with reduced odds of overall abnormal semen quality and abnormal sperm morphology. However, the association with sperm morphology was weakened and lost statistical significance following adjustment for total energy intake. Prospective investigations are warranted to further clarify these associations.

Keywords: Male infertility, Semen parameters, Low-Carbohydrate Dietary Patterns, Low-Protein Dietary Pattern, and Low-Fat Dietary Pattern

SUSTAINABLE VALORIZATION OF RED BEETROOT POMACE BIOACTIVES THROUGH NANOENCAPSULATION FOR ENHANCED QUALITY OF FRESH PLUM JUICE

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ABSTRACT

The addition of food industry byproducts to the functional food systems is a new and sustainable strategy to enhance the nutritional and sensory properties. The red beetroot pomace, which is a win-win product during the extraction of juices, harbors numerous bioactive components such as betalains, phenolics, and dietary fibers that boast of effective antioxidant and coloring properties. Nevertheless, these chemicals are inherently unstable to light, temperature and oxidative stress thus limiting their immediate application in food compositions. Nanoencapsulation has become a new method of overcoming these challenges as it protects sensitive bioactives, enables them to be released on-demand and enhances solubility. The current review has suggested the potential of nanoencapsulation technique through Nano emulsions, liposomes, and polymer-coated nanoparticles, as well as, spray-dried nanocarriers, to stabilize the red beetroot pomace compounds and to incorporate them into fresh plum juice. This is because the encapsulation efficiency, interactions of nanocarrier- matrix and release kinetics are discussed in reference to improving physicochemical, sensory and functional quality of fortified juice. Encapsulation of bioactives of beetroot enhances colour stability, antioxidant and nutritional value and reduces oxidative browning and pigment degradation during storage. Furthermore, the nanoscale dispersion enhances bioavailability, consistent colour distribution, and mouthfeel without altering the original flavor of plum juice. The synergistic interaction of plum polyphenols and encapsulated beetroot antioxidants results in a fortified beverage with improved stability, shelf life, and health benefits.Although there are positive lab results, scale-up, cost-effectiveness, and regulatory considerations are significant concerns when trying to implement it in the industry. Overall, nanoencapsulation of bioactives from red beetroot pomace offers a potential and sustainable way to create next-generation functional drinks with better quality features and consumer appeal.

Key wordsi; Nanoencapsulation, Red beetroot pomace, bioactive compounds, Functional beverage, Antioxidant stability, Waste Valoriation

CLIMATE-DRIVEN PEST OUTBREAKS AND PESTICIDE RESIDUES: SUSTAINABLE PEST MANAGEMENT FOR SAFER FRESH PRODUCE

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ABSTRACT

Climate change is reshaping the ecology and seasonal activity of agricultural insect pests, with important implications for crop protection and food safety. Rising temperatures, altered rainfall patterns, longer growing seasons, and more frequent extreme weather events can affect pest development, voltinism, geographic distribution, and the timing and severity of outbreaks. In many horticultural systems, these changes may alter both the frequency and timing of pesticide applications, with potential consequences for pesticide residues in fresh fruits and vegetables. This review examines the links among changes in pest dynamics associated with climate change, pesticide use, and residue risks in fresh produce, with particular attention to sustainable approaches that can reduce unnecessary reliance on conventional insecticides. Integrated pest management, biological control, biopesticides, pheromone based methods, mass trapping, attract and kill techniques, physical exclusion, particle films, and precision application technologies are considered within this context. Effective pest monitoring, forecasting, the use of economic thresholds, appropriate pesticide selection, and strict observance of preharvest intervals are also critical for reducing unnecessary applications and minimizing residues at harvest. Although postharvest treatments can reduce certain pesticide residues, prevention should begin during crop production, where decisions regarding whether, when, and how pesticides are applied are made. Integrating adaptive pest management with residue prevention can therefore contribute to safer fresh produce, reduced environmental impacts, and more sustainable horticultural production under changing climatic conditions.

Keywords: Climate change; Agricultural entomology; Integrated pest management; Pesticide residues; Food safety; Fresh produce

ASSESSING SUPERIOR AGRONOMIC TRAITS IN LOCAL WHEAT GERMPLASM USING FUNCTIONAL MARKERS

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ABSTRACT

Wheat (*Triticum aestivum*), a staple crop is grown all over the world. This study surveyed functional markers (FMs) across 67 historical wheat varieties comprising old and modern genotypes to detect alleles linked to key agronomic traits including plant height (PH), photoperiod response, and drought stress tolerance. Field data on these traits validated the molecular findings. Descriptive statistics, correlation analysis, and principal component analysis (PCA) of agronomic traits showed a progressive shift in wheat genotypes toward shorter PH and photoperiod insensitivity over time, without sacrificing yield. The WMS-261 marker for the *Rht-8* allele (192 bp), linked to reduced PH) amplified in 43 genotypes, which exhibited significantly shorter heights than the 11 genotypes with the 200 bp fragment. The *Ppd-D1* markers for photoperiod response detected the sensitive *Ppd-D1b* allele (414 bp) in 11 mostly pre-Green Revolution genotypes while the insensitive *Ppd-D1a* (288 bp) appeared in the rest, except 14 genotypes with no amplification. Insensitive genotypes flowered earlier than sensitive ones, while non-amplifying genotypes flowered latest. The combination of *Ppd-D1a* (288 bp) and *Rht-8* (192 bp) both associated to high-yield traits occurred in 25 genotypes. *Dreb-B1* primers for drought tolerance amplified a 717 bp fragment in all but nine genotypes; among these, seven varieties (excluding Miraj 2008 and AARI 2011) were released between 1965 and 1990. Generalized linear model (GLM)-based association analysis confirmed significant links between WMS-261 and *Ppd-D1* markers and traits like PH, days to flowering (DF), days to maturity (DM), and yield components validating their utility for genetic selection. Overall, the study highlights gradual adaptation of superior agronomic traits across eras and provides valuable genotypic data for breeding.

Keyword: Molecular markers, Yield, Agronomic traits, PH, Photoperiod response, Drought tolerance

FROM AGRO-INDUSTRIAL RESIDUES TO NEXT-GENERATION FOOD TECHNOLOGIES: A CRITICAL REVIEW ON EMERGING NANOTECHNOLOGICAL, BIOMOLECULAR, AND ADVANCED STRUCTURING PARADIGMS FOR DATE PALM (PHOENIX DACTYLIFERA L.) SEED BIOMASS

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ABSTRACT

The transition toward sustainable and circular food systems demands transformative upcycling strategies that transcend conventional agro-waste utilization and leverage next-generation food technologies. This comprehensive review synthesizes the multifaceted, high-tech valorization pathways of date palm (Phoenix dactylifera L.) seed biomass across advanced food structuring, nanobiotechnology, precision bioprocessing, and computational design. In advanced food formulation, date seed biopolymers and nanostructures serve as multifunctional building blocks, enabling the development of solid-fat mimetic oleogels, surfactant-free Pickering emulsions, high-moisture extruded plant-based meat texturizers, and customizable three-dimensional food printing inks for personalized nutrition. Concurrently, nanotechnological interventions harness date seed cellulose nanocrystals and bioactive phenolics for active and intelligent biocomposite packaging films, as well as green-synthesized carbon quantum dots tailored for optical nanosensing of foodborne contaminants. At the biomolecular and processing frontier, subcritical water depolymerization yields high-purity prebiotic oligosaccharides, while specialized biopolymeric matrices facilitate targeted synbiotic microencapsulation for enhanced gastrointestinal probiotic survival. Furthermore, the integration of in silico molecular docking and machine-learning screening illuminates the mechanistic interactions between date seed bioactives and key metabolic enzymes. By unifying these advanced food processing, nanotechnology, and precision bio-ingredient concepts into an integrated zero-waste biorefinery framework, this review establishes date seed biomass as a cornerstone for next-generation, high-value, and resilient food manufacturing ecosystems.

Keywords: Phoenix dactylifera L.; Date seed biorefinery; Next-generation food technologies; Oleogelation; Pickering emulsions; Three-dimensional food printing; Active and smart packaging; Prebiotic oligosaccharides; Synbiotic microencapsulation; Computational food science.

PRECISION METABOLIC NUTRITION IN CANCER THERAPY: SYNCHRONIZING GLUCOSE CONTROL AND METHIONINE MODULATION TO EXPLOIT TUMOR VULNERABILITIES

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ABSTRACT

Cancer is increasingly recognized not only as a genetic disease but also as a metabolic disorder characterized by profound alterations in glucose and amino-acid utilization. These metabolic adaptations can create vulnerabilities that may be exploited alongside conventional anticancer therapies. In this context, nutritional intervention represents a potentially modifiable component of cancer care, yet conventional dietary approaches often focus primarily on preventing malnutrition rather than targeting tumor metabolism. This work proposes a precision metabolic nutrition framework based on the temporal modulation of nutrient availability during cancer treatment. Rather than advocating generalized carbohydrate or protein restriction, the proposed strategy combines the reduction of rapidly absorbable carbohydrate loads with a controlled modulation of dietary methionine while maintaining adequate energy and high-quality protein intake to preserve lean body mass and nutritional status. The central hypothesis is that transient metabolic modulation synchronized with therapeutic windows may create a differential metabolic pressure on tumor cells while minimizing nutritional stress in the host. Glucose availability, insulin dynamics, ketone-body production, circulating methionine, methylation-related metabolites, oxidative stress, inflammatory biomarkers, body composition, and treatment response would be integrated to characterize the metabolic response to the intervention. Particular attention would be given to tumor-specific methionine dependence, which has emerged as a potential therapeutic vulnerability and is currently being investigated from preclinical models toward early clinical applications. Importantly, the proposed approach recognizes the metabolic complexity of the tumor microenvironment and the potential effects of nutrient availability on antitumor immunity, emphasizing individualized rather than universal dietary prescriptions. By integrating nutritional assessment with metabolic and oncological biomarkers, this framework aims to move beyond the simplistic concept of “sugar restriction” toward a time sensitive, mechanism based nutritional strategy designed to exploit tumor metabolic plasticity while protecting the patient. This concept may provide a translational basis for future clinical studies investigating whether personalized metabolic nutrition can complement anticancer therapy, improve treatment responsiveness, and preserve nutritional and functional status.

Keywords: Precision nutrition; Cancer metabolism; Nutritional oncology; Glucose metabolism; Methionine restriction; Tumor metabolism; Personalized nutrition.

AGRICULTURE'S POTENTIALS TO MITIGATE YOUTH MIGRATION IN SUB-SAHARAN AFRICA: A CASE STUDY OF EDO STATE, SOUTH-SOUTH NIGERIA

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ABSTRACT

Youth migration from rural to urban areas and across national borders has become an important feature of demographic and socioeconomic change in Sub-Saharan Africa. Currently half of Sub-Saharan Africa population is under 25-years old and almost 20 Million young people enter the job market in Africa each year, 12 Million of whom are rural youths. In fact, according to FAO research, 65-75% of African migrants are youth, mostly in search of employment opportunities. Although migration can generate remittances, skills, networks and other benefits, persistent rural out-migration can weaken agricultural labour supplies, reduce community human capital and accelerate the depopulation of economically productive rural areas. This paper examines the potential of agriculture and agrifood systems to mitigate the economic pressures that contribute to youth migration, using Edo State in South-South Nigeria as a case study. The paper argues that agriculture should not be presented merely as traditional farming or as an alternative to migration. Rather, it should be repositioned as a modern economic system encompassing production, processing, logistics, marketing, agricultural services, digital agriculture, mechanization, finance and agribusiness entrepreneurship. Recent evidence shows that agriculture remains the largest employment sector for young people in Sub-Saharan Africa, accounting for nearly 60% of youth employment in 2021, while the region faces a continuing expansion of its youth labour force (International Labour Organization [ILO], 2024). Edo State possesses considerable agricultural resources, including cultivable land and opportunities in oil palm, rubber, cassava, rice, maize, cocoa, plantains and other commodities. State programmes have also increasingly focused on youth training, agribusiness, market linkages and agricultural employment. However, the capacity of agriculture to reduce migration depends on whether young people can obtain productive land, affordable finance, modern technology, infrastructure, extension services, reliable markets and decent incomes. The paper therefore proposes an integrated Edo Youth Agrifood Employment Strategy built around commercial agriculture, value addition, rural infrastructure, agricultural education, digital platforms, youth-friendly finance, cooperatives and market development. The central argument is that young people are unlikely to remain in rural communities simply because agriculture exists; they are more likely to remain when agriculture provides credible pathways to income, dignity, innovation, social mobility and entrepreneurship.

Keywords: youth migration, agriculture, agribusiness, rural development, youth employment, Sub-Saharan Africa, Edo State, Nigeria

REDOUBLING EFFORTS TO ADDRESS FOOD INSECURITY IN DEVELOPING COMMUNITIES: A CASE STUDY OF GUMA LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA

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ABSTRACT

Food insecurity remains one of the most pressing development challenges confronting developing communities, particularly rural areas whose livelihoods depend heavily on agriculture. Nigeria faces a complex food-security situation driven by rising food prices, insecurity, climate-related shocks, inadequate infrastructure, limited access to agricultural inputs and declining purchasing power. The Food and Agriculture Organization (FAO) reported that about 30.6 million Nigerians were projected to experience acute food and nutrition insecurity during the June–August 2025 lean season. Guma Local Government Area (LGA) of Benue State presents an important case because agriculture is central to household livelihoods, while recurrent farmer–herder conflicts, displacement and disruption of farming activities have weakened local food production. Recent evidence from Guma indicates that violent attacks reduce agricultural output, disrupt household income and force affected households to adopt negative coping strategies, including reduced food consumption. This opinion paper argues that addressing food insecurity in Guma requires a coordinated approach combining peace and security, agricultural productivity, climate resilience, food storage and processing, market development, social protection, agricultural extension and community participation. Redoubling efforts should therefore move beyond emergency food assistance toward building resilient local food systems capable of producing, processing, storing and distributing nutritious food sustainably.

Keywords: Food insecurity, agriculture, rural communities, Guma LGA, Benue State, food production, agricultural development, Nigeria.

SYNERGISTIC ANTIOXIDANT AND ANTIMICROBIAL EFFICACY OF BOTANICAL EXTRACTS AS NATURAL ALTERNATIVES TO SYNTHETIC PRESERVATIVES IN FUNCTIONAL FOOD MATRICES

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ABSTRACT

The food industry faces growing consumer demand for clean-label products and safer preservation technologies. Although synthetic preservatives such as butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA) and sodium benzoate effectively delay oxidative degradation and microbial spoilage, concerns about their long-term toxicological safety have accelerated the search for plant-derived alternatives. This study evaluates the dual-functional efficacy of selected essential oils and botanical extracts as biological preservatives, focusing on their combined antioxidant and antimicrobial action compared with conventional synthetic additives.

Bioactive compounds were obtained by hydrodistillation and Soxhlet extraction. Antioxidant capacity was assessed using DPPH and ABTS radical scavenging assays together with the ferric reducing antioxidant power (FRAP) assay. Antimicrobial activity was evaluated quantitatively against common foodborne pathogens and spoilage microorganisms, including *Escherichia coli*, *Staphylococcus aureus* and *Listeria monocytogenes*, using the agar disc diffusion method and broth microdilution assays to determine minimum inhibitory concentrations (MICs). Comparative stability trials were carried out in model food systems under controlled storage conditions over a 30-day period.

These findings highlight the strong potential of multi-target plant extracts as sustainable, dual-action natural preservatives. By simultaneously limiting oxidative deterioration and controlling pathogenic growth, botanical bio-additives offer a viable, consumer-friendly substitute for synthetic food preservatives in functional food formulation.

Keywords: Natural preservatives, Botanical extracts, Antioxidant capacity, Antimicrobial stability, Synthetic additives, Food safety, Clean-label formulations.

BIOASH AS A CIRCULAR AMENDMENT FOR METAL-CONTAMINATED SOILS: TRADE-OFFS BETWEEN METAL IMMOBILIZATION AND RHIZOSPHERE MICROBIOME FOOTPRINT

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ABSTRACT

Bioash from bioenergy production is increasingly used in circular bioeconomy systems to recycle nutrients and reduce soil acidity, yet its influence on rhizosphere bacteria in metal-contaminated soils (MCS) remains unclear. We examined how four bioash types applied at three rates affected rhizosphere biogeochemistry and bacterial communities of lettuce grown in MCS. All bioashes increased soil pH and electrical conductivity while lowering bioavailable Zn and Cd. 16S rRNA sequencing showed minimal changes in alpha diversity, with slight increases only at the highest doses, whereas beta diversity revealed clear, dose- and type-dependent shifts in community composition. These shifts were primarily associated with rhizosphere pH, salinity, exchangeable K, DTPA-extractable Cd, and mineral N. Bioash generally enriched *Pseudomonadota* and reduced *Bacillota*, *Bacteroidota*, and *Gemmatimonadota* at high rates. Differential abundance analysis identified distinct responsive taxa, including enrichment of *Galbitalea*, *Dongia*, and *Caulobacter* and depletion of several metal-sensitive groups. In conclusion, bioash reduced metal bioavailability and restructured the rhizosphere microbiome, supporting its role in sustainable remediation while highlighting the need to optimize application rates to maintain microbial ecological integrity.

Keywords: Bioash; Rhizosphere microbiome; Metal-contaminated soil; Lettuce

ARTIFICIAL INTELLIGENCE IN AGRICULTURE AND FOOD SECURITY

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ABSTRACT

The emergence of Artificial Intelligence (AI) plays a vital role in transforming Global Agricultural landscape.. It has opened new Horizons of farming Operations with greater Accuracy, Sustainability and Efficiency Worldwide. The Contemporary World is facing Resource Scarcity, Environmental destruction, growing demands of an increasing Population and food Shortages. Hence, It Enhancing the need for a Technology enabled Sustainable Change. Artificial Intelligence refers to those Processes or things that have Intelligence in the manner of a human, including Predictive analysis, forecasting, classification,detection,monitoring and optimization.Furthermore; it tackles different decision making problems that require the adaptation of AI in Agriculture.

This study also concentrates on bridging the gap between existing technology, effective and productive changes to increase Agricultural Productivity and Sustainability. Recent Studies Suggest that explainable AI or Hybrid AI builds trust in Predictive Systems and increases their adaptability in the agri-food systems. This study provides a Critical Evaluation of recent developments in AI in the Production of crops, farm Management, food quality and food Supply Chain Management.

By Machine Learning, Deep Learning, Computer Vision, Robotic Technologies, Internet of Things (IoT) and Remote Sensing food quality and Food Supply Chains can be improved much faster. The Reviewed Literature Suggests that AI can aid in yield estimation, crop and disease surveillance, Logistics, irrigation Scheduling, Precision farming, Site specific nutrient and soil management. It can enhance the optimization of Resources and minimization of food loss.

However, evidence suggests that technology alone cannot provide platforms for Effective and successful AI adoption; but other factors such as Infra structural, Institutional, Environmental, Socio-Economic Conditions, Policy frame works, Education, data quality, availability of resources and Inequality play a pivotal role in determining the success of AI adoption in Agriculture.Therefore,the Integration of technological advancement with the above mentioned dimensions is essential for effective, Sustainable Agriculture and Food Security.

Key Words:- Artificial Intelligence; Precision farming; Digital Agriculture; Smart farming; Machine Learning; Deep Learning;EdgeAI,ExplainableAI;Agriculture5,0; Food Security; Agri-food systems, Agricultural Value Chain; Food Safety ;Food Security, Computer vision; Internet of Things{IoT).

GREEN-SYNTHESIZED TRIDECA-HERBAL SILVER NANOFORMULATIONS AS ANTIMICROBIAL AGENTS TO COMBAT POLYMICROBIAL DENTAL PATHOGENS

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ABSTRACT

Polymicrobial interactions between *Streptococcus mutans* and *Candida albicans* are strongly implicated in the pathogenesis of dental caries and oral candidiasis, presenting a persistent challenge to conventional antimicrobial therapy. To address this, the present study reports an environmentally sustainable synthesis of silver nanoparticles (TDHNPs) using an aqueous trideca-herbal extract, obtained from thirteen medicinal plants, as a natural reducing and capping agent eliminating the use of hazardous chemical reagents. TDHNE were formulated using clove oil. The synthesized nanoformulations were subjected to biophysical characterization techniques including UV-Vis spectroscopy, which confirmed nanoparticles synthesis through surface plasmon resonance; X-ray diffraction established crystallinity and phase composition; field emission scanning electron microscopy revealed surface morphology; energy-dispersive X-ray analysis verified elemental silver content; and dynamic light scattering with zeta potential measurements characterized particle size distribution and colloidal stability. Fourier-transform infrared spectroscopy identified the phytoconstituents and eugenol-associated functional groups responsible for bioreduction and stabilization. Antimicrobial efficacy was assessed against *S. mutans* and *C. albicans*, individually and in *co-culture*, to emulate the polymicrobial oral biofilm. MIC and MBC/MFC assays revealed, dose-dependent inhibitory activity, with increased susceptibility under *co-culture* conditions. Biofilm assays demonstrated significant suppression of microbial adhesion and matrix formation, while biochemical analysis highlighted oxidative stress and membrane disruption as principal mechanisms underlying the antimicrobial action.

Keywords: Green synthesis, Silver nanoparticles, Biophysical characterization, *Streptococcus mutans*, *Candida albicans*, Oxidative stress biomarkers

FROM CHEMICAL BREAKDOWN TO HEALTH IMPACT: PHYSICOCHEMICAL EVALUATION OF COOKING OILS FROM VARIOUS FOOD MATRICES IN MOROCCO

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ABSTRACT

Vegetable oils are mainly composed of saturated, monounsaturated and polyunsaturated fatty acids, which provide nutritional and energy value. In traditional Moroccan cuisine, dishes are often prepared using vegetable oils, employing different cooking methods, durations and heat intensities. The oxidation of lipids in oils is promoted by moisture, high temperatures, metal particles, ultraviolet rays and exposure to oxygen. Heat treatment accelerates oxidation reactions, leading to the formation of undesirable compounds and a deterioration in sensory, nutritional and functional quality. This study aims to examine the physico-chemical quality of edible vegetable oils used for frying in the Rabat region of Morocco.

A total of Thirty oil samples were subjected to physicochemical evaluation, focusing on the peroxide value (PV) and acid value (AV) using the iodometric titration method in order to determine the degree of degradation.

This study demonstrates that the peroxide values ranged from 0 to 60.7 meqO_2/kg, as well as the acid values ranged from 0 to 8.69 mg/g. According to international standards (0–30 meqO_2/kg), 40 per cent of the samples showed low levels of peroxide, 43.33 per cent showed moderate levels and 16.66 per cent showed severe oxidation levels. Several samples exceeded the regulatory limits indicating advanced lipid oxidation.

These results show that some frying oils have high peroxide and acid values due to the oxidation of fatty acids during heating. This deterioration in physicochemical properties can adversely affect the quality of the oil and raising potential health safety concerns regarding daily edible oil consumption.

Keywords: Plant Oils, Lipid Peroxidation, chemistry Technique, Health Status.

STRUCTURAL AND COMPARATIVE DOCKING ANALYSIS OF HUMAN GUT-DERIVED *AKKERMANSIA MUCINIPHILA* AMUC_1100 WITH INNATE IMMUNE RECEPTORS

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ABSTRACT

Outer membrane protein Amuc_1100 from beneficial gut bacterium *Akkermansia muciniphila* is widely used probiotic and presumed to mediate host-microbe communication by receptor-mediated interaction. Although Amuc_1100 has been known able to interact with Tol-like receptor 2 (TLR2), whether it could interact with other receptors remains unexplored. Using comparative structural and protein-protein docking analysis, we aim to explore the potential interaction of B2UR41_AKKM8 (Amuc_1100) with three immune receptors in human: SIGIRR (IL-1R8), IL1RL2 (IL-36R), CLEC7A (Dectin-1). Quality assessment of the structure of the proteins involved suggests an overall reliable model: ERRAT scores for B2UR41_AKKM8, SIGIRR, IL1RL2 and CLEC7A are 85.47%, 94.96%, 92.93% and 96.31% based on Ramachandran plots respectively. Protein-Protein docking was performed using ClusPro with Balanced, Electrostatic-favored, Hydrophobic-favored and Van der Waals + electrostatic. For all chosen pairs of receptors, models with reproducible docking clusters have been generated in four scoring schemes, providing structural plausibility of the interaction interface. According to weighted scores, B2UR41_AKKM8 interact effectively with SIGIRR (-1487.0), IL1RL2 (-1792.7) and CLEC7A (-1833.9). Overall, SIGIRR, IL1RL2 and CLEC7A were suggested to be the candidate interactors of Amuc_1100, providing computational grounds for further biochemical and cellular investigation.

Keywords: *Akkermansia muciniphila*; protein–protein docking; ClusPro; innate immunity; structural modeling.

CROSS-BORDER GRAIN MARKETING AND FOOD SECURITY STATUS OF MARKETERS IN NIGERIA AND NIGER REPUBLIC

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ABSTRACT

Cross-border grain marketing constitutes an important component of food distribution and livelihood generation in the Nigeria–Niger Republic border corridor. It facilitates the movement of grains between areas of production and consumption while providing income-generating opportunities for traders and marketers. However, differences in market institutions, border procedures, transportation costs, access to capital and the degree of formality of trade may influence the welfare outcomes of marketers. This study examined the marketing channels of cross-border grain marketing, analysed the food security status of grain marketers, and estimated the effect of cross-border grain marketing on their food security status in Nigeria and Niger Republic. Primary data were obtained from 333 cross-border grain marketers, comprising 216 marketers in Nigeria and 117 in Niger Republic. Descriptive statistics were used to examine the marketing channels and food security status, while a binary logit regression model was used to estimate the effect of cross-border grain marketing and other socioeconomic and marketing factors on food security status. The findings showed substantial differences in marketing channels between the two countries. Formal cross-border trade was more prevalent among Nigerian marketers (67.6%) than among marketers in Niger Republic (35.0%), where informal trade accounted for 65.0%. Open markets were widely used in both countries, while Nigerian marketers recorded greater participation in retail and farm-gate channels. Food security was higher among Nigerian marketers, with 86.1% classified as food secure compared with 65.8% in Niger Republic. The food insecurity incidence, gap and severity were also higher in Niger Republic. The logit results showed that source of cross-border trade, market size, source of capital and income had positive and significant effects on food security, while transportation cost, household size and distance to market reduced the probability of being food secure. The study concludes that efficient and accessible cross-border grain marketing can contribute to marketers' food security through improved income and market opportunities, although high transaction and transportation costs can weaken these benefits.

Keywords: cross-border trade, grain marketing, food security, marketing channels, Nigeria, Niger Republic

DRUG REPURPOSING: AN INNOVATIVE APPROACH TO ACCELERATING DRUG DISCOVERY AND THERAPEUTIC DEVELOPMENT

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ABSTRACT

Drug repurposing, also known as drug repositioning or reprofiling, is the development of a known drug for a new therapeutic indication. Unlike conventional drug discovery, which commonly begins with identification of a new molecular entity and proceeds through extensive preclinical and clinical development, repurposing can build on existing pharmacological, toxicological, manufacturing and clinical knowledge. This approach has gained importance because the discovery of new medicines is time-consuming, costly and associated with substantial attrition. Repurposing strategies may use clinical observations, mechanistic knowledge, phenotypic screening, computational analyses, real-world data, molecular docking, network pharmacology and artificial intelligence to identify new drug–disease relationships. Several medicines have reached new indications through this approach, demonstrating its potential to shorten development pathways when adequate evidence already exists. At the same time, repurposing is not automatically faster or cheaper: new indications may require additional pharmacokinetic, dose-finding, safety and efficacy studies, intellectual-property strategies and regulatory evaluation. This chapter reviews the concept and evolution of drug repurposing, major discovery strategies, evidence sources, clinical development considerations, regulatory and economic aspects, representative examples, limitations and future directions. The chapter also highlights the contribution of pharmaceutical scientists and pharmacists to formulation optimization, evidence assessment, pharmacovigilance and translation of repurposed therapies into patient care.

Keywords; Drug repurposing; drug repositioning; drug discovery; drug development; pharmacology; computational drug discovery; precision medicine; pharmacovigilance

GENDER VARIATION IN THE PERCEPTION OF CLIMATE CHANGE AND ADPTATION STRATEGIES AMONG CROP FARMERS IN AGROECOLOGICAL ZONE B OF KOGI STATE, NIGERIA

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ABSTRACT

Climate change is a critical threat to agricultural production in Nigeria because erratic rainfall, severe floods, and rising temperatures constantly ruin crops and reduce food supplies. However, existing literatures reviewed farmer's perception about climate change effects in agricultural production, but only few evidence were given about gender variations in the perception of climate change and adaptation strategies. It is against this background that this study proposed to examine the gender variations that exist in the perception of climate change and adaptation strategies among crop farmers. A field survey was conducted involving 130 crop farmers randomly selected from farming communities, stratified by gender to ensure adequate representation of both male(n=77) and female (n=53) respondents. Primary data were collected through a well-structured questionnaire, data were analyzed using descriptive statistics, Binary Logit regression and multivariate Probit model. The result shows that socio-economic characteristics revealed key demographic differences: male farmers predominantly fell within the age ranges of 21–30 years (22.08%), 31–40 years (27.27%), and 41–50 years (29.87%), while female respondents were concentrated in the 31–40 years (37.74%) and 41–50 years (24.53%) age brackets, the majority of male respondents had 6–10 members (55.84%), whereas female respondents mostly had 1–5 members (30.19%) or 6–10 members (41.51%). The primary occupation and income generation, all male respondents (100.00%) engaged in farming as their primary livelihood, whereas 57.14% of female respondents engaged in farming, with others deriving income from trading (16.88%) or professional/services (25.97%). Credit access was severely constrained for both groups, with 68.83% of males and 75.47% of females having no access to credit. Both male and female strongly perceived temperature increases (94.34% female, 76.62% male) as the most prominent climate event, alongside rising farming input costs (male mean=3.89, female mean=3.39) and pest invasions (male mean=3.47; female mean=2.72). In response, key adaptation strategies adopted included crop rotation (96.10%) male, 96.11% female), use of disease/pest-resistant crops (71.43% male, 86.02% female), and agrochemical application (75.32% male, 77.36% female). Furthermore, information dissemination relies heavily on smart phones, internet, friends/family/neighbors, and extension officers (100% utilization across respondents). In conclusion, the study demonstrate that climate change is a reality affecting both male and female crop farmers, therefore, the study recommends the formulation of gender-responsive climate adaptation policies, targeted financial inclusion initiatives to remove credit constraints, and improved extension services to strengthen food security and agricultural resilience in Kogi State.

Keywords: *Climate Change, Gender Variation, Adaptation Strategies, Agroecological Zone B Kogi State.*

VALORIZATION OF *GLADIOLUS SEGETUM* KER-GAWL: A REVIEW OF ITS PHYTOCHEMICAL DIVERSITY AND ANTIPROLIFERATIVE POTENTIAL

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ABSTRACT

Gladiolus segetum Ker-Gawl is a herbaceous plant belonging to the Iridaceae family, cultivated in Egypt as an ornamental plant and known locally as "Seif El-Ghorab". This species holds considerable therapeutic potential, particularly due to its richness in bioactive secondary metabolites. The purpose of this paper is to synthesize and create value from the scientific literature supporting the phytochemical and pharmacological applications of *G. segetum*. Scientific evidence was compiled from published studies investigating the chemical composition and cytotoxic activity of this species. The synthesis compiled from these studies confirmed the presence of a wide diversity of chemical constituents, including triterpenes, saponins, anthraquinones, flavonoids, and lignans. Phytochemical investigation led to the isolation and characterization of two new compounds: a triterpenoidal saponin (compound 1) and an oleanane triterpene (compound 2), together with six known compounds (3-8). The in vitro cytotoxic activity of the saponin fraction and isolated compounds was evaluated against five human cancer cell lines (PC-3, A-549, HepG-2, MCF-7, and HCT-116). The saponin fraction exhibited potent activity against all tested cell lines, with maximum activity against PC-3 (IC_{50} = 1.13 µg mL^{-1}) and A-549 (IC_{50} = 1.98 µg mL^{-1}). Compound 1 showed potent activity against A-549 (IC_{50} = 2.41 µg mL^{-1}) and PC-3 (IC_{50} = 3.45 µg mL^{-1}), while compound 2 exhibited maximum activity against PC-3 (IC_{50} = 2.01 µg mL^{-1}). Molecular docking studies suggested that the cytotoxic activity of these compounds, particularly compound 2, may occur through inhibition of the HER-2 enzyme. The successful valorization of *G. segetum* can support the development of natural product-based anticancer agents and contribute to the discovery of new therapeutic leads. This data capitalization establishes a knowledge base for the sustainable exploitation of *G. segetum* and highlights its promising role in future pharmaceutical development initiatives.

Keywords: *Gladiolus segetum*, Iridaceae, triterpenes, saponins, cytotoxic activity, HER-2 inhibition, phytochemical valorization.

WHY CAN GRAPEFRUIT TURN A SAFE MEDICINE INTO A DANGEROUS ONE? CHEMISTRY AND BIOCHEMISTRY OF A CLASSIC FOOD–DRUG INTERACTION

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ABSTRACT

Grapefruit is generally regarded as a healthy food, yet its consumption can profoundly alter the pharmacokinetics of certain medicines and, in some cases, increase the risk of serious adverse effects. The present work examines the chemical and biochemical basis of this classic food–drug interaction. Particular focus is placed on naturally occurring furanocoumarins, especially bergamottin and 6',7'-dihydroxybergamottin, which can inhibit intestinal cytochrome P450 3A4 (CYP3A4) and thereby reduce the presystemic metabolism of susceptible drugs. As a consequence, compounds that normally undergo extensive intestinal first-pass metabolism may reach unexpectedly high plasma concentrations after grapefruit consumption. The paper discusses why the magnitude of the interaction varies markedly among medicines and among individuals, and why the effect may persist long after the fruit or juice has been consumed. Examples from several therapeutic classes are used to illustrate the clinical relevance of the phenomenon, including certain statins, calcium-channel blockers, immunosuppressants, and other drugs with narrow therapeutic margins. The role of intestinal transport proteins is also considered, since grapefruit components may influence drug absorption through mechanisms that are not limited to CYP3A4 inhibition. Differences between whole grapefruit, juice, processing conditions, and other citrus fruits are briefly addressed in relation to furanocoumarin content. The work underlines an important lesson in everyday pharmacology: a food considered beneficial from a nutritional perspective can become problematic when its natural constituents modify drug metabolism. Understanding this interaction provides a clear example of how organic chemistry, enzymology, nutrition, and pharmacotherapy intersect in daily life.

Keywords: grapefruit, furanocoumarins, CYP3A4, drug metabolism, food–drug interactions

THE CHEMISTRY OF HUMAN BODY ODOR: WHY DO WE SMELL AND WHY DOES OUR SMELL CHANGE WITH AGE?

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ABSTRACT

Human body odor is a familiar but chemically complex phenomenon resulting from interactions between secretions of the skin, microbial metabolism, and numerous volatile organic compounds. Interestingly, freshly secreted sweat is largely odorless, while characteristic body odors develop mainly after transformation of its components by microorganisms inhabiting the skin. This paper presents an overview of the chemistry responsible for human body odor, with emphasis on the origin, formation, and chemical diversity of the volatile molecules involved. The different contributions of eccrine, apocrine, and sebaceous secretions are discussed, together with the role of the skin microbiome in converting initially non-volatile or weakly odorous precursors into volatile compounds. Particular attention is devoted to volatile fatty acids, sulfur-containing compounds, steroids, aldehydes, and other molecules responsible for characteristic odors originating from different regions of the human body. The influence of genetic factors, diet, hormonal status, hygiene, medication, and disease on individual odor profiles is also considered. Furthermore, the paper highlights the chemical changes occurring during aging and their consequences for body odor. Special attention is given to 2-nonenal, an unsaturated aldehyde associated with age-related changes in skin lipid composition and oxidative degradation. Not least, the potential use of characteristic volatile compounds as non-invasive indicators of physiological or pathological processes is presented. The paper emphasizes that human body odor is not simply a consequence of perspiration, but represents a complex chemical signature generated by the interaction of human metabolism, skin chemistry, microorganisms, and environmental factors.

Keywords: body odor, skin microbiome, volatile organic compounds, 2-nonenal, aging

HYDROGEN SULFIDE IN THE HUMAN BODY: FROM A TOXIC GAS TO AN ESSENTIAL BIOLOGICAL MESSENGER

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ABSTRACT

Hydrogen sulfide is traditionally associated with the characteristic odor of rotten eggs and with severe toxicity resulting from inhibition of cellular respiration. During the last decades, however, this apparently simple toxic gas has emerged as an endogenously produced signaling molecule with important physiological functions. This work discusses the dual chemical and biological identity of hydrogen sulfide, focusing on the mechanisms responsible for its formation, reactivity, signaling activity, and toxicity. In mammalian tissues, H_2S is generated mainly from sulfur-containing amino acids through enzymatic pathways involving cystathionine β-synthase, cystathionine γ-lyase, and 3-mercaptopyruvate sulfurtransferase. Its acid–base equilibrium, particularly the distribution between H_2S and HS^- under physiological conditions, strongly influences its transport and chemical behavior. The biological effects of endogenous H_2S are examined in relation to vascular tone, neurotransmission, inflammation, mitochondrial function, and cellular responses to oxidative stress. Special emphasis is placed on protein persulfidation, a post-translational modification increasingly recognized as an important mechanism of H_2S-mediated signaling. The interaction of sulfide species with metal centers, reactive oxygen and nitrogen species, and thiol-containing biomolecules is also considered. At elevated concentrations, the same molecule becomes hazardous by interfering with mitochondrial electron transport and oxygen utilization, illustrating the crucial importance of dose and intracellular localization. Hydrogen sulfide therefore represents an intriguing example of a compound whose biological role cannot be classified simply as beneficial or toxic, but must be understood through the balance between endogenous production, chemical reactivity, cellular regulation, and exposure level.

Keywords: hydrogen sulfide, gasotransmitter, persulfidation, sulfur metabolism, toxicity

INFLUENCE OF CASSAVA ROOT SIEVATE FORTIFIED WITH PALM OLEIN ON SERUM BIOCHEMISTRY OF ABOR ACRES BROILER CHICKEN

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ABSTRACT

The effect of using the cassava root sieviate meal fortified with palm olein on the serum biochemical parameters of Arbor Acres broiler chickens at the finisher phase was investigated. One hundred and fifty (150) day-old Arbor Acres broiler chicks were used for the experiment. The birds were randomly distributed among five dietary treatments of three replicates and ten birds were assigned to each replicate. The treatments were: 0%, 25%, 50%, 75% and 100% replacement of maize with fortified cassava root sievate meal. The experiment was conducted for 6 weeks, with continuous allowance to feed and water. Blood samples were collected from 2 birds per replicate for serum biochemistry evaluation. The cholesterol, triglycerides, HDL and LDL were measured in the serum. The data obtained were analyzed using one-way ANOVA of SPSS program and the significant means ($P>0.05$) were separated by Duncan's Multiple Range Test. Total protein, albumin, globulin, albumin/globulin, AST, ALT, ALP, BUN, creatinine, glucose, cholesterol, triglycerides and LDL showed no significant difference ($P>0.05$) between the diet treatments. HDL was significantly affected ($P<0.05$) with the highest in T1 and the lowest in T2. The study findings indicated that cassava root sievate fortified with palm olein (PO) is appropriate as an alternative to maize in finisher broiler feed as it did not affect the majority of serum biochemical indices.

Keywords: Blood, chicken, Oil, cholesterol

THE EFFECT OF PLANTING MEDIA COMPOSITION AND TRICHODERMA SP. DOSAGE ON THE GROWTH OF COCOA SEEDLINGS (*THEOBROMA CACAO* L.)

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ABSTRACT

This study aims to determine the effect of planting media composition and Trichoderma sp. dosage on the growth of cocoa seedlings (Theobroma cacao L.), as well as their interaction. The research was conducted from March to June 2024 at the Agricultural Research Field, Widya Gama Mahakam University, Samarinda. The design used was a factorial randomized block design (RBD) 3 × 4 with three replications. The first factor was planting media composition: P0 (control), P1 (1:1 cattle manure : topsoil), P2 (1:2 cattle manure : topsoil). The second factor was Trichoderma sp. dosage: T0 (control), T1 (20 g/polybag), T2 (30 g/polybag), T3 (40 g/polybag). Parameters observed were number of leaves, plant height, and stem diameter at 30, 60, and 90 DAP. Results showed that P2 and T2 significantly improved cocoa seedling growth. The best interaction was observed in P2T2 for plant height at 90 DAP.

Keywords:Cocoa, growing media, cattle manure, Trichoderma sp

THE EFFECT OF PROVIDING HOUSE HOLD WASTE TRICHOCOMPOST AND PELANGI NPK ON THE GROWTH OF OIL PALM (*ELAEIS GUINEENSIS* JACQ.) SEEDLINGS IN PRE – NURSERIES

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ABSTRACT

The Effect of Applying Trichokompos Made from Household Waste and Pelangi NPK Fertiliser on the Growth of Oil Palm Seedlings (Elaeis guineensis Jacq.) in a Pre-Nursery, under the supervision of Rustam Baraq Noor and Hamidah. The aim of this study was to determine the optimal application rates of Trichokompos made from domestic waste and Pelangi NPK fertiliser, as well as the interaction between Trichokompos made from domestic waste and Pelangi NPK fertiliser, on the growth of oil palm seedlings in a pre-nursery. The study was conducted at the experimental plot of the Faculty of Agriculture, Widya Gama Mahakam, Samarinda, and lasted for three months, from December 2023 to February 2024. The study employed a factorial randomised block design (RAK). In total, there were 4 × 3 = 12 treatment combinations, and each treatment combination was replicated three times, resulting in 36 experimental units. The first factor was Trichokompos (T), comprising four levels: T0 = no treatment (control), T1 = 200 g per polybag, T2 = 250 g per polybag, and T3 = 300 g per polybag. The second factor was Pelangi NPK fertiliser (N), comprising three levels: N0 = no treatment (control), N1 = 20 g/polybag, N2 = 30 g/polybag. The results of this study indicate that the application of Trichokompos made from household waste had a significant effect on plant height at 9 MST and a highly significant effect on plant height at 12 MST and the number of leaves at 12 MST; Pelangi NPK fertiliser had a highly significant effect on plant height at 12 MST and the number of leaves at 12 MST; Pelangi NPK fertiliser had a highly significant effect on plant height at 9 MST and 12 MST, stem diameter at 9 MST, the number of leaves at 9 MST, and the interaction between Trichokompos made from household waste and Pelangi NPK fertiliser had a significant effect on plant height at 9 MST and 12 MST (T2 N1), stem diameter at 6 MST and 12 MST (T3 N1), and a highly significant effect on stem diameter at 9 MST (T3 N1).

Keywords: Oil palm, NPK, Fertiliser, Trichokompos

THE EFFECTIVENESS OF LIQUID ORGANIC FERTILISER MADE FROM BANANA PEEL WASTE AND UREA FERTILISER ON THE GROWTH OF OIL PALM SEEDLINGS (*ELAEIS GUINEENSIS* JACQ) IN A PRE-NURSERY

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ABSTRACT

The purpose of this study was to determine the effect of Banana Peel Waste POC and Urea Fertilizer and the interaction of the two treatments on the growth of oil palm seedlings in the Pre-nursery. The study was conducted for 4 months, starting from March 2025 preparation to June 2025 the final data collection and took place at the Research Field of the Faculty of Agriculture, Widya Gama Mahakam University Samarinda, Jalan Wahid Hasyim, Sempaja Village, North Samarinda District, East Kalimantan. The research method used a Factorial Randomized Block Design (RAK) consisting of 2 factors with 3 replications. The first factor is Banana Peel Waste POC (P) which consists of 4 levels, namely: P0 (Control), P1 (50 ml/polybag), P2 (75 ml/polybag) P3 (100 ml/polybag The second factor is Urea Fertilizer (U) which consists of 4 levels, namely: U0 (Control), U1 (8 g/polybag), U2 (10 g/polybag), and U3 (12 g/polybag). The observation variables are plant height growth, stem diameter and number of leaves. The results showed that Banana Peel Waste Liquid Organic Fertilizer (POC) significantly affected all parameters at 90 days after planting (HST) with the best dose of 50 ml/polybag. Urea fertilizer significantly affected all parameters at 60 and 90 days after planting at a dose of 12 g/polybag. Meanwhile, the interaction between Banana Peel Waste Liquid Organic Fertilizer (POC) and Urea did not significantly affect all observed parameters.

***Keywords*:** Palm oil, Banana peel waste, POC, Urea

GREEN BUSINESS AND GREEN INNOVATION: SMALL AND MEDIUM-SIZED ENTERPRISES AND MICRO-ENTERPRISES IN EAST KALIMANTAN

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ABSTRACT

This community engagement initiative was designed to educate and encourage the implementation of the Green Business concept amongst MSMEs in East Kalimantan as part of efforts to foster environmentally conscious and sustainable businesses. The programme was implemented in three phases: (1) needs assessment, (2) awareness-raising and training, and (3) intensive mentoring. A total of 30 micro-entrepreneurs from the culinary, handicrafts and services sectors were actively involved in this initiative. Programme evaluation revealed that 85 per cent of participants demonstrated increased awareness of sustainable business principles, particularly regarding the application of the 5R method (Reduce, Reuse, Recycle, Rethink, Recovery). The main challenges faced were the high cost of environmentally friendly materials and low market demand for green products. As a solution, the community service team proposed collaboration between stakeholders (the government, academia and the business sector) in the form of incentives, technical guidance and increased consumer awareness. This initiative also successfully identified opportunities for MSMEs in the utilisation of waste and the adoption of eco-friendly packaging as a foundation for greener business practices.

Keywords: Green Business, Green Innovation, Micro and Small Enterprises, Sustainable Development, the 5R Principles, Technical Guidance

COCONUT SHELL CHARCOAL EXTRACTION AS A SUBSTITUTE FOR SYNTHETIC PIGMENTS ON THE PHYSICAL AND MECHANICAL PROPERTIES OF COMPOSITE MATERIALS

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ABSTRACT

This study investigates the potential of coconut shell charcoal extract as an alternative to synthetic pigments in composite materials. Coconut shell charcoal was chosen due to its abundant availability and its dual function as a natural dye and a structural reinforcement agent. The research examines the effects of varying volume fraction and particle size of the charcoal on the physical and mechanical properties of composites. The experimental methodology encompasses planning, execution, and data analysis using an orthogonal arrayesign coupled with Structural Composite (SNR) evaluation. Banding tests indicate that particle size (Factor B) is the dominant variable, contributing 78.06% to the total variation, while the interaction between volume fraction (Factor A) and particle size is significant at 19.58%. Although volume fraction contributes a relatively small yet significant 1.71%, its role remains critical. Impact tests reveal that the interaction between Factors A and B is significant, accounting for 53.64% of the variation, with other factors contributing 43.66%. Moreover, water absorption tests show that the interaction between both factors contributes 43.96%, particle size 13.58%, and volume fraction 7.76%, with additional influences amounting to 34.70%. These findings provide valuable insights for optimizing composite formulations and enhancing the performance of environmentally friendly materials.

Keywords: composite, charcoal extraction, composite fraction, physical and mechanical properties

EFFECT OF SEED DRYING ON THE QUALITY OF GERMINATION OF CHILLI (*CAPSICUM ANNUM* L.)

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ABSTRACT

Red peppr is a type of chili that is needed by the community, especially for cooking ingredients and the food sources in Indonesia. There is a need to improve the quantity and quality of domestic red pepper production. In this case, seeds processing be one of factors that can affect the quality of red pepper production, one of them is drying. Drying is a method to reduce the seed moisture content which aims to decrease the respiration rate and the metabolic rate of the seed, so that the seed can be maintained for a longer period of time. The obyectives of experiment were the effect of drying on the germination of Chilli red pepper (Capsicum annum L.). The experiment was conducted at -field laboratory Faculty of Agriculture. The experimental design used was faclorial experiment 2 x 2 aruanged in Complelely Randomized Design (CRD) with replications four times. The first factor-was, drying (D) narnely: room drying (dl) and sun drying (d2). The second factor was drying period (P) namely: I days (pl) and 7 days (p2). The result showed lhat the drying and drying period was afected significanls on the germination.

***Keywords*:** seed, drying, germinatiory, red pepper

YIELD TEST OF TWO VARIETIES OF WELSHAW RICE WITH NITROGEN FERTILIZER APPLICATION FOLLOWING THE SRI METHOD

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ABSTRACT

This research aims was determine the response of both varieties of low land and get aosage of nitrogen fertilizer that increases growth and yield in rice fields and obtained a method which can increase the productivity of paddy fields. The study was conducted on farmers' rice area on Singa Geweh village North Sengata in East Kutai Regency. This research uses a Split Plots Design is repeated 3 replications, with treatment sconsisting of two factors. The first factoris the use of nitrogen fertilizer (P) as main plots, wich are Without Nitrogen Fertilizer (P0), Nitrogen fertilizers 35 $kgha^{-1}$ (P1), Nitrogen Fertilizers 70 $kgha^{-1}$ (P2), Nitrogen Fertilizers 105 $kgha^{-1}$ (P3) Nitrogen Fertilizer 140 $kgha^{-1}$ (P4). Second factoris the variety (V) as the subplot, which are: IR-64 Variety (V1) and Ciherang Variety (V2) The results of this research are indicating that the treatment dosage of nitrogen fertilizer showed non-significant results to all parameters of the observations. The highest dry milled grain is produced by treatment of P2(the dosage of nitrogen 70kgha-1) is 5.99 Mg ha-1. The results of this research indicating that the treatment of varieties test of rice plants showed non-significant results to all parameters of the observations. The highest production produced by treatment of V1 (variety IR64) is 5.96 Mg ha^{-1} The results of this research indicating that the interaction of nitrogen fertilizer treatment and testing rice varieties showed non-significant results to all parameters. The highest production produced by the interaction of P4 treatment (dosage of nitrogen 140kg ha^{-1}) and V1 treatment (variety IR 64) is 6.64 Mg ha^{-1}.

Keywords : Nitrogen Fertilizer, Variety, SRI, Rice.

AMPHIPHILIC EMULGELS LOADED WITH POMEGRANATE CARBON DOTS AND ROSEMARY OIL FOR METABOLIC pH MONITORING

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ABSTRACT

The development of sustainable, smart food packaging materials that simultaneously provide antimicrobial protection and real-time monitoring of food quality is a critical frontier in food safety. This study reports the fabrication of a multifunctional amphiphilic emulgel designed for the detection of pathogen-induced metabolic pH changes in food systems. The system utilizes Pomegranate-derived nitrogen-doped quasi-spherical carbon dots (QS-CDs) as fluorescent nanoprobes and Rosemary Essential Oil (REO) as a natural antimicrobial agent, both encapsulated within a polyelectrolyte complex of chitosan and sugarcane bagasse-derived carboxymethyl cellulose (CMC). A low degree of substitution (DS = 0.4) was specifically engineered for the CMC to ensure an amphiphilic character, enabling nanocomposite complex stabilization of the REO droplets without synthetic surfactants. Structural characterization via Transmission Electron Microscopy (TEM) revealed well-dispersed QS-CDs (4.71–6.62 nm) and stable oil droplets (~605.49 nm) anchored within a zipped polymer network. Thermal analysis (TGA/DSC) using the Coats–Redfern model revealed a significant synergistic effect: the smart-emulgel exhibits a distinct two stage degradation profile, with the high-temperature stage requiring an activation energy (Ea) of 95.19 kJ/mol, a substantial increase over the corresponding stage in the CD-emulgel baseline (18.69 kJ/mol). This enhanced stability is complemented by a slight increase in crystallinity (Xc from 0.11 to 0.14). While the smart-emulgel remains predominantly amorphous, this shift suggests that the integration of REO and QS-CDs into the polymer network promotes the formation of localized, more ordered domains, contributing to a more robust and structurally integrated matrix. The emulgel demonstrated a dual-mode optical response (colorimetric and fluorometric) sensitive to the metabolic byproducts (e.g., or ganic acids, amines, other alkaline compounds) produced by Escherichia coli and Staphylococcus aureus. These findings were corroborated by Density Functional Theory (DFT) calculations, which confirmed the thermodynamic stability and optimized electronic energy gaps for pH-responsive sensing. This research provides a green, high-performance plat form for the real-time monitoring of food freshness and the prevention of foodborne illnesses.

Keywords: pomegranate-derived carbon dots; heat-map; polyelectrolyte; rosemary essential oil; amphiphilic emulgel; food spoilage sensing; metabolic pH signatures; nanocomposite complex stabilization.

EFFECT OF PRESERVATION METHODS ON THE NUTRITIONAL STABILITY OF ZOBO (HIBISCUS SABDARIFFA) BEVERAGE DURING STORAGE

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ABSTRACT

Zobo drink, produced from the calyces of Hibiscus sabdariffa, is a popular Nigerian beverage valued for its nutritional and potential health benefits but is highly susceptible to deterioration during storage due to its high moisture content. This study investigated the effect of different preservation methods on the nutritional stability of Zobo beverage during storage. Three treatment groups were prepared: unpreserved Zobo (control), Zobo preserved with natural preservatives (ginger, cloves and cinnamon), and Zobo preserved with a chemical preservative (sodium bicarbonate). The samples were analysed for moisture, crude protein, carbohydrate and pH on Days 1, 4, 8, 12 and 15 of storage. Results showed progressive changes in the nutritional composition of the samples during storage. Moisture content decreased from 98.93% to 87.97% in the control, 94.46% to 89.54% in the naturally preserved sample, and 95.38% to 87.97% in the chemically preserved sample. Crude protein decreased from 34.95% to 18.80% in the control, 52.46% to 37.57% in the naturally preserved sample, and 34.92% to 22.57% in the chemically preserved sample. Carbohydrate concentration also declined from 195.95 to 80.55 mg/mL in the control, 214.60 to 91.05 mg/mL in the naturally preserved sample, and 191.35 to 81.15 mg/mL in the chemically preserved sample. The naturally preserved Zobo generally demonstrated better retention of crude protein and carbohydrate during storage, indicating comparatively greater nutritional stability. In contrast, the chemically preserved sample demonstrated comparatively better pH stability during storage. Overall, the findings indicate that preservation method influences the nutritional stability and physicochemical characteristics of Zobo beverage during storage. Natural preservatives may therefore provide a useful approach for maintaining the nutritional quality of Zobo, while chemical preservation may offer advantages in maintaining pH stability and prolonging storage quality.

Keywords: Zobo, Hibiscus sabdariffa, preservation methods, natural preservatives, chemical preservatives, nutritional stability, pH; storage.

GEOGRAPHICAL DISTRIBUTION AND DIVERSITY OF TABLE GRAPE CULTIVARS IN THE AÏN TÉMOUCHENT REGION (ALGERIA)

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ABSTRACT

Table grape (*Vitis vinifera* L.) cultivation is an important agricultural activity in the Aïn Témouchent region, northwestern Algeria, contributing to local food supply, farm income and the preservation of viticultural heritage. Despite this importance, the diversity and spatial distribution of table grape cultivars in the region remain insufficiently documented. This study aimed to assess the geographical distribution and diversity of table grape cultivars grown across the region, in order to identify the most widespread cultivars and to highlight areas of particular varietal richness.A field survey was carried in 22 vineyards, selected to represent the main agro-ecological zones of the region. Data were collected through direct observation and interviews with growers, covering cultivar names, planting area, vineyard age, rootstocks and cultural practices. Cultivars were identified and characterized using morphological descriptors, and diversity was analyzed using morpho J and multivariate analysis.

A total of 13 cultivars were recorded, the most widely distributed, while Victoria, Red Glob, Muscat Italia and Michel Palleri were found only in a few localities. The distribution of cultivars varied according to climate, altitude, soil type, proximity to the coast, market demand. These findings provide a baseline inventory of table grape genetic resources in Aïn Témouchent. They underline the need to conserve local germplasm, to promote cultivar diversification, and to guide sustainable vineyard management and future breeding programs.

Keywords: table grape, *Vitis vinifera*, cultivar diversity, geographical distribution, Aïn Témouchent, Algeria

INTEGRATED AGRICULTURE-AQUACULTURE SYSTEMS: IMPLICATIONS ON FOOD AND NUTRITION SECURITY

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ABSTRACT

Integrated agriculture-aquaculture systems (IAAS) is becoming an increasing trend as a sustainable alternative to improve food and nutrition security, especially in smallholder and resource-bound conditions. IAAS maximize resource use, recycle nutrients and diversify the diets by integrating crop, livestock and aquatic production. Asia and African evidence indicates that IAAS enhance food availability, dietary diversity, and household income and enhance resilience to climate and market shocks. Examples of successful models include the classic rice-fish farms and VAC to the new aquaponics and pondcrop-livestock recombinations. These systems help to achieve sustainability of the environment by recycling nutrients, reducing wastes as well as providing ecological services, and social benefits of the system include empowerment of women and diversification of livelihoods. Although they have such benefits, there are still difficulties, such as lack of water, risk of food safety, lack of technical knowledge, and poor policy backing. The existing evidence is robust but tends to be context-specific, there are gaps in the longitudinal and multi-country studies and scalability and trade-offs research. In general, IAAS can be a promising, flexible approach to food security, better nutrition, and environmental sustainability, although their broad application requires facilitating policies, extension services, and further studies on system optimization and the management of risks.

Keyword: Integrated agriculture-aquaculture systems; Nutrition security, Aquaponics; Sustainability; Scalability

LEVERAGING DIGITAL AGRICULTURAL EXTENSION SERVICES TO STRENGTHEN HOUSEHOLD FOOD SECURITY AMONG SMALLHOLDER FARMERS IN NORTH CENTRAL NIGERIA

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ABSTRACT

Digital agricultural extension services provide an emerging channel for improving farmers' access to timely production information, yet evidence on their relationship with household food security remains limited in North Central Nigeria. This study examined the use and adoption of digital agricultural extension service delivery applications and their relationship with household food security among smallholder farming households in Kogi, Niger and Nasarawa States. Primary data were collected from 351 households comprising 117 respondents from Kogi, 140 from Niger and 94 from Nasarawa State. Descriptive statistics were used to identify digital extension applications and determine adoption levels, while the Foster, Greer and Thorbecke framework was used to estimate food insecurity incidence, gap and severity. State specific probit models were estimated to examine the relationship between digital extension adoption and household food security. The results showed that Facebook agricultural pages or groups (63.5%) and WhatsApp groups (42.5%) were the most commonly used digital extension channels. Overall, digital extension adoption was low, with 76.9% of respondents classified as low adopters and a pooled mean adoption index of 0.20. Food security results showed that 57.0% of households were food secure, while 43.0% were food insecure. The pooled food insecurity incidence and gap were 0.430 and 0.295, respectively. The probit estimates showed statistically significant relationships between digital extension adoption and household food security in Kogi, Niger and Nasarawa States at the 1% level, with higher adoption associated with a lower probability of household food insecurity according to the estimated models. The study concludes that expanding meaningful use of digital agricultural extension services could provide an important pathway for supporting household food security among smallholder farmers in North Central Nigeria.

Keywords: digital agricultural extension, digital application adoption, food security, food insecurity, Foster Greer Thorbecke, probit model, smallholder farmers, North Central Nigeria

VALORIZATION OF *LUPINUS PILOSUS* MURR.: A REVIEW OF ITS AGRONOMIC POTENTIAL AND TOLERANCE TO CALCAREOUS SOILS FOR SUSTAINABLE AGRICULTURE

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ABSTRACT.
Lupinus pilosus Murr., commonly known as rough-seeded lupin, is an annual legume native to the Mediterranean basin, including Morocco. This wild species holds considerable agronomic and economic potential, particularly as an alternative crop for calcareous soils where conventional lupin species fail to thrive. The purpose of this paper is to synthesize and create value from the scientific literature supporting the multiple applications and potential of *L. pilosus*. Scientific evidence was compiled from published studies investigating genetic variation, tolerance screening methods, and field performance of this species. The synthesis compiled from these studies confirmed the existence of a wide range of intraspecific genetic variation in response to calcareous soils, with certain genotypes (e.g., P23370 and P22937) showing remarkable tolerance to high bicarbonate concentrations and elevated pH. Soil-based screening using highly calcareous soil (up to 50% $CaCO_3$) and solution-based screening using 15 mM $KHCO_3$ were validated as effective tools for identifying tolerant genotypes. Field studies confirmed that tolerant genotypes maintain higher grain yields on calcareous soils compared to intolerant ones, with yields reaching up to 9 g per plant, comparable or superior to narrow-leafed lupin on non-calcareous soils. The tolerance is associated with the ability to maintain adequate iron (Fe) and manganese (Mn) nutrition under stress conditions. The successful valorization of *L. pilosus* can support the expansion of lupin cultivation into marginal calcareous regions, contribute to crop diversification, and promote sustainable agricultural practices. This data capitalization establishes a knowledge base for the sustainable exploitation of *L. pilosus*, an emblematic Mediterranean species, and highlights its promising role in future breeding and development initiatives for calcareous soil adaptation.

Keywords: *Lupinus pilosus*, rough-seeded lupin, calcareous soil tolerance, genetic variation, screening methods, agronomic valorization, Mediterranean region.

MITIGATING THE EFFECTS OF CLIMATE CHANGE IN RUMINANT LIVESTOCK PRODUCTION TO IMPROVE FOOD SECURITY AND LIVELIHOODS IN NIGERIA

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ABSTRACT

Climate change is important challenge in facing the global agricultural production. Thus, it also impacts ruminant livestock production negatively through the emission of green-house-gas (GHG), which include methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). However, there are adaptation and mitigation measures that could be adopted in other to minimize the negative effects of climate change, so as to improve food security and livelihoods in Nigeria. Some of the methods for the mitigating the effects of climate change in ruminant livestock production include carbon sequestration, improving ruminant diets to reduce enteric fermentation and upgrading manure management practices. The use of organic fertilizer and the combining of legumes with grasses in pasture areas do help to decrease GHG emissions in ruminant livestock feed production. Policies to mitigate the effects of climate change on agricultural productivity must involve the governments and institutions in the whole world, in order to prioritize agricultural research and development.

In conclusion, climate change could impact ruminant livestock production negatively. Significant interventions are required to mitigate climate change effects on livestock production and improve food security and livelihoods in Nigeria. Government extension workers need to continually educate farmers. The adoption of crop-livestock production system could also be encouraged to minimize effects of climate change at lowest cost.

Keywords: Climate change, livestock production, food security and livelihoods

MOLECULAR AND BIOTECHNOLOGICAL APPROACHES TO IMPROVING FRUIT CROP RESILIENCE TO CLIMATE CHANGE

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ABSTRACT.

Climate change is becoming an important challenge for sustainable fruit production. Increasing temperatures, drought, irregular precipitation and other environmental stresses can negatively affect vegetative growth, flowering, fruit set, yield and fruit quality. Fruit trees are particularly vulnerable because of their perennial nature and long breeding cycles. Therefore, the development of climate-resilient fruit cultivars requires approaches that can complement conventional breeding and accelerate the identification and utilization of useful genetic variation. This review summarizes the main molecular and biotechnological approaches used to improve the resilience of fruit crops to climate-related stresses. Particular attention is given to the molecular mechanisms associated with drought and heat tolerance, including calcium signalling, abscisic acid, reactive oxygen species, transcriptional regulation and microRNAs. The potential contribution of genomics, transcriptomics, molecular markers and genomic selection to the identification of stress-tolerant genotypes is also discussed. In addition, tissue culture and regeneration technologies are considered as important platforms for modern fruit biotechnology. Recent advances in CRISPR/Cas genome editing provide opportunities for targeted modification of genes associated with stress tolerance and other important horticultural traits. The integration of molecular breeding, biotechnology and conventional field evaluation may contribute to the development of fruit crops better adapted to changing climatic conditions.

Keywords: climate change; fruit crops; drought stress; molecular mechanisms; biotechnology; CRISPR/Cas

NEPETA TUBEROSA L. SSP. *TUBEROSA*: A REVIEW OF ITS ESSENTIAL OIL COMPOSITION AND POTENTIAL APPLICATIONS

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ABSTRACT.
Nepeta tuberosa L. ssp. *tuberosa* is a herbaceous plant belonging to the Lamiaceae family, growing wild in Portugal and well-represented in the southwest of the Iberian Peninsula. This species holds considerable potential as a source of bioactive essential oils, particularly due to its richness in monoterpenes and sesquiterpenes with recognized biological activities. The purpose of this paper is to synthesize and create value from the scientific literature supporting the phytochemical composition and potential applications of *N. tuberosa* ssp. *tuberosa*. Scientific evidence was compiled from published studies investigating the essential oil composition of this species. The synthesis compiled from these studies confirmed that the essential oil isolated from inflorescences is predominantly composed of monoterpenes (89%), with 5,9-dehydronepetalactone (69%) and geranyl acetate (17%) being the main components. The sesquiterpene fraction amounted to 8% and was dominated by β-caryophyllene (5%) and β-caryophyllene epoxide (2%). The oil also contained minor amounts of nepetalactone (1.6%), linalool, citronellyl acetate, α-humulene, and other components. The presence of 5,9-dehydronepetalactone in such high proportion is a distinctive feature of this subspecies compared to other *Nepeta* species, where it generally occurs in amounts not exceeding 1%. Nepetalactone and its isomers, commonly found in *Nepeta* species, are known for their feline attractant effect and their potential as insect repellents or attractants. The limited number of components (13 identified compounds representing 98.9% of the total oil) makes this essential oil particularly interesting for potential industrial and pharmaceutical applications. This data capitalization establishes a knowledge base for the sustainable exploitation of *N. tuberosa* ssp. *tuberosa* and highlights its promising role in future development initiatives for natural bioactive products.

Keywords: *Nepeta tuberosa*, Lamiaceae, essential oil, 5,9-dehydronepetalactone, nepetalactone, geranyl acetate, monoterpenes, bioactive compounds.

OPTIMAL NITROGEN MANAGEMENT IN IRRIGATED WHEAT UNDER SOUTH OF IRAN

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ABSTRACT.

Climate change and the specific agro-climatic conditions of Hormozgan Province, Iran, necessitate optimized nitrogen (N) management for wheat (cv. Mehregan). A field experiment was conducted in Hormozgan, during 2024–2025. Four treatments were evaluated: (1) farmers' conventional practice (300 kg urea + 200 kg triple superphosphate per hectare), (2) no N application (other nutrients based on soil test), (3) fixed N splitting (30% at second irrigation, 40% at late tillering, 30% at stem elongation), and (4) optimized N splitting based on wheat phenology for warm climate (25% at second irrigation, 50% at mid-tillering, 25% at early-to-mid stem elongation). The results of present study showed that the fixed splitting treatment produced the highest spike number (466 m^{-2}), biological yield (16.60 t ha^{-1}), and grain yield (8.45 t ha^{-1}), in comparison with other treatments. However, the 1000-grain weight in optimized splitting was improved compared to farmers' practice treatment. The cost-benefit analysis indicated that fixed splitting had the highest net income and benefit-cost ratio, with about 12% higher grain yield than optimized splitting. Overall, fixed N splitting application is recommended as the most economical and agronomical effective strategy for irrigated wheat in south region of Iran.

Keywords: Climate change, Cost-benefit, Nitrogen, Wheat

POLYHERBAL ORAL DISSOLVING FILMS : FORMULATION STRATEGIES & THERAPEUTIC POTENTIAL OF BOUGAINVILLEA & CILTORIA TERNATEA EXTRACT

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ABSTRACT.

Polyherbal oral dissolving films (ODFs) offer a convenient novel drug delivery approach for herbal extracts without water**.** ***Bougainvillea*** and ***Clitoria ternatea*** contain flavonoids, phenolic compounds, anthocyanins, and other bioactive constituents associated with antioxidant and anti-inflammatory activities. This review evaluates their therapeutic potential and incorporation into polyherbal ODFs, with emphasis on formulation strategies, excipient selection, preparation methods, and evaluation parameters. Both plants demonstrate reported antioxidant and anti-inflammatory activities and complementary phytochemical profiles. ODFs provide rapid disintegration, convenient administration, water-free dosing, and potentially improved patient acceptability. However, extract variability, taste, polymer compatibility, phytochemical stability, dose uniformity, moisture sensitivity, and standardization remain important challenges. The combination of *Bougainvillea* and *Clitoria ternatea* in an ODF represents a promising polyherbal formulation approach. Further studies on standardization, formulation optimization, stability, phytochemical characterization, in-vitro/in-vivo evaluation, and clinical assessment are required to establish its quality, safety, efficacy, and therapeutic applicability.

RESEDA LUTEOLA L. (WELD): A REVIEW OF ITS AGRONOMIC POTENTIAL AND NATURAL DYEING PROPERTIES FOR SUSTAINABLE TEXTILE PRODUCTION

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ABSTRACT.
Reseda luteola L., commonly known as weld, is a biennial or polycarpic perennial herbaceous plant belonging to the Resedaceae family, native to Euro-Asia and naturalised in the Mediterranean region. This plant holds considerable agronomic and industrial potential, particularly as a renewable source of natural yellow pigments for textile dyeing. The purpose of this paper is to synthesize and create value from the scientific literature supporting the agronomic and dyeing applications of *R. luteola*. Scientific evidence was compiled from published studies investigating the agronomic characteristics, luteolin content, and dyeing properties of this species. The synthesis compiled from these studies confirmed that weld produces flavonoids in its aerial parts, the most important being luteolin (5,7,3',4'-tetrahydroxyflavone), a very stable yellow pigment used mainly for dyeing wool and silk since ancient times. Agronomic evaluation of six weld genotypes over a four-year field study in Central Italy revealed good performances with an overall dry yield of about 40 g per plant and an estimated yield of 2.8 tons per hectare. Genetic variability existed for luteolin content in leaves and reproductive structures, ranging from 13.6 to 28.7 mg g^{-1} dry weight among the six accessions. The harvest during flowering or at the beginning of fruit ripening did not affect overall dry yield, but luteolin was most abundant in the driest year and in plants harvested during flowering. Dyeing experiments demonstrated that dry powder from leaves and reproductive structures produced good and bright yellow colours on cotton, wool, and silk yarns using a ratio of 30:100 (w/w) of weld on textile materials. All dyed specimens exhibited good resistance to light and wash fastness, making the use of weld a viable alternative to synthetic yellow dyes. The successful valorization of *R. luteola* can support the development of sustainable and eco-friendly natural dye production and contribute to the reduction of pollution associated with synthetic textile dyes. This data capitalization establishes a knowledge base for the sustainable exploitation of *R. luteola* and highlights its promising role in future agricultural and industrial development initiatives for natural textiles production.

Keywords: *Reseda luteola*, weld, natural dyes, luteolin, agronomic evaluation, dyeing properties, sustainable textiles, Mediterranean region.

RETHINKING AGRICULTURAL SUSTAINABILITY THROUGH THE WATER–ENERGY–FOOD NEXUS: A REVIEW OF TECHNOLOGIES, MODELS, AND POLICY PATHWAYS

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ABSTRACT

Today the Water-Energy-Food (WEF) nexus is a systems-based approach to address the challenges of food security, water scarcity, energy demand and climate change in agricultural systems. In addition, integrated resource management strategies need to be adopted in order to optimize productivity, environmental protection and water resources efficiency, as agriculture is responsible for around 70% of global freshwater withdrawals and 21–37% of annual greenhouse gas emissions. The review highlights recent developments on WEF nexus research and its areas of focus such as nexus frameworks, climate-smart agriculture (CSA), and water-efficient technologies and technologies that integrate renewable energy, as well as governance mechanisms for sustainable agriculture.Optimisation-based studies have shown that nexus approaches can lead to considerable gains in efficiency of resource use and less pressure on the environment. The multi-objective optimization models have resulted in more reliable water demands for agriculture for up to 19.8%, reduced groundwater depletion, and improved cropping sequences, which are more climate smart. Technologies for improved management of soil health, soil productivity and emissions mitigation, including climate-smart agriculture (CSA) have been implemented, such as precision agriculture, conservation tillage, agroforestry, and cover cropping, and application of biochar. Renewable energy technologies, such as solar irrigation, agrivoltaics, biogas, smart microgrids and more, further contribute to sustainability by reducing dependence on fossil fuels, irrigation water savings up to 40%, yield gains of 10-25% and carbon emissions.Despite these progress, implementation remains limited, due to governance, financial, infrastructure and technological fragmentation. The challenge of scaling up nexus-based solutions involves effective stakeholder engagement, policy integration, capacity building, and investments in digital and renewable energy infrastructure. To summarise, WEF nexus offers a promising way towards a climate-resilient, resource-efficient and low-carbon agriculture, and further research is needed to explore dynamic modelling of WEFs, trade-offs analysis, and governance strategies in order to adapt them to specific contexts.

Keywords: Water–Energy–Food nexus; climate-smart agriculture; renewable energy; water-use efficiency; sustainable agriculture; food security; governance

FOOD SECURITY AND INTERNATIONAL COOPERATION: BUILDING RESILIENT AGRICULTURAL SYSTEMS IN A CHANGING WORLD

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ABSTRACT

Food security has emerged as a major global challenge as climate change, population growth, environmental degradation, economic instability, conflicts, and disruptions to agricultural supply chains increasingly affect food production and access. Because food systems are interconnected across national borders, addressing these challenges requires cooperation among states, international organizations, research institutions, agricultural communities, and other stakeholders. This study examines the relationship between food security, international cooperation, and agricultural resilience in the context of a rapidly changing global environment.

Using a qualitative review of existing academic literature and international reports, the study explores how international cooperation can contribute to resilient and sustainable agricultural systems. Particular attention is given to knowledge and technology sharing, climate-smart agriculture, sustainable water and land management, agricultural investment, emergency food assistance, and international coordination of food systems. The study also considers the importance of international institutions and multilateral frameworks in supporting countries that are particularly vulnerable to food insecurity and climate-related agricultural challenges.

The analysis indicates that strengthening agricultural resilience requires not only technological and agricultural solutions but also effective international cooperation and coordinated policy responses. Greater collaboration can facilitate the exchange of agricultural knowledge, mobilize financial and technical resources, strengthen food supply chains, and improve countries' capacity to respond to climate and food-related crises. The study concludes that international cooperation is an important component of long-term food security and sustainable agricultural development and can contribute to progress toward the Sustainable Development Goals, particularly SDG 2 (Zero Hunger) and SDG 17 (Partnerships for the Goals).

Keywords: Food Security; International Cooperation; Agricultural Resilience; International Relations; Sustainable Agriculture; Climate Change; Food Systems; Sustainable Development Goals

OPTIMIZING POTASSIUM FERTILIZATION FOR WHEAT UNDER SALINE AND WATER-SCARCE CONDITIONS IN THE MIDDLE EAST

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ABSTRACT

In the Middle East, where water resources are scarce and both soil and irrigation water are frequently saline, effective management of potassium fertilization is essential for sustainable and profitable wheat production. Potassium sulfate is preferred over potassium chloride because it contributes less to soil salinity and supports better crop performance under stress conditions. Fertilizer applications should be split: a portion applied as a basal dressing before planting, with the remainder delivered through fertigation using highly soluble potassium sources. Timing is carefully matched to critical growth stages of wheat, namely the onset of stem elongation, the period of stem development, and the grain-filling stage, to maximize nutrient uptake and minimize losses. A cost-benefit analysis of this approach shows improved potassium-use efficiency, reduced fertilizer wastage, and higher grain yields compared with conventional single-dose applications. These agronomic gains translate into greater net economic returns, making the strategy financially attractive for farmers operating under resource constraints. Overall, the combined agronomic and economic advantages of split, stage-specific potassium fertilization with sulfate sources provide a practical pathway toward more resilient and profitable wheat systems in saline and water-limited environments of the Middle East.

Keywords: Cost-benefit; Wheat; Salinity; Fertigation; Split application; Water scarcity; Middle East

TRANSFORMING FOOD AND AGRICULTURAL SYSTEMS FOR SUSTAINABLE DEVELOPMENT IN AFRICA: INNOVATION, CLIMATE RESILIENCE, FOOD SECURITY AND EMERGING OPPORTUNITIES

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ABSTRACT

Africa's food and agricultural systems are undergoing a period of significant policy, technological and institutional change. At the same time, the continent continues to face persistent food insecurity, high food-price pressures, climate-related shocks, weak rural infrastructure and unequal access to productive resources. The researcher examines how innovations in agricultural production and markets can be connected with climate resilience, inclusive finance, trade integration and stronger governance to support sustainable agri food systems in Africa. The researcher adopts a desk-review approach, drawing on recent African Union policy documents, United Nations reports, development-bank publications and peer-reviewed studies, with particular attention to evidence published from 2023 to 2026. The analysis focuses on four interrelated areas: the post-Malabo CAADP policy architecture, digital and technological innovation, climate adaptation and agroecology, and emerging opportunities in finance, trade and social inclusion. The evidence indicates that the African Union's CAADP Strategy and Action Plan for 2026–2035 provides an important continental framework, but implementation at national and subnational levels remains decisive. Digital agriculture can improve access to information, advisory services, markets and data, although connectivity, affordability and digital skills continue to limit equitable adoption. Similarly, climate-smart agriculture and agro ecological approaches can strengthen resilience, but their effects depend strongly on local institutions, extension systems, finance, and land security and farmer participation. The researcher argues that sustainable transformation should therefore be understood as a systems process rather than a technology-led intervention. Greater attention to smallholder farmers, women, young people, local knowledge, value-chain infrastructure and accountable institutions will be essential if Africa is to translate continental commitments into improved food security, livelihoods and environmental sustainability.

Keywords: agrifood systems; African agriculture; CAADP; climate resilience; digital agriculture; food security; agroecology; AfCFTA; agricultural finance; sustainable development

USE OF ARTIFICIAL INTELLIGENCE FOR MEDICATION ADHERENCE ASSESSMENT IN PATIENTS WITH TYPE 2 DIABETES: AN EXPLORATORY STUDY IN MOROCCO USING CHATGPT AND THE VALIDATED GENERAL MEDICATION ADHERENCE SCALE

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ABSTRACT

Objectives: Medication adherence remains a major challenge in the management of type 2 diabetes (T2D), especially in middle-income countries such as Morocco. With the rapid development of artificial intelligence, large language models, including ChatGPT, may offer new opportunities for clinical research through simulated patient profiles. This study examined the feasibility of using ChatGPT to generate culturally contextualized virtual profiles of Moroccan patients with T2D and to apply the validated Moroccan Arabic dialect version of the general medication adherence scale (GMAS).

Methods: This exploratory pilot simulation study used ChatGPT-4 to generate 11 virtual profiles based on representative sociodemographic and clinical characteristics of Moroccan patients with T2D. Each profile was administered the validated Moroccan Arabic dialect version of the GMAS.

Results: Four profiles (36.4%) showed high adherence, 6 (54.5%) displayed moderate adherence, and 1 (9.1%) exhibited low adherence. Expert evaluations were consistent, with all ratings ≥3 on a 4-point scale, supporting the credibility and cultural appropriateness of the profiles. The simulated patterns reflected real-world trends, with higher adherence among profiles treated with oral antidiabetic drugs, covered by health insurance, and having shorter disease duration, and lower adherence among profiles using insulin, lacking insurance, and having longer disease duration.

Conclusion: ChatGPT generated credible, culturally adapted patient profiles that enabled application of a validated psychometric tool in a simulated environment. This rapid, low-cost approach may support exploratory research, healthcare training, and intervention design. Comparative studies using real patient data are needed to confirm validity.

Keywords: Artificial intelligence; Diabetes mellitus, type 2; Feasibility studies; Medication adherence; Morocco; Psychometrics

PSYCHOPHYSIOLOGICAL ASPECTS OF IMPLEMENTING SHORT FOOD SUPPLY CHAINS AS AN ELEMENT OF PSYCHOLOGYOF HEALTH

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ABSTRACT

Currently, several factors including availability, cost, nutritional value, and hedonistic preferences play a significant role in food consumption. Characteristics such as health consciousness and consumer knowledge can also be important. These factors contribute to the growth of a consumer segment that opts for a balanced, healthy, eco-friendly, and safe diet. At the same time, consumers tend to value closer ties with local producers, as the environmental and social attributes of the products they consume become more apparent and, consequently, easier to compare. Consumers appreciate the opportunity to buy directly from farmers, associating this practice with local products and more eco-friendly and thus sustainable production methods.

Presentations of local food products offer an opportunity to explore local culinary traditions through specialized events, tastings, fairs, and festivals that place a strong emphasis on healthy eating, related merchandise, and health-oriented foods and dishes. The target audience (the customers and consumers) for a regional organic brand, for instance, may include the local population, visitors, and tourists.

In our view, the application of communication and marketing strategies based on "short food supply chains" will foster the development of farms cultivating vegetables, fruits, and "niche" crops of high biological and physiological value; ensure the population has access to wholesome food products; reduce the environmental impact of transport, pesticide use, and water consumption; expand the range of high-value products to meet the needs of consumers seeking a balanced, healthy, eco-friendly, and safe diet; make "superfoods" accessible to a broader segment of the population through affordable pricing; enable consumers to trace the entire food supply chain–thanks to its localized nature–in order to obtain product information and assess quality; and facilitate familiarity with local culinary traditions, technological and consumption methods, and the region with its historical and cultural heritage.

Thus, it can be stated that the consumption of local food products yields both physiological effects (organic produce with high biological and physiological value) and psychological effects (accessibility, trust in producers, control on food production, and positive emotions associated with sustainable, conscious food consumption).

Keywords: eco-friendly food, short food supply chains, physiological effects, psychological effects, conscious food consumption..

USE OF ARTIFICIAL INTELLIGENCE IN PLANT BIOMASS BIOREFINING ON THE EXAMPLE OF LIGNOCELULOSIC AND LEGUME CROPS

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ABSTRACT

The relevance of the study stems from the necessity to overcome the raw-material dependence of Ukraine's agricultural sector under global decarbonization by implementing AI technologies for value-added growth of plant raw materials. The research objective lies in substantiating how artificial intelligence enhances the precision of deep processing (biorefining) of lignocellulosic and legume feedstocks to minimize corporate expenditures and obtain maximum value-added products. The methodological framework comprises structural systems analysis, predictive modeling, and economic evaluation of integrated manufacturing.

The study forms a comprehensive concept of integrated biorefining that combines two strategic vectors of plant raw material processing – energy (lignocellulosic) and food (legume) – within a unified AI platform.

The implementation of predictive AI modeling in the energy sector makes it possible to stabilize the hydrolysis process of heterogeneous lignocellulosic feedstock and optimize enzyme consumption during bioethanol synthesis.. In the food sector, artificial intelligence and computer vision systems are effective for the precise molecular purification of legumes and the accurate control of wet extrusion, ensuring the consistent quality of isolates free of chemical impurities. The use of machine learning algorithms at every stage of processing minimizes human error and ensures that the final product fully complies with strict international quality standards. An overall economic assessment confirms that AI-driven cross-platform synergy drastically reduces operating costs. The redistribution of energy from the combustion of lignin by-products minimizes the external energy consumption of the entire complex, ensuring high production margins (EBITDA). The project demonstrates high investment appeal, as simultaneous entry into the eco-friendly fuel and global FoodTech markets guarantees a rapid return on capital investment and stable protection against market risks.

The integration of artificial intelligence into the deep processing of lignocellulosic and legume crops is transforming the traditional agricultural sector into a DeepTech industry, eliminating the risks associated with the unstable characteristics of incoming plant resources. The cross-platform interaction of fuel and food processing streams yields a zero-waste circular economy model, acting as a strategic tool to overcome the raw-material dependence of the agricultural sector and generate high value added.

Keywords: Artificial Intelligence, Plant Biomass Biorefining, Lignocellulosic Crops, Legume Crops, Predictive Modeling, Value Added.

COMPARATIVE EVALUATION OF AGRO-MORPHOLOGICAL PERFORMANCE IN SELECTED NACGRAB COWPEA GERMPLASM

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ABSTRACT

Cowpea (*Vigna unguiculata* (L.) Walp.) is a vital grain legume widely cultivated in sub-Saharan Africa for its nutritional, economic and soil-fertility benefits. However, many cowpea accessions conserved in gene banks such as the National Centre for Genetic Resources and Biotechnology (NACGRAB) remain poorly characterized. This study evaluated the agro-morphological performance of five NACGRAB accessions (NGB05580, NGB07599, NGB07661, NGB08062 and NGB08063) under uniform conditions, using a Randomized Complete Block Design with six replications. Vegetative traits (plant height, leaf area, leaf number and stem girth) were recorded monthly from 4 to 12 weeks after planting, while phenological and yield traits (days to 50% flowering, pods per plant, seeds per pod, pod length, 100-seed weight, peduncle length and grain yield per plant) were recorded at maturity. Sampling period significantly affected all vegetative traits ($P<0.05$), whereas accession effects were not significant. In contrast, accessions differed significantly ($P<0.05$) in yield and yield components. NGB05580 and NGB08063 recorded the highest number of pods per plant (4.67±2.08), seeds per pod (10.67±4.19), 100-seed weight (4.95±3.45) and grain yield per plant (2.47±1.73), while NGB08062, despite vigorous vegetative growth, failed to produce any reproductive yield (0.00±0.00). Strong positive correlations were observed between pods per plant and seeds per pod ($r = 0.9934$) and between 100-seed weight and grain yield per plant ($r = 0.9541$), while days to 50% flowering correlated negatively with the yield parameters. These results show that vegetative vigour is not a reliable indicator of yield performance in the materials tested. NGB05580 and NGB08063 were superior in agronomic performance and are recommended for further evaluation and inclusion in breeding programmes.

Keywords: Cowpea; *Vigna unguiculata*; NACGRAB; germplasm characterization; agro-morphological traits; yield components; genetic resources

GENOTYPE-SPECIFIC RESPONSES OF SOYBEAN (GLYCINE MAX L.) TO ARBUSCULAR MYCORRHIZAL FUNGAL INOCULUM DOSES

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ABSTRACT

Soybean (*Glycine max* L.) is a vital plant-based protein source and essential raw material for products like tofu, tempeh, and feed. Indonesia faces a severe production deficit, yielding only 230 thousand tons against a 2.58 million ton demand. Addressing this requires higher productivity, yet limited soil phosphorus availability remains a major bottleneck. Utilizing beneficial soil microorganisms, such as arbuscular mycorrhizal fungi and phosphate-solubilizing microbes, offers an effective biological strategy to improve phosphorus uptake and boost yields sustainably.

Research shows arbuscular mycorrhizal fungi (AMF) improve soybean growth, phosphorus acquisition, and yield under low-phosphorus conditions. However, symbiotic effectiveness varies significantly among host genotypes due to differences in root traits, mycorrhizal responsiveness, and rhizosphere fungal community composition. Selecting responsive soybean genotypes is therefore crucial. This study evaluates selected soybean genotypes across various AMF inoculum doses to identify optimal combinations for enhanced root colonization and superior agronomic performance.

This study evaluated the responses of selected soybean genotypes to different AMF inoculum doses and determined the genotypes and dose levels associated with high root colonization and favorable agronomic performance. The experiment used a factorial randomized complete block design with three replications. The first factor comprised four early-maturing soybean genotypes: G1 (GH8), G2 (GH63), G3 (GH73P), and G4 (Dega-1), while the second factor consisted of four AMF doses: M0 (0 g polybag^{-1}), M1 (10 g polybag^{-1}), M2 (20 g polybag^{-1}), and M3 (30 g polybag^{-1}).

Genotype significantly affected branch number, productive nodes, 100-seed weight, and AMF root colonization. G1, G2, and G3 produced more branches and productive nodes than G4, whereas G4 had the highest 100-seed weight (25.07 g). Root colonization was highest in G1 and G3 (86.67%), followed by G2 (85.00%) and G4 (61.67%). Increasing AMF dose increased colonization from 46.67% in M0 to 78.33%, 95.00%, and 100.00% in M1, M2, and M3, respectively. M2 and M3 did not

differ significantly, indicating that 20 g polybag^{-1} was sufficient to achieve high AMF colonization under the experimental conditions. These findings demonstrate genotypic variation in AMF colonization and agronomic traits, with G1–G3 showing high colonization and G4 superior seed size.

Keywords: *Glycine max*, arbuscular mycorrhizal fungi, AMF colonization, genotype response, inoculum dose, soybean growth.

STUDY ON PROCESSING AND VALUE ADDITION OF ONION IN SINDH PROVINCE OF PAKISTAN

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ABSTRACT

Onion is largely cultivated in Sindh Province of Pakistan. Most of the fresh onion is wasted due to lack of market and processing facility. The aim of this study is to develop the new by products from onion to increase the shelf life and nutritional value to reduce the post-harvest losses. The fresh sample of onion were subjected for preparation of different products by following the different processing methods of sample selection, washing, cutting, removal of inedible parts, cutting, drying, curing, packaging. The selected samples on onion powder, onion paste, onion pickle, fried onions were analyzed for physico-chemical and sensory analysis. The results obtained for various products has shown significant variation on the quality of product. The low moisture content results extension of onion powder product more and increase in onion powder yield %. These results contribute to a deeper understanding of how processing affects the quality and functionality of onion-based products, providing valuable results for both manufacturers and consumers to preserve onion into various by products, it will also helps into onion market growth and industrialization.

Keywords: Onion powder, onion shelflife, powder yield, quality.

OCCURRENCE OF *CRONOBACTER SPP* IN LOCALLY FERMENTED RAW COW MILK PRODUCTS IN SOUTHERN DELTA SENATORIAL REGIONS OF DELTA STATE, NIGERIA

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ABSTRACT

Foodborne pathogens remain a global public health challenge, with developing countries particularly vulnerable due to limited food safety infrastructure and the widespread consumption of unpasteurized or traditionally processed foods. Among these pathogens, *Cronobacter species*—a Gram-negative opportunistic bacterium—has gained increasing attention owing to its ability to persist in harsh environments and its association with severe, often fatal infections in neonates, infants, and immunocompromised individuals. Recent evidence suggests that the pathogen also contaminates raw milk and fermented dairy products, raising significant concerns for food safety in low-resource settings. This study investigated the occurrence of *Cronobacter spp* in locally fermented raw cow milk products in Southern Delta Senatorial regions of Delta State, Nigeria A total of fifty representative samples were collected and subjected to microbiological and biochemical analyses, including enrichment, culture on selective media, Gram staining, and confirmatory biochemical tests, to isolate and identify the presence of C. sakazakii. The study further assessed hygienic practices among local vendors to establish potential sources and risk factors for contamination. The findings revealed the presence of presumptive C. sakazakii in both raw cow milk and fura de nunu, which highlights a potential public health risk associated with their consumption. Contamination was linked to inadequate hygienic practices, lack of pasteurization, and poor storage conditions, which facilitated bacterial persistence and proliferation. The study underscores the urgent need for improved hygienic practices among dairy vendors, increased public awareness on the risks of consuming unpasteurized dairy products, and stricter regulatory oversight on local food markets. By providing localized baseline data, this study contributes to bridging the knowledge gap on *C. sakazakii* prevalence in Nigerian dairy products. It further emphasizes the importance of targeted interventions, including consumer education, regulatory enforcement of food safety standards, and the adoption of affordable control measures such as pasteurization, to safeguard public health. The study also lays a foundation for future epidemiological and molecular investigations into *C. sakazakii* and related foodborne pathogens in traditional African food systems.

Keywords: Cronobacter species; foodborne pathogen; raw cow milk; fura de nunu; milk product contamination

VARIATIONS IN ACIDIFICATION AND MICROBIAL RECOVERY AMONG YOGURT FORMULATIONS DURING REFRIGERATED STORAGE

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ABSTRACT

Yogurt continues to undergo physicochemical and microbiological changes after fermentation, and these changes may vary among formulations. This study compared acidification and culture-based microbial recovery in six yogurt formulations prepared using household yogurt, retail yogurt, or the commercial Y411 starter, each with or without Yogmix 800 at 1 g/L. Each formulation was independently prepared in four production batches and stored at 4 ± 1°C. Samples were analysed on Days 1, 7, 14, and 21 using pH, titratable acidity, and general, lactic-acid-bacteria, fungal, and selective cultivation media. All formulations showed decreasing pH and increasing titratable acidity. The pH decrease ranged from 0.04 to 0.46 units, while titratable acidity increased by 3–14°T. The Y411–Yogmix 800 formulation (Y6) showed a pH decrease of 0.07 units and an acidity increase of 14°T. Its Plate Count Agar counts ranged from 8.01 to 8.21 log10 CFU/g, and MRS recovery remained detectable throughout storage. No detectable growth was observed in Y6 on DRBC, VRB, TBX, or Baird-Parker agar during the evaluated period. Other formulations showed variable fungal recovery and presumptive growth on selective media. These descriptive findings indicate differing storage profiles among yogurt formulations. Since initial viable-cell concentrations were not standardized across starter sources and selective-media findings were not confirmed, the results do not establish a causal stabilizer effect or validate food safety or commercial shelf life. Further quantitative and sensory evaluation of Y6 is warranted.

Keywords: yogurt; starter source; stabilizer; post-acidification; microbial recovery; refrigerated storage

PRINCIPAL COMPONENT ANALYSIS OF TRADITIONAL MOROCCAN FOOD INTAKE AND ITS ASSOCIATION WITH ATTENTIONAL OUTCOMES IN MOROCCAN SCHOOL-AGED CHILDREN AND ADOLESCENTS

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ABSTRACT

Objective: Exploring the potential link between dietary patterns and selective attention among Moroccan children and adolescents.

Methods: A sample of 330 adolescents aged 9–17 years was enrolled in this cross-sectional study. Eating habits based on 22 Moroccan foods were collected through a validated food-frequency questionnaire. Dietary patterns were identified using Principal Component Analysis (PCA). The d2-R test was used to assess selective attention. Structural Equation Modeling and Generalized Linear Models were adopted to explore the link between dietary patterns and attention performance with adjustment for individual and familial factors. The study was conducted across rural and urban schools in Morocco, ensuring socio-economic diversity. Attention outcomes included processing speed, concentration capacity, and error rates, analyzed using appropriate distribution-specific models. Parental and sociodemographic variables (age, education, occupation, and handedness) were included to explore potential moderating effects. Model fit and robustness were assessed using standard statistical indices.

Results: Mediterranean diet (PC1) and Traditional/Festive (PC2) were identified as distinct dietary patterns according to PCA. Better processing speed, concentration capacity, and accuracy (all $p < 0.001$) have been assigned to PC1 adherence. However, PC2 showed an adverse association. Moreover, poorer attentional performance was associated with advanced paternal age and left-handedness, while students from educated mothers adopted healthier dietary patterns. Interaction analyses revealed that attention benefits from the Mediterranean pattern were reinforced by an intermediate maternal education level and attenuated by advanced paternal age.

Conclusions: Adopting a Mediterranean-like dietary pattern in Moroccan adolescent nutrition was associated with good attentional performance, while Traditional/Festive patterns showed an adverse association. These results suggest the importance of diet quality in cognitive health as well as family education in the nutritional orientation of adolescents.

Keywords: Feeding Behavior; Diet, Mediterranean; Attention; Adolescent; Morocco; Principal Component Analysis; Structural Equation Modeling; Cognition.

THERMAL-SENSITIVE FOOD PRODUCTS FOR THERAPEUTIC APPLICATIONS

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ABSTRACT

The advancements in thermally sensitive food products intended for medical use, focus on their efficacy. Encapsulation, nanotechnology, and controlled release systems are some of the unique approaches that are investigated in this research. These approaches are used to protect the integrity of bioactive components throughout the production, storage, and consumption processes. The paper also explores recent developments in improving the nutritional value of heat-sensitive food products by integrating essential vitamins, minerals, and other bioactive compounds. The paper focuses on developing novel delivery strategies that maintain the stability and bioavailability of these compounds, particularly in the realm of therapeutic nutrition. The review evaluates the effects of these enhancements on the nutritional content, sensory attributes, and consumer perception of thermally sensitive functional meals designed for therapeutic purposes. Important considerations include the encapsulation of probiotics, proteins, and vitamins, the utilization of nanocarriers for targeted delivery, and the implementation of controlled-release mechanisms inside food matrices. The paper discusses the successful utilization of thermal-sensitive compounds for certain treatments, such as addressing nutritional deficiencies, enhancing immune function, and managing chronic illnesses.
Keywords: Thermal-sensitive, Bioactive substance, Food product, Targeted delivery

SOCIOECONOMIC CHARACTERISTICS, CULTURAL NORMS, AND MATERNAL FOOD SELECTION PRACTICES OF PRE-SCHOOL CHILDREN IN PLATEAU STATE, NIGERIA

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ABSTRACT

This study examined socioeconomic characteristics, cultural norms and maternal food-selection practices among rural and urban mothers of pre-school children in Plateau State, Nigeria. Specifically, the study determined the socioeconomic characteristics of rural and urban mothers, examined the cultural norms associated with their food-selection practices, and examined the relationships between socioeconomic characteristics, cultural norms and maternal food-selection practices. The study adopted a cross-sectional correlational survey design. The study involved 50 mothers of pre-school children, comprising rural and urban mothers. A structured questionnaire developed by the researcher was used for data collection. The instrument was subjected to face and content validation by experts. Data were analysed using frequency counts, percentages, means and standard deviations to answer the research questions, while inferential statistics were proposed for testing the hypotheses at the 0.05 level of significance. The findings revealed that socioeconomic characteristics influenced maternal food-selection practices among both rural and urban mothers, although urban mothers reported greater influence of these characteristics. Factors such as employment, income, access to affordable healthy foods, educational attainment and independent food-purchasing decisions were associated with food selection. However, rural mothers reported challenges relating to access to safe water, cooking facilities, nutrition-related social groups, partner support, external nutritional assistance and year-round food availability. The findings also revealed that cultural norms were associated with food-selection practices, with rural mothers reporting greater cultural influence than urban mothers. Traditional food preferences, food restrictions and community expectations were notable aspects of cultural influence, while some mothers combined traditional practices with modern nutrition knowledge. The study concluded that maternal food-selection practices are associated with socioeconomic circumstances and cultural norms, with variations between rural and urban settings. It was recommended that nutrition education programmes should be culturally sensitive, consider the socioeconomic circumstances of mothers, promote locally available nutritious foods and address differences in rural and urban food environments.

Keywords: socioeconomic characteristics, cultural norms, maternal food-selection practices, pre-school children, rural and urban mothers.

COMPARATIVE EVALUATION OF AGRO-MORPHOLOGICAL PERFORMANCE IN SELECTED NACGRAB COWPEA GERMPLASM

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ABSTRACT

Cowpea (*Vigna unguiculata* (L.) Walp.) is a vital grain legume widely cultivated in sub-Saharan Africa for its nutritional, economic and soil-fertility benefits. However, many cowpea accessions conserved in gene banks such as the National Centre for Genetic Resources and Biotechnology (NACGRAB) remain poorly characterized. This study evaluated the agro-morphological performance of five NACGRAB accessions (NGB05580, NGB07599, NGB07661, NGB08062 and NGB08063) under uniform conditions, using a Randomized Complete Block Design with six replications. Vegetative traits (plant height, leaf area, leaf number and stem girth) were recorded monthly from 4 to 12 weeks after planting, while phenological and yield traits (days to 50% flowering, pods per plant, seeds per pod, pod length, 100-seed weight, peduncle length and grain yield per plant) were recorded at maturity. Sampling period significantly affected all vegetative traits ($P<0.05$), whereas accession effects were not significant. In contrast, accessions differed significantly ($P<0.05$) in yield and yield components. NGB05580 and NGB08063 recorded the highest number of pods per plant (4.67±2.08), seeds per pod (10.67±4.19), 100-seed weight (4.95±3.45) and grain yield per plant (2.47±1.73), while NGB08062, despite vigorous vegetative growth, failed to produce any reproductive yield (0.00±0.00). Strong positive correlations were observed between pods per plant and seeds per pod ($r = 0.9934$) and between 100-seed weight and grain yield per plant ($r = 0.9541$), while days to 50% flowering correlated negatively with the yield parameters. These results show that vegetative vigour is not a reliable indicator of yield performance in the materials tested. NGB05580 and NGB08063 were superior in agronomic performance and are recommended for further evaluation and inclusion in breeding programmes.

Keywords: Cowpea; *Vigna unguiculata*; NACGRAB; germplasm characterization; agro-morphological traits; yield components; genetic resources

FROM TRADITIONAL CUISINE TO CREATIVE HALAL CUISINE: INNOVATION, BRANDING, AND CULINARY TOURISM IN BATANG REGENCY

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ABSTRACT

The transformation of traditional culinary products is increasingly important in responding to changing consumer preferences, market competition, and the development of digital marketing. One of the key aspects of this transformation is packaging modernization, which goes beyond the function of protecting food and has become an important element of product identity, communication, branding, and marketing. This chapter examines the role of packaging modernization in increasing the value and competitiveness of traditional culinary products in Batang Regency. Modern packaging is expected to provide physical protection, maintain product quality, extend shelf life, improve convenience, and communicate essential information such as ingredients, net weight, expiration dates, producer identity, halal certification, and distribution permits. In addition, attractive visual elements, including logos, colors, typography, illustrations, and local cultural motifs, can strengthen product identity while maintaining its traditional character. The integration of appropriate packaging technology, such as vacuum sealing, can also support wider distribution by reducing the risk of product damage. Packaging modernization is closely connected to digital marketing because visually appealing packaging can strengthen product presentation on social media and online marketplaces. Furthermore, the use of environmentally responsible packaging materials provides an opportunity to respond to growing consumer awareness of sustainability. However, packaging innovation should consider food safety, product characteristics, production costs, consumer needs, and the financial capacity of small and medium enterprises. Therefore, packaging modernization can serve as a strategic instrument for transforming traditional culinary products into more competitive, professional, informative, and market-oriented products without eliminating their cultural identity.

Keywords: Traditional Cuisine; Packaging Modernization; Product İnnovation; Branding; Halal Culinary Products; Digital Marketing; Batang Regency

THE ROLE OF HALAL FOOD AND HOSPITALITY IN SUPPORTING MUSLIM-FRIENDLY TOURISM DEVELOPMENT IN PEMALANG, INDONESIA

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ABSTRACT

The development of Muslim-friendly tourism requires not only attractive destinations but also supporting products and services that meet the needs of Muslim travelers. Halal food and hospitality are two important components that can influence tourists' confidence, comfort, and overall travel experience. This study aims to examine the role of halal food and hospitality in supporting Muslim-friendly tourism development in Pemalang, Indonesia, while identifying the potential and challenges associated with their development. This study employs a qualitative descriptive approach through literature and document analysis of academic studies, reports, publications, and documented information related to halal certification, food-based micro, small, and medium enterprises (MSMEs), local culinary businesses, hospitality services, and tourism development in Pemalang. The findings indicate that Pemalang has considerable potential to strengthen its Muslim-friendly tourism ecosystem through halal-certified food products, local culinary businesses, and hospitality services. Halal certification and assistance programs can increase consumer confidence while creating opportunities for local food products to become part of tourism supply chains, including restaurants, hotels, and souvenir businesses. Meanwhile, the quality of hospitality is influenced by human resource competence, cleanliness, comfort, responsiveness, and service quality. However, several challenges remain, including limited information and assistance regarding halal certification, administrative and logistical barriers, inconsistent implementation of halal standards, and the need to improve service competencies and public facility management. The integration of halal food and hospitality can strengthen tourist confidence and comfort while expanding market opportunities for local MSMEs. Therefore, strengthening halal certification assistance, human resource competencies, service quality, and collaboration among stakeholders is important for developing Pemalang as a Muslim-friendly tourism destination.

Keywords: Halal food; hospitality; Muslim-friendly tourism; halal certification; MSMEs; tourism development.

ASSESSMENT OF THE HEALTH AND NUTRITIONAL IMPACTS OF MILLET IRRIGATED WITH TRICKLING FILTER EFFLUENT UNDER ARID NORTH AFRICAN CONDITIONS

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ABSTRACT

Millets are important crops for dry land farmers. They are highly nutritious and climate compliant crops , millet also known as Bachna (Illane), is one of the four most important cereals (rice, maize, sorghum and millets) grown in the semi-arid tropical regions of the world, mainly in Africa (North of Africa imntanoute marrakech – Morocco) and Asia. Our aim is to topic the potential health benefits of millet. it is rich in a number of nutrients and non-nutrients such as phenols. It is high in energy, contains less starch, lots of fibre (1.2 g/100 g, most of which is insoluble), 8 to 15 times more α-amylase activity than wheat, a low glycaemic index (55) and is glutenfree. The protein content varies from 8 to 19% and millet is low in lysine, tryptophan, threonine and sulphur amino acids. The energy content of millet is higher than that of sorghum and almost equal to that of brown rice, as the fat content is generally higher (3 to 6%). millet can be recommended in the treatment of coeliac disease, constipation and a number of noncommunicable diseases. Nutritional studies on the population living in the millet belts of the world and clinical trials on the impact of millet in specific pathological conditions are needed.An experimental reuse study was performed using raw (RWW) and treated urban wastewater (TWW) by Trickling Filter (TF) process to irrigate millet in comparison to well water (WW) as a control over a period of 5 months the highest productivity of millet and leaf area were obtained in response to irrigation with RWW and TWW compared to WW; while macroelements (TP, TKN, and K) were also affected in millet irrigated with RWW compared to TWW and WW. However, the plants irrigated with well water accumulate more Ca, Na, and Mg than those irrigated

with RWW and TWW, the biochemical parameters (protein and sugar content) were adversely affected in millet irrigated with RWW as compared to TWW and WW. Moreover, the use of treated urban wastewater **Keywords:** *Millet ; nutritional ,health* , irrigation; treated wastewater reuse; physiological proprieties; Trickling Filter.

COMPARATIVE EVALUATION OF WATER YAM (*Dioscorea alata*), COCOYAM (*Colocasia esculenta*) AND COWPEA (*Vigna unguiculata*) FLOURS AND THEIR COMPOSITE FLOUR BLENDS

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ABSTRACT

Water yam (*Dioscorea alata*), cocoyam (*Colocasia esculenta*) and cowpea (*Vigna unguiculata*) are important food crops with complementary nutritional and technological characteristics. Water yam and cocoyam are predominantly starch-rich crops, whereas cowpea is a legume that contributes substantially more protein and dietary fibre. Their combination may therefore provide a practical approach to improving the nutritional composition and functional versatility of locally available flour ingredients. This paper presents a comparative framework for evaluating the proximate composition, mineral content, functional properties, pasting characteristics, colour, antinutritional factors and potential food applications of the three individual flours and their composite blends. The proposed experimental approach involves processing the raw materials into flours under standardized conditions and formulating blends at different proportions of water yam, cocoyam and cowpea. Analyses should be conducted using validated standard procedures, with results expressed on a clearly defined moisture basis and statistically compared. The expected nutritional advantage of cowpea inclusion is an increase in protein, fibre and selected minerals, accompanied by a reduction in the relative proportion of carbohydrate. However, the magnitude of these changes will depend on the formulation, raw-material variety and processing conditions. Changes in water absorption, oil absorption, bulk density, swelling, foaming and pasting behaviour may also influence the suitability of the blends for specific food products. The study provides a basis for identifying formulations that balance nutritional quality, processing performance, sensory acceptability and safety. Effective utilization of these crops could support local food diversification, value addition and the development of affordable, nutrient-enriched food products.

Keywords: Water yam; cocoyam; cowpea; composite flour; proximate composition; functional properties; nutritional enhancement.

HONEYBEE PEST AWARENESS AND PERCEPTIONS AMONG TRADITIONAL BEEKEEPERS IN KATSINA STATE, NIGERIA

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ABSTRACT

Beekeeper knowledge and awareness play important roles in the early recognition and monitoring of honeybee colony health problems. Information on beekeeper awareness of honeybee parasites and pests in Katsina State remains limited. A questionnaire-based survey involving 15 traditional beekeepers from Batagarawa, Kaita, and Rimi Local Government Areas was conducted to assess knowledge, awareness, perceptions, and reported threats affecting honeybee colonies. All respondents were male and used traditional hives. None of the beekeepers reported awareness of honeybee parasites, while awareness of pests was moderate, with 53.3% of respondents indicating awareness. Ants were the most commonly reported pests among respondents who observed pests, while 46.7% reported not observing any pest. Lizards were identified as the most important perceived threat to honeybee colonies (40.0%), followed by pesticides (26.7%), bush burning (20.0%), and heavy rainfall (13.3%). Regarding seasonal vulnerability, 40.0% of respondents identified the rainy season as the period with the greatest colony problems. Differences in pest awareness and perceptions among the three locations were not statistically significant. The complete absence of awareness of honeybee parasites and the moderate awareness of pests indicate an important knowledge gap among traditional beekeepers in the study area. Strengthening beekeeper education and colony health awareness may improve early detection and monitoring of honeybee health challenges.

Keywords: Beekeeper knowledge; awareness; traditional beekeeping; honeybee pests; parasites; Katsina State.

QABAQKİMİLƏR FƏSİLƏSİNİN TƏRƏVƏZ KİMİ İSTİFADƏ OLUNAN NÖVLƏRİNİN FUNKSİONAL XÜSUSİYYƏTLƏRİ

FUNCTIONAL PROPERTIES OF SPECIES OF THE FOREGROUND SECTION USED AS VEGETABLES

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XÜLASƏ

Patisson və göy qabaq ölkəmizdə qabaqkimilər fəsiləsinin az yayılan növləridir. Texniki yetişkənlik dövründə - meyvə lətinin daha şirəli və kövrək, qida maddələri ilə daha zəngin olduğu dövrdə istifadəyə yararlı olur, bu da onların tərəvəz kimi istifadə olunmasına əsas verir. Patisson və göy qabaq vitamin və mineral maddələr kompleksinə malikdir, orqanizmi ağır metallardan təmizləyən pektinlə zəngindir. Müasir dövrdə bu tərəvəzlərə sağlam qida kimi maraq artmışdır. Tədqiqatlarla müəyyən olunmuşdur ki, ölkəmizdə patisson və göy qabağın məhsuldarlığı və məhsulun keyfiyyəti yüksəkdir, xarici mühitin stress təsirlərinə qarşı davamlıdır, konservləşdirmək üçün qiymətli xammaldır.

Məqalədə bu tərəvəz növlərinin becərilmə texnologiyası, seleksiya və toxumçuluğu, yeni çeşid konserv məhsullarının hazırlanması istiqamətində aparılan tədqiqatlardan və alınan nəticələrdən bəhs edilir.

Açar sözlər: patisson, göy qabaq, tərəvəz, minerallar, pektin.

ABSTRACT

Varieties of patty pan squash and zucchini (vegetable marrow) from the gourd family are relatively uncommon in Azerbaijan. These types of vegetables are suitable for consumption at the stage of technical ripeness, when the fruit flesh is more juicy, tender, and rich in nutrients, which justifies their classification as vegetable crops. Patty pan squash and zucchini contain a range of vitamins and minerals, as well as pectin, which helps remove heavy metals from the body. In the context of growing demand for healthy nutrition, there has been increasing interest in canned products made from these vegetables, which are imported into our country.

Long-term studies have shown that patty pan squash and zucchini are distinguished by high yields and product quality, resilience to environmental stress factors, and are valuable raw materials for canning. The article discusses the cultivation technologies of these vegetable crops, issues of breeding and seed production, as well as the directions and results of work on the creation of new types of canned products.

Keywords: patty pan squash, zucchini, vegetables, minerals, pectin.

AI-POWERED CROP DISEASE DETECTION FOR SMALLHOLDER FARMERS IN PAKISTAN: A REVIEW AND DEPLOYMENT ROADMAP

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ABSTRACT

Background: Agriculture contributes roughly a quarter of Pakistan's GDP and employs over a third of its labor force, yet smallholder farmers — who form the backbone of the sector — lose a significant share of yield to plant diseases every season. Early detection is the cheapest intervention, but most farmers have no access to agronomists or diagnostic labs. Meanwhile, smartphone penetration in rural Pakistan keeps rising, creating an opening for AI-based tools.

Aim: This paper reviews the current state of AI-driven crop disease detection and proposes a practical deployment roadmap tailored to Pakistan's smallholder context.

Methods: A narrative review of recent literature on deep-learning plant disease classification — including convolutional neural networks and vision transformers — combined with an analysis of deployment constraints in rural Pakistan: connectivity, cost, language, and farmer trust.

Findings: Four themes emerged: **(1)** models report high accuracy on curated datasets but degrade sharply on real in-field images with complex backgrounds; **(2)** lightweight, mobile-friendly models with offline inference are the only viable path where connectivity is unreliable; **(3)** adoption barriers are human rather than technical — trust, Urdu-first interfaces, and integration with agricultural extension workers matter more than raw accuracy; and **(4)** Pakistan-specific, in-field crop image datasets are scarce, which is both the biggest gap and the biggest research opportunity.

Conclusion: The paper proposes a three-stage roadmap: build open local datasets, deploy offline-first mobile diagnostic tools through agricultural extension workers, and design Urdu-first user experiences. This path is low-cost, scalable, and directly serves the farmers who need it most.

Keywords: precision agriculture; crop disease detection; deep learning; smallholder farmers; Pakistan; edge AI

A GLOBAL OUTLOOK ON THE FUTURE OF NANOCHEMICAL AND BIOLOGICAL FERTILIZERS IN AGRICULTURAL PRODUCTION

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ABSTRACT

Agricultural production faces the combined challenges of increasing food demand, declining soil quality, nutrient losses, and environmental pressures associated with inefficient fertilizer use. Conventional fertilizers remain essential to modern crop production, but their performance depends on application rate, timing, soil properties, climatic conditions, and crop requirements. These limitations have encouraged research into improved fertilizer formulations, including nanofertilizers, microbial biofertilizers, and combined bio-nano systems. (Maaz et al., 2025; Santos et al., 2024)

Nanofertilizers are designed to modify nutrient delivery through approaches such as controlled release, improved nutrient availability, or interactions between engineered materials and the plant–soil system. Their potential benefits include improved nutrient-use efficiency and reduced nutrient losses; however, these outcomes are formulation-specific and cannot be assumed for every crop, soil, or production system. (Wang et al., 2025; Bastakoti et al., 2026)

Biofertilizers contain beneficial microorganisms that can contribute to plant nutrition through processes such as biological nitrogen fixation, phosphorus solubilization, nutrient mobilization, and plant-growth promotion. Their performance depends on microbial strain, product quality, crop compatibility, soil conditions, and environmental factors. Inconsistent definitions and regulatory approaches also complicate the evaluation and commercialization of microbial products. (Santos et al., 2024)

Recent research has also examined hybrid approaches that combine nanotechnology with beneficial microorganisms. These bio-nanofertilizers may offer opportunities to coordinate nutrient delivery and biological activity, but their long-term agronomic performance, environmental behavior, safety, and economic feasibility require further investigation. (Swain et al., 2026; Wang et al., 2025)

This review examines the mechanisms, potential benefits, limitations, and future prospects of nanofertilizers and biofertilizers, with particular attention to recent studies published in 2024–2026. It argues that these technologies should be evaluated as potential components of integrated nutrient management rather than as universal replacements for conventional fertilizers. (Maaz et al., 2025; Santos et al., 2024; Bastakoti et al., 2026)

Keywords: nanofertilizers; biofertilizers; nutrient-use efficiency; sustainable agriculture; microbial inoculants; bio-nanofertilizers; soil health. (Maaz et al., 2025; Santos et al., 2024)

EFFECTIVENESS OF DIGITAL AGRICULTURAL COMMUNITY OUTREACH INFORMATION SERVICES IN MITIGATING ADVERSE CLIMATE CHANGE EFFECTS ON AGRICULTURAL PRODUCTIVITY FOR FOOD SECURITY AMONG SMALLHOLDER FARMERS IN UGANDA

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ABSTRACT

Introduction: Uganda's smallholder farmers face increasing droughts, floods, erratic rainfall, pests and declining soil productivity, threatening household livelihoods and food security. The National Adaptation Plan for Agriculture emphasizes climate-resilient production supported by knowledge, evidence and information. Purpose: We assessed the effectiveness of digital agricultural community outreach information services (DACOIS) in helping smallholder farmers understand, prepare for and respond to climate-change risks. **Objectives:** To (i) assess the contribution of digital information to climate-smart farming; (ii) identify effective communication channels and practices; (iii) document lessons learned and best practices; and (iv) develop a scalable farmer-centred outreach model. **Research question:** How effectively can digital agricultural community outreach information services mitigate adverse climate-change effects on agricultural productivity and strengthen food security among Ugandan smallholder farmers? **Materials and methods:** A systematic literature review, policy/document analysis, lessons-learned synthesis and best-practice assessment were conducted. Diffusion of Innovations Theory guided analysis of how credible, timely and locally understandable information influences farmers' knowledge, attitudes and adoption of climate-smart practices. **Findings:** Evidence demonstrates substantial potential. An ICT-based Ugandan climate-adaptation initiative reached more than 100,000 farmers with weather forecasts, agricultural advisories, market information and drought/flood coping guidance; reported crop losses and damage declined by up to 65%. Similarly, an experimental study involving approximately 4,000 households in eastern Uganda found that video-based agricultural advice increased maize yields by 10.5%, alongside improved knowledge and adoption of recommended practices. However, digital inequality, limited farmer digital literacy, connectivity costs and inadequate extension staffing can restrict reach. Recent evidence indicates that less than 15% of extension officers reported using digital applications to respond to farmers' questions. **Discussion:** Effective outreach should combine mobile phones, interactive voice response, SMS, radio, WhatsApp, videos and face-to-face extension, using local languages and seasonal climate information. **Conclusion:** DACOIS can become a practical "early-warning and learning bridge" connecting farmers with actionable climate knowledge. We need to invest in multilingual digital platforms, train community digital-extension champions, strengthen weather-information partnerships, improve rural connectivity, integrate women and digitally excluded farmers, and monitor adoption, productivity and food-security outcomes.

Keywords: Climate adaptation; Digital agriculture; Food security; Smallholder farmers; Agricultural extension.

THE ROLE OF SCIENCE JOURNALISM IN STRENGTHENING PUBLIC AWARENESS COMMUNICATION CAMPAIGN STRATEGY FOR AGRICULTURAL VALUE CHAIN EMPLOYMENT INNOVATION OPTIONS FOR THE YOUTH AND WOMEN IN UGANDA

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ABSTRACT

Introduction: Agriculture is a major source of livelihoods and employment in Uganda, while women and youth face persistent barriers to decent, innovative value-chain jobs. Earlier national evidence indicated that agriculture employed about 65% of Uganda's working population, with youth constituting approximately 63% of agricultural workers. Purpose: This study examined how science journalism can strengthen public-awareness communication campaigns that promote agricultural value-chain employment and innovation opportunities for youth and women. **Objectives:** To (i) assess the contribution of science journalism to agricultural innovation awareness; (ii) identify communication barriers affecting youth and women; (iii) document lessons and best practices; and (iv) innovate an inclusive communication campaign strategy. **Research question:** How can science journalism improve public awareness and uptake of agricultural value-chain employment and innovation opportunities among Ugandan youth and women? **Materials and methods:** A systematic literature review, policy/document analysis, lessons-learned synthesis and best-practice assessment were conducted. Diffusion of Innovations Theory and participatory communication principles guided the analysis of how credible, understandable and locally relevant information influences knowledge, attitudes and adoption. **Findings:** Evidence shows that opportunities extend beyond farming into processing, packaging, logistics, digital agriculture, agro-inputs, marketing, and finance and value addition. Uganda's youth-employment strategy specifically promotes communication through social media, mass media, meetings and public gatherings. However, a Ugandan study found that 31% of respondents perceived agricultural research information providers as offering poor products and services, demonstrating a communication and trust challenge. **Discussion:** Science journalists can humanize agricultural research by translating technical evidence into stories, radio programmes, podcasts, videos and market-oriented information that showcase real youth and women innovators. Existing programmes also demonstrate the value of ICT-enabled agricultural information services. **Conclusion:** Strategic science journalism can transform agricultural information from technical knowledge into practical employment intelligence. Form a sustainable youth- and women-focused agricultural science desks; train journalists in agricultural science; strengthen researcher–media partnerships; use multilingual digital/radio campaigns; and track campaign reach, engagement, adoption and jobs created.

Keywords: Agricultural innovation; Communication campaigns; Science journalism; Value chains; Youth and women employment.

ACCELERATING THE PROSPECTS OF BLENDING MODERN SCIENTIFIC BIOMEDICAL RESEARCH WITH TRADITIONAL MEDICINE THROUGH COMMUNITY HERBAL FARMING INFORMATION SERVICES IN UGANDA

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ABSTRACT

Introduction: Traditional herbal medicine remains an important community health resource in Uganda, where WHO estimates that about 60% of the population uses traditional medicine. But, valuable indigenous knowledge and medicinal plants are not sufficiently connected to modern biomedical research, quality assurance and formal health systems. **Purpose:** We examined how community herbal farming information services (CHFIS) can accelerate responsible blending of biomedical science with traditional herbal medicine in Uganda. **Objectives**: To (i) examine evidence on community cultivation and use of medicinal plants; (ii) assess relevant Ugandan policies and institutional practices; (iii) identify lessons learned and best practices; and (iv) develop a communication-oriented framework for linking herbal farmers, traditional healers, researchers, health professionals and communities. **Research question:** How can CHFIS strengthen evidence-based, safe and sustainable integration of traditional herbal medicine with biomedical research in Uganda? **Materials and methods**: A systematic literature review, policy/document analysis and comparative synthesis of lessons learned and best practices were applied. Communication Theory, particularly the Diffusion of Innovations perspective, guided analysis of how credible information, trusted community networks and feedback can move validated herbal knowledge from farms to laboratories and health services. **Findings**: Evidence indicates substantial potential for integration, but major gaps remain in scientific validation, standardization, documentation, pharmacovigilance, intellectual-property protection and farmer–researcher communication. WHO reports that less than 1% of global health-research funding is devoted to traditional medicine, highlighting an evidence gap? Community medicinal-plant cultivation, farmer training, digital information platforms, participatory documentation and multidisciplinary research can create a practical bridge between indigenous knowledge and biomedical innovation. WHO's 2025–2034 strategy prioritizes evidence, safety, health-system integration and community empowerment. **Discussion**: CHFIS can humanize research by making communities active knowledge partners rather than passive recipients. Uganda should treat herbal farming as a living research and innovation ecosystem. **Conclusion:** Establish community herbal demonstration farms; develop multilingual information services; strengthen researcher–traditional-healer partnerships; introduce traceability and quality standards; protect indigenous knowledge; and support competitive research grants for validated medicinal plants.

Keywords: Biomedical research; Community herbal farming; Herbal medicine; Information services; Traditional medicine.

DETERMINANT OF FOOD INSECURITY DYNAMICS AMONG RURAL FARMING HOUSEHOLDS IN SOUTHWEST NIGERIA

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ABSTRACT

Food insecurity continues to be a significant issue in rural Southwest Nigeria, notwithstanding the region's considerable agricultural potential. This research analyzed the factors influencing food insecurity in 240 rural farming households, which were selected using a multistage sampling method across three states in Southwest region of Nigeria: Oyo, Osun, and Ondo. Data were collected through interview guide and analyzed using descriptive statistics and Pearson Product-Moment Correlation (PPMC). Result shows that high input costs, poor rural infrastructure, inadequate access to agricultural inputs, and water scarcity were major contributors to food insecurity. Increasing food prices and restricted market access have further limited household food availability and dietary diversity. Participation in institutions, such as cooperative membership (75.0%) and extension contact (82.6%), correlated with enhanced resilience; however, gender disparities and infrastructural deficiencies remained evident. The findings indicated that high fertilizer prices (97.5%), inadequate access to inputs (58.7%), poor rural infrastructure (98.3%), rising food prices (100%), and high transportation costs (100%) are the primary factors contributing to food insecurity. The PPMC analysis revealed significant associations between food insecurity status and inadequate input access ($p<0.01$), water scarcity ($p<0.01$), and farming income ($p<0.01$). The findings highlight the necessity for targeted interventions such as subsidized inputs, enhanced rural infrastructure, expanded irrigation facilities, and reinforced institutional support. This research offers empirical evidence to guide policies focused on improving food and nutrition security, in accordance with Sustainable Development Goals (SDGs) 1 and 2.

Keywords: Food insecurity, Rural farming households, Southwest Nigeria, Determinants, Agricultural inputs, Infrastructure, Sustainable Development Goals

MAL ƏTİNİN YETİŞMƏ PROSESİNİN TƏDQİQATI
ИССЛЕДОВАНИЕ ПРОЦЕССА СОЗРЕВАНИЯ ГОВЯДИНЫ

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XÜLASƏ

Yenicə kəsilmiş heyvan ətinin əmtəəlik və texnoloji göstəriciləri, yəni ətin zərifliyi, sututma qabiliyyəti, aşpazlıq əməliyyatı zamanı verdiyi dad, qoxu sabit qalmayıb, müxtəlif amillərin təsiri nəticəsində dəyişilir. Kəsilmiş heyvan ətində baş verən çox mürəkkəb və hələlik dəqiq öyrənilməyən problemlərlə izah edilir. İnsanların qida məhsulu kimi istehlak etdikləri çox qiymətli hesab edilən mal ətinin tədqiqatı DÖST 779-55 standartına uyğun aparılmışdır. Nəticədə təzə kəsilmiş ətin keyfiyyətliliyi müəyyən edilmişdir.

Respublikada istehsal edilən mal ətinin yetişmə prosesi haqqında məlumat yox dərəcəsindədir. Məhz buna görə də heyvan kəsildikdən sonra ətdə baş verən dəyişikliklərin tədqiqatını aparmaq, bu ətin orqanzim üçün əhəmiyyətini aydınlaşdırmaqdır. Respublikada istehsal olunan ətin yetişmə prosesi haqqında məlumat yox dərəcəsində olduğuna görə məhz ətin yetişməsi zamanı onun tərkibində olan zülal, yağ, karbohidrat, mineral maddə və vitaminlərin müəyyənləşdirilməsi vacibdir.

Təzə kəsilmiş ət çox qədim zamanlardan insanların iaşəsində çox mühüm rol oyandığından bu məhsula tələbat çox yüksəkdir. Bu onunla izah edilir ki, ət və ət məhsulları insanların orqanziminin inkişafında, sağlam böyüməsində və həzm olunarkən yüksək kalorilik verməsi ilə izah edilir. Ətin hələ çox qədim zamanlardan insanların qidasında mühüm rol oynadığı üçün onun keyfiyyətinin yüksəldilməsi və ilk dəfə ətin tərkibində olan qeyri üzvi və üzvi maddələr tədqiqatı böyük maraq doğurur.

Açar sözlər: keyləşmə prosesi, keyləşmə zamanı baş verən dəyişiklilər, ətin 1-ci və 2-ci keyləşşməsi zamanı kimyəvi tərkibinin dəyişməsi.

РЕЗЮМЕ

Коммерческие и технологические показатели свежезабитого мяса животных, а именно нежность мяса, его влагоудерживающая способность, вкус и запах, которые оно приобретает в процессе приготовления, не остаются неизменными, а изменяются под воздействием различных факторов. Это объясняется очень сложными и еще недостаточно изученными проблемами, возникающими при обработке мяса забитых животных. Исследование говядины, которая считается очень ценным продуктом питания и потребляется людьми, проводилось в соответствии со стандартом DÖST 779-55. В результате было определено качество свежезабитого мяса.

Информация о процессе созревания говядины, производимой в республике, крайне ограничена. Поэтому важно провести исследования изменений, происходящих в мясе после убоя, и выяснить значение этого мяса для организма. Поскольку информации о процессе созревания мяса в республике мало, важно определить содержание белков, жиров, углеводов, минералов и витаминов в мясе в процессе его созревания.

Свежеприготовленное мясо с древних времен играло очень важную роль в питании человека, поэтому спрос на этот продукт очень высок. Это объясняется тем, что мясо и мясные продукты способствуют развитию человеческого организма, здоровому росту и обеспечивают высокую калорийность в процессе пищеварения. Поскольку мясо играет важную роль в питании человека с древних времен, улучшение его качества и изучение содержащихся в нем неорганических и органических веществ представляет большой интерес.

Ключевые слова: процесс темперирования, изменения, происходящие во время темперирования, изменения химического состава мяса во время 1-го и 2-го темперирования.

ABSTRACT

The commercial and technological characteristics of freshly slaughtered meat namely its tenderness, water-holding capacity, and the flavor and aroma it yields during cooking do not remain constant; rather, they change under the influence of various factors. These changes are attributed to highly complex processes occurring in the meat that are not yet fully understood. A study of beef a highly valued food product was conducted in accordance with the GOST 779-55 standard, resulting in the determination of the quality characteristics of the freshly slaughtered meat.

There is virtually no information regarding the maturation process of beef produced in the republic. Therefore, it is essential to investigate the changes that occur in the meat after slaughter and to clarify its significance for the human body. Given the lack of data on the maturation process of domestically produced beef, it is crucial to determine the content of proteins, fats, carbohydrates, minerals, and vitamins during this maturation phase.

Since fresh meat has played a vital role in human nutrition since ancient times, the demand for this product remains very high. This is attributed to the fact that meat and meat products are essential for the development and healthy growth of the human body, while also providing high caloric value during digestion. Given the long-standing importance of meat in the human diet, there is significant interest in improving its quality and in the study of the organic and inorganic substances it contains.

Keywords: rigor mortis process, changes occurring during rigor mortis, changes in chemical composition during the first and second stages of rigor mortis.

INTERACTIONS OF BIOACTIVE POLYPHENOL MOLECULES FOUND IN PLANTS WITH DOUBLE HELIX DNA USING SPECTROSCOPIC METHODS

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ABSTRACT

Investigating the interaction of bioactive polyphenol compounds with double-stranded DNA (dsDNA) in solution is important in drug development, nutraceutical research, toxicology, cancer biology, and analytical biosensor design. These studies reveal not only whether a compound binds to DNA, but also the mechanism by which it binds, the binding strength, and the changes it causes in the DNA structure. Characterization of small molecule-dsDNA interactions in solution requires the simultaneous evaluation of the binding mode (intercalation, groove binding, electrostatic), binding constant, thermodynamic parameters, and conformational changes. Therefore, a multi-technique approach is usually preferred. These diverse approaches primarily include: "Spectroscopic methods (UV-Vis absorption spectroscopy, fluorescence spectroscopy, circular dichroism, FTIR spectroscopy), electrochemical methods (voltammetry, especially differential pulse voltammetry and cyclic voltammetry), electroanalytical DNA biosensors, thermodynamics and binding analyses (such as isothermal titration calorimetry and UV/fluorescence titrations), viscosity measurements, gel electrophoresis methods (such as agarose gel electrophoresis and comet assay (single-cell gel electrophoresis)), molecular modeling and simulation (including molecular docking and molecular dynamics), thermal denaturation studies (e.g., melting point (Tm) analysis), nuclear magnetic resonance (NMR) spectroscopy and X-ray crystallography, surface-based techniques (such as surface plasmon resonance and quartz crystal microbalance)". This presentation will summarize the spectroscopic methods we have used in our small molecule-dsDNA research in our laboratory over the past ten years, and the most recent developments documented in the global literature on these studies.

Keywords: Bioactive polyphenol, dsDNA, spectroscopic methods, binding mechanism

SHEWANELLA PUTREFACİENS ve BESİN MİKROBİYOLOJİSİNDE ÖNEMİ

SHEWANELLA PUTREFACIENS AND ITS IMPORTANCE IN FOOD MICROBIOLOGY

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ÖZET

Gıda kaynaklı bakteriler, et ve su ürünlerinin hem güvenliğini hem de kalitesini olumsuz yönde etkileyerek halk sağlığı ve ekonomi açısından önemli sorunlara yol açmaktadır. Bu bakteriler arasında yer alan *Shewanella putrefaciens*, özellikle deniz ürünlerinde ve yüksek pH'lı etlerde bozulmaya neden olan önemli bir mikroorganizma olarak öne çıkmaktadır. Deniz ve tatlı su ortamlarında yaygın olarak bulunan bu bakteri, düşük sıcaklıklarda gelişebilme yeteneği sayesinde soğukta depolanan su ürünlerinde baskın hale gelebilmekte ve trimetilamin, hidrojen sülfür ve biyojenik aminler gibi istenmeyen metabolitler üreterek ürünlerin raf ömrünü kısaltmaktadır. *S. putrefaciens*'in yalnızca bir bozulma etkeni olmadığı, aynı zamanda fırsatçı bir patojen olarak insanlarda ve balıklarda enfeksiyonlara neden olabildiği de bildirilmektedir. Son yıllarda hem klinik vakalarda hem de akuakültür alanında bu bakteriye bağlı enfeksiyonların artış göstermesi, gıda güvenliği açısından önemini daha da artırmıştır. Bu derlemede, *S. putrefaciens*'in genel özellikleri, taksonomisi, ekolojik dağılımı, gıdalarla ilişkisi, bozulmadaki rolü, patojenitesi ve tanı yöntemleri ele alınarak besin mikrobiyolojisi açısından önemi değerlendirilmiştir.

Anahtar kelimeler: *Shewanella putrefaciens*, besin mikrobiyolojisi, gıda bozulması, su ürünleri, patojenite

ABSTRACT

Foodborne bacteria negatively affect both the safety and quality of meat and seafood, leading to significant problems for public health and the economy. Among these bacteria, *Shewanella putrefaciens* stands out as a significant microorganism causing spoilage, particularly in seafood and meats with high pH levels. Commonly found in marine and freshwater environments, this bacterium can become dominant in refrigerated seafood due to its ability to grow at low temperatures, shortening shelf life by producing undesirable metabolites such as trimethylamine, hydrogen sulfide, and biogenic amines. It is also reported that *S. putrefaciens* is not only a spoilage agent but also an opportunistic pathogen capable of causing infections in humans and fish. The increase in infections caused by this bacterium in both clinical cases and aquaculture in recent years has further increased its importance in terms of food safety. This review evaluates the importance of *S. putrefaciens* in food microbiology by discussing its general characteristics, taxonomy, ecological distribution, relationship with food, role in spoilage, pathogenicity, and diagnostic methods.

Keywords: *Shewanella putrefaciens*, food microbiology, food spoilage, aquaculture, pathogenicity.

KAFKASLARDAN ANADOLUYA; ALVEOLEAR EKİNEKOKKOZİS VE GIDA BULAŞI

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GİRİŞ

Alveolar Ekinokokkoz (AE), küresel çözüm gerektiren gıda bulaşı ile öne çıkan zoonozlardan biri olarak yaşadıkları ekosistemde tilki ve insan teması ile hızla yayılan ölümcül bir hastalıktır. Bu yayılma hızı; hızlı şehirleşme, çiftçilik sistemlerindeki hızlı değişme, çiftlik hayvanları ve yaban hayatının giderek yakınlaşması, ormanlara zarar verilmesi, ekosistemlerdeki değişiklik ve hayvansal ürün ticaretinin küreselleşmesini içeren birçok neden ile bağlantılıdır (1). Bugün, insanları enfekte eden önem kazanan enfeksiyonların %75'i hayvan kaynaklıdır (2). AE insanlarda görülen en ciddi paraziter hastalıklardan birisi olması hasabi ile DSÖ tarafında "ihmal edilen 20 tropikal hastalıktan" biri olarak belirlemiştir. Etken Echinococcus multilocularis (E. multilocularis) gıda kaynaklı parazit olarak 24 paraziter hastalık arasında üçüncü en büyük küresel etkili hastalık olarak belirlemiştir (3). Tedavi edilmediğinde ölümcül olan AE, kesin konakçının dışkısıyla atılan E. multilocularis yumurtalarının yutulması ile bulaşan ve parazitin larval metasestod evresinden kaynaklanan bir hastalıktır (4,5). E. multilocularis'in yaşam döngüsü, kesin konakçı olan köpekler ve ara konakçı görevi gören kemirgenler gibi küçük memeliler arasında gerçekleşir. Parazitin başta kızıl tilkiler (Vulpes vulpes) ve tarla fareleri gibi vahşi hayvanlardaki orijinal döngülerin yanı sıra, döngülerin evcil köpeklerde (Canis lupus familiaris) de yerleşmiş olduğu bilinmektedir (6,7). İnsanlar tesadüfi ara konaklar olup kesin konakçılarla temas yoluyla, toprak teması, yiyecek özellile orman meyvaları , kontamine su hatta hava ile ancak genellikle fekal-oral yolla alınmasıyla enfekte olurlar (8-10). İnsanlarda enfeksiyon öncelikle karaciğerde ortaya çıkar. Parazitin metacestod evresi, ekzojen tomurcuklanma ile sonsuza kadar çoğalıp yavaş yavaş çevredeki dokuyu istila ederek tümör benzeri kötü huylu bir büyüme gösterir ve tedavi edilmediği takdirde vakaların %90'ında tanıdan sonraki 10-15 yıl içinde ölüme neden olur (Şekil 1) (11).

Anahtar Kelimeler: Alveolear Ekinekokkozis, Gıda Bulaşı, Erzurum

ESCHERİCHİA COLİ VE *STAPHYLOCOCCUS AUREUS* İZOLATLARI ÜZERİNDE FARKLI SİRKELERİN "ANTİBAKTERİYEL ETKİNLİĞİNİN" ARAŞTIRILMASI

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ÖZET

Amaç: Bu çalışmada; elma, üzüm ve beyaz sirkenin, mutfak hijyenini tehdit eden gıda kaynaklı iki model patojen olan *Escherichia coli* ve *Staphylococcus aureus* klinik izolatları üzerindeki antibakteriyel ve dezenfektan etkinliklerinin in-vitro karşılaştırılması amaçlanmıştır.

Materyal ve Metot: Atatürk Üniversitesi Araştırma Hastanesi Tıbbi Mikrobiyoloji Laboratuvarı'nda yürütülen çalışmada, 8 adet *S. aureus* ve 8 adet *E. coli* klinik izolatı kullanılmıştır. Sirke türlerinin minimum inhibitör (MİK) ve minimum bakterisidal (MPC) konsantrasyonları sıvı mikrodilüsyon yöntemiyle belirlenmiştir.

Bulgular: Sirkelerin tamamı, Gram-pozitif *S. aureus* üzerinde Gram-negatif *E. coli*'ye kıyasla daha düşük konsantrasyonlarda yüksek etkinlik göstermiştir. Yüksek asetik asit %5-6 içeren beyaz sirke, *S. aureus* suşlarının %87.5'ini en düşük basamakta %1.625'ini inhibe ederek en efektif sirke olmuştur. *E. coli* suşları ise dış membran yapıları nedeniyle daha yüksek konsantrasyonlarda %3.25 - %6.25 oranında inhibe olmuştur. %100 saf sirke kullanımı, her iki bakteri türünün tüm izolatlarında %100 üremeyi tamamen sıfırlayarak mutlak bakterisidal etki (MPC) göstermiştir.

Sonuç ve Öneriler: Çalışma, sirkelerin düşük dozda bakteriyostatik, saf formda ise tam bakterisidal olduğunu kanıtlamıştır. Halk sağlığı ve ev ortamında güvenli sebze dezenfeksiyonu için; 1 litre yıkama suyuna 1 çay bardağı sirke (yaklaşık %10) konsantrasyon eklenmesi ve en az 10-15 dakika bekletilmesi önerilmektedir.

Anahtar Kelimeler: *Escherichia coli*, *Staphylococcus aureus*, Sirke, Sıvı Mikrodilüsyon, MİK, MPC.

YÜKSEK YOĞUNLUKLU ULTRASON UYGULAMASININ KABAK ÇEKİRDEĞİ PROTEİN İZOLATININ FENOLİK İÇERİĞİ, ANTİOKSİDAN AKTİVİTESİ VE AMİNO ASİT PROFİLİ ÜZERİNDEKİ ETKİSİ

EFFECTS OF HIGH-INTENSITY ULTRASOUND ON THE PHENOLIC CONTENT, ANTIOXIDANT ACTIVITY, AND AMINO ACID PROFILE OF PUMPKIN SEED PROTEIN ISOLATE

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ÖZET

Kabak çekirdeği protein izolatı (PsPI), yüksek besinsel potansiyele sahip, umut vadeden bitkisel protein bileşenlerinden biridir. Bununla birlikte, PsPI'nin fizikokimyasal ve bileşimsel özellikleri uygulanan işlem koşullarından etkilenebilmektedir. Bu çalışmada, yüksek yoğunluklu ultrason (HIUS) uygulamasının PsPI'nin fenolik madde içeriği, antioksidan aktivitesi ve amino asit profili üzerindeki etkisi araştırılmıştır. PsPI, alkali ekstraksiyon ve ardından izoelektrik çöktürme yoluyla elde edilmiş ve daha sonra 20 kHz frekansta çalışan prob tipi HIUS sistemi kullanılarak 3, 6 ve 9 dakika süreyle ultrason işlemine tabi tutulmuştur. İşlem uygulanmayan örnek, kontrol grubu olarak kullanılmıştır. Sonikasyonun toplam fenolik madde içeriği (TPC), ABTS radikal süpürme aktivitesi ve amino asit kompozisyonu üzerindeki etkileri değerlendirilmiştir. HIUS uygulaması, PsPI'nin biyoaktif özelliklerinde belirgin değişikliklere neden olmuş; TPC, kontrol grubunda 342,31 ± 17,97 µg TE/g iken 3, 6 ve 9 dakikalık uygulamalar sonrasında sırasıyla 384,85 ± 7,91, 411,90 ± 2,84 ve 460,07 ± 2,36 µg TE/g değerlerine yükselmiştir. ABTS aktivitesi ise kontrol grubunda 464,79 ± 4,43 µmol TE/g iken 6 dakikalık uygulama sonrasında 541,53 ± 3,91 µmol TE/g ile en yüksek değerine ulaşmış, 9 dakikalık uygulamada ise 530,51 ± 3,22 µmol TE/g'a gerilemiştir. On dokuz amino asidin analiz edilmesi sonucunda, glutamik asit (142,63–146,46 mg/g), arjinin (97,47–102,28 mg/g) ve aspartik asidin (92,37–95,37 mg/g) PsPI'nin baskın amino asitleri olduğu belirlenmiştir. HIUS uygulaması, bireysel amino asitlerin miktarlarında uygulama süresine bağlı değişikliklere neden olmuş; en belirgin artış metiyonin içeriğinde gözlenmiş ve kontrol grubunda 19,23 ± 0,13 mg/g olan metiyonin miktarı 6 dakikalık uygulama sonrasında 25,48 ± 0,05 mg/g'a yükselmiştir. Alanin içeriği de kontrol grubundaki 35,22 ± 0,24 mg/g değerinden 9 dakikalık uygulama sonrasında 38,46 ± 0,05 mg/g'a yükselmiştir. Sonuç olarak, HIUS uygulamasının PsPI'nin TPC değeri, antioksidan aktivitesi ve amino asit kompozisyonunu değiştirdiği ve özellikle 6–9 dakikalık uygulamalarda en belirgin değişimlerin meydana geldiği belirlenmiştir. Bu bulgular, HIUS uygulamasının kabak çekirdeği protein izolatının biyoaktif ve bileşimsel özelliklerinin modüle edilmesinde umut vadeden bir termal olmayan işlem

yaklaşımı olduğunu ve PsPI'nin gıda uygulamalarında fonksiyonel bir bitkisel protein bileşeni olarak değerlendirilmesine olanak sağlayabileceğini göstermiştir.

Anahtar Kelimeler: Kabak çekirdeği protein izolatı; Yüksek yoğunluklu ultrason uygulaması; Fenolik madde içeriği; Antioksidan aktivite; Amino asit profili.

ABSTRACT

Pumpkin seed protein isolate (PsPI) is a promising plant-based protein ingredient with considerable nutritional potential. However, its physicochemical and compositional characteristics may be influenced by processing conditions. This study investigated the effect of high-intensity ultrasound (HIUS) treatment on the phenolic content, antioxidant activity, and amino acid profile of PsPI. PsPI was obtained by alkaline extraction followed by isoelectric precipitation and subsequently subjected to probe-type HIUS treatment at 20 kHz for 3, 6, and 9 min, while an untreated sample served as the control. The effects of sonication on total phenolic content (TPC), ABTS radical-scavenging activity, and amino acid composition were evaluated. HIUS treatment significantly altered the bioactive characteristics of PsPI, with TPC increasing progressively from 342.31 ± 17.97 μg TE/g in the control to 384.85 ± 7.91, 411.90 ± 2.84, and 460.07 ± 2.36 μg TE/g after 3, 6, and 9 min of treatment, respectively. ABTS activity increased from 464.79 ± 4.43 μmol TE/g in the control to a maximum of 541.53 ± 3.91 μmol TE/g after 6 min, followed by a slight decrease to 530.51 ± 3.22 μmol TE/g after 9 min. Amino acid profiling of 19 amino acids revealed that glutamic acid (142.63–146.46 mg/g), arginine (97.47–102.28 mg/g), and aspartic acid (92.37–95.37 mg/g) were the predominant amino acids in PsPI. HIUS treatment induced treatment-dependent changes in individual amino acid contents, with the most notable increase observed for methionine, which increased from 19.23 ± 0.13 mg/g in the control to 25.48 ± 0.05 mg/g after 6 min of treatment. Alanine also increased from 35.22 ± 0.24 to 38.46 ± 0.05 mg/g after 9 min. Overall, HIUS treatment modulated the TPCC value, antioxidant activity, and amino acid composition of PsPI, especially 6–9 min treatments produced the most pronounced changes. These findings highlighted the potential of HIUS as a non-thermal processing strategy for tailoring the bioactive and compositional characteristics of pumpkin seed protein isolate, providing a promising basis for its development as a functional plant protein ingredient for food applications.

Keywords: Pumpkin seed protein isolate; High-intensity ultrasound treatment; Phenolic content; Antioxidant activity; Amino acid profile.

INTERACTIVE EFFECT OF WATER POTENTIAL AND TEMPERATURE ON GERMATION AND AGRONOMIC PARAMETERES OF *TRITICIUM AESTIVUM* L.

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ABSTRACT

Triticium aestivum L. belongs to family Poaceae and is one of the most common cereals planted all over the world. To investigate the effect of different environmental conditions which affects the seed germination and agronomic parameters of *Triticium aestivum* L. The hydrothermal time (HTT) model offers an efficient conceptual framework of studying the effect of the environmental factors, especially the temperature and water potential (Ψ) on seed germination. Additionally certain other factors that contribute to rate of seed germination of this plant including dormancy and water potential. However, water potential and temperature have potential effects on the germination rate of *Triticium aestivum* L. seeds. *Triticium aestivum* L. show response according to the variation in water potential and temperature which are measured by the hydrothermal time model. In the present study based on the germination rate of *Triticium aestivum* L. in a variety named Khyber 2023. Polyethylene glycol (PEG 6000) was used to create osmotic stress on an in vitro experiment. Water potentials of (0, -0.3, -0.6, -0.9, and -1.2 MPa) were examined at five constant temperatures (15C°, 20C°, 25C°, 30C°, and 35C°). Agronomic parameters such as the radical length, plumule length were used to measure germination performance, which showed the maximum germination rate attained at 20C° and 0MPa, for Khyber 2023 variety of *Triticium aestivum* L. while minimum at 30C° and -0.3Mpa and showed zero germination rate at 35C°.These findings indicate that the hydrothermal time model is useful in the interactive prediction of the effect of temperature and water potential on wheat seed germination.

Keywords: *Triticum aestivum* L., wheat, hydrothermal time model, seed germination, PEG 6000, water potential.

PEKİN ÖRDEKLERİNİN GÖĞÜS ETİNİN DOKU ÖZELLİKLERİ ÜZERİNE CİNSİYETİN ETKİSİ

GENDER EFFECT ON TEXTURE CHARACTERISTICS OF BREAST MEAT FOR PEKIN DUCKS

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ÖZET

Bazı araştırmalar, et kalitesinin cinsiyetten büyük ölçüde etkilenebileceğini öne sürmüştür. Ördek eti, kırmızı etin özelliklerini kümes hayvanı etinin besleyici özellikleriyle birleştirdiği için oldukça değerlidir. Ördek eti, tavuk ve hindi etine göre daha yüksek yağ içeriğine ve ayrıca daha yüksek düzeyde hem pigmentlerine (hemoglobin ve miyoglobin) sahiptir. Bu çalışmanın amacı, Tekstür Profil Analizi (TPA) parametrelerini (Hardness, Adhesiveness, Springiness, Cohesiveness, Gumminess, Chewiness, Resilience) cinsiyet değişkeni (Erkek ve Dişi) açısından karşılaştırmak, parametreler arası ilişkileri incelemek ve cinsiyetler arasındaki genel korelasyon yapısı benzerliğini değerlendirmektir. Çalışmada elde edilen dokusal parametrelerin ortalama değerleri ve standart sapmaları hesaplanmış, cinsiyetler arası farkların istatistiksel anlamlılığı tek yönlü varyans analizi kullanılarak analiz edilmiştir. Cinsiyet grupları içinde değişkenler arası ilişkileri belirlemek amacıyla Pearson korelasyon matrisleri oluşturulmuş; iki korelasyon matrisinin genel yapısal benzerliği ise 10000 permütasyonlu Mantel Testi kullanılarak değerlendirilmiştir. İncelenen tüm tekstür özelliklerinde erkek ve dişi grupları arasında istatistiksel olarak anlamlı bir fark bulunamamıştır ($p>0,05$). Örnek olarak sertlik (hardness) erkeklerde 87,38±15,49, dişilerde 87,99±9,93 ($p=0,973$) olarak; çiğnenebilirlik (chewiness) ise erkeklerde 33,55±6,37, dişilerde 31,62±3,98 ($p=0,793$) olarak saptanmıştır. Her iki grupta da hardness ile gumminess ($r_{erkek}=0,992$, $r_{dişi}=0,981$) ve hardness ile chewiness ($r_{erkek}=0,967$, $r_{dişi}=0.979$) arasında oldukça güçlü pozitif ilişkiler gözlemlenmiştir. Ancak bazı parametre çiftlerinde belirgin cinsiyet farklılıkları tespit edilmiştir: Chewiness – resilience arasındaki korelasyon erkeklerde negatif bir ilişki gösterirken ($r=-0,498$), dişilerde çok güçlü pozitif bir ilişki sergilemektedir ($r=0,931$). Gumminess – resilience: Erkeklerde negatif yönlüyken ($r=-0,502$$), dişilerde zayıf ve pozitiftir ($r=0,105$). Hardness – resilience arasındaki korelasyon erkeklerde belirgin negatif ($r=-0,557$) iken, dişilerde nötre yakındır ($r=-0,068$). Mantel testi sonucunda elde edilen korelasyon katsayısı $r=0.7991$ ve istatistiksel anlamlılık değeri $p=0,0030$ olarak bulunmuştur. Bireysel parametre ortalamaları açısından cinsiyetler arasında doğrudan anlamlı farklar bulunmasa da, Mantel testi sonuçları her iki cinsiyetin genel dokusal korelasyon yapılarının yüksek düzeyde benzer ve uyumlu olduğunu göstermektedir ($r \approx 0.80$, $p < 0.05$$). Bununla birlikte, chewiness ve gumminess

parametrelerinin resilience ile olan spesifik ilişkilerindeki zıtlıklar, cinsiyetler arasında mikro düzeyde farklı dokusal etkileşim mekanizmalarının varlığına işaret etmektedir.

Anahtar Kelimeler: Tekstür profili, Pekin ördeği, Cinsiyet, Et kalitesi

ABSTRACT

Some studies have suggested that meat quality can be significantly influenced by gender. Duck meat is highly valued because it combines the characteristics of red meat with the nutritional properties of poultry. Duck meat has a higher fat content and also higher levels of heme pigments (hemoglobin and myoglobin) compared to chicken and turkey meat. The aim of this study is to compare the Texture Profile Analysis (TPA) parameters (Hardness, Adhesiveness, Springiness, Cohesiveness, Gumminess, Chewiness, Resilience) in terms of the gender variable (Male and Female), to examine the relationships between the parameters, and to evaluate the similarity of the overall correlation structure between genders. In the study, the mean values and standard deviations of the textural parameters obtained were calculated, and the statistical significance of the differences between genders was analyzed using one-way analysis of variance. Pearson correlation matrices were created to determine the relationships between variables within gender groups; the overall structural similarity of the two correlation matrices was evaluated using the 10,000-permutation Mantel Test. No statistically significant differences were found between male and female groups in any of the texture characteristics examined ($p>0.05$). For example, hardness was found to be 87.38±15.49 in males and 87.99±9.93 in females ($p=0.973$); chewiness was found to be 33.55±6.37 in males and 31.62±3.98 in females ($p=0.793$). Strong positive correlations were observed between hardness and gumminess ($r_{male}=0.992$, $r_{female}=0.981$) and between hardness and chewiness ($r_{male}=0.967$, $r_{female}=0.979$) in both groups. However, significant gender differences were detected in some parameter pairs: The correlation between chewiness and resilience showed a negative relationship in males ($r=-0.498$), while it exhibited a very strong positive relationship in females ($r=0.931$). Gumminess – resilience: While negative in males ($r=-0.502$), it is weak and positive in females ($r=0.105$). The correlation between hardness and resilience is significantly negative in males ($r=-0.557$), while it is close to neutral in females ($r=-0.068$). The correlation coefficient obtained from the Mantel test was $r=0.7991$ and the statistical significance value was $p=0.0030$. Although there were no directly significant differences between genders in terms of individual parameter means, the Mantel test results show that the general textural correlation structures of both genders are highly similar and congruent (r approximately 0.80, $p < 0.05$). However, the contrasts in the specific relationships of chewiness and gumminess parameters with resilience indicate the existence of different micro-level textural interaction mechanisms between genders.

Keywords: Texture profile, Peking duck, Gender, Meat quality

GERZE ERKEK CİVCİVLERDE FARKLI BESİ SÜRESİNİN KARKAS VE ET KALİTESİ ÖZELLİKLERİ ÜZERİNE ETKİLERİ

EFFECTS OF DIFFERENT FATTENING PERIODS ON CARCASS AND MEAT QUALITY TRAITS IN GERZE MALE CHICKS

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ÖZET

erli tavuk genotiplerinin farklı yaşlarda kesiminin karkas ve et kalitesi özellikleri üzerindeki etkilerinin belirlenmesi, üretim performansı ve et kalitesinin optimize edilmesi açısından önem taşımaktadır. Bu çalışmada Gerze tavuğuna ait erkek civcivler araştırma materyali olarak kullanılmış ve civcivler 8 hafta (n=20) ve 14 hafta (n=20) süreyle standart broiler besisine tabi tutulmuştur. Besi dönemlerinin sonunda hayvanlar kesilmiş ve kesim karkas özellikleri belirlenmiştir. Kesim sonrasında pectoralis major kasları izole edilerek kesim sonrası ve 24. saatte renk (L*, a*, b*) ve pH değerleri belirlenmiş; ayrıca kas örneklerinde kuru madde, kül, protein ve kas içi yağ düzeyleri analiz edilmiştir. Et kalitesi kapsamında 96. saat sızdırma kaybı, dondurma kaybı, pişirme kaybı ve su tutma kapasitesi (WHC) belirlenmiş, pişmiş kas örneklerinde ise Hardness, Adhesiveness, Springiness, Cohesiveness, Gumminess, Chewiness ve Resilience parametrelerini içeren tekstür profil analizi gerçekleştirilmiştir. On dört haftalık grupta canlı ağırlık, sıcak karkas ve soğuk karkas ağırlıkları 8 haftalık gruba göre ileri düzeyde yüksek bulunmuştur ($P < 0,0001$). Yaşın ilerlemesiyle birlikte vücut ve karkas kütlesinde belirgin bir artış gözlenmiştir. Sıcak ve soğuk karkas pH değerleri ile L*, a* ve b* renk parametreleri bakımından gruplar arasında istatistiksel olarak anlamlı farklılık belirlenmemiştir. Pectoralis major kasında kuru madde oranı 14 haftalık grupta (%27,47), 8 haftalık gruba (%26,23) göre anlamlı düzeyde daha yüksek bulunmuştur ($P = 0,0489$), buna karşılık kül oranı 8 haftalık grupta daha yüksek belirlenmiştir ($P = 0,0004$). Protein miktarı bakımından gruplar arasında anlamlı bir farklılık saptanmamıştır. Kas içi yağ oranı ise yaşın ilerlemesiyle %1,73'ten %2,00'ye yükselmiş ve bu artış istatistiksel olarak önemli bulunmuştur ($P < 0,0001$). Sızdırma kaybı, dondurma kaybı, pişirme kaybı ve WHC bakımından yaş grupları arasında anlamlı bir farklılık belirlenmemiştir. Adhesiveness dışında ($P = 0,8434$), Hardness, Springiness, Cohesiveness, Gumminess, Chewiness ve Resilience değerlerinin 14 haftalık grupta 8 haftalık gruba göre anlamlı düzeyde daha yüksek olduğu belirlenmiştir ($P < 0,05$). Elde edilen bulgular, Gerze tavuklarında kesim yaşının karkas verimi ve etin teknolojik ve tekstürel özellikleri üzerinde önemli bir etkiye sahip olduğunu göstermiştir. On dört haftalık yaşta daha yüksek canlı ve karkas ağırlıkları ile birlikte kas içi yağ oranı ve tekstürel özelliklerde artış gözlenmesi, ileri yaşta kesimin daha yüksek karkas kütlesi ve daha belirgin et tekstürü sağladığını ortaya koymuştur. Buna karşılık, et rengi, pH, su tutma kapasitesi ve pişirme kaybı gibi bazı kalite özelliklerinin kesim

yaşından etkilenmemesi, bu özelliklerin yaş dışındaki faktörler tarafından daha fazla belirlenebileceğini düşündürmektedir.

Anahtar Kelimeler: Gerze tavuğu, Besi süresi, Et kalitesi, Karkas özellikleri, Tekstür profili.

ABSTRACT

Determining the effects of slaughter age of indigenous chicken genotypes on carcass and meat quality traits is important for optimizing production performance and meat quality. In the present study, male chicks of the Gerze chicken breed were used as the experimental material, and the chicks were subjected to standard broiler feeding for 8 weeks (n = 20) and 14 weeks (n = 20). At the end of the feeding periods, the animals were slaughtered and carcass characteristics were determined. Following slaughter, the pectoralis major muscles were isolated, and colour (L*, a*, b*) and pH values were determined immediately after slaughter and at 24 h post-slaughter. In addition, dry matter, ash, protein, and intramuscular fat contents were analysed in the muscle samples. As part of the meat quality assessment, 96-h drip loss, freezing loss, cooking loss, and water-holding capacity (WHC) were determined. Texture profile analysis was also performed on cooked muscle samples, including the parameters Hardness, Adhesiveness, Springiness, Cohesiveness, Gumminess, Chewiness, and Resilience. Live weight, hot carcass weight, and cold carcass weight were found to be markedly higher in the 14-week-old group than in the 8-week-old group ($P < 0.0001$). A marked increase in body and carcass mass was observed with advancing age. No statistically significant differences were detected among the groups in hot and cold carcass pH values or in the L*, a*, and b* colour parameters. The dry matter content of the pectoralis major muscle was significantly higher in the 14-week-old group (27.47%) than in the 8-week-old group (26.23%) ($P = 0.0489$), whereas the ash content was significantly higher in the 8-week-old group ($P = 0.0004$). No statistically significant difference was found between the groups in terms of protein content. Intramuscular fat content increased from 1.73% to 2.00% with advancing age, and this increase was statistically significant ($P < 0.0001$). No significant differences were determined between the age groups in terms of drip loss, freezing loss, cooking loss, or WHC. Except for Adhesiveness ($P = 0.8434$), the values of Hardness, Springiness, Cohesiveness, Gumminess, Chewiness, and Resilience were significantly higher in the 14-week-old group than in the 8-week-old group ($P < 0.05$). The findings demonstrate that slaughter age has a significant effect on carcass yield and the technological and textural properties of meat in Gerze chickens. The higher live and carcass weights, together with the increased intramuscular fat content and textural characteristics observed at 14 weeks of age, indicate that slaughter at an older age provides greater carcass mass and more pronounced meat texture. In contrast, the lack of significant effects of slaughter age on certain quality traits, such as meat colour, pH, water-holding capacity, and cooking loss, suggests that these characteristics may be influenced more strongly by factors other than age.

Keywords: Gerze chicken, Fattening period, Meat quality, Carcass characteristics, Texture profile.

ÜRÜNÜ YÖREYLE ÖZDEŞLEŞTİREN UNSURLARIN BELİRLENMESİ: NAZİLLİ PATLICAN KURUSU ÜZERİNE BİR ARAŞTIRMA

IDENTIFYING THE ELEMENTS THAT ASSOCIATE A PRODUCT WITH ITS LOCALITY: A STUDY ON NAZİLLİ DRIED EGGPLANT

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ÖZET

Bir gıda ürününün belirli bir yöre ile özdeşleşmesi, o yörede uzun süredir üretiliyor olmasının yanı sıra üretim bilgisinin yerelliğine, ürünün ölçülebilir niteliklerine, mutfaktaki kullanım değerine ve pazarda yöre adıyla tanınmasına bağlıdır. Bu çalışma, Aydın ilinin Nazilli ilçesinde geleneksel yöntemlerle üretilen patlıcan kurusunun yöre ile kurduğu bağı, üretici verileri ve laboratuvar bulgularını birlikte kullanarak incelemeyi amaçlamaktadır. Ürün doğrudan tüketilen bir gıda değil, dolma yapımına yönelik bir mutfak girdisidir. Meyve, iç harcı alabilecek bir kap hâline getirilmek üzere kabuk bütünlüğü korunarak oyulmakta ve kullanımdan önce sıcak suda yumuşatılmaktadır. Araştırmada betimsel tarama modeli benimsenmiş, yirmi üretici ile yüz yüze anket uygulanmış ve açık uçlu yanıtlar içerik analiziyle çözümlenmiştir. Ürünün fizikokimyasal ve biyoaktif profili, Aydın Adnan Menderes Üniversitesi Gıda Mühendisliği Bölümü laboratuvarlarında iki numune üzerinde belirlenmiştir. Bulgular, üretim uygulamalarının yüksek düzeyde benzeştiğini ortaya koymaktadır. Katılımcıların tamamına yakını ürünü doğrudan güneş altında ve birkaç gün içinde kurutmakta, toptancı üzerinden pazarlamakta ve yurt dışına yalnızca aracı yoluyla ulaştırmaktadır. Buna karşılık ürün pazara yöre adıyla girmemektedir. Üreticilerin büyük çoğunluğu satışta yöre adı içermeyen bir ad kullanmakta ve ürünlerin neredeyse tamamı etiketsiz olarak satılmaktadır. Katılımcıların dörtte üçü ürünün başka yörelerin ürününden belirgin biçimde ayrıldığını düşünmemektedir. Buna karşılık üretim kültürü kendine özgü bir dil geliştirmiştir. Meyve burun, orta ve sap parçalarına ayrılmakta, bu parçalar mutfakta farklı kullanım değerleri taşımakta ve ürün dizi ile külte adı verilen yöresel birimlerle ticarete konu olmaktadır. Laboratuvar bulguları ise ürünün düşük nem içeriğine, yüksek kül oranına ve yüksek fenolik madde ile antioksidan kapasite düzeylerine sahip olduğunu göstermektedir. Elde edilen bulgular, köklü üretim ve mutfak kültürü ile zayıf kalan coğrafi adlandırma arasındaki tezatı ortaya koymaktadır. Söz konusu açığı kapatmayı hedefleyen bu çalışma, adlandırma, etiketleme, ortak kurutma tesisleri ve mutfak odaklı tanıtım stratejileri sunmaktadır.

Anahtar Kelimeler: Yöresel Ürün, Patlıcan Kurusu, Nazilli, Gastronomik Miras, Ürün-Yöre Bağı, Kırsal Kalkınma

ABSTRACT

The association of a food product with a particular locality depends not only on a long history of production there, but also on the local character of production knowledge, the measurable properties of the product, its value in the kitchen and its recognition in the market under the name of the locality. This study examines the link between locality and dried eggplant traditionally produced in the Nazilli district of Aydın province, Türkiye, by combining producer data with laboratory findings. The product is not consumed on its own but serves as a culinary input for stuffed dishes. The fruit is hollowed out with the skin left intact so that it can hold a filling, then softened in hot water before use. A descriptive survey design was adopted, a face-to-face questionnaire was administered to twenty producers, and open-ended responses were examined through content analysis. The physicochemical and bioactive profile was determined on two samples at the Food Engineering laboratories of Aydın Adnan Menderes University. The findings reveal a high degree of similarity in production practices. Almost all participants dry the product in direct sunlight within a few days, market it through wholesalers, and reach export markets only through intermediaries. The product, however, does not enter the market under the name of its locality. The great majority of producers use a name that contains no place reference, and virtually all output is sold unlabelled. Three quarters of the participants do not consider the product to be distinctly different from that of other regions. The production culture, however, has developed a vocabulary of its own. The fruit is divided into tip, middle and stem segments, these segments carry different culinary values, and the product is traded in local units known as dizi and külte. Laboratory findings indicate low moisture content, high ash content, and high levels of phenolic compounds and antioxidant capacity. The findings expose the contrast between a deep-rooted production and culinary culture and a territorial naming that has remained weak. Addressing this gap, the study proposes strategies for naming, labelling, shared drying facilities and culinary-based promotion.

Keywords: Local Food Product, Dried Eggplant, Nazilli, Gastronomic Heritage, Product–Locality Link, Rural Development

RESTORANLARDA DİJİTAL DÖNÜŞÜM VE AKILLI RESTORANLAR: SİSTEMATİK LİTERATÜR TARAMASI

DIGITAL TRANSFORMATION IN RESTAURANTS AND SMART RESTAURANTS: A SYSTEMATIC LITERATURE REVIEW

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ÖZET

Dijital dönüşüm, diğer bütün alanlarda olduğu gibi turizm sektöründe de kendini göstermiş ve yiyecek içecek hizmeti sunan restoranları yakından etkilemiştir. Bu etkileşim ile birlikte akıllı restoranlar ortaya çıkmıştır. Akıllı restoranlar, dijital teknolojilerin yiyecek içecek hizmet süreçlerine entegre edildiği yenilikçi restoranları ifade etmektedir. Akıllı restoranlarda kullanılan teknolojiler, hizmet süreçlerinin dijitalleşmesini ve operasyonel verimliliğin artırılmasını sağlamaktadır. Bu gelişmelerin, zaman içinde alanyazına da yansıdığı ve araştırmalarda, restoranların yaşadığı dijital dönüşümün çeşitli boyutları ile ele alındığı görülmektedir. Bu çalışmada, hakemli dergilerde yayınlanan ve restoranlarda dijital dönüşüm ve akıllı restoran konularını ele alan makalelerin sistematik olarak incelenmesi amaçlanmıştır. Bu amaç doğrultusunda hazırlanan çalışmada, 2015-2025 yıllarında yayınlanan makaleler incelemeye alınmıştır. Taramalar, Scopus ve Web of Science (WoS) veri tabanlarında yapılmış ve araştırma süreci, PRISMA modeline göre yürütülmüştür. Araştırma kapsamında 172 makale analiz edilmiştir. Analizler, önceden hazırlanan sistematik veri çıkarma formu aracılığıyla yapılmıştır. Bu kapsamda her makale, çeşitli özellikler göz önünde bulundurularak kodlanmış ve elde edilen kodlar, benzer özelliklerine göre temalandırılmıştır. Bu işlemin sonunda, 12 ana tema ve 50 alt tema elde edilmiştir. İncelemelerin sonunda, akıllı restoran literatürünün 2016 yılından itibaren görünür hâle geldiği, asıl ivmeyi 2020 yılından sonra kazandığı bulgusuna ulaşılmıştır. Literatürde bu konunun yapay zekâ, robotik, otomasyon, dijital hizmet sistemleri, müşteri deneyimi ve sürdürülebilirlik gibi farklı araştırma alanlarında ele alındığı da elde edilen bir başka bulgudur. Sonuçta, akıllı restoran araştırmalarının, üç temel eksende geliştiği görülmüştür. Bu eksenler, teknolojik uygulamaların restoran hizmet süreçlerine entegrasyonu; bu teknolojilerin müşteri deneyimi, hizmet kalitesi, müşteri memnuniyeti, teknoloji kabulü ve davranışsal niyet üzerindeki

etkisi; ve işletme performansına ve stratejik dönüşüme yönelik konular şeklinde belirlenmiştir.

Anahtar Kelimeler: Restoranlarda Dijital Dönüşüm, Akıllı Restoranlar, Sistematik Literatür Taraması.

ABSTRACT

Digital transformation, as in all other areas, has also made its presence felt in the tourism industry and has significantly impacted restaurants that provide food and beverage services. This interaction has led to the emergence of smart restaurants. Smart restaurants refer to innovative restaurants where digital technologies are integrated into the food and beverage service processes. Technologies used in smart restaurants enable the digitalization of service processes and increase operational efficiency. These developments have been reflected in the literature over time, and research has addressed various aspects of the digital transformation experienced by restaurants. This study aims to systematically examine articles published in peer-reviewed journals that address the topics of digital transformation in the restaurants and smart restaurants. This study, prepared for this purpose, examined articles published between 2015 and 2025. Searches were made in Scopus and Web of Science (WoS) databases and the research process was carried out according to the PRISMA model. 172 articles were analyzed as part of the research. The analyses were conducted using a pre-prepared systematic data extraction form. In this context, each article was coded considering various characteristics, and the resulting codes were themed according to their similar features. This process resulted in 12 main themes and 50 sub-themes. The study concluded that the literature on smart restaurants became visible from 2016 onwards, but gained significant momentum after 2020. Another finding obtained from the study is that this topic is addressed in different research areas in the literature, such as artificial intelligence, robotics, automation, digital service systems, customer experience, and sustainability. Ultimately, smart restaurant research has been shown to evolve along three key axes. These axes have been identified as the integration of technological applications into restaurant service processes; the impact of these technologies on customer experience, service quality, customer satisfaction, technology adoption, and behavioral intention; and issues related to business performance and strategic transformation.

Keywords: Digital Transformation in Restaurants, Smart Restaurants, Systematic Literature Review.

OLGUNLAŞMAMIŞ MUZ UNU İKAMESİNİN GLUTENSİZ BİSKÜVİLERİN FİZİKSEL, RENK, TEKSTÜREL VE DUYUSAL ÖZELLİKLERİ ÜZERİNE ETKİSİ

EFFECT OF UNRIPE BANANA FLOUR SUBSTITUTION ON THE PHYSICAL, COLOR, TEXTURAL, AND SENSORY PROPERTIES OF GLUTEN-FREE BISCUITS

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ÖZET

Glutensiz ürünlerde besinsel ve teknolojik özelliklerin geliştirilmesi amacıyla alternatif bitkisel unların kullanımı giderek önem kazanmaktadır. Bu çalışmada, birinci olgunluk aşamasındaki yeşil muzlardan elde edilen olgunlaşmamış muz ununun, glutensiz bisküvilerin renk, fiziksel, tekstürel ve duyusal özellikleri üzerindeki etkisi araştırılmıştır. Kontrol bisküvisinin un bileşimi %50 mısır unu ve %50 pirinç unundan oluşturulmuştur. Kontrol un karışımı, toplam un esasına göre %25, %50, %75 ve %100 oranlarında olgunlaşmamış muz unu ile ikame edilmiştir. Olgunlaşmamış muz unu oranındaki artış bisküvilerin L* değerini yaklaşık 82'den 66'ya düşürürken a* değerini yaklaşık −0,4'ten 4,5'e yükseltmiş; böylece örneklerin daha koyu ve kırmızımsı bir renk kazanmasına neden olmuştur. b* değeri, renk doygunluğu ve renk tonu açısı da formülasyondan önemli ölçüde etkilenmiştir ($p < 0,05$). İkame oranı arttıkça bisküvi çapı yaklaşık 55 mm'den 51 mm'ye ve yayılma oranı 7,5'ten 6,2'ye azalırken kalınlık 7,2 mm'den 8,3 mm'ye yükselmiştir. Kontrol örneğinin sertliği yaklaşık 6300 g iken olgunlaşmamış muz unu içeren örneklerde bu değer 2800–3500 g aralığına gerilemiştir. Buna karşılık, %75 ve %100 ikame düzeylerinde kırılabilirlik mesafesi hafifçe artmıştır. Duyusal değerlendirmede %25 ve %50 ikameli bisküviler renk, tat, koku, görünüş, gevreklik ve genel beğeni bakımından yüksek puanlar almış ve çoğu özellikte kontrolle benzer bulunmuştur. %75 ikame düzeyi görünüş açısından yüksek beğeni sağlamasına rağmen tat ve gevreklik puanları azalmaya başlamıştır. %100 olgunlaşmamış muz unu kullanımı özellikle tat, gevreklik ve genel beğeniyi belirgin biçimde düşürmüştür. Sonuç olarak, olgunlaşmamış muz unu glutensiz bisküvilerin fiziksel yapısını ve rengini yönlendiren işlevsel bir bileşen olarak kullanılabilir; ancak duyusal kabulün korunması bakımından %25–%50 ikame aralığı en uygun düzey olarak değerlendirilmiştir.

Anahtar Kelimeler: Glutensiz bisküvi, olgunlaşmamış muz unu, pirinç unu, mısır unu, duyusal kabuledilebilirlik.

ABSTRACT

The use of alternative plant flours has gained importance for improving the nutritional and technological properties of gluten-free products. This study investigated the effects of unripe banana flour obtained from green bananas at ripening stage 1 on the color, physical, textural, and sensory properties of gluten-free biscuits. The flour base of the control biscuits consisted of 50% corn flour and 50% rice flour. This control flour blend was replaced with unripe banana flour at 25%, 50%, 75%, and 100% of the total flour weight. Increasing the unripe banana flour level decreased biscuit L* values from approximately 82 to 66 and increased a* values from approximately −0.4 to 4.5, producing a darker and more reddish appearance. The b* value, saturation index, and hue angle were

also significantly affected by the formulation ($p < 0.05$). As the substitution level increased, biscuit diameter decreased from approximately 55 to 51 mm and the spread ratio declined from 7.5 to 6.2, whereas thickness increased from 7.2 to 8.3 mm. The hardness of the control biscuit was approximately 6300 g, while biscuits containing unripe banana flour showed substantially lower values ranging from about 2800 to 3500 g. In contrast, fracture distance increased slightly at the 75% and 100% substitution levels. In sensory evaluation, biscuits containing 25% and 50% unripe banana flour received high scores for color, taste, odor, appearance, crispness, and overall acceptability and were comparable to the control for most attributes. Although the 75% formulation received a high appearance score, its taste and crispness scores began to decline. Complete replacement with unripe banana flour markedly reduced taste, crispness, and overall acceptability. Consequently, unripe banana flour can be used as a functional ingredient to modify the color and physical structure of gluten-free biscuits; however, a substitution range of 25–50% was considered the most suitable for maintaining consumer acceptance while achieving the desired product modification.

Keywords: Gluten-free biscuit, unripe banana flour, rice flour, corn flour, sensory acceptance.

BEYAZ, SARI VE MOR SOĞAN KABUĞU TOZU İKAMESİNİN KRAKERLERİN FİZİKSEL, RENK, TEKSTÜREL VE DUYUSAL ÖZELLİKLERİ ÜZERİNE ETKİSİ

EFFECT OF WHITE, YELLOW, AND RED ONION PEEL POWDER SUBSTITUTION ON THE PHYSICAL, COLOR, TEXTURAL, AND SENSORY PROPERTIES OF CRACKERS

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ÖZET

Soğan işleme endüstrisinde açığa çıkan kabuklar, renk pigmentleri ve fenolik bileşenler bakımından zengin olmalarına rağmen çoğunlukla atık olarak uzaklaştırılmaktadır. Bu çalışmada, beyaz, sarı ve mor soğan kabuğu tozlarının buğday unu yerine kullanımının krakerlerin renk, fiziksel, tekstürel ve duyusal özellikleri üzerindeki etkisi karşılaştırılmıştır. Kontrol formülasyonu soğan kabuğu tozu içermemiş; beyaz, sarı veya mor soğan kabuğu tozu buğday unu ile toplam un esasına göre %2, %4 ve %6 oranlarında ikame edilmiştir. Soğan kabuğu çeşidi ve ikame oranı kraker rengini önemli ölçüde etkilemiştir ($p < 0,05$). Beyaz ve sarı soğan kabuğu ilavesi L* değerinde sınırlı bir azalmaya, a* ve b* değerlerinde ise artışa neden olmuştur. Mor soğan kabuğu tozu daha belirgin bir etki göstererek L* değerini yaklaşık 80'den 53'e ve renk tonu açısını yaklaşık 89°'den 53°'ye düşürmüş, a* değerini yaklaşık 11'e yükseltmiş ve böylece daha koyu, kırmızı-mor tonlu krakerler oluşturmuştur. Beyaz ve sarı soğan kabukları renk doygunluğunu artırırken mor soğan kabuğu doygunluk indeksini azaltmıştır. Fiziksel analizlerde özellikle beyaz soğan kabuğu tozu çapı ve yayılma oranını artırmış; tüm kabuk türlerinde ikame oranındaki artış genel olarak kalınlığı azaltmıştır. Sertlik, soğan kabuğu düzeyi yükseldikçe belirgin biçimde artmış; en yüksek değerler %6 beyaz soğan kabuğu içeren örneklerde görülmüştür. Sarı ve mor soğan kabuğu içeren örneklerde de %6 düzeyinde sertlik önemli ölçüde yükselmiştir. Kırılabilirlik mesafesindeki değişimler sertliğe göre daha sınırlı kalmıştır. Duyusal puanlar genel olarak 6–7 aralığında bulunmuş ve %2 ile %4 ikame düzeyleri kontrolle benzer kabul edilebilirlik göstermiştir. Buna karşılık, %6 ikame düzeyi kabuk çeşidine bağlı olarak tat, koku, renk, gevreklik veya genel beğeni puanlarında azalmaya yol açmıştır. Sonuç olarak, soğan kabuğu tozları krakerlerde doğal renk ve işlevsel bileşen kaynağı olarak değerlendirilebilir; ancak tekstürel sertleşmenin ve duyusal kayıpların sınırlandırılması için %2–%4 ikame aralığı daha uygun bulunmuştur.

Anahtar Kelimeler: kraker, soğan kabuğu tozu, yan ürün değerlendirme, doğal renklendirici, duyusal kabuledilebilirlik.

ABSTRACT

Onion peels generated by the processing industry are commonly discarded despite being rich in color pigments and phenolic compounds. This study comparatively evaluated the effects of white, yellow, and red onion peel powders used as wheat-flour substitutes on the color, physical, textural, and sensory properties of crackers. The control formulation contained no onion peel powder, whereas each peel powder replaced wheat flour at 2%, 4%, and 6% of the total flour weight. Onion type and substitution level significantly affected cracker color ($p < 0.05$). White and yellow onion peel powders

caused moderate reductions in L* and increased a* and b* values. Red onion peel powder produced the most pronounced color change: L* decreased from approximately 80 to 53, hue angle declined from about 89° to 53°, and a* increased to approximately 11, resulting in darker crackers with a distinct red-purple tone. White and yellow onion peels increased the saturation index, whereas red onion peel reduced color saturation. Physical measurements showed that white onion peel powder particularly increased cracker diameter and spread ratio. Increasing substitution generally reduced thickness for all peel types. Hardness rose markedly with onion peel concentration, and the highest value was observed in crackers containing 6% white onion peel powder. Significant hardness increases were also recorded at the 6% levels of yellow and red onion peel powders. Changes in fracture distance were comparatively limited. Sensory scores generally ranged between 6 and 7, and crackers containing 2% or 4% onion peel powder showed acceptability similar to the control. In contrast, 6% substitution caused decreases in taste, odor, color, crispness, or overall acceptability depending on onion peel type. The results demonstrate that white, yellow, and red onion peel powders can be valorized as natural colorants and functional ingredients in cracker production. However, a substitution range of 2–4% was considered more appropriate for achieving desirable color modification while limiting excessive hardness and maintaining sensory acceptance.

Keywords: cracker, onion peel powder, by-product valorization, natural colorant, sensory acceptance.

SÜRDÜRÜLEBİLİR MATERNAL BESLENME: GEBELİKTE ORGANİK GIDA TÜKETİMİ VE SAĞLIK SONUÇLARI

SUSTAINABLE MATERNAL NUTRITION: ORGANIC FOOD CONSUMPTION DURING PREGNANCY AND HEALTH OUTCOMES

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ÖZET

Giriş ve Amaç: Gebe kadınlarda sağlıksız beslenme küresel bir halk sağlığı sorunudur ve özellikle düşük-orta gelirli ülkelerde bu soruna yönelik yaklaşımlar yetersiz kalmaktadır. Maternal beslenme; fetal gelişim ve yaşam boyu sağlık çıktıları üzerinde belirleyici bir role sahip olduğundan, Birleşmiş Milletler Çocuk Fonu (UNICEF) gibi uluslararası kurumlar maternal malnütrisyonun olumsuz sonuçlarını ortadan kaldırmaya dönük stratejiler geliştirmektedir. Günümüzde çevre kirliliği ve endüstriyel tarım uygulamaları, gebelerin pestisit ve kimyasal kalıntılara maruz kalma riskini artırmaktadır. Bu bağlamda, sürdürülebilir maternal beslenme ve organik gıda tüketimi hem anne hem de bebek sağlığını korumada alternatif ve koruyucu bir yaklaşım olarak öne çıkmaktadır. Nispeten iyi beslenen popülasyonlarda bile anne diyetinin çocuğun uzun vadeli sağlığını etkilediğine dair kanıtlar artarken, gebelik döneminde organik gıda tüketiminin etkileri hakkındaki bilgiler halen sınırlıdır. Bu derlemenin amacı; gebelikte organik gıda tüketiminin anne, fetüs ve yenidoğan sağlığı üzerindeki etkilerini güncel literatür ışığında incelemek ve kadın doğum hemşiresinin bu süreçteki rolünü tartışmaktır.

Yöntem: Bu çalışma; 2020-2026 yılları arasında Google Akademik (Google Scholar) veri tabanı üzerinde; "organik gıda", "hamilelik", "anne beslenmesi", "sürdürülebilir beslenme" ve "emzirme" "organic food", "pregnancy", "maternal nutrition", "sustainable diet" ve "nursing" anahtar kelimeleri kullanılarak taranan ulusal ve uluslararası literatüre dayalı bir derlemedir.

Bulgular: Yapılan çalışmalar gebelikte organik gıda (özellikle organik sebze, meyve ve süt ürünleri) tüketiminin, anne adayının idrarındaki organofosfatlı pestisit düzeylerini ve preeklampsi riskini anlamlı ölçüde azalttığını göstermektedir. Bunun yanı sıra organik gıdaların daha yüksek antioksidan ve çoklu doymamış yağ asidi içermesi nedeniyle maternal bağışıklığı desteklediği bildirilmektedir. Ayrıca gebelikte organik gıda tercihinin bebeklerde hipospadias ve kriptorşidizm gibi konjenital anomalilerin görülme sıklığını düşürdüğü ortaya konulmuştur.

Sonuç ve Öneriler: Gebelikte organik gıda tüketimi, maternal-fetal sağlığı korumada ve sürdürülebilir bir gelecek inşa etmede güçlü bir potansiyele sahiptir. Kadın doğum hemşireleri; antenatal bakım sürecinde gebelere beslenme danışmanlığı verirken gıda güvenliği ve sürdürülebilirlik kavramlarını bakıma entegre etmeli; bütçe dostu organik gıda alternatifleri (yerel pazarlar, mevsimsel beslenme, doğru gıda saklama ve yıkama yöntemleri) konusunda ailelere rehberlik yapmalıdır.

Anahtar Kelimeler: Sürdürülebilir beslenme, maternal beslenme, organik gıda tüketimi, gebelik, kadın doğum hemşireliği.

ABSTRACT

Background and Aim: Unhealthy nutrition among pregnant women is a global public health problem, and approaches addressing this issue remain insufficient, particularly in low- and middle- income countries. Since maternal nutrition plays a decisive role in fetal development and lifelong health outcomes, international organizations such as the United Nations Children's Fund (UNICEF) develop strategies to mitigate the adverse effects of maternal malnutrition. Today, environmental pollution and

industrial agricultural practices increase the risk of pregnant women being exposed to pesticides and chemical residues. In this context, sustainable maternal nutrition and organic food consumption emerge as alternative and protective approaches to safeguarding both maternal and infant health. While evidence grows that maternal diet influences the long-term health of children-even in relatively well-nourished populations-knowledge regarding the specific effects of organic food consumption during pregnancy remains limited. This review aims to examine the impact of organic food consumption during pregnancy on maternal, fetal, and neonatal health in light of current literature and to discuss the role of obstetric and gynecological nurses in this process.

Methods: This study is a literature review based on national and international research published between 2016 and 2026. The literature was selected by searching the Google Scholar database using the keywords "organic food", "pregnancy", "maternal nutrition", "sustainable diet", and "nursing".

Results: Studies indicate that the consumption of organic foods (especially organic vegetables, fruits, and dairy products) during pregnancy significantly reduces maternal urinary organophosphate pesticide levels and the risk of preeclampsia. Furthermore, due to their higher content of antioxidants and polyunsaturated fatty acids, organic foods are reported to support maternal immunity. Additionally, choosing organic food during pregnancy has been shown to decrease the incidence of congenital anomalies in infants, such as hypospadias and cryptorchidism.

Conclusion and Recommendations: Organic food consumption during pregnancy holds strong potential for protecting maternal-fetal health and building a sustainable future. Obstetric and gynecological nurses should integrate food safety and sustainability concepts into care during antenatal counseling. Furthermore, they should guide families on budget-friendly organic food alternatives, such as local markets, seasonal nutrition, and proper food preservation and washing techniques.

Keywords: Sustainable nutrition, maternal nutrition, organic food consumption, pregnancy, obstetric nursing.

GELENEKTEN BİLİME: ANADOLU'DA ANNE SÜTÜNÜ ARTIRMADA KULLANILAN YÖRESEL GIDALARIN FONKSIYONEL ÖZELLİKLERİ

FROM TRADITION TO SCIENCE: FUNCTIONAL PROPERTİES OF REGİONAL FOODS USED TO STIMULATE BREAST MILK PRODUCTION IN ANATOLİA

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ÖZET

Anne sütü, yenidoğanın sağlıklı büyümesi, gelişimi ve bağışıklık sisteminin desteklenmesi için yeri doldurulamaz, dinamik bir besin kaynağıdır. Dünya Sağlık Örgütü, bebeklerin ilk altı ay sadece anne sütüyle beslenmesini ve laktasyon sürecinin en az iki yaşına kadar sürdürülmesini önermektedir. Ancak doğum sonrası (postpartum) dönemde birçok anne, süt miktarının yetersizliği endişesi yaşamakta ve laktasyonu destekleyici arayışlara yönelmektedir. Tarih boyunca bu sorunun çözümünde, süt üretimini ve salgılanmasını artıran "galaktagog" etkili geleneksel gıdalar önemli bir rol oynamıştır. Köklü bir mutfak kültürüne sahip olan Anadolu, lohusalık döneminde anne sütünü artırmak ve annenin toparlanmasını sağlamak amacıyla tüketilen çok sayıda yöresel gıda ve içecek tarifine ev sahipliği yapmaktadır.

Bu derleme çalışmasının amacı, Anadolu'da anne sütünü artırmada yaygın olarak kullanılan yöresel gıdaları tespit etmek ve bu gıdaların galaktagog etkilerini modern gıda bilimi ve fonksiyonel bileşenler perspektifinden incelemektir. Yapılan literatür taraması sonucunda; Anadolu genelinde lohusa şerbeti, sıcak boza, tahıl bazlı çorbalar, rezene, anason, çemen otu, ısırgan otu gibi bitkisel çaylar ile belirli kuruyemiş ve meyve kompostolarının sıklıkla tercih edildiği görülmüştür. Bu gıdaların bileşiminde yer alan anetol gibi biyoaktif uçucu yağlar, polifenoller, beta-glukanlar, diyet lifleri, vitamin ve mineraller fonksiyonel özellikleriyle öne çıkmaktadır. Söz konusu fitokimyasalların, laktasyonu uyaran prolaktin ve oksitosin hormonlarının sentezini mekanizmasal olarak desteklediği, ayrıca annenin hidrasyon düzeyini optimize ederek süt hacmine olumlu katkı sağladığı klinik ve deneysel çalışmalarla doğrulanmaktadır. Sonuç olarak, Anadolu'nun geleneksel lohusa gıdaları, içerdikleri fonksiyonel bileşenlerle anne sütünü destekleyen doğal nutrasötik kaynaklardır. Bu geleneksel reçetelerin gıda sanayiine kazandırılması ve modern beslenme protokollerine entegre edilmesi, postpartum dönemdeki maternal ve bebek sağlığının korunması açısından büyük önem taşımaktadır.

Anahtar Kelimeler: Anadolu kültürü, anne sütü, galaktagog, yöresel gıdalar, lohusalık, kadın doğum hemşireliği.

ABSTRACT

Breast milk is an irreplaceable, dynamic nutrient source essential for the healthy growth, development, and immune support of newborns. The World Health Organization recommends exclusive breastfeeding for the first six months and continuing lactation up to two years of age. However, during the postpartum period, many mothers experience anxiety regarding insufficient milk supply and seek methods to support lactation. Throughout history, traditional foods with "galactagogue" effects, which stimulate milk production and secretion, have played a vital role in addressing this challenge. Anatolia, with its deep-rooted culinary heritage, hosts numerous regional food and beverage recipes consumed during the postpartum period to increase breast milk and promote maternal recovery.

The aim of this review is to identify regional foods commonly used in Anatolia to enhance breast milk production and evaluate their galactagogue effects from the perspective of modern food science and functional components. Literature reviews indicate that postpartum drinks like *lohusa şerbeti* and *kaynar*, fermented beverages like *boza*, grain-based soups, herbal teas (fennel, anise, fenugreek,

stinging nettle), and specific nut or dried fruit compotes are widely preferred across Anatolia. Bioactive volatile oils such as anethole, polyphenols, beta-glucans, dietary fibers, vitamins, and minerals within these foods stand out for their functional properties. Clinical and experimental studies confirm that these phytochemicals mechanistically support the synthesis of prolactin and oxytocin hormones, which stimulate lactation, and positively contribute to milk volume by optimizing maternal hydration. In conclusion, Anatolia's traditional postpartum foods are natural nutraceutical resources that support breastfeeding through their functional ingredients. Integrating these traditional recipes into the food industry and modern nutritional protocols is highly significant for protecting maternal and infant health in the postpartum period.

Keywords: Anatolian culture, breast milk, galactagogues, traditional foods, postpartum period, obstetric nursing.

HAYVANSAL KAYNAKLI GIDALARDA POLİKLORLU BİFENİL (PCB) KONTAMİNASYONU: GÜNCEL DURUM VE TÜKETİCİ MARUZİYETİNİN DEĞERLENDİRİLMESİ

POLYCHLORINATED BIPHENYL (PCB) CONTAMINATION IN ANIMAL-ORIGIN FOODS: CURRENT STATUS AND ASSESSMENT OF CONSUMER EXPOSURE

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ÖZET

Poliklorlu bifeniller (PCB), Stockholm Sözleşmesi kapsamında üretimi yasaklanmış olmasına karşın çevresel kalıcılıkları ve lipofilik yapıları nedeniyle besin zincirinde birikmeye devam eden kalıcı organik kirleticilerdir. İnsan maruziyetinin büyük bölümü süt, yumurta ve bal gibi hayvansal kaynaklı gıdaların tüketimiyle gerçekleşmektedir. Bu çalışmada, hayvansal kaynaklı gıdalarda PCB kontaminasyonuna ilişkin güncel literatürün derlenmesi ve tüketici maruziyetine bağlı sağlık risklerinin genel olarak değerlendirilmesi amaçlanmıştır. Bu amaçla farklı ülke ve bölgelerde yürütülen uluslararası çalışmalar incelenmiştir. Dioksin benzeri ve indikatör PCB kongenerlerine ait bildirilen veriler matris bazında bir araya getirilmiş; ortalama kontaminasyon düzeyleri ve tahmini günlük alım (EDI) değerleri hesaplanmıştır. İncelenen veriler arasında en yüksek PCB yükünün yumurtada olduğu, bunu bal ve sütün izlediği görülmüştür. Vücut ağırlığına göre maruziyet bebeklerde yetişkinlere kıyasla belirgin biçimde yüksek bulunmuştur. Bölgesel izleme verileri, gıdalardaki PCB düzeylerinin genel olarak azaldığını ve çoğunlukla yasal maksimum limitlerin altında kaldığını göstermektedir. Ancak EFSA tolere edilebilir haftalık alım (TWI) değerini önemli ölçüde düşürmüştür. Bu nedenle yasal limitlere uygun ürünlerde dahi bebek ve çocuklar gibi hassas grupların bu değeri aşabileceği bildirilmektedir. Bunun yanında çalışmalar arasında yağ bazlı normalizasyon, analiz edilen kongener sayısı ve maruziyet hesaplama yaklaşımlarındaki farklılıkların karşılaştırılabilirliği sınırladığı belirlenmiştir. Sonuç olarak, hayvansal kaynaklı gıdalarda PCB'lerin düzenli izlenmesi, standart risk değerlendirme yaklaşımlarının benimsenmesi ve hassas gruplardaki maruziyetin yakından takip edilmesi halk sağlığı açısından önem taşımaktadır.

Anahtar Kelimeler: Poliklorlu bifeniller, hayvansal kaynaklı gıdalar, tüketici maruziyeti, risk değerlendirmesi, gıda güvenliği

ABSTRACT

Polychlorinated biphenyls (PCBs) are persistent organic pollutants that, despite being banned under the Stockholm Convention, continue to accumulate in the food chain owing to their environmental persistence and lipophilic nature. Most human exposure occurs through the consumption of animal-origin foods such as milk, eggs and honey. This study aimed to compile the current literature on PCB contamination in animal-origin foods and to provide a general evaluation of the health risks associated with consumer exposure. For this purpose, international studies conducted in different countries and regions were reviewed. Reported data on dioxin-like and indicator PCB congeners were pooled by matrix, and mean contamination levels and estimated daily intake (EDI) values were calculated.

Among the data examined, the highest PCB burden was found in eggs, followed by honey and milk. Exposure relative to body weight was markedly higher in infants than in adults. Regional monitoring data indicate that PCB levels in foods have generally declined and mostly remain below legal maximum limits. However, EFSA has substantially lowered the tolerable weekly intake (TWI). Consequently, vulnerable groups such as infants and children may exceed this value even when consuming products that comply with legal limits. In addition, differences among studies in lipid normalisation, the number of congeners analysed and exposure calculation approaches were found to limit comparability. In conclusion, regular monitoring of PCBs in animal-origin foods, the adoption of standardised risk assessment approaches and close follow-up of exposure in vulnerable groups are important for public health.

Keywords: Polychlorinated biphenyls, animal-origin foods, consumer exposure, risk assessment, food safety

THE ASSOCIATION BETWEEN THE CUTANEOUS MICROBIOME AND HIDRADENITIS SUPPURATIVA

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ABSTRACT

Background Hidradenitis suppurativa is a chronic disease of the pilosebaceous unit. Patients experience multiple nodules, abscesses, and draining fistulae in intertriginous skin, which cause a significant impact on their quality of life. The skin microbiome thus plays a critical role in the induction and education of host immunity, enabling sustained tolerance to innocuous antigens, a process termed “homeostatic immunity”.

Objective To arrive at these observations, the authors examined how Polenoplasmin and Imuniplant solve hidrosadenitis suppurativa.

Materials and methods The cutaneous microbiota is a necessary component of the immune barrier, with commensal skin microorganisms preventing the colonisation and growth of pathogenic bacteria, a process known as colonisation resistance. In this review we assimilate the existing literature regarding the role played by the cutaneous microbiome in hidradenitis suppurativa to identify novel and much needed treatment strategies.

Results The pathophysiology of hidradenitis suppurativa is multifaceted and is the product of interactions between inflammation, a genetic tendency, the cutaneous microbiome, and environmental factors. Whilst it is now recognised as an autoinflammatory condition rather than an infective disease, bacteria are implicated in disease pathogenesis. Hidradenitis suppurativa skin appears to have a microbiome distinct from that of healthy skin and which is overwhelmingly populated by anaerobic Gram-negative bacteria. Further research should be undertaken examining the cutaneous and gut microbiome in hidradenitis suppurativa.

Conclusion Our research investigating the role of microbiota in the development of inflammatory skin diseases has largely focused on hidradenitis suppurativa, this may help identify potential future therapeutic targets.

Keywords: hidradenitis suppurativa, cutaneous microbiome, Polenoplasmin, Imuniplant

POMEGRANATE-DERIVEDPHOSPHORUS,NITROGEN-DOPED CARBON NANOFLOWER/NANOFIBER HYBRIDS AND QUASI SPHERICAL DOT STABILIZED PICKERING EMULSIONS WITH LOW-DS AMPHIPHILIC CMC FOR DUAL-MODE DETECTION OF PATHOGENIC BACTERIA AND THEIR METABOLIC pH SIGNATURES

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ABSTRACT

This study introduces a sustainable dual-waste valorization strategy, transforming agricultural residues (e.g. pomegranate skin and sugarcanebagasse) into amulti functional smart diagnostic platform for the real-time detection of pathogenic bacteria. Utilizing a microwave-assisted hydrothermal route, we engineered a morphological evolution from quasi-spherical nitrogen-doped carbon dots (NCQDs) to hierarchical phosphorus and nitrogen co-doped carbon nanoflower/fiber hybrids (PNCNFs). The strategic introduction of phosphorus induced lattice strain and electronic reconfiguration, resulting in a significant increase in the hydrophilic–lipophilic balance (HLB) from 5.57 to 8.95. This elevated HLB, coupled with a tailored low-degree of substitution (DS 0.4) carboxymethyl cellulose (CMC) from bagasse, optimized the stability of Pickering nanoemulsions at the rosemary essential oil/water interface. The PNCNF hybrids demonstrated a superior surface-to-volume ratio, facilitating high-density functional site accessibility for dual-mode sensing. This platform provided synchronized colorimetric and fluorometric responses to the metabolic pH signatures of Escherichia coli and Staphylococcus aureus. DFT calculations and fluorescence dynamics confirmed that the P,N-doped framework possesses high kinetic reactivity and a pH-switchable electronic structure. Beyond detection, the system showed enhanced antibacterial efficacy through the synergistic action of the hierarchical petals and encapsulated bio-actives. This research demonstrates that the controlled manipulation of biomass-derived molecular precursors provides a viable pathway for developing multifunctional nanophotonic sensors, with potential applications for real-time monitoring in food safety and clinical diagnostics

AZƏRBAYCANDA YETİŞƏN YABANI MEYVƏLƏRİN KEYFİYYƏT GÖSTƏRİCİLƏRİ VƏ QİDA TƏHLÜKƏSİZLİYİNDƏ ROLU

ПОКАЗАТЕЛИ КАЧЕСТВА ДИКОРАСТУЩИХ ФРУКТОВ, ВЫРАЩИВАЕМЫХ В АЗЕРБАЙДЖАНЕ, И ИХ РОЛЬ В ОБЕСПЕЧЕНИИ БЕЗОПАСНОСТИ ПИЩЕВЫХ ПРОДУКТОВ.

QUALITY INDICATORS AND ROLE IN FOOD SAFETY OF WILD FRUITS GROWING IN AZERBAIJAN

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XÜLASƏ

Yabanı və yarımyabanı meyvələr vitaminlər, mineral maddələr, pəhriz lifləri və bioloji fəal birləşmələrlə zəngin təbii qida mənbələridir. Azərbaycanın müxtəlif iqlim və ekoloji şəraiti böyürtkən, bağ çiyələyi və moruq kimi meyvələrin yetişməsi üçün əlverişli imkanlar yaradır. Bu meyvələrin qida dəyərinin öyrənilməsi ilə yanaşı, keyfiyyət göstəricilərinin və təhlükəsizlik səviyyəsinin qiymətləndirilməsi istehlakçı sağlamlığının qorunması baxımından mühüm əhəmiyyət daşıyır.

Tədqiqatın məqsədi Azərbaycanda yetişən böyürtkən, bağ çiyələyi və moruğun əsas keyfiyyət göstəricilərini elmi ədəbiyyat əsasında təhlil etmək, mümkün təhlükəsizlik risklərini müəyyənləşdirmək və onların azaldılmasına dair təkliflər irəli sürməkdir. İşdə təsviri ədəbiyyat təhlili və müqayisəli elmi qiymətləndirmə yanaşmasından istifadə edilmişdir. Meyvələrin orqanoleptik xüsusiyyətləri, həll olan quru maddələrin miqdarı, titrlənən turşuluq, pH göstəricisi, C vitamini və mikrobioloji təhlükəsizlik məsələləri nəzərdən keçirilmişdir. Eyni zamanda becərilmə, yığım, daşınma, saxlanma və satış mərhələlərində yarana bilən bioloji, kimyəvi və fiziki təhlükələr araşdırılmışdır.

Keyfiyyət göstəricilərinin sortdan, yetişmə dərəcəsindən, iqlim şəraitindən və yığımdan sonrakı emal və saxlanma üsullarından asılı olaraq dəyişə biləcəyi vurğulanmışdır. Təhlükəsiz istehsal təcrübələrinin genişləndirilməsi, izlənəbilənliyin təmin edilməsi, gigiyena qaydalarına riayət olunması və laboratoriya nəzarətinin gücləndirilməsi əsas təkliflər kimi irəli sürülmüşdür. Tədqiqat yerli meyvə ehtiyatlarından səmərəli istifadə zamanı keyfiyyətə nəzarət və qida təhlükəsizliyinin kompleks şəkildə qiymətləndirilməsinin vacibliyini göstərir.

Açar sözlər: yabanı meyvələr, keyfiyyət göstəriciləri, qida təhlükəsizliyi, böyürtkən, bağ çiyələyi, moruq.

РЕЗЮМЕ

Дикорастущие и полудикорастущие фрукты являются природными источниками пищи, богатыми витаминами, минералами, пищевыми волокнами и биологически активными соединениями. Разнообразные климатические и экологические условия Азербайджана создают благоприятные условия для выращивания таких фруктов, как ежевика, клубника и малина. Помимо изучения пищевой ценности этих фруктов, оценка их качественных показателей и уровня безопасности имеет большое значение для защиты здоровья потребителей.

Цель исследования – анализ основных показателей качества ежевики, клубники и малины, выращиваемых в Азербайджане, на основе научной литературы, выявление возможных рисков для безопасности и выдвижение предложений по их снижению. В исследовании использовался описательный анализ литературы и сравнительный научно-оценочный подход. Рассматривались органолептические свойства плодов, количество растворимого сухого вещества, титруемая кислотность, показатель pH, содержание витамина C и вопросы

микробиологической безопасности. Одновременно исследовались биологические, химические и физические опасности, которые могут возникнуть на этапах выращивания, сбора урожая, транспортировки, хранения и продажи.

Было подчеркнуто, что показатели качества могут варьироваться в зависимости от сорта, степени зрелости, климатических условий, а также методов послеуборочной обработки и хранения. В качестве ключевых рекомендаций были предложены расширение безопасных методов производства, обеспечение прослеживаемости, соблюдение гигиенических норм и усиление лабораторного контроля. Исследование подчеркивает важность комплексной оценки контроля качества и безопасности пищевых продуктов при эффективном использовании местных фруктовых ресурсов.

Ключевые слова: дикие ягоды, показатели качества, безопасность пищевых продуктов, ежевика, земляника, малина.

ABSTRACT

Wild and semi-wild fruits are natural food sources rich in vitamins, minerals, dietary fiber, and biologically active compounds. Azerbaijan's diverse climatic and ecological conditions create favorable environments for the growth of fruits such as blackberries, strawberries, and raspberries. In addition to studying the nutritional value of these fruits, assessing their quality indicators and safety levels is of great importance for protecting consumer health.

The aim of the study is to analyze the key quality indicators of blackberries, garden strawberries, and raspberries grown in Azerbaijan based on scientific literature, to identify potential safety risks, and to propose measures for their mitigation. The study employs a descriptive literature analysis and a comparative scientific assessment approach. Aspects such as the organoleptic properties of the fruits, soluble solids content, titratable acidity, pH levels, Vitamin C content, and microbiological safety were examined. Additionally, biological, chemical, and physical hazards that may arise during the stages of cultivation, harvesting, transportation, storage, and sale were investigated.

It has been emphasized that quality indicators can vary depending on the variety, degree of ripeness, climatic conditions, and post-harvest processing and storage methods. Key recommendations include expanding safe production practices, ensuring traceability, adhering to hygiene regulations, and strengthening laboratory oversight. The study highlights the importance of a comprehensive assessment of quality control and food safety when making efficient use of local fruit resources.

Key words: wild fruits, quality indicators, food safety, blackberry, garden strawberry, raspberry.

GIDA ATIKLARININ SÜRDÜRÜLEBİLİR DEĞERLENDİRİLMESİNDE ENZİM DESTEKLİ EKSTRAKSİYON

ENZYME-ASSISTED EXTRACTION FOR SUSTAINABLE UTILIZATION OF FOOD WASTE

Özlem AKPINAR

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ÖZET

Gıda endüstrisi atıklardan sürdürülebilir bir şekilde biyomoleküllerin elde edilmesi, atık yönetiminde önemli bir konudur. Özellikle bitkisel atıklar önemli düzeyde polisakkarit, diyet lifleri, şekerler, protein, yağ, aroma bileşikleri, pigmentler, fenolik bileşikler ve fitokimyasallar içerdiğinden alternatif fonksiyonel gıdaların geliştirilmesinde düşük maliyetli ve sürdürülebilir bir kaynak olarak hizmet edebilir. Atıkların bu değerli bileşenlerinin geri kazanılmasında ekstraksiyon temel bir faktördür ve çevreye zarar vermeyen, sürdürülebililir, yüksek verimli ve düşük maliyetli ekstraksiyon tekniklerini geliştirmek ve keşfetmek için sürekli bir çaba sarf edilmektedir. Verimli bir ekstraksiyonun süresinin kısa, uygulamasının kolay ve maliyetinin de düşük olması istenir. Ayrıca hedeflenen madde ekstraksiyon süresince kayba uğramamalı veya yapısı bozulmamalı ve ekstrakt çözücü kalıntısı içermemelidir. Bu yüzden son zamanlarda geleneksel ekstraksiyon tekniklerine alternatif olarak farklı yenilikçi ekstraksiyon teknikler araştırılmaya başlanmıştır. Araştırılan yöntemler arasında enzim destekli ekstraksiyon yöntemi, geleneksel ve diğer yenilikçi ekstraksiyon yöntemlerinin eksikliklerini tamamlamak adına organik solvent ve kimyasal kullanımını elimine ettiğinden çevre dostu alternatif bir tekniktir ve yeşil ekstraksiyon teknolojileri kategorisindedir. Ek olarak düşük sıcaklık ve ılımlı pHlarda gerçekleşmektedir. Bu yöntemde enzimler ılımlı koşullar altında, seçici olarak hammaddeye uygulanmakta ve hücre duvarının ya da bağlı olduğu bileşiklerin parçalanması ile hedeflenen maddenin serbest kalması sağlanmaktadır. Bu çalışmada enzim destekli ekstraksiyon yöntemi ele alınmıştır, yöntemin ilkeleri, verimi etkileyen parametreler ve avantajları derlenmiştir.

Anahtar Kelimeler: Atıklar, Enzimler, Biyomolekülleri, Ekstraksiyon, Sürdürülebilirlik

ABSTRACT

The sustainable extraction of biomolecules from food waste is a crucial aspect of waste management in the food industry. Especially, plant wastes contain significant levels of polysaccharides, dietary fiber, sugars, proteins, fats, flavor compounds, pigments, phenolic compounds and phytochemicals, they can serve as a low-cost and sustainable source for the development of alternative functional foods. Extraction is a fundamental factor in recovering these valuable components from waste, and continuous efforts are being made to discover and develop environmentally friendly, sustainable, high-efficiency, and low-cost extraction techniques. An efficient extraction process is desired to be short-time, easy to perform, and low-cost. Furthermore, the target substance must not undergo loss or structural degradation during the extraction process, and the extract must be free of residual solvent. For this reason, various innovative extraction techniques have recently begun to be investigated as alternatives to traditional extraction techniques. Among the methods investigated, enzyme-assisted extraction is an eco-friendly alternative technique that falls under the category of green extraction technologies, since it eliminates the use of organic solvents and chemicals, thereby addressing the shortcomings of conventional and other innovative extraction methods. Moreover, it takes place at low temperatures and moderate pH levels. In this method, enzymes are selectively applied to the raw material under mild conditions, and the target substance is released through the breakdown of the cell

wall or the compounds to which it is bound. In this study the enzyme-assisted extraction method was addressed, and its principles, parameters affecting the yield and advantages were reviewed.

Keywords: Waste, Enzymes, Biomolecules, Extraction, Sustainability

TÜRK MUTFAĞINDA YEMEK ADLARININ LEZZET BEKLENTİSİ VE KÜLTÜREL ANLAMLANDIRMADAKİ ROLÜ ÜZERİNE NİTEL BİR ARAŞTIRMA

A QUALITATIVE STUDY ON THE ROLE OF FOOD NAMES IN TASTE EXPECTATIONS AND CULTURAL MEANING-MAKING IN TURKISH CUISINE

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ÖZET

Yemek, fizyolojik bir ihtiyaç olmasının yanı sıra kültürel kimlik, toplumsal hafıza, aidiyet ve geleneklerin aktarılmasında önemli bir role sahiptir. Yemek adları ise içerik, pişirme yöntemi, kişi veya yer gibi unsurlardan türetilerek tüketici ile yemek arasındaki ilk iletişim noktalarından birini oluşturmaktadır. Bu yönüyle yemek adları, yemeğe ilişkin bilgi vermenin yanı sıra kültürel anlamların aktarılmasına da aracılık edebilmektedir. Bir yemeğin yöresini, hazırlanış biçimini, kültürel geçmişini ya da geleneksel niteliğini çağrıştıran isimler, henüz yemeği deneyimlememiş olan tüketicilerin o yemeğe ilişkin beklentiler geliştirmesine neden olabilmektedir. Nitekim araştırmalar, yemeklerin adlandırılma biçiminin duyusal algıları ve algılanan özgünlüğü etkileyebildiğini göstermektedir (Wansink ve ark., 2005; Youn ve Kim, 2017). Bu araştırmanın amacı, Türk mutfağındaki yemek adlarının tüketicilerin lezzet beklentileri ve yemeklere yükledikleri kültürel anlamlar üzerindeki rolünü incelemektir. Araştırmada nitel araştırma yaklaşımı benimsenecek olup, menülerde sıklıkla yer alan Türk yemekleri üzerinden katılımcılarla, yemek adlarına ilişkin beklentilerini ve yöresellik, geleneksellik ve kültürel aidiyet bağlamındaki çağrışımlarını ortaya koymaya yönelik yarı yapılandırılmış görüşmeler gerçekleştirilecektir. Katılımcıların araştırma kapsamında belirlenen yemekleri daha önce deneyimleme durumları dikkate alınacaktır. Elde edilen veriler tematik analiz yöntemiyle değerlendirilecektir (Braun & Clarke, 2006). Araştırmanın, yemek adlarının bireylerin lezzet beklentileri ve yemeklere ilişkin kültürel anlam oluşturma süreçlerindeki rolüne ilişkin nitel bir bakış açısı sunmasının yanı sıra, menü tasarımı, gastronomi turizmi ve yöresel mutfağın tanıtımına yönelik uygulamalar açısından alana pratik katkı sağlaması beklenmektedir.

Anahtar Kelimeler: Türk mutfağı, yemek adları, lezzet beklentisi, kültürel anlam, tüketici algısı, nitel araştırma.

ABSTRACT

In addition to being a physiological need, food plays an important role in the transmission of cultural identity, collective memory, a sense of belonging, and traditions. Dish names, in turn, are derived from elements such as ingredients, cooking methods, people, or places and constitute one of the initial points of communication between consumers and dishes. In this respect, dish names can convey cultural meanings as well as provide information about the dishes. Names that evoke a dish's region of origin, preparation method, cultural background, or traditional character may lead consumers who have not yet experienced the dish to develop expectations about it. Indeed, research shows that the way dishes are named can influence sensory perceptions and perceived authenticity (Wansink et al., 2005; Youn & Kim, 2017). This study aims to examine the role of dish names in Turkish cuisine in

consumers' taste expectations and the cultural meanings they attribute to dishes. The study will adopt a qualitative research approach, and semi-structured interviews will be conducted with participants using Turkish dishes frequently featured on menus to explore their expectations regarding dish names and the associations these names evoke in relation to regionality, traditionality, and cultural belonging. Whether participants have previously experienced the dishes selected for the study will be taken into account. The data obtained will be analysed using thematic analysis (Braun & Clarke, 2006). The study is expected to offer a qualitative perspective on the role of dish names in individuals' taste expectations and their processes of constructing cultural meanings related to dishes, while also making a practical contribution to the field through applications in menu design, gastronomy tourism, and the promotion of regional cuisine.

Keywords: Turkish cuisine, food names, taste expectations, cultural meaning, consumer perception, qualitative research.

QİDA SƏNAYESİNDƏ DAYANIQLI İNKİŞAFIN TƏMİN EDİLMƏSİNDƏ İNNOVATİV TEXNOLOGİYALARIN VƏ TULLANTILARIN TƏKRAR EMALININ ROLU

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XÜLASƏ:

Bu məqalədə rəqəmsal texnologiyaların və qida sənayesində yaranan əlavə məhsulların təkrar emal edilərək dəyərləndirilməsinin qida müəssisələrinin dayanıqlılığının artırılmasındakı rolu araşdırılır. Beynəlxalq təşkilatların hesabatlarına əsaslanaraq qida itkilərinin yaranma səbəbləri müəyyənləşdirilir və resurslardan səmərəli istifadənin təmin edilməsi üçün praktik həll yolları təhlil olunur. Azərbaycanın qida emalı müəssisələri üçün mərhələli idarəetmə modeli təklif edilir. Aparılan təhlil göstərir ki, qida itkilərinin qarşısının alınması, qida təhlükəsizliyinin təmin edilməsi və iqtisadi fəaliyyətin ölçülə bilən göstəricilər əsasında qiymətləndirilməsi dayanıqlı inkişafın əsas prioritetləridir.

Açar sözlər: qida sənayesi, dayanıqlı inkişaf, innovasiya, qida tullantıları, dövri iqtisadiyyat.

ABSTRACT:

This paper examines the role of digital technologies and food by-product valorisation in improving the sustainability of food enterprises. Based on international institutional reports, it outlines the causes of food losses and discusses practical solutions for resource efficiency. A phased management framework is proposed for Azerbaijani food processors. The analysis highlights prevention, food safety and measurable economic performance as central priorities.

Keywords: food industry, sustainability, innovation, food waste, circular economy.

АННОТАЦИЯ:

В статье рассматривается роль цифровых технологий и использования побочных продуктов в обеспечении устойчивого развития пищевой промышленности. На основе материалов международных организаций анализируются причины продовольственных потерь и возможности повышения ресурсной эффективности. Предложена поэтапная модель управления для пищевых предприятий Азербайджана. Особое внимание уделено предупреждению отходов, безопасности продукции и оценке экономических результатов.

Ключевые слова: пищевая промышленность, устойчивое развитие, инновации, отходы, циркулярная экономика.

PELEMİR EKSTRAKTI İLAVESİNİN BEYAZ EKMEĞİN ÇEŞİTLİ FİZİKOKİMYASAL ÖZELLİKLERİ VE İN VİTRO NİŞASTA SİNDİRİM KİNETİĞİ ÜZERİNE ETKİSİNİN BELİRLENMESİ

DETERMINATION OF THE EFFECTS OF PELEMIR EXTRACT ADDITION ON THE PHYSICOCHEMICAL PROPERTIES AND IN VITRO STARCH DIGESTION KINETICS

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ÖZET

Cephalaria syriaca, Türkçe'de genellikle "pelemir" adıyla bilinen, Caprifoliaceae familyasına ait tek yıllık otsu bitki türüdür. Pelemirin buğday ununa ilavesinin, elde edilen ekmeklerin biyoaktif ve tekstürel özelliklerini iyileştirdiği, aynı zamanda bayatlama ve küflenmeye karşı koruyucu bir etki gösterdiği bilinmektedir. Ayrıca, geleneksel kaynaklarda, pelemir tohumunun antidiyabetik ve hipoglisemik özellikleri olduğuna dair bilgiler de yer almaktadır. Türkiye'de yaygın olarak tüketilen beyaz ekmek, yüksek glisemik indekse (Gİ) sahip gıdalar arasında yer almaktadır. Yüksek Gİ değerine sahip gıdaların tüketimi, tip 2 diyabet, obezite, kardiyovasküler hastalıklar ve metabolik sendrom gibi çeşitli sağlık sorunlarıyla ilişkilendirilmektedir. Bu çalışmada, pelemir ilavesinin beyaz ekmeğin tahmini Gİ (tGİ) değeri üzerindeki düşürücü etkisinin in vitro sindirim yöntemi kullanılarak araştırılması amaçlanmıştır. Bu amaçla, yağı alınmış pelemir tohumu unundan (PU) etanol-su (71:29

h:h) kullanılarak pelemir ekstraktı (PE) elde edilmiştir. Elde edilen PE, beyaz un miktarı esas alınarak %0,005, %0,01 ve %0,02 oranlarında hamur formülasyonuna ilave edilmiş ve bu şekilde pelemir ekstraktı içeren beyaz ekmekler üretilmiştir. Kontrol grubu olarak PE içermeyen beyaz ekmek ve yağsız pelemir unu (%0,1 a:a beyaz una göre) ile hazırlanan ekmekler üretilmiştir. Üretilen ekmeklerin renk, nem ve glisemik indeks değerleri belirlenmiştir. Örneklerin tGİ değerlerinin belirlenmesinde örnekler sırasıyla ağız, mide ve pankreatik sindirim aşamalarını içeren in vitro sindirim işlemine tabi tutulmuş ve sindirim süresince açığa çıkan indirgen şeker miktarı, modifiye 3,5-dinitrosalisilik asit (DNS) kolorimetrik yöntemi kullanılarak belirlenmiştir. Elde edilen sonuçlara göre, ekmeklerin nem değerleri %34,70-35,91 arasında değiştiği ve PE ve PU ilavesinin ekmek nem içeriği üzerinde istatiksel olarak önemli bir etkisinin olmadığı tespit edilmiştir (P>0,05). PE ilavesi ekmek içi ve kabuğunun *L** değerlerinde istatistiksel olarak önemli bir değişikliğe (P>0,05) yol açmamıştır. Buna karşılık, PU ilavesi ile ekmek içinin *L** değeri 76,33'ten 70,89'a düşmüş ve bu değişimin istatistiksel olarak önemli (P<0,05) olduğu belirlenmiştir. Ayrıca, beyaz ekmeğin tahmin edilen tGİ değeri 96,61 olarak belirlenirken, %0,02 oranında PE ilavesi ile bu değer 73,47'ye kadar düşmüştür. PU ilaveli ekmeklerin tGİ değerindeki düşüşün PE'ye kıyasla daha sınırlı olduğu görülmüştür. Sonuç olarak, PE ilavesinin ekmeğin renk ve nem özelliklerinde önemli bir değişikliğe neden olmaksızın in vitro koşullarda belirlenen tGİ değerini düşürme potansiyeline sahip olduğu ortaya konulmuştur.

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Anahtar Kelimeler: Beyaz ekmek, pelemir, glisemik indeks, nem içeriği, renk özellikleri, tip 2 diyabet.

ABSTRACT

Cephalaria syriaca, commonly known as "pelemir" in Turkish, is an annual herbaceous plant species belonging to the Caprifoliaceae family. The incorporation of pelemir into wheat flour has been reported to improve the bioactive and textural properties of the resulting bread, while also providing protective effects against staling and mold growth. Furthermore, traditional sources have described pelemir seeds as having antidiabetic and hypoglycemic properties. White bread, which is widely consumed in Türkiye, is considered a high glycemic index (GI) food. Consumption of high GI value has been associated with various health problems including type 2 diabetes, obesity, cardiovascular diseases, and metabolic syndrome. The aim of this study was to investigate the potential of pelemir addition to reduce the GI of white bread using an in vitro digestion method. For this purpose, pelemir extract (PE) was obtained from defatted pelemir seed flour (PU) using an ethanol–water mixture (71:29, w:w). The resulting PE was incorporated into the dough formulation at concentrations of 0.005%, 0.01%, and 0.02% based on the weight of white flour, and white breads containing PE were produced. As control groups, white bread without PE and bread containing defatted pelemir flour at a level of 0.1% (w/w, based on white flour) were prepared. The color, moisture content, and estimated GI (eGI) values of the bread samples were determined. For eGI determination, the samples were subjected to sequential in vitro oral, gastric, and pancreatic digestion, and the amount of reducing sugars released during digestion was determined using a modified 3,5-dinitrosalicylic acid (DNS) colorimetric method. The results showed that the moisture content of the breads ranged from 34.70% to 35.91%, and the addition of PE and PF had no statistically significant effect on bread moisture content. PE addition did not cause a statistically significant change in the *L** values of either the crumb or crust (P>0.05). In contrast, the addition of PU decreased the *L** value of the crumb from 76.33 to 70.89, and this decrease was statistically significant (P<0.05). The in vitro eGI value of white bread was determined to be 96.61, whereas the addition of 0.02% PE reduced the eGI value to 73.47. The

decrease in eGI observed in breads containing PU was more limited compared with that observed in PE-containing breads. Overall, the results demonstrated that PE has the potential to reduce the eGI of white bread under in vitro conditions without significantly affecting its color and moisture properties.

Note: This study was supported by the Sivas Cumhuriyet University Scientific Research Projects Coordination Unit under project code SBF-2025-104.

Keywords: White bread, pelemir, glycemic index, moisture content, color properties, type 2 diabetes.

SÜD VƏ ƏT MƏHSULLARINDA EKOLOJİ TƏMİZLİYİN BİOKİMYƏVİ GÖSTƏRİCİLƏRLƏ QİYMƏTLƏNDİRİLMƏSİ

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XÜLASƏ

Süd və ət məhsullarının ekoloji təmizliyinin obyektiv qiymətləndirilməsi qida təhlükəsizliyinin təmin olunmasında mühüm əhəmiyyət daşıyır. Tədqiqatın məqsədi heyvandarlıq məhsullarının mənşəyini və keyfiyyətini əks etdirən biokimyəvi göstəricilərin — yağ turşusu profili, zülal-laktoza biomarkerləri, mioqlobin, metabolomik parametrlər və ağır metal qalıqlarının sistemləşdirilməsidir. Orqanik yetişdirmə sistemlərindən alınan süddə polidoymamış yağ turşularının, xüsusilə omeqa-3 fraksiyasının payının ənənəvi sistemlərlə müqayisədə yüksək olduğu müəyyən edilmişdir. Laktoza və zərdab zülalları heyvanın sağlamlıq statusunun qiymətləndirilməsində, mioqlobinin oksidləşmə dərəcəsi isə ətin təzəliyinin müəyyənləşdirilməsində mühüm göstəricilərdir. Sənaye zonalarına yaxın ərazilərdə istehsal olunan süd və ət nümunələrində kadmium və qurğuşun qalıqlarının yol verilən hədləri aşdığı hallar müşahidə edilir. Probiotik ştamların tətbiqi kimi bəzi bioremediasiya üsulları bu çirkləndiricilərin miqdarının azaldılmasına kömək edə bilər.

Ekoloji mənşənin qiymətləndirilməsində heyvanların yemlənməsi, su mənbələrinin və torpağın kimyəvi tərkibi də nəzərə alınmalıdır. Çirkləndiricilərin yem və su vasitəsilə heyvan orqanizminə keçməsi onların süd və əzələ toxumasında toplanmasına səbəb ola bilər. İzotop və metabolomik analizlər məhsulların coğrafi mənşəyinin və istehsal sisteminin müəyyənləşdirilməsini dəstəkləyir. Yağ turşuları, biomarkerlər və toksikoloji göstəricilərin kompleks qiymətləndirilməsi orqanik məhsulların obyektiv sertifikatlaşdırılması üçün elmi baza yaradır və Naxçıvan Muxtar Respublikası kimi ekoloji baxımdan əlverişli regionlarda praktik əhəmiyyət daşıyır.

Açar sözlər: ekoloji təmizlik, biokimyəvi göstəricilər, yağ turşuları, ağır metallar, məhsul keyfiyyəti

BUĞDAY ÇİMİ PROTEİNİ–*ARONİA MELANOCARPA* MEYVE SUYU KOMPLEKSLERİ: YAPISAL KARAKTERİZASYON, MOLEKÜLER KENETLENME VE ARTIRILMIŞ BİYOERİŞİLEBİLİRLİK

WHEATGRASS PROTEIN–*ARONIA MELANOCARPA* JUICE COMPLEXES: STRUCTURAL CHARACTERIZATION, MOLECULAR DOCKING, AND ENHANCED BIOACCESSIBILITY

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ÖZET

Aronia melanocarpa suyu (AMJ) kaynaklı antosiyaninler yüksek antioksidan potansiyele sahip olmakla birlikte, gastrointestinal sistemdeki kimyasal kararsızlıkları nedeniyle sindirim stabiliteleri zayıftır ve bağırsak biyoerişilebilirlikleri oldukça düşüktür (<%1). Bu çalışmada, buğday çimi (*Triticum aestivum*) proteini (WGP), aronya antosiyaninlerini korumak ve sindirim stabilitesini artırmak amacıyla çevre dostu ve bitki bazlı doğal bir taşıyıcı matriks olarak değerlendirilmiştir. WGP–AMJ kompleksleri farklı ağırlık oranlarında (100:25, 100:50 ve 100:100; a/a) hazırlanmış ve Fourier dönüşümlü kızılötesi (FTIR) spektroskopisi ile karakterize edilmiştir. Spektral analizler; O–H gerilme bandında (3200–3500 cm^{-1}) konsantrasyona bağlı genişleme ve Amit I/II bantlarında kaymalar sergileyerek, proteinin konformasyonel düzenlenmesiyle birlikte hidrojen bağlarının yönlendirdiği non-kovalent kompleksleşmeyi doğrulamıştır. Standart statik INFOGEST *in vitro* sindirim protokolü sonrasında, saf aronya suyunun bağırsak fazındaki toplam fenolik madde (TPC) miktarı 23,82 ± 0,47 mg GAE/g seviyesine gerilerken; WGP–AMJ 100:100 kompleksi belirgin bir koruma sağlayarak 83,81 ± 2,10 mg GAE/g TPC değerine ulaşmıştır ($p < 0,05$). Bu koruyucu etki, saf meyve suyuna kıyasla bağırsak fazında 6 kat yüksek DPPH radikal süpürme aktivitesi ve 3 kat yüksek CUPRAC indirgeme kapasitesi ile kanıtlanmıştır. Moleküler mekanizmayı atomik düzeyde aydınlatmak amacıyla pH 3,0 koşullarında buğday lektini (WGA; PDB ID: 1WGC) kullanılarak AutoDock Vina ile yürütülen kenetlenme analizlerinde, dört ana antosiyaninin karbonhidrat bağlama cebine termodinamik açıdan kararlı bağlandığı ve siyanidin-3-*O*-galaktozid (−7,821 kcal/mol) > siyanidin-3-*O*-glukozid (−7,614 kcal/mol) > siyanidin-3-*O*-rutinozid (−7,607 kcal/mol) > siyanidin-3-*O*-arabinozid (−7,505 kcal/mol) şeklinde sıralandığı belirlenmiştir. Sonuç olarak WGP kompleksleşmesi, aronya antosiyaninlerini gastrointestinal degradasyona karşı etkin şekilde koruyarak fonksiyonel gıda formülasyonları için sürdürülebilir bir taşıyıcı stratejisi sunmaktadır.

Anahtar Kelimeler: *Aronia melanocarpa*, buğday çimi proteini, *in vitro* sindirim, biyoerişilebilirlik, moleküler kenetlenme.

ABSTRACT

Anthocyanins from *Aronia melanocarpa* juice (AMJ) possess remarkable antioxidant properties; however, their severe degradation across the gastrointestinal tract results in poor digestive stability and limited bioaccessibility (<1%). This study investigated the protective efficacy of wheatgrass (*Triticum aestivum*) protein (WGP) as a plant-based delivery matrix for stabilizing aronia anthocyanins. WGP–AMJ complexes were prepared at three weight ratios (100:25, 100:50, and 100:100; w/w) and characterized by Fourier transform infrared (FTIR) spectroscopy. The spectra exhibited concentration-dependent broadening in the O–H stretching band (3200–3500 cm^{-1}) and shifts in the Amide I/II regions, confirming non-covalent, hydrogen-bond-mediated complexation accompanied by protein conformational rearrangement. Following standardized static INFOGEST *in vitro* gastrointestinal digestion, uncomplexed AMJ showed extensive phenolic loss, retaining only 23.82 ± 0.47 mg GAE/g total phenolic content (TPC) in the intestinal phase. In contrast, the WGP–AMJ 100:100 complex provided substantial intestinal protection, yielding 83.81 ± 2.10 mg GAE/g TPC ($p < 0.05$). This stabilization was corroborated by functional antioxidant preservation, displaying a sixfold increase in DPPH radical scavenging activity and a threefold increase in CUPRAC reducing capacity relative to pure juice. To elucidate atomic level mechanisms, in silico molecular docking was performed using AutoDock Vina at pH 3.0 targeting Wheat Germ Agglutinin (WGA; PDB ID: 1WGC). All four major anthocyanins demonstrated thermodynamically favorable binding into the carbohydrate-binding cavity, ranked as cyanidin-3-*O*-galactoside (−7.821 kcal/mol) > cyanidin-3-*O*-glucoside (−7.614 kcal/mol) > cyanidin-3-*O*-rutinoside (−7.607 kcal/mol) > cyanidin-3-*O*-arabinoside (−7.505 kcal/mol). In conclusion, WGP complexation effectively shields aronia anthocyanins against gastrointestinal breakdown, presenting a promising, sustainable formulation strategy for functional foods and nutraceuticals.

Keywords: *Aronia melanocarpa*, wheatgrass protein, *in vitro* digestion, bioaccessibility, molecular docking.

OIL AND WATER EMULSIONS FOR POSTHARVEST PRESERVATION AND QUALITY MAINTENANCE OF FRUITS

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ABSTRACT

Postharvest losses significantly reduce the availability, nutritional value, and economic quality of fresh fruits. Oil and water emulsions have emerged as promising approaches for extending fruit shelf life while maintaining physicochemical and sensory quality. These emulsions can form thin protective coatings on fruit surfaces, reducing moisture loss, respiration, oxidation, and microbial contamination during storage. Depending on their composition, emulsions may contain edible oils, natural extracts, proteins, polysaccharides, organic acids, or other bioactive compounds with preservation properties. The application of oil-in-water or water-in-oil emulsions can modify gas and water-vapor exchange between the fruit and surrounding environment, thereby slowing physiological deterioration. In addition, natural antimicrobial and antioxidant components incorporated into emulsions may help suppress fungal growth and delay oxidative changes, color degradation, softening, and nutrient losses. Emulsion-based coatings have been investigated for various fruits, including citrus, apples, strawberries, mangoes, tomatoes, and other highly perishable commodities. Their effectiveness depends on factors such as emulsion composition, droplet size, coating thickness, application method, storage temperature, relative humidity, and fruit type. Recent research also emphasizes the use of plant-derived oils and biodegradable materials to develop safer and more environmentally sustainable preservation systems. However, challenges remain concerning formulation stability, coating uniformity, sensory effects, regulatory requirements, and large-scale application. Overall, oil and water emulsions represent a versatile postharvest technology with potential to reduce fruit deterioration, prolong marketability, and maintain nutritional and sensory quality. Further research is needed to optimize formulations and establish standardized application conditions for commercial fruit preservation.

Keywords: Oil-in-water emulsions; Postharvest preservation; Fruit quality; Edible coatings; Shelf life; Food preservation

BOOKKEEPING PRACTICES AND FINANCIAL SUSTAINABILITY AMONG SMALLHOLDER AGRICULTURAL AND FOOD PROCESSING ENTERPRISES IN NORTH CENTRAL NIGERIA

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ABSTRACT:

Smallholder agricultural enterprises and agro-food processors form the backbone of local food security and rural economic development in sub-Saharan Africa. However, poor financial record-keeping and informal accounting practices severely hinder their operational sustainability, access to institutional credit, and market integration. This empirical study examines the nature and extent of bookkeeping practices among small-scale food production and processing micro-enterprises in North Central Nigeria. Utilizing a cross-sectional survey design across selected agricultural clusters, data were collected from food processors and farm proprietors regarding primary record-keeping mechanisms, cost identification, and inventory tracking. Findings reveal that a vast majority of operators rely on single-entry or unwritten memory-based accounting methods, leading to miscalculated production costs, unaccounted post-harvest losses, and poor profit estimation. The study demonstrates that basic financial literacy and structured bookkeeping adoption significantly enhance credit accessibility and long-term business resilience. Consequently, the study recommends tailored capacity-building programs in cost accounting and simplified bookkeeping systems for smallholder food producers to optimize agricultural supply chain efficiency.

Keywords: Agro-processing accounting, Smallholder enterprises, Bookkeeping practices, Financial sustainability, Cost management, Agricultural food security.

DIGITAL TAX ADMINISTRATION AND COMPLIANCE BEHAVIOR IN THE AGRICULTURAL AND FOOD SUPPLY CHAIN SECTOR: EVIDENCE FROM NIGERIA

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ABSTRACT

Digital tax transformation has emerged as a cornerstone policy for expanding domestic revenue mobilization in developing economies. However, integrating the informal food production, distribution, and processing sectors into modern digital tax frameworks presents distinct structural and accounting challenges. This paper evaluates the influence of digital tax administration initiatives on tax compliance behavior and revenue generation within the agricultural and food supply chain sector in Nigeria. Employing a mixed-methods research approach, primary data were gathered from tax administrators, agribusiness accountants, and commercial food enterprise managers, alongside secondary revenue performance metrics. The analysis indicates that while automated tax filing and electronic invoicing platforms reduce transaction costs and mitigate tax evasion among formal food processing corporations, significant compliance barriers remain for informal rural food distributors due to digital infrastructure gaps and limited tax accounting awareness. The paper underscores the necessity of designing inclusive, user-friendly digital tax portals integrated with agricultural accounting frameworks. Recommendations emphasize targeted tax incentives and accounting capacity building for agricultural stakeholders to foster tax compliance while supporting food sector growth.

Keywords: Digital tax administration, Agro-sector taxation, Tax accounting, Revenue mobilization, Compliance behavior.

VETERINARY GOVERNANCE AT THE HUMAN-ANIMAL HEALTH INTERFACE: A ONE HEALTH APPROACH TO GLOBAL HEALTH SECURITY

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ABSTRACT

The COVID-19 pandemic and the growing occurrence of zoonoses, antimicrobial resistance, food-borne diseases and transboundary animal diseases have highlighted the deep interlinkages between animal and human health. The One Health approach has taken this interdependence increasingly into account, but veterinary governance is not properly embedded in public health and global health security governance. This misalignment poses significant governance problems with regard to disease surveillance, antimicrobial stewardship, animal movement, livestock production, food safety, biosecurity, and zoonotic transmission. In this context, the present study explores the role and importance of veterinary governance at the human-animal health interface to support the global health security..

The research is based on a qualitative and interdisciplinary approach, involving a doctrinal and policy analysis of the relevant regulatory frameworks, institutional mechanisms, and international One Health principles. It outlines governance deficiencies and implementation difficulties, as well as opportunities to enhance the coordination between different sectors. The study concludes that veterinary governance must encompass more than just protecting animal health, and should be recognised as a significant part of preventive public health governance. Enhancing veterinary surveillance, stewardship of antimicrobial use, accountability of regulators, and institutional collaboration can aid in early detection, prevention, and control of health threats. Finally, the research suggests an improved governance structure for the One Health approach, bridging the animal–human health interface with the broader public health protection and global health security goals.

Keywords: One Health, Veterinary Governance, Human-Animal Health Interface, Global Health Security.

ÖZEL NİTELİKLERLE PAZARLANAN PAKETLİ BESİNLER DAHA SAĞLIKLI MI? BESİN PROFİLİ ve NUTRI-SCORE AÇISINDAN KARŞILAŞTIRMALI BİR DEĞERLENDİRME

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ÖZET

Paketli besinlerde "glütensiz", "diyabetik", "laktozsuz" veya "yüksek proteinli" gibi özellikler tüketici tercihlerini etkileyebilmekte; ancak bu özellikler ürünün genel besin kalitesinin daha yüksek olduğu anlamına gelmeyebilir. Bu çalışmanın amacı, marketlerde standart ve özel niteliklerle satışa sunulan paketli besinlerin besin ögesi profillerini ve Nutri-Score değerlerini karşılaştırmalı olarak değerlendirmektir. Çalışmada süt, diyabetik ürün, glütensiz ürün, yoğurt, kefir ve quark gruplarında toplam 84 adet paketli ürün incelenmiştir. Ürünlerin enerji, karbonhidrat, şeker, protein, yağ, doymuş yağ ve tuz içerikleri besin etiketlerinden elde edilmiş ve besin kaliteleri Nutri-Score sistemi kullanılarak değerlendirilmiştir. Bulgular, özel nitelikle pazarlanan ürünlerin besin profillerinin ürün grubuna göre farklılık gösterdiğini ve bu ürünlerin standart ürünlere kıyasla tutarlı bir besinsel üstünlük göstermediğini ortaya koymuştur. Yüksek proteinli sütlerde protein içeriği daha yüksek, yağ ve doymuş içeriği daha düşük bulunurken; karbonhidrat, şeker, protein, yağ, doymuş yağ ve Nutri-Score değerleri bakımından standart sütlerle anlamlı farklılıklar saptanmıştır ($p<0,05$). Glutensiz granolaların şeker içeriğinin standart granolalardan anlamlı düzeyde daha yüksek olduğu belirlenirken ($p=0,025$), glutensiz un ve yulaf ezmelerinde incelenen besin ögeleri ve Nutri-Score açısından standart ürünlere göre anlamlı bir üstünlük saptanmamıştır ($p>0,05$). Süt ürünlerinde ise özellikle meyveli çeşitlerin daha yüksek şeker içeriği ve daha olumsuz Nutri-Score değerleriyle öne çıktığı görülmüştür. Sonuç olarak, paketli bir besinin özel bir beslenme özelliği ile pazarlanması tek başına daha yüksek besin kalitesinin göstergesi sayılmamaktadır. Ürünlerin değerlendirilmesinde etiket üzerindeki tekil beyanlar yerine enerji ve besin ögesi profilinin bir bütün olarak ele alınması önem taşımaktadır. Nutri-Score bu değerlendirmeyi destekleyen pratik bir araç olmakla birlikte ürünlerin bütüncül değerlendirilmesinde tek başına yeterli olmayabilir.

Anahtar Kelimeler: Nutri-Score, Paketli Besin, Besin Kalitesi, Besin Etiketi

ABSTRACT

Packaged foods marketed with attributes such as "gluten-free," "diabetic," "lactose-free," or "high-protein" may influence consumer preferences; however, these attributes do not necessarily indicate higher overall nutritional quality. This study aimed to comparatively evaluate the nutrient profiles and Nutri-Score values of conventional packaged foods and those marketed with special nutritional attributes available in retail markets. A total of 84 packaged products, including milk, diabetic products, gluten-free products, yogurt, kefir, and quark, were evaluated. Information on energy, carbohydrate, sugar, protein, fat, saturated fat, and salt contents was obtained from nutrition labels, and the nutritional quality of the products was assessed using the Nutri-Score system. The findings demonstrated that the nutrient profiles of products marketed with special attributes varied across

product categories and did not consistently indicate a nutritional advantage over their conventional counterparts. High-protein milks had higher protein and lower fat and saturated fat contents, with significant differences observed between conventional and high-protein milks in carbohydrate, sugar, protein, fat, saturated fat, and Nutri-Score values ($p<0.05$). Gluten-free granolas had significantly higher sugar content than conventional granolas ($p=0.025$), whereas gluten-free flours and oatmeals showed no significant advantage over their conventional counterparts in terms of the evaluated nutrients or Nutri-Score ($p>0.05$). Among dairy products, fruit-flavored varieties were particularly characterized by higher sugar contents and less favorable Nutri-Score values. In conclusion, marketing a packaged food with a specific nutritional attribute should not, by itself, be considered an indicator of higher nutritional quality. Rather than relying on individual label claims, the overall energy and nutrient profile of a product should be considered when evaluating its nutritional quality. Although Nutri-Score may serve as a practical tool to support such evaluations, it may not be sufficient as a standalone measure for the comprehensive assessment of packaged foods.

Keywords: Nutri-Score, Packaged Foods, Nutritional Quality, Food Labeling

RESPONSE SURFACE OPTIMIZATION OF TEMPERATURE AND VOLTAGE FOR THE CAPILLARY ELECTROPHORETIC SEPARATION OF NITRATE AND NITRITE

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ABSTRACT

This study aimed to investigate the effects of temperature and voltage on the separation performance of nitrate and nitrite by capillary electrophoresis and to determine the optimum analysis conditions using Response Surface Methodology. Temperature and voltage were evaluated as independent variables using a Central Composite Design. Analyses were performed using a standard solution of 25 µg/mL nitrate and nitrite, a capillary column with 50 µm inner diameter and 56 cm total length, 30 mM formate buffer (pH 4), hydrodynamically injection at 50 mbar 10 s, and a UV wavelength of 210 nm. Migration time, theoretical plate numbers for nitrate and nitrite peaks, response factors, and resolution were examined as responses. Nitrate migration time ranged from 5.13 to 10.4 min. The interaction between temperature and voltage significantly (P<0.05) affected migration time; increasing voltage shortened migration time, with a more pronounced effect at lower temperatures. Increasing both temperature and voltage reduced the theoretical plate numbers for nitrate and nitrite. Nitrate and nitrite response factors increased with increasing temperature but decreased with increasing voltage. Resolution ranged from 5.00 to 6.48, with only temperature having a significant effect (P<0.05). In multi-response optimization, migration time and resolution were maintained within their experimental ranges, while theoretical plate numbers and response factors were maximized. The optimum conditions were 36 ºC and -17 kV, with a desirability value of 0.752. Validation of these optimized conditions in food matrices and evaluation of analytical performance parameters may contribute to the development of a reliable capillary electrophoretic method for determination of nitrate and nitrite.

Keywords: Resolution, theoretical plate number, migration, capillary electrophoresis, nitrate

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RELEASE BEHAVIOUR OF BIOLOGICAL GROUPS IN CAKES ENRICHED WITH SPRAY-DRIED BLUEBERRY JUICE DURING IN VITRO DIGESTION

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ABSTRACT

Bakery products are widely consumed but usually contain low levels of bioactive compounds, making them suitable carriers for functional ingredients. In this study, blueberry juice was converted into powder via spray drying, and the resultant powder was incorporated into a cake formulation at concentrations of 5% and 10%. The juice was characterized in terms of pH (3.14), titratable acidity (1.15 g/100 mL), total phenolics (1.84 mg GAE/mL), and anthocyanin content (310.56 mg/L). Spray drying resulted in a powder yield of 31.22%, characterized by low moisture content (4.23%) and high solubility (96.05%). The powder's Hausner ratio and Carr index were 1.20, and 16.20%, in an order. The powder had a phenolic content of 9.0 mg GAE/g and an anthocyanin level of 0.98 mg C3G/g. Its antioxidant capacities were measured as 47.58, 78.99, 61.78, and 42.36 µmol TE/g in the DPPH, ABTS, FRAP, and CUPRAC assays, respectively. Adding the powder raised the cake's total phenolic content from 18.42 to 86.55 mg GAE/100 g at 5%, and to 147.33 mg GAE/100 g at 10%. Anthocyanin levels were less than 1 mg/100 g in the control sample, but increased to 4.40 and 7.72 mg C3G/100 g in the enriched cakes. Adding powder resulted in cakes with a darker, more reddish color, higher moisture and hardness, and reduced chewiness and gumminess. The sensory scores for the enriched cakes remained within the acceptable range, although panelists observed a slight foreign taste at the 10% level. Release actions of functional groups, namely phenolics and anthocyanins in the enriched cakes were investigated during *in vitro* gastrointestinal tract. These findings suggest that adding spray-dried blueberry juice powder to cakes can boost their nutritional value without compromising consumer appeal.

Keywords: Blueberry juice, spray drying, powder, functional cake, anthocyanins, release properties

SIMULTANEOUS MICROWAVE-ASSISTED ENZYMATIC EXTRACTION OF THYME ESSENTIAL OIL: OPTIMIZATION THROUGH RESPONSE SURFACE METHODOLOGY AND A COMPARATIVE ASSESSMENT WITH CONVENTIONAL HYDRODISTILLATION

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ABSTRACT

Conventional hydrodistillation is the most widely used method for producing essential oils. However, exploring alternative extraction methods continues to be important because of challenges like low yields and long processing durations. This study examined the feasibility of using the simultaneous microwave-assisted enzymatic extraction (MAEE) method to obtain thyme essential oil and worked on optimizing the process conditions. Initially, various ratios of cellulase and hemicellulase enzymes were tested; yields varied from 3.57% to 4.96%, with the maximum yield obtained using a combination of both enzymes (1 mg cellulase and 1 mg hemicellulose). For microwave-assisted enzymatic extraction, the process was customized to these specific enzymes and their ratios. Furthermore, the effects of microwave power and processing time on yield were examined through Response Surface Methodology. The linear effects of both variables were significant, with processing time ($p<0.001$) proving a more decisive factor than microwave power ($p<0.05$). Quadratic terms were statistically significant ($p<0.001$), while the interaction term was not ($p>0.05$). The model showed strong explanatory capability with R^2 of 0.98 and adjusted R^2 of 0.96 ($p<0.0001$), and the lack-of-fit test was not significant. The optimal conditions were 555.27 W and 51.24 min. The model forecasted a yield of 5.57% under these conditions, and a value of 5.56% ± 0.11 was obtained in the validation

experiment. This value was roughly 1.8 times higher than the 3.14% ± 0.08 yield obtained through conventional hydrodistillation. In GC-MS analysis, the thymol content was 69.04% in conventional hydrodistillation and 79.25% in MAEE. Characteristic bands in the FTIR spectra appeared at similar wavenumbers, showing that the method did not change the core functional group structure. The oil obtained via MAEE was lighter in color (L*: 33.33 vs. 29.67) and exhibited stronger antioxidant activity (DPPH EC_{50}: 0.73 vs. 0.98 mg/mL; FRAP EC_{50}: 0.74 vs. 0.91 mg/mL). The inhibition zones of the essential oil extracted through MAEE against Staphylococcus aureus, Salmonella typhi, and Escherichia coli O157 were 34.80 mm, 35.10 mm, and 28.80 mm, respectively. These values were significantly greater than those for the oil obtained by conventional hydrodistillation (32.60 mm, 32.60 mm, and 28.30 mm) ($p<0.05$). The findings show that MAEE not only boosts yield but also results in oil that is richer in thymol and exhibits greater biological activity.

Keywords: Thyme essential oil, microwave-assisted enzymatic extraction, Response Surface Methodology, thymol.

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FOOD CONTAMINATION BY MICROPLASTICS

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ABSTRACT :

Microplastics are tiny plastic particles smaller than 5 mm that can enter food through water, soil, air, and plastic packaging. They are commonly found in seafood, fish, salt, and drinking water. Their presence in food raises concerns about human health. However, more research is needed to understand their potential effects. Reducing plastic waste and improving food safety practices can help limit contamination.

Keywords: Microplastics, food contamination, seafood, human health, food safety.

PACKAGING INNOVATION FOR PEMALANG HERITAGE CULINARY PRODUCTS

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ABSTRACT

Heritage culinary products represent not only traditional flavors and inherited recipes but also the cultural identity, history, and local values of a region. In Pemalang, traditional culinary products have considerable potential to be developed as local products with wider market reach while maintaining their traditional characteristics. However, the development of traditional culinary products also requires adaptation to the needs and preferences of modern consumers. One important aspect that can support this development is packaging innovation. Packaging is no longer limited to functioning as a wrapper or container, but also serves as product protection, information media, identity builder, and promotional tool. This study aims to examine the role of packaging innovation in developing Pemalang heritage culinary products while preserving their traditional identity and cultural values. This study uses a descriptive qualitative approach through a literature review of previous studies related to traditional food packaging, packaging design, product protection, food safety, visual identity, consumer communication, and marketing. The results indicate that packaging innovation should consider several aspects, including product protection, food-grade materials, durability, visual appeal, product information, local identity, and promotional functions. The visual elements of packaging, such as colors, illustrations, typography, symbols, and local narratives, can be adapted to communicate the characteristics and cultural identity of Pemalang heritage culinary products. In addition, information such as product descriptions, origin stories, producer contacts, social media accounts, and QR codes can strengthen communication between traditional products and modern consumers. Therefore, packaging innovation should not be limited to changes in packaging materials or shapes, but should integrate functional, aesthetic, informative, cultural, and promotional elements. Appropriate packaging can strengthen product identity, increase attractiveness and added value, support product distribution, and provide opportunities for wider market expansion while preserving the traditional character and cultural heritage of Pemalang culinary products.

KEYWORDS: packaging innovation, heritage culinary, traditional food, local identity, Pemalang, product development.

COASTAL CULINARY HERITAGE OF THE PANTURA REGION: CULTURAL IDENTITY, ECONOMIC POTENTIAL, AND PRESERVATION CHALLENGES

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ABSTRACT

The North Coast of Java (Pantura) is widely recognized as a region with rich and diverse culinary traditions shaped by the interaction of Sundanese and Javanese cultures. As a historical center of trade, transportation, and coastal livelihoods, Pantura has developed distinctive culinary characteristics that reflect its cultural diversity, maritime resources, and social history. This study aims to examine the cultural significance, economic value, and preservation challenges of Pantura's coastal cuisine. Using a descriptive qualitative approach based on literature review, the study explores the relationship between culinary traditions, local identity, and community development in the coastal areas of Java.

The findings reveal that Pantura cuisine is strongly influenced by the abundance of marine resources, resulting in a variety of seafood-based dishes that represent the livelihoods of fishing communities. Traditional foods such as nasi lengko, rumbah, burbacek, pindang gombyang, and nasi grombyang demonstrate the creativity of local communities in utilizing both marine and agricultural products. These culinary traditions function not only as sources of nutrition but also as expressions of cultural identity and historical heritage. Furthermore, coastal culinary products contribute significantly to local economic development through small and medium enterprises (SMEs), culinary tourism, and the creative economy sector. However, the sustainability of traditional cuisine faces challenges from globalization, changing consumption patterns, limited innovation, and inadequate marketing strategies.

In conclusion, Pantura's coastal culinary heritage represents a valuable cultural asset that embodies the historical, social, and economic dynamics of coastal communities. Therefore, preservation efforts through documentation, digital promotion, culinary tourism development, and stakeholder collaboration are essential to ensure the continuity of its cultural values and economic benefits for future generations.

KEYWORDS: Pantura cuisine, coastal culinary heritage, cultural identity, local economy, culinary tourism, cultural preservation.

CULINARY TOURISM VILLAGES AS A STRATEGY FOR LOCAL TOURISM AND CREATIVE ECONOMIC DEVELOPMENT IN PEMALANG REGENCY

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ABSTRACT

Culinary tourism villages represent a form of community-based tourism development that integrates local culinary heritage, cultural identity, tourism activities, and community economic empowerment. In Pemalang Regency, the diversity of culinary products associated with coastal and mountainous areas provides an important foundation for developing culinary destinations that are distinctive and locally rooted. This study aims to examine the potential and development of culinary tourism villages in Pemalang Regency by highlighting the relationship between local culinary heritage, tourism attractiveness, community participation, and creative economic development. The study employs a qualitative descriptive approach through literature review and analysis of secondary information concerning local culinary traditions, tourism potential, community-based tourism, and regional economic development. The analysis indicates that culinary tourism villages can function not merely as locations for food consumption but also as spaces for cultural interaction, preservation of local culinary knowledge, promotion of traditional products, and strengthening of community-based economic activities. The development of these destinations requires the integration of culinary products with tourism experiences, improvement of supporting infrastructure, digital promotion, enhancement of human resource capacity, and active participation of local communities. Furthermore, the development of culinary tourism villages can strengthen the competitiveness of local culinary products while creating opportunities for micro, small, and medium enterprises. Therefore, a sustainable and participatory development model is essential to ensure that culinary tourism contributes to cultural preservation, community welfare, and the long-term development of the local creative economy.

Keywords: Culinary Tourism; Tourism Village; Local Culinary Heritage; Community-Based Tourism; Creative Economy

UMKM IN THE HALAL FOOD INDUSTRIAL AREA OF PEMALANG

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ABSTRACT

Background/Aims: Micro, Small, and Medium Enterprises (MSMEs) have a central role in the development of the Halal Food Industrial Area in Pemalang because they are closely connected to local agricultural, livestock, and fisheries resources. However, MSMEs still face several challenges, including limited access to capital, product standardization, halal certification, technology adoption, and integration with larger industries. This study aims to examine the role and development needs of MSMEs in strengthening the halal value chain and supporting the development of a competitive halal food industrial area in Pemalang.

Materials/Method: This study uses a descriptive qualitative approach based on a review and analysis of information related to MSMEs, halal value chains, product standardization, halal certification, production innovation, digital technology, and business partnerships. The analysis focuses on identifying the strategic position of MSMEs, existing challenges, and potential development strategies within the halal food industrial ecosystem.

Results: The findings indicate that MSMEs function as important actors connecting local raw materials with consumers through processing and value creation. Product standardization is necessary to ensure quality, safety, consistency, and market access. Halal certification is also an important legal and competitiveness instrument for MSMEs. In addition, the adoption of appropriate production technology and digitalization can improve production efficiency, product quality, record keeping, and market access. Integration with medium and large industries through supply-chain partnerships can further strengthen MSME market access and provide more stable demand.

Conclusion/Implications: Strengthening MSMEs in the Halal Food Industrial Area of Pemalang requires an integrated approach involving standardization, halal certification, technological innovation, capacity building, and fair partnerships with larger industries. These efforts can enhance the competitiveness of local MSMEs and support the development of Pemalang as an integrated halal food processing center.

Keywords: MSMEs; Halal Value Chain; Halal Certification; Product Standardization; Digitalization; Pemalang

HARVEST-PERIOD VARIATION IN THE PHENOLIC PROFILE AND ANTIOXIDANT CAPACITY OF SUPERCRITICAL CO_2 EXTRACTS OF CULTIVATED ROSMARINUS OFFICINALIS L. FROM ALBANIA

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ABSTRACT

Rosmarinus officinalis L. is an important Mediterranean aromatic and medicinal plant rich in volatile constituents, phenolic acids, flavonoids and antioxidant diterpenes. The chemical composition of rosemary extracts may vary according to environmental conditions, plant physiological stage, harvesting period and extraction procedure. The present study evaluated the influence of harvesting period on the chemical composition and antioxidant capacity of supercritical carbon dioxide (SC-CO2) extracts obtained from cultivated rosemary collected in January and May 2025 in the Lalez Bay area, Durrës, Central Albania. Dried and ground rosemary leaves were extracted using a laboratory-scale Super C system at 150 bar and 32.5 °C for 45 min. Caffeic acid, hesperidin, rosmarinic acid, luteolin, apigenin, carnosol and carnosic acid were quantified by LC–MS. Antioxidant capacity was evaluated using ABTS, DPPH and FRAP assays and expressed as mg Trolox equivalents per gram of extract. The SC–CO_2 extracts were strongly dominated by lipophilic antioxidant diterpenes. Carnosic acid increased from 303.842 mg/g in January to 414.424 mg/g in May, while carnosol increased from 24.628 to 29.100 mg/g. Rosmarinic acid showed a small increase from 3.298 to 3.459 mg/g, whereas caffeic acid, hesperidin, luteolin and apigenin were moderately lower in May. The May extract also showed higher antioxidant capacity, reaching 300.589 mg TE/g for ABTS, 224.144 mg TE/g for DPPH and 190.728 mg TE/g for FRAP. These values were respectively 112%, 123% and 68% higher than those measured in January. The results indicate that harvesting period affected the quantitative phytochemical profile of rosemary SC–CO_2 extracts, with May appearing more favorable for recovering carnosic acid, carnosol and extracts with stronger antioxidant potential. Because the plant material was pooled and the study included two extraction replicates per harvesting period, the observed seasonal differences should be interpreted as descriptive trends requiring confirmation through additional biological replication.

Keywords: *Rosmarinus officinalis* L.; SC–CO_2 extraction; harvesting period; phenolic content; antioxidant capacity; LC–MS.

TURKISH GASTRONOMY HERITAGE IN HUNGARY: STUFFED VEGETABLES, RICE DISHES, SWEETS OF TURKISH ORIGIN AND TURKISH SPICES: PEPPER, PARSLEY, CUMIN, ANISE

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ABSTRACT

The Ottoman occupation of Hungary (1541–1686) exerted an enduring influence on Hungarian culinary culture, introducing dietary practices, ingredients, and techniques that remain integral to everyday cuisine. Stuffed cabbage, peppers, kohlrabi, and vine leaves derive from the Ottoman traditions of dolma and sarma. Likewise, the popular deep-fried flatbread served with sour cream, garlic, and cheese reflects Turkish fried-dough traditions. The savoury biscuit known as “pogácsa”, now customary at receptions and conference breaks, takes its name from the Old Turkic “bagandja,” indicating a possible pre-Ottoman lineage. Although often regarded as uniquely Hungarian, it constitutes part of a broader Turkish gastronomic legacy. Hungarian strudel similarly developed from the baklava tradition, while *bejgli*, a walnut- or poppy-seed-filled Christmas roll, is also attributed to Turkish influence.

The Hungarian dish *lecsó*—a stew of onions, peppers, tomatoes, and eggs—closely parallels the Turkish breakfast dish *menemen*. Ottoman rule also facilitated rice cultivation in sixteenth-century Hungary; by the seventeenth century, rice-based preparations, including meat served with rice, had become established components of the national diet. Tomatoes and other New World crops entered Hungarian cuisine partly through Ottoman commercial networks. Turkish cultural influence further encouraged the cultivation of almonds, sour cherries, figs, walnuts, grapes, peaches, apricots, and cherries. Among seasonings, pepper—historically termed “Turkish pepper”—is especially significant, alongside parsley, cumin, anise, and horseradish.

Today, this culinary heritage contributes substantially to tourism revenue and cultural representation. The Ottoman period in Hungary should therefore be understood not solely as an era of occupation, but also as a sustained encounter between distinct civilisations whose interaction reshaped Hungarian foodways.

Keywords: Hungary, Ottoman, Gastronomy_Heritage, Rice, Spices.

SUSTAINABLE UNDERGROUND AGROTOURISM DEVELOPMENT THROUGH PERMACULTURE PRINCIPLES: A CASE STUDY KORÇA REGION, ALBANIA

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ABSTRACT

Tourism is an important driver of rural development in Albania, especially in areas where natural landscapes, agriculture, and cultural heritage coexist. This study proposes an innovative agrotourism model in Korça region, Albania, based on permaculture and ecological sustainability. The 18.3-hectare site along the Korça–Ersekë national road integrates traditional agriculture, biodiversity conservation, landscape design, and rural tourism into a multifunctional and economically viable system. The landscape design aims to improve agricultural productivity and resilience through diverse, integrated plant communities. Organic food production is combined with protection against hazards such as wildfires, strong winds, and drought. A multilayered vegetation system of herbs, shrubs, and trees creates a stable microclimate by providing shade, fixing nitrogen, retaining moisture, and reducing climatic stress. This vegetation also protects soil from rainfall and solar exposure, supports groundwater accumulation, and reduces irrigation needs. The research uses landscape analysis, functional zoning, questionnaires, field interviews, and design software to develop a sustainable strategy. The project aims to support local economic development, environmental protection, biodiversity, and agri-food production while remaining suitable as a manageable family business. An innovative underground agrotourism concept is also proposed to improve land-use efficiency, ecological performance, and long-term maintenance.

Keywords: landscape architecture, permaculture, ecosystem sustainability, guesthouse, agrotourism, rural development, Korça.

NOHUT AQUAFABA TOZUNUN YOĞURDUN LAKTİK ASİT BAKTERİLERİNİN CANLILIĞI, ANTİOKSİDAN AKTİVİTESİ VE KALİTE ÖZELLİKLERİ ÜZERİNE ETKİLERİ

EFFECTS OF CHICKPEA AQUAFABA POWDER ON LACTIC ACID BACTERIA VIABILITY, ANTIOXIDANT ACTIVITY, AND QUALITY CHARACTERISTICS OF YOGURT

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ÖZET

Nohut aquafabası, nohut işleme sürecinin bir yan ürünü olup besin bileşimi ve teknolojik fonksiyonel özellikleri nedeniyle sürdürülebilir bir fonksiyonel bileşen olarak giderek daha fazla ilgi görmektedir. Bu çalışmada, püskürtmeli kurutma yöntemiyle elde edilen nohut aquafaba tozunun (CAP) %1, %2 ve %3 (a/a) oranlarında yoğurda ilave edilmesinin, 14 günlük soğukta depolama süresince yoğurdun fizikokimyasal, mikrobiyolojik, biyoaktif ve duyusal özellikleri üzerindeki etkileri araştırılmıştır. CAP ilavesi, yoğurdun çeşitli kalite özelliklerini önemli düzeyde etkilemiştir ($p < 0.05$). Protein içeriği kontrol grubunda %3.09 iken %3 CAP ilavesiyle %3.78'e yükselmiş, sinerez ise %70.97'den %61.60'a düşmüştür. En yüksek görünür viskozite (4708 cP), depolamanın 14. gününde %2 CAP içeren yoğurtta belirlenmiştir. CAP ilavesi ayrıca laktik asit bakterilerinin canlılığını desteklemiş ve zenginleştirilmiş yoğurtlarda depolama süresince bakteri sayıları 7 log CFU g^{-1}'nin üzerinde korunmuştur. Bunun yanı sıra, toplam fenolik madde içeriği 26.24'ten 40.82 mg GAE/100 g'a yükselirken, ABTS radikal süpürme aktivitesi 0.13'ten 0.32 µmol TE g^{-1}'ye yükselmiştir. Buna karşılık, DPPH radikal süpürme aktivitesi ve CUPRAC indirgeme antioksidan kapasitesi depolama süresince nispeten küçük değişimler göstermiştir. Duyusal değerlendirme, %2 CAP içeren yoğurdun fonksiyonel iyileştirme ile duyusal kabul edilebilirlik arasında en uygun dengeyi sağladığını göstermiştir. Genel olarak, püskürtmeli kurutulmuş nohut aquafaba tozu, yoğurdun kalitesini ve fonksiyonel özelliklerini geliştirmek ve nohut işleme yan ürünlerinin değerlendirilmesine katkı sağlamak amacıyla sürdürülebilir bir fonksiyonel bileşen olarak kullanım potansiyeline sahiptir.

Anahtar Kelimeler: Nohut aquafaba tozu; yoğurt; laktik asit bakterileri; antioksidan aktivite; toplam fenolik madde; sinerez; sürdürülebilir bileşen.

ABSTRACT

Chickpea aquafaba, a by-product of chickpea processing, has gained increasing interest as a sustainable functional ingredient due to its nutritional composition and techno-functional properties. This study investigated the effects of spray-dried chickpea aquafaba powder (CAP) supplementation (1, 2, and 3%, w/w) on the physicochemical, microbiological, bioactive, and sensory properties of yogurt during 14 days of refrigerated storage. CAP supplementation significantly affected several quality characteristics of yogurt ($p < 0.05$). Protein content increased from 3.09% in the control to 3.78% in yogurt containing 3% CAP, while syneresis decreased from 70.97% to 61.60%. The highest apparent viscosity (4708 cP) was observed in yogurt supplemented with 2% CAP after 14 days of

storage. CAP supplementation also supported the viability of lactic acid bacteria, with counts remaining above 7 log CFU g^{-1} throughout the storage period. In addition, total phenolic content increased from 26.24 to 40.82 mg GAE/100 g, while ABTS radical-scavenging activity increased from 0.13 to 0.32 µmol TE g^{-1}. DPPH radical-scavenging activity and CUPRAC reducing antioxidant capacity showed comparatively minor changes during storage. Sensory evaluation indicated that yogurt containing 2% CAP provided the most favorable balance between functional improvement and sensory acceptability. Overall, spray-dried chickpea aquafaba powder shows potential as a sustainable functional ingredient for enhancing yogurt quality and supporting the valorization of chickpea-processing by-products.

Keywords: Chickpea aquafaba powder; yogurt; lactic acid bacteria; antioxidant activity; total phenolic content; syneresis; sustainable ingredient.

TARIMSAL BİYOKÜTLE KÖKENLİ GAMA-VALEROLAKTON (GVL) KATKILI YAKITLARIN EGZOZ EMİSYONLARI VE GIDA LOJİSTİĞİNDE ÇEVRESEL GÜVENLİK AÇISINDAN DEĞERLENDİRİLMESİ

EXHAUST EMISSIONS OF AGRICULTURAL BIOMASS-DERIVED GAMMA-VALEROLACTONE (GVL) BLENDS AND ENVIRONMENTAL SAFETY EVALUATION IN FOOD LOGISTICS

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ÖZET

Gıda güvenliği ve kalitesi; tarla düzeyindeki tarımsal üretimden başlayarak işleme tesislerine, depolamaya ve soğuk zincir lojistiğine kadar uzanan tedarik zincirinin her aşamasında çevresel faktörlerden doğrudan etkilenmektedir. Hasat makineleri, sera içi nakliye ekipmanları ve gıda dağıtım araçlarında fosil yakıtların kullanılması; atmosfere yüksek konsantrasyonda karbonmonoksit (CO) ve yanmamış hidrokarbon (HC) salınmasına yol açmaktadır. Bu toksik egzoz kirleticileri, tarım havzalarında ve yükleme-boşaltma alanlarında doğrudan taze gıda yüzeylerinde ve toprakta birikerek kimyasal kontaminasyon riski doğurmaktadır. Bu sorunun bertaraf edilmesinde, tarımsal/lignoselülozik atıklardan döngüsel ekonomi modeliyle üretilen biyo-esaslı ve yüksek oksijen içeriğine sahip bir platform kimyasalı olan gama-valerolaktonun (GVL) çevre dostu yakıt katkısı olarak değerlendirilmesi büyük bir potansiyel sunmaktadır.

Bu çalışmada, gıda lojistiğinde kullanılan içten yanmalı motorların çevresel etkilerini hafifletmek amacıyla saf benzin (G100) ile hacimsel olarak %10 ve %20 oranlarında gama-valerolakton içeren yakıt karışımlarının (GGV10 ve GGV20) farklı çalışma devirlerindeki (1400–3000 rpm) egzoz emisyon karakteristikleri (CO, CO_2, NOx ve HC) deneysel olarak incelenmiştir. Elde edilen veriler, GVL ilavesiyle zenginleşen oksijen yapısının yanmayı iyileştirdiğini ve zehirli CO emisyonlarını saf benzine kıyasla ortalama %28,57 (GGV10) ve %39,33 (GGV20) oranında düşürdüğünü ortaya koymuştur. Yanmamış hidrokarbon (HC) salımında ise özellikle düşük ve orta devirlerde belirgin azalmalar elde edilmiş, GGV20 karışımı ile ortalama HC seviyesinde %14,18'lik gerileme kaydedilmiştir. İyileşen oksidasyon sürecine bağlı olarak CO_2 oranlarında ılımlı bir artış gözlenirken, yüksek yanma odası sıcaklıklarının etkisiyle NOx salımlarında artış eğilimi tespit edilmiştir. Sonuçlar, tarımsal atık kökenli GVL katkısının, gıda tedarik ve dağıtım zincirinde hava kaynaklı toksik kimyasal yükü ve yüzey kontaminasyonu riskini önemli ölçüde sınırlandırarak gıda güvenliğinin çevresel korunmasına ve sürdürülebilir yeşil gıda lojistiğine değerli katkılar sunduğunu göstermektedir.

Anahtar Kelimeler: Gama-valerolakton (GVL), Gıda Güvenliği, Egzoz Emisyonları, Yeşil Gıda Lojistiği, Çevresel Sürdürülebilirlik, Döngüsel Biyoekonomi.

ABSTRACT

Food safety and quality are inextricably linked to environmental conditions across the entire food supply chain, spanning from farm machinery and post-harvest handling to storage and cold-chain logistics. The combustion of conventional petroleum fuels in agro-transport fleets and distribution vehicles releases substantial quantities of toxic pollutants, notably carbon monoxide (CO) and unburned hydrocarbons (HC). These airborne contaminants present critical surface deposition and chemical contamination risks to raw produce, agricultural soils, and distribution hubs. In this context, utilizing gamma-valerolactone (GVL)—an oxygen-rich, bio-based platform chemical synthesised from lignocellulosic agro-waste—as a renewable blend agent provides an eco-friendly pathway to mitigate these hazards.

To address environmental risks associated with food logistics, this study experimentally examined the tailpipe emissions (CO, CO_2, NOx, and HC) of pure gasoline (G100) and gasoline blends containing 10 vol% and 20 vol% gamma-valerolactone (GGV10 and GGV20) across 1400–3000 rpm engine speeds. The experimental results demonstrated that the molecular oxygen present in GVL substantially enhanced combustion efficiency. Consequently, toxic CO emissions were reduced on average by 28.57% for GGV10 and 39.33% for GGV20 compared to G100. Unburned HC concentrations showed pronounced reductions across low-to-medium operating speeds, achieving an average overall reduction of 14.18% with GGV20. Concurrently, improved oxidation led to a moderate rise in CO_2 levels, while elevated in-cylinder thermal conditions resulted in higher NOx emissions. These findings demonstrate that valorizing agro-biomass into GVL as a fuel additive can substantially lower hazardous airborne contaminants around food transit hubs, effectively minimizing indirect chemical exposure risks and advancing environmental sustainability within green food supply systems.

Keywords: Gamma-valerolactone (GVL), Food Safety, Exhaust Emissions, Green Food Logistics, Environmental Sustainability, Circular Bioeconomy.

GOFRET ÜRÜNLERİNDE KAKAO TOZU İKAMESİNE YÖNELİK ALTERNATİF FORMÜLASYON GELİŞTİRİLMESİ

DEVELOPMENT OF AN ALTERNATIVE FORMULATION FOR COCOA POWDER SUBSTITUTION IN WAFER PRODUCTS

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ÖZET

Son yıllarda küresel kakao arzında yaşanan dalgalanmalar ve tedarik zincirindeki sorunlar, kakao bazlı hammaddelerin maliyetlerinde önemli artışlara neden olmuş ve kakao içeren gıda ürünlerinde alternatif hammadde kullanımını önemli bir araştırma alanı haline getirmiştir. Bu çalışma kapsamında, gofret yaprakları arasında kullanılan kremalarda bulunan kakao tozunun kullanım oranının azaltılması ve kakao tozunun duyusal ve fiziksel fonksiyonlarını karşılayabilecek alternatif girdiler ile ikame edilmesi amaçlanmıştır. Çalışmada, ürünün karakteristik tat, renk ve tekstür özelliklerinin korunmasıyla birlikte hammadde maliyetinin ve kakao kullanımına bağlı çevresel etkinin azaltılması hedeflenmiştir.

Çalışmada öncelikle kakao tozuna alternatif olabilecek bitkisel kaynaklı girdiler ve ekstrakt tozlar ile tat profilini destekleyici aroma vericiler belirlenmiş ve farklı ürün formülasyonları oluşturulmuştur. Oluşturulan formülasyonlar laboratuvar ölçekli denemelerle değerlendirilmiş, uygun bulunan alternatiflerin endüstriyel üretim hattındaki uygulanabilirliği test edilmiştir. Geliştirilen ürünlerde tat profili, renk ve tekstürel özellikler değerlendirilmiştir. Raf ömrü süresince meydana gelebilecek oksidatif ve tekstürel değişimler takip edilmiştir. Ayrıca mikrobiyolojik, fiziksel ve kontaminant analizleri gerçekleştirilerek alternatif formülasyonlar mevcut ürün reçetesi ile karşılaştırılmıştır.

Gerçekleştirilen çalışmalar sonucunda, kremalarda kullanılan yağı azaltılmış kakao tozunun kullanımını azaltmaya yönelik olarak bitkisel kaynaklı baz girdiler, ekstrakt tozlar ve uygun aroma vericilerden oluşan alternatif bir girdi kompozisyonu geliştirilmiştir. Geliştirilen kompozisyon ile ürünün karakteristik lezzet profili ve tekstürel özellikleri korunurken kakao tozu kullanım miktarı azaltılmıştır. Kakao tozunun alternatif hammaddelerle ikame edilmesiyle üretim maliyetlerinde iyileşme sağlanmış, aynı zamanda kakao kullanımının azaltılmasına bağlı olarak ürünün karbon ayak izinin düşürülmesine katkı sağlanmıştır. Elde edilen formülasyon altyapısının gofret kremalarının yanı sıra diğer krema gruplarına uyarlanabilirliği ortaya konulmuştur.

Anahtar Kelimeler: Kakao tozu, gofret kreması, hammadde ikamesi, ürün formülasyonu

ABSTRACT

In recent years, fluctuations in the global cocoa supply and disruptions in supply chains have led to significant increases in the cost of cocoa-based raw materials, making the use of alternative ingredients in cocoa-containing food products an important area of research. This study aimed to reduce the amount of cocoa powder used in the cream fillings between wafer sheets and to partially substitute cocoa powder with alternative ingredients capable of providing comparable sensory and physical functions. The study focused on reducing raw material costs and the environmental impact associated with cocoa use while maintaining the characteristic taste, color, and texture of the product.

Initially, plant-based ingredients and extract powders with the potential to serve as alternatives to cocoa powder were identified, together with flavorings to support the desired flavor profile, and different product formulations were developed. The formulations were evaluated through laboratory-scale trials, and the applicability of the selected alternatives under industrial production conditions was tested. The flavor profile, color, and textural properties of the developed products were evaluated. Oxidative and textural changes that could occur during shelf life were also monitored. In addition, microbiological, physical, and contaminant analyses were performed, and the alternative formulations were compared with the existing product formulation.

As a result of the study, an alternative ingredient composition consisting of plant-based base ingredients, extract powders, and suitable flavorings was developed to reduce the use of reduced-fat cocoa powder in cream fillings. The developed composition enabled a reduction in cocoa powder usage while maintaining the characteristic flavor profile and textural properties of the product. The substitution of cocoa powder with alternative ingredients resulted in an improvement in production costs and contributed to reducing the product's carbon footprint through lower cocoa consumption. Furthermore, the developed formulation approach was demonstrated to be adaptable not only to wafer cream fillings but also to other cream-based product groups.

Keywords: Cocoa powder, wafer cream filling, raw material substitution, product formulation

TÜRKİYE'DE SATIŞA SUNULAN TİCARİ BAL ÜRÜNLERİNDE KURŞUN VE KADMİYUM DÜZEYLERİ: ÇOK MARKALI BİR ICP-MS ÇALIŞMASI

LEAD AND CADMIUM LEVELS IN COMMERCIAL HONEY PRODUCTS MARKETED IN TÜRKİYE: A MULTI-BRAND ICP-MS STUDY

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ÖZET

Bal, yaygın biçimde tüketilen doğal bir ürün olup çevresel kirlilik, bitkisel kaynaklar ve işleme süreçleri aracılığıyla ağır metal biriktirebilmektedir. Bu çalışmada Türkiye'de satışa sunulan ticari bal ürünlerinde kurşun (Pb) ve kadmiyum (Cd) konsantrasyonlarının belirlenmesi, marka kimliğine bağlı olası farklılıkların değerlendirilmesi ve Pb–Cd ilişkisinin incelenmesi amaçlanmıştır. Beş yerli markaya (Marka A–E) ait, 250–2000 g aralığında gramaja sahip toplam 25 bal örneği ülke genelindeki perakende satış noktaları ve çevrimiçi platformlardan temin edilmiştir. Kapalı sistem mikrodalga yaş yakma işleminin ardından Pb ve Cd konsantrasyonları ICP-MS ile tayin edilmiştir. Yöntem doğruluğu geri kazanım testleriyle (%85–115) teyit edilmiş; Pb için LOD 0,002 µg/kg, Cd için LOD 0,0003 µg/kg olarak belirlenmiştir. İncelenen 25 örneğin tamamı AB yasal sınır değerlerine (EC 2023/915: Pb 100 µg/kg; Cd 50 µg/kg) uygun bulunmuştur. Ortalama Pb konsantrasyonu 0,0246 ± 0,0079 µg/kg, ortalama Cd konsantrasyonu ise 0,00252 ± 0,00065 µg/kg olarak saptanmıştır. Tek yönlü ANOVA analizinde markalar arasında istatistiksel olarak anlamlı bir farklılık saptanmamıştır ($p > 0,05$). Pb ile Cd arasında güçlü, pozitif yönlü bir Pearson korelasyonu gözlemlenmiştir ($r = 0,967$, $p < 0,001$); bu bulgu ortak çevresel kontaminasyon kaynaklarına işaret etmektedir. Elde edilen sonuçlar, Türk piyasasındaki ticari bal ürünlerinin güncel gıda güvenliği standartları çerçevesinde avantajlı ve homojen bir ağır metal profiline sahip olduğunu ortaya koymaktadır.

Anahtar Kelimeler: ICP-MS; bal; kurşun; kadmiyum; gıda güvenliği; marka karşılaştırması; Türkiye

ABSTRACT

Honey is a widely consumed natural product that may accumulate heavy metals through environmental contamination, floral sources, and processing. This study aimed to determine lead (Pb) and cadmium (Cd) concentrations in commercial honey products marketed in Türkiye, to evaluate potential differences associated with brand identity, and to examine the Pb–Cd relationship. A total of 25 honey samples from five domestic brands (Brands A–E; 250–2000 g) were collected from retail outlets and online platforms nationwide. Following closed-vessel microwave digestion, Pb and Cd concentrations were determined by ICP-MS. Method validation included spike-recovery tests (85–115%), with LOD values of 0.002 µg/kg (Pb) and 0.0003 µg/kg (Cd). All 25 samples complied with EU regulatory limits (EC 2023/915: Pb 100 µg/kg; Cd 50 µg/kg). Mean Pb concentration was 0.0246 ± 0.0079 µg/kg and mean Cd was 0.00252 ± 0.00065 µg/kg. One-way ANOVA revealed no statistically significant inter-brand differences for either element ($p > 0.05$). A strong positive Pearson correlation was observed between Pb and Cd ($r = 0.967$, $p < 0.001$), suggesting shared environmental contamination pathways. These findings indicate that commercial honey products in the Turkish

market display a favourable and homogeneous heavy metal profile, well within current food safety standards.

Keywords: ICP-MS; honey; lead; cadmium; food safety; brand comparison; Türkiye

ORMAN MEYVELERİ PÜRESİ İLE MODERNİZE EDİLMİŞ AŞURENİN DUYUSAL ÖZELLİKLERİNİN DEĞERLENDİRİLMESİ

EVALUATION of THE SENSORY CHARACTERISTICS of ASHURA MODERNIZED with FOREST FRUITS PUREE

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ÖZET

Aşure, Türk mutfak kültüründe önemli bir yere sahip geleneksel bir üründür. Bu çalışmada, geleneksel aşurenin orman meyvesi püresi ilavesiyle modernize edilmesinin duyusal özellikler üzerindeki etkisinin belirlenmesi amaçlanmıştır. Araştırmada klasik aşure (A1) ve orman meyveli aşure (A2) olmak üzere iki ürün hazırlanmıştır. A2 formülasyonuna eşit oranlarda böğürtlen, ahududu ve yaban mersininden hazırlanan toplam 300 g orman meyvesi püresi ilave edilmiştir. Numuneler aynı üretim koşullarında hazırlanmış ve 14 kişilik yarı eğitimli panel tarafından 1–5 puanlık ölçek kullanılarak değerlendirilmiştir. Görünüm açısından A1'in genel görünüm (4,79±0,43), renk çekiciliği (4,64±0,63) ve renk uygunluğu (4,79±0,43) puanları A2'den yüksek bulunurken, malzeme dağılımında A2 (4,93±0,27) daha yüksek puan almıştır. Koku yoğunluğu iki numunede benzer bulunmuş, geleneksel aşure kokusunda A1 (4,71±0,61) A2'den (4,14±0,95) yüksek değerlendirilmiştir. Lezzet yoğunluğu ve aroma uyumunda A1 (4,64±0,50) A2'den (4,36±0,74) yüksek; malzeme dengesi her iki numunede 4,64±0,63; tatlılık dengesi ise A2'de (4,71±0,61) A1'den (4,57±0,51) yüksek bulunmuştur. Tekstürde yumuşaklık A2'de (4,50±0,65), ağızda bırakılan his A1'de (4,64±0,63) daha yüksek puan almıştır. Genel kabul edilebilirlik A1'de 4,57±0,51, A2'de 4,36±0,93 olarak belirlenmiştir. Sonuç olarak, her iki ürünün de yüksek duyusal puanlar aldığı ve orman meyvesi püresi ilavesinin bazı duyusal özelliklerde farklılaşmaya neden olduğu belirlenmiştir. Böğürtlen, ahududu ve yaban mersininin antosiyaninler ve diğer fenolik bileşikler bakımından zengin olması ve antioksidan kapasiteye katkı sağlayabilmesi, bu meyvelerin geleneksel gıdaların fonksiyonel bileşenler açısından çeşitlendirilmesinde önemli bir potansiyele sahip olduğunu düşündürmektedir. Bu bağlamda, orman meyvesi püresi ilavesiyle geliştirilen A2 numunesi, geleneksel aşurenin duyusal kimliğini yenilikçi bir bileşenle birleştiren ve fonksiyonel gıda potansiyeli taşıyan modernize bir ürün alternatifi olarak değerlendirilebilir. Çalışma, geleneksel Türk mutfağı ürünlerinin biyoaktif bileşenler açısından zengin meyvelerle yeniden yorumlanmasının gastronomik inovasyon ve fonksiyonel ürün geliştirme açısından değerlendirilebileceğini göstermektedir.

Anahtar Kelimeler: Aşure, antioksidan, fonksiyonel gıda, duyusal analiz, gastronomik inovasyon.

ABSTRACT

Ashura is a traditional product that holds an important place in Turkish culinary culture. This study aimed to determine the effects of modernizing traditional ashura through the addition of forest fruit puree on its sensory characteristics. Two products were prepared: traditional ashura (A1) and forest fruit puree-enriched ashura (A2). A total of 300 g of forest fruit puree, prepared from equal proportions of blackberry, raspberry, and blueberry, was added to the A2 formulation. The samples

were prepared under the same production conditions and evaluated by a 14-member semi-trained panel using a 5-point scale. In terms of appearance, A1 received higher scores for overall appearance (4.79±0.43), color attractiveness (4.64±0.63), and color appropriateness (4.79±0.43), whereas A2 received a higher score for ingredient distribution (4.93±0.27). Odor intensity was similar between the two samples, while the traditional ashura odor was rated higher for A1 (4.71±0.61) than for A2 (4.14±0.95). A1 received higher scores than A2 for flavor intensity (4.64±0.50 vs. 4.36±0.74) and aroma harmony (4.64±0.50 vs. 4.36±0.74), whereas ingredient balance was rated equally for both samples (4.64±0.63). Sweetness balance was higher for A2 (4.71±0.61) than for A1 (4.57±0.51). Regarding texture, A2 received a higher score for softness (4.50±0.65), whereas A1 received a higher score for mouthfeel (4.64±0.63). Overall acceptability scores were 4.57±0.51 for A1 and 4.36±0.93 for A2. Overall, both products received high sensory scores, and the addition of forest fruit puree resulted in differences in certain sensory characteristics. The richness of blackberry, raspberry, and blueberry in anthocyanins and other phenolic compounds, as well as their potential contribution to antioxidant capacity, suggests that these fruits may have potential for diversifying traditional foods in terms of bioactive components. In this context, the A2 sample developed with the addition of forest fruit puree may be considered a modernized product alternative that combines the sensory identity of traditional ashura with an innovative ingredient and has potential for functional food development. This study demonstrates that reinterpreting traditional Turkish culinary products with fruits rich in bioactive compounds may be considered in terms of gastronomic innovation and functional product development.

Keywords: Ashura, antioxidants, functional food, sensory analysis, gastronomic innovation.

FARKLI POSTBİYOTİKLERİN *CANDİDA ALBİCANS* ÜZERİNE ANTİMİKROBİYEL ETKİLERİNİN DİSK DİFÜZYON YÖNTEMİ İLE BELİRLENMESİ

DETERMINATION OF THE ANTIMICROBIAL EFFECTS OF DIFFERENT POSTBIOTICS ON CANDIDA ALBICANS USING THE DISK DIFFUSION METHOD

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ÖZET

Son yıllarda probiyotiklerin sağlık üzerindeki olumlu etkilerinin yanı sıra, giderek artan sayıda araştırma postbiyotiklerin de sağlık alanında önemli bir potansiyele sahip olduğunu göstermektedir. Postbiyotikler, probiyotik mikroorganizmalar tarafından salgılanan veya hücresel liziz sonrasında açığa çıkan ve konak üzerinde yararlı etkiler gösterebilen biyoaktif bileşenlerdir. Bu bileşenlerin çeşitli biyolojik etkilerinin yanı sıra antimikrobiyal aktivite gösterebildikleri de bildirilmektedir. Postbiyotiklerin canlılıklarını koruma gereksiniminin bulunmaması, yüksek ısıl işlem uygulanan ürünlere daha kolay entegre edilebilmeleri, soğuk zincire ihtiyaç duymamaları ve probiyotiklere kıyasla daha uzun raf ömrüne sahip olabilmeleri güvenilir ve uygulanabilir bir alternatif olarak değerlendirilmesine katkı sağlamaktadır Diğer taraftan, *Candida* türlerinin neden olduğu fungal enfeksiyonlar önemli bir sağlık sorunudur. Özellikle *Candida albicans*, fırsatçı bir fungal patojen olarak çeşitli enfeksiyonlara neden olabilmektedir. Bu doğrultuda, *C. albicans*'a karşı etkili olabilecek alternatif antimikrobiyal bileşenlerin araştırılması önem taşımakta ve postbiyotiklerin potansiyel antimikrobiyal etkileri bu açıdan dikkat çekmektedir. Bu çalışmada, farklı mikroorganizmalardan elde edilen postbiyotiklerin *Candida albicans*'a karşı antimikrobiyal potansiyellerinin araştırılması amaçlanmıştır. Bu kapsamda *Saccharomyces cerevisiae, Bifidobacterium bifidum, Lactobacillus kefiri, Lactobacillus acidophilus* ve *Lactobacillus casei* kaynaklı postbiyotikler ile granül formdaki postbiyotik örneğinin antimikrobiyal aktiviteleri disk difüzyon yöntemi kullanılarak belirlenmiştir. Bu amaçla *C. albicans* inokulumu 0,5 McFarland bulanıklık standardına göre hazırlanarak %2 glukoz ve 0,5 µg/mL metilen mavisi içeren Mueller-Hinton Agar besiyerine inoküle edilmiştir. Postbiyotik emdirilmiş diskler besiyeri yüzeyine yerleştirilmiş ve örnekler 25 ± 0,1 °C'de 72–96 saat inkübasyona bırakılmıştır. İnkübasyon sonunda disklerin çevresinde mikroorganizma gelişiminin engellendiği inhibisyon zonları mm cinsinden ölçülerek postbiyotik örneklerinin *C. albicans*'a karşı antimikrobiyal etkinlikleri karşılaştırılmıştır. Postbiyotik örneklerinin *C. albicans*'a karşı farklı düzeylerde antimikrobiyal aktivite gösterdiği belirlenmiştir. En yüksek inhibisyon zonu *L. kefiri* kaynaklı postbiyotikte 1,30 mm olarak belirlenirken, bunu *B. bifidum* ve *L. casei* kaynaklı postbiyotikler 0,70 mm ile takip etmiştir. *L. acidophilus* ve *S. cerevisiae* kaynaklı postbiyotiklerde inhibisyon zonları sırasıyla 0,50 ve 0,40 mm olarak ölçülürken, en düşük değer granül postbiyotik örneğinde 0,20 mm olarak tespit edilmiştir. Elde edilen bulgular, postbiyotiklerin antimikrobiyal aktivite gösterdiğini ve postbiyotiklerin *C. albicans*'a karşı antimikrobiyal aktivitelerinin postbiyotik kaynağına bağlı olarak değişebileceğini ortaya koymuştur. İncelenen örnekler arasında *L. kefiri* kaynaklı postbiyotiğin en

yüksek inhibisyon zonunu oluşturduğunu göstermiştir. Sonuç olarak bu çalışma, postbiyotiklerin antimikrobiyal potansiyelinin daha iyi anlaşılmasına **katkı sağlamakta** ve farmasötik uygulamalardaki kullanımlarının optimize edilmesine yönelik bilgi sunmaktadır**.**

Anahtar Kelimeler: Postbiyotik, *C. albicans*, disk difüzyon yöntemi, antimikrobiyal aktivite

ABSTRACT

In recent years, in addition to the beneficial effects of probiotics on health, a growing body of research has demonstrated that postbiotics also have significant potential in the field of health. Postbiotics are bioactive components secreted by probiotic microorganisms or released following cellular lysis and may exert beneficial effects on the host. In addition to their various biological effects, these components have also been reported to exhibit antimicrobial activity. The fact that postbiotics do not require the maintenance of cell viability, can be more easily incorporated into products subjected to high-temperature processing, do not require a cold chain, and may have a longer shelf life than probiotics contributes to their consideration as a reliable and practical alternative. On the other hand, fungal infections caused by *Candida* species represent an important health concern. In particular, *Candida albicans* is an opportunistic fungal pathogen capable of causing a variety of infections. Therefore, the investigation of alternative antimicrobial agents that may be effective against *C. albicans* is of considerable importance, and the potential antimicrobial effects of postbiotics have attracted increasing attention in this context. This study aimed to investigate the antimicrobial potential of postbiotics derived from different microorganisms against *C. albicans*. For this purpose, the antimicrobial activities of postbiotics derived from *Saccharomyces cerevisiae*, *Bifidobacterium bifidum*, *Lactobacillus kefiri*, *Lactobacillus acidophilus*, and *Lactobacillus casei*, as well as a postbiotic sample in granular form, were evaluated using the disk diffusion method. The *C. albicans* inoculum was adjusted to a 0.5 McFarland turbidity standard and inoculated onto Mueller–Hinton Agar supplemented with 2% glucose and 0.5 µg/mL methylene blue. Disks impregnated with the postbiotic samples were placed on the agar surface, and the samples were incubated at 25 ± 0.1 °C for 72–96 h. Following incubation, the inhibition zones formed around the disks were measured in millimeters, and the antimicrobial activities of the postbiotic samples against *C. albicans* were compared. The postbiotic samples exhibited varying levels of antimicrobial activity against *C. albicans*. The largest inhibition zone was observed for the postbiotic derived from *L. kefiri* (1.30 mm), followed by those derived from *B. bifidum* and *L. casei* (0.70 mm each). The inhibition zones of postbiotics derived from *L. acidophilus* and *S. cerevisiae* were 0.50 and 0.40 mm, respectively, while the granular postbiotic sample showed the lowest inhibition zone (0.20 mm). These findings demonstrate that postbiotics exhibit antimicrobial activity against *C. albicans* and that their effectiveness may vary depending on the microbial source. Among the samples investigated, the *L. kefiri*-derived postbiotic exhibited the greatest inhibition zone. In conclusion, this study contributes to a better understanding of the antimicrobial potential of postbiotics and provides useful information for optimizing their potential use in pharmaceutical applications.

Keywords: Postbiotic, *C. Albicans*, disk diffusion method, antimicrobial activity

IDENTIFICATION OF *CBH* GENES ASSOCIATED WITH BILE SALT HYDROLASE ACTIVITY IN *LACTOBACILLUS ACIDOPHILUS* STRAIN L2

LACTOBACILLUS ACIDOPHILUS L2 SUŞUNDA SAFRA TUZU HİDROLAZ AKTİVİTESİ İLE İLİŞKİLİ *cbh* GENLERİNİN BELİRLENMESİ

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ÖZET

Lactobacillus acidophilus ve *Limosilactobacillus reuteri*, bağırsak mikrobiyotasında bulunabilen ve çeşitli probiyotik özellikler gösterebilen laktik asit bakterileridir. Bu çalışmada, üç *L. acidophilus* ve bir *L. reuteri* suşunun safra tuzu hidrolaz (BSH) aktivitesinin fenotipik olarak değerlendirilmesi ve en yüksek BSH aktivitesi gösteren suşta BSH ile ilişkili *cbh* genlerinin belirlenmesi amaçlanmıştır. Suşlar MALDI-TOF MS ile tanımlanmış ve tanımlama skorları 2,201–2,573 aralığında bulunmuştur. Seçilen suşlarda canlı hücre sayısındaki azalma pH 2 koşullarında 0,20–0,83 log birim, %0,3 (w/v) safra tuzu varlığında üç saat sonunda ise 0,26–1,20 log birim olarak belirlenmiştir. BSH aktivitesi, sodyum glikokolat (Na-GCA) ve sodyum taurokolat (Na-TCA) kullanılarak plate assay yöntemiyle değerlendirilmiştir. Tüm suşlarda her iki substrat için de pozitif hidroliz zonları gözlenmiştir. Zon çapları Na-GCA için 20–27 mm, Na-TCA için 24–32 mm arasında değişmiştir. *L. acidophilus* L2 suşu, Na-GCA ve Na-TCA için sırasıyla 27 ve 32 mm zon çapları ile incelenen suşlar arasında en yüksek BSH aktivitesini göstermiştir. *L. acidophilus* L2 suşunun Prokka ile anotlanmış taslak genomunun incelenmesi sonucunda, choloylglycine hydrolase olarak anotlanmış *cbh_1* ve *cbh_2* olmak üzere iki BSH adayı belirlenmiştir. Her iki kodlayan dizi 978 bp uzunluğunda olup 325 amino asitlik proteinleri kodlamaktadır. Tam uzunlukta protein dizi karşılaştırmalarında *cbh_1* ve *cbh_2* adaylarının, *L. acidophilus* La-14 genomunda tanımlanan ilgili BSH proteinleriyle %100 amino asit özdeşliği gösterdiği belirlenmiştir. Sonuç olarak, *L. acidophilus* L2'nin hem GCA ve TCA substratlarına karşı belirgin BSH aktivitesi göstermesi hem de genomunda referans BSH proteinleriyle %100 amino asit özdeşliği gösteren iki BSH adayı taşıması, bu suşun safra tuzu hidrolizi açısından belirgin bir fenotipik ve genomik potansiyele sahip olduğunu ortaya koymuştur.

Anahtar Kelimeler: *Lactobacillus acidophilus*, safra tuzu hidrolaz, *cbh* genleri, MALDI-TOF MS, genomik analiz

ABSTRACT

Lactobacillus acidophilus and *Limosilactobacillus reuteri* are lactic acid bacteria found in the gut microbiota that exhibit various probiotic properties. This study phenotypically evaluated bile salt

hydrolase (BSH) activity in three *L. acidophilus* and one *L. reuteri* strain, then identified the *cbh* genes responsible for BSH activity in the strain with the highest activity. We identified the strains using MALDI-TOF MS, with identification scores ranging from 2.201 to 2.573. The reduction in viable cell counts for the selected strains was 0.20–0.83 log units at pH 2 and 0.26–1.20 log units in the presence of 0.3% (w/v) bile salts after three hours. We assessed BSH activity by plate assay using sodium glycocholate (Na-GCA) and sodium taurocholate (Na-TCA). All strains showed positive hydrolysis zones for both substrates. Zone diameters ranged from 20–27 mm for Na-GCA and 24–32 mm for Na-TCA. The *L. acidophilus* L2 strain exhibited the highest BSH activity among the tested strains, with zone diameters of 27 mm and 32 mm for Na-GCA and Na-TCA, respectively. Analysis of the draft genome of *L. acidophilus* L2, annotated using Prokka, revealed two BSH enzymes designated *cbh_1* and *cbh_2*, annotated as choloylglycine hydrolase. Both coding sequences are 978 bp long and encode 325-amino-acid proteins. Full-length protein sequence comparisons revealed 100% amino acid identity between the *cbh_1* and *cbh_2* candidates and the corresponding BSH proteins identified in the *L. acidophilus* La-14 genome. Consequently, *L. acidophilus* L2 shows significant BSH activity against both GCA and TCA substrates, and its genome contains two BSH candidates with 100% amino acid identity to reference BSH proteins, demonstrating that this strain has strong phenotypic and genomic potential for bile salt hydrolysis.

Keywords: *Lactobacillus acidophilus*, bile salt hydrolase, BSH, *cbh* genes, MALDI-TOF MS, genomic analysis

GELECEĞİN PROTEİN KAYNAKLARI: YENİLEBİLİR BÖCEKLER ve ALG BAZLI BİLEŞENLER

FUTURE PROTEIN SOURCES: EDIBLE INSECTS AND ALGAE-BASED INGREDIENTS

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ÖZET

Dünya nüfusunun artması, doğal kaynakların azalması ve geleneksel hayvansal üretimin çevre üzerindeki etkileri, yeni protein kaynaklarının araştırılmasını önemli hale getirmiştir. Bu çalışmada, geleceğin protein kaynakları arasında değerlendirilen yenilebilir böcekler ve alg bazlı bileşenler ele alınmıştır. Çalışmada bu kaynakların protein içerikleri, besinsel özellikleri, sürdürülebilirlik açısından sağladıkları avantajlar ve gıda alanındaki kullanım olanakları incelenmiştir. Yenilebilir böcekler, yüksek protein ve esansiyel amino asit içerikleriyle dikkat çekmektedir. Ayrıca geleneksel hayvansal üretime göre daha az yem, su ve arazi gerektirmeleri önemli bir avantaj olarak değerlendirilmektedir. Bununla birlikte böcek tüketimine yönelik tüketici kabulünün düşük olması, gıda güvenliği, alerjenite ve mevzuat konuları önemli sınırlılıklar arasında yer almaktadır. Algler de alternatif protein kaynakları içinde öne çıkan seçeneklerden biridir. Özellikle Spirulina, yüksek protein içeriği ve esansiyel amino asitleri bakımından dikkat çekmektedir. Makroalgler ise protein ve biyoaktif bileşen içerikleri nedeniyle farklı gıda uygulamalarında kullanılabilmektedir. Alglerin makarna, içecek ve çeşitli fonksiyonel gıdalarda kullanılması, bu kaynakların gıda endüstrisindeki potansiyelini göstermektedir. Sonuç olarak, yenilebilir böcekler ve alg bazlı bileşenler, hem besinsel özellikleri hem de sürdürülebilir üretim potansiyelleri nedeniyle gelecekte protein ihtiyacının karşılanmasına katkı sağlayabilecek alternatiflerdir. Ancak bu kaynakların yaygınlaşması için tüketici kabulünün artırılması, gıda güvenliği ve alerjenite risklerinin değerlendirilmesi ve uygun mevzuatın geliştirilmesi gerekmektedir. Gelecekte farklı alternatif protein kaynaklarının birlikte değerlendirilmesi, protein ihtiyacının karşılanmasında daha çeşitli bir yaklaşım sağlayabilmektedir.

Anahtar Kelimeler: Alternatif protein, yenilebilir böcekler, entomofaji, algler, Spirulina, sürdürülebilir beslenme

ABSTRACT

The increase in the world population, the depletion of natural resources, and the environmental impacts of conventional animal production have made the search for new protein sources increasingly important. This study examines edible insects and algae-based components as alternative protein sources for the future. Their protein contents, nutritional properties, advantages in terms of

sustainability, and potential applications in the food sector are discussed. Edible insects attract attention due to their high protein and essential amino acid contents. Their lower requirements for feed, water, and land compared with conventional animal production are also considered an important advantage. However, low consumer acceptance of insect consumption, food safety, allergenicity, and regulatory issues are among the main limitations. Algae are another promising group of alternative protein sources. In particular, Spirulina stands out due to its high protein content and essential amino acids. Macroalgae can also be used in different food applications because of their protein and bioactive compound contents. The use of algae in pasta, beverages, and various functional foods demonstrates their potential in the food industry. In conclusion, edible insects and algae-based components can contribute to meeting future protein needs due to their nutritional properties and sustainable production potential. However, increasing consumer acceptance, evaluating food safety and allergenicity risks, and developing appropriate regulations are necessary for their wider use. Considering different alternative protein sources together may provide a more diverse approach to meeting future protein requirements.

Keywords: Alternative protein, edible insects, entomophagy, algae, Spirulina, sustainable nutrition

AZERBAYCAN'DA HAZAR DENİZİ'NDE BULUNAN MERSİN BALIĞI VE HAVYARINDA AĞIR METAL DÜZEYLERİNİN BELİRLENMESİ

DETERMINATION OF HEAVY METAL LEVELS IN STURGEON FISH AND CAVIAR FOUND IN THE CASPIAN SEA IN AZERBAIJAN

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ÖZET

Ağır metaller, çevrede doğal olarak bulunabilen ve antropojenik faaliyetler sonucunda gıda zincirine taşınabilen önemli çevresel kirleticiler arasında yer almaktadır. Özellikle kurşun (Pb) ve kadmiyum (Cd) gibi elementler, gıdalarda belirli düzeylerin üzerinde bulunmaları durumunda insan sağlığı ve gıda güvenliği açısından önem taşımaktadır. Su ürünleri ise yaşadıkları ortamdan çeşitli kirleticileri bünyelerinde biriktirebilmeleri nedeniyle ağır metal kontaminasyonunun izlenmesinde önemli gıda gruplarından biridir. Bu çalışmada, Azerbaycan'da Hazar Denizi'nde bulunan mersin balığı ve mersin balığı havyarında ağır metal düzeylerinin belirlenmesi amaçlanmıştır.

Çalışma kapsamında Azerbaycan'ın Hazar Denizi'nden elde edilen mersin balığı ve mersin balığı havyarı örnekleri incelenmiştir. Numunelerin laboratuvar analizleri öncesinde uygun koşullarda hazırlanması ve homojenleştirilmesinin ardından ağır metal analizleri gerçekleştirilmiştir. Analizlerde kurşun (Pb) ve kadmiyum (Cd) düzeylerinin belirlenmesine yönelik instrumental analiz yöntemi kullanılmıştır. Elde edilen sonuçlar, incelenen ürünlerde ağır metal düzeylerinin değerlendirilmesine olanak sağlamıştır.

Mersin balığı örneklerinde Pb konsantrasyonunun aritmetik ortalaması 0,01435 mg/kg olarak belirlenmiş, minimum değer 0,008 mg/kg ve maksimum değer 0,020 mg/kg olarak tespit edilmiştir. Mersin balığı örneklerinde Cd ise tespit edilebilir düzeyde bulunmamıştır. Mersin balığı havyarında yapılan analizlerde ise Pb düzeyi 0,015 mg/kg olarak belirlenirken, Cd düzeyi 0,0047 mg/kg olarak ölçülmüştür. Elde edilen bulgular, incelenen mersin balığı ve havyarı örneklerinde Pb ve Cd düzeylerinin laboratuvar analizleri kapsamında belirlenebilir düzeylerde olduğunu göstermektedir. Çalışma sonucunda elde edilen verilerin, Hazar Denizi'nden elde edilen su ürünlerinin ağır metal düzeylerinin izlenmesi ve Azerbaycan'da gıda güvenliği çalışmalarına katkı sağlaması açısından önemli olduğu düşünülmektedir.

Anahtar Kelimeler: Ağır metal, kurşun, kadmiyum, mersin balığı, havyar, Hazar Denizi, gıda güvenliği

ABSTRACT

Heavy metals are among the important environmental contaminants that can occur naturally in the environment and enter the food chain as a result of anthropogenic activities. In particular, elements such as lead (Pb) and cadmium (Cd) are of concern in terms of human health and food safety when present in foods above certain levels. Fishery products are important food groups for monitoring heavy metal contamination because they can accumulate various contaminants from their surrounding environment. The aim of this study was to determine the heavy metal levels in sturgeon fish and sturgeon caviar found in the Caspian Sea in Azerbaijan.

Within the scope of the study, sturgeon fish and sturgeon caviar samples obtained from the Caspian Sea in Azerbaijan were examined. Following the preparation and homogenization of the samples under appropriate conditions prior to laboratory analysis, heavy metal analyses were performed. An instrumental analytical method was used to determine the levels of lead (Pb) and cadmium (Cd). The obtained results enabled the evaluation of heavy metal levels in the analyzed products.

In sturgeon fish samples, the arithmetic mean concentration of Pb was determined to be 0.01435 mg/kg, with a minimum value of 0.008 mg/kg and a maximum value of 0.020 mg/kg. Cadmium (Cd) was not detected at a detectable level in the sturgeon fish samples. In the sturgeon caviar samples, the Pb level was determined to be 0.015 mg/kg, while the Cd level was measured as 0.0047 mg/kg. The findings indicate that the levels of Pb and Cd in the analyzed sturgeon fish and caviar samples were detectable within the scope of the laboratory analyses. The data obtained from this study are considered important for monitoring heavy metal levels in fishery products obtained from the Caspian Sea and for contributing to food safety studies concerning aquatic products in Azerbaijan.

Keywords: Heavy metals, lead, cadmium, sturgeon fish, caviar, Caspian Sea, food safety

TÜRKİYE'DE YETİŞTİRİLEN FARKLI SUSAM TÜRLERİ VE GIDA ENDÜSTRİSİNDE KULLANIM ALANLARI

DIFFERENT SESAME VARIETIES GROWN IN TURKEY AND THEIR USES IN THE FOOD INDUSTRY

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ÖZET

Susam (*Sesamum indicum L.),* kendi kendine tozlaşan yıllık bir bitki olup dünyada en önemli yağlık tohum bitkilerinden biri olarak kabul edilmektedir. İlk kez M.Ö. 2250 yılında Hindistan'da kültüre alınan susam, günümüzde Asya, Afrika ve Orta Doğu başta olmak üzere pek çok ülkede yaygın biçimde yetiştirilmektedir. Türkiye'de ise Ege, Akdeniz ve Güneydoğu Anadolu bölgelerinde önemli üretim miktarlarına ulaşılmaktadır. Bu derleme çalışmasında Türkiye'de yetiştirilen farklı susam türlerinin (siyah, beyaz ve altın susam) kimyasal ve fiziksel özellikleri, biyoaktif bileşenleri ile gıda endüstrisinde başlıca kullanım alanları olan tahin ve susam yağı incelenmiştir. Susam tohumlarının yüksek yağ (%40-60), kaliteli protein ve sesamin, sesamolin, lignan, tokoferol gibi biyoaktif bileşikler açısından zengin yapısı ile tahin ve susam yağı üretimindeki önemi ortaya konulmuştur. Farklı tohum rengi ve çeşitlerine göre kimyasal bileşim farklılıkları da literatür bulguları çerçevesinde değerlendirilmiştir.

Anahtar Kelimeler: Susam, Sesamum indicum, siyah susam, beyaz susam, altın susam, tahin, susam yağı, lignan

ABSTRACT

Sesame (*Sesamum indicum L.)* is a self-pollinating annual plant and one of the most important oilseed crops in the world. First cultivated in India around 2250 BC, sesame is today widely grown in Asia, Africa and the Middle East, as well as in Turkey, particularly in the Aegean, Mediterranean and Southeastern Anatolia regions. In this review, the chemical and physical properties, bioactive components and main food industry applications—namely tahini and sesame oil production—of different sesame varieties grown in Turkey (black, white and golden sesame) are examined. The rich composition of sesame seeds in terms of high oil content (40–60%), quality protein, and bioactive compounds such as sesamin, sesamolin, lignans and tocopherols, as well as their importance in tahini and sesame oil production, are discussed. Differences in chemical composition based on seed color and variety are also evaluated within the framework of current literature findings.

Keywords: Sesame, Sesamum indicum, black sesame, white sesame, golden sesame, tahini, sesame oil, lignan

MOLECULAR AND IMMUNOLOGICAL APPROACHES FOR DETECTING FOODBORNE PARASITES IN MEAT AND ANIMAL-DERIVED PRODUCTS: A REVIEW

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ABSTRACT

Parasites transmitted through meat remain a food safety and public health concern, and they cause economic losses at slaughter. Classical control relies on carcass inspection, microscopy and artificial digestion. These methods are reliable for some parasites, but they have limited sensitivity, depend on the inspector, and cannot always identify species or viability. This review summarizes molecular (PCR, real-time and digital PCR, LAMP, RPA, CRISPR-based assays) and immunological (ELISA and related serological tests) approaches for detecting *Toxoplasma gondii*, *Trichinella* spp. and *Taenia saginata* (*Cysticercus bovis*) in meat and animal-derived products. For each parasite we compare classical, molecular and serological tools, report published detection limits, and discuss practical issues such as DNA extraction from meat, sampling error, viability, cost and validation. Artificial digestion remains the reference for *Trichinella* in routine testing, whereas molecular assays add speed, species identification and sensitivity at low parasite loads. For *T. gondii* and *C. bovis*, where no fully standardized routine test exists for food, combining farm-level serology or enhanced inspection with molecular confirmation appears the most realistic strategy. Validation in food matrices and cost-effective field formats are the main gaps.

Keywords: foodborne parasites; meat safety; PCR; LAMP; ELISA; Toxoplasma gondii; Trichinella; Taenia saginata

DETECTION OF HONEY BEE PARASITES AND THEIR DNA TRACES IN HONEY AND HIVE PRODUCTS: MOLECULAR METHODS FOR COLONY HEALTH SURVEILLANCE AND FOOD SAFETY ASSURANCE

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ABSTRACT

Honey bee parasites such as *Varroa destructor* and *Nosema* spp. (*N. apis* and *N. ceranae*) threaten colony health and, indirectly, the supply and quality of honey and other hive products. Classical diagnosis relies on mite counts and microscopic spore counts, which are inexpensive and standardized but need sampling of bees, are labour-intensive and cannot distinguish *Nosema* species. This review summarizes molecular approaches for bee parasites, including multiplex PCR, real-time PCR and droplet digital PCR, and the use of honey and hive debris as non-invasive sources of environmental DNA (eDNA). We compare published performance figures, including the higher detection rate of PCR over microscopy and the lack of harmonization between laboratories, and discuss sampling, DNA extraction from honey and the interpretation of positive results. Honey eDNA can detect several pathogens, parasites and pests at national and international scales, but findings differ between studies and DNA detection does not prove active infection. Because bee parasites are not human foodborne hazards, their relevance to food analysis lies in colony health monitoring, quality assurance and the development of rapid, non-invasive tools, together with other honey DNA applications such as origin authentication. Standardized extraction, quantitative assays and links between DNA signals and colony infection levels are the main research needs.

Keywords: honey; Varroa destructor; Nosema ceranae; environmental DNA; PCR; digital PCR; food safety assurance

OHMİK ISITMA DESTEKLİ GLİKASYON İLE HAZIRLANAN BEZELYE PROTEİNİ-GAM ARABİK KONJUGATLARININ TEKNO-FONKSİYONEL ÖZELLİKLERİ

TECHNO-FUNCTIONAL PROPERTIES OF PEA PROTEIN-GUM ARABIC CONJUGATES PREPARED BY OHMIC HEATING-ASSISTED GLYCATION

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ÖZET

Bezelye (*Pisum sativum*) proteini, besleyici değeri ve düşük alerjenite riski sayesinde önemli bir bitkisel protein kaynağıdır. Bununla birlikte, sınırlı çözünürlük ve düşük fonksiyonel özellikleri, gıda endüstrisindeki kullanımını kısıtlayabilmektedir. Proteinlerin polisakkaritlerle glikasyonu, fonksiyonel özelliklerin geliştirilmesinde kullanılan yaklaşımlardan biridir. Bu çalışmada, bezelye proteininin Gam Arabik (GA) ile glikasyonu sırasında ohmik ısıtma uygulamasının proteinin fonksiyonel özellikleri üzerindeki etkisinin araştırılması amaçlanmıştır. Ohmik ısıtmanın hızlı ve homojen ısı üretmesi ve enerji verimliliği sağlaması, geleneksel ısıtma yöntemlerine alternatif bir proses olarak değerlendirilmesini mümkün kılmaktadır. Bu kapsamda, ohmik ısıtma 10, 15 ve 20 V/cm elektrik alan şiddetlerinde 60 ve 90 dakika uygulanmış; örnekler geleneksel ısıtma ile 60 ve 90 dakika işlem görmüş gruplar ve işlem uygulanmamış kontrol ile karşılaştırılmıştır. Örneklerin çözünürlük, emülsifiye edici aktivite indeksi (EAI), emülsifiye stabilite indeksi (ESI), köpürme kapasitesi, köpük stabilitesi, su tutma kapasitesi (WHC) ve yağ tutma kapasitesi (OHC) belirlenmiştir. Çözünürlük en yüksek OH15-60 grubunda (%53,20), en düşük OH20-90 grubunda (%39,40) bulunmuştur. EAI ve ESI değerleri sırasıyla OH15-60 (21,40 m^2/g) ve OH10-90 (34,06 dk) gruplarında en yüksek değerlerine ulaşmıştır. Köpürme kapasitesi OH20-90 grubunda (%66,67), köpük stabilitesi ise OH10-60 grubunda (%55,56) en yüksek bulunmuştur. Ayrıca, en yüksek WAC OH15-60 (1,72), OAC ise OH15-90 (3,02) grubunda belirlenmiştir. Bulgular, ohmik ısıtma koşullarının bezelye proteini–GA sisteminin fonksiyonel özelliklerini elektrik alan şiddeti ve işlem süresine bağlı olarak farklı şekilde etkilediğini ve glikasyonun bitkisel proteinlerin teknolojik özelliklerinin geliştirilmesinde değerlendirilebileceğini göstermektedir.

Anahtar Kelimeler: Bezelye proteini, Gam Arabik, Glikasyon, Maillard reaksiyonu, ohmik ısıtma, fonksiyonel özellikler.

ABSTRACT

Pea (*Pisum sativum*) protein is an important plant-based protein source due to its nutritional value, and low risk of allergenicity. However, its limited solubility and certain functional properties can restrict its use in the food industry. The glycation of proteins with polysaccharides is one of the approaches used to enhance functional properties. In this study, the aim was to investigate the effect of ohmic heating on the functional properties of pea protein during its glycation with Gum Arabic (GA). The ability of ohmic heating to generate rapid and homogeneous heat and provide energy efficiency makes it a viable alternative to traditional heating methods. In this context, ohmic heating was applied for 60 and 90 minutes at electric field strengths of 10, 15, and 20 V/cm; the samples were compared with groups treated with conventional heating for 60 and 90 minutes and with an untreated control. The samples were evaluated for solubility, emulsifying activity index (EAI), emulsifying stability index (ESI), foaming capacity, foam stability, water-holding capacity (WHC), and oil-holding capacity (OHC). Solubility was highest in the OH15-60 group (53.20%) and lowest in the OH20-90 group (39.40%). The EAI and ESI values reached their highest levels in the OH15-60 (21.40 m^2/g) and OH10-90 (34.06 min) groups, respectively. Foaming capacity was highest in the OH20-90 group (66.67%), while foam stability was highest in the OH10-60 group (55.56%). Additionally, the highest WAC was determined in the OH15-60 group (1.72), and the highest OAC in the OH15-90 group (3.02). The findings indicate that ohmic heating conditions affect the functional properties of the pea protein–GA system differently depending on electric field intensity and processing time, and that glycation can be utilized in improving the technological properties of plant proteins.

Keywords: Pea protein, gum arabic, glycation, Maillard reaction, ohmic heating, functional properties.

PEYNİRALTI SUYUNUN *LACTOBACİLLUS CASEİ* İLE FERMENTASYONU VE *C. ALBİCANS* ÜZERİNE ETKİSİNİN İNCELENMESİ

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ÖZET

Süt endüstrisinin en büyük hacimli yan ürünü olan peyniraltı suyunun (PAS), laktik asit bakterileri ile fermente edilerek katma değerli postbiyotiklere dönüştürülmesi, çevresel atık yönetimi ve yeni nesil antimikrobiyal stratejiler açısından büyük önem taşımaktadır. Son yıllarda çoklu ilaç direnci gösteren fırsatçı patojen *Candida albicans* enfeksiyonlarının tedavisinde doğal alternatiflere duyulan ihtiyaç ciddi oranda artmıştır. Bu çalışmada, farklı oranlarda steril yağsız süt içeren PAS matrislerinin *Lacticaseibacillus casei* ile fermentasyonu sonucu elde edilen hücresiz süpernatantların (CFS), *C. albicans* üzerindeki in vitro antifungal etkisi araştırılmıştır. Bu doğrultuda, tamamen saf PAS ve artan oranlarda süt içeren dört farklı deneysel formülasyon 10^5 kob/mL L. casei ile aşılanarak 35 °C'de statik inkübasyona bırakılmıştır. İnkübasyonun logaritmik tepe noktası olan 24. saatte izole edilen postbiyotik sıvıların etkinliği, modifiye edilmiş CLSI disk difüzyon yöntemiyle test edilmiştir. Analizler sonucunda, en yüksek hücresel biyokütle yoğunluğuna (7.89 $\log_{10}$ kob/mL) protein ve tamponlama kapasitesi artırılmış kısmi süt takviyeli grupta (75 mL PAS + 25 mL Süt) ulaşılmıştır. Buna karşılık, en geniş antifungal inhibisyon zonu (2.4 mm) sadece saf PAS içeren grupta gözlemlenmiştir. Ortamdaki süt oranı ve dolayısıyla tamponlama kapasitesi arttıkça, inhibisyon zon çapı kademeli olarak 1.1 mm'ye kadar gerilemiştir. Bu durum, *L. casei* hücre çoğalmasını maksimize eden besin koşulları ile, ortamdaki organik asitlerin patojen zarına nüfuz edebilen "disosiye olmamış" (aktif) formda kalmasını sağlayan stres koşullarının birbirinden farklı olduğunu göstermektedir. Sonuç olarak saf PAS, *C. albicans*'a karşı kullanılabilecek güçlü ve doğal bir biyoterapötik ajana dönüştürülme potansiyeli taşımaktadır.

Anahtar Kelimeler: Peyniraltı suyu, *Lacticaseibacillus casei*, *Candida albicans*, Postbiyotik, Antifungal aktivite, Atık valorizasyonu.

ABSTRACT

The biotransformation of cheese whey (CW), the largest volume byproduct of the dairy industry, into value-added postbiotics through fermentation with lactic acid bacteria is of great importance for environmental waste management and novel antimicrobial strategies. In recent years, the need for natural alternatives in the treatment of opportunistic *Candida albicans* infections, which increasingly exhibit multidrug resistance, has grown significantly. This study investigated the in vitro antifungal effect of cell-free supernatants (CFS) obtained from the fermentation of CW matrices containing

different ratios of sterile skim milk by Lacticaseibacillus casei against *C. albicans*. Accordingly, four different experimental formulations containing purely pure CW and increasing ratios of milk were inoculated with 10^5 CFU/mL of *L. casei* and subjected to static incubation at 35 °C. The efficacy of the postbiotic liquids isolated at the 24th hour, the logarithmic peak of incubation, was tested using a modified CLSI disk diffusion method. The analyses revealed that the highest cellular biomass density (7.89 $\log_{10}$ CFU/mL) was reached in the partially milk-supplemented group (75 mL CW + 25 mL Milk), where protein and buffering capacity were increased. In contrast, the widest antifungal inhibition zone (2.4 mm) was observed solely in the pure CW group. As the milk ratio and consequently the buffering capacity in the environment increased, the inhibition zone diameter gradually decreased to 1.1 mm. This situation indicates that the nutritional conditions maximizing *L. casei* cellular proliferation differ from the environmental stress conditions that allow organic acids to remain in their "un-dissociated" (active) form capable of penetrating the pathogen membrane. In conclusion, pure CW holds strong potential to be transformed into a potent and natural biotherapeutic agent against *C. albicans*.

Keywords: Cheese whey, *Lacticaseibacillus casei*, *Candida albicans*, Postbiotic, Antifungal activity, Waste valorization.

ZEYTİNYAĞI, ZEYTİNYAĞININ BİYOAKTİF BİLEŞENLERİ VE SAĞLIK ÜZERİNE ETKİLERİ

OLIVE OIL, BIOACTIVE COMPONENTS OF OLIVE OIL AND ITS EFFECTS ON HEALTH

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ÖZET

Zeytinyağı, *Olea europaea L.* türüne ait zeytinden mekanik veya fiziksel yöntemlerle elde edilen, rafinasyon işlemi uygulanmaksızın tüketilebilen değerli bir bitkisel yağdır. Yüksek oleik asit içeriği, zengin fenolik bileşik profili ve çeşitli biyoaktif minör bileşenleriyle zeytinyağı, özellikle Akdeniz diyetinin temel yağ kaynağı olarak dünya genelinde önem taşımaktadır. Bu derleme çalışmasında zeytinyağı üretim yöntemleri, Türk Gıda Kodeksi' ne göre sınıflandırılan zeytinyağı çeşitleri, yağ asidi profili ve kimyasal özellikleri ile başta hidroksitirozol, oleuropein ve tirozol olmak üzere fenolik bileşiklerin biyolojik aktiviteleri ve biyoerişebilirlikleri ele alınmıştır. Fenolik bileşiklerin antioksidan, antienflamatuvar, antikanserojen, kardiyoprotektif, nöroprotektif ve anti-diyabetik etkileri mevcut literatür bulgularıyla özetlenmiştir. Sonuç olarak, zeytinyağının insan sağlığı üzerindeki olumlu etkilerinin büyük ölçüde içeriğindeki biyoaktif bileşenlerden kaynaklandığı ve bu bileşenlerin biyoerişebilirliğine ilişkin çalışmaların yetersiz kaldığı görülmektedir.

Anahtar kelimeler: Zeytinyağı, fenolik bileşikler, hidroksitirozol, oleuropein, biyoerişebilirlik, Akdeniz diyeti

ABSTRACT

Olive oil is a valuable vegetable oil obtained from the fruit of *Olea europaea L.* by mechanical or physical methods, which can be consumed without the application of refining processes. With its high oleic acid content, rich phenolic compound profile, and various bioactive minor components, olive oil holds worldwide importance as the main fat source of the Mediterranean diet. In this review, olive oil production methods, olive oil types classified according to the Turkish Food Codex, fatty acid profile and chemical properties, as well as biological activities and bioaccessibility of phenolic compounds, mainly hydroxytyrosol, oleuropein and tyrosol, are discussed. The antioxidant, anti-inflammatory, anticancer, cardioprotective, neuroprotective and anti-diabetic effects of phenolic compounds are summarized with current literature findings. In conclusion, the beneficial effects of olive oil on human health are largely attributed to the bioactive compounds in its composition, and studies on the bioaccessibility of these compounds remain insufficient.

Keywords: Olive oil, phenolic compounds, hydroxytyrosol, oleuropein, bioaccessibility, Mediterranean diet

OKUL KANTİNLERİ VE YEMEKHANELERİNDE ÇÖLYAKLI ÇOCUKLARIN GÜVENLİ BESLENMESİ: ÇAPRAZ BULAŞMA RİSKİ, MEVCUT DÜZENLEMELER VE HEMŞİRELİĞİN ROLÜ

SAFE NUTRITION OF CHILDREN WITH CELIAC DISEASE IN SCHOOL CANTEENS AND CAFETERIAS: CROSS-CONTAMINATION RISK, CURRENT REGULATIONS AND THE ROLE OF NURSING

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ÖZET

Çölyak hastalığının kanıtlanmış tek tedavisi yaşam boyu sürdürülen glutensiz diyettir. Okul öncesi ve ilkokul öğrencileri en az bir öğünü okulda tüketebildiğinden okul, çölyaklı çocukların diyete uyumu açısından belirleyici bir ortamdır. Bu derlemenin amacı, okul kantinleri ve yemekhanelerinde çölyaklı çocukların güvenli beslenmesini çapraz bulaşma riski, mevcut düzenlemeler ve hemşireliğin rolü açısından değerlendirmektir. PubMed ve DergiPark veri tabanları ile Google Scholar üzerinden 2014-2026 yılları arasında yayımlanmış 27 bilimsel yayın ile 12 resmi belge ve rehber incelenmiştir. İspanya'da 50 okul mutfağında temizlenmiş gıda temas yüzeylerinin %57'sinde gluten saptanmış; yalnızca glutensiz menülere ayrılmış yüzeylerde de bu oran %58 olmuştur. Macaristan'da glutensiz yemeklerin paketli olarak gelip ortak mutfakta saklandığı, ısıtıldığı ve servis edildiği 39 okul mutfağında yüzeylerin %37'sinde gluten bulunmuş, personel eğitimi sonrasında bu oran %18'e gerilemiştir. Glutenin ayrı bir tehlike olarak tanımlandığı HACCP temelli protokollerin uygulandığı bir okul ve bir hastane mutfağında glutensiz yemeklerin büyük çoğunluğu 20 mg/kg eşik değerinin altında kalmıştır. Türkiye'de ise yerli üretim glutensiz ürünlerin %18,6'sında gluten bu eşik değerin üzerindedir. Türkiye'de 2018 yılında çölyaklı öğrencilerin kantin ve yemekhanelerde beslenmesine ilişkin yönlendirmeler oluşturulmuştur. Ancak okul gıda işletmelerinin denetim ölçütlerinde çölyağa özgü bir madde yer almamakta ve bu yönlendirmelerin okullarda uygulanma düzeyini değerlendiren bir saha çalışmasına rastlanmamaktadır. Bu boşluğu doldurabilecek konumdaki okul sağlığı hemşiresinin görev tanımı çölyaklı öğrenciye bakım planlamayı ve kantin ve yemekhane çalışanlarının eğitimini kapsamakla birlikte hemşire istihdamı sınırlıdır. Okul sağlığı hemşiresi başta olmak üzere çocuk sağlığı alanında çalışan hemşireler; bakım planı, çocuk ve aile eğitimi, personel eğitimi ve psikososyal izlem yoluyla güvenli gıdaya erişim ile bireysel öz-yönetimi birlikte ele alabilir. Bu nedenle okul düzeyinde saha çalışmaları ve hemşire koordinasyonunda eğitim girişimleri önerilmektedir.

Anahtar Kelimeler: Çölyak hastalığı, çapraz bulaşma, okul beslenmesi, çocuk sağlığı hemşireliği, gıda güvenliği

ABSTRACT

The only proven treatment for celiac disease is a lifelong gluten-free diet. Since preschool and primary school students may consume at least one meal at school, the school is a decisive setting for dietary adherence in children with celiac disease. The aim of this review is to evaluate the safe nutrition of children with celiac disease in school canteens and cafeterias in terms of cross-contamination risk, current regulations and the role of nursing. Twenty-seven scientific publications published between 2014 and 2026, retrieved from the PubMed and DergiPark databases and through Google Scholar, and 12 official documents and guidelines were reviewed. In Spain, gluten was detected on 57% of cleaned food-contact surfaces in 50 school kitchens; the rate was 58% even on surfaces used exclusively for gluten-free menus. In Hungary, in 39 school kitchens where gluten-free meals arrived prepackaged and were stored, reheated and served in a shared kitchen, gluten was found on 37% of surfaces, and this rate

decreased to 18% after staff training. In one school kitchen and one hospital kitchen applying HACCP-based protocols in which gluten was defined as a separate hazard, the vast majority of gluten-free meals remained below the 20 mg/kg threshold. In Türkiye, gluten exceeded this threshold in 18.6% of domestically produced gluten-free products. In Türkiye, guidance on the nutrition of students with celiac disease in school canteens and cafeterias was established in 2018. However, the inspection criteria for school food businesses contain no celiac-specific item, and no field study evaluating the implementation of this guidance in schools was found. Although the job description of the school health nurse, who is well positioned to fill this gap, covers care planning for students with celiac disease and the training of canteen and cafeteria staff, the employment of school nurses is limited. Nurses working in child health, particularly school health nurses, can address both access to safe food and individual self-management through care planning, child and family education, staff training and psychosocial monitoring. Therefore, school-level field studies and nurse-coordinated educational interventions are recommended.

Keywords: Celiac disease, cross-contamination, school nutrition, pediatric nursing, food safety

SÜTLÜ ÇİKOLATADA TEMPERLEMEYE ALTERNATİF OLARAK ULTRASON DESTEKLİ ÖN KRİSTALİZASYON

ULTRASON-ASSISTED PRE-CRYSTALLIZATION AS AN ALTERNATIVE TEMPERING METHOD FOR MILK CHOCOLATE

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ÖZET

Geleneksel çikolata temperleme, operasyonel verimliliği sınırlandırabilen, zaman ve enerji yoğun bir kristalizasyon sürecidir. Bu çalışmada, sütlü çikolata formülasyonlarında geleneksel temperleme rejimine hızlı ve yenilikçi bir alternatif olarak yüksek yoğunluklu ultrason destekli ön kristalizasyon

(sonokristalizasyon) tekniği incelenmiştir. Erimiş çikolata kütleleri 32 °C'de farklı ultrasonik güç (100, 150, 200 ve 250 W) ve işlem süresi (10, 15 ve 20 s) kombinasyonlarına tabi tutulmuş ve konvansiyonel temperlenmiş kontrol grubu ile karşılaştırılmıştır. DSC analizleri, özellikle 150–200 W aralığındaki uygulamaların konvansiyonel kontrol grubu ($T_{pik} = 30.60$ °C, $\Delta H = 26.40$ J/g) ile benzer erime profilleri ($T_{pik} \approx 29.9 - 30.6$ °C ve $\Delta H \approx 23.4 - 26.9$ J/g) sağladığını göstermiştir. Tekstür analizlerinde akustik kavitasyonun mekanik sertliği belirgin biçimde artırdığı, en yüksek sertliğin 100 W–15 s kombinasyonunda (4014.66 N) elde edildiği; buna karşılık aşırı enerji girdisinin (250 W–20 s) lokal termal yumuşamaya ve entalpi kaybına (18.27 J/g) yol açtığı belirlenmiştir. Casson reolojik modellemesi örneklerin psödoplastik akış sergilediğini ($R^2 \geq 0.995$) ve tiksotropik histerezis alanlarının işlem parametrelerine bağlı olarak modüle edildiğini ortaya koymuştur. Hacim ağırlıklı partikül boyutu ($D[4,3]$) tüm uygulamalarda kumsu his eşiği olan 25 µm'nin altında kalmıştır. Kimyasal stabilite açısından kısa süreli sonikasyon, peroksit değerini ($0.70 - 1.46$ meq O_2/kg) kontrol grubuna (1.69 meq O_2/kg) kıyasla baskılayarak primer oksidasyonu sınırlandırmış ve serbest yağ asitliğini kabul edilebilir düzeyde tutmuştur. Ayrıca kavitasyonel kütle transferi, kakao matrisindeki bağlı fenoliklerin analitik erişilebilirliğini artırarak toplam fenolik madde (1.92 mg GAE/g'a kadar) ve DPPH radikal süpürme kapasitesini (1.09 mg Trolox eşd./g'a kadar) önemli ölçüde yükseltmiş; FTIR spektrumları ise triaçilgliserollerin kovalent yapısının bozulmadan korunduğunu teyit etmiştir. Sonuçlar, optimize edilmiş ultrason destekli temperlemenin sütlü çikolata üretiminde süreci kısaltan, dokusal direnci ve biyoaktif ölçülebilirliği artıran sürdürülebilir bir teknolojik alternatif olduğunu göstermektedir.

Anahtar Kelimeler: Çikolata, ultrason, temperleme, erime profili.

Teşekkür: Bu çalışma, Eskişehir Osmangazi Üniversitesi BAP tarafından ***FOA-2023-2525*** (Proje Koordinatörü: İ. Atalar) numaralı araştırma projesi olarak desteklenmiştir. Bu çalışma Betül ÖZEN'in yüksek lisans tezinden üretilmiştir.

ABSTRACT

Conventional chocolate tempering is a time- and energy-intensive crystallization process that can limit operational efficiency. In this study, high-intensity ultrasound-assisted pre-crystallization (sonocrystallization) was investigated as a rapid and innovative alternative to the conventional tempering regime in milk chocolate formulations. Molten chocolate masses were treated at 32 °C with different combinations of ultrasonic power (100, 150, 200 and 250 W) and treatment time (10, 15 and 20 s) and compared with a conventionally tempered control. DSC analyses showed that treatments, particularly in the 150–200 W range, produced melting profiles (T_peak ≈ 29.9–30.6 °C; ΔH ≈ 23.4–26.9 J/g) similar to that of the conventional control (T_peak = 30.60 °C; ΔH = 26.40 J/g). Texture analyses revealed that acoustic cavitation markedly increased mechanical hardness. The highest hardness was obtained with the 100 W–15 s combination (4014.66 N), whereas excessive energy input (250 W–20 s) caused localized thermal softening and a loss of melting enthalpy (18.27 J/g). Casson rheological modeling showed that the samples exhibited pseudoplastic flow behavior ($R^2 \geq 0.995$) and that the thixotropic hysteresis areas were modulated by the processing parameters. The volume-weighted mean particle diameter (D[4,3]) remained below the 25 µm grittiness threshold in all treatments. In terms of chemical stability, short-duration sonication suppressed the peroxide value (0.70–1.46 meq O_2/kg) relative to the control (1.69 meq O_2/kg), thereby limiting primary oxidation, and kept free fatty acidity at acceptable levels. Furthermore, cavitation-induced mass transfer

enhanced the analytical accessibility of bound phenolics in the cocoa matrix. This significantly increased total phenolic content (up to 1.92 mg GAE/g) and DPPH radical scavenging capacity (up to 1.09 mg Trolox eq./g). FTIR spectra confirmed that the covalent structure of the triacylglycerols remained intact. The results indicate that optimized ultrasound-assisted tempering is a sustainable technological alternative for milk chocolate production that shortens processing time and enhances both textural resistance and the measurable bioactive content.

Keywords: Chocolate, ultrasound, tempering, melting profile

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PEYNİR ÜRETİMİ VE KALİTE KONTROLÜNDE YAPAY ZEKANIN ROLÜ
THE ROLE OF ARTIFICIAL INTELLIGENCE IN CHEESE PRODUCTION AND QUALITY CONTROL

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ÖZET

Peynir, zengin bileşimi nedeniyle beslenme literatüründe stratejik bir gıda olarak kabul edilmekte olup; besinsel ve fonksiyonel özelliklerinin korunması ise üretim parametrelerinin dikkatli bir şekilde kontrol edilmesini gerektirmektedir. Ancak hammadde bileşimindeki farklılıklar, mikrobiyolojik aktivite ve olgunlaşma sırasında meydana gelen karmaşık biyokimyasal değişimler nedeniyle peynir üretimini standartlaştırmak zordur. Bu süreçlerin kontrol edilmesinde geleneksel yöntemlerin sınırlılıkları, yapay zeka (YZ) tabanlı algoritmaların ve dijital izleme sistemlerinin kullanımının giderek artmasına yol açmıştır. Peynir teknolojisindeki yapay zeka uygulamaları; sütün standardizasyonu, pıhtı kesme süresinin optimizasyonu, olgunlaşma kinetiğinin izlenmesi ve kalite kontrol süreçlerinde önemli bir rol oynamaktadır. Bu bağlamda üreticiler; makine öğrenimi (ML), derin öğrenme (DL) ve Nesnelerin İnterneti (IoT) gibi teknolojileri üretim sistemlerine entegre etmektedir. ML algoritmaları, çiğ sütün kimyasal ve mikrobiyolojik özelliklerini değerlendirebilmekte ve farklı peynir çeşitleri için en uygun işleme koşullarını öngörebilmektedir. Benzer şekilde, YZ destekli sistemler; peynirin kalitesini, görünümünü ve duyusal özelliklerini büyük ölçüde etkileyen olgunlaşma sürecinin daha hassas ve tutarlı bir şekilde izlenmesini sağlamaktadır. IoT destekli sensörler, olgunlaştırma odalarındaki sıcaklık, nem ve pH değerlerini sürekli olarak izleyerek insan kaynaklı hataları en aza indirebilmekte ve gıda güvenliği sistemlerinde dijital izlenebilirliği geliştirebilmektedir. Ayrıca, yapay zeka tabanlı bilgisayarlı görüntü işleme sistemleri; peynir yüzey dokusunu, gözenek yapısını ve renk değişimlerini non-destriktif yöntemlerle analiz ederek kusurların erken tespit edilmesini sağlamakla beraber kalite kontrol süreçlerini güçlendirmektedir. Son yıllarda geliştirilen "Dijital İkiz" modelleri, fiziksel sistemlerin sanal kopyaları aracılığıyla üretim süreçlerinin simülasyonuna da olanak tanımaktadır.

Sonuç olarak, yapay zeka tabanlı yaklaşımların ve dijital teknolojilerin peynir endüstrisine entegrasyonu; operasyonel maliyetlerin düşürülmesi, ürün kalitesinin artırılması, karar destek sistemlerinin güçlendirilmesi ve kaynak kullanımının optimize edilmesi konularında önemli avantajlar sunmaktadır. Gelecekteki çalışmaların, farklı peynir çeşitlerine yönelik yapay zeka modellerinin doğruluğunu ve endüstriyel uygulanabilirliğini geliştirmeye odaklanması beklenmektedir.
Anahtar **Kelimeler**: Peynir üretimi, Yapay zeka, Dijital ikiz, Kalite kontrol, Endüstri 4.0, Akıllı üretim.

ABSTRACT

Cheese is considered a strategic food in the nutrition literature due to its rich composition, and maintaining its nutritional and functional properties requires careful control of production parameters. However, cheese production is difficult to standardize because of variations in raw material

composition, microbiological activity, and complex biochemical changes occurring during ripening. The limitations of conventional methods in controlling these processes have led to the increasing use of artificial intelligence (AI)-based algorithms and digital monitoring systems. AI applications in cheese technology play an important role in milk standardization, optimization of curd cutting time, monitoring of ripening kinetics, and quality control. In this context, manufacturers integrate technologies such as machine learning (ML), deep learning (DL), and the Internet of Things (IoT) into production systems. ML algorithms can evaluate the chemical and microbiological properties of raw milk and predict optimal processing conditions for different cheese varieties. Similarly, AI-supported systems enable more precise and consistent monitoring of the ripening process, which strongly influences the quality, appearance, and sensory characteristics of cheese. IoT-supported sensors can continuously monitor temperature, humidity, and pH values in ripening chambers, minimizing human-related errors and improving digital traceability in food safety systems. In addition, AI-based computer vision systems can analyze cheese surface texture, pore structure, and color changes through non-destructive methods, enabling early defect detection and strengthening quality control processes. Recently developed Digital Twin models also allow simulation of production processes through virtual replicas of physical systems.

In conclusion, the integration of AI-based approaches and digital technologies into the cheese industry offers significant advantages in reducing operational costs, improving product quality, supporting decision-making systems, and optimizing resource utilization. Future studies are expected to focus on improving the accuracy and industrial applicability of AI models for different cheese varieties.

Keywords: Cheese production, Artificial intelligence, Digital twin, Quality control, Industry 4.0, Smart manufacturing.

HELAL GIDALARDA TÜR DOĞRULAMASI VE TAĞŞİŞİN BELİRLENMESİNDE GÜNCEL YÖNTEMLER

CURRENT METHODS FOR SPECIES AUTHENTICATION AND ADULTERATION DETECTION IN HALAL FOODS

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ÖZET

Helal gıdalarda hayvansal bileşenlerin tür kökeninin belirlenmesi, ürün beyanının doğrulanması ve tağşişin araştırılması açısından önem taşımaktadır. Gıda üretiminde hayvansal bileşenler, doğrudan et olarak kullanılabildiği gibi jelatin ve diğer işlenmiş bileşenler şeklinde de ürünlerde bulunabilmektedir. Bu bileşenlerin hangi hayvan türünden elde edildiği, helal gıda değerlendirmesinde yanıtlanması gereken temel sorulardan biridir. Özellikle çok bileşenli ve işlem görmüş ürünlerde tür kökeni duyusal özelliklerden anlaşılamadığı için laboratuvarda kullanılan yöntemler önem kazanmaktadır. Bu çalışmanın amacı, helal gıdalarda tür doğrulaması için kullanılan analitik yöntemleri, farklı ürünlerdeki uygulamaları ve sınırlılıkları açısından değerlendirmektir. Tür doğrulamasında kullanılacak yöntemin seçimi, ürünün bileşimine, içerdiği hayvansal bileşenin miktarına ve uygulanan işlemlere bağlıdır. DNA temelli yöntemler, türe özgü gen bölgelerini hedefleyerek beyan edilen ve edilmeyen hayvan türlerinin araştırılmasına olanak tanımaktadır. Geleneksel serolojik yöntemler ve ELISA gibi immünolojik testler türe özgü proteinleri araştırmaktadır. Histolojik incelemeler ise özellikle et ürünlerinde kullanılan dokuların tanımlanmasına ve ürün bileşiminin değerlendirilmesine katkı sağlamaktadır. DNA temelli yöntemler arasında türe özgü PCR, multipleks PCR ve real-time PCR, hedeflenen hayvan türlerinin saptanmasında yaygın olarak kullanılmaktadır. Kütle spektrometrisi ile türe özgü protein ve peptitler araştırılabilirken spektroskopik teknikler ürünlerin kimyasal profillerine dayalı tamamlayıcı bilgiler sunabilmektedir. Gıdalara uygulanan ısıl işlem proteinlerin yapısını değiştirerek immünolojik testleri etkileyebilmekte ve DNA'nın parçalanması ise özellikle uzun hedef bölgelerin çoğaltılmasını güçleştirebilmektedir. Jelatin gibi yoğun işlem görmüş bileşenlerde hem proteinlerin hem de DNA'nın değişime uğraması, tür kökeninin belirlenmesini daha karmaşık hale getirmektedir. Farklı ilkelere dayanan yöntemlerin birlikte kullanılması, özellikle sonuçların belirsiz olduğu örneklerde değerlendirmeyi güçlendirebilir. Sonuç olarak, tür doğrulaması helal gıda değerlendirmesine önemli kanıtlar sağlamakla birlikte, hayvanın kesim koşullarını veya üretim sürecinin tamamını doğrulamaz. Bulguların hammadde belgeleri, üretim kayıtları ve izlenebilirlik bilgileriyle birlikte yorumlanması daha kapsamlı bir değerlendirme sağlayacaktır.

Anahtar kelimeler: Helal gıda, tür doğrulaması, gıda güvenliği, gıda tağşişi

ABSTRACT

Determining the species origin of animal-derived components in Halal foods is crucial for verifying product declarations and investigating adulteration. Animal components in food production can be used directly as meat as well as present in products in the form of gelatin and other processed ingredients. Determining which animal species these components are derived from is one of the

fundamental questions that must be answered in Halal food evaluation. Since the species origin cannot be distinguished from sensory characteristics, particularly in multi-component and processed foods, laboratory-based methods gain importance. The aim of this study is to evaluate the analytical methods used for species verification in Halal foods in terms of their applications in different products and their limitations. The selection of the method for species verification depends on the product's composition, the amount of animal component it contains, and the processes applied. DNA-based methods enable the investigation of declared and undeclared animal species by targeting species-specific gene regions. Traditional serological methods and immunological tests, such as ELISA, investigate species-specific proteins. Histological examinations contribute to identifying the tissues used, particularly in meat products, and to evaluating product composition. Among DNA-based methods, species-specific PCR, multiplex PCR, and real-time PCR are widely used to detect targeted animal species. While species-specific proteins and peptides can be investigated using mass spectrometry, spectroscopic techniques can provide complementary information based on the chemical profiles of products. Heat treatments applied to foods can alter the protein structure and affect immunological tests, whereas DNA degradation can hinder the amplification of particularly long target regions. In heavily processed components such as gelatin, alterations in both proteins and DNA make determining species origin more complex. The combined use of methods based on different principles can strengthen the evaluation, especially in samples with ambiguous results. Consequently, although species verification provides significant evidence for Halal food evaluation, it does not verify the animal's slaughter conditions or the entire production process. Interpreting the findings together with raw material documents, production records, and traceability information will provide a more comprehensive assessment.

Keywords: Halal food, species authentication, food safety, food adulteration

GIDALARDA RAF ÖMRÜ TESTLERİ

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ÖZET

Gıdaların taze halde uzun süre depolanmaları pek çok durumda mümkün olmadığından farklı tekniklerle ve farklı amaçlarla kullanılmak üzere işlenmeleri ve depolanmaları gerekmektedir (Doğan and Aydın 2020).

Günümüzde gıda sanayii büyük gelişmeler göstermiş ve üretim kapasitesini ciddi boyutlara ulaştırmıştır. Bu denli çok üretilen gıda maddelerinin hemen tüketilmesi imkânsız olduğundan üretimden satışa kadar geçen süre içerisinde raf ömrü kavramını ortaya çıkarmıştır. Raf ömrü ambalajlı bir ürünün önerilen koşullarda kalite özellikleri önemli bir değişikliğe uğramadan, sağlığa zarar vermeyecek şekilde tüketiciye ulaşması için öngörülen teknolojik, fiziksel, kimyasal ve mikrobiyolojik dayanım süresi olarak tanımlamaktadır (Gökmen and Öztan 1995).

Bir ürünün raf ömrü, üretici tarafından saptanır. Üretici, ürünün son satış günün bildirmek durumundadır. Bugüne, ürünün çekilme tarihi de denir.

Kullanma Tarihi (Open Date): Kullanma tarihi üç değişik biçimde olabilir.

i) Paketleme Tarihi (pack date): Gıdanın işlemden veya üretimden sonra paketlenirken verildiği tarih paketleme tarihi olarak yazılır.
ii) Arz Tarihi (display date): Gıdanın satılmak üzere üreticiden çıkıp depolara ilk giriş tarihine arz tarihi denir. Hamburger gibi taze gıdalar için bu tarih paketleme tarihi ile aynıdır.
iii) Son Kullanma (sell by) veya Çekme Tarihi (pull-date): Ürünün son satış gününe veya depolardan geri çekilme gününe son kullanma (sell by) tarihi veya çekme tarihi (pull-date) denir. Bu günden sonra belirli bir süre daha, ürün tüketici tarafından tüketilebilir durumdadır. Bu süre içinde kullanma veya kullanmama kararının tüketiciye bırakılması için, "en iyi kullanma tarihi" (best if used by) veya "kullanma tarihi" (use by date) gibi tarihler de verilebilir (Armutak and Bayındırlı 1995).

Ürünün kullanma tarihinin belirlenmesi için, depolama, muhafaza etme metotlarına göre gıdalarda olması muhtemel bozulma (kimyasal, tekstürel, enzimatik, mikrobiyal) çeşitlerinin bilinmesi gerekir. Bu amaçla raf ömrünün belirlenmesinde kullanılacak kriterlerin doğru belirlenmesi ve üründe en hızlı bozunan veya reaksiyonlar sonucu oluşan istenmeyen bileşenlerin amaca uygun seçilmesi tüketicinin gıdayı yeterli kalitede güvenilir ve sağlıklı olarak alabilmesi ve kullanabilmesi için önem taşımaktadır (Evranuz 1987, Doğan and Aydın 2020).

Raf ömrü denemeleri büyük ya da küçük ölçekli olmak üzere hemen hemen bütün gıda firmaları tarafından yapılabilmektedir. Bu doğrultuda yapılan çalışmalar, bazen çok basit bir yaklaşımda yürütülürken bazen daha komplike olabilmekte ve ürün kalitesini izlemeye yönelik bilgisayar sistemleri de kullanılabilmektedir. Uygulanan raf ömrü çalışmalarında, temel olarak mikrobiyolojik güvenlik ya da besin içeriği değişimi ele alınmakta ve tüm bu çalışmalarda objektif metotlar kullanılmaktadır. Gıdanın satışını etkileyecek potansiyel zehirlenme veya aşırı kötü koku olmadığı sürece gıda ürünlerinde duyusal özelliklerdeki değişimler izlenmemektedir. Ancak, söz konusu duyusal özelliklerdeki değişimler, ilk tüketimde beklenen duyusal özellikleri karşılamıyorsa, tüketici, ürünü satın almama kararı ile bu ürünün duyusal raf ömrünü etkin olarak belirlemektedir (Labuza and Schmidl 1988, Taoukis, Labuza and Saguy 1997).

GENOME EDITING OF WHEAT STARCH BIOSYNTHESIS FOR THE DEVELOPMENT OF LOW-GLYCEMIC WHEAT

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ABSTRACT

Introduction and Purpose

Wheat (*Triticum aestivum* L.) is a major source of dietary carbohydrates, but conventional wheat products are generally rich in rapidly digestible starch and may produce substantial postprandial increases in blood glucose. This presents a nutritional challenge for individuals with type 2 diabetes. Increasing amylose and resistant starch (RS) in wheat represents a potential strategy for reducing starch digestibility and moderating postprandial glycemic responses. Previous research has demonstrated that targeted CRISPR/Cas9 editing of *TaSBEIIa*, which encodes starch branching enzyme IIa, can modify wheat starch composition and increase amylose and resistant starch. This study proposes the development of genome-edited wheat with improved starch quality for potential use in low-glycemic food products.

Materials and Methods

CRISPR/Cas9 will be used to target the *TaSBEIIa* gene involved in starch branching and amylopectin formation. Guide RNAs will be designed to generate targeted loss-of-function mutations, followed by regeneration and molecular screening of edited plants. Candidate lines will be evaluated through DNA sequencing to confirm the desired mutations and determine their allele composition. Grain samples will subsequently be characterized for amylose-to-amylopectin ratio, resistant starch content, total starch, starch structure, and enzymatic digestibility. In-vitro digestion assays will be used to estimate predicted glycemic response. Agronomic performance, grain yield, thousand-kernel weight, and basic flour and dough characteristics will also be assessed to determine whether modification of starch composition compromises crop productivity or end-use quality.

Results

The expected outcome is the identification of CRISPR/Cas9-edited wheat lines with increased amylose and resistant starch and reduced susceptibility to enzymatic starch digestion compared with conventional wheat. Previous TaSBEIIa-editing studies produced high-amylose wheat and demonstrated that the extent of starch modification depended on the number and type of edited alleles. High-amylose wheat has also been associated with increased resistant starch and reduced postprandial glucose responses in some studies. However, the proposed study will critically evaluate whether increased amylose and resistant starch consistently translate into lower predicted glycemic responses after processing, because food preparation and starch structure can substantially influence the final physiological effect.

Discussion and Conclusion

CRISPR/Cas9-mediated modification of starch biosynthesis provides a promising approach for improving the nutritional quality of wheat without changing its fundamental role as a staple crop. Increasing resistant starch could reduce the proportion of rapidly digestible carbohydrate and potentially moderate postprandial glucose responses. However, increased resistant starch alone should not be interpreted as a treatment for diabetes, and improvements observed at the grain or in-vitro level require validation in properly designed food and human studies. Therefore, this research will integrate genome editing, starch biochemistry, nutritional characterization, and agronomic evaluation to identify wheat germplasm with improved carbohydrate quality while maintaining acceptable yield and processing characteristics.

Key Words: CRISPR/Cas9; Triticum aestivum; TaSBEIIa; resistant starch; amylose; starch digestibility; glycemic response; type 2 diabetes; genome editing; nutritional quality

EFFECTS OF CLIMATE CHANGE ON MAIZE FARMERS' PRODUCTION

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ABSTRACT

This study examined the effects of climate change on maize production among maize farmers in Oyo State, Nigeria. Specifically, the study assessed the socio-economic characteristics of maize farmers, examined maize production trends, assessed vulnerability and examined the relationship between socio-economic characteristics, climate change effects, and maize production. A multistage sampling procedure was used to select 227 maize farmers from the study area. Primary data were collected through a structured questionnaire and analyzed using descriptive statistics, vulnerability indices, Likert-type rating scales. The findings revealed that the majority (72.2%) of the respondents were between 41 and 50 years of age, with a mean age of 44 years, while 99.6% were male. Most respondents (66.1%) had no formal education, 76.7% had household sizes of 6–10 persons, and 89.4% possessed between 10 and 20 years of farming experience. The mean monthly household income was ₦69,869. Maize yield showed a slight increase from 1,683.13 kg/ha in 2023 to 1,707.25 kg/ha in 2025, while the mean cost of production increased substantially from ₦574,757.71 to ₦646,475.77 during the same period. . Vulnerability assessment indicated that 67.0% of farmers were moderately vulnerable and 33.0% were highly vulnerable to climate change, with none classified as having low vulnerability.

Keywords: Climate change, maize production, vulnerability, maize farmers, Oyo State.

ŞƏRAB ISTEHSALI TULLANTILARININ BIOLOJI POTENSIALI VƏ ONLARIN FUNKSIONAL QIDA MƏHSULLARININ ISTEHSALINDA ISTIFADƏ PERSPEKTIVLƏRI

BIOLOGICAL POTENTIAL OF WINE PRODUCTION WASTE AND PROSPECTS FOR ITS USE IN THE PRODUCTION OF FUNCTIONAL FOOD PRODUCTS

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Məhsulların çeşidinin genişləndirilməsinin ən vacib istiqamətlərdən biri - əvəz olunmayan qida maddələri, həmçinin bioloji fəal maddələrlə zənginləşdirilmiş yeni içkilərin hazırlanmasıdır.

Şərab istehsalı zamanı alınan ikinci dərəcəli xammallar, tərkiblərində bioloji fəal maddələrin olması ilə yüksək potensiala malikdir. Üzüm cecəsi, qabıqlar, toxumlar və maya çöküntüləri polifenollar, flavonoidlər, antosianinlər, qida lifləri ilə zəngindir. Onların təkrar emalı və qida texnologiyasında tətbiqi, alınan tullantıları azaltmaqla bərabər, eyni zamanda yeni funksional məhsulların istehsalında tətbiqinə imkan verir.

Saperavi, Kaberne-Sovinyon və Merlo üzüm sortlarının cecəsi xlorod turşusu ilə ekstraksiya edilmiş və onların kimyəvi tərkibi tədqiq edilmişdir. Alınmış ekstraktlarda antosianlar müəyyən olunan maddələrə görə 18-27%, ümumi quru maddələrə görə 2-10% olmuşdur. Bu baxımdan ekstraktlaşma prosesinin tədqiqi və ekstraktlar istehsalının texnologiyasının işlənməsi və onlardan məhsullara qatılan bioloji fəal əlavələr kimi istifadə olunması təcrübi maraq kəsb edir.

Açar sözlər: şərab istehsalı tullantıları, üzüm cecəsi, ekstraksiya, bioloji aktiv maddələr, funksional qida məhsulları, təkrar emal.

ABSTRACT

One of the most important directions for expanding product ranges is the development of new beverages enriched with essential nutrients and biologically active substances.

By-products obtained during winemaking possess significant potential due to their content of biologically active substances. Grape pomace, skins, seeds, and yeast lees are rich in polyphenols, flavonoids, anthocyanins, and dietary fibers. Reprocessing these materials and applying them within food technology not only reduces waste but also enables the production of new functional products.

Pomace from Saperavi, Cabernet Sauvignon, and Merlot grape varieties was subjected to extraction using chlorogenic acid, and its chemical composition was analyzed. In the resulting extracts, anthocyanins accounted for 18–27% of the identified compounds and 2–10% of the total dry matter. Consequently, investigating the extraction process, developing technologies for extract production, and utilizing these extracts as biologically active additives in food products are of practical interest.

Keywords: winemaking waste, grape pomace, extraction, biologically active substances, functional food products, recycling/reprocessing.

EMAL EDİLMİŞ BALIQ MƏHSULLARININ TƏHLÜKƏSİZLİK VƏ MİKROBİOLOJİ GÖSTƏRİCİLƏRİ

SAFETY AND MICROBIOLOGICAL INDICATORS OF PROCESSED FISH PRODUCTS

Kamil Arif oğlu İsmayılov

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XÜLASƏ

İnsanların qidalanmasında balıq və balıq məhsullarının xüsusi əhəmiyyəti vardır. Çünki balıq və balıq məhsullarının tərkibində insan orqanizmi tərəfindən asanlıqla mənimsənilən zülallar, yağlar, mineral maddələr (xüsusən fosfor, yod) və digər fəal bioloji maddələr vardır. Qeyd etmək lazımdır ki, balıq və balıq məhsulları başqa yeyinti məhsullarından tez xarab olması ilə fərqlənir. Bu, onunla izah olunur ki, balıq və balıq məhsulları saxlanılarkən, onların tərkibində biokimyəvi, kimyəvi və mikrobioloji proseslər baş verir ki, bu da nəticədə bu məhsulların keyfiyyətinin aşağı düşməsinə səbəb olur. Belə məhsullardan istehlakçılar istifadə etdikdə bir sıra zəhərlənmə hadisələrinə səbəb olur. Ona görə belə hadisələrin qarşısını almaq üçün emal edilmiş balıq məhsullarının keyfiyyət göstəricilərinin ekspertizasının aparılması xüsusi əhəmiyyət kəsb edir.

ABSTRACT

Fish and fish products hold special significance in human nutrition. This is because they contain proteins, fats, minerals (particularly phosphorus and iodine), and other biologically active substances that are easily assimilated by the human body. It should be noted that fish and fish products differ from other food items in that they spoil more rapidly. This is explained by the fact that during storage, biochemical, chemical, and microbiological processes occur within these products, ultimately leading to a decline in their quality. The consumption of such products can result in various instances of food poisoning. Therefore, conducting an expert assessment of the quality indicators of processed fish products is of particular importance for preventing such occurrences.

QİDA SƏNAYESİNDƏ YARANAN QABLAŞDIRMA TULLANTILARININ ƏTRAF MÜHİTƏ MƏNFİ TƏSİRİ

THE NEQATIVE ENVIRONMENTAL IMPACT OF PACKAGING WASTE GENERATED IN THE FOOD INDUSTRY

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XÜLASƏ

Texnoloji tərəqqi cəmiyyətin inkişafında keyfiyyətcə yeni, yüksək töhvələr versə də, lakin, sosial sivilizasiyanın inkişafının ekoloji və insan sağlamlığı ilə bağlı bəzi təəssuf doğuran tərəfləri də var. Kütləvi reklam üçün vacib olan və rəngarəngliyi ilə istehlakçının zövqunə əsaslı dərəcədə təsir göstərən plastik qablaşdırmalar ekoloji problemlər baxımından planet üçün böyük təhlükə mənbəyi hesab edilir. Plastik qablaşdırma materiallarından istifadə prespektivlər açdığı kimi, həmçinin insanların sağlamlığına mənfi təsir edən bəzi problemlər yaradır. Buna baxmayaraq məlum sahələrdən onlardan tamamilə imtina etmək də mümkün deyil.

ABSTRACT

While techogical progress makes significant, dualitatively new contributions to societal development, the advancement of social civilization also entails certain regrettable aspects concerning the environment and human health. Plastik packaging-which a vital role in mass adverting and significantly influences consumer tastes through its variety – is considered a major

threat to the planet in terms of environmental issues. While the use of plastik packaging materials, it also creates certain problems that negatively affest human health. Neverheless, it is not possible to completely abandon them in the relevant sectors.

Today, environmental pollution caused by plastik waste undoubtedly leads to the disruption of the ecologial balance not only in the immediate areas of impact but across the entire planet. Consequently, thisproblem affects everyone. Therefore, it is the duty of each of us to take measures – such as reducing the amount of plastik and considering human health and the future of the planet-and to adhere to them.

YARPAQ SEYRƏLDİLMƏSİNİN ÜZÜM SALXIMININ BƏZİ GÖSTƏRİCİLƏRİNƏ TƏSİRİ

THE EFFECT OF LEAF THINNING ON SOME CHARACTERISTICS OF GRAPE BUNCHES

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XÜLASƏ

Yarpaqların seyrəldilməsi üzüm məhsulunun keyfiyyətinə və sağlamlığına birbaşa təsir göstərməklə, gilənin yetişmə müddətini dəyişir və şəkərliliyini artırır. Bununla belə, yaşıl kütlənin həddindən artıq kənarlaşdırılması, tənəyi zəiflədə və ümumi məhsulun həcmini azalda bilər. Bizim tədqiqatlarda zoğların böyüməsi fenoloji mərhələdə Şamaxı mərəndisi süfrə üzüm sortunun salxımları ətrafında yarpaqların 25 və 50%-i kənarlaşdırılmışdır. Aldığımız nəticələrdən məlum olmuşdur ki, müxtəlif səviyyədə yarpağın seyrəldilməsinin salxımın ölçülərinə təsiri olmadığı halda, salxımın orta kütləsində nəzərəçarpacaq fərq müşahidə edilmişdir – 25% seyrəltmədə 247 q, 50% seyrəltmədə isə 328 q. Beləliklə, Abşeron şəraitində Şamaxı mərəndisi sortunda yarpaqların 50% seyrəldilməsinin səmərəli olduğunu və bu istiqamətdə digər sortlar üzərində tədqiqatların davam etdirilməsinin vacib olduğunu söyləmək olar.

Açar sözlər: yarpaq seyrəltmə, məhsuldarlıq, Abşeron, Şamaxı mərəndisi sortu.

ABSTRACT

Leaf thinning directly affects the quality and storability of the harvest by altering the ripening period and the sugar content of the berries. At the same time, excessive removal of green foliage weakens the grapevine and leads to a reduction in yield. In a study conducted on the 'Shamakhy Marandisi' grape variety, 25% and 50% of the leaves in the zone surrounding the grape bunches were removed. The results indicate that, while the degree of leaf thinning did not affect the size of the clusters, it led to a significant difference in their average weight: 247 g with 25% leaf removal and 328 g with 50% leaf removal. Thus, it can be concluded that, under the conditions of the Absheron Peninsula, removing 50% of the leaves is effective for the 'Shamakhy Marandisi' grape variety; further research in this area is warranted for other grape varieties as well.

Keywords: leaf thinning, yield, Absheron Peninsula, 'Shamakhy Marandisi' grape variety.

ARPA SORT NÜMUNƏLƏRİNDƏ DƏNİN KEYFİYYƏT GÖSTƏRİCİLƏRİNİN QİYMƏTLƏNDİRİLMƏSİ

EVALUATION OF GRAIN QUALITY TRAITS IN BARLEY ACCESSIONS

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XÜLASƏ

Arpa (*Hordeum vulgare L.*) dəninin keyfiyyət göstəricilərinin öyrənilməsi yüksək məhsuldarlığa malik, qida və yemlik xüsusiyyətləri ilə seçilən genotiplərin müəyyənləşdirilməsi və seleksiya prosesində məqsədyönlü istifadəsi baxımından mühüm əhəmiyyət kəsb edir. Dənin keyfiyyət göstəriciləri genotipin bioloji xüsusiyyətləri ilə yanaşı, becərildiyi torpaq-iqlim şəraitinin təsiri altında dəyişə bilər. Bu baxımdan müxtəlif aqroekoloji şəraitlərdə arpa genotiplərinin məhsuldarlıq və keyfiyyət göstəricilərinin kompleks qiymətləndirilməsi seleksiya üçün qiymətli materialların müəyyən edilməsinə imkan verir.

Məqalədə 2018-2020-ci illərdə Əkinçilik Elmi-Tədqiqat İnstitutunun Kürdəmir Təsərrüfat Sınaq Stansiyasında və Qobustan Bölgə Təcrübə Stansiyasında müxtəlif mənşəli arpa sort-nümunələrinin dən keyfiyyəti göstəricilərinin müqayisəli qiymətləndirilməsi nəticələri təqdim olunur. Tədqiqatlar zamanı 1000 dənin kütləsi, zülalın və lizinin miqdarı öyrənilmişdir. Müəyyən edilmişdir ki, zülalın miqdarı 9,1-13,4%, 1000 dənin kütləsi 36,6 - 46,0 q, lizinin miqdarı isə 1,98-2,70% intervalında dəyişmişdir. Xüsusilə, Hispanic/Sararood ICB06-2099-21AP-0AP-0AP, Mzq/Gva//PI002917/3/WI2291/WI2269/4/WI3213ICB01-0018-0AP-32AP-7AP-0AP, BREA/DL70//TOCTE/3/ BREA/ DL70//CABUYA/4/CALI92/ROBUSTICB09-1441-0AP-OTR-0AP-OTR-0 AP-0TR, PENCO/CHEVRONBAR /3/LEGACY //PENCO /CHEVRON-BARCBSS04Y00047S - 20Y-3M-0Y-0M-0Y-0A, LA MOLINA 96/LEGACY CBSS05Y00161S-17Y-0M-0Y-0M-4AP və MERITB/IBTA80 CBSS06Y00091S-4Y-0M-0AP-0TR sort-nümunələrində 1000 dənin kütləsi 39,4-41,3 q təşkil edərək Cəlilabad 19 standart sortunu (38,8-41,6q) üstələmişdir. WI3159/6/ANCA/2469//TOJI/3/SHYRI/4/ ATACO /5/ALELIICB01-1137-48AP- 9AP-0AP və DD-21/Mundah ICB02-0555-0AP-10TR-7AP-0AP nümunələrində isə bu göstərici 46,0 q olmaqla standartlardan 4,4-7,2 q yüksək göstərici nümayiş etdirmişdir. Tədqiqat nəticələri arpanın istifadə təyinatına (yemlik və ya pivəlik) uyğun olaraq müvafiq becərmə texnologiyalarının tətbiqinin və seleksiya proqramlarında kompleksi göstəricilərin nəzərə alınmasının vacibliyini sübut edir.

Açar sözlər: Arpa (Hordeum vulgare L.), zülal, lizin, 1000 dənin kütləsi, genotip, seleksiya.

ABSTRACT

Studying the grain quality traits of barley (*Hordeum vulgare* L.) is of significant importance for identifying high-yielding genotypes with superior nutritional and feed characteristics and for their targeted utilization in breeding programs. Grain quality traits are influenced not only by the biological characteristics of the genotype but also by the prevailing soil and climatic conditions. In this regard, a comprehensive evaluation of the yield and quality indicators of barley genotypes under diverse agroecological conditions allows for the identification of valuable donor material for breeding purposes.

This paper presents the results of a comparative assessment of grain quality traits in barley accessions of diverse origins, conducted during 2018-2020 at the Kurdamir Agricultural Testing Station and the Gobustan Regional Experiment Station of the Research Institute of Crop Husbandry. During the research, 1000-grain weight, crude protein content, and lysine content were investigated. It was established that the protein content ranged between 9.1-13.4%, 1000-grain weight varied from 36.6 to 46.0 g, and lysine content ranged from 1.98 to 2.70%. Notably, in accessions Hispanic/Sararood ICB06-2099-21AP-0AP-0AP, Mzq/Gva// PI002917/3/ WI 2291/W I2269/4/WI3213ICB01-0018-0AP-32AP-7AP-0AP, BREA/DL70//TOCTE/3/ BREA/ DL70//CABUYA/4/CALI92/ROBUSTICB09-1441-0AP-

OTR-0AP-OTR-0 AP-0TR, PENCO / CHEVRONBAR /3/LEGACY //PENCO /CHEVRON-BARCBSS04Y00047S - 20Y-3M-0Y-0M-0Y-0A, LA MOLINA 96/LEGACY CBSS05Y00161S-17Y-0M-0Y-0M-4AP, and MERITB /IBTA80 CBSS06Y00091S-4Y-0M-0AP-0TR, the 1000-grain weight ranged from 39.4 to 41.3 g, surpassing the standard cultivar Jalilabad 19 (38.8-41.6 g). Furthermore, accessions WI3159/6/ANCA/2469//TOJI/3/SHYRI/4/ ATACO /5/ALELIICB01-1137-48AP- 9AP-0AP and DD-21/Mundah ICB02-0555-0AP-10TR-7AP-0AP exhibited a 1000-grain weight of 46.0 g, exceeding the standard cultivars by 4.4-7.2 g. The research results demonstrate the importance of applying appropriate cultivation technologies based on the intended use of barley (feed or malting/brewing) and considering complex traits in future breeding programs.

Keywords: *Barley (Hordeum vulgare L.), protein, lysine, 1000-grain weight, genotype, breeding.*

ÇƏHRAYI ŞƏRABLARIN SAXLANMA ŞƏRAİTİNİN FİZİKİ-KİMYƏVİ VƏ ORQANOLEPTİKİ GÖSTƏRİCİLƏRƏ TƏSİRİ

THE INFLUENCE OF STORAGE CONDITIONS ON THE PHYSICOCHEMICAL AND ORGANOLEPTIC CHARACTERISTICS OF ROSÉ WINES

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XÜLASƏ

Fərqli temperaturlarda bir il saxlanılmış çəhrayi şərab nümunələrindən hər 3 aydan bir nümunələr götürülərək təhlillər aparılmışdır. Alınan nəticələr cədvəllərdə verilir (cədvəl 1, 2). Zirzəmidə saxlanma zamanı 12 ay müddətində Mədrəsə şərab nümunəsində bir sıra dəyişikliklər müşahidə olunmuşdur. Belə ki, pH ədədində bir qədər yüksəlmə, titrləşən turşuların miqdarında ilk aylarda artım və sonra azalma baş vermişdir.

Mədrəsə şərab nümunələrində saxlanmağa qoyulduğu şəraitdən asılı olmayaraq ümumi fenol birləşmələrinin ilkin miqdarı eyni olsa da, zirzəmi şəraitində saxlanma zamanı 12 ay müddətində onun azalması 25%, otaq şəraitində isə 29% təşkil etmişdir.

Açar sözlər: zirzəmi şəraitində saxlanma, otaq şəraitində saxlanma, Mədrəsə şərab nümunələri, çəhrayı şərab, pH ədədi, titrləşən turşular, antosianlar.

ABSTRACT

Samples of rosé wine stored at different temperatures were analyzed at 3-month intervals over a one-year period. The results obtained are presented in tables (Tables 1 and 2). During 12 months of storage in a cellar, several changes were observed in the Madrasa wine samples: a slight increase in pH, and an initial rise in titratable acidity followed by a subsequent decline.

Although the initial content of total phenolic compounds was identical for the Madrasa wine samples regardless of the storage conditions, a decrease of 25% was observed after 12 months of storage in a cellar, compared to a 29% decrease under room-temperature conditions.

Keywords: cellar storage, room-temperature storage, Madrasa wine samples, rosé wine, pH, titratable acidity, anthocyanins.

İlgili makama;

ICONFOOD'26 5. ULUSLARARASI GIDA ARAŞTIRMALARI KONGRESİ 16-18 Ekim 2026 tarihleri arasında Azerbaycan Kooperasiya Üniversitesi'nde 26 farklı ülkenin akademisyen/araştırmacılarının katılımıyla gerçekleşmiştir. Kongre kapsamında sunumu yapılan 212 bildirinin 103 adeti Türkiye'den katılımcılar tarafından; 109 bildiri ise 26 ülkeden katılımcılar tarafından sunulmuştur. Kongre 16 Ocak 2020 Akademik Teşvik Ödeneği Yönetmeliğine getirilen "*Tebliğlerin sunulduğu yurt içinde veya yurt dışındaki etkinliğin uluslararası olarak nitelendirilebilmesi için Türkiye dışında en az beş farklı ülkeden sözlü tebliğ sunan konuşmacının katılım sağlaması ve tebliğlerin yarıdan fazlasının Türkiye dışından katılımcılar tarafından sunulması esastır.*" değişikliğine uygun düzenlenmiştir.

Bilgilerinize arz edilir,

Saygılarımla,

Prof. Dr. Özlem Pelin CAN
Chair of Congress / Kongre Başkanı

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Rektör V.

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İKSAD Başkanlığına

Hörmətli Dr. Mustafa Lətif EMEK!

Sizin 07.05.2026-cı il tarixli Aze-824 saylı məktubunuza cavab olaraq bildiririk ki, 16 oktyabr 2026-cı ildə keçirilməsi nəzərdə tutulan ***"5.Uluslararası Gıda Araştırmaları Kongresi-ICONFOOD-26"*** ***https://iconfood.cumhuriyet.edu.tr/*** konfransı Bakı şəhərində Azərbaycan Kooperasiya Universiteti ilə birgə onlayn və yaxud oflayn şəkildə təşkili üçün ev sahibliyi etməkdən məmnun olardıq.

Konfransın rəhbər heyətinə daxil ediləcək nümayəndələrimizin siyahısını təqdim edirik:

Konfransın sədri	– Azərbaycan Kooperasiya Universitetinin rektoru, iqtisad elmləri doktoru, professor Eldar Allahyar oglu Quliyev.
Konfransın sədr müavini, təşkilat komitəsinin sədri	– Azərbaycan Kooperasiya Universitetinin elm və innovasiyalar üzrə prorektoru, Əməkdar elm xadimi, iqtisad elmləri doktoru, professor Bəyalı Xanalı oğlu Ataşov.
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- "Sosial iş və tərcümə" fakültəsinin dekanı, iqtisad elmləri doktoru, professor Elnurə Bünyat qızı Məmmədova.
- "İqtisadi nəzəriyyə" kafedrasının müdiri, iqtisad elmləri doktoru, professor Anar Əli oğlu Əzizov.

Hörmətlə,
Azərbaycan Kooperasiya Universitetinin rektoru

prof. Eldar Quliyev