



INTERNATIONAL CONGRESS 2024

***Looking into Food Safety, Innovation,
Sustainability and Entrepreneurship
COIL***



Ed. *Cristina Juan* & *Ana Juan-García*

VNIVERSITAT
ID VALÈNCIA

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Facultat de Farmàcia i
Ciències de l'Alimentació

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VALENCIANA**
Conselleria de Educación,
Universidades y Empleo

Acknowledgements

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VALENCIA (ES)
OCTOBER 29TH-30TH, 2024

***Looking into Food Safety, Innovation,
Sustainability and Entrepreneurship***

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VALENCIA (ES)
OCTOBER 29TH-30TH, 2024

*Looking into Food Safety, Innovation,
Sustainability and Entrepreneurship*

Oral
SESSIONS

International
SPEAKERS

*Collaborative Online
International Learning*

Food
INDUSTRY

KMZERO
CREANDO EL FUTURO DE LA ALIMENTACIÓN



FAMILIA
Martínez

VICKY
FOODS



Agilent Technologies

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PROLOGUE

From the Faculty of Pharmacy and Food Science of the University of Valencia, it is presented this prologue for the book **“Looking into Food Safety, Innovation, Sustainability, and Entrepreneurship”** for the International Congress MindInnFood'24 which was held on October 29th -30th, 2024 in Valencia (Spain) with the funding support of the “Conselleria de Educación, Cultura, Universidades y Empleo” from Generalitat Valenciana (CIAORG/2022/105).

The book contains the designed and defined program of MindInnFood'24 Congress which was prepared under the challenge of being attractive for all participants registered and those invited from both European and American countries for offering a great event that helped to create networking and share knowledge and science. However, due to the unexpected climatological circumstances of the DANA that hit our region -Valencian Community- and the advice received by our institution -the University of Valencia- we had to reorganize the sessions and transformed into an *online* event. It was considered to preserve under all circumstances the safety of all participants and we hope that it was reached the best of it and with great results besides the difficulties. Thus, despite the devastating situation that DANA has left us, we would like to give also our support and be placed beside all those families, friends, and Valencians who have lost the lives of their relatives and support the difficulties of standing up for the future.

MindInnFood'24 was focused on innovation and entrepreneurship, two factors that in the last two decades have gained significant relevance mainly in ensuring the viability and safety of global food systems. After years of relative neglect, these factors now attract considerable attention from researchers and educational institutions involved in Food Science and Technology. It is widely recognized that knowledge-driven innovation and entrepreneurial activities can enhance the value of food systems and supply chains, contributing to the food sector's growth and addressing the rising global food demand.

From an academic perspective, innovation and entrepreneurship engage a wide range of disciplines and involve diverse strategies to promote sustainability and safety within food systems; which makes to contemplate innovative strategies for facing topics from a multidisciplinary perspective in education as Collaborative Online International Learning (COIL). Research teams explore not only how innovation and entrepreneurship manifest within specific disciplines but also examine underlying factors related to individual behavior and creativity.

This book compiles scientific contributions on food safety, innovation, sustainability, and entrepreneurship in the agri-food sector, presented at the International Congress MindInnFood '24 as well as COIL activities and projects on food safety conducted in 2024 at the University of Valencia. The event featured participation from leading companies committed to food innovation, such as VickyFoods, Familia Martínez, Agilent, and KMZERO Hub. Additionally, it involved the participation of research centres and universities from both European and American countries such as: the University of Córdoba (Spain), University of Zaragoza (Spain), University of Valencia (Spain), Polytechnic University of Valencia (Spain), Valencian Community Food Safety Research Institute of FISABIO-Public Health of Valencia (Spain), Institute of Food Science and Technology of Entre Ríos (Argentina), University of Cartagena (Colombia), University of Warmia and Mazury in Olsztyn (Poland), University of Camerino (Italy), University of Naples "Federico II" (Italy), University of Coimbra (Portugal), University of Turku (Finland), Harvard University (USA), Chouaib Doukkali University (Morocco), University of Antwerp (Belgium), and Iuliu Hațieganu University of Medicine and Pharmacy Cluj-Napoca (Romania).

All in all, and from these lines, we would like to give a big thank you to all who were involved and contributed directly or indirectly to creating this event for the success and scientific level. We encourage all to keep working in the future for the knowledge of science and research.

*Ana Juan-García and Cristina Juan
Vicepresident and President MindInnFood'24*



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International Congress MindInnFood 2024

*Faculty of Pharmacy and Food Science
Valencia (ES), October 29th -30th, 2024*

PROGRAM Collaborative Online International Learning Sessions

October 29th, 2024

9.30	Opening Ceremony <i>Salón de Grados</i> - Dean of Faculty of Pharmacy and Food Science - President of Organizer Committee of the Congress MindInnFood'24
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Sustainability and Innovation in Food Science

S.1.	Chair <i>Cristina Juan García, PhD (UV, ES) & Juan Carlos Moltó Cortés, PhD (UV, ES)</i>
10:00	Gianni Sagratini, PhD (Keynote Speaker) University of Camerino From food waste to nutraceuticals: an added value to sustainability (IT)
10:40	Francisco José Barba, PhD University of Valencia (ES) Impact of fermentation assisted by lactic acid bacteria on the nutritional and bioactive properties of a wheat-based beverage
11.15	Coffee break (by Agilent Technologies and VickyFOODS) Poster Viewing
S.2.	Chair <i>Juan Manuel Castagnini, PhD (UV, ES) & Manuel Salgado-Ramos, PhD (UCLM, ES)</i>
11:45	Clara Coscollà, PhD (Keynote Speaker) Food Safety Research Area of FISABIO-Public Health of Valencia (ES) Exposure to food pollutants using human biomonitoring
12:15	Joaquim Calvo-Lerma, PhD University of Valencia (ES) Digestibility of lipids in different nuts and seeds and impact on colonic microbiota
12:45	Beatriz Martínez, PhD University of Valencia (ES) Artificial Intelligence for crop monitoring. Description of potential applications
13:15	D. Jaume Morales (LCMS Product Specialist) AGILENT Agilent solutions for PFAS concern in food Agilent Technologies
14:00	Break

Entrepreneurship in Food Sector

S.3.	<i>Chair</i>	<i>Ana Juan-García, PhD (UV, ES) & Karina Caballero-Gallardo, PhD (UdeC, COL)</i>
15:00	D. Beatriz Jacoste (Keynote Speaker) Rethinking the Food System: Recommendations and Priorities for a Sustainable Future	KMZERO Food Innovation Hub (ES)
15:40	Pau Sendra, PhD EMPRESOOP: Entrepreneurship in Social and Cooperative Economy	University of Valencia (ES)
16:15	D. Álvaro Mayordomo Familia Martínez, alimentando retos	Familia Martínez (ES)
16:45	<i>Poster Viewing</i> Collaborative Online International Learning Session (Cristina Juan García, PhD and Beatriz Jacoste)	

October 30th, 2024

Innovation in Food Safety

S.4.	<i>Chair</i>	<i>Noelia Pallarés Barrachina, PhD (UV, ES) & Ana Juan-García, PhD (UV, ES)</i>
10:00	Liliana João Gatões da Silva, PhD (Keynote Speaker) Food safety and plant-based meat alternatives: the mycotoxins' issue	University of Coimbra (PT)
10:40	Olga Pardo, PhD The role of food safety monitoring in the risk assessment of chemical contaminants	University of Valencia (ES)
11:00	Eeva-Riikka Vehniäinen, PhD OneHealth in endocrine disruption: wildlife as bioindicators for EDCs in drinking water?	University of Turku (FI)
11:30	<i>Coffee Break (by VickyFOODS)</i> <i>Poster Viewing</i> Collaborative Online International Learning Session (Cristina Juan García, PhD and Beatriz Jacoste)	
S.5.	<i>Chair</i>	<i>Francisco J. Martí-Quijal, PhD (UV, ES) & Iris Usach Pérez, PhD (UV, ES)</i>
12:30	Ana Juan-García, PhD (Keynote Speaker) Advances of mycotoxin research: alternative methods contribution on adverse outcome pathways. Study of the pro-inflammatory toxic effect.	University of Valencia (ES)
13:10	Yasuko Isoe, PhD Food-induced change in social behavior in <i>medaka</i> larvae	Harvard University (USA)

	ORAL SESSION	<i>Cristina Juan García, PhD (UV)</i>
13:30	1) Nutritional and culinary evaluation of cricket powder-enriched pasta. Musto L., Makran M., Mercatante D., Cilla A., Albano I., Rodriguez-Estrada M.T., Garcia-Llatas G. 2) Bars with added edible insects as an innovative food - evaluation of their food safety in terms of chlorinated hydrocarbon residues. Kinga Wieczorek, Renata Pietrzak-Fiećko	
14:00	Break	

Innovation and Entrepreneurship in Food Sector

S.6.	<i>Chair</i>	<i>Joaquim Calvo-Lerma, PhD (UV, ES) & Neda Álvarez-Ortega, PhD (UMayor, CO)</i>
15:00	Juan Manuel Castagnini, PhD (Keynote Speaker) Green extraction technologies for recovering bioactive compounds from sweet potato peels	University of Valencia (ES)
15:30	D. Paula Llorens Nutrition and tasty plant-based meat alternative	University of Valencia (ES)
16:00	Maria Orero Blat, PhD Empowering female agro-entrepreneurs through social projects	University of Valencia (ES)
16:30	Closing Ceremony <i>Salón de Grados</i> - Vice-Dean of Innovation and Vice-Dean of Food Science and Technology (Faculty of Pharmacy and Food Science –UV) - President of Scientific and Organizer Committee of the Congress MindInnFood '24	



LIST OF ORAL AND POSTER COMMUNICATIONS in Collaborative Online International Learning Sessions (COILs)

INVITED SPEAKERS						
NUMBER	CORRESPONDING AUTHOR		TITLE	AUTHORS	AFFILIATION	PAGE
October 29 th , 2024						
SP-1.1	Gianni	Sagratini	From food waste to nutraceuticals: an added value to sustainability	Sagratini, G.	Chemistry Interdisciplinary Project (ChIP), University of Camerino, Italy	28
SP-1.2	Francisco José	Barba Orellana	Impact of fermentation assisted by lactic acid bacteria on the nutritional and bioactive properties of a wheat-based beverage	Barba Orellana, F. J.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, University of Valencia , Spain	30
SP-1.3	Clara	Coscollá Raga	Exposure to food pollutants using human biomonitoring	Coscollá Raga, C.	Head Food Safety Research Area FISABIO-Public Health, Valencia (Spain)	32
SP-1.4	Joaquim	Calvo Lerma	Digestibility of lipids in different nuts and seeds and impact on colonic microbiota	Calvo-Lerma, J.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, University of Valencia . Spain	34

SP-1.5	Beatriz	Martínez Díaz	Artificial intelligence for crop monitoring. Description of potential applications	Martínez B.; Campos-Taberner M.; Sánchez-Ruiz S.; Jiménez-Guisado A.; García-Haro F.J.; Gilabert, M.A	Environmental Remote Sensing group (UV-ERS), Universitat de València, Dr. Moliner, 46100 Burjassot, València, Spain	36
SP-1.6.	Jaume	Morales Sediles	Agilent solutions for PFAS concern in food	Morales J.	Agilent Technologies	40
SP-1.7	Beatriz	Jacoste Lozano	Rethinking the Food System: Recommendations and Priorities for a Sustainable Future	Prada C.; Valencia C., Jacoste Beatriz	KM ZERO Food Innovation Hub, The Food Changemakers Think Tank	42
SP-1.8	Pau	Sendra-Pons	EMPRESOCOOP: Entrepreneurship in Social and Cooperative Economy	Català Estada B.; Savall Morera T.; Cuñat Giménez R.; Sendra-Pons P.; Garzón D.	Department of Accounting, University of Valencia, Spain	44
SP-1.9	Álvaro	Mayordomo Martínez	"Familia Martínez, alimentando retos"	Mayordomo A.	Familia Martínez	46

October 30th, 2024

SP-2.1	Liliana	Silva	Food Safety and Plant-Based Meat Alternatives: the mycotoxins' issue	Llorens, P.; Juan, C.; Juan-García, A.; Moltó-Cortés, J. C.; Leite, M.; Freitas, A.; Pereira, A.; Pena, A.; Silva, L.	LAQV, REQUIMTE, Laboratory of Bromatology and Pharmacognosy, Faculty of Pharmacy, University of Coimbra, Portugal	47
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SP-2.2	Olga	Pardo Marín	The role of food safety monitoring in the risk assessment of chemical contaminants	Pardo Marín O.	Department of Analytical Chemistry, University of Valencia, Spain	49
SP-2.3	Eeva-Riikka	Vehniäinen	One Health in endocrine disruption: Wildlife as indicators for EDCs in drinking water?	Ashrafi R.; Rintanen H.; Anttila K.; Vehniäinen E-R.	Department of Biology, University of Turku, Finland	51
SP-2.4	Ana	Juan-García	Advances of mycotoxin research: alternative methods contribution on adverse outcome pathways. Study of the pro-inflammatory toxic effect.	Juan-García A.; Juan C.	Laboratory of Food Science and Toxicology, Faculty of Pharmacy and Food Science, University of Valencia	53
SP-2.5	Yasuko	Isoe	Food-induced dynamical changes in social behavior in medaka larvae	Isoe Y.	Department of Molecular and Cellular Biology, Faculty of Arts and Sciences, Harvard University, Cambridge, Massachuset, USA	55
SP-2.6	Paula	Llorens Castelló	Nutritious and Tasty Plant-Based Meat Alternatives	Llorens, P.; Juan-García A.; Moltó, J.C; Juan, C.	Laboratory of Food Science and Toxicology, Faculty of Pharmacy and Food Science, University of Valencia	57
SP-2.7	Juan Manuel	Castagnini	Green extraction technologies for recovering bioactive compounds from sweet potato peels	Castagnini J.M.; Alanis A.F.; Dawidowicz K.; Salgado-Ramos M.; Pallares N.; Martí-Quijal F.J.; Martínez-Culebras P.V.; Roig P.; Barba, F.J.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, Universitat de València	59

SP-2.8	Maria	Orero Blat	Empowering female agro-entrepreneurs through social and solidarity economy initiatives in Costa Rica: A gendered approach to food sustainability	Orero-Blat, M.; Rey-Martí, A.; Mas-Tur, A.	MEYES, Department of Business Management, University of Valencia	61
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ORAL COMMUNICATIONS (Oct 30th, 2024 - 13:30h)						
NUMBER	CORRESPONDING AUTHOR (Name, Surnames)		TITLE	AUTHORS	AFFILIATION	PAGE
O-1	Kinga	Wieczorek	Bars with added edible insects as an innovative food - evaluation of their food safety in terms of chlorinated hydrocarbon residues	Wieczorek K., Pietrzak-Fiećko R.	Department of Commodities and Food Analysis, University of Warmia and Mazury in Olsztyn, Poland	65
O-2	Leonardo	Musto Safont	Nutritional and culinary evaluation of cricket powder-enriched pasta	Musto L., Makran M., Mercatante D., Cilla A., Albano I., Rodriguez-Estrada M.T., Garcia-Llatas G.	Nutrition and Food Science Area, Faculty of Pharmacy and Food Sciences, University of Valencia, Spain	67

Collaborative Online International Learning Sessions						
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Moyano López	Claudia	COIL-1	Huasca-CARE: A Revolutionary Approach to Neurodegenerative Disease Prevention	Moyano López, C.; Navas Pasos, J.A.; Fuentes López, D.; Mocanu, D.; Caballero-Gallardo, K.; Juan-García, A.	University of Valencia, Spain; Universidad de Cartagena, Colombia; Univerisity; Iuliu Hațieganu University of Medicine and Pharmacy Cluj-Napoca, Romania	69
Sauca	Elena	COIL-2	NutriScan: AI-powered Application that Integrates a Wearable	Bracelet Sauca, E.; del Valle Cervera, L.; de León fuentes, L.; Mila Martínez, J.; Juan, C.; Juan-García, A.	University of Valencia, Spain; Universidad de Cartagena, Colombia; Univerisity; Iuliu Hațieganu University of Medicine and Pharmacy Cluj-Napoca, Romania	71
Sinmihaian	Adriana	COIL-3	Genius: the App of Personalized Dietary and Lifestyle Recommendations	Sinmihaian, A.; Plesca, I-R.; Mendoza Quintana, B.L.; Brad Bianca, V.M.; Strugariu, M-R.; Kaballero-Gallardo, K.; Juan-García, Ana	University of Valencia, Spain; Universidad de Cartagena, Colombia; Univerisity; Iuliu Hațieganu University of Medicine and Pharmacy Cluj-Napoca, Romania	73
Bella Sentandreu	Ana	COIL-4	AMSPEN: NeuroProtect Aromatherapy Mist	Bella, A., Moreno, N., Ștefănescu, I., Sănduleasa E.; Juan, C.; Juan-García, A.	University of Valencia, Spain; Universidad de Cartagena, Colombia; Univerisity; Iuliu Hațieganu University of Medicine and Pharmacy Cluj-Napoca, Romania	75

Martínez Beleño	María José	COIL-5	Diabetes-App: Treatment Diabetes Friendly Dining. Revolutionizing Gut Health	wit Belei, D.; Martínez, M. J.; Zapata, M.; Kose, S.; Stacianu, O.; Juan-García, A.	University of Valencia, Spain; Universidad de Cartagena, Colombia; Univerisity; Iuliu Hațieganu University of Medicine and Pharmacy Cluj-Napoca, Romania	78
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POSTER COMMUNICATIONS						
CORRESPONDING AUTHOR		NUMBER	TITLE	AUTHORS	AFFILIATION	PAGE
Alanis	Ana Florencia	P-27	PEF favors the extraction of compounds with antioxidant capacity in the yeast Saccharomyces cerevisiae BY4741	Alanis A.F.; Castagnini J.M.; Barba Orellana F.J.; Gil Ponce J.V.; Roig Montoya P.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, University of Valencia , Spain	137
Banach	Joanna Katarzyna	P-31	The use of an innovative electrical method to assess selected physicochemical and health-promoting parameters of varietal honeys	Banach J.K., Wilczyńska A., Żak N., Grzywińska-Rapca M.	Institute of Management and Quality, Faculty of Economics, University of Warmia and Mazury in Olsztyn, Poland	145
Bernabeu	Alejandro	P-42	Transdermal Delivery of Cyanocobalamin via Dissolving Microneedles as a Novel Approach to Mitigate Skin Inflammation	Bernabeu-Martínez JA; Guillot AJ; Martínez-Navarrete M; Melero A.	DrugBiOp, Department of Pharmacy and Pharmaceutical Technology and Parasitology, University of Valencia, Valencia, Spain	167

Belasla	Nouhaila	P-23	Biotechnological Properties of Lactic Acid Bacteria Isolated from Natural Resources Ingredients for Potential Use as Starter Cultures	Belasla N.; Brahim I.; Benyamane M.; Errachidi F.; EL Adlouni C.; Zinedine A.	BIOMARE Laboratory, Faculty of Sciences, Chouaib Doukkali University, El Jadida, Morocco	129
Benyamane	Meryem	P-24	Comparative Study of the Composition and Antifungal Activity of Mentha rotundifolia Essential Oil Collected in Two Moroccan Regions	Benyamane M.; Belasla N.; Brahim I.; Errachidi F.; EL Adlouni C.; Zinedine A.	BIOMARE Laboratory, Faculty of Sciences, Chouaib Doukkali University, El Jadida, Morocco	131
Brahimi	Imane	P-25	Antimicrobial and Antioxidant Properties of Ethanolic Extracts of Two Marine Algae Collected from the Moroccan Atlantic Coast	Brahimi I.; Benyamane M.; Belasla N.; Errachidi F.; Rihani M.; Zinedine A.	BIOMARE Laboratory, Faculty of Sciences, Chouaib Doukkali University, El Jadida, Morocco	133
Bridgeman	Luna	P-4	Genotoxic Effects of Acrylamide, Penitrem A, and 3-Acetyldeoxynivalenol Individually and in Combination in SH-SY5Y Cells	Bridgeman L.; Berrada H.; Juan-García A.	Laboratory of Food Science and Toxicology, Faculty of Pharmacy and Food Science, University of Valencia , Spain	91
Caballero Gallardo	Karina	P-41	Health Impacts of Heavy Metal Exposure on Children in the Colombian Caribbean Region	Palomares-Bolaños J.; Olivero-Verbel J.; Caballero-Gallardo K.	Functional Toxicology Group. School of Pharmaceutical Sciences, Zaragocilla Campus, University of Cartagena, Colombia	165
Calleja Gómez	Mara	P-37	Assessment of cytotoxicity and ROS production in CACO-2 cells from edible mushroom extracts obtained by pulsed electric fields (PEF)	Calleja-Gómez M.; Martí-Quijal F. J.; Pallarés N.; Berrada H.; Barba F. J.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, University of Valencia , Spain	157

Caprioli	Giovanni	P-6	Nutritional profile, polyphenols content, antioxidant activity and volatiles profile of a corn flour.	Caprioli G.; Acquaticci L.; Santanatoglia A.; Vittadini E.; La Terza A.; Beghelli D.; Marti A.; Bresciani L.	Chemistry Interdisciplinary Project (ChIP), University of Camerino, Italy	95
Chiacchio	Manuela Flavia	P-5	Effects of chickpea flour-enriched crackers on Caco-2 cell viability: the influence of fermentation and concentration	Chiacchio M.F.; Juan C.; Vitaglione P.; Juan-García A.	Department of Agricultural Sciences, University of Naples "Federico II", Italy	93
Cuenca Ortolá	Marta	P-9	Total Antioxidant Capacity and Total Polyphenols in black garlic, lemon and kombucha homemade vs. industrially fermented	Cuenca-Ortolá M.; Gandía M.; Filice S.; Gamero A.; Cilla A.	Nutrition and Food Science Area, Faculty of Pharmacy and Food Sciences, University of Valencia, Spain	101
Dawidowicz	Katarzyna	P-19	Analysis of Neltuma affinis Fruit Powders: Minerals, Heavy Metals, Polyphenols, and Cytotoxicity.	Dawidowicz K., Esposito N.N., Marti-Quijal F.J., Busch V.M., Genevois C.E., Castagnini J.M.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, University of Valencia, Spain	122
Ferrandis Rossell	Anna	P-17	Total Fat Content and Lipid Profile from date seeds residue after green liquid-solid extraction of biocompounds	Ferrandis-Rosell A.; Cortés C.; Blesa J.; Frigola A.; López-Malo D.; Esteve M. J.	Nutrition and Food Science, Faculty of Pharmacy, Universitat de València. Avenida Vicent Andrés Estellés s/n. 46100, Burjassot, Spain.	118
Ferrer García	Emilia	P-38	Vitamin D as a Key Factor in the Health of Women During Climacteric Age	Julve R.; Ferrer E.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, University of Valencia, Spain	159

Gao	Weilan	P-20	Species identification and safety evaluation of novel starter cultures isolated from plant material	Gao W.; Hernandez L.; Castagnini J.M.; Barba F.J.; Pallarés N.; Martínez Culebras P.V.	Research group in Innovative Technologies for Sustainable Food (ALISOST), Department of Preventive Medicine and Public Health, Food Science, Toxicology and Forensic Medicine, Faculty of Pharmacy and Food Science, University of Valencia, Spain	124
García Juan	Alejandro	P-3	High-resolution mass spectrometry for determination of lipophilic marine biotoxins in bivalve molluscs	García-Juan A.; Herreros R.; Armenta S.; Pardo O.	Department of Analytical Chemistry, University of Valencia, Spain	89
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SP-1.1

From food waste to nutraceuticals: an added value to sustainability

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Abstract

Food waste is produced in all phases of the product life cycle, during agricultural production, during processing and technological transformation, during the distribution and consumption of the product itself. From the biomass of the waste, in a circular economy perspective, bioactive substances and molecules can be extracted and, after chemical characterization, they can then be technologically formulated to produce nutraceuticals or active ingredients for functional food. From the waste of the fish industries, Vitamin D3 can be extracted, through high-performance techniques that use CO₂ in the supercritical phase, and, after appropriate pharmaceutical formulation, the clinical efficacy of the nutraceutical produced can be tested. This is the objective of the PRIN 2022 VITADWASTE project funded by Italian Minister of the University and Research (MUR). Moreover, from the waste of wine production and in particular from the vine shoots, bioactive substances of phenolic nature can be recovered and then, appropriately extracted and formulated, can be used for the nutraceutical or cosmetically use. This is one of the objectives of the recently funded European project LIFE NATURAL AGRO. The “value from waste” approach is effectively increasing by applying the principles of the circular economy.

Keywords: food waste, nutraceuticals, fish, wine shoots

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SP-1.2

Impact of fermentation assisted by lactic acid bacteria on the nutritional and bioactive properties of a wheat-based beverage

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Abstract

Although fermentation assisted by lactic acid bacteria is a process used since ancient times, for the development of traditionally known foods, especially for their ability to preserve them, as well as in the development of organoleptic and sensory characteristics that are widely accepted by consumers, it has now gained renewed interest. In fact, it is a process widely accepted by consumers and the scientific community due to the perception they have of fermentation as a natural process of food treatment and potential health benefit due, among other things, to the probiotic capacity of some of the lactic acid bacteria used in the development of fermented products (Durazzo et al., 2022).

The aim of this study is to evaluate the impact of different lactic acid bacteria, on the one hand *L. plantarum*, obtained from the CECT, and on the other hand of wheat bacteria, previously isolated in anaerobiosis, for the fermentation of wheat in order to obtain new fermented beverages. Subsequently, the growth of these lactic acid bacteria during different fermentation times will be evaluated, as well as their antioxidant and enzymatic activities. Moreover, in order to promote the fermentation process, a pretreatment with pulsed electric fields technology was applied to the wheat to promote the liberation of sugars, thus facilitating fermentation process.

From the results obtained it can be depicted that PEF promoted the release of reducing sugars, proteins and polyphenols, achieving a maximum after 90 min of treatment and obtaining values of 42.22 ± 0.71 mg/mL, 6.92 ± 0.04 mg/mL and 176.31 ± 2.45 µg/mL, respectively.

Once the matrix was optimized to be fermented, some initial experiments were performed with lactic acid bacteria obtained from the CECT (*L. brevis*, *L. casei* and *L. pentosus*). Then they were inoculated in a mixture of 20 g of malted wheat flour and 100 mL of water). The pH levels in all cases experienced a rapid decline in the initial 6 hours and all tested isolates

were able to acidify the solution to pH values at 24 h within the range 3.31-4.30. *Lactobacillus casei* exhibited the most pronounced effect on pH reduction. The total titratable acidity (TTA) changes, which revealed a rapid increase from 6 h of fermentation reaching a peak value in the range of 0.4-1%. An increase in viability of LAB in all cases. From an inoculation of about 6.0 Log₁₀ CFU/mL, counts higher than 8.0 Log₁₀ CFU/mL were observed after 24 h of microbial fermentation.

Finally, *Pediococcus pentosaceus* isolated from wheat was inoculated in a wheat samples and the physicochemical, nutritional and bioactive properties of the samples were evaluated, observing that fermentation decreased the pH of the wheat beverages, increasing the total acidity, and reaching CFU levels between 10⁸ and 10⁹ CFU/mL. The results of polyphenols analyses showed that both PEF treatment and fermentation changed the phenolic composition of wheat beverages. Moreover, the analysis of mineral profiles and contents by ICP-MS, showed that both PEF pretreatment and fermentation increased the mineral content of wheat beverages; however, PEF pretreatment + fermentation decreased some of the mineral values, although a significant increase was found for Fe. Although more studies with new experimental designs are needed, preliminary results suggest that the use of PEF may have potential for the development of fermented products such as wheat-based beverages.

Keywords: Pulsed electric fields; Wheat fermentation; lactic acid bacteria; antioxidants; bioactive compounds

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SP-1.3

Exposure to food pollutants using human biomonitoring studies

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Abstract

Human Biomonitoring studies (HBM) consists of the direct analysis of a chemical substance and/or its metabolites in human biological samples, taking into account all possible routes and sources of exposure. HBM is a very useful tool for health protection as it provides specific information on the population's exposure to chemical substances. This information is essential to support the development of specific policies, focused on reducing exposure, as well as to verify the effectiveness of such measures after their implementation.

The Valencia Region of Spain has carried out HBM studies in order to evaluate adult and vulnerable human exposure such as children and breastfeeding women to pollutants. The CIPAV project was a pilot study that evaluated the risk of exposure to pesticides and metals in the child population (n=125) in a rural and urban area of the Valencia Region, investigating the biomarkers of exposure to pesticides and metals in urine. The BIOVAL programme, funded by the Directorate General of Public Health of the Valencian Community, assessed the risk of exposure to food contaminants in a representative sample of the child population of the Valencian Community (n=666), analysing the biomarkers of exposure for metals, polycyclic aromatic hydrocarbons, bisphenols, parabens, acrylamide, phthalates and pesticides in urine and hair samples. The Bettermilk project studied the exposure of lactating women to organic contaminants (polycyclic aromatic hydrocarbons, bisphenols, parabens, acrylamide, phthalates, pesticides and dioxins) and metals, analysing their exposure biomarkers in urine, breast milk and hair. The human biomonitoring research project "Human Biomonitoring in the Valencia Region-BioMoVal" has been funded by the Directorate General of Public Health of the Valencian Community and FISABIO. The BioMoVal project evaluates the internal exposure and risk of the adult population of the Valencian Community (18-65 years) to different environmental and food contaminants, both persistent (dioxins, PCBs, metals) and non-persistent (phthalates, bisphenols, PAHs, acrylamide, pesticides, metals). The biological samples

studied are urine, serum and blood. The design of the study took into account the representativeness of the population of the Valencian Community. A total of 548 individuals were recruited in 2021, taking into account the strata of age, sex, province and economic sector.

The presentation will describe the results of some of the most relevant contaminants studied in the population of the Valencia Region, such as pesticides, metals, polycyclic aromatic hydrocarbons and acrylamide. During the risk assessment studies for pesticides, no risk was observed in the adult or child population. However, in both populations, a very high exposure to biomarkers of pyrethroid pesticides was observed in the population studied compared to other countries. Regarding the exposure to metals, the high levels of organic mercury accumulated in the hair of children and breastfeeding mothers stand out, which is related to the consumption of fish. Among the hydroxylated forms of polycyclic aromatic hydrocarbons that are excreted in urine, the presence of naphthalene biomarkers stands out, with a risk of this compound being observed in the populations studied. A risk derived from exposure to acrylamide is also observed in all populations studied, with the presence of this compound being detected in practically all the analysed samples. Exposure to acrylamide is related to the consumption of pastries and chips in children; in addition to tobacco in adults; and with the consumption of coffee, consumption of precooked foods, pastries and tobacco in breastfeeding women.

Keywords: biomonitoring; risk assessment; exposure; organic pollutants; biological samples

SP-1.4

Digestibility of lipids in different nuts and seeds and impact on colonic microbiota

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Abstract

Nuts and seeds offer nutrient profile rich in dietary fibre and unsaturated fatty acids, making them a promising dietary source for promoting a healthy microbiota and meeting lipid intake requirements. However, these foods are characterised by a hard physical structure, with previous studies showing that their breakdown during gastric and intestinal digestion is limited, resulting in reduced lipid bioaccessibility (Grundy et al. Additionally, children with cystic fibrosis (CF) experience reduced pancreatic enzyme secretion, which further impairs lipid digestibility. Additionally, nuts and seeds are scarcely consumed by younger populations, who instead favour ultra-processed foods and snacks high in saturated fats and low in dietary fibre. The aim of this study was to assess the lipid digestibility and prebiotic potential of milled common nuts and seeds through an in vitro digestion and colonic fermentation model, comparing healthy children and those with CF, to evaluate their potential beneficial effects in supporting dietary recommendations.

Almonds, hazelnuts, peanuts, walnuts, and sunflower, pumpkin, and sesame seeds were subjected to simulated gastrointestinal digestion. Lipolysis of the bioaccessible fraction was characterised using nuclear magnetic resonance (NMR) (Asensio-Grau et al., 2021), while the non-digestible fraction was used to simulate colonic fermentation with faecal inocula from a pool of children. Changes in the colonic microbiota (16S rRNA sequencing) and metabolic activity (short-chain fatty acids, SCFA, by gas chromatography GC-FID) were assessed against baseline measures, as previously done in other studies (Asensio-Grau et al., 2023).

Results demonstrated that total lipolysis (sum of 2-monoglycerides and free fatty acids) under healthy conditions was approximately 80% for all foods, whereas under CF conditions, only sunflower seeds and peanuts (50%) and hazelnuts and almonds (40%) were hydrolysed. In terms of colonic microbiota changes, the genus *Bacteroides* exhibited variable effects depending on the food matrix (ranging from a +10% to -10% change in relative abundance), with the exception of peanuts in CF conditions, which led to a +25% increase. The remaining genera showed similar trends, with an increase in *Acidaminococcus* and a decrease in *Alistipes* in both CF and healthy conditions.

In conclusion, nuts and seeds exhibit similar digestibility patterns under healthy conditions, though significant differences emerge under the altered conditions of CF. In particular, sunflower seeds and almonds appear to be the most beneficial and should therefore be recommended.

Keywords: nuts, seeds, lipids species, microbiota, short-chain fatty acids

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SP-1.5

Artificial intelligence for crop monitoring. Description of potential applications

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Abstract

This work aims to give an overview of different applications using Earth Observation (EO) data to assess and manage several aspects related to food security such as crop monitoring, biomass estimation and land cover mapping at different spatial scales.

At global scale, the use of geostationary satellites, such as Meteosat Second Generation (MSG) platform and the polar Advanced Very High Resolution Radiometer (AVHRR) on board the EUMETSAT Polar System (EPS) (García-Haro et al., 2018), respectively, offer an interesting alternative for a near-real time characterization of the same area due to their high temporal resolution. Particularly, the Land Surface Analysis SAF (LSA SAF) as part of the Satellite Application Facility (SAF) network of European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) contributes to the monitoring of the biosphere from space with an ensemble of operational products derived from different methodologies based on (some of them) in machine and deep learning approaches (ML and DL). The vegetation products include essential climate variables (ECVs) such as the leaf area index (LAI), the fraction of absorbed photosynthetically active radiation by vegetation ($fAPAR$), the gross primary production (GPP, the rate at which plant absorbs the incident radiation during the photosynthesis) and the water content (<https://landsaf.ipma.pt>) (Trigo et al., 2011). Some examples are provided at regional scale in the context of a national project ECCE EO (Ecosystems changes and carbon exchanges by means of EO data) focused on the monitoring

of carbon sequestration data to quantify biosphere growth and carbon stocks (Campos-Taberner et al., 2024).

On a local scale, land use (LU) monitoring and mapping from remote sensing (RS) requires powerful/robust classification approaches able to provide reliable identifications in decision-making applications, even over challenging areas. The increasing availability of multi-temporal optical EO data such as Sentinel-2, serves as a very valuable source of information to support the modernization and simplification of the European Common Agricultural Policy (CAP). The combination of EO-based information along with artificial intelligence methods, such as ML and DL, may offer an application for precision farming techniques, enhancing crop monitoring, predicting yields, and optimising resource usage. Some examples are given in the context of the ERMES (An Earth observation model based rice information service) project and a local project of *Generalitat Valenciana* (Campos-Taberner, et al., 2023).

Keywords: Earth Observation, biosphere, monitoring, machine and deep learning.

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SP-1.6

Screening for fluorinated substances in food

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Abstract

"Fluorinated substances" is a general, non-specific name that describes a universe of organic and inorganic substances containing at least 1 F atom.

A subset of fluorinated substances are highly fluorinated aliphatic chain substances containing 1 or more C atoms in which all H substituents have been replaced by F atoms, such that they contain the perfluoroalkyl moiety C_nF_{2n+1} .

These compounds are called "perfluoroalkyl or polyfluoroalkyl substances" and denoted by the acronym PFAS.

Since 1950, the so-called PFAS have been widely used in numerous industrial and commercial applications. Its C-F bond is extremely strong and stable, and its hydrophobic and lipophobic nature lead to very useful and long-lasting properties in surfactants and polymers.

Polymer applications include stain and dirt repellent textiles as well as grease-proof food contact paper.

As a result of the widespread use of PFAS and their resulting emissions, a wide range of these substances have been detected in the environment, wildlife, and humans.

PFAS have been found in more than 90% of all European rivers and have also been detected in drinking water, which is one of the possible routes of exposure to humans (Ahrens et al., 2014).

A 2018 review by the U.S. Centers for Disease Control and Prevention described a number of health effects associated with PFAS exposure, including cancer, liver damage, decreased fertility, and increased risk of asthma and thyroid disease.

A June 20, 2018 ProPublica article noted that the CDC report recommends an exposure limit for a PFAS compound that is 10 times lower than the U.S. Environmental Protection Agency's current limit. The effect of this high exposure also reaches the food sector both through irrigation with contaminated water and through contact with materials.

In this presentation we will show two different approaches to be able to face this analytical challenge, on the one hand to comply with the current and recent legislation on maximum levels in foods as another research approach to discover and characterize the wide families of PFAS compounds that may be present in products and the environment.

Keywords: (PFAS, Food, disease, Mass Spectrometry)



Agilent Technologies

SP-1.7

Rethinking the food system: Recommendations and priorities for a sustainable future

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Abstract

The Think Tank conducted during the Food Changemakers Summit 2024 brought together 50 leading experts from diverse fields to tackle pressing issues in the food system and generate actionable recommendations that could be useful for governments, corporations, and organizations globally in shaping their strategies. By focusing on the interconnected challenges within the food system, the goal was to enhance sustainability, ensure equitable food access, and support long-term resilience in national and global food systems.

The Think Tank was structured around six thematic blocks: food security and hunger, soil health and regenerative agriculture, nutrition and health, decarbonization, food waste, and water management. Each block consisted of one-hour sessions where experts shared insights, analyzed challenges, and identified best practices. They also developed recommendations for practical policy changes and industry innovations. The methodology included collective intelligence gathering through task forces and data synthesis to ensure that the proposed strategies were comprehensive, actionable, and tailored to real-world applications in both governmental and private sectors.

The Think Tank produced several critical findings, including:

- **Food security and waste:** Current food systems result in 30-40% food loss. Efficient recovery and redistribution of food waste have the potential to nourish over two billion people while reducing greenhouse gas emissions by up to 10%.

- **Soil health:** Regenerative agriculture can enhance biodiversity and sequester carbon, improving the nutritional density of crops while reducing environmental degradation.
- **Nutrition and health:** The adoption of preventive nutrition was emphasized as a way to combat the rise of diet-related chronic diseases. Promoting nutrient-dense, plant-based diets will reduce healthcare costs and improve public health outcomes.
- **Decarbonization:** The food system contributes significantly to global greenhouse gas emissions, especially livestock farming. Shifting towards plant-based diets and complementary proteins can reduce this impact.
- **Water management:** Agriculture accounts for 70% of global freshwater use. Technologies like precision irrigation and drought-resistant crops are essential for addressing water scarcity, particularly in water-stressed regions.

The findings from the Think Tank highlight that the challenges within the global food system are interconnected and solvable. The key to success lies in collective action, cross-sector collaboration, and well-targeted policies that address these issues in a holistic manner. By supporting innovation, improving food system governance, and incentivizing sustainable practices, the proposed strategies can transform food systems, making them more equitable, resilient, and sustainable for future generations.

Keywords: food security, regenerative agriculture, decarbonization, food waste, water management.

Acknowledgements: We would like to extend our sincere thanks to all the experts and participants of ftalks The Food Changemakers Summit 2024 Think Tank for their valuable insights and contributions to this report.

Reference

All insights, data, and conclusions presented in this report were gathered from the discussions held during the Think Tank at ftalks The Food Changemakers Summit 2024, organized by KM ZERO Food Innovation Hub.

SP-1.8

EMPRESCOOP: Entrepreneurship in the Social and Cooperative Economy

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Abstract

The promotion of a university entrepreneurial ecosystem that fosters the development of students with entrepreneurial skills and competencies has become a central issue in higher education (Revuelto-Taboada et al., 2021). As entrepreneurship gains popularity as a career path among Spanish university graduates, universities have had to rethink traditional programs aimed at enhancing student employability to include entrepreneurship as a viable career opportunity. In this context, universities have been compelled to develop training, funding, and support programs for entrepreneurial talent, focusing on entrepreneurship across a wide range of sectors, including the social and cooperative economy. This paper addresses the design, implementation, and evaluation of a training program, known as “Emprescoop”, for students interested in entrepreneurship in the social and cooperative economy, using a competition format. In this way, it aims to add value to the social economy ecosystem (Catala et al., 2023).

The training program included 20 hours of certified training on (i) diagnosing students' entrepreneurial motivations, (ii) identifying needs, (iii) generating business ideas within the social and cooperative economy, and (iv) implementing these ideas. To this end, both academics and professionals from the social and cooperative economy engaged with the participating students to make this reality more accessible to them. Teaching innovation was assessed through a questionnaire on social sensitivity, social economy expertise, and entrepreneurial vocation. Additionally, a satisfaction questionnaire was conducted to evaluate various aspects of the activity. The results of the questionnaire on social sensitivity, social economy expertise, and entrepreneurial vocation, administered both pre- and post-training, show a positive trend across all items. On a scale of 1 to 5, social sensitivity increased from 4.17 to 4.35, entrepreneurial vocation from 3.71 to 3.99,

and knowledge of the social economy from 3.00 to 3.98. This indicates that specific knowledge of the business opportunities associated with the social economy was limited prior to the training but has since improved, although further enhancement is still needed. Regarding the satisfaction questionnaire, high ratings were reported for the organization (4.42), the training (4.47), the satisfaction with the mentors (4.42), the learning derived from the project (4.37), and the perception of the results achieved by each group (4.11), with all scores above 4 on a scale of 1 to 5.

The development of this teaching innovation further suggests the need to create entrepreneurial programs within the social and cooperative economy framework that help disseminate the potential for establishing companies with a deeper understanding of their contributions to the environment and society. Results indicate a limited understanding of what the social economy is and its importance prior to the training, which improves afterwards. This reinforces the idea that the training program can also serve as a means of promoting sustainable business creation.

While support for students with entrepreneurial vocations is widely expanding across Spanish universities, the need to develop specific programs aimed at particular sectors, such as the social and cooperative economy, remains a priority. This project presents a training program that combines academic knowledge with professional mentorship and is focused on designing a business idea within the social economy framework. Results demonstrate students' interest in understanding how they can contribute to a more sustainable entrepreneurial ecosystem through their ideas.

Keywords: entrepreneurship, entrepreneurial vocation, social and cooperative economy.

Acknowledgements: The authors would like to acknowledge funding from the UVemprén Aprèn call for projects on entrepreneurial training, supported by the Vice-Rectorate for Lifelong Learning, Educational Transformation, and Employability at the University of Valencia.

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SP-1.9

“FAMILIA MARTÍNEZ, alimentando retos”

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Abstract

Increasing social changes have caused the food industry to be in constant progress, betting on products that adapt to consumer needs. The Familia Martínez group recognizes the importance of investing in new products that are tasty, high quality and high value.

The Familia Martínez group feeds more than 2 million people every day, consequently, it has a team of people who work together every day to obtain new and better results. The team that makes up the R&D department of the Familia Martínez group is made up of technologists, chefs, nutritionists and chemists.

Keywords: food industry, technologists, food, Familia Martínez.



FAMILIA
Martínez

SP-2.1

Food Safety and Plant-Based Meat Alternatives: the mycotoxins' issue

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Abstract

Recently, there has been a notable increase in the consumption of plant-based meat alternatives (PBMAs) given their nutritional and environmental benefits along with ethical issues (Circus & Robinson, 2019). In particular, in Spain and in Portugal, between 2020 and 2022, an increase of 75% and 25% in sales, respectively, was observed (gfiEurope, 2024). The presence of mycotoxins, fungi secondary metabolites, in PBMAs' ingredients poses a potential concern for the safety and quality of these products.

With this work we aimed to evaluate the occurrence of 20 mycotoxins in PBMAs' samples commercially acquired. For optimization purposes, a previously validated QuEChERS-based method was followed, with slight modifications (Leite et al., 2023). The final method, consisting of extraction using QuEChERS and d-SPE with C18 and Z-Sep sorbents, following by ultra high-performance liquid chromatography coupled to tandem mass spectrometry (UHPLC-MS/MS), was validated in-house. Acceptable performance was obtained, in line with specific and general European regulations, for both regulated and emerging mycotoxins. It showed high specificity and selectivity for all mycotoxins, with LODs and LOQs below 4.53 and 13.71 ng g⁻¹, respectively, and recoveries ranging from 71.08% to 120.01%. The method was successfully applied to real Portuguese samples and, in general, 12 mycotoxins were found with detection frequency and levels reaching up 46% for moniliformin and 83.31 ng g⁻¹ for tenuazonic acid, respectively.

The presence of mycotoxins in these food products needs continuous monitoring in order to evaluate the risk to which each population group is exposed to, guaranteeing human health protection.

Keywords: Plant-based meat alternatives, mycotoxins' analysis, Portugal and Spain, food safety.

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SP-2.2

The role of food safety monitoring in the risk assessment of chemical contaminants

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Abstract

Food remains a significant source of human exposure to chemical contaminants, which can unintentionally make their way into commodities worldwide. These substances may be introduced into food during various stages of production, processing, or transportation, or they may arise from environmental pollution. Among the most relevant contaminants found in food and animal feed are natural toxins like alkaloids and mycotoxins, as well as environmental pollutants such as polychlorinated biphenyls (PCBs), dioxins, and persistent chlorinated pesticides. Other harmful substances include brominated flame retardants, heavy metals such as arsenic, cadmium, lead, and mercury, and process-related contaminants like acrylamide and furan.

To safeguard public health and ensure food safety, robust monitoring systems are essential for detecting these chemical contaminants. Effective food safety monitoring helps assess the risks posed by contaminants in the food supply chain, thereby ensuring regulatory compliance and protecting consumers. A critical piece of this regulatory framework within the European Union is Regulation (EU) 2023/915, which sets maximum allowable levels for specific contaminants in foodstuffs. This regulation plays a key role in harmonizing food safety standards across EU member states. The data generated through monitoring and testing not only ensures compliance with this regulation but also supports exposure assessments and toxicological studies, which are necessary for a comprehensive risk evaluation.

Food risk assessment is a pivotal tool in protecting consumer health. In assessing the risk of food contaminants, understanding human exposure is a fundamental component. Dietary

exposure assessment integrates food consumption data with the concentration levels of chemicals found in food. Traditionally, the approach to evaluating human exposure to chemicals has been focused on one chemical and one exposure route at a time. However, it is increasingly recognized that both humans and animals are exposed to numerous chemicals on a daily basis, through multiple channels including food, water, air, dust, and soil. This multi-route exposure complicates risk assessments and necessitates more holistic approaches to understanding the cumulative impact of chemicals on human health.

As global food systems become more complex, the challenge of ensuring food safety will require continued advancements in monitoring technologies, regulatory frameworks, and risk assessment methodologies. Integrating new scientific knowledge about the cumulative effects of chemical exposures and improving international cooperation on food safety standards will be essential steps in minimizing the risks posed by chemical contaminants in food.

Keywords: food safety, chemical contaminants, risk assessment, Regulation 2023/915, public health.

Acknowledgements: This work has been supported by the Conselleria d'Educació, Universitats i Ocupació from Generalitat Valenciana project CIAICO2022/217.

Reference

Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006. (2023). Official Journal of the European Union.

SP-2.3

One Health in endocrine disruption: Wildlife as indicators for EDCs in drinking water?

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Abstract

Endocrine disruptive compounds (EDCs) are chemicals that can interfere with the normal endocrine function of organisms. They can be introduced into water systems through municipal and industrial wastewaters, and agriculture. Being resistant to conventional water treatment processes, EDCs may reach surface waters and be present in drinking water. Vertebrates share similar endocrine systems, making EDCs research a good example of OneHealth – what promotes the health of animals and ecosystems, also promotes the health of people. Therefore, it might be possible to use wildlife as bioindicators of EDCs in natural water bodies that are sources of drinking water. In the presentation we will discuss the advantages of this approach. We will also show results from two field studies, in which we aimed at investigating potential endocrine disruption in fish in two areas where reproductive problems had been found. We analyzed the reproductive status of fish and histological structure of gonads in study and reference areas. We found out that in both study areas there were a large number of sexually immature fish in age and size classes that should have been sexually mature (Ashrafi et al. 2024, Rintanen et al. unpublished). The gonads of these individuals contained cells at early stages of maturation, but there were no clear cases of intersex, suggesting that the effects were not caused by on-going exposure to estrogens or androgens (Ashrafi et al. 2024, Rintanen et al. unpublished).

We conclude that wildlife could be a useful biomarker of EDCs. Further research, monitoring and risk assessment are needed to protect both human health and the environment from EDCs.

Keywords: endocrine disruption, fish, OneHealth (maximum 5)

Acknowledgements: The research was funded by Kone Foundation and Eurofins.

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SP-2.4

Advances of mycotoxin research: alternative methods contribution on adverse outcome pathways. Study of the pro-inflammatory toxic effect.

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Abstract

The growth of the global population has led to an increased demand for food worldwide. Research into ecological and sustainable agricultural models has become essential, as contamination of stored food and the use of toxic herbicides result in significant economic losses and environmental damage (Lampridi et al., 2019). Among the most harmful contaminants found in food are mycotoxins, due to their extensive range of contamination. Consequently, the co-occurrence in the same food commodity is an issue that cannot be overlooked.

Some key events associated with mycotoxins' toxic effect have contributed to describing AOPs (Adverse Outcome Pathways) which help bridge knowledge gaps, identify targets, and guide the development of testing methods for chemical risk assessment (Penalva-Olcina et al., 2024). However, due to the complexity of many toxicological processes, single AOPs are often insufficient. AOP networks have thus been created to understand better-interconnected events that contribute to toxicity, particularly in complex exposure scenarios.

Taking this into consideration, here it will be presented the use of an *in vitro* alternative method to study of the key event of pro-inflammation by determining two immunological mediators (IL-6 and TNF- α using ELISA) on SH-SY5Y cells exposed to two mycotoxins, gliotoxin (GTX) and ochratoxin A (OTA) (Villeneuve et al., 2018). Accurately predicting

toxicological outcomes related to inflammation remains challenging, even with the development of a more comprehensive network of inflammation-centered AOPs aiding in the protection of human health and the environment.

Keywords: Adverse Outcome Pathway, AOP, mycotoxins, pro-inflammation A, OTA, GTX

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SP-2.5

Food-induced change in social behavior in *medaka* larvae

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Abstract

Social animals change interactions between conspecifics based on many factors. One of them is the limitation of resources, such as a scarcity of sexual partners, territory, or food (Carpenter, F. L. 1987). Uncovering the neural mechanisms of how resource limitations modify behaviours is important to study, but examining it at the whole brain level in mammals is challenging, and primate studies raise ethical concerns.

Recently, teleost have been intensively studied for understanding social behaviours. For example, adult male medaka fish (*Oryzias latipes*) display mate-guarding behaviour when the number of females is limited (Yokoi, S. et al. 2015). However, studying the neural circuits at the whole-brain level in adults remains difficult. Larvae, on the other hand, serve as excellent models for studying behaviours and neural circuits, as their small bodies readily lend themselves to behavioural assays, offer transparency for visualizing neurons, and have small brains that facilitate brain-wide analysis. While many tools are available for zebrafish larvae research, similar resources are limited for medaka larvae.

In this presentation, I will show that medaka larvae exhibit more approaching behaviour when food floats than when preys swim around, which led us to hypothesize that the food localization changes their behaviour. We investigated the behavioural algorithms and examined the brain regions that represent the food and social cues brain -widely. This study will uncover the evolutionary origin of modifications in social behaviour based on resource limitations.

Keywords: Social approach, Social avoidance, Serotonin, Medaka, Larval teleost

Acknowledgements: I appreciate all the experimental help from the people in the Engert lab.

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SP-2.6

Green extraction technologies for recovering bioactive compounds from sweet potato peels

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Abstract

The reuse of by-products from food processing and their reintegration into the production cycle is a promising strategy for developing a more sustainable food industry. In this context, recovering bioactive compounds from by-products using innovative non-thermal green technologies offers a valuable approach for creating new ingredients and products. Purple and orange sweet potato peels are particularly promising sources of bioactive compounds. This study aimed to valorise these peels by recovering bioactive compounds through innovative non-thermal extraction methods, with potential applications in functional foods and probiotics.

The study employed pulsed electric field (PEF) and accelerated solvent extraction (ASE) to obtain extracts from purple and orange sweet potato peels. The extracts were analyzed for total phenolic content (TPC), *in vitro* antioxidant capacity (TEAC), *in vivo* antioxidant capacity using *Saccharomyces cerevisiae* BY4741 yeast, and their ability to enhance probiotic bacterial growth. PEF extracts from purple sweet potato demonstrated significant levels of carbohydrates, polyphenols, and flavonoids (12.5 mg/mL, 4.34 mg GAE/g, and 1.73 mg GAE/g, respectively), surpassing conventional extraction methods. These extracts also enhanced the growth of probiotic bacteria, such as *Lactobacillus* species, and increased the production of short-chain fatty acids (SCFAs), highlighting their potential prebiotic benefits. In addition, orange sweet potato extracts were studied for their *in vitro* and *in vivo* antioxidant activities. *In vivo* tests using yeast cells exposed to oxidative stress showed

statistically significant antioxidant protection at various extract concentrations, with both PEF and ASE extracts offering substantial antioxidant defence, particularly at higher doses (20 mg GAE/mL).

These results suggest that sweet potato peels are a valuable source of bioactive compounds with antioxidant and prebiotic properties, supporting the potential of PEF and ASE extraction methods for developing sustainable, health-promoting ingredients for the food industry.

Keywords: Sweet potato peel, pulsed electric field, accelerated solvent extraction, antioxidant capacity, probiotics

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SP-2.7

Nutrition and tasty plant-based meat alternatives (PBMA)s

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Abstract

The increasing global demand for sustainable and health-conscious food options has led to the rapid development of plant-based meat alternatives (PBMA)s. These innovative products are designed to mimic the taste, texture, and nutritional profile of traditional meat, using plant-derived ingredients (Bohrer, 2019). As a result, PBMA)s have become a promising solution to reduce the environmental footprint of animal agriculture while providing nutritionally balanced options that appeal to a wide range of consumers (Joshi & Kumar, 2015). The aim of this study is to review the ingredients used for its preparation and the nutritional aspects. From a nutritional standpoint, PBMA)s offer several advantages over conventional meat products. Key ingredients such as pea protein, soy, wheat gluten, and lentils serve as the primary protein sources, providing lower protein content (and many lack or are deficient in one or more essential amino acids) to that of animal-based meat but lower saturated fats and cholesterol, making them heart-healthy alternatives (Bohrer, 2019). Many are fortified with essential vitamins and minerals, such as vitamin B12, iron, and zinc (Willet *et al.*, 2019). In addition to their health and nutritional benefits, PBMA)s have a significantly lower environmental impact compared to animal meat production (Ahmad *et al.*, 2022). The cultivation of plant-based ingredients requires fewer natural resources, such as land and water, and produces fewer greenhouse gas emissions. This makes PBMA)s a more sustainable choice for addressing global food security and climate change challenges.

Keywords: plant-based meat alternatives, ingredients, sustainability

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SP-2.8

Empowering female agro-entrepreneurs through social and solidarity economy initiatives in Costa Rica: a gendered approach to food sustainability

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Abstract

This presentation explores the impact of the “Plataforma Virtual y Fortalecimiento de Iniciativas Femeninas de Economía Social Solidaria” project, which aims to empower female entrepreneurs in rural and indigenous communities of Costa Rica. The focus is on building their capacity to develop sustainable agro-food ventures within the Social and Solidarity Economy (SSE), contributing to food security, economic empowerment, and gender equality. The project targeted 40 women leading entrepreneurial initiatives, including two primary groups: indigenous women from Telire, Talamanca, and women associated with Unbound, an organization that supports disadvantaged families. A mixed-method approach was used to gather data, including surveys, interviews, and participatory workshops. These tools helped assess socio-economic conditions, educational levels, business formalization, and the specific challenges faced by women in the agro-food sector. The participants were then provided with training on entrepreneurial skills, gender-sensitive business strategies, and digital tools for social collaboration.

The results revealed distinct differences between the two groups. Indigenous women predominantly engage in agriculture, with 55% still in the ideation phase of their businesses, while the majority of Unbound participants have already initiated formal business operations, focusing on food production and sales. The training programs significantly improved business knowledge and capacity, especially in areas such as financial management, formalization processes, and the integration of digital technologies into their

ventures. However, indigenous women still face challenges related to business formalization, infrastructure, and access to markets.

Interestingly, the participants across both groups demonstrated strong interest in expanding their businesses. All women expressed a vision of growth, with 60% aiming for expansion and diversification in the next five years. The digital platform was identified as a critical tool for fostering collaboration, networking, and knowledge-sharing among women entrepreneurs, providing access to resources otherwise unavailable in their remote areas.

The project demonstrates that gender-focused entrepreneurship initiatives within the Social and Solidarity Economy can play a crucial role in fostering sustainable food systems and empowering marginalized women. While there are clear differences in the stage and scale of businesses between indigenous and non-indigenous participants, the training and support provided through this initiative have enabled all participants to strengthen their business models. Moreover, by leveraging digital platforms, these women are better equipped to overcome geographical and infrastructural barriers, creating more resilient agro-food ventures. The insights gathered underscore the importance of continued investment in capacity-building and digital tools to promote sustainable, gender-sensitive entrepreneurship in the agro-food sector.

Keywords: gender entrepreneurship, food sustainability, social economy, agro-food venture, digital abilities

Acknowledgements: We would like to acknowledge to Prof. Rita Picado from TEC Costa Rica and the Project 1381061.

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SELECTED ORAL COMMUNICATIONS

O-1

Bars with added edible insects as an innovative food - evaluation of their food safety in terms of chlorinated hydrocarbon residues

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Abstract

Nowadays, edible insects are considered an excellent source of nutrients, especially protein (Aguilar-Toalá et al., 2022). In many countries, edible insects are eaten daily as a regular part of the diet in all kinds of forms, such as fried or cooked (Nicole, 2020; Ivanišová et al., 2023). The purpose of the study was to evaluate cricket meal bars for food safety in terms of chemical contaminants (γ -HCH, DDT, DDE, DDD). For the study, bars made according to the author's recipe and those available on the market were used. The prepared batter for the bars from the author's recipe was divided into three parts. Edible insect meal was added to them in proportion to the weight of the dough mass. One weight contained no added edible cricket meal, the second contained 5% and the third 10%. The purchased bars and those made in the laboratory were subjected to fat extraction followed by organochlorine insecticide determination, and at the very end they were subjected to chromatographic determination, which detected the level of chemical contaminants. The fat content of the purchased bars varied between 2.66 - 3.48 g per about 20g of product, while in the bars made in the laboratory the fat varied between 2.99 - 3.56 g per about 20g of product. All of the bars tested are as safe as possible to eat, as their content of chemical contaminants does not exceed unacceptable levels in food. DDE (dichlorodiphenylenedichloroethylene) contaminants are metabolized DDT (dichlorodiphenyltrichloroethane) contaminants and the results for this measurement ranged between 0,37 - 3,14 $\mu\text{g/kg}$ of fat. On the other hand, γ -

HCH (hexachlorocyclohexane) contamination ranged from 0,95 to 18,13 $\mu\text{g/kg}$ of fat. The results obtained in the study are very promising and show that products with edible insects can be a very good substitute for, for example, protein bars or all kinds of high-protein snacks, and are as safe as possible for human consumption.

Keywords: Food safety, edible insects, fat extraction, chromatograph

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O-2

Nutritional and culinary evaluation of cricket powder-enriched pasta

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Abstract

This study aimed to assess the nutritional and culinary properties of *penne rigate* pasta formulated with 10% cricket powder, using 100% wheat pasta as a reference. Nutritional composition and culinary characteristics were analyzed using standardized methods established by the American Association of Cereal Chemists (AACC) (Duda et al., 2019). Starch digestibility was evaluated *in vitro* using the standardized INFOGEST 2.0 gastrointestinal digestion method (Makran et al., 2022). Colorimetric properties were assessed using the CIE L*a*b* system. The proximate composition analysis showed that the cricket-enriched pasta had significantly ($p < 0.05$) higher protein (18.9 vs. 13.9 g/100 g), lipid (2.5 vs. 1.3 g/100 g), total dietary fiber (5.5 vs. 2.9 g/100 g), and ash (1.0 vs. 0.9 g/100 g) content, along with a lower starch content (62.3 vs. 70.0 g/100 g) compared to the 100% wheat pasta. Cricket-enriched pasta showed lower proportion of digestible starch (62.3% vs. 80.9% of total starch) and higher resistant starch content (37.7% vs. 19.1%). Additionally, starch hydrolysis kinetics in the 100% wheat pasta followed a linear trend ($C_t = 0.3864t + 34.58$), while the cricket-enriched pasta exhibited first-order kinetics ($C_t = 32.39 + 29.94 (1 - e^{-0.03678t})$), indicating a stabilization of starch breakdown over time. The greater content of resistant starch could provide beneficial effects for the consumer health according to its bioactive properties (Han et al., 2023). Culinary properties such as water absorption and

cooking loss did not show statistically significant differences between the 100% wheat and cricket-enriched pasta. However, colorimetric analysis revealed a darker appearance in the cricket-enriched pasta (L^* 48.9 vs. 61.8, $p < 0.05$), which could be more similar to that of whole wheat pasta. The incorporation of the cricket powder into the pasta formulation improves its nutritional composition along with its starch hydrolysis kinetics, providing a higher content of resistant starch. Additionally, its culinary properties were not compromised, indicating that cricket powder is a viable ingredient for producing pasta products. Further research is necessary to investigate the potential functional properties of cricket powder-enriched pasta and consumers' acceptance.

Keywords: Cricket; culinary properties; pasta; proximate composition; starch hydrolysis kinetics.

Acknowledgements: We thank Italian Cricket Farm for providing the samples of cricket-based pasta.

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Collaborative Online International Learning - COIL Sessions

COIL-1

Huasca-CARE: A revolutionary approach to neurodegenerative disease prevention and mental health treatment

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Abstract

Huasca-CARE is a groundbreaking research project aimed at harnessing the therapeutic potential of Ayahuasca for treating neurodegenerative diseases, including Alzheimer's and dementia. Given the alarming prevalence of mental disorders—affecting one in eight people worldwide, according to scientific research—and the projected doubling of dementia cases by 2050 (Scheltens et al., 2021), Huasca-CARE aims to offer a preventive solution. Our objective is to develop jelly-textured candies made from natural Ayahuasca extracts, focusing on the neuroprotective metabolites DMT (dimethyltryptamine) and harmine (Maia et al., 2023). These extracts are obtained by boiling the Ayahuasca vine (*Banisteriopsis caapi*) and the chacruna shrub (*Psychotria viridis*) in distilled water. To enhance the product's palatability and acceptance, we incorporate Valencian apricot juice, which adds sweetness and antioxidant properties (González-Fuentes et al., 2018; Vahedi-Mazdabadi et al., 2020), improving the overall organoleptic qualities of the final product. This innovation not only addresses taste challenges associated with Ayahuasca but also makes the treatment more appealing to patients. Our formulation uniquely promotes the proliferation of human neural progenitor cells within just four days of treatment, providing a potential therapy for both

psychiatric disorders and neurodegenerative conditions. Huasca-CARE aligns with the United Nations' Agenda 2030, contributing to several Sustainable Development Goals (SDGs) (Arora & Mishra, 2019). It supports SDG 3 (Good Health and Well-being) by offering accessible treatment options, while SDG 10 (Reduced Inequalities) ensures that diverse socio-economic groups can benefit from this therapy. Moreover, the project fosters local economic growth through the cultivation and processing of Ayahuasca and apricot, promoting sustainable development and creating job opportunities in rural communities. Therefore, our product provides a definitive opportunity in the treatment and prevention of neurodegenerative disorders, shifting alarming news to more positive headlines such as: "HUASCA-CARE: What Mental Health Needs" or "A Positive Approach to Mental Health."

Keywords: ayahuasca, harmine, DMT, antioxidant properties, neuroprotection.

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COIL-2

NutriScan: AI-powered application that integrates a wearable bracelet

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Abstract

NutriScan proposal introduces an AI-powered application that integrates a wearable bracelet to enhance consumer safety and health awareness by giving nutritional information. It constitutes a reliable and fast solution for those who have the need or curiosity to know detailed information about the safety and components of the foods they consume, specifically, to know about their potential toxicity. The proposed application and bracelet will have the main objective of helping people with multiple allergies to identify allergens in foods to avoid possible allergic reactions; however, it can also be used by the general public due to the personalized and adapted eating plans to the needs offered by the application. The assembly of a bracelet with biosensors that can identify allergens, know the toxicity of the compounds, and visualize this information in real time is an innovation that would significantly improve the quality of life and safety of the customers. On the other hand, the combination of artificial intelligence and biosensors also constitutes an innovation that is not common to find in other products or services. The core functionality of NutriScan involves maintaining an extensive database capable of analyzing products for their toxicity levels. By scanning any product, the AI can instantly inform users about the potential toxicity, thereby providing consumers with information regarding the safety of various products and food items. The functionality of NutriScan will be achieved through biosensors that scan the food and detect specific proteins or DNA sequences of allergens. The detected information will be displayed on the *app* and the bracelet's mini-screen. Moreover, the bracelet will include a personal nutritionist on your wrist.

It can be used by anyone looking to improve their health, thanks to the application's personalized and adapted eating plans for any dietary needs. Whether you're managing allergies or just wanting a healthier lifestyle this innovative solution will improve the quality of your life.

Keywords: nutrition, toxic compounds, food, allergens, AI, artificial intelligence

Acknowledgements: The authors would like to thank the Program ToxiCOIL-UV (Collaborative Online International Learning in Toxicology) within the framework of the UVemprén - Santander Open Academy Campus and the three institutions: Universitat de València (Spain), University of Cartagena (Colombia) and University of Medicine and Pharmacy of Cluj-Napoca (Romania).

COIL-3

Genius: the App of personalized dietary and lifestyle recommendations

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Abstract

Genius is proposed as an innovative mobile application that utilizes the user's genetic information and personal pharmacology data to provide personalized dietary and lifestyle recommendations. It is aimed to optimize individual health and well-being. It has been noticed that many patients have different needs that stem from their genetics point of view, and that is where the solution to this problem was born; we address the need for personalized dietary and lifestyle recommendations by leveraging genetic information and pharmacological data. Our proposed innovation lies in creating a mobile application that tailor advice based on individual genetic and pharmacological profiles. Although personalized nutrition services exist, the integration of genetic and pharmacological information sets us apart, offering more accurate and complete recommendations. Genius App will be based on entering the personal data along with blood analyses to see exactly if the patient suffers, from anemia, an infection, or even leukemia, also genetic tests to see if the individual has predispositions to certain diseases, food allergy tests, Intolerance tests... It will be of interest to register the patient's pathologies, drug treatment, and also patient's preferences. Genius groundbreaking approach involves an application that utilizes genetic studies to craft personalized diets. Genius will take into account the food preferences of the consumer but also how human body processes food based on a unique genetic makeup. Genius app will harness this information to deliver precise dietary recommendations customized for the clients/users. Furthermore, by incorporating the science of medications, it will also consider how certain drugs may interact with a

personalized diet of the consumer. With Genius, it will be thrilled to elevate personalized nutrition to the next level and assist individuals in achieving their health objectives in an entirely new manner.

Keywords: App, health, recommendations, food, allergens, AI, artificial intelligence

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COIL-4

AMSPEN: NeuroProtect Aromatherapy Mist

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This project was proposed in the ToxiCOIL-UVEmprèn program under the acronym of AMSPEN. It was based on the development a *NeuroProtect Aromatherapy Mist*, a bedtime spray designed to enhance relaxation and support brain health. This innovative product combines traditional plant extracts with advanced aromatherapy techniques to provide a neuroprotective solution for improving sleep quality and reducing stress. The spray is infused with essential oils known for their neuroprotective and calming effects, such as bergamot, lavender, and ginseng, delivered through a simple spray application onto the pillow before sleep. It was conducted extensive bibliographic research on plant extracts known for their neuroprotective properties, focusing on their ability to combat oxidative stress and inflammation. Key essential oils (bergamot, lavender, and ginseng) were selected based on scientific evidence of their benefits. Bergamot oil is known to boost immunity and alleviate depression, lavender oil provides antioxidant protection and supports cognitive function (Cui, 2022); while ginseng oil, known for its memory-enhancing properties, plays a key role in neuroprotection (Li, 2022). Benefits of AMSPEN: The essential oils studied have shown to improve sleep quality and mood and contribute to neuroprotection by reducing oxidative stress. *NeuroProtect Aromatherapy Mist* intends to address neurodegenerative conditions such as Alzheimer's and Parkinson's by providing nightly support for brain health. Unlike existing solutions, this product offers a non-invasive, natural approach to combating neuronal damage. Additionally, the product aligns with several **Sustainable Development**

Goals (SDGs), including SDG 3 (Good Health and Well-being) through the promotion of mental health, SDG 9 (Industry, Innovation, and Infrastructure) by fostering innovation within the wellness industry, and SDG 12 (Responsible Consumption and Production) through the use of sustainable, natural ingredients (United Nations, 2015). Future perspectives of AMSPEN: **If developed, it could be** a promising, innovative product that merges traditional plant-based neuroprotective remedies with modern aromatherapy techniques. It provides a practical, accessible, and eco-friendly solution for individuals seeking to improve their sleep and in some extend also brain health. Its alignment with the SDGs further underscores its potential for social, environmental, and economic viability, making it a sustainable option for the growing wellness industry.

Keywords: Neuroprotection, Aromatherapy, Essential Oils, Sleep Quality, Brain Health

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COIL-5

Diabetes-App: treatment diabetes friendly dining. Revolutionizing gut health with a predictive mobile App.

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Abstract

Diabetes-App is a mobile application designed to empower individuals with diabetes to make informed food choices that contribute to a long and healthy life. The gut microbiota, the collective community of microorganisms in the gastrointestinal, interacts with dietary components and affects glucose and lipid metabolism, inflammation, insulin sensitivity, and overall energy homeostasis in the host (Gurung et al., 2020). Accordingly, alteration of the gut microbiota has been pointed to as a driver of the metainflammation observed in diabetes (Scheithauer et al., 2020; Llewellyn, et al., 2018). The Diabetes-App will not only provide personalized diets but also emphasize foods rich in probiotics; live microorganisms that confer a health benefit to the host when administered in adequate amounts. Based on the growing body of scientific evidence highlighting the crucial role of gut health in overall wellness, a healthy gut microbiome has been linked to better glycemic control, reduced inflammation, and improved immune function, all of which are essential factors in the management of diabetes. By encouraging the consumption of foods that support a thriving gut environment, the Diabetes-App will contribute to a sustainable approach to diabetes management. In addition, such an app will merge nutrition, technology and personalized, affordable healthcare, making it an innovative solution in the field of digital health. It will be a user-friendly app providing personalized dietary guidance, taking into account the unique needs of each individual. By gathering information about the user's diabetes type, daily water intake, age, medications, and other relevant factors, the app will generate tailored recommendations for meals and snacks rich in probiotic

recipes. The application pretends to be designed not only to provide dietary recommendations that take into account carbohydrate control, lean protein, portion control, fiber-rich food intake, but it will also offer educational resources to help users understand the benefits of probiotics and how to integrate them effectively into their daily diets. This will empower users to make informed choices about their food, ultimately contributing to a healthier lifestyle and a more sustainable approach to managing diabetes status.

Keywords: diabetes, App, microbiota, food, recipes, AI, artificial intelligence

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P-1

Exploring the cytotoxicity and bioavailability of gliotoxin, ochratoxin A, and their combined effects in Caco-2 cells.

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Abstract

Gliotoxin (GTX) and Ochratoxin A (OTA) are secondary metabolites produced by *Aspergillus* and *Penicillium* fungi species present in food and feed (Smith et al., 2016). These mycotoxins have been proved to have deleterious effects in human and animal health (Juan-García et al., 2021). This study has aimed to investigate the GTX and OTA medium inhibitory concentration (IC₅₀) and bioavailability using Caco-2 cells as a model of the human intestinal epithelium. The evaluation of GTX, OTA and its combination IC₅₀ was performed by the MTT assay, for 24h and 48h. *In vitro* bioavailability of GTX (1.5, 0.75 and 0.4 µM), OTA (25, 12.5 and 6.25 µM) and its combination ([1.5+25] µM, [0.75+12.5] µM and [0.4+6.25] µM) was assessed using Caco-2 cells then analyzing mycotoxins remaining by liquid chromatography–mass spectrometry (LC–MS). GTX showed a cytotoxic effect after 48 h with an IC₅₀ of 1.2 µM. OTA showed an IC₅₀ of 7.9 µM and 5.1 µM after 24 and 48 h respectively. Regarding mycotoxin's bioavailability, the lowest concentrations of both, GTX and OTA together with its combination, revealed to have a higher bioavailability, around 35% and 30% respectively when compared to the highest concentrations. This study demonstrates that GTX and OTA exhibit greater bioavailability at lower concentrations, with bioavailability decreasing as concentrations increase. Additionally, prolonged exposure revealed the cytotoxic effects of both mycotoxins, particularly at higher concentrations, indicating a potential risk for toxicity over time in human intestinal cells.

Keywords: Gliotoxin, Ochratoxin A, Caco-2, Bioavailability.

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P-2

Characterization and *in vitro* skin permeation of voriconazole from hyalurosomes

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Abstract

Candida albicans is a fungus present in the human microbiota, mainly in the skin and mucous membranes. It can proliferate excessively, causing superficial candidiasis or invasive candidiasis, and is considered an opportunistic pathogen (Kaur, 2023). Nowadays, candidiasis has a high impact since there is a small group of antifungal drugs with limitations such as serious side effects, narrow antifungal spectrum and development of resistance to treatment (Lu, 2023). These problems could be solved with the formulation of nanosystems loaded with a novel drug such as voriconazole (VCZ), a second-generation drug from the azole group with a broad antifungal spectrum (Dragicevic, 2024; Martín-Aragón, 2004). In this work, VCZ-loaded hyalurosomes have been designed as a pharmaceutical form intended for the topical treatment of candidiasis caused by *Candida albicans*. Three different formulations were developed, characterized and evaluated their transdermal absorption through *in vitro* assays using Franz cells and pig ear skin. Formulations were prepared dissolving sodium hyaluronate (0.1 %), polysorbate 80 (0.5 %) and Phospholipon® 90G (1, 4 and 10 %) in water/ethanol (90:10, v/v). VCZ concentration was 500 µg/ml. Mixtures were sonicated with 3 cycles of 5 minutes with a high intensity ultrasonic disintegrator (5 s on and 2 s off, 60 % and 45 % amplitude). Empty hyalurosomes were also formulated to assess the effect of VCZ on vesicles assembly. Characterization of formulations reported particle sizes smaller than 160 nm, polydispersity indexes between 0.2 and 0.4, negative or neutral Z

potentials and encapsulation efficiencies higher than 72 %. Using TEM, spherical particles of several lipid layers were observed. *In vitro* release studies showed that adding increasing amounts of phospholipid to the formulation decreased the VCZ release rate, reaching the complete release of VCZ over the studied time period of 24 h. Differences between the percentage of VCZ per gram of tissue accumulated into skin layers after the administration of different formulations and a VCZ solution were found. The formulation with the lowest concentration of phospholipid (1 %) allowed the drug to be distributed more homogeneously in the different layers of the skin and to reach the deepest layers, highlighting the greater drug load in epidermis and dermis, which may represent a more effective reservoir in the treatment of more invasive fungal skin infections. In conclusion, promising VCZ-loaded hyalurosomes were formulated for the treatment of more superficial or invasive cutaneous candidiasis. However, these results should be confirmed with *in vivo* studies.

Keywords: Hyalurosomes, voriconazole, phospholipid, candidiasis, transdermal absorption.

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P-3

High-resolution mass spectrometry for determination of lipophilic marine biotoxins in bivalve molluscs

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Abstract

Marine biotoxins are produced during harmful algal blooms by some microalgae. They can accumulate in bivalve molluscs, posing health risks to humans who consume contaminated shellfish. Among the most extensively studied lipophilic marine biotoxins (LMBs) are okadaic acid, dinophysistoxins, pectenotoxins, yessotoxins, azaspiracids, and cyclic imines. To protect consumers, the European Union Regulation No. 853/2004 has established maximum allowable levels for these LMBs in bivalve molluscs (European Commission, 2004). This study outlines the validation of a liquid chromatography coupled to high-resolution mass spectrometry (LC-HRMS) method for detecting 13 LMBs in bivalve mollusc samples. A preliminary screening identifies positive samples, which are then quantified. Validation demonstrated satisfactory accuracy and precision, with limits of quantification (LOQs) complying with European Union regulations. Method performance was also assessed through an inter-laboratory comparison, showing satisfactory results. Analysis of 62 bivalve mollusc samples collected between 2022 and 2023 revealed the presence of okadaic acid (OA) and dinophysistoxin-2 (DTX2) in nine samples.

Keywords: Lipophilic marine biotoxins, high-resolution mass spectrometry, liquid chromatography, food contaminants

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P-4

Genotoxic effects of acrylamide, penitrem A, and 3-acetyldeoxynivalenol individually and in combination in SH-SY5Y cells.

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Abstract

This study explores the genotoxic effects of acrylamide (AA), penitrem A (PEN A), and 3-acetyldeoxynivalenol (3-ADON), both individually and in combination, on SH-SY5Y neuroblastoma cells. AA is a chemical commonly produced in foods during high-temperature cooking, while PEN A and 3-ADON are mycotoxins often found in contaminated foods and animal feed (Bridgeman et al., 2024; Juan-García et al., 2015, 2016). Using micronucleus assays, the frequency of micronuclei, known to be a marker of genotoxicity, was assessed following exposure to AA (2500 μ M, 1750 μ M, 650 μ M), PEN A (10 μ M, 5 μ M, 2.5 μ M), and 3-ADON (4 μ M, 2 μ M, 1 μ M), individually and in binary and tertiary combinations. The dilution ratios of the concentrations for the binary combinations were (1250:1) for [AA + 3-ADON], (250:1) for [AA + PEN A], (5:1) for [PEN A + A-ADON], and (1250:250:1) for the tertiary combination [AA + 3-ADON + PEN A]. The study found a significant increase in micronuclei frequency in cells exposed to the combination of [AA + PEN A + 3-ADON] compared to individual exposures. Suggesting an enhanced genotoxic effect from the chemical mixture. These findings emphasize the need to evaluate potential interactions between chemicals in complex mixtures during genotoxicity assessments (Agahi et al., 2020; Bridgeman et al., 2023; Penalva-Olcina et al., 2022). This work provides valuable insights for risk assessment and regulatory decisions regarding the genotoxic effects of chemical mixtures. Further research into the mechanisms of these interactions and expansion to other cell lines and exposure scenarios is needed.

Keywords: acrylamide, penitrem A, 3-acetyldeoxynivalenol, mixtures, micronucleus assay

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P-5

Effects of chickpea flour-enriched crackers on Caco-2 cell viability: the influence of fermentation and concentration.

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ABSTRACT

The enrichment of foods with plant-based proteins represents an effective and sustainable intervention to improve food nutritional value and to modulate the diet toward healthier choices (Verni et al., 2022). The presence of bioactive compounds in pulses, such as chickpeas, make them promising ingredients; however, their content of anti-nutritional factors (i.e., such as trypsin inhibitor, protease inhibitor, phytic acid, saponin, tannins) and their flavor have limited the incorporation into food formulations. Fermentation may overcome these drawbacks while improving the content of nutritive compounds such as bioactive peptides and polyphenols (Chen et al., 2019).

This study investigated the effects of incorporating both fermented and non-fermented chickpea flours, at different proportions, into crackers on the viability of Caco-2 cells—an *in vitro* model that simulates *in vivo* conditions at the enterocyte level.

Fermented (FF) and non-fermented (NFF) chickpea flours were used to replace wheat flour and realize two levels of enrichment corresponding to: i) prototype 1 fermented (P1F) and unfermented (P1NF), and ii) prototype 2 fermented (P2F) and unfermented (P2NF). A control cracker made with wheat flour was prepared accounting for five prototypes. The FF, NFF, and the five crackers underwent into *in vitro* digestion according to the INFOGEST protocol, and each bioaccessible fraction (BF) was collected at the end of the intestinal phase. Thereafter, Caco-2 cells were exposed to intestinal digesta previously diluted in series from 1:2 to 1:256, and cell viability was assessed by MTT assay after 24h and 48h of exposure.

Neither diluted nor non-diluted BF exhibited cytotoxic effects on Caco-2 cells, with viability ranging in the range 68-197%. After 24h and 48 h of exposure, cellular viability was globally comparable, except for FF, P1NF, and P2NF, where viability increased by 1.1-, 1.4-, and 1.7-fold after 48 h compared to 24 h, respectively. Both prototypes of crackers enriched with NFF influenced cell viability relative to the control flour NFF, whereas those made with FF flour showed even higher viability in the range 67-195%. Among all the tested samples, P1F and P2NF showed greater cell viability than the control after both 24h and 48 h. Specifically, the P1F prototype had a 1.4-fold higher viability than P1NF, although the unfermented samples exhibited greater viability after 48 h. A similar trend was observed for the P2F cracker, which reached its highest viability after 24 h.

This study demonstrated that chickpea flour is a potential functional ingredient in cracker formulations. Further *in vivo* studies are needed to confirm these findings and better understand the health benefits for its future incorporation in food products.

Keywords: pulses, chickpeas, fermentation, Caco-2 cells, functional food.

Acknowledgements: This work has been supported by National Recovery and Resilience Plan (NRRP) Italian Ministry of University and funded by the European Union -Next Generation EU(PE000000003); Conselleria d'Educació, Universitats i Ocupació from Generalitat Valenciana project CIAICO2022/199.

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P-6

Nutritional profile, polyphenols content, antioxidant activity and volatiles profile of a corn flour

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Abstract

Acorn flour resulted to be a promising alternative to the cereal flour for different applications thanks to its nutritional value, lack of gluten proteins and polyphenols content.

The aim of the study was to chemically characterize acorn flour in terms of nutritional value, polyphenols, antioxidant properties and volatile profile and to promote it as a rich source of nutrients and bioactive constituents. This study received funding from the European Union - Next-GenerationEU - National Recovery and Resilience Plan (NRRP) – MISSION 4 COMPONENT 2, INVESTMENT N. 1.1, CALL PRIN 2022 PNRR D.D. 1409 del 14-09-22 (CUP J53D23018470001).

The nutritional value of a corn flour was evaluated using the AOAC (AOAC, 2000). The analysis of polyphenols has been carried out by ultra-high performance liquid chromatography/tandem mass spectrometry (UHPLC-MS/MS). Total phenolic content (TPC), total flavonoid content (TFC), total tannin content (TTC) and antioxidant activity measured through DPPH radical scavenging activity has been evaluated by using a UV-visible spectrophotometer. The vitamin A and E content has been analyzed by HPLC-DAD. Furthermore, the volatile fingerprints (semi-quantitative approach) have been obtained by using gas chromatography–mass spectrometry (GC-MS).

From our results, acorn flour resulted to be a rich source of carbohydrates (50%), dietary fiber (25%), protein (10%) and macro-microelements, such as potassium and calcium. Moreover, it was rich in unsaturated fatty acids, mainly oleic and linoleic acids (44.92% and 36.51%, respectively). Acorn flour resulted to be rich in ellagic acid (539.56 mg·Kg⁻¹), gallic acid (135.88 mg·Kg⁻¹) and other polyphenols such as cyanidin-3-glucoside, hyperoside, caffeic and vanillic acids. The spectrophotometric analysis confirmed the results obtained previously with polyphenolic analysis. In fact, DPPH value was high (6273.16 mg TE/ kg DW) as well as TPC (58176.00 mg GAE/kg DW), TFC (82903.33 mg RE/kg DW) and TTC (35359.95 mg tannic acid /Kg DW). A total of 43 volatile compounds were identified in acorn flour, belonging to different chemical classes: alcohols, aldehydes, terpenes, alkanes, furans, esters, ketones, acids.

Acorn flour resulted to be a promising alternative as food ingredient for its great nutritional value, polyphenolic and volatile composition.

Keywords: acorn flour, nutritional value, polyphenols, volatile compounds, spectrophotometrical assays.

Acknowledgements: This study received funding from the European Union - Next-GenerationEU - National Recovery and Resilience Plan (NRRP) – MISSION 4 COMPONENT 2, INVESTMENT N. 1.1, CALL PRIN 2022 PNRR D.D. 1409 del 14-09-22 (CUP J53D23018470001).

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Assessing the potential and biocompatibility of hyalurosomes as an antifungal treatment against cutaneous candidiasis

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Abstract

Candidiasis is an opportunistic fungal infection that affects the health of patients with compromised immune systems (Di Cosola et al., 2021). Nowadays, topical antifungal agents as clotrimazole are generally used as conventional cream and gel preparations in the treatment of superficial candidiasis (Güngör et al., 2013). Second-generation triazole drugs such as voriconazole (VCZ), with expanded spectrum of antifungal activity, represent a new alternative in the treatment of this type of infection. On the other hand, liposomes are the most common drug nanocarriers due to their high biocompatibility, low toxicity and they also enhance drug solubility and stability (Abbasi et al., 2023). In this sense, the objective of this study was to evaluate the antifungal effect of aqueous solutions of VCZ and VCZ-loaded hyalurosomes against *Candida albicans* and the biocompatibility of these formulations on keratinocytic human cells. Four formulations were prepared by dissolving sodium hyaluronate (0.1 %), polysorbate 80 (0.5 %) and Phospholipon[®] 90G (4 %) in water/ethanol (90:10, v/v) or water/ethanol/glycerine (90:2.5:7.5, v/v). VCZ concentrations were 0.5 or 5 mg/mL. Additionally, empty hyalurosomes were formulated to assess the effect of VCZ on antifungal activity and biocompatibility. The growth curves of *C. albicans* in the presence of different concentrations of VCZ showed higher inhibition as the concentration of VCZ increases. The highest concentration of VCZ tested (500 µg/mL) provoked an inhibition of 2.3 Log with respect to the negative control. In the case of hyalurosomes, real growth inhibition was calculated considering that caused by empty

formulations. No differences in the inhibitory effect were observed between the formulations of higher (500 µg/mL) and lower concentration (50 µg/mL), resulted in a significant reduction in *C. albicans* counts between 0.7 and 1.17 log CFU/mL at 48 hours compared to growth in the absence of drug. Higher inhibitions were found in the case of formulations with glycerine in their composition. *In vitro* studies on keratinocytes confirmed that the formulations were biocompatible with cells as no cytotoxicity was observed, obtaining cell viability percentages determined by MTT assay after 48 h of incubation between 80 and 100 %. In conclusion, VCZ was suitably loaded in hyalurosomes that resulted biocompatible with skin cells and demonstrated to inhibit the growth of *C. albicans*, making them a promising formulation for the treatment of cutaneous candidiasis. However, further studies are needed to confirm their applicability.

Keywords: Voriconazole, hyalurosomes, antifungal activity, biocompatibility and *Candida albicans*.

Acknowledgements: This work was supported by Generalitat Valenciana through project CIGE/2022/112.

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Survival of biofilm and planktonic cells of *Listeria monocytogenes* after their transfer to cooked ham and storage at refrigeration prior to their simulated *in vitro* gastrointestinal digestion

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Abstract

Listeria monocytogenes was the fifth most frequent zoonosis in humans in the European Union in 2022 (EFSA and ECDC, 2023 and Serrano et al., 2024). The aim of this study was to evaluate the survival capacity of three strains of *L. monocytogenes* in a planktonic and biofilm state in cooked ham, with and without storage period and after *in vitro* gastrointestinal digestion. On the one hand, biofilms were created with an initial concentration of 10^4 CFU/cm² which were transferred by contact to slices of cooked ham for 90 seconds. On the other hand, slices of cooked ham were inoculated with a suspension of *Listeria* in a planktonic state with the same initial concentration. Subsequently, all samples were subjected to *in vitro* digestion immediately or after storage for 7 days at 7 °C in vacuum packaging. The results showed an overall transfer rate of *L. monocytogenes* biofilm to cooked ham of 11.61%. A comparative analysis have been done for of the overall concentration of *L. monocytogenes* during all stages studied for biofilm cells and planktonic cells. Considering the average values for the overall strains, it can be seen that biofilm cells (B) at all stages had higher counts than planktonic cells (P). In both cases, the immediate digestion process (D) led to a reduction in the initial concentration of B and P, being higher in P, although in both cases showed a significant reduction in the population ($p < 0.05$). In addition, the 7-day conservation process at 7 °C led to a significant increase in the population ($p < 0.05$) in the case of B, which could be due to the resistance mechanisms of the biofilms. This increase in concentration after the vacuum conservation process in refrigeration (B77) was equivalent to the subsequent reduction due to digestion (B77D), thus reaching the same

initial concentration of B. However, in the case of planktonic cells (P), conservation in refrigeration (P77) did not produce an increase in the population of *L. monocytogenes* in cooked ham and the concentration after digestion (P77D) was 0.11 log CFU/cm² higher than the initial P concentration. In conclusion, *L. monocytogenes* poses a risk to public health due to its transfer capacity and survival under acidic conditions, since both P and B survived *in vitro* gastrointestinal digestion at pH 3, and factors such as the biofilm state and the storage under vacuum refrigeration for 7 days at 7 °C increase the survival of *L. monocytogenes*.

Keywords: *Listeria monocytogenes*, survival, biofilm, transference, ready-to-eat foods, digestion

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Total antioxidant capacity and total polyphenols in black garlic, lemon and kombucha homemade vs. industrially fermented

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Abstract

The MEDIET4ALL project (MEDIET4ALL, 2023) aims to modernize traditional Mediterranean Diet recipes (TMR) in terms of nutritional and antioxidant properties. Fermentation of foods can increase its antioxidant capacity (Zhou, 2022). This study aims to evaluate the total antioxidant capacity (TAC) of three fermented foods (black garlic, lemon and kombucha) and compare the type of fermentation. Therefore, in a further step they could be added to TMR to enhance their antioxidant properties.

For the evaluation of antioxidant capacity, the antioxidants had to be extracted into two fractions: extractable (aqueous-organic solvents) and non-extractable (acid hydrolysis) (Cuenca-Ortolá, 2023). The TAC was then determined using three methods: Oxygen Radical Absorbance Capacity (ORAC), Trolox Equivalent Antioxidant Capacity (TEAC) and Total Polyphenols (TP). Two types of fermentation were applied to black garlic, lemon and kombucha: homemade (HM) and industrial (IN).

The results, expressed per 100 g of dry weight, show that black garlic has the highest TAC ($p<0.05$) in sample HM compared to IN using TEAC (10,773 vs. 3,528 μM Trolox), while sample HM do not surpass IN in ORAC and TP (121,659 vs. 182,557 μM Trolox and 1,499 vs. 2,040 mg of Gallic Acid Equivalent (GAE), respectively). In comparison, unfermented garlic presents 546 (Najman, 2020) and 5,708 μM Trolox (USDA, 2010) (TEAC and ORAC, respectively), as well as 242 mg GAE in TP (Phenol-Explorer, 2017). These results suggest that fermentation improves TAC, with industrial fermentation highly favouring the release of certain antioxidants in this food. For lemon, HM shows a significantly ($p<0.05$) higher TAC than IN (363,294 vs. 98,518 μM Trolox in ORAC; 1,910 vs. 993 mg GAE in TP, respectively).

However, no significant differences were observed in the TEAC method ($p>0.05$) (8,314 vs. 6,734 μM Trolox). Compared to natural lemon, fermentation significantly increases TAC: 1,150 (Funes, 2009) and 1,225 μM Trolox (USDA, 2010) (TEAC and ORAC, respectively) and 46 mg GAE in TP (Calderón Cuadrado, 2020). In kombucha, HM shows a lower ($p<0.05$) TAC than IN (3,449 vs. 48,180 μM Trolox in TEAC; 51,680 vs. 276,547 μM Trolox in ORAC; 483 vs. 4,717 mg GAE, respectively).

This study demonstrates that both HM or IN fermentation improves TAC of samples compared to its non-fermented counterparts, probably attributed to breaking down compounds, generating new antioxidants, facilitating their release, and reducing antinutrients (Saritaş, 2024); thus, enhancing their effectiveness and could be incorporated in TMR to increase their antioxidant properties (Saritaş, 2024).

Keywords: Antioxidant capacity; black garlic; lemon; kombucha; total polyphenols

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Assessment of bioactive compounds in defatted European sea bass (*Dicentrarchus labrax*) viscera extracted by supercritical fluid extraction (SFE) and fermented with Lactic Acid Bacteria (*L. plantarum* and *L. casei*)

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Abstract

Fermentation is a widely used method in the food industry, and fish by-products, often discarded, can be valuable sources of bioactive compounds, especially for lactic acid bacteria (LAB) fermentation. This study used lipid-free sea bass viscera as a medium to ferment *Lactobacillus plantarum* and *Lactobacillus casei* over 72 hours, monitoring bacterial counts and pH changes every 24 hours. After fermentation, solid matrices and supernatants were separated by centrifugation and analysed for protein content, bioactive peptides, minerals, and heavy metals. Both LAB strains significantly increased protein content in the supernatants ($P < 0.05$). Six types of bioactive peptides were identified, demonstrating antioxidative, anti-inflammatory, anticancer, antithrombotic, immunomodulatory, and hypolipidemic effects. Among these, 28 antioxidative peptide sequences were found. Mineral and heavy metal analysis confirmed safety, while tests also showed that the LAB strains notably enhanced the antioxidative properties of the supernatants. This study highlights the potential of fish by-products in generating bioactive compounds through fermentation.

Keywords: *L. Plantarum*; *L. Casei*; fermentation; PEF; bioactive compounds

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Determinants of intention to consume edible insects by students in Poland to ensure food security

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Abstract

Aim: The study of young consumers' preferences, acceptance, willingness to try, eat and/or purchase insect-based foods is of significant importance to the future prospects of entomophagy in Poland. The objective of this study was to determine whether the lifestyles of young consumers in Poland (Generation Z) are associated with their attitudes and preferences regarding the attributes of foods with edible insects, and whether they can influence their willingness to consume new, innovative foods with edible insects.

Methodology: The empirical study was conducted by indirect interview method, via an online platform, among 749 students in Poland in 2023.

Results: The younger consumers, namely students, were characterized by positive attitudes towards food with edible insects. These consumers demonstrated an attentiveness to the consumption of foods with high nutritional value, a tendency towards physical activity, and a lack of attachment to the culinary traditions of their region of origin. Most lifestyle determinants (commitment to learning, attention to the nutritional value of food, valuing the culinary traditions of the region of origin, health awareness and physical activity) correlated positively with environmental concern in terms of willingness to eat food containing edible insects. Generation Z's acceptance of foods containing edible insects as a solution or support to the problem of finding new food ingredients with high nutritional value was correlated with pleasure orientation (among men), lack of attachment to the culinary traditions of the region of origin (among men and women), high nutritional value of food and high health awareness (among women).

Conclusion: The research enriches the existing literature on entomophagy by highlighting the potential acceptability of insect-based foods among young adults, thereby contributing to broader discussions on sustainable food systems and environmental protection. This novel approach not only addresses current environmental and nutritional issues, but also provides a basis for future research and policy development aimed at improving food security and sustainability. The study contributes to the existing body of knowledge

regarding the attitudes of young adults, commonly referred to as Generation Z, towards environmental care, food security concerns, and environmental sustainability. In doing so, it considers the influence of lifestyle variables.

Keywords: edible insects, novel food, food attributes, food sustainability, consumer studies

Utilization of the oils and the remaining solid matrices obtained after the SC-CO₂ extraction of salmon side streams: Evaluation of the fatty acids, bioactive peptides, mineral and heavy metals contents and profiles

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Abstract

Atlantic salmon (*Salmo salar*) side streams (head, backbone, and viscera) are rich in nutrients and present an opportunity for valorization. This study compares the effects of supercritical fluid extraction (SC-CO₂) and solvent extraction (SE) on oil extracts and solid matrices from these side streams. Evaluations include oil, fatty acids (GC-FID), protein, bioactive peptides (LC-MS/MS), minerals, heavy metals (ICP-MS), and antioxidants. SC-CO₂ displayed a more comprehensive fatty acid profile, notably enhancing fatty acid methyl esters (FAME) extraction. A clear difference in the amount of bioactive peptides with different potential functional properties was found between the solids obtained by SC-CO₂ and SE, with 6 different types (antioxidant (EL), anti-inflammatory (GPAGPL), antithrombotic (GP, PGP), immunomodulating (YG), anticancer (VVV), and hypolipidemic (EF)). Mineral and heavy metal levels adhere to safety standards. In conclusion, the recovery of these compounds from the remaining solid matrices open the doors to a greater exploitation of salmon side streams.

Keywords: SC-CO₂; salmon side streams; oil and remaining solid matrices; nutrients; bioactive compounds

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Food security and the willingness of young Poles to consume food containing edible insects

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Abstract

Edible insect can play a significant role in addressing global food insecurity. In order to enhance public awareness and appreciation of the influence of dietary choices on climate change and the environment, a multidimensional approach that considers attitudes towards health, the environment, the consumption of novel foods containing edible insects, and intentions to purchase such foods, may prove beneficial. From this perspective, an investigation into the relationship between sustainable eating behaviour involving edible insects and new food products containing edible insects and stated attitudes and intentions is a worthwhile undertaking.

The aim of the study was to determine whether health and environmental concerns and attitudes and intentions towards purchasing edible insects and foods containing edible insects are associated with willingness to consume them among young consumers (Generation Z) in Poland.

An empirical study was carried out in 2023, using a questionnaire with an indirect interview method via an online platform.

The willingness to consume foods containing edible insects in the form of different product categories was found to be associated with environmental concern and attitudes and intentions to purchase them. Conversely, health concerns were associated with the willingness to consume only specific products containing edible insects, including ready-made meals (such as soups, pasta, pancakes, sauces, etc.), bread, rolls, pizza, other bakery products, cakes, pastries, chocolate-covered insects and other pastry and confectionery products, post-workout drinks, nutritional supplements for individuals with high protein requirements, cottage cheese, yogurt and other dairy drinks. It is also noteworthy that respondents who expressed more positive attitudes towards health and environmental concerns demonstrated a greater willingness to consume foods containing edible insects.

There was a positive correlation between attitudes and intentions towards foods containing edible insects and willingness to purchase and consume this type of food. Our research indicates that environmental concerns, attitudes and intentions towards purchasing foods containing edible insects are significant factors influencing the potential willingness of Generation Z to purchase and consume both edible insects and foods containing them. Marketing communication of foods with edible insects should prioritise the communication of the environmental benefits associated with the production of these foods. This is of particular importance with regard to the development of consumer awareness in this field. Furthermore, it will influence the formation of positive attitudes towards foods containing edible insects from different product categories, and thus the willingness to consume edible insects and foods with insects.

Keywords: entomophagy, insect-based foods, edible insects, willingness to consume, generation Z

Could sustainable products from edible insects become the food of the future? - exploring Poland's Generation Z

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Abstract

Over the past decade, there has been a growing global interest in insects in the context of animal and human nutrition. The emphasis on the need for and potential use of insect protein stems from the search for alternative, sustainable sources of protein in both animal and human nutrition. For consumers, the concept of entomophagy can be both new and controversial, so building a market for insect products will require educational efforts to raise socio-economic awareness of the potential benefits of rearing and consuming insects. This study fills a research gap by exploring the attitudes and interest of young Polish consumers towards new insect-based foods. The empirical study was conducted among young consumers of Generation Z in Poland using a questionnaire, indirect interview method, via an online platform (CAWI).

It was observed that gender and place of residence did not statistically significantly differentiate young consumers' attitudes towards insect foods ($p > 0.001$). About 29% of the respondents said they would be willing to buy new innovative foods containing edible insects if they appeared on the market. About 30% said they would be willing to try dishes made from insects or with insect ingredients. In contrast, about 19% were interested in eating insect dishes or foods/products in the near future. It was found that gender and place of residence did not make a statistically significant difference in consumers' behaviour and stated intentions towards insect foods. ($p > 0.001$). In order to classify the significant

determinants of the choice of new products containing insects, a factor analysis was carried out, from which three uncorrelated dimensions were extracted. It was found that the evaluation of the determinants influencing the purchase of insect products could be based on variables: 1) those driven by health and environmental concerns, 2) organoleptic attributes, and 3) circumstantial considerations/conditions.

Research into young consumers' attitudes towards novel foods is legitimate and provides much valuable information about the development of the market for unconventional protein sources.

Keywords: edible insects, novel food, food attributes, food sustainability, consumer studies

Toxicity assessment of citrinin, beauvericin, and moniliformin in SH-SY5Y cells: effects of single and combined exposures

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Abstract

Citrinin (CTN), beauvericin (BEA), and moniliformin (MON) are mycotoxins, also known as fungal metabolites found in food and feed. Ingesting these compounds can harm the health of both humans and animals (Marin et al., 2013), from cultivation to consumption, and their simultaneous presence can worsen these effects (Ali et al., 2023; Malir et al., 2023). The objective of this study was to carry out an experimental study to analyze how mycotoxins CTN, BEA, MON and their binary combinations affect the human neuroblastoma cell line (SH-SY5Y). The MTT cytotoxicity assay (Juan-García et al., 2015) was performed 24 h and 48 h after individual exposure to CTN concentrations of 0.39 - 100 μ M, BEA concentrations of 0.12 - 30 μ M, and MON concentrations of 0.78 - 200 μ M. The effect of the binary combinations was performed according to the following combination ratios: (5:1) for [CTN + BEA], (10:3) for [MON + CTN] and (50:3) for [MON + BEA]. The cytotoxicity evaluation revealed that BEA showed levels of cell viability 5 times lower than its control, while CTN induced a decrease of 60%. On the other hand, [BEA + MON] was the combination for which lower levels of cell viability were obtained compared to the other mixtures, while [MON + CTN] only achieved the suppression of 50% of cell proliferation after 48 h of exposure. These results allow us to conclude that the toxicity order would be BEA > CTN > MON and that the combination [BEA + MON] was the most toxic of those tested. Moreover, these findings highlight the importance of further monitoring and research to understand the mechanisms involved in the alteration of SH-SY5Y cells after exposure, both individually and in combination, to mycotoxins of interest, in order to control food mycotoxin contamination.

Keywords: mycotoxin, mixtures, SH-SY5Y cell line, cytotoxicity, *in vitro*.

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Risk assessment of acrylamide through popcorn intake

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Abstract

Popcorn is a widely consumed cereal-based snack, with increasing consumption in Spain (MAPA, 2021). However, popcorn is susceptible to the formation of acrylamide (AA), a compound classified as a probable human carcinogen by the International Agency for Research on Cancer (IARC) (IARC, 1994). AA is generated through the Maillard reaction between reducing sugars and amino acids, particularly asparagine, when foods are heated above 120°C (Sebastià et al., 2023). This study aimed to evaluate the dietary exposure of the Spanish population to AA via popcorn consumption. For this purpose, a total of 91 popcorn samples of different tastes (salted, butter and caramel) and cooking methods (ready-to-eat, popcorn maker and microwave) purchased from supermarkets and grocery stores across Spain were analysed for AA content using a previously validated method involving solid-liquid extraction (SLE) and liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS) (Sebastià et al., 2024). The results showed that all popcorn samples contained detectable levels (limit of detection > 17 µg kg⁻¹) of AA, with a content ranging from < LOQ to 627 µg kg⁻¹ and a mean concentration of 277 ± 119 µg kg⁻¹. Estimated AA intake for an adult and child population was 0.013 and 0.029 µg kg⁻¹ day⁻¹, respectively. Risk assessment was conducted using the margin of exposure (MOE) approach, following guidelines from the Joint FAO/WHO Expert Committee on Food Additives (JECFA) (EFSA, 2005). A MOE value below 10,000 (indicates a potential health concern) was obtained for the development of Harderian gland tumors for the child population. These findings highlight the necessity for

stricter monitoring and control measures to reduce AA levels in commercially available popcorn, in line with European Commission recommendations.

Keywords: Acrylamide, risk assessment, popcorn, dietary intake

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Total Fat Content and Lipid Profile from date seeds residue after green liquid-solid extraction of biocompounds

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Abstract

Dates are an economically important crop, but produce significant waste, including seeds. These nutrient-rich by-products offer potential for the reuse of valuable molecules like polyphenols, fiber, fat, and proteins (Chandrasekaran & Bahkali, 2013; Moslemi et al., 2022). As extractants, green solvents are environmentally friendly and safer alternatives that offer numerous advantages such as a lower toxicity, recyclability and biodegradability. Among these green solvents, Natural Deep Eutectic Solvents (NADES) have attracted considerable interest from researchers. Bioactive compounds obtained after the solvent extraction mostly remain in the supernatant fraction but just few studies have analysed the potential biocompounds remaining in the post-extraction residue. The aim of this study is to valorise the use of the date seeds pellet after an extraction with NADES by determining the Total Fat Content (TFC) and obtaining the lipid profile. The pellet of date seeds was obtained after heating-stirring (HS) - NADES extraction under optimal conditions determined by response surface methodology: a 1/3 (w/v) solid-to-liquid ratio, at 45 °C for 45 minutes using date seed powder (DSP). After centrifugation, the supernatant and the pellet were separated. The pellet was washed twice with 5% (v/v) EtOH (washing procedure optimised) to remove any possible solvent. TFC was measured by the Soxhlet method and expressed as g /100 g DSP. The lipid profile was obtained by gas chromatography-Flame Ionisation Detector (GC-FID), showing the relative percentages of 17 fatty acids. Five hydrophobic NADES with different molar ratios were used: Menthol/Eucalyptol (Men:Eu, 1:1), Menthol/Lauric acid (Men:LA, 4:1), Menthol/lactic acid (Men:Lact, 1:2), Caprylic acid/Proline (Oct:Pro, 4:1), Caprylic acid/Lauric acid (Oct:LA, 3:1) with hexane (Hex) as control.

The pellet with the highest amount of TFC was Oct:Pro (6.0 ± 0.8 g /100 g DSP) and the lowest was Men:Lau with 2.5 ± 0.7 g /100 g DSP. Different lipid profiles were obtained depending on the type of NADES. On the one hand, in menthol-based NADES, lauric acid was the predominant acid (78.7-95.6%), whereas in caprylic acid-based NADES and Hex, the predominant acid was oleic acid (42.4-50.2%). Oil is one of the most interesting components of the date seeds containing 5–13% oil, with lauric and oleic acids as the main fatty acids (Mrabet et al., 2020).

Therefore, it may be worthwhile to study the residue from NADES extraction of date seeds to explore the extraction of fat and bioactive compounds present in the fat fraction remaining in the pellet.

Keywords: Green extraction; NADES; fatty acids; date seed; residue

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Inhibitory effect of cell-free supernatants from Lactic Acid Bacteria isolated from table olives against foodborne pathogenic bacteria

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Abstract

The most commonly used methods for preserving commercial table olives are the addition of synthetic preservatives and thermal treatments (Codex Alimentarius, 1981). However, these conventional methods are being replaced by biopreservation strategies as consumers are increasingly aware of environmental sustainability and the consumption of more natural and preservative-free foods (Souza, 2022). Biopreservation uses natural microbiota and/or antimicrobial compounds to prolong shelf life and improve food safety. Some of the essential microorganisms in the fermentation of table olives are lactic acid bacteria (LAB) that generate antimicrobial substances, such as organic acids, capable of inhibiting the growth of food spoilage microorganisms and pathogens of food interest (Bangar, 2022).

The objective of this work is to assess the antimicrobial activity of cell-free supernatants (CFS) produced by LAB isolated from table olives on foodborne pathogenic bacteria.

For this purpose, three strains isolated from table olives, identified as *Lactococcus lactis* ssp. *lactis*, and *Carnobacterium maltaromaticum*, and a control strain with recognised inhibitory activity, *Lactococcus lactis*, were employed. For the production of antimicrobial substances, these isolates were incubated at 37 °C for 72 h. The obtained CFS were filtered and concentrated before evaluating their antimicrobial activity. Moreover, the activity of neutralized CFS with 2M NaOH was also evaluated to check if the inhibitory effect of the supernatants was due to the presence of organic acids. The evaluation of the antimicrobial activity was carried out by the agar well diffusion method against 10 food-borne pathogenic bacteria (*Listeria monocytogenes*, *Salmonella enterica*, *Escherichia coli*, among others). The determination of the organic acids profile of the CFS was conducted by high-performance liquid chromatography (HPLC).

All the evaluated CFS presented antimicrobial activity against the 10 pathogenic bacteria, with greater intensity on *Listeria monocytogenes*. Since the antimicrobial activity of the CFS was lost after neutralization, it can be established that the inhibitory activity may be attributed to the organic acids present in the CFS. The analysis of the organic acids revealed the presence of 6 organic acids in all the CFS, being succinic and acetic acid the major ones. The antimicrobial effect of these organic acids, alone or in combination, against certain microorganisms has been demonstrated in other studies (Ribes, 2019; Rus-Fernández, 2024).

In conclusion, these results suggest that LAB have the potential to be used as natural biopreservatives in the food industry, mainly thanks to the production of organic acids, such as acetic acid, providing a natural alternative to synthetic preservatives.

Keywords: lactic acid bacteria, cell-free supernatant, organic acids, food-borne pathogenic bacteria.

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Analysis of *Neltuma affinis* fruit powders: minerals, heavy metals, polyphenols, and cytotoxicity.

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Abstract

This study analyzed the mineral and heavy metal content, phenolic profile, and impact on CACO-2 cell viability of two *Neltuma affinis* extracts. The extracts were prepared from different parts of the fruit: the exocarp with mesocarp, and the seed with endocarp.

Ethanol extracts were obtained through magnetic stirring. The mineral and heavy metal contents were analyzed using an inductively coupled plasma mass spectrometer (ICP-MS) (de la Fuente, 2021). The phenolic profile was characterized by triple-TOF-LC-MS-MS (Zhou, 2022). The CACO-2 cell viability assay, along with cytotoxicity testing, was conducted using the MTT assay (Taroncher, 2023).

Potassium was found to be the mineral with the highest concentration in both extracts, measuring 6.75 mg/g in the exocarp-mesocarp extract and 6.55 mg/g in the seed-endocarp extract. A high concentration of lead (205 µg/kg) was detected in the exocarp-mesocarp extract. The MTT assay showed that both extracts were able to maintain at least 75% of live cells, indicating a relatively low cytotoxic impact under the experimental conditions. However, the elevated lead content in the exocarp-mesocarp extract raises significant safety concerns.

Keywords: cell viability, minerals, heavy metals, polyphenols

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Species identification and safety evaluation of novel starter cultures isolated from plant material.

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Abstract

The objective of this study was to identify and evaluate safety of novel starter cultures from different plant materials, wheat, oat, and soy. Isolated strains were firstly identified as lactic acid bacteria (LAB) by Gram-positive and catalase-negative phenotypic characterization. Subsequently, the isolates were typed by combining RAPD-PCR profiling and clustered to obtain 12 molecular patterns, and through 16S ribosomal DNA sequencing and phylogenetic analysis, a total of 6 species were identified: *Enterococcus durans* (1), *Enterococcus faecium* (6), *Lactobacillus coryniformis* (1), *Lactobacillus casei* (1), *Pediococcus acidilactici* (1) and *Pediococcus pentosaceus* (2). Among them, *Enterococcus spp.* was found to be the most abundant (70.18%) among the isolates, which may be attributed to its high adaptability to different environmental conditions and its ability to survive over a wide pH and temperature range. Finally, the identified species were evaluated for safety by antibiotic susceptibility test, hemolytic activity test and mucin degradation assay. Safety evaluation revealed that none of the strains exhibited undesirable hemolytic activity or mucin hydrolysis. LAB strains were not resistant to most tested antibiotics except for vancomycin, gentamycin, and streptomycin. Nevertheless, more studies on the characteristics and functional activities of LAB are still needed in the future to establish a foundation for the development of probiotics and their application in food and other related fields.

Keywords: Isolation; Identification; Lactic Acid Bacteria; Safety Evaluation

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The influence of fermentation technology on the functional properties of hemp

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Abstract

Hemp (*Cannabis sativa* L.) is a high-yielding, annual, industrial plant cultivated for its stem fibers and seed oil. The increase in the number of consumers (increase in the popularity of a plant-based diet) of plant-based foods has led to a growing interest in the use of, among others, hemp seeds as a food and feed source.

The aim of the work was to investigate the influence of the fermentation technology on the functional properties of hemp.

Hemp flour, wheat flour and hemp with wheat flour was fermented using a two-phase method. The basic chemical composition of flours and profile of amino acids of flours and sourdoughs were determined. Analysis of volatile compounds using the electronic nose and chemical compounds using electronic tongue of sourdoughs were determined.

Hemp flour was characterised by significantly higher protein, fat, dietary fibre and ash content compared to wheat flour. The fermentation process affected the conversion of the content of individual proteins, compared to their content in the raw materials. Fermentation also influenced a change in the flavour profile.

The use of lactic fermentation makes it possible to obtain a product with the expected sensory and nutritional characteristics.

Keywords: hemp, fermentation, amino acids profile, volatile compounds.

Biopreservation potential of Lactic Acid Bacteria isolated from table olives: A sustainable alternative for the food industry

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Abstract

Consumers increasingly concerned about finding healthy, natural, and sustainable foods, have driven the food industry to seek alternatives to traditional preservation methods, such as the use of additives. In this context, biopreservation has emerged as a promising option (Souza, 2022). This technique is based on extending the shelf life and improving the safety of foods through the use of natural or controlled microbiota and/or the metabolites produced by these microorganisms (Stiles, 1996).

The aim of this study was to evaluate the potential of different strains of lactic acid bacteria (LAB) isolated from table olives to be used as biopreservative agents.

To achieve this objective, 3 strains of LAB isolated from lyophilized Spanish-style fermented olives (MDL1, MDL2, and MDL5) were employed and the antimicrobial activity of the cell-free supernatants (CFS) produced by these isolated strains and by *Lactococcus lactis*, employed as a control strain, was evaluated. Their activity was tested against microorganisms relevant to the food industry, *Escherichia coli*, *Raoultella planticola*, *Bacillus subtilis* and *Listeria innocua*. For collecting the CFS, the LAB strains were incubated anaerobically in MRS broth at 37 °C for 72 h and *L. lactis* under the same conditions but in a microaerophilic environment. Subsequently, the CFS were lyophilized and reconstituted at a 5-fold concentration from the original CFS. Then, to characterize the antimicrobial activity of the CFS, the agar well diffusion method was carried out on: non-neutralized CFS, neutralized CFS, catalase-treated CFS, and neutralized and catalase-treated CFS. Additionally, the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal

Concentration (MBC) for each CFS was determined through microdilution assays, using the 2,5, 5 and 10-fold concentrated CFS from the original one.

The results of this study showed that all CFS exhibited antimicrobial activity against the microorganisms of interest, being MDL2 supernatant the most effective against *E. coli* and the MDL1 supernatant showing strong inhibition against *L. innocua*. The neutralized CFS and the neutralized and catalase-treated CFS did not show inhibition, which suggests that the inhibitory effect of the CFS was due to the organic acids produced by the isolated LAB strains. Lastly, in all cases 2.5-fold concentrated CFS showed inhibitory effect against the tested bacteria in the microdilution assay.

These results suggest that the LAB strains isolated from table olives could be used as natural biopreservative agents in the food industry, providing a sustainable alternative to traditional preservatives.

Keywords: lactic acid bacteria, biopreservative, antimicrobial, cell-free supernatant, table olive.

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Biotechnological properties of Lactic Acid Bacteria isolated from natural resources ingredients for potential use as starter cultures.

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Abstract

Lactic acid bacteria (LAB) are a diverse group of bacteria that play a crucial role in the production of fermented foods and beverages from various by-products, which could be important for human and animal health could have a good economic impact.

This study aimed at isolating, characterizing, and identifying new LAB strains from natural resources and to study their biotechnological properties. Indeed, a total of LAB were isolated on MRS (De Man, Rogosa, and Sharpe) medium. Preliminary tests were carried out to study the potential biotechnological properties including fermentation type, temperature growth, NaCl tolerance, enzyme production (lipase and protease), acidification capacity, exopolysaccharide (EPS) production, and their antifungal activity against *Aspergillus flavus* (EL Boujamaai, 2023).

Results showed that 30% of LAB isolates were thermophilic (45°C), 65% were resistant to NaCl (6.5%). In addition, 75% of LAB isolates were capable of producing EPS. Concerning enzyme production, 80% and 90% of isolates showed lipolytic and proteolytic activities, respectively. Low pH values (3.7-4.0) were obtained after 24h of incubation of LAB strains in MRS broth. The antifungal activity test against *Aspergillus flavus* showed an inhibition rate of up to 57%.

These results suggest that the isolated LAB strains have excellent multifunctional properties and could be used as starter cultures to produce innovative food products (Raman, 2022).

Keywords: Lactic acid bacteria, natural resources, biotechnological properties, biotechnological applications.

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Comparative study of the composition and antifungal activity of *Mentha rotundifolia* essential oil collected in two Moroccan regions

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Abstract

Essential oils (EO), renowned for their chemical diversity and wide range of biological activities, have emerged as promising candidates for the development of new antifungal agents. This study focuses on the (EO) of *Mentha rotundifolia*, a plant traditionally used in Moroccan medicine, yet its scientific potential remains largely underexplored and undervalued. Thus, this work aimed at comparing the chemical composition and the antifungal properties of EO extracted from *M. rotundifolia* collected in two different regions: Marrakech (MRM) and Taounate (MRT). The plant EO was extracted through hydrodistillation and analyzed using gas chromatography-mass spectrometry (GC-MS/MS). The antifungal activity of EO was evaluated against two fungal strains, (*Aspergillus flavus* and *Aspergillus niger*) four yeast species (*Candida tropicalis*, *Rhodotorula spp.*, *Saccharomyces cerevisiae*, and *Geotrichum spp.*) by using the Agar well diffusion method for yeast, and agar incorporation method for molds, and by determining the Minimum Inhibitory Concentration (MIC) and Minimum Fungicidal Concentration (MFC).

Results showed that the major identified EO components included Rotundifolone (27.95% in MRM and 21.90% in MRT), Pulegone (19.11% in MRT), and Chlorcarvacrol (15.75% in MRM). Results demonstrated also that the EO obtained from MRT exhibited stronger antifungal activity compared to the EO of MRM. These findings underscore the potential of EO of *Mentha rotundifolia* as natural antifungal agents and emphasize the influence of geographical variation on their chemical composition and their biological activity.

Keywords: *Mentha rotundifolia*, GC-MS/MS, Bioactive compounds, Climatological effect, Morocco.

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Antimicrobial and Antioxidant Properties of Ethanolic Extracts of Two Marine Algae Collected from the Moroccan Atlantic Coast

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Abstract

Marine algae are a valuable source of bioactive compounds used in various fields such as biomedicine, cosmetics, food, and pharmacology (Araújo & al., 2023). They produce various metabolites, including phenolic compounds responsible for their antimicrobial properties. This study assessed the antimicrobial and antioxidant properties of ethanolic extracts of two marine algae (*Ulva lactuca* and *Sargassum muticum*), collected in the Sidi Bouzid region (El Jadida).

Algae extracts were tested against various pathogenic bacterial strains to determine the Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC), and Minimum Fungicidal Concentration (MFC). The antioxidant activity was assessed using DPPH assay to measure reducing capacity. Results showed that *U. lactuca* demonstrated the best overall inhibitory activity, particularly against *Proteus. inconstans* (0.053 µg/mL), while *S. muticum* extract was more effective against *P. inconstans* (3.12 µg/mL) and *E. coli* (18.75 µg/mL). Regarding the antifungal activity, the ethanolic extract of *U. lactuca* significantly inhibited *Aspergillus flavus* (67.6%), *A. niger* (36.1%), and *Fusarium spp.* (39.6%), while *S. muticum* extract exhibited inhibition rates of 52.8%, 22.2%, and 34.2%, respectively. The antioxidant activity was 60.9% with IC₅₀ 4 µg/mL for *Ulva lactuca* and 53.6% with IC₅₀ 4.5 µg/mL for *Sargassum muticum*.

Due to their antibacterial, antifungal and antioxidant properties, marine algae could be used for the development of new natural ingredients as antibacterial and antifungal agents to be used in the food industry and pharmaceutical applications.

Keywords: Marine algae, phenolic compounds, antimicrobial properties, antioxidant activity, Morocco.

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Use of sea bream by-products in the production of sliced fish products.

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Abstract

Aquaculture has experienced exponential growth in world fishery production, which in turn has led to an increase in discards and by-products derived from fish processing. Even though fish by-products have a high nutritional value that is of great interest for use in human food, they are mainly discarded as waste (Munekata *et al.*, 2020). The objective of this study was to elaborate fish products by introducing a new ingredient obtained from the by-products generated by the sea bream processing industry. For this purpose, bones, meat remaining and fins from sea bream filleting were processed to obtain a fish by-product flour. Two formulations were selected: sliced fish product with the by-product ingredient (BP) and control sample without the by-product flour (C). For sample preparation, all ingredients were added sequentially into a Thermomix and mixed under certain conditions. The samples were then heated in moulds (85°C/30 min and 95°C/30 min), cooled and refrigerated at 4°C until use. Physico-chemical and sensory analyses were performed on the samples. The BP formulation showed a higher protein content than the control sample, which shows that the inclusion of the sea bream by-product flour increased the nutritional value of the product. With respect to texture analysis, the TPA test showed that formulation C had higher values of hardness, cohesiveness, elasticity, chewiness and gumminess, and lower adhesiveness than formulation BP, indicating that the presence of the by-product flour could hinder the correct formation of the emulsion (García-Calabuig, 2012). Sensory analysis of fresh and grilled sliced products was carried out. For both type of samples, grilled preparations obtained higher acceptability scores. The results showed a higher acceptance value of the C formulations, both fresh and grilled. Even so, the grilled BP sample obtained high rates in

the attributes of texture and flavour, and a high percentage of responses in scores 7 and 8 on the overall acceptance. However, the attributes of appearance, color and texture were particularly low in the case of the fresh BP sample. These results demonstrate that fish by-product flour can be considered an interesting new ingredient for obtaining a sliced sea bream product with high protein content and good acceptability, contributing to reducing food waste and reintroducing by-products into the human food chain. The sensory analysis has determined the potential of this product in the market for its consumption cooked on the grill.

Keywords: sea bream, sliced, by-products, sustainability

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Antioxidant potential of orange sweet potato extracts obtained using innovative extraction techniques: *in vitro* and *in vivo* evaluation

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Abstract

The increasing consumption of orange sweet potatoes is mainly attributed to their health benefits, due to their high concentration of antioxidant compounds, mainly polyphenols and carotenoids (Kurabachew, 2015; Neela, et al, 2019). Furthermore, EU Regulation (EC) 1924/2006 sets standards for nutritional and health claims on foods, requiring a sound scientific basis to support these claims. This is based on the FUFOSSE strategy promoted by the European Commission, which establishes the need for experimental scientific evidence on health claims of ingredients or functional foods.

In the present study, the *in vitro* and *in vivo* antioxidant capacity of an aqueous extract of orange sweet potato obtained by pulsed electric field assisted maceration (PEF) and pressurized liquids extraction (ASE) was analysed. First, its total phenolic compound (TPC) content was quantified using the Folin-Ciocalteu method (PEF=218.5 mg GAE/g product and ASE=604.96 mg GAE/g product), and its *in vitro* antioxidant capacity was determined using the ABTS method (PE=1.5 μ mol eq. Trolox/g product and ASE=4.34 μ mol eq. Trolox/g product). On the other hand, studies were carried out to determine the capacity to induce antioxidant response *in vivo* using *Saccharomyces cerevisiae* BY4741 yeast cells in a multiwell plate, following the method described by Peláez-Soto et al., 2017. In this way, the protective capacity of different concentrations of the extract (0.1, 1, 10 and 20 mg GAE/mL) was evaluated by exposing the cells to two different concentrations of H₂O₂ (0.5 and 4 mM) to

cause sublethal oxidative stress. When the concentration of 0.5 mM of H₂O₂ was used, a statistically significant antioxidant protection was observed at an extract concentration of 10 mg GAE/mL with PEF and 20 mg GAE/mL for ASE. When oxidative stress was induced with 4 mM H₂O₂, the maximum protection was observed at the concentration of 20 mg GAE/mL of the PEF extract as well as with the ASE extract.

These results show the antioxidant capacity of orange sweet potato *in vitro* and *in vivo*. The use of the yeast model allowed us to investigate the molecular mechanisms of the response and the possibility of establishing connections with the antioxidant response in humans, which is essential as a first step for its applicability as a functional ingredient in the food industry, in line with EU regulations and the growing demand for healthy and nutritious foods.

Keywords: antioxidants, sweet potato, non-thermal technologies, PEF, ASE.

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Determination of perchlorate in tea samples.

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Abstract

Perchlorate is a ubiquitous inorganic anion that can contaminate food from natural and anthropogenic sources as the use of fertilizers or the degradation of de hypochlorite ion, used for the disinfection of water. This contaminant is related to the inhibition of the thyroid iodine uptake and thyroid hormone production; so, can cause several health issues as chronical hypothyroidism in children (EFSA Panel on Contaminants in Food Chain (CONTAM), 2015). The European Food Safety Authority (EFSA) has published the dietary exposure assessment to perchlorate in food, including teas and infusions (324 µg/kg), spices and condiments (63 µg/kg) and fruits and vegetables (100 µg/kg) (EFSA, 2017). The European Commission has set maximum legal limits of this contaminant in different types of food, including herbs and infusions with a maximum legal limit of 750 µg/kg, which is specified in the Commission Regulation (UE) 2023/915 (European Commission (EC) 2013/915). The aim of this investigation is the development of an accurate and sensitive methodology for the determination of perchlorate in tea samples. This methodology consists in an extraction step using acetonitrile followed by a clean-up step using dispersive solid phase extraction (dSPE) with C₁₈ and graphitized carbon black (GCB) sorbents. The final extract is analysed using liquid chromatography with a HILIC-OH₅ column coupled with tandem mass spectrometer. A validation of the methodology has been developed according to the Analytical Quality Control and Method Validation Procedures for Pesticide Residues Analysis in Food and Feed SANTE 11312/2021 v2 in which linearity, limit of quantification (LOQ), recovery and precision were evaluated using different tea samples. An external calibration curve ranging from 0.5 to 20 ng/mL was prepared with a constant concentration of isotopically labelled perchlorate internal standard of 5 ng/mL. The proposed method provides satisfactory linearity ($R^2 >$

0.99), accuracy ranging from 70 to 136 % and precision (RSD) ranging from 9 to 21 %. A LOQ of 40 µg/kg was achieved, being twenty times lower than the maximum residue level (MRL) for tea. Ten field samples of tea purchased in local markets have been analyzed, showing all of them concentrations lower than the EU MRL. A 40% of the samples analyzed provided detectable concentrations of perchlorate ranging from 76 to 505 µg/kg. Thus, an accurate, precise, sensitive and reliable methodology have been developed for the determination of perchlorate in tea samples.

Keywords: perchlorate, contaminants, tea, UPLC, MS/MS

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Development and validation of an analytical method for the determination of pyrrolizidine and tropane alkaloids in honey

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Abstract

Pyrrolizidine (PAs) and tropane alkaloids (TAs) are toxins produced by specific plant species, including the Boraginaceae, Astraceae and Fabaceae in case of pyrrolizidine alkaloids and Solanaceae in case of tropane alkaloids. The main source of human exposure is the ingestion of plant-derived products such as teas, infusions or honey. Human exposure to 1,2-unsaturated PAs cause liver toxicity resulting in the development of hepatic veno-occlusive disease (Chen and Huo, 2010), furthermore, laboratory experiments reported a potential to induce genotoxicity and carcinogenicity following a chronic oral exposure (Chen et. al. 2010). Many intoxications due to the presence of PAs in food have been reported as the intoxication by flour in Afghanistan in 2008 (Kakar et. al. 2010). Regarding TAs, the consumption of berries of specific plants have caused severe intoxications, including deaths in young children (EFSA Panel on Contaminants in the Food Chain (CONTAM), 2013). Due to the poisonous effects of these pollutants the UE Commission Regulation 2023/915 has established maximum levels of these toxins in a broad range of food, such as cereals, pollen, tea or species (Commission Regulation (UE) 2023/915, 2023). It is necessary to develop and validate sensitive analytical methodologies for the determination of TAs and Pas; so, the aim of this research is the development and validation of multi-analyte methodology for the determination of 28 PAs, including those specified in the Commission Regulation 2023/915, and 2 TAs species, including scopolamine and atropine, in honey samples. The determination of these compounds is commonly carried out by GC-MS previous a derivatization step; however, the proposed methodology is based on a quick, easy, cheap, effective, rugged and safe (QuEChERS) extraction and an extract preconcentration. The determination of the studied alkaloids is carried out by a matrix-matched calibration curve ranging from 5 to 100

µg/kg with its analysis without derivatization by ultra high-performance liquid chromatography - tandem mass spectrometry (UHPLC-MS/MS). The validation of the methodology has been developed according to the criteria established in the Commission Implementing Regulation (UE) 2023/2783 which specifies sampling and analysis procedure. The proposed method provided satisfactory linearity ($R^2 > 0.99$) with residuals ≤ 25 %, precision below 25 %, recoveries between 89 and 127 % and limits of quantification (LOQ) from 5 to 10 µg/kg. A total of 5 honey samples were analysed, showing only one sample PA levels above the LOQ for lasiocarpine-N-oxide and senkirkine of 5.2 and 5.7 µg/kg, respectively.

Keywords: pyrrolizidine alkaloids, tropane alkaloids, plant toxins, honey, UHPLC-MS/MS

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Development of an analytical methodology for the determination of citrinin in foodstuffs

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Abstract

Citrinin is a mycotoxin produced as secondary metabolite by specific types of filamentous fungus as *Aspergillus*, *Penicillium*, and *Monascus* which can infect crops both, during the grow or after harvest. The European Food Safety Authority (EFSA) classifies citrinin mycotoxin as nephrotoxic, hepatotoxic, and fetotoxic. Additionally, the International Agency for Research of Cancer (IARC) has classified citrinin as a Group 3 carcinogen [1]. The primary source of exposure to citrinin is through ingestion of red yeast rice and its supplements. However, numerous studies have also detected citrinin in a wide range of foods, including beans, fruits, vegetables, species, olives, and mouldy cheese [2]. Due to its mutagenic and toxic properties, the European Commission has established a maximum limit for citrinin in food supplements at 100 µg/kg [3]. However, no maximum level has been set for other types of foodstuffs. Given the limited data on citrinin levels in various foods and the lack of an official method for its determination, this research aims to develop a simple, generic, and sensitive methodology for the determination of citrinin across a broad range of foodstuffs. The proposed methodology involves an extraction step using acidified organic solvent, assisted by a QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) extraction kit. Citrinin is determined using internal standard calibration, with concentrations ranging from 0.025 to 10 ng/mL, using ¹³C₁₃-citrinin, as isotopically labelled internal standard at 1 ng/mL. The analysis is performed by ultra-high-performance liquid chromatography coupled with tandem mass spectrometry (UHPLC-MS/MS). Method validation was conducted following the criteria outlined in Commission Implementing Regulation (UE) 2023/2732 of December 14, 2023, which specifies the sampling and analysis procedure. The proposed method

demonstrated satisfactory linearity ($R^2 > 0.99$) with residuals ≤ 20 %, precisions below 20%, recoveries between 76 to 90 %, and limits of detection and quantification of 0.07 and 0.23 $\mu\text{g/kg}$, respectively. Among 44 samples analyzed, including beer, species, dehydrated fruit, olives and cereals, citrinin was detected in 10 samples. These included garam-masala, basil, parsley, nutmeg, brewer's yeast, dehydrated pineapple, apricot and mango, a cocktail of dehydrated fruit, and raisins, with concentrations ranging from 0.234 to 1.325 $\mu\text{g/kg}$.

Keywords: citrinin, mycotoxin, food, mass spectrometry, liquid chromatography

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Quality of innovative non-fermented and fermented plant-based beverages produced from oat and buckwheat grains

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Abstract

The aim of the study was to assess selected quality parameters of innovative plant-based beverages, non-fermented and fermented, produced according to own recipes with the use of naked oat grain and unroasted buckwheat groats (Biel et al., 2009; Christa & Soral Śmietana, 2008; Peyer et al., 2016; Mehany et al., 2023). The quality of the obtained plant-based beverages was compared with the quality of available equivalents from retail trade. The research material consisted of 28 variants of plant-based beverages produced in laboratory conditions, with various additions of naked oat grain of the "Nagus" variety (8–12%) and unroasted buckwheat groats, Bio Planet brand (10–12%). Apart from the basic raw material and the level of its addition, the beverages were differentiated by the temperature of the added water (room temperature and 30°C) and the use or not of a half-hour extraction process. Selected beverages were inoculated with an active culture of *Lactobacillus plantarum* in a liquid medium or with a yogurt starter (*Streptococcus thermophilus* + *Lactobacillus delbrueckii ssp. Bulgaricus*) prepared from an industrial vaccine. They were then incubated for 24 hours at 37°C. The reference samples were commercially available beverages with the addition of 16% of oat grain from Eco Mil brand and 12.5% of buckwheat groats from Natumi brand. They were determined the dry mass, density, viscosity, and color of all beverages. In selected beverage variants, the content of total phenolic compounds and antioxidant activity were determined, and microbiological analysis was performed for them.

It was found that regardless of the type of cereal raw material used and the level of its addition, the density of all tested beverages was similar. With the increase in the base raw material addition, the viscosity of the beverages increased. The highest antioxidant activity was characteristic of buckwheat beverages (both self-prepared and commercially produced), while the most similar in color to their commercial counterpart were oat beverages. Due to the high content of lactic acid bacteria in the finished cereal beverage, it can be a beneficial alternative to dairy counterparts. Cereal-based milk analogs can be a good carrier of both bioactive ingredients and probiotics. Currently, probiotics are most often found in dairy products, but fermented foods of plant origin can also have high sensory and nutritional value (Peyer et al., 2016).

Among the non-fermented beverages, the buckwheat beverage (10% addition of the base raw material), which was produced using water at a temperature of 30 °C and an extraction process, exhibited the best quality. Among the fermented beverages, the highest-rated was the oat beverage (8% addition of the base raw material), inoculated with yogurt starter.

Keywords: innovative milk analogs, naked oat grain, unroasted buckwheat groats, non-fermented and fermented beverages, quality

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The use of an innovative electrical method to assess selected physicochemical and health-promoting parameters of varietal honeys

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Abstract

Scientists are looking for fast, cheap, and environmentally friendly electrical methods as an alternative to reference methods of honey quality control (Yakubu et al. 2021; Oroian et al. 2023).

The aim of the study was to determine the possibility of using an innovative electrical method and the suitability of conductivity and dielectric parameters for assessing selected quality parameters of varietal honeys.

The experimental material consisted of 7 varieties of honey (linden, rapeseed, buckwheat, goldenrod, phacelia, multifloral, acacia), obtained from beekeepers from northern Poland. The quality of honey was assessed based on physicochemical and health-promoting parameters, i.e. the content of: water, reducing sugars, 5-HMF, diastase number, ability to capture free radicals DPPH, total number of free radicals TP; and acidity and color. Electrical measurements were performed using: LCR meter E4980a, own design of the measuring sensor and the substitute RCC model of food products. Conductivity parameters (Z , G) and dielectric parameters (C_s , C_p) were measured at the frequency of: 100Hz - 1 MHz. The suitability of electrical parameters for quality control of the honeys tested was determined using the statistical methods of Ward and Profit.

Analysis of the degree of similarity of changes in the examined physicochemical parameters of honeys distinguished Cluster 1 and Cluster 2. Profit analysis showed that conductivity

parameters (Z, G) correlate the most with water content in buckwheat and lime honeys and with the color parameter L^* in rapeseed and phacelia honeys. In the case of dielectric parameters, significant relationships were obtained between acidity and water content of goldenrod honey and the CS_{100kHz} , CS_{1kHz} and CS_{10kHz} parameters, as well as between color parameters (L^* , b^*) of lime and phacelia honeys and Cp_{1kHz} and $Cp_{100 kHz}$. Interpretation of the perception map of cluster 2 parameters indicated the strongest correlation between impedance with reducing sugars and sucrose for: rapeseed, phacelia, and acacia honeys. The preference for using conductivity parameters for honey evaluation was also confirmed by Talapessy et al. (2023). Diastase number, TP, AADPPH and 5-HMF of buckwheat and lime honeys correlated most strongly with conductivity (G). In the case of dielectric parameters, a strong correlation with respect to the quality and health-promoting features of all honey species (except buckwheat and goldenrod) was observed only for Cp_{1kHz} and Cp_{100Hz} .

The statistical analysis performed showed the possibility of using an innovative electrical method to assess the quality parameters of selected honey varieties. The most useful parameters were conductivity parameters (Z and G, in the entire frequency range), and to a slightly lesser extent dielectric parameters (Cp, Cs). Their usefulness was observed in relation to the assessment of quality and health-promoting parameters, i.e.: acidity, water content, color (cluster 1) and reducing sugars, sucrose, diastase number, TP, AADPPH and 5-HMF (cluster 2) for the following honeys: buckwheat and lime, rapeseed, phacelia and acacia.

Keywords: honey quality attributes, conductivity and dielectric parameters, correlation

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P-33

Assessment of the resistance of *Listeria monocytogenes* to acid stress conditions and estimation of sublethal damage

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Abstract

Acidification is widely employed to extend the shelf life and guarantee safety of foodstuffs (Gahan, O'Driscoll, & Hill, 1996). However, it has been proven that some bacteria can develop the ability to adapt to mildly acidic conditions and subsequently become resistant to extreme acidic conditions (Dhowlaghar et al., 2019). *Listeria monocytogenes* is a foodborne pathogen associated with listeriosis, considered one of the most serious and severe foodborne diseases. Acid stress adaptation of *L. monocytogenes* has been previously demonstrated (Dhowlaghar et al., 2019) and different theories have been proposed for the underlying mechanisms (Wu et al., 2021).

The objective of the present study was to evaluate the resistance of different *L. monocytogenes* strains to acidic conditions and to estimate its sublethal damage. For this purpose, a total of 7 strains of *L. monocytogenes* were used in this study. *Listeria* inocula were prepared in 1 mL of BHI with one colony stock cultures and incubated (37 °C, 6 h) . Early log-phase cultures were prepared by transferring 100 µL overnight culture into 1 mL BHI and incubated (37 °C, 18 h). Then, 100 µL of the culture was transferred into 900 µL 0.85% saline solution previously acidified with 2.5 M HCl or lactic acid 1 M to achieve a pH of 2, 2.5 and 3 (sublethal acidic conditions). Tubes were incubated at 22 °C for 1 and 24h. Finally, bacterial counts were determined by plating appropriate dilutions on TSA. All the assays were performed in triplicate.

The results indicate significant differences depending on the strain tested, exposure time and the acid employed for broth acidification. Strains stressed in lactic acid yielded higher counts and, therefore, less reductions in comparison with the control than strains stressed in HCl. Also, pHs as low as 2 and incubation times of 24 h achieved the most reductions (between 3-4 log) in all strains tested. Strains isolated from different environments showed clear acid stress adaptation patterns as they presented the highest survival rates.

The results obtained in the present study have shown the survival acidic conditions for different *L. monocytogenes* strains. This evaluation provides useful information to define sublethal stress treatments in the validation and verification of reference methods for *L. monocytogenes* analyses, in which these conditions are considered. Therefore, this information could be considered to improve the current methodologies, give more accurate data and avoid false negative results.

Keywords: *Listeria monocytogenes*, low pH, acid, food matrix, detection

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P-34

Evaluation of the Antioxidant Potential of Phenolic Extracts from Olive Mill Wastewater (OMW) Provided by Abandoned Ponds

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Abstract

The industrial production of olive oil generates significant quantities of olive mill wastewater (OMW), also known as alpechín, which is rich in phenolic compounds. The aim of this study was to optimize the conventional extraction methods of phenolic fractions from alpechín, characterize the total phenolic content (TPC), and evaluate their antioxidant potential using the TEAC assay. Eight OMW samples and five alpechín sludge samples from abandoned ponds in the Mediterranean and southern Spain were analyzed. After defatting with hexane and drying, the total phenolic content and antioxidant activity of the extracts were determined spectrophotometrically. Samples from Cordoba, Tarragona, Alicante, and Toledo (codes TED-4, TED-15, TED-14, TED-16) displayed high TPC levels, ranging from 7.2 to 18.9 g GAE/kg, and antioxidant capacity equivalent to 10-60 micromoles of Trolox/g, surpassing other samples. Factors such as matrix condition, seasonality, pond abandonment, and environmental conditions influenced polyphenol content. Additionally, variables like pH, temperature, extraction method, and solvent type impacted phenolic recovery. This research highlights the potential of alpechín as a valuable source of bioactive compounds for the food and agricultural industries.

Keywords: Olive mill wastewater, Ponds, Extraction, Phenolic compounds, Antioxidant

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Heavy metal content of infant formulas in relation to specified standards

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Abstract

Heavy metals are a group of metals and semi-metals which are characterized by high density and often toxic properties. Among them, in addition to superfluous heavy metals, there are trace elements and micronutrients, which in moderate amounts are necessary for the proper functioning of the human body, and may cause toxicity only after exceeding a certain level (Angon et al., 2024). This study aimed to evaluate the content of selected heavy metals in infant formula available in Poland. The determined values were compared to those declared by the manufacturer on the label and compared to the requirements of the European Commission. The study material consisted of fourteen infant formulas, including eight conventional formulas for first- (C-A1, C-B1, C-C1, C-D1) and follow-on feeding (C-A2, C-B2, C-C2, C-D2) infant feeding, as well as six specialist formulas (S1, S2, S3, S4, S5, S6) for feeding infants with special dietary needs. The content of the metals: iron (Fe), zinc (Zn), copper (Cu), and manganese (Mn) was determined according to the method described by Whiteside and Miner (1984) using atomic absorption spectroscopy (AAS). Of the formulations tested, more than 20% variations in the determined Fe content were noted among nine of them, compared to the value declared on the labels. One conventional infant formula contained 40% higher Mn content relative to the manufacturer's stated value. Two types of specialist infant formulas showed excessive deviations in Cu content; the labelled values were about 30 and 75% higher than those declared on the labels. The S5 formula had 40% higher Cu content than the upper range of Cu content specified by the European Commission. Infant food should be subjected to periodic checks for heavy metal content. Excess metals ingested with food must be excreted from the body, which is difficult in infants due to the immaturity of the digestive system and kidneys (Carroquino et al., 2012).

Keywords: heavy metals, food for infants, infant formulas safety

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Validation of an Aflatoxins Detection Method in Plant-Based Meat Alternatives (PBMA) Using UHPLC-QTRAP-MS/MS and UHPLC-TOF-MS"

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Abstract

The global increase in plant-based meat alternatives (PBMA) as sustainable protein sources has garnered attention due to their environmental and health benefits (Ahmad *et al.*, 2022). However, concerns arise regarding mycotoxin contamination, especially aflatoxins, in these products, derived from plant ingredients susceptible to fungal contamination. This study aimed to develop and validate a method for the detection and quantification of aflatoxins (AFB1, AFB2, AFG1 and AFG2) in PBMA using two techniques: ultra-high-performance liquid chromatography coupled with Time-of-Flight mass spectrometry (UHPLC-TOF-MS) for semi-quantitative screening and ultra-high-performance liquid chromatography coupled with QTRAP tandem mass spectrometry (UHPLC-QTRAP-MS/MS) for confirmation. Three extraction methods for mycotoxins were tested on the PBMA matrices: (1) C18 d-SPE, (2) Z-sep, and (3) a combination of Z-sep and C18. The method was validated according to Commission Implementing Regulation (EU) 2023/2782, assessing parameters such as linearity, repeatability, reproducibility, recovery, limits of detection (LOD), and limits of quantification (LOQ). Additionally, twelve PBMA samples from Spain and Portugal were analyzed. The extraction method 3 was selected for its superior performance in terms of apparent recovery and signal/noise ratio. The validated method demonstrated high sensitivity, precision, and recovery across a range of mycotoxins, meeting EU regulatory criteria. LOD and LOQ values for aflatoxins were below established limits. Application to real

samples revealed aflatoxin contamination in PBMAAs, with AFB1 ($4.60 \text{ ng}\cdot\text{g}^{-1}$) exceeding regulatory threshold set for AFB1 in cereal-based products (Regulation (EU) 2023/915). Co-occurrence of multiple mycotoxins (AFB1+AFB2+AFG1) was also observed, posing additional health risks. The validated method offers a reliable tool for monitoring, ensuring the safety of the products. This study highlights the need for specific mycotoxin regulations in PBMAAs, given the growing market and potential health risks of mycotoxins present in these matrices.

Keywords: plant-based meat alternatives, mycotoxins, method validation, UHPLC-TOF-MS, UHPLC-QTRAP-MS/MS

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Assessment of cytotoxicity and ROS production in CACO-2 cells from edible mushroom extracts obtained by pulsed electric fields (PEF)

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Abstract

Mushrooms have been considered a food with great therapeutic potential for hundreds of years due to their content of high-quality proteins, beta-glucans and antioxidant compounds. For this reason, electroporation generated by pulsed electric fields (PEF) extraction technology would allow greater recovery of the compounds and, in addition, contribute to the fulfillment of the Sustainable Development Goals (SDGs). In this sense, the aim of the present study is to evaluate the cytotoxicity and radical oxygen species (ROS) production of extracts from *Lentinula edodes* and *Pleurotus ostreatus* obtained by PEF. For this purpose, 40 g of fresh mushrooms were treated with PEF under optimal conditions (50 kJ/kg, 2.5 kV/cm) and shaken for 6 hours at room temperature. Conventional extraction was carried out by aqueous maceration for 6h at 20 °C. The extracts were then freeze-dried and the cell viability of human colorectal adenocarcinoma cells (CACO-2) and ROS production were examined after 2h and 24h at concentrations ranging from 62 to 1000 µg/mL. The results showed a decrease in cell viability of more than 75% for both mushrooms, with the highest concentrations showing high cytotoxicity. On the other hand, depending on the concentration, an increase in early ROS production was observed after 2 hours, with an increase of up to 218% at 1000 µg/mL. According to the observed results, the decrease in tumor cell viability could be due to the content of bioactive compounds at the highest concentrations, which may cause oxidative damage to the cells. However, further research is needed to understand the mechanisms by which the observed cytotoxicity occurs.

Keywords: cytotoxicity; *Pleurotus ostreatus*; *Lentinula edodes*; pulsed electric fields; bioactive compounds

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P-38

Vitamin D as a key factor in the health of women during climacteric age

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Abstract

Vitamin D, primarily obtained through sun exposure and diet, is essential for bone, muscle, and immune health. Menopause (cessation of menstruation) and the climacteric period (the hormonal transition before and after menopause) can cause various symptoms such as cardiovascular issues, bone problems, and insomnia, some of which are well-studied and related to vitamin D deficiency. This paper reviews vitamin D deficiency in women during menopause and the climacteric period, examining vitamin D levels, its possible relationship with less- studied symptoms, available treatments, and the impact of diet and knowledge about vitamin D in this population group. A literature search was conducted in the PubMed, Web of Science, and Scopus databases, and a survey was conducted among 116 women of climacteric-menopausal age. The results obtained show a high prevalence (80-90%) of vitamin D insufficiency and/or deficiency in women during the climacteric-menopausal period in the studied countries. No conclusive results were obtained regarding the relationship between symptoms such as hot flashes, vulvovaginal atrophy, urinary incontinence, breast cancer, polycystic ovary syndrome, and vitamin D deficiency. The most effective pharmacological treatment for vitamin D deficiency is calcifediol. A benefit has been observed from daily supplementation compared to monthly. Diet can meet the recommended daily needs for vitamin D, although small modifications can cause significant variations in its intake. 89% of the surveyed women have a vitamin D deficiency, in line with the literature. These women are aware of pharmacological treatments but are unaware of vitamin D-rich foods they can include in their diet to increase their intake.

Keywords: Menopause, climacteric, vitamin D, 25(OH)D, deficiency, women.

P-39

Antimicrobial activity of graphene oxide (GO) against *Escherichia coli* and *Listeria monocytogenes*

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Abstract

Foodborne diseases are a significant public health concern, highlighting the urgent need to reduce zoonotic agents' impact. The development of antibacterial nanomaterials offers a promising approach to enhancing food safety and minimizing additive use in industry. Among these, graphene oxide (GO) stands out for its antimicrobial properties, ideal for food sector applications (Hu, 2010; Lukowiak, 2016; Smith, 2019; Rossa, 2022). However, its antimicrobial effects have not yet been fully characterized, requiring further investigation. The aim of this research was to evaluate the antimicrobial capacity of GO against a Gram-positive and Gram-negative microorganism under various incubation conditions.

To conduct the research, inactivation treatments with GO were conducted in two culture media against *Listeria monocytogenes* and *Escherichia coli*. In Ringer's solution (RS), the antimicrobial effect of GO was determined at concentrations of 250, 450, and 650 µg/mL over exposure times of 0.17, 3, 6, 9, and 24 hours under orbital shaking at 37 °C. The other culture medium tested was Tryptic Soy Broth (TSB), where the antimicrobial effect of GO was evaluated in different growth phases of the two bacteria, in the exponential and stationary phases. The concentration of GO tested was 3000 µg/mL, with exposure times of 0.17, 3, 6, 18, 21, and 24 hours under orbital shaking at 37 °C.

The results showed that, in RS, a nutrient-poor medium, the bactericidal effect of GO increased with higher concentrations and longer exposure times for both microorganisms. These results are consistent with those obtained by Gurunathan (2012) in the treatment of *Pseudomonas aeruginosa*. Additionally, GO showed greater inactivation in *E. coli* than in *L. monocytogenes*, with a difference of up to 0.7 Log CFU/mL. However, Krishnamoorthy

(2012) demonstrated greater antimicrobial activity against Gram-positive bacteria. In TSB, a highly nutritious medium, no inactivation effect of GO was observed, as both microorganisms showed an increase in their counts over the incubation period. It is worth noting that GO exhibited a bacteriostatic effect in the exponential phase of *L. monocytogenes*.

In conclusion, GO exhibits a concentration and time-dependent bactericidal effect in RS, with a slightly stronger effect on *E. coli*. In TSB, it does not show an inactivation effect, allowing the growth of both microorganisms, but it does exhibit a bacteriostatic effect during the exponential phase of *L. monocytogenes*. All the results obtained suggest that GO could be a promising alternative in the food industry to help ensure food hygiene and safety.

Keywords: Graphene oxide, *Listeria monocytogenes*, *Escherichia coli*, antimicrobial activity, growth phase.

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***In vitro* gastrointestinal digestion for bioaccessibility study of alternative plasticizers present in edible insects (*Acheta domesticus* and *Tenebrio molitor*).**

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Abstract

Phthalates are widely used as plasticizers in different plastic products and are known endocrine disruptors. These chemicals are added to make flexible, soft and to extend lifetime of plastics. Despite their widespread use, most phthalates, such as di-2-ethylhexyl phthalate (DEHP), have been classified as carcinogenic, mutagenic or toxic for reproduction (ECHA, 2006). During the past decade, alternative plasticizers (APs), including tris-(2-ethylhexyl) trimellitate (TOTM) and di-(2-ethylhexyl) adipate (DEHA) have been used as substitutes for DEHP (Cao et al., 2016). Animal and human exposure to phthalates is ubiquitous and occurs from various environmental sources, including dust, household products and food contact materials (Cao et al., 2016).

In recent years, edible insects have been increasingly considered as alternative and sustainable food and are currently used in both food and feed products. Dried *Tenebrio molitor* larvae were mentioned in 2021 as new foods (Execution Regulation (EU) 2021/882 of the European Commission) and both *Acheta domesticus* and *Tenebrio molitor* larvae were authorized for commercialization in frozen, dried, and powdered forms through Regulations 2021/1975, 2022/169, and 2022/188 of the European Commission.

In the current risk assessment approaches, bioavailability from a specific product is considered to be equal to bioavailability found in toxicity studies ingested via liquids or food matrices. However, to become bioavailable, contaminants must be released from the product during the digestion process (i.e. become bioaccessible), yet, often in consumer products they are less bioaccessible depending on the chemical status (solid, liquid, gas).

The aim of this study was to assess the gastrointestinal bioaccessibility of alternative plasticizers

present in two edible insects species (*Acheta domesticus* and *Tenebrio molitor*) using INFOGEST, as *in vitro* digestion model (Brodkorb et al., 2019).

A total of nine alternative plasticizers, following the analysis protocol describe by Poma et al (2019), were targeted the insects, including acetyl triethyl citrate (ATEC), diisobutyl adipate (DIBA), cresyl diphenyl phosphate (CDPHP), acetyl tributyl citrate (ATBC), dibutyl sebacate (DBS), di-2-ethylhexyl adipate (DEHA), butyryl trihexyl citrate (BTHC), tri-n-hexyl trimellitate (THTM) and tris(2-ethylhexyl) trimellitate (TOTM). Analysis was performed by using an Agilent 1200 Infinity liquid chromatography system coupled to an Agilent 6410 Triple Quadrupole mass spectrometer (Christia et al. 2019).

Results showed that ATEC and ATBC were detected in both edible insect species samples. Bioaccessibility was 21% and 5% for *Tenebrio molitor* larvae; and 20% and 21% for *Acheta domesticus* for ATEC and ATBC, respectively.

Similar to previous studies, it has been observed that assessing the chemical safety of edible insects focusing solely on the transfer of pollutants from the substrate during the rearing phase can be limited, since post-harvesting contamination is also likely to occur (Poma et al., 2019). Furthermore, this study highlights the importance of assessing the digestion process that can contribute to establish the risk assessment to contaminants.

Keywords: phthalates, plasticizers, edible insects, bioaccessibility, *in vitro*.

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Health impacts of heavy metal exposure on children in the Colombian Caribbean region

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Abstract

Heavy metals, such as cadmium, lead, and mercury are environmental contaminants with adverse effects on health, particularly impacting neurodevelopment and hematology in children. This study aimed to evaluate biomarkers of exposure (Cadmium-Cd, Lead-Pb, Mercury-Hg, and Selenium-Se) in children from Mojana Bolivarenses, Colombia, and assess their relationships with biochemical and hematological profiles. Hair and blood samples from 333 children aged 6-12 years from the municipalities of Achi, Magangué, and Arjona were analyzed. Metal concentrations were measured using the Milestone DMA 80 and atomic absorption techniques per US EPA methods. Enzymatic neurotoxicity markers (Acetylcholinesterase-AChE, Monoamine oxidase A (MAO-A), Serotonin) were analyzed with commercial kits, and hematological profiles were obtained through automated hemograms. Notably, T-Hg levels in hair followed the order Achi (0.97 µg/g) > Magangué (0.74 µg/g) > Arjona (0.23 µg/g), with 35% and 44.4% of children in Magangué and Achi surpassing WHO safety guidelines. The hair-to-blood Hg ratio averaged 402 (IQR 240-712), significantly exceeding the 250:1 WHO benchmark, indicating elevated exposure. Pb levels in hair were highest in Magangué (1.85 µg/g), with Cd and Se concentrations showing similar trends across sites. Neurotoxicity markers revealed regional variations, with Spearman's analysis showing a negative correlation between Pb concentrations and blood serotonin levels. Cd levels in hair also correlated negatively with MAO-A, while Se levels positively correlated with serotonin and MAO-A. Multivariate analysis revealed associations between metal levels (Hg, Cd, Pb) and hematological parameters (HGB, MCH, MCHC, LYM%, WBC, MCV, RDW, and

GRA), suggesting that chronic exposure to metals may compromise immune and neurodevelopmental health, particularly in children. The metal concentrations observed in hair samples reflect prolonged exposure, supporting hair as a valuable matrix for linking metabolic products to potential health effects. Given children's critical developmental stages, exposure to metals poses a serious public health concern, underscoring the need for continued studies of this type in pediatric populations.

Keywords: Children's Health, Toxic Metals, Neurotoxicity, Public Health, Biomarkers.

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Transdermal delivery of cyanocobalamin via dissolving microneedles as a novel approach to mitigate skin inflammation

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Abstract

Skin inflammatory diseases are highly prevalent globally and significantly impair patient quality of life. Standard first-line therapies, while effective, pose risks of severe side effects with long-term use, especially in chronic cases. This underscores the need for novel therapeutic approaches to provide safe and effective alternatives. Elevated reactive oxygen species (ROS) levels are a hallmark of these conditions, making ROS modulation a strategic therapeutic target. Cyanocobalamin (Vitamin B12), with its antioxidant and ROS-scavenging properties, emerges as a potential alternative treatment (van de Lagemaat, 2019). However, its large molecular size limits passive skin absorption, necessitating an advanced transdermal delivery system (Guillot, 2023).

Here, we introduce several prototypes of Cyanocobalamin-loaded Dissolving Microarray Patches (B12@DMAPs) designed with sufficient mechanical strength to penetrate the stratum corneum, enabling effective drug delivery into the skin.

Ex vivo penetration and permeability was assessed by a Franz-diffusion model set-up using excised mice skin. Biocompatibility of B12@DMAPs was studied in representative skin lines such as fibroblasts and keratinocytes measuring their metabolic activity. Finally, B12@DMAPs were challenged in a delayed-type hypersensitivity model.

Ex vivo penetration and permeability studies confirm the presence of the drug within dermal layers, while in vitro compatibility tests in L929 fibroblasts and HaCaT keratinocytes demonstrate safety. In vivo efficacy testing in a delayed-type hypersensitivity murine model, simulating an inflammatory skin condition, shows promising results, namely, reduced MPO-related photon emission in bioluminescence studies, protection against histological damage, and lowered inflammatory cytokine levels, collectively supporting B12@DMAPs' potential to attenuate skin inflammation.

These findings suggest that B12@DMAPs could serve as a cost-effective, translatable alternative to enhance skin health care for affected patients.

Keywords: Cyanocobalamin, Vitamin B12, Dissolving Microneedles, Skin Inflammation

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Cytoprotective effects of essential oils from *Cymbopogon flexuosus* and *Tagetes lucida* against H₂O₂-Induced oxidative stress in HepG2 cells

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Abstract

Cymbopogon flexuosus (lemongrass) and *Tagetes lucida* (winter tarragon) are aromatic plants widely recognized in traditional medicine for their health-promoting properties. Lemongrass is well-known for its antioxidant (Bhatnagar, 2020) and antimicrobial activities (Adukwu et al., 2016), while *T. lucida* has been valued for its anti-inflammatory effects (Porrás-Davila et al., 2021). Both plants are rich in bioactive compounds, making them promising candidates for natural therapeutic applications. This study aimed to evaluate the protective effects of essential oils (EOs) from these plants in a model of oxidative damage induced by H₂O₂ in HepG2 cell lines. Cells were treated with each EO for 24 hours, followed by exposure to 200 µM H₂O₂ for up to 120 minutes. Intracellular reactive oxygen species (ROS) production was measured using the H₂-DCFDA probe. The solar protection factor (SPF), critical wavelength (λ_c), and total phenolic content of *C. flexuosus* and *T. lucida* EOs were determined through spectrophotometry, and cell viability was assessed with the MTT assay. EO composition was analyzed by GC/MS, revealing that *C. flexuosus* (IC₅₀=74.5 µg/mL) was more cytotoxic than *T. lucida* (IC₅₀>250 µg/mL). Both EOs displayed some proliferative activity at low concentrations, though this effect was not concentration-dependent. The protective effect of the EOs on HepG2 cells exposed to H₂O₂-induced ROS at a concentration of 15.6 µg/mL for 24 hours demonstrated ROS inhibition of 15.6% and 35.4% in cells pretreated with *C. flexuosus* and *T. lucida* EOs, respectively, after 120 minutes. SPF values were similar for both EOs, and λ_c measurements indicated photoprotective activity against

long-wavelength UVA (>370 nm). Although *T. lucida* exhibited a higher total phenolic content than *C. flexuosus*, both were within the same order of magnitude. The chemical compositions of the EOs were distinct, with *C. flexuosus* containing neral (28.2%), geranial (28.2%), and geranyl acetate (10.0%) as major components, while *T. lucida* primarily contained estragole (95.7%), known for its antioxidant properties that may counteract H₂O₂ effects. Overall, these findings suggest that *C. flexuosus* and *T. lucida* EOs hold promise as natural ingredients in sunscreen formulations, exhibiting protective effects against H₂O₂-induced oxidative stress in HepG2 cells without significantly increasing intracellular ROS levels. These results highlight the potential of these oils for the development of effective, natural sunscreen products.

Keywords: ROS, Bioactive compounds, Traditional medicine, Cytoprotection, Essential oils.

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Transformation of agricultural surpluses into healthy and sustainable food: A circular economy experience

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Abstract

Transform agricultural surpluses into healthy and sustainable foods, starting from a proof of concept to reach a level of development equivalent to TRL 4.

The first stage of the project included the standardization of the sanitation process with sustainable disinfectants available on the market, starting with microbiological analyses of raw materials (celery leaves and stems, broccoli leaves and stems, and beet leaves) prior to the disinfection of these raw materials to determine the presence of *Escherichia coli*, *Salmonella spp.*, *Listeria monocytogenes*, and *Staphylococcus aureus*. Four experimental formulations of the salted Concentrated Green Food Prototype (PACV) were developed from surplus broccoli, celery and beetroot at different concentrations. The results of bacterial growth kinetics showed that the BioFruit disinfectant at different incubation times at 2 and 3 minutes, observing that at concentrations between 500 and 200 ppm, a high germicidal power was achieved in the raw material, making Biofruit an alternative as a sustainable disinfectant. The development involved the elimination of ingredients other than broccoli, celery and beetroot, and the adaptation of the formula to the availability of raw materials

from food valorisation, in order to guarantee its replicability at any time of the year. The final formulation (n°4) only uses broccoli leaves and stems, celery leaves and stems and beetroot leaves. Formulation No. 4 was sanitized with Biofruit and high hydrostatic pressures were applied at 6,000 bar for 180 seconds.

The proximate composition showed a value of 12 kcal per 100 grams of food; the fiber content was 2.7 g/100 g, which can be labeled with a healthy message of “good source of fiber”. The carbohydrate content was 0.8 g/100 g. The sodium content was 109 mg/100 g. The values of vitamins and minerals were: Vitamin A: 102.09 ($\mu\text{g}/100\text{ g}$); Vitamin C 5.42 (mg/kg), Vitamin E: 0.28 (mg/100 g); Vitamin B9: 18.38 (mg/kg); Magnesium: 228.8 (mg/kg); Potassium: 2769.5 (mg/kg). Regarding antioxidant capacity, the value of total polyphenols: 42.9 ± 1.7 (mg EAG 100 g⁻¹ mta); ORAC: 1004.9 ± 82.3 ($\mu\text{mol ET 100 g}^{-1}$ mta). After 21 days of refrigerated storage, they did not show the presence of pathogens of interest such as: *Escherichia coli*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Salmonella enterica*.

This research proposes new ways of consuming vegetables from agro-food waste. However, it is important to recognize the multiple challenges for the effective valorization of vegetable waste.

Keywords: Agro-food surpluses, valorization, circular economy, sustainability

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