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Proceedings For the 1st International Multidisciplinary Acorn as Food Workshop

17-18 December, 2024

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PROCEEDINGS FOR THE 1ST INTERNATIONAL MULTIDISCIPLINARY ACORN AS FOOD WORKSHOP

Editors, Dr. Canan Urhan

Istanbul, 2025

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Preface

It is with great pleasure that we present the proceedings of the “1st International Multidisciplinary Acorn as Food Workshop”, hosted by İstanbul Technical University (İTÜ) on December 17- 18, 2024. This workshop marks a significant milestone in the study and promotion of acorns as a valuable yet often overlooked resource in sustainable food systems. By bringing together experts from diverse fields—ranging from biology to food science to social studies and food policy—this event sought to foster interdisciplinary dialogue and collaboration around the multifaceted potential of acorns as a food source. The workshop featured contributions from researchers, practitioners, and policymakers with an international scope, reflecting a growing recognition of acorns' role in addressing critical global food challenges, such as food security, biodiversity conservation, and cultural heritage preservation. Topics explored include the historical and cultural significance of acorns, their nutritional and economic potential, and the challenges associated with integrating them into modern food systems. In addition, the workshop highlighted innovative methodologies and strategies for overcoming barriers, such as limited awareness, fragmented supply chains, and the erosion of traditional knowledge. This proceedings book presents a rich collection of research findings, case studies, and theoretical insights presented by our esteemed participants at this workshop. Each contribution commits to the collaborative and multidisciplinary spirit of the event, aiming to bridge gaps between academic research, local practices, and global policy frameworks. We are confident that this volume will serve as an essential resource for researchers, practitioners, and stakeholders interested in advancing the knowledge base and the sustainable development of acorns as a food resource. On behalf of the organizing committee, I extend my heartfelt gratitude to all participants, contributors, and reviewers whose efforts have made this publication possible. I also thank İTÜ Press for their support in disseminating this important work. I hope that this collection will inspire further research, collaboration, and innovation in the growing field of acorn as food studies and contribute to the development of sustainable, resilient, and inclusive food systems.

Dr. Canan Urhan

Editor-in-Chief, Workshop Chair

1st International Multidisciplinary Acorn as Food Workshop

İstanbul Technical University

ACKNOWLEDGEMENTS

This research was carried out within the framework of the MEDACORNET project. The MEDACORNET is part of the PRIMA program supported by the European Union. This project received funding from the FCT, the CDTI, Croatian Ministry of Science and Education, MIUR, TÜBİTAK, MESRS/IRESA/ANPR, DGRSDT, Morocco State Secretariat for Higher Education and Scientific Research as part of the PRIMA program.

FUNDING

This work was supported by the PRIMA Program supported by the European Union, with co-funding from the Scientific and Technological Research Council of Turkey (TÜBİTAK).

Organizing Committee

Dr. Canan Urhan	Department of Food Engineering (Istanbul Technical University)
Prof. Esra Çapanoğlu Güven	Department of Food Engineering (Istanbul Technical University)
Prof. Şebnem Burnaz	Department of Management Engineering (Istanbul Technical University)
Prof. Beraat Özçelik	Department of Food Engineering (Istanbul Technical University)
Assoc. Prof. Şeyda Serdar Asan	Department of Industrial Engineering (Istanbul Technical University)

Scientific Committee

Prof. Sedef Akgüngör	Department of Economics (Dokuz Eylul University)
Dr. Pedro Babo	Landratech, Instituto Politécnico de Bragança
Assoc. Prof. Haluk Ergezer	Department of Food Engineering (Pamukkale University)
Prof. Marko Jukic	Faculty of Food Technology (J.J. Strossmayer University of Osijek)
Prof. Jasmina Lukinac	Faculty of Food Technology (J.J. Strossmayer University of Osijek)
Prof. Beraat Özçelik	Department of Food Engineering (Istanbul Technical University)

PROGRAMME

DAY ONE: 17 DECEMBER 2024

09.00- 09.30 WELCOME RECEPTION

09.30- 10.00 OPENING REMARKS

Prof. Funda Karbancıoğlu Guler- Vice Dean, Faculty of Chemical and Metallurgical Engineering

Prof. Esra Capanoğlu Guven- Department Head, Food Engineering

Dr. Canan Urhan- Principle Investigator of the Medacornet Project at İTÜ/Workshop Chair

10.00- 10.30 Pedro Babo (Landratech, Instituto Politecnico de Braganca)- ***MEDACORNET: Rescuing Acorns as a Mediterranean Traditional Superfood***

10.30-12.00 SESSION I- NUTRITIONAL VALUE OF ACORN AS FOOD I (Session Chair: Esra Capanoğlu Guven)

10.30-11.00 Naouel Klibi (UNIVERSITY OF TUNIS EL MANAR) – ***Oak Acorns in Tunisia: Evaluation and Current Status***

11.00-11:30 Antonella Pasqualone & Carmine Summo (UNIVERSITA DEGLI STUDI DI BARI ALDO MORO)- ***Exploring acorn flour as nutritional ingredient: Compositional and Antioxidant Characterization of three oak species grown in Apulia***

11:30-12.00: Cristiano Mateus (INSTITUTO POLITECNICO DE BRAGANCA)- ***From Trees to Flour: Unlocking the Hidden Wonders of Acorns***

12.00-13.30 LUNCH

13.30-15.30 SESSION II- THE INSTITUTIONAL AND ORGANISATIONAL TERRAIN (Session Chair: Şebnem Burnaz)

13.30-14.00 Huseyin Turksoy & Tarık Durmuş (General Directorate of Forestry in Turkey)- ***General Directorate of Forestry Studies Related to Acorns***

14.00-14.30 Ana Oliveira & Ines Ferreira (Arcadia International)- ***Navigating the Food Regulatory Landscape of Acorns in the European Union***

14.30-15.00 Jose Ferrao (Pepe Aromas)- ***ACORN: The food of the future***

15.00-15.30 Peter Pechacek (FAO of the UN) – ***Food Products Among the Non-Wood Forest Products***

15.30-16.00 COFFEE BREAK

16:00-17:00 ROUNDTABLE AND CONCLUSIONS

DAY TWO: 18 DECEMBER 2024

10:30-11:30 SESSION I- NUTRITIONAL VALUE OF ACORN AS FOOD II (Prof. Beraat Özçelik- İTÜ Food Engineering)

10.30-11.00 Haluk Ergezer & Tolga Akcan (Pamukkale University & Dokuz Eylul University)- *Use of Acorns in Food Industry*

11.00-11.30 Yaren Sarıduman (Ar-Tu Kimya)- *Acorn Coffee: A Unique Caffeine-Free Beverage with Promising Qualities*

11.30-12.00 SURVEY ADMINISTRATION

12.00-13.30 LUNCH

13.30- 15.00- SESSION II- ACORN VALUE CHAIN AND STAKEHOLDERS (Session Chair: Şeyda Serdar Asan)

13.30-14.00 Liliana Duarte (Cor De Tangerina)- *Finding meanings: the capacity to approach acorns, chefs and communities*

14.00-14.30 Claudia Socol (CENCIRA)- *From Forest to Table: The Cultural, Nutritional and Ecological Role of Acorns in Romania*

14.30-15.00 Canan Urhan (Istanbul Technical University)- *Promises and Challenges of Acorn as Food Value Chain in Turkey*

15.00-15.30 COFFEE BREAK

15.30-16.00 ACORN FOOD TASTING

16.00-17.00 FINAL DISCUSSIONS, OUTPUTS AND OUTCOME

POSTER PRESENTATION (DISPLAYED BOTH DAYS IN THE WORKSHOP ROOM) Jasmina Lukinac & Marko Jukić (J.J. Strossmayer University of Osijek)- *Optimisation of the Computer Image Analysis Method for Evaluating the Quality of Bread with Added Acorn Flour*

Presenters' Short Biographies

Pedro Babo is the Co-founder and Chief Scientific Officer of LANDRATECH, LDA. With a PhD in Tissue Engineering and Stem Cells (University of Minho, 2016) and over 28 scientific publications, he has made key contributions to regenerative therapies and biomaterials for maxillofacial diseases. Since 2018, he has focused on the circular bioeconomy, leading projects like "Armazém da Bolota" and fostering global collaborations. Pedro drives innovation in acorn valorization and sustainable agri-food systems, positioning Landratech as a leader in sustainable innovation. He is coordinator of the PRIMA Med project Medacornet.

Liliana Duarte was born and works in Guimarães, Portugal. She is a Chef and Social Educator, managing the Cor de Tangerina project. Graduated in Social Education from Escola Superior de Educação do Porto, she worked in Mexico as a Social Educator, where she developed her culinary passion. In 2011, she created Cor de Tangerina's Educational Service and co-founded Mercadinho, Guimarães' Biological Market. Her culinary expertise spans 12 years, emphasizing Fair Trade, Slow Food, and organic cooking. She has led training programs, food-art collaborations, and represented Portugal at Terra Madre 2018. Her research focuses on food heritage, education, and community engagement.

Haluk Ergezer is a food engineer. After completing his undergraduate and graduate education at Pamukkale University, he completed his doctorate education at Ege University Institute of Science and Technology in 2013. His areas of expertise include Meat Science and Technology, Hygiene and Sanitation practices and Healthy Nutrition. In recent years, he has published many studies on the use of acorns in meat and its products. Also, he has many publications in international journals, presentations at conferences and ongoing projects.

Jose Ferrao is the Co-founder and Chief Executive Officer of Pepe Aromas, Lda. With a degree on Sociology (University of Évora, 2002) and with over ten years of formation and experience in agriculture, he understands like few the oak forests in Alentejo region in Portugal. He also combines a strong knowledge of the current and future impact of climate change on oak forests with a powerful expertise on the policies and possibilities of adaptation. As agriculture director, José leads Pepe Aromas, Lda. company, to strategic partnerships with research collaborators, positioning the company at the forefront of innovation and development of acorn products. His role is pivotal in identifying opportunities for enhanced acorn, driving differentiation, sustainability, and innovative solutions in a continuous changing world. His career also spans roles where he played an important role on agriculture and forests ecosystem management.

Inês Ferreira is a food engineer and consultant at Arcadia International. Currently, at Arcadia International, Inês works both for public and private clients. As such, she is currently part of the team working on a PRR-funded project called 'Oak Food - Integrated valorisation of acorns as a Portuguese raw material for differentiating food products. For private clients, the core of her daily work is to advise private operators on how best to comply with EU and national legislation.

Naouel Klibi is a specialist in Microbiology. Associate Professor at the University of Sciences, University Tunis El Manar and Coordinator of the Research Group "Antibiotic Resistance Team" of Laboratory of Microorganisms and Bioactive Molecules, UTM. Her main research interest is the characterization of antibiotic resistance mechanisms in bacteria of different origins as humans, animals, food, water and the environment, as well as the

performance of studies of molecular epidemiology to characterize the genetic lineages of antibiotic-resistant bacteria. Director of several doctoral and masters' theses. Also responsible for different international and national research projects. She has published 80 articles in international journals.

Jasmina Lukinac is a Full Professor at the Faculty of Food Technology, J.J. Strossmayer University of Osijek, Croatia. Specializing in food process engineering, her research focuses on non-destructive testing techniques, image analysis, and mathematical modeling applied to food technology. She is actively involved in projects on innovative food products, including gluten-free formulations and sustainable resource recovery. An experienced researcher and educator, Dr. Lukinac has published extensively in international journals and is a member of several scientific committees and editorial boards. Her contributions aim to bridge technological advancements with practical applications in the food industry.

Cristiano Gabi dos Santos Mateus completed an MSc in Biotechnological Engineering (02/12/2022) and a BSc in Biology and Biotechnology (03/12/2020) by Escola Superior Agrária- Polytechnic Institute of Bragança (IPB). He is a 1st-year PhD student in Technology and Natural-Based Products at the Escola Superior de Tecnologia e Gestão- IPB. Since 10/03/2023, he has been a research fellow at the Mountain Research Center (CIMO) for the MEDACORNET project. Based at the Polytechnic Institute of Bragança, CIMO is a multidisciplinary research unit addressing Mediterranean mountain issues, and it's part of the national research network coordinated by the Portuguese Science and Technology Foundation (FCT).

Ana Olivera is a veterinary doctor and consultant at Arcadia International. Currently, at Arcadia International, Ana works both for public and private clients. Currently, she is part of the team working on a PRR-funded project called 'Oak Food - Integrated valorisation of acorns as a Portuguese raw material for differentiating food products. Additionally, she provides consultancy on Food and Veterinary Policies and Legislation at EU and national level.

Antonella Pasqualone Associate Professor of Food Science and Technology at the University of Bari, Italy. She mostly does research in Cereal Science and Technology and is scientific responsible of many national and international projects. Her current main research interests are: improvement of the nutritional and functional quality of cereal-based foods, also gluten-free, by incorporating sustainable crops such as pulses or upcycled ingredients from food waste; studies on the rediscovery of neglected but traditional cereal-based ethnic foods and beverages, such as specific flatbreads and non-alcoholic fermented drinks, to preserve their memory while achieving qualitative improvement and standardization.

Peter Pechacek is a forest scientist, and associated professor for Conservation Biology at the University of Freiburg. Over the course of his professional career, Peter managed and directed programmes and projects related to application of scientific knowledge in sustainable management of forests and biodiversity. After working in Germany, USA, UAE, China, and Timor-Leste, he joined the FAO Subregional Office in Ankara as a Forestry Officer. Peter is currently based in the FAO Liaison Office in Geneva and works under the FAO Regional Office for Europe and Central Asia with seat in Budapest.

Yaren Sarıduman is a Food Engineer with both Bachelor's and Master's degrees from the Department of Food Engineering at Ege University, Turkey. For the past three years, she has been working at Ar-Tu Kimya San. ve Tic. A.Ş., where she is actively involved in quality management and R&D activities. During her Master's studies, she collaborated with Ar-Tu Kimya on acorn-based food research, and the outcomes of these projects are currently being further developed within the company for industrial-scale applications. Furthermore, sustainability is a core principle embraced by the company in all areas of its work.

Claudia Socol has a relevant background in agrifood, with a strong background and dedicated to advancing research and innovation. Claudia's work bridges the gap between academia and private sector, fostering collaboration and knowledge exchange to drive growth and success in both fields. She has also been engaged in various European and international collaborations such as Green Initiative Cluster- a collaborative effort under the EU GREEN funded project that focuses on sustainable education and research, and other green activities and practices, fostering interdisciplinary research and practical actions to promote environmental stewardship. She is Review Editor for Nutrition and Sustainable Diets and Sustainable Food Processing in *Frontiers in Sustainable Food Systems* and *Frontiers in Nutrition* journals.

Carmin Summo is an Associate Professor of Food Science and Technology at the University of Bari. Actually, he is the coordinator of the bachelor's and master's degree in food science and technology at the University of Bari Aldo Moro. Scientific coordinator of several research projects in the field of the food science and Technology, his current research activities are related to the i) development of innovative vegetable-based foods by incorporating of vegetable protein from sustainable processing; ii) improvement of the nutritional and functional quality of cereal-based foods, incorporating sustainable crops such as pulses and acorn; iii) improvement of the nutritional quality of the meat-based products.

Hüseyin Türksoy works as a Forest Engineer in the Department of Ecosystem Services of the General Directorate of Forestry. After graduating from Istanbul University Faculty of Forestry in 2009, he completed his master's degree at the same university and is currently continuing his doctoral studies. Hüseyin TÜRKSOY, whose area of expertise is non-wood forest products, develops projects on the sustainable management of forest ecosystems and the protection of natural resources, and makes academic and professional contributions in this field.

Canan Urhan is a Management and Organisation Studies scholar. She has worked as faculty member in the Business Administration departments of several Turkish universities including Bahçeşehir and Beykent University for over 10 years. She was a Visiting Researcher at Goldsmiths, Political Economy Research Center in 2019-20 as a TÜBİTAK fellow and at UCL Institute of Advanced Studies in the 2023-24 academic year. She is currently a Visiting Scholar at UC Berkeley Sociology Department and Haas Business School during the 2025 Spring semester. As of June 2023, she has taken the role of Principle Investigator of the MEDACORNET project supported by the TÜBİTAK in the framework of the PRIMA programme at the Food Engineering Department at the Faculty of Chemical and Metallurgical Engineering at Istanbul Technical University. In addition to being involved in all research activities related to the social sciences, marketing and management aspects of this project, she is responsible for the coordination of an interdisciplinary research team at İTÜ within the scope of the project consortium.

1st International Multidisciplinary Acorn as Food Workshop | Day 1

KEYNOTE SPEECH

MEDACORNET: RESCUING ACORNS AS A MEDITERRANEAN TRADITIONAL SUPERFOOD

Pedro Babo^{1,2}

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²*CIMO, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança*

ABSTRACT

The MEDACORNET project, funded under the PRIMA Innovation Action (1.3.1-2021), aims to revive acorns as a valuable Mediterranean diet ingredient by establishing a sustainable value chain. With a budget of €1,251,600, the 36-month project (2023–2026) unites a consortium of 11 partners across eight countries: Portugal, Spain, Italy, Croatia, Turkey, Tunisia, Algeria, and Morocco.

Acorns, naturally gluten-free and rich in starch, fiber, and lipids, are the most abundant nut in Mediterranean endemic forests. Despite their historical significance in Mediterranean diets, their current human consumption is limited to regional dishes due to challenges such as tannin content, inconsistent annual productivity, and a weak value chain.

MEDACORNET leverages expertise in agro-food systems, technological innovation, and strategic communication to enhance adherence to the Mediterranean diet as a sustainable, health-oriented, and culturally rooted food system. The project's key objectives include:

- Mapping Mediterranean oak forest distribution and stakeholder networks;
- Developing advanced acorn processing technologies;
- Launching a digital marketplace to connect producers with consumers;
- Evaluating the socioeconomic impact of adopting acorn-based foods;
- Promoting acorns as a sustainable, gluten-free, and healthy dietary component.

This initiative bridges scientific research, traditional knowledge, and innovation to reposition acorns as a cornerstone of Mediterranean cuisine, fostering environmental sustainability, social well-being, and food sovereignty.

Keywords: *Mediterranean Diet; Acorn Value Chain; Sustainable Food Innovation; Gluten-Free Ingredients; Circular Economy*

Session I: Nutritional Value of Acorn as Food I

HIGHLIGHTING THE ANTIBACTERIAL, CYTOTOXICITY AND ANTIVIRAL ACTIVITY OF QUERCUS COCCIFERA

Naouel Klibi¹ , Oumayma Kenza Chabbar¹, Mohamed Iheb Ben Tekfa¹, Abir Haddada², Lamjed Bousselema³, Hedia Hannachi² , Imen Ouzari¹, Sondes Stambouli²

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ABSTRACT

This study investigates the antibacterial and antiviral properties of hydroethanolic extracts obtained from acorn kernels and shells of Kermes oak (*Quercus coccifera*) harvested from northwestern Tunisian forests generally associated with cork oak trees. This study analysed the phenolic composition, and antioxidant and antimicrobial activity, using different solvents for each shell and kernel. For the antibiofilm activity, cytotoxicity test, and antiviral activity, hydroethanolic extracts obtained from the shell and the kernel were used. The methods used to determine polyphenols, flavonoids, and condensed tannins are based on a colorimetric determination by the Folin-Ciocalteu reagent, the AlCl₃ method, and the ClH-vanillin method, respectively. The DPPH method was employed to evaluate the antioxidant potential in vitro. For the antimicrobial activity, the MICs were determined for *Enterococcus faecalis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, and *Pseudomonas aeruginosa*. The cell viability and antiviral activity were tested on Vero cells isolated from kidney epithelial cells of the African green monkey and Herpes virus HSV-2 respectively.

The *Quercus coccifera* is rich in polyphenolic compounds with 200 mg EAG/ g of dry sample, the highest flavonoid concentrations were found in the hydro-methanolic extract with 22,28 mg ER/g dry extract of the kernel and 52,50mgER/g dry extract of the shell. In addition, the ethanolic extracts obtained showed antibacterial, antibiofilm and antioxidant properties. The kernel and the shell extracts show significant antiviral activity against the Herpes virus HSV-2. The cytotoxicity concentrations of 50% are 812,83 µg/mL and 432,64 µg/mL for the hydroethanolic extract of kernel and shell respectively.

This study confirms that the extracts of kermes oak are an excellent source of natural antioxidants and antimicrobial compounds which could be exploited in the pharmaceutical, agriculture and food sectors

Keywords: *Quercus coccifera* , Antibacterial, Antiviral, Cytotoxicity , Phenolic compounds

EXPLORING ACORN FLOUR AS NUTRITIONAL INGREDIENT: COMPOSITIONAL AND ANTIOXIDANT CHARACTERIZATION OF THREE OAK SPECIES GROWN IN APULIA

Antonella Pasqualone¹, Giacomo Squeo¹, Francesca Vurro¹, Carmine Summo¹

¹ Department of Soil, Plant and Food Science, University of Bari Aldo Moro, Via Amendola, 165/a, 70126 Bari, Italy

ABSTRACT

The *Quercus* genus includes both evergreen and deciduous trees within the *Fagaceae* family. While oak wood is commonly used for wine aging and woodcraft, oak fruits, namely acorns, have historically been used as a food source. In the past, acorns were widely utilized in the Mediterranean region for making breads, flatbreads, soups, and beverages. Today they are mainly used as animal feed (Zocchi et al., 2022; Szablowska et al., 2021).

To explore the use of acorn flour as nutritional ingredient, acorns from three oak species - *Quercus pubescens* W., *Quercus ilex* L., and *Quercus trojana* W. - were collected in the Apulia region (south of Italy) to study their composition and antioxidant properties. Among the nutrients, carbohydrates were the largest component of acorns (86-90% d.m.) with a fiber content ranging from 7.35% (*Quercus ilex* L.) to 14.52% (*Quercus trojana* W.), making the flours suitable for the fortification of foods with the aim to increase the fiber content. The protein fraction, which is characterized by the absence of gluten, ranging from 3.3% to 6.4% d.m. and was dominated primarily by aspartic and glutamic acids.

Acorns exhibited relevant antioxidant activity, due to the content of both hydrophilic (phenols) and lipophilic (tocopherols) antioxidant compounds. *Quercus ilex* L. was the richest species.

Acorn flour composition was influenced by oak species and geographical origin. The peculiar composition indicates its potential as a functional ingredient and as a gluten-free alternative to conventional cereals. Reviving traditional practices and advancing acorn-based research could support its reintroduction as a sustainable food source, responding to the current consumer trends.

Keywords: *Quercus*; Apulia; food heritage; nutritional composition; antioxidants

FROM TREES TO FLOUR: UNLOCKING THE HIDDEN WONDERS OF ACORNS

Cristiano Mateus¹, José Ignacio Alonso-Esteban^{1,2}, Tiane C. Finimundy¹, Filipa Mandim¹, Izamara Oliveira¹, Isabel C.F.R. Ferreira¹, Pedro Babo^{1,3}, Raphaël Canadas^{1,3,4}, Lillian Barros¹

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⁴ Faculty of Medicine of the University of Porto, Porto, Portugal.

ABSTRACT

With around 600 species globally, the genus *Quercus* holds significant ecological and economic value. In Portugal, *Quercus robur*, *Quercus rotundifolia*, and *Quercus suber* species cover about 1.151 million hectares, 36% of the national forest area.¹ This study analyzed acorns' nutritional and bioactive properties, including their fatty acids, sugars, phenolic compounds, and bioactivities, focusing on both the kernel and the shell, a processing by-product.

In proximate composition, *Q. rotundifolia*, *Q. suber*, and *Q. robur* were richest in fat (8.8 g/100 g), protein (6.1 g/100 g), and fiber (25.7 g/100 g), respectively. Major fatty acids included oleic (C18:1n9c), palmitic (C16:0), and linoleic acids (C18:2n6c), while fructose, glucose, and sucrose were the predominant sugars. Seventeen phenolic compounds were tentatively identified, mainly gallic acid, ellagic acid, and derivatives.

Antioxidant activity correlated with phenolic content, significantly inhibiting lipid peroxidation but not free radical neutralization in cells. *Q. rotundifolia* exhibited the strongest antiproliferative effect, especially on AGS tumor cells, while *Q. suber* was cytotoxic to non-tumor cells. *Q. robur* and *Q. suber* species demonstrated potent antibacterial activity against clinical and foodborne bacteria. Shell extracts revealed nine phenolic compounds, with *Q. suber* samples showing superior antioxidant (TBARS assay, IC₅₀ lower than trolox) and antiproliferative effects.

In summary, acorn flours are nutritionally rich, especially in fiber, and offer significant antioxidant and antiproliferative potential, with *Q. robur* and *Q. rotundifolia* extracts standing out. Shell extracts, mainly from *Q. suber*, exhibited potent antioxidant and antibacterial properties. These findings highlight the potential of acorn-based products in functional foods and biomedical applications.

Keywords: *Quercus rotundifolia* Lam.; *Quercus suber* L.; *Quercus robur* L., Acorn flour; Acorn Shell.

OPTIMISATION OF THE COMPUTER IMAGE ANALYSIS METHOD FOR EVALUATING THE QUALITY OF BREAD WITH ADDED ACORN FLOUR

Jasmina Lukinac¹, Ema Salopek¹, Ana Šušak¹, Daliborka Koceva Komlenić¹, Petra Lončarić¹, Marko Jukić¹

¹*J.J. Strossmayer University of Osijek, Faculty of Food Technology Osijek, Osijek, CROATIA*

ABSTRACT

This study investigates the development of an automated image analysis method for assessing the structural quality of gluten-free bread enriched with acorn flour (*Quercus rotundifolia* L.). The unique techno-functional properties of acorn flour in bread dough pose significant challenges for bakery and pastry applications, making this research timely and relevant. The primary objective of this study is to evaluate key structural parameters of bread, including void count, average void size, and porosity, using various image segmentation algorithms. The algorithms tested include Default, IsoData, Li, Moments, and Otsu, with IsoData identified as the most stable and reliable for this application.

The results demonstrate that increasing the acorn flour content leads to higher void count, larger void size, and increased porosity, with 100% acorn flour showing the most pronounced effects. Additionally, increasing the water content in the dough reduces void count while increasing void size and porosity, further highlighting the role of acorn flour in influencing bread texture and structure. These findings underscore the potential of acorn flour to improve the quality of gluten-free bread and contribute to the development of healthier, innovative bakery products.

This study offers valuable insights into optimizing the use of acorn flour in bakery applications and promotes its potential as a sustainable ingredient in gluten-free and functional food products.

Keywords: *acorn flour; image analysis; bread quality; segmentation algorithms; gluten-free bread*

Session II- The Institutional and Organisational Terrain

GENERAL DIRECTORATE OF FORESTRY STUDIES RELATED TO ACORNS

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ABSTRACT

Turkey has a significant potential in the production of non-wood forest products (NWFPs) thanks to its rich biodiversity. Its geographical location and historical past have enabled people to make extensive use of wild plants, resulting in a rich plant diversity.

One of the important elements of this richness is the acorn, known as the fruit of the Oak tree, which has been used in leather and textile production since ancient times and has the potential to be a strategic product for Turkey. Acorns are used in leather tanning as a vegetable tannin in the production of adhesives and dyestuffs and are produced only in Turkey under the trade name valex (valonea extract). Acorn pulp from the production is used as biofuel and organic fertilizer. In addition to animal feed, acorn pellets are also utilized as gluten-free flour through a specific process. Acorn extracts have a wide range of uses in Turkey and are also exported abroad.

Regarding this species, which is among our non-wood products with high economic and commercial potential, the Acorn Action Plan (2022-2026) was put into effect by the General Directorate of Forestry in 2022. The Action Plan aims to contribute to the national economy and forest villagers by subjecting acorns to regular and sustainable utilization.

Keywords: *Acorn, General Directorate of Forestry, Action Plan*

NAVIGATING THE FOOD REGULATORY LANDSCAPE OF ACORNS IN THE EUROPEAN UNION

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ABSTRACT

Acorns played an important role in human nutrition for centuries in Europe, particularly in the Mediterranean region, where they were consumed in various forms during times of poverty and famine. Despite their historical importance, acorns are now primarily used as animal feed. However, recent interest has revived their potential as a sustainable and nutritious food source. Nonetheless, only a few acorn species are authorised for human consumption within the European Union. Under the EU's Novel Food Regulation, acorns not consumed in significant quantities before 15 May 1997 require an authorisation or notification (in case of traditional food from a third country) in order to be used. Currently, only two species of acorns are listed in the EU Novel Food Catalogue: *Quercus robur* L (for use in food supplements) and the fruit of *Quercus rotundifolia* Lam (for general use). Additional evidence of acorn consumption exists at EU Member State level such as in Spain, Italy, Belgium and Germany. For instance, Italy and Belgium have national legislation that permits the use of nine different *Quercus* species in food supplements. Furthermore, acorn-derived products like flour, oil, and starch may also require separate evaluations and authorisations, with some of them potentially qualifying as food additives (i.e., chemically modified starches). Acorns have the potential to position themselves in the market as a sustainable, nutritious, and versatile ingredients but their successful integration into the food system necessitates careful navigation of the EU regulatory landscape.

Keywords: *Acorns, Novel food, Authorisation, European Union, Legislation*

INTRODUCTION

Acorns played an important role in human nutrition for centuries in Europe, particularly in the Mediterranean region. Historically associated with times of poverty and famine, they were largely consumed in various forms such as raw, flour, roasted, and more. Despite their historical importance and nutritional potential, acorns are now underused and mainly used as animal feed, particularly for Iberian pigs and other livestock (Inácio et al., 2024). Recognising the potential, the project *OakFood – Integrated Valorisation of Acorns as a Portuguese Raw Material for Differentiated Food Products*, co-financed by the Recovery and Resilience Plan, aims to reintroduce acorns as a valuable resource for the development of value-added products (Figure 1).

Figure 1. OAK Food project



Recent interest highlights the potential of acorns as a sustainable resource, thanks to their minimal agricultural requirements and their nutritional benefits. Generally, acorns are a good source of carbohydrates (specially starch), lipids (unsaturated fatty acids), fibre, carotenoids,

phenolic acids, flavonoids, vitamin E and minerals (Fe, Cu, Zn, K, P, among others) (Correia et al., 2013; Silva et al., 2016; León-Camacho et al., 2004; Custódio et al., 2015). Considering their specific nutritional profile, acorn-based products may bear certain nutrition and health claims, provided they meet the conditions established under Regulation (EC) No 1924/2006. For example, acorn-based products can be labelled as "source of fibre" if they contain at least 3 g of fibre per 100 g or at least 1.5 g of fibre per 100 kcal, as specified by the regulation. Additionally, acorns are gluten-free, making them an appealing ingredient for products aimed at people intolerant to gluten or celiac. There are hundreds of species of acorns documented in scientific publications. However, only a few of them can currently be used for human consumption within the European Union (EU).

ACORNS IN THE EUROPEAN UNION: REGULATORY FRAMEWORK

Currently, only two species of acorns are listed in the EU Novel Food Catalogue. Common oak (*Quercus robur* L) can only be used in food supplements (Figure 2) and the fruit of holm oak (*Quercus rotundifolia* Lam) can be used in food (Figure 3).

Figure 2. EU Novel Food status Catalogue '*Quercus robur* L' entry

STATUS	
Whole (bark, fruit, nut gal, leaf, bud, seeds and wood)	
	NOT NOVEL IN FOOD SUPPLEMENTS - According to the information available to Member States' competent authorities, this product was used in food supplements in the EU before 15 May 1997. Therefore, its use in food supplements is not considered to be novel and is not subject to the pre-market authorisation in accordance with Regulation (EU) 2015/2283. Any other food uses of this product, other than as, or in, food supplements, might be considered to be novel and consequently might need to be authorised pursuant to the requirements of the Novel Food Regulation (EU) 2015/2283 before they can be placed as food on the EU market.

Figure 3. EU Novel Food status Catalogue '*Quercus rotundifolia* Lam' entry

STATUS	
Fruit (acorn)	
	NOT NOVEL IN FOOD - According to the information available to the Member States' competent authorities, this product was used for human consumption to a significant degree within the Union before 15 May 1997. Thus, it is not considered to be 'novel' according to the provisions of the Novel Food Regulation (EU) 2015/2283 and its access to the market is not subject to the pre-market authorisation in accordance with Regulation (EU) 2015/2283.

Therefore, for the other species and even for *Quercus robur* L. in terms of food applications, the EU Novel Food framework must be considered.

In the EU, according to Article 2 (iv) of Regulation (EU) No 2015/2283 ('Novel Food Regulation'), 'novel food' means any food that was not used for human consumption to a significant degree within the Union before 15 May 1997 including, among others: «Food consisting of, isolated from or produced from plants or their parts, except when the food has a

history of safe food use within the Union and is consisting of, isolated from or produced from a plant or a variety of the same species obtained by:

- *Traditional propagating practices which have been used for food production within the Union before 15 May 1997; or*
- *Non-traditional propagating practices which have not been used for food production within the Union before 15 May 1997, where those practices do not give rise to significant changes in the composition or structure of the food affecting its nutritional value, metabolism or level of undesirable substances. »*

In essence, if an acorn species has not been significantly consumed by humans in the EU before 15 May 1997, it is classified as a novel food and must undergo a lengthy approval process at the EU level before it can be used.

Proving significant consumption in the EU before that date is challenging, as much of the information is not digitalised or preserved, and it dates back a considerable time. Besides that, while there is evidence of general consumption across Europe, particularly in the Mediterranean region, much of this evidence does not specifically link consumption to individual acorn species.

When there is some consumption evidence, but the novel food status remains unclear, Article 4 of Novel Food Regulation allows food business operators to consult the competent authorities of the EU Member State where they first intend to place the food product or ingredient on the market. The applicant that requests such consultation must provide specific information, including a technical dossier. The technical dossier must contain the information required in Annex II of Regulation (EU) 2018/456 which includes, among others, full description of the food, production process, history of human consumption within the Union before 15 May 1997, availability of the food on the market (if applicable), among others.

In such cases, the EU Member State will provide a conclusion within 4 months, which may be extended once by an additional 4 months. In order to help to determine whether a food qualifies as a novel food, the EU Member State may consult other EU Member States and the European Commission. The experiences and precedents of individual EU Member States will serve as an important piece of evidence in this assessment.

If an acorn is ultimately deemed as a novel food, it faces an approval process at EU level before it can be authorised. There are two different pathways to apply for a novel food application: the authorisation procedure and the notification procedure.

The authorisation procedure, detailed in Article 10 of Novel Food Regulation, requires food business operators to submit a comprehensive technical dossier containing detailed information about, among others, the full description of the production process, detailed composition of the novel food, scientific evidence demonstrating that the novel food does not pose a safety risk to human health. The analytical information provided in the dossier should be provided preferably on at least five representative batches of the novel food that have been independently produced.

This is generally the most time-consuming procedure, with a minimum duration by law of 17 months. On average, the full authorisation process of a novel food dossier – i.e., from the submission of an application until the adoption of an authorisation decision by the European Commission- may take up to 3 years.

Alternatively, the notification process available for traditional foods from third countries outlined in Article 14 of Novel Food Regulation offers a faster option. If an acorn species has been consumed safely for at least 25 years in a third country and this consumption can be proven, the notification procedure becomes a more viable and less time-consuming alternative. While the technical dossier for this process is less complex than that required for

full authorisation, the analytical data should be provided for at least five representative batches. The European Food Safety Authority (EFSA) provides a guidance for the preparation of notifications for authorisation of traditional foods (EFSA, 2024). To date, no request has ever been made for any acorn species.

NATIONAL EXPERIENCES AND APPROACHES

As said, the practical experience and specific legislation of individual EU Member State play a crucial role in determining whether a specific specie of acorn is authorised or not. Therefore, some examples will be cited of human acorn consumption in different EU Member States.

In Spain, there is evidence that acorns from different species of *Quercus* were consumed from prehistoric times, throughout the 20th century until the 1960s, mainly in times of scarcity. They were consumed in different ways, including raw, cooked, roasted, coffee, flour, among others. Nowadays, new and differentiated products are emerging, such as acorn liqueur, caramels and other specialty items, although production remains on a small scale (García-Gómez et al., 2017).

Italy, on the other hand, has a legal diploma Ministerial Decree of 10 August 2018 that contains the list of substances and plant preparations permitted for use in food supplements, including nine species of *Quercus*. The decree specifies the parts of the plant that can be used (e.g. *Quercus alba* L.- cortex, lignum, folium, fructus and *Quercus suber* L - cortex, folium, fructus), while also outlining the obligations food producers must meet to demonstrate safety and protect consumers.

Similarly, Belgium, has national legislation regulating the use of plants and plant preparations in food supplements. The Arrêté Royal du 31 Août 2021 governs the manufacture and trade of foods containing plants or plant preparations, listing nine permitted species of *Quercus* (e.g. *Quercus coccifera* L.- bark, fruit, nut gal, leaf, bud; *Quercus pubescens* Wild. - bark, fruit, nut gal, leaf, bud).

Germany, however, does not have a legally binding positive or negative list with other substances or plants that may be used in food supplements. Decisions about the inclusion of specific plants are generally based on a case-by-case evaluation. National experts from Germany, Austria, and Switzerland have compiled a list of plants that represent borderline cases, known as “Stoffliste des Bundes und der Länder”. The list includes *Quercus cortex* (*Eichenrinde*): BAnz Nr. 22a, 1.2.1990.

ACORN-DERIVED PRODUCTS: REGULATORY IMPLICATIONS

In addition to the acorn itself, there are different ways to consume acorns and products that can be obtained from them, such as flour, oil, and starch (Silva et al., 2016; Parsaei et al., 2018; Dabija et al., 2019; Akcan et al., 2017; Zarroug et al., 2020).

Even if an acorn species is not classified as a novel food or is eventually dully authorised as such, a product derived or extracted from acorns may still require an individual authorisation. A novel food is, as said above, a food consisting of, isolated from or produced from plants or their parts, with no history of safe food use. Besides that, it is also a novel food, according to Article 2 (vii) of Novel Food Regulation «*food resulting from a production process not used for food production within the Union before 15 May 1997, which gives rise to significant changes in the composition or structure of a food, affecting its nutritional value, metabolism or level of undesirable substances*». Therefore, the extraction of a specific ingredient, such as an oil or starch could result in a novel food if the process has never been used before in food production and gives rise to significant changes of the food. Therefore, the use of these

ingredients requires an evaluation from the perspective of their regulatory framework within the EU.

Regarding specifically about the acorn starch, its use is even more complex, as it may not only be considered a novel food for the reasons mentioned above, but it could also be a food additive, which falls under a completely different regulatory framework.

In the EU, food additives are regulated by Regulation (EC) No 1333/2008. According to Article 3, an additive is *«any substance not normally consumed as a food in itself and; not normally used as a characteristic ingredient of food, whether or not it has nutritive value, and the intentional addition of which to food for a technological purpose in the manufacture, processing, preparation, treatment, packaging, transport or storage of such food results, or may be reasonably expected to result, in it or its by-products becoming directly or indirectly a component of such foods»*.

Also, according to this Regulation, certain substances, such as white or yellow dextrin, roasted or dextrinated starch, starch modified by acid or alkali treatment, bleached starch, physically modified starch and starch treated by amylolytic enzymes, are not considered food additives. On the other hand, modified starches are considered food additives when they are *"obtained by one or more chemical treatments of edible starches, which may have undergone a physical or enzymatic treatment, and may be acid or alkali thinned or bleached"*. Based on this, depending on the process used to modify or even extract the starch from the acorn, it may fall under the scope of a food additive as a (chemically) modified starch.

The Regulation (EC) No 1333/2008 provides a list of authorised food additives, specifying their conditions to be used in different food categories. Modified starches like E 1404 (oxidised starch), E 1410 (monostarch phosphate), E 1412 (distarch phosphate), and E 1420 (acetylated starch), are examples of authorised additives used for specific technological purposes (e.g. stabilizers, thickeners, and emulsifiers).

Additives that are not listed cannot be used without undergoing a thorough authorisation process in the EU. The authorisation process is distinct from the novel food and is governed by Regulation (EC) No 1331/2008. It typically takes on average three years to complete.

CONCLUSION

Overall, acorns have the potential to achieve a market position as a sustainable, nutrition and versatile ingredient. However, their integration into the human diet within the EU faces some regulatory challenges. In the EU, acorn species that were not consumed to a significant degree within the Union before 15 May 1997 are considered novel foods and must be authorised before they can be marketed.

Demonstrating significant human consumption of acorn species - either within the EU or in third countries - can help streamline the approval process. If there is evidence of consumption within the EU, but the legal status remains uncertain, food business operators can pursue the consultation pathway under Article 4 of the Novel Food Regulation. Alternatively, if an acorn species has been safely consumed for at least 25 years in a third country but not in the EU, the notification procedure under Article 14 provides a faster and less complex route to approval. If the species is classified as a novel food with no history of consumption, the standard procedure outlined in Article 10 must be followed.

Therefore, evidence of consumption from scientific publications, expert opinions, monographs, data from international or national organizations, government documentation, cultivation/harvesting statistics, sales and trade figures, as well as information from cookbooks and recipes, can all be crucial in determining the appropriate regulatory pathway.

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ACORN: THE FOOD OF THE FUTURE

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ABSTRACT

Acorns are among the Mediterranean region's one of the most precious yet forgotten fruits. Historically, they have played a significant role in human diets and served as a crucial food source for livestock and wildlife, especially during times of scarcity. Recently, there has been a renewed interest in acorns for human consumption, sparking the creation of innovative food products. However, tannin-rich content in some species, fluctuations in annual productivity, and a lack of a well-developed value chain still present challenges for their adoption in the agro-food industry as a primary food source.

This is why it is essential to promote scientific, technical, and socioeconomic knowledge centred on production and on consumer demand to establish a sustainable value chain for acorns in the agro-food industry, providing healthy, safe, and sustainable food products.

Studies show that acorns are gluten-free, rich in antioxidants, tannins, and phenolic compounds, and may help manage certain diseases and some types of cancer. The inclusion of acorn-based products is undoubtedly a good choice to improve the nutritional profile of various foods, especially gluten-free options.

Acorns can contribute to nourishing future generations safely and sustainably.

Keywords: *acorn, gluten-free, Quercus spp., oak fores,; sustainability*

FOOD PRODUCTS AMONG THE NON-WOOD FOREST PRODUCTS (NWFPs) – THE FAO PERSPECTIVE

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ABSTRACT

Non-wood forest products (NWFPs) are linked to living organisms inhabiting forests. NWFPs and especially those that are edible are major source of social and economic benefits for rural people. NWFPs can also support national economies. However, systematic monitoring of utilization of NWFPs proves to be difficult. Accurate assessments are rare. Bearing this limitation in mind, information reported by the member states to UNECE (United Nation Economic commission for Europe) are impressive. Data suggest significant contribution of selected NWFPs in monetary terms: Mushrooms including truffles worth 1,200 to 1,400 million USD, game meat 300 to 400 million USD, honey including bee wax 270 to 280 million Euros (Europe only), fruits and berries over 265 million USD (four main European producers only), and maple syrup from the USA and Canada over 84 million USD (FAO. 2001; FOREST EUROPE, UNECE and FAO. 2015; UNECE/FAO. 2000). Against the backdrop of implications for forest policies and management that would prevent overharvesting, FAO stands ready to assist its members with design of periodical surveys and inventories on NWFPs.

Keywords: *Non-wood forest products (NWFPs), economic contribution, overharvesting, monitoring, reporting*

1st International Multidisciplinary Acorn as Food Workshop | Day 2

Session I: Nutritional Value of Acorn as Food II

Session I: Nutritional Value of Acorn as Food II

USE OF ACORNS IN FOOD INDUSTRY

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ABSTRACT

Acorn, is a dry fruit of oak trees with a hard shell, which belongs to the same family as the chestnut. Acorn has been used in the cuisine of many countries and civilizations around the world for thousands of years due to its high nutritional value, particularly during times of famine when economic situations are terrible. Acorns are utilized in bakery products including bread, cakes, biscuits, muffins, and pastries, as well as in beverages like coffee, hot chocolate, and liqueur, and the oil sector, according to recent studies. Acorn is a fruit rich in carbohydrates and unsaturated fatty acids, high in minerals and vitamins. At the same time, the fact that the protein fraction is gluten-free, an excellent source of dietary fiber, and high in antioxidants such as polyphenols, gallic acid, and tocopherols increases the potential of acorns as an alternative additive in the preparation of functional foods. In this paper, some studies on the use of acorns in the food industry are summarized.

Keywords: *Acorn, Food Additive, Functional food, Antioxidants, Gluten- free*

ACORN COFFEE: A UNIQUE CAFFEINE-FREE BEVERAGE WITH PROMISING QUALITIES

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ABSTRACT

Acorns are an alternative food source that offers numerous potential health benefits for human nutrition. When dried, roasted, ground and brewed, acorns can be processed into a coffee-like beverage, and their caffeine-free nature is an intriguing feature. This characteristic creates a noteworthy opportunity to meet the growing demand for decaffeinated coffee and address challenges in coffee production caused by climate change.

Acorn coffee samples roasted at 220°C for several durations—750 s (A), 585 s (B), and 270 s (C)—were evaluated for their physicochemical and sensory attributes.

In coffee brewing, wettability and solubility are crucial factors. Samples that were roasted for longer durations exhibited prolonged dissolution and wetting times ($p < 0.05$). Bulk density, Carr Index (CI), and Hausner Ratio (HR) values are indicative of the packaging and flowability/adhesiveness characteristics of powdered products. No statistical differences were observed in these parameters among the three acorn coffee samples ($p > 0.05$), demonstrating uniform suitability for packaging regardless of roasting level.

Sensory evaluations further revealed no significant differences in flavor, aroma, and overall acceptability between samples A and B ($p > 0.05$), while sample C received significantly lower scores ($p < 0.05$). Additionally, brewing ratios (1/30, 1/40, 1/50) did not significantly influence sensory preferences ($p > 0.05$), providing flexibility in preparation guidelines for consumers.

Acorn coffee offers a unique, decaffeinated option for those seeking a different coffee experience.

Keywords: *Acorn Coffee, Coffee Alternative, Caffeine-Free Beverage, Physicochemical Properties, Sensory Evaluation*

Session II- Acorn Value Chain and Stakeholders

REVITALIZING GASTRONOMIC HERITAGE: SUSTAINABILITY, COMMUNITY, AND THE ROLE OF ACORNS IN MODERN CUISINE

Liliana Duarte

Cor de Tangerina, Manager and Chef

ABSTRACT

Kitchens are often places of production, dynamics and rhythm. Kitchens are also open laboratory spaces, depending on the chef's vision and intention. Accordingly, we need to rethink together, with all community stakeholders, what kind of gastronomic heritage we have in our territories. After that assessment, each restaurant or food project must evaluate the kind of social, economic and cultural impact it wants to have on itself and its surroundings. In this line, all menu choices represent a certain kind of community impact and intervention – not all align with circular economy and sustainability in a real strong commitment. So, for me as a chef, the importance of these kinds of initiatives is the possibility to integrate our food history (where acorns were part of human food, as much as other sylvester and wild plants) in the collection of resources that we can use for our creations. Additionally, we can promote people's engagement in the gathering, restoration and production of recipes and enrich the local economy, adding value to citizens' daily consumption. In this vision, we are reinforcing the capacity of our forest to be more visited and appropriated by people and to strengthen our sense of liberty. All the experiences that we have managed with our partners represent a meeting between kitchen exploration and technological development, in connection with nature. It was a great process, with exchanges between parties, and adjustments where we worked creatively with the many expressions of acorn applications in food.

Keywords: *Acorn, Gastronomic heritage, Sustainability Circular Economy, Food Innovation*

FROM FOREST TO TABLE: THE CULTURAL, NUTRITIONAL, AND ECOLOGICAL ROLE OF ACORNS IN ROMANIA

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ABSTRACT

Acorns, the seeds of oak trees (*Quercus* spp.), have historically served as an essential food source in various cultures and wooded pastures or forests, including Romania. Rich in carbohydrates, fats, and antioxidants, they provide nutritional and caloric value that has supported both human and animal populations. In Romania, the diversity of oak species such as *Q. robur* (pedunculate oak), *Q. petraea* (sessile oak), and *Q. cerris* (Turkey oak) offers a robust basis for acorn utilization. Historically, acorns were used during periods of scarcity, ground into flour for bread or porridge. The use of acorns as food in Romania is not largely used, and quite limited to experimental and niche culinary initiatives. There is, however, a renewed interest in acorns as part of sustainable and local food systems, echoing global trends toward rediscovering ancient and resilient food sources. There is a growing interest in their ecological and culinary applications, particularly in sustainable diets and traditional gastronomy and feed applications. The ecological and cultural significance of oaks in Romania remains strong, as these trees play a key role in forest ecosystems and traditional rural landscapes. Promoting acorns as food will contribute to biodiversity conservation, local economies, and the revival of traditional ecological knowledge and implementation. However, logistical challenges, including the labor-intensive processing required to remove tannins, need to be addressed for acorns to become a viable food source in Romania.

Keywords: *Acorns, Oak species, Sustainable food, Traditional gastronomy, Tannin removal*

PROMISES AND CHALLENGES OF ACORN AS FOOD VALUE CHAIN IN TÜRKİYE

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ABSTRACT

This study provides an in-depth analysis of the acorn food value chain in Türkiye by employing an integrated SWOT-PESTEL framework to assess its current state and future potential. It explores the growing interest in traditional and sustainable food sources, focusing on acorns as a valuable yet underutilized resource. Through qualitative fieldwork conducted in three villages in the Aegean Region, with additional research planned in Central Türkiye, the study incorporates stakeholder interviews with acorn collectors, chemical producers, government representatives, researchers, and non-governmental organizations. The findings highlight the traditional culinary uses of acorns while also identifying key challenges, including the decline of cultural knowledge related to preparation techniques, limited awareness, and the absence of established market mechanisms to position acorns as a valued food source. By structuring a SWOT analysis within the PESTEL framework—encompassing Political, Economic, Social, Technological, Environmental, and Legal dimensions—the study provides a comprehensive assessment of internal strengths and weaknesses alongside external opportunities and threats affecting the acorn food value chain. This approach offers a nuanced understanding of the factors influencing the development of acorns as a sustainable food resource. Preliminary results underscore the significant potential of acorns to contribute to sustainable food systems, although barriers such as insufficient awareness, the erosion of traditional knowledge, and underdeveloped market structures remain. The research contributes to academic discourse and practical applications by mapping the current utilization of acorns in Türkiye and identifying pathways for their sustainable development. These insights hold valuable implications for policymakers, local communities, and businesses aiming to promote sustainable food systems and preserve traditional culinary heritage. Future research will expand the geographical scope of the study and propose targeted recommendations for stakeholders across the acorn value chain.

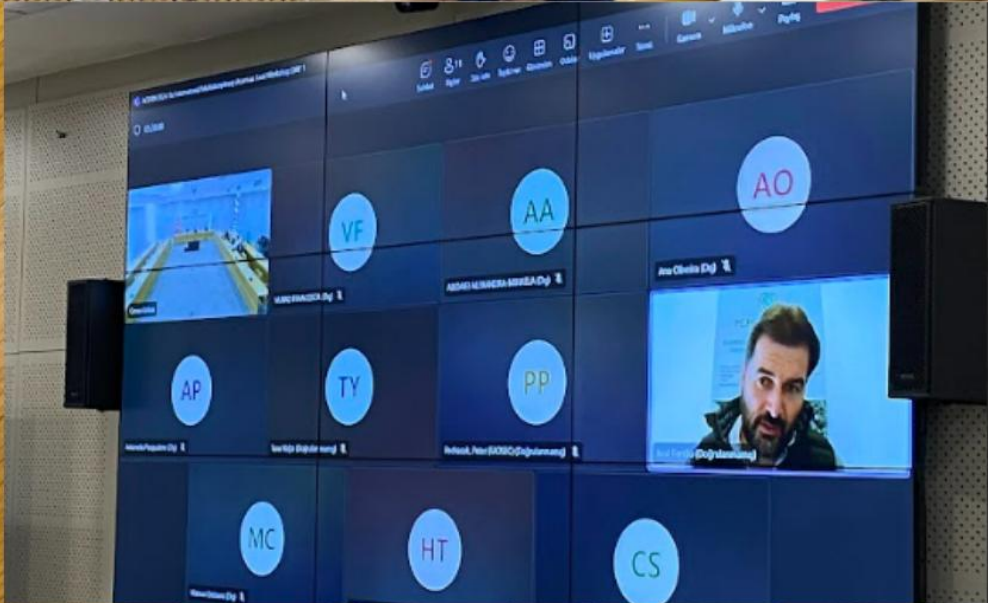
Keywords: *Acorn value chain, SWOT-PESTEL analysis, Stakeholder analysis, Local communities, Market mechanisms*

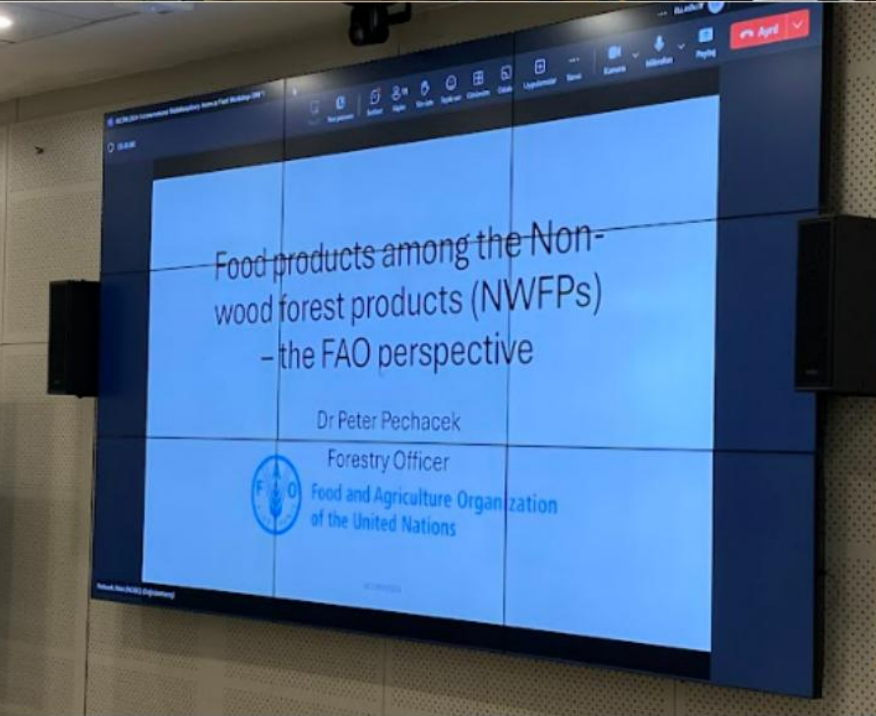
1st International Multidisciplinary Acorn as Food Workshop | Day 1

Photos









1st International Multidisciplinary Acorn as Food Workshop | Day 2

Photos

