6TH INTERNATIONAL CONFERENCE ON FOOD CONTAMINANTS: CHALLENGES ON EMERGING CONTAMINANTS AND PLANETARY HEALTH

ICFC 2025
International Conference on Food Contaminants
Challenges in Emerging Contaminants and Planetary Health

BOOK OF ABSTRACTS

25-26th September 2025
Funchal, Madeira, Portugal

ICFC 2025

International Conference on Food Contaminants

Challenges in Emerging Contaminants and Planetary Health

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Challenges in Emerging Contaminants and Planetary Health

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Acknowledgments

The Organizing Committee sincerely thanks everyone whose contributions and support made this event possible.

This event succeeds other events held in Lisbon (ICFCF2015), Braga (ICFC2017), Aveiro (ICFC2019), Lisbon online (ICFC2021) and Campinas, Brazil (ICFC2023) under the seal of the National Institute of Health Doctor Ricardo Jorge (INSA).

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Dear Participants,

On behalf of the National Institute of Health Doctor Ricardo Jorge (INSA), we are honored and delighted to welcome you to the 6th International Conference on Food Contaminants (ICFC2025): "Challenges on Emerging Contaminants and Planetary Health," to be held in person from 25–26 September 2025 at the Museu de Eletricidade – Casa da Luz Auditorium in the beautiful city of Funchal, Madeira, Portugal.

The 2025 edition will focus on the growing challenge of emerging contaminants (ECs) in food and the environment, emphasising how their spread through the food chain threatens food safety and public health. Discussions will explore policies to reduce food-contaminant exposure, examine the health impacts of chemical and biological contaminants—including occurrence, exposure assessment, and biomonitoring—highlight advances in analytical methods for detecting emerging contaminants, and consider the full spectrum of their toxicity. These interconnected themes will frame a comprehensive dialogue on safeguarding both human health and the wider ecosystem.

This multidisciplinary meeting will provide a vibrant forum for established experts and early-career researchers to exchange the latest knowledge on food contaminants and their impacts on human and planetary health. The program features keynote lectures by world-renowned scholars, oral and poster presentations, and two round-table discussions.

We look forward to welcoming you to Madeira for this important exchange of ideas and discoveries.

Sincerely,
Fernando de Almeida
Chairman of the Executive Board of the National Institute of Health Doctor Ricardo Jorge, I.P.
ICFC2023 Honorary President

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On behalf of the Organizing Committee, we would like to welcome all of you to the 6th International Food Contaminants Conference (ICFC2025) and thank you for joining us in Funchal, Madeira, Portugal.

The organization of ICFC2025 is the result of a joint effort between researchers from the National Institute of Health Doctor Ricardo Jorge (INSA) in Lisbon and the Centre for Environmental and Marine Studies (CESAM) at the University of Aveiro, in close collaboration with the Madeira Regional Secretariat of Health and Civil Protection (SRS), the Regional Secretariat for Agriculture and Fisheries (SRAP), and the Association of Senior Diagnostic and Therapeutic Technicians of the Autonomous Region of Madeira (TSDTRAM).

This two-day conference serves as an international forum bringing together researchers from across continents to share and discuss their findings in the broad, interdisciplinary field of food contaminants, under the theme "Challenges on Emerging Contaminants and Planetary Health.

Following the rationality on the impact of food contaminants on human health of ICFC conferences (ICFC2015 http://hdl.handle.net/10400.18/3214, ICFC2017 http://hdl.handle.net/10400.18/4882, ICFC2019 http://hdl.handle.net/10400.18/7166, ICFC2021 http://hdl.handle.net/10400.18/7795 and ICFC2023 https://repositorio.insa.pt/handle/10400.18/8785), ICFC2025 will address the challenges related to the i) impact of Chemical and Biological Contaminants on Health (occurrence, exposure assessment, biomonitoring); ii) advances for Emerging Contaminants Determination and iii) toxicity Spectrum of Food Contaminants.

Participants of this conference are cordially invited to contribute with a full manuscript to the Special Issue on " Emerging Food Contaminants: A Global Challenge for Health and the Environment " on Food Research International.

Throughout this conference, we hope to create an atmosphere where everyone, academia, professionals and students, can exchange ideas and establish collaborations.

We look forward to welcoming and hosting you in Funchal and hope this conference becomes an unforgettable moment.

Paula Alvito and Elsa Vasco

Chairs of ICFC2025

25.09.2025 – Day 1

08.00h - 09.00h		Registration and Welcome
09.00h - 09.45h		"The Intersection of Food Safety and Planetary Health" *Conference Chair & Honorary Committee* ***Micaela Freitas,*** *Regional Secretary, Madeira Regional Secretariat of Health and Civil Protection (SRS), Madeira, Portugal* ***Amadeu Soares*** *, Director of the Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Portugal* ***Fernando de Almeida*** *, Chairman of the Executive Board, National Institute of Health Doutor Ricardo Jorge (INSA), Portugal; Honorary President ICFC conferences*

Session 1 - Emerging Contaminants and Planetary Health: a call for integrated action

Chairs: *Cristina Abreu dos Santos and Paula Alvito*

09.45h - 10.15h	KL	One Planet… many contaminants! How can a One Health approach help address these complex challenges?. *Carlos das Neves, EFSA, Italy.*
10.15h - 10.45h		**COFFEE BREAK & POSTER VIEWING AND NETWORKING**
10.45h - 12.00h	RT	"The Role of Multilateral Policies in Food Contaminant Mitigation and Planetary Health" (Interative Debate) ***Amadeu Soares*** *, Director, Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Portugal* ***Carlos das Neves*** *, Chief Scientist, European Food Safety Authority (EFSA), Italy* ***Paula Garcia*** *, Deputy Director-General, General Directorate for Food and Veterinary (DGAV), Portugal* ***Sara Tavares*** *, Deputy Head of Unit F5, Directorate General for Health and Food Safety (DG Sante), European Commission, Irland*

12.00h - 12.30h	L1	"Unraveling the Microplastics: From Ubiquity to Human Health Impacts" *Rosa Perestrelo, University of Madeira, Portugal*
12.30h - 13.45h		**LUNCH & POSTER VIEWING AND NETWORKING**

Session 2 - Impact of Chemical and Biological Contaminants on Health

Chairs: *Marthe De Boevre and Carlos Oliveira*

13.45h - 14.15h	L2	"Investigation of the human mycobolome through large-scale population cohorts and poly-omic designs" *Martha de Boevre, Ghent University, Belgium*
14.15h - 14.30h	OC1	Children's exposure to mycotoxins and risk characterization using urinary biomarkers in São Paulo, Brazil *Sher Ali, FZEA/USP, Brazil*
14.30h - 14.45h	OC2	Nixtamalization of maize to reduce mycotoxin exposure: a human biomonitoring intervention study in Soweto, South Africa *Elias Maris, Ghent University, Belgium*
14.45h - 15.00h	OC3	Monitoring and risk assessment of environmental pollutants in edible seaweeds *Cristina Soares, REQUIMTE/LAQV, ISEP, Portugal*
15.00h - 15.15h	OC4	Elemental Composition of Cultivated Red Seaweed Gracilaria gracilis and Green Seaweed Codium sp.: Risks and Benefits *Carlos Cardoso, IPMA, Portugal*
15.15h - 15.30h		*Q&A*
15.30h - 16.00h		**COFFEE BREAK & POSTER VIEWING AND NETWORKING**

16.00h - 16.30h	L3	Early-life exposure to dietary mycotoxins in Brazil: What is the extent of protection provided by the health surveillance systems? *Carlos Oliveira, FZEA/USP, Brazil*
16.30h - 16.45h	OC5	Fumonisins' risk assessment in maize-based breads – An example from the Portuguese market *Pedro Nabais, ASAE, Portugal*
16.45h - 17.00h	OC6	Aflatoxin contamination in dairy production: implications for milk safety and quality *Giuseppina Avantaggiato, ISPA-CNR, Italy*
17.00h - 17.15h	OC7	Impact of cooking procedures on coccidiostats in poultry muscle *André Pereira, REQUIMTE/LAQV, FFUC,Portugal*
17.15h - 17.30h		*Q&A*
17.30h		Closing Day
		Social Event and Conference Dinner

26.09.2025 – Day 2

Session 3 - Advances for Emerging Contaminants Determination

Chairs: *Isabelle Oswald and Andrea Gianotti*

09.00h - 09.30h	L4	"How in vitro gut models can support gut microbiome human and animal health research? The INFOGUT project." Andrea Gianotti, University of Bologna, Italy
09.30h - 09.45h	OC8	Understanding brown spot disease in "Rocha" pear: fungal prevalence, resistance, and mycotoxin and phytotoxin production *Sónia Silva, Universidade do Minho, Portugal*
09.45h - 10.00h	OC9	Circular Packaging Solutions: Assessing Food-Contact Safety of Recycled-Layer Multilayer Systems *Catarina Freire, MARE, IPL, Portugal*
10.00h - 10.15h	OC10	Predicting endemic marine toxins in shellfish and identifying emerging threats in Portuguese waters *Pedro Reis, IPMA, Portugal*
10.15h - 10.30h		*Q&A*
10.30h - 11.00h		**COFFEE BREAK & POSTER VIEWING AND NETWORKING**
11.00h - 12.15h	RT	"Analytical techniques and risk communication strategies" (Interative Debate) ***Isabel Oswald**, Researcher Director, French National Research Institut for Agriculture, Food and Environment (INRAE), France* ***Pedro Nabais**, Head of the Food Risk Division, Portuguese Authority for Food and Economic Security (ASAE), Portugal* ***Pedro Reis**, Researcher, Portuguese Institute for Sea and Atmosphere (IPMA), Portugal* ***Rita Câmara**, Medical Doctor, Doctor Nélio Mendonça Hospital, RAM EPERAM Health Service, Madeira, Portugal*
12.15h - 13.30h		**LUNCH & POSTER VIEWING AND NETWORKING**

Session 4 - Toxicity Spectrum of Food Contaminants

Chairs: *Rosa Gouveia and Paula Alvito*

13.30h - 14.00h	L5	"Deoxynivalenol : new effect of an old toxin" Isabelle Oswald, INRAE, France
14.00h - 14.15h	OC11	"Microplastics-gut microbiota interactions in an in vitro model of the toddler colon" *Stephanie Blanquet-Diot, Université Clermont Auvergne, France*
14.15h - 14.30h	OC12	A Roadmap for Investigating the Neurotoxicity of Food Chemical Contaminants: Cellular and Barrier-Level Effects Along the Gut–Brain Axis *Miguel Faria, LAQV/REQUIMTE, FFUP, Portugal*
14.30h - 14.45h	OC13	Influence of short-term iron and copper exposure on cadmium and lead accumulation in Ulva spp. *Cláudia Lopes, MARE, IPL, Portugal*
14.45h - 15.00h	OC14	Brain on plastics: How surface-modified nanoplastics disrupt human neuronal cells *Ana Araújo, LAQV/REQUIMTE, FFUP, Portugal*
15.00h - 15.15h		Q&A
15.15h - 15.45h		**COFFEE BREAK & POSTER VIEWING AND NETWORKING**
15.45h - 16.00h		Best Poster Award (Associação Portuguesa de Nutrição and Sovena)
16.00h - 16.30h		Remarks and Future Directions
16.30h - 17.00h		Closing ICFC2025 ***Cristina Abreu dos Santos*** *, Vice-President of the Executive Board, National Institute of Health Doctor Ricardo Jorge - INSA, Portugal* ***Alexandra Bento*** *, Head of the Food and Nutrition Department, National Institute of Health Doctor Ricardo Jorge (INSA), Portugal*

INVITED LECTURES

KL - One Planet… many contaminants! How can a One Health approach help address these complex challenges?

Carlos das Neves
European Food Safety Authority, Parma, Italy
Carlos.DASNEVES@efsa.europa.eu

Human activities, including those related to food production and processing, release a diverse range of chemical and biological contaminants into the environment. These hazards do not remain confined to their source — they circulate through soil, water, air, and food chains, threatening human, animal, plant, and ecosystem health. Many persist for decades, bioaccumulate, and travel across continents and oceans, making them a truly global challenge.

This presentation will highlight how recognising contaminants as a One Health issue — as promoted in the Joint Plan of Action of the Quadripartite (FAO, UNEP, WHO, WOAH) — enables more effective prevention, monitoring, and remediation. The One Health approach, by integrating human, animal, plant, and environmental health perspectives, is uniquely suited to address the complexity of these interconnected threats.

Some examples will include natural toxins, environmental contaminants or process contaminants, with a focus also on aquatic and marine environments. Oceans act both as sinks and conduits for contaminants, concentrating them in sediments and marine organisms. This contamination can compromise seafood safety, threaten marine biodiversity, and cycle back to human populations dependent on these ecosystems. Addressing such hazards demands coordinated international action, harmonised monitoring, and cross-sectoral risk management — the core principles of the One Health paradigm. By breaking down disciplinary silos and connecting expertise, this approach offers a pathway to reduce contaminant loads, restore ecosystems, and protect health at all levels of life.

We will also highlight EFSA's efforts to promote science and protect against contaminants through activities such as Scientific Advice and Risk Assessments, dedicated Panels and Working Groups, Data Collection and Monitoring, or identification of Emerging Risks.

By fostering collaboration across all sectors—from policy-makers and scientific researchers to industrial stakeholders and local communities—it is possible to proactively prevent disease outbreaks, significantly enhance food safety, effectively reduce the burden of contaminants, and safeguard both global health security and biodiversity.

The message is clear: contaminants are not isolated issues but shared planetary. While the challenges are complex and multifaceted, the path forward is clear: it lies in the comprehensive embrace and operationalization of the One Health approach.

L1 - Unraveling the Microplastics: From Ubiquity to Human Health Impacts

Perestrelo, R[1]**;** Câmara, J.S.[1,2]
[1]CQM – Centro de Química da Madeira, Universidade da Madeira, Campus da Penteada, 9020-105 Funchal, Portugal.
[2]Departamento de Química, Faculdade de Ciências Exatas e Engenharia, Universidade da Madeira, Campus da Penteada, 9020-105 Funchal, Portugal
jsc@staff.uma.pt

Keywords: microplastics; occurence; emerging analytical techniques; health effects

Microplastics, synthetic small plastic particles less than five millimetres long, which are pervasive contaminants that originate from a variety of sources including larger plastic pieces that have broken apart, resin pellets used for plastic manufacturing, or in the form of microbeads, which are small, manufactured plastic beads used in health and beauty products.

Their ubiquity has been confirmed across all ecosystems, spanning remote terrestrial regions, the deep ocean, food and drinking water, and even atmospheric dust, leading to unavoidable human exposure. The unique physicochemical properties of microplastics enable them to act as vectors for environmental pollutants and biological agents, thereby amplifying their potential toxicity.

Emerging evidence implicates microplastics in adverse health outcomes for humans, including inflammation, oxidative stress, disruption of gut microbiota, and potential translocation across biological barriers, raising concerns about their role in chronic disease development. Despite this, considerable uncertainty remains regarding dose-response relationships and long-term impacts, emphasizing the need for improved exposure assessment.

The detection, characterization, and quantification of microplastics in environmental and biological matrices are challenged by the complexity of their size, shape, and chemical diversity. Analytical methodologies such as Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy, pyrolysis–gas chromatography/mass spectrometry (py-GC/MS), and advanced imaging techniques are employed to unravel their distribution and composition, but a lack of standardization hampers data comparability across studies. Thus, the scientific community continues to seek harmonized, high-throughput analytical tools to better elucidate the occurrence and impacts of microplastics on human health.

L2 - Investigation of the human mycobolome through large-scale population cohorts and poly-omic designs

Marthe De Boevre[1], Tess Goessens[1], Lia Visintin[1], Truong Nguyen[1], Yasmine Bader[1] & the ERC StG HUMYCO-collaborators
[1] Centre of Excellence in Mycotoxicology and Public Health, Department of Bioanalysis, Ghent University, Ghent, Belgium
marthe.deboevre@ugent.be

The human mycobolome - encompassing chronic and cumulative exposures to dietary mycotoxins - represents a critical component of the exposome. Through the ERC-funded HUMYCO project, we are building the first systems-level framework to characterise mycotoxin exposure and its biological consequences across vulnerable life stages and diverse populations. This lecture presents key advances achieved through HUMYCO's poly-omic and population-based strategy. We report pioneering work on exposure assessment via several population cohorts, revealing amongst others dynamic mother–infant transfer profiles of mycotoxins. Analytical breakthroughs include the development of harmonised LC-MS/MS validation protocols and active participation in international efforts to standardise retention time indexing (NAPS), enabling reproducible multi-mycotoxin quantification at scale. On the computational front, novel high-dimensional modelling approaches have been developed to address multicollinearity and co-exposure complexity-most notably in the context of hepatocellular carcinoma risk prediction. In parallel, we introduce a toxico-epigenomic perspective, integrating histone PTM profiling to elucidate epigenetic disruptions induced by single and combinatory mycotoxin exposures in relevant human cell models. Looking forward, HUMYCO aims to deliver a curated, publicly accessible atlas of the human mycobolome, including predictive biomarkers of exposure-response relationships. Our findings challenge the conventional boundaries of mycotoxin risk assessment and position the mycobolome as a critical dimension in systems toxicology, precision public health, and healthy living.

L3 - Early-life exposure to dietary mycotoxins in Brazil: What is the extent of protection provided by the health surveillance systems?

Ali, S.[1], Tonin, F.G.[2]; Corassin, C.H.[1]; Rosim, R.E.[1]; Sana Ullah[1], Ramalho, F.S.[3], Ramalho, L.Z.[3], Ferraz, I.S.[4], Del Ciampo, L.A.[4]; **Oliveira, C.A.F.[1]**

[1]Department of Food Engineering, Faculty of Animal Science and Food Engineering, University of São Paulo at Pirassununga, SP, Brazil. [2]Department of Biosystem Engineering, Faculty of Animal Science and Food Engineering, University of São Paulo at Pirassununga, SP, Brazil. [3]Department of Pathology, Medical School at Ribeirão Preto, University of São Paulo, Ribeirão Preto, SP, Brazil. [4]Department of Puericulture and Pediatrics, Medical School at Ribeirão Preto, University of São Paulo, Ribeirão Preto, SP, Brazil.

carlosaf@usp.br

Keywords: Exposure assessment, biomonitoring, infant foods, health risks.

Mycotoxins are secondary metabolites produced by fungi that occur naturally in foodstuffs, which can cause a large variety of toxic effects, mainly to children and young animals due to their high physiological vulnerability. Given the health concerns raised by mycotoxin exposure, regulatory bodies have established maximum levels (ML) for these compounds in a variety of food products worldwide. In Brazil, the National Health Regulatory Agency (ANVISA) set up ML for aflatoxins (AFs), ochratoxin A (OTA), fumonisins (FBs), zearalenone (ZEN) and deoxynivalenol (DON) in cereal- and milk-based infant foods. However, despite these regulations, the frequent occurrence of mycotoxins in foods continues to pose significant health risks in Brazil, particularly for children. In addition, a recent survey on urinary biomarkers of exposure to mycotoxins in Brazilian infant populations have indicated high frequencies of ZEN and its metabolites (α-zearalenol and β-zearalenol), followed by FB1, DON, and OTA, with co-exposure to 2–6 mycotoxins observed in 63% of urine samples from preschoolers (3–6 years), schoolers (7–10 years), and adolescents (11–17 years).

The maternal diet is a major source of prenatal exposure to food contaminants, including mycotoxins. The prenatal phase—conception through birth—involves critical stages of organogenesis, tissue growth, and physical maturation. Each trimester presents unique biological vulnerabilities, with the first trimester being particularly sensitive to toxic compounds that drastically affect the prenatal development. Emerging evidence links dietary mycotoxins to health issues during the prenatal period. Recently, a study based on mycotoxin biomarkers determined in liver and blood samples collected from newborns and fetuses autopsied at the Hospital das Clínicas of Ribeirão Preto, São Paulo, Brazil, demonstrated that frequencies and levels of AFB1, OTA, FB1, ZEN or DON correlated with the presence of congenital morphological abnormalities found in the autopsied patients.

These findings raise critical concerns about the adequacy of current food safety frameworks in Brazil, which largely overlook real-life dietary mycotoxin co-exposures. Given children's delicate physiological vulnerability, regulatory strategies are directed to urgently adopt mycotoxin mixture-based risk assessments for infant foods and implement biomonitoring surveillance programs for assessing the early-life exposure to dietary mycotoxins. Acknowledgements: FAPESP (Grants # 2019/21603-1; 2022/03952-1; 2023/05989-2).

L4 - How in vitro gut models can support gut microbiome human and animal health research? The INFOGUT project.

Andrea Gianotti[1], Stephanie Blanquet-Diot[2], Pilar Acedo[3,4], Alessandra Bordoni[1], Anthony Buckley[5], Enrique Carrillo[6], Laure-Alix Clerbaux[7], Ilze Elbere[8], Lucie Etienne-Mesmin[1], Clarisse Salome Nobre Goncalves[9], Thomas Hitch[10], Harsh Mathur[11], Lorenzo Nissen[1], Lidia Tomas-Cobos[12].
[1]Department of Agricultural and Food Sciences (DISTAL), Alma Mater Studiorum - University of Bologna, Bologna, Italy. [2]UMR 454 MEDIS Microbiology, Digestive Environment and Health, Université Clermont Auvergne, Clermont-Ferrand, France. [3]Division of Surgery and Interventional Science, University College London, London, United Kingdom. [4]Institute for Liver and Digestive Health, Division of Medicine, University College London, London, United Kingdom. [5]Microbiome and Nutritional Sciences Group, School of Food Science & Nutrition, Faculty of Environment, University of Leeds, Leeds, UK. [6]Computational Biology Group, Research Institute on Food and Health Sciences, Madrid, Spain. [7]Institute of Experimental and Clinical Research (IREC), UCLouvain, Brussels, Belgium. [8]Translational Omics Group, Latvian Biomedical Research and Study Centre, Riga, Latvia. [9]Center of Biological Engineering, Universidade do Minho Centro de Engenharia Biológica, Portugal. [10]Functional Microbiome Research Group, Institute of Medical Microbiology, RWTH University Hospital, Aachen, Germany. [11]Teagasc Food Research Centre, Fermoy, Co. Cork, Ireland. [12]AINIA in Vitro Preclinical Studies Area, Parque Tecnológico de Valencia, Paterna, Spain
andrea.gianotti@unibo.it

Keywords: in vitro gut microbiota colon models; 3R principles; omics; risk assessment

Introduction Scientific research highlights the central role of the gastrointestinal tract in human health. Indeed, the physiologic effects of nutrients, bioactives and even toxic compounds (including foodborne pathogens) are mediated by their absorption rate in the intestine and by their interaction with gut microbiota and its host ecosystem. Testing food, feed, supplements or drugs in clinical studies gives rise to ethical issues, and the transferability of animal data across species is often problematic because of differences in physiology, metabolism and chemical susceptibilities. According to EURL ECVAM (2021), complex in vitro models (CIVMs) approaches should be adequate not only for regulatory use-contexts, but also for application in the research field provided that standardized CIVMs are developed, enabling a consensus on their use.

Methodology INFOGUT is a COST Action to fill the knowledge gap on in vitro colon models providing consensus protocols and robust data sets to improve our knowledge of the events taking place in the intestinal milieu, including the complex interactions between the microbiota and the host. Moreover, innovative educational tools will be suggested to increase knowledge on gut models in young researchers and to society to avoid any unhealthy consumer choices coming from misleading messages. Bringing together different experts in Gastroenterology, Microbiology, Physiology, Nutrition, Food Science, Biochemistry, Bioinformatics, Biotechnology etc., INFOGUT could represent an effective strategy for the development of healthy food and for the counteraction of diseases.

Expected results INFOGUT will integrate advances in microbiome science – including in silico and in vitro models and omics technologies – to enhance food contaminant risk assessment by incorporating gut microbiome data. Specifically to this area, it may contribute to: i) clarify causal links between chemical-induced microbiome changes and host metabolic or inflammatory disorders; ii) Develop biomarkers for microbiome-related adverse effects; iii) collect data to link dietary exposures, microbiome alterations, and health outcomes. Some examples of impact on gut microbiota of antibiotics, microplastics and mycotoxins will be reported.

Topic relevance This initiative will promote networking activities (exchanges, conferences, training schools etc) but also educational tools for young researchers and raise societal awareness to prevent misleading consumer choices related to gut health.

L5 - Deoxynivalenol: new effect of an old toxin

Isabelle P. OSWALD
Toxalim (Research Centre in Food Toxicology), University of Toulouse, INRAE, ENVT, INP-Purpan, UPS, 31027, Toulouse, France
isabelle.oswald@inrae.fr

Mycotoxins are the most prevalent natural dietary toxins and contaminate up to 70% of global crop production (Eskola et al., 2020). They represent a major issue for food safety (Payros et al., 2021). These secondary metabolites, produced by microscopic fungi, resist industrial processes and cooking, and contaminate finished processed food. Among mycotoxins, deoxynivalenol (DON) is a trichothecene mycotoxin produced by Fusarium species, commonly contaminating cereals and animal feeds. Its main effects are both acute and chronic, impacting multiple physiological systems. The main effect of DON is to cause gastrointestinal distress, suppress feed intake and growth, and disrupt immune and intestinal function through mechanisms involving oxidative stress, inflammation, and neuroendocrine signaling. The primary molecular target of DON is the ribosome; leading to a ribotoxic stress (Garofalo et al., 2025).
DON, which is not genotoxic on its own, but we recently been described that this toxin is capable of increasing the genotoxicity induced by multiple compounds. Indeed we observed that effect is observed with several dugs with different modes of action (Garofalo et al., 2022), but also by captan, a pesticide contaminating the food (Garofalo et al., 2023), by colibactin a genotoxin produced by Escherichia coli bacteria in the gut (Payros et al., 2017) and by acrylamide, a compound formed during cooking processes and commonly found in fried foods and cereal products (Huertas et al., 2025). The genotoxicity exacerbation is not only an effect caused by DON, but also caused by T-2, DAS, NIV, FX, and NX (Garofalo et al., 2023). This effect is mediated by the ability of TCT to bind to the ribosome as (i) it is observed other ribosome inhibitors but (ii) not observed with de-epoxy-deoxynivalenol (DOM-1), a modified form of DON that does not induce ribotoxic stress (Garofalo et al., 2022).
The association between dietary exposure to DON and hepatocellular cancers was further investigated in the European Prospective Investigation into Cancer and Nutrition (EPIC) cohort. EPIC questionnaire data were matched to mycotoxin food occurrence data compiled by the European Food Safety Authority to assess long-term dietary mycotoxin exposure and then relate them to the risk of hepatocellular carcinoma (HCC). Analyses were conducted using multivariable Cox proportional hazards regression models indicated that intake of deoxynivalenol (DON) and its derivatives was positively associated with HCC risk (Huybrecht et al 2024).
Taken together these data question the current classification of DON as “not classifiable as to its carcinogenicity to humans” and indicate that more data is needed to fully understand the toxicity of DON.

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ORAL COMMUNICATIONS

OC1 - Children's exposure to mycotoxins and risk characterization using urinary biomarkers in São Paulo, Brazil

Ali S[1], Franco BB[1], Rezende VT[2], Ullah S[1], Wahab N[3], Freire LGD[1], Rosim RE[1], Tonin FG[4], Corassin CH[1], Del Ciampo LA[5], Ferraz IS[5], **Oliveira CAF**[1]

[1]Department of Food Engineering, Faculty of Animal Science and Food Engineering, University of São Paulo, Pirassununga, SP, Brazil. [2]Faculty of Veterinary Medicine and Animal Science, University of São Paulo, Pirassununga, SP, Brazil. [3]Department of Chemistry, Federal University of Paraná, Curitiba, PR, Brazil. [4]Department of Biosystems Engineering, Faculty of Animal Science and Food Engineering, University of São Paulo, Pirassununga, SP, Brazil. [5]Department of Puericulture and Pediatrics, Medical School at Ribeirão Preto, University of São Paulo, Ribeirão Preto, SP, Brazil.

alisher@usp.br (Ali S) & carlosaf@usp.br (Oliveira CAF)

Keywords: Mycotoxins, exposure, risk, children, urine, biomarkers, UPLC-MS/MS.

Children are highly disposed to dietary mycotoxin exposure, yet biomonitoring data for estimating mycotoxin intake at early-life stages remain limited in Brazil.

This study assessed mycotoxin exposure among preschoolers (3–6 years, n = 27), schoolers (7–10 years, n = 29), and adolescents (11–17 years, n = 49) in São Paulo, Brazil, through the analysis of urinary mycotoxin biomarkers. Analyses were performed using ultra-performance liquid chromatography coupled with tandem mass spectrometry (UPLC–MS/MS) to determine aflatoxin M1 (AFM1), ochratoxin A (OTA), fumonisins B1 (FB1) and B2 (FB2), deoxynivalenol (DON), T-2/HT-2 toxins, zearalenone (ZEN) and its metabolites α-/β-zearalenol (ZEL).

Urinary ZEN and its metabolites (α-/β-ZEL) were the most frequently detected biomarkers, followed by FB1, DON, and OTA. Co-exposure to 2–6 mycotoxins was observed in 63% of samples, most prominently among schoolers (69%), followed by adolescents (63%) and preschoolers (59%). The most common co-occurring urinary toxins were: ZEN+α–ZEL+β–ZEL > FB1+FB2 > AFM1+OTA > DON+ZEN+α–ZEL+β–ZEL > T2+HT2 > ZEN+α–ZEL > OTA+DON > AFM1+FB1+FB2. Estimated daily intake (EDI) values were calculated under lower (LB), middle (MB), and upper bound (UB) scenarios. Several 95th percentile UB-EDI values exceeded maximum level or tolerable daily intake limits, mainly for preschoolers regarding exposure to AFM1 (EDI: 0.786 µg/kg body weight (bw)/day), FB1 (EDI: 3.921 µg/kg bw/day) and OTA (0.683 µg/kg bw/day), as well as for schoolers regarding DON exposure (1.423 µg/kg bw/day), and for adolescents regarding FB2 (2.540 µg/kg bw/day). Under the UB scenario, hazard quotient (HQ) values > 1 were found for OTA in 100% of preschoolers (median: 1.71) and schoolers (1.4), and for FB1, DON, and T-2/HT-2 in selected individuals. Margin of exposure (MoE) values for AFM1 were < 10,000 across all age groups, indicating potential carcinogenic concern, particularly in preschoolers.

These findings underline substantial real-life co-exposure to multiple mycotoxins in Brazilian children, reinforcing the need for age-specific surveillance and risk management strategies. The detection of multiple

toxins above safety thresholds highlights the vulnerability of this population and the importance of strengthened food safety policies.

Acknowledgments

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OC2 - Nixtamalization of maize to reduce mycotoxin exposure: a human biomonitoring intervention study in Soweto, South Africa

Maris E[1,2], Ndlangamandla P[3], Adelusi OA[3], Akinmoladun OF[3], Odukoya J[1,3], Fagbohun TR[3], Oyeyinka SA[3,4], Sekhejane P[C], Pero-Gascon R[1,5], De Boevre M[1], Croubels S[6], De Saeger S[1,3], Njobeh PB[3]

[1]Centre of Excellence in Mycotoxicology and Public Health, Faculty of Pharmaceutical Sciences, Ghent University, Belgium. [2]Laboratory of Molecular Bacteriology, Department of Microbiology and Immunology, Rega Institute, KU Leuven, Belgium. [3]Department of Biotechnology and Food Technology, Faculty of Science, Doornfontein Campus, University of Johannesburg, South Africa. [4]School of Agr-Food Technology and Manufacturing, College of Health and Science, University of Lincoln, United Kingdom. [5]Department of Chemical Engineering and Analytical Chemistry, Institute for Research on Nutrition and Food Safety (INSA-UB), University of Barcelona, Spain. [6]Laboratory of Pharmacology and Toxicology, Department of Pathobiology, Pharmacology and Zoological Medicine, Faculty of Veterinary Medicine, Ghent University, Belgium.

elias.maris@ugent.be

Keywords: mycotoxins, maize, nixtamalization, Sub-Saharan Africa, human biomonitoring, food safety.

Mycotoxin contamination is a global threat to food safety and human health, particularly in regions with high food insecurity, such as Sub-Saharan Africa. This intervention study evaluates the effectiveness of nixtamalization, a traditional food processing method, in reducing mycotoxin levels in raw maize and their corresponding urinary biomarkers of exposure over time.

Forty participants from informal settlements in Kliptown, Soweto (South Africa), were randomly assigned to a control group (consuming maize not showing fungal contamination), or an experimental group (consuming naturally contaminated maize that had been processed through nixtamalization). First-morning urine samples were collected on day 1, 3, and 5 during the 5-day study period to assess exposure to multiple mycotoxins (40) using a newly validated LC-MS/MS method. Participants received two portions of either control or nixtamalized maize, prepared as a porridge, on the 2nd and 4th day of the study.

Analysis of the maize grains revealed that out of 13 mycotoxins investigated, 6 were detected in naturally contaminated maize and 3 in control maize. Nixtamalization achieved a complete reduction of fumonisin B3 and deoxynivalenol to below detectable levels, while reducing fumonisin B1 (FB1), fumonisin B2, and zearalenone (ZEN) by 95.1%, 94.8%, and 89.0%, respectively. Aflatoxin B1 was detected in the naturally contaminated maize below the lower limit of quantification but undetectable after nixtamalization. Biomonitoring revealed that urinary levels of FB1, ZEN and its metabolites α-and β-zearalenol, increased significantly ($p<0.05$) following the consumption of the maize porridges. However, no significant differences were observed between study groups after both consumption periods. These results indicate that consumption of nixtamalized maize led to internal exposure levels comparable to those from the control maize.

This study highlights nixtamalization as an effective strategy for reducing mycotoxin levels in maize and presents the evidence, through human biomonitoring, of its benefit in lowering internal mycotoxin exposure. Additionally, it underscores the urgent need for educational initiatives to raise food safety awareness and

improve handling practices, particularly in vulnerable, low-education communities that rely heavily on maize-based diets.

OC3 - Monitoring and risk assessment of environmental pollutants in edible seaweeds

Soares C[1], Sousa S[1], Ramalhosa MJ[1], Cruz Fernandes V[1,2,3], Couto J[4], Jorge R[4], Oliveira TAC[4], Fernandes Domingues V[1], Delerue-Matos C[1]
[1]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Porto, Portugal. [2]RISE-Health, Center for Translational Health and Medical Biotechnology Research (TBIO), ESS, Polytechnic of Porto, Porto, Portugal. [3]Chemical Sciences and Biomolecules, ESS, Polytechnic of Porto, Porto, Portugal. [4] WeDoTech, Porto, Portugal.
cds@isep.ipp.pt

Keywords: Organochlorine pesticides, Polycyclic Aromatic Hydrocarbons, Target Hazard Quotient (THQ), cancer risk, food safety

Seaweed consumption is growing in Europe, driven by its nutritional value and sustainability. However, their bioaccumulative nature raises concerns about potential chemical contamination. This study investigates the presence of multiple pollutants in wild-harvested, commercially available seaweeds and assesses potential health risks associated with their consumption.

Five macroalgae species (Himanthalia elongata, Undaria pinnatifida, Codium tomentosum, Chondrus crispus, Laminaria sp.) were analysed for the presence of: (i) Organochlorine pesticides, (ii) Polychlorinated biphenyls (PCBs), (iii) Brominated flame retardants (BDEs), (iv) Organophosphorus pesticides and esters, (v) Aliphatic hydrocarbons, and (vi) Polycyclic aromatic hydrocarbons (PAHs). A moderate intake of 5 g (dry weight) per week was assumed for exposure assessment. Non-carcinogenic and carcinogenic risks were assessed using Target Hazard Quotient (THQ) and Cancer Risk (CR) indices.

Among the analysed contaminants, two compounds were detected across all samples: naphthalene (max 0.216 mg/kg dw in C. tomentosum) and β-HCH (max 0.180 mg/kg dw in C. crispus). THQ values for naphthalene were all <0.0002, indicating negligible non-carcinogenic risk. For β-HCH, THQ values ranged from 0.0066 to 0.0305, approaching thresholds of concern in C. crispus. CR values for β-HCH ranged from 3.06×10^{-7} to 1.41×10^{-6}, all within the US EPA's acceptable risk range ($<10^{-4}$). Other pollutants were detected at trace or non-quantifiable levels.

The results suggest low overall health risk from current levels of organochlorines and PAHs in wild edible seaweeds under typical consumption scenarios. However, β-HCH requires continued monitoring due to its persistence and toxicological relevance. While PAHs are not classified as emerging contaminants per se, their occurrence in emerging food products like seaweed introduces new challenges for food safety and regulatory control. This study supports the safe dietary integration of seaweed while highlighting the importance of targeted contaminant surveillance in novel food products.

This work aligns with the ICFC2025 theme, "Impact of Contaminants on Health and the Toxicity Spectrum of Food Contaminants." By applying comprehensive contaminant profiling and quantitative health risk assessment, it contributes valuable data to guide public health policy, food safety regulation, and consumer awareness regarding chemical risks in emerging dietary components.

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OC4 - Elemental Composition of Cultivated Red Seaweed Gracilaria gracilis and Green Seaweed Codium sp.: Risks and Benefits

Afonso C[1,2], Matos J[1], Pedras MI[1], Mourato M[3], **Cardoso C[1,2]**
[1]Division of Aquaculture and Upgrading (DivAV), Portuguese Institute for the Sea and Atmosphere (IPMA, IP), Avenida Alfredo Magalhães Ramalho, 6, 1495-165 Algés, Portugal. [2]CIIMAR, Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Rua dos Bragas 289, 4050-123 Porto, Portugal. [3]LEAF, Linking Landscape, Environment, Agriculture and Food, Universidade de Lisboa, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisbon, Portugal.
carlos.cardoso@ipma.pt

Keywords: Chemical contaminants; IMTA; seasonality; novel foods; nutrition; health

Introduction Seaweed is an undervalued resource known for its richness in nutrients and bioactives. Its utilization is hampered by seasonal variability of wild seaweed. This has led to seaweed cultivation, including Integrated Multi-Trophic Aquaculture (IMTA) systems. Another limitation derives from toxic levels of non-essential elements, such as As. Whether IMTA seaweed is safe regarding such contaminants and whether it is a source of essential elements to human diet are key issues. The elemental composition and anti-inflammatory activity of red seaweed Gracilaria gracilis and green seaweed Codium sp. grown under IMTA conditions were studied and, specifically, the seasonal effect (seaweed grown during Winter or Summer) was assessed for G. gracilis.
Methodology G. gracilis was harvested in April (grown during Winter) and November (Summer) and Codium sp. was harvested in November at Aqualvor fish farm (Algarve, Portugal), an IMTA system. Macroelements, Na, Mg, P, S, K, and Ca, and microelements, Cr, Fe, Cu, Zn, As, Cd, and Pb, were determined by Inductively Coupled Plasma Atomic Emission Spectroscopy using a Thermo Scientific iCap 7000 equipment. Inhibition of cyclooxygenase-2 (COX-2) enabled to assess anti-inflammatory activity.
Results Regarding macroelements, while G. gracilis was rich in P, reaching 2.07-3.64 g/kg dw, Codium sp. was a plentiful source of Mg, 5.93-6.87 g/kg dw, and S, 21.2-26.5 g/kg dw. As to microelements, whereas Cr, Cu, Zn, As, Cd, and Pb were present at low levels in seaweed, not exceeding, 7.0, 15.0, 50.0, 25.0, 0.1, and 1.0 mg/kg dw, respectively (with higher Cr, Zn, and As contents in Summer G. gracilis), Fe was the main microelement in both species, >300 mg/kg dw. Anti-inflammatory activity of Winter G. gracilis ensured 64.1±6.4% COX-2 inhibition.
Conclusions Macroelements' results reflect the specific ability of each seaweed species in extracting nutrients from the IMTA water and the importance of combining species in order to achieve optimal bioremediation action upon the wastewater of fish farms. Microlements' levels, including As, did not raise major toxicity concerns.

Topic relevance Consumption of cultivated G. gracilis and Codium sp. does not pose any major risk concerning inorganic contaminants and may be a source of anti-inflammatory compounds in the diet.

OC5 - Fumonisins' risk assessment in maize-based breads – An example from the Portuguese market

Nabais P[1,2], Carmona P[1,2], Monteiro S [1,2], Sousa H [1,2], Melo de Vasconcelos F[1], Cunha Silva L[3]
[1]The Economic and Food Safety Authority, Lisbon, Portugal. [2]Food Risks Unit, The Economic and Food Safety Authority, Lisbon, Portugal. [3]Veterinary Public Health Institute, Vetsuisse Faculty, University of Bern, Bern, Switzerland.
pmnabais@asae.pt

Keywords: Mycotoxins; PNCA; Food Safety; HPLC-FL

Introduction Maize-based bread ("broa") is a traditional Portuguese food product widely consumed across the country. Its safety, however, may be compromised by the presence of mycotoxins, particularly fumonisins, as identified in the National Sampling Plan (PNCA).
Methodology This study assessed fumonisin contamination in maize-based bread sampled in Portugal between 2017 and 2022 and estimated dietary exposure levels using food consumption data from the IAN-AF 2015–2016 survey. A total of 39 maize-based bread samples were analysed for fumonisins B1 and B2 using HPLC-FL. Exposure assessments were carried out for multiple population groups under three consumption scenarios (mean, P95, P99), and compared with the EFSA's tolerable daily intake (TDI) of 1.0 µg/kg bw/day.
Results Fumonisins B1 and B2 were detected in 94.9% and 61.5% of the samples, respectively. Maximum concentrations were 292 µg/kg (FB1), 87 µg/kg (FB2), and 379 µg/kg (sum). All samples complied with the EU maximum level of 1000 µg/kg for maize-based foods. Estimated daily intake (EDI) under normal conditions ranged from 0.001 to 0.021 µg/kg bw/day, corresponding to 0.1%–2.1% of the TDI. Even in high-consumption scenarios, exposure remained below 51.6% of the TDI. However, a worst-case calculation revealed that a child could exceed the TDI by consuming a single slice (56,2g of highly contaminated bread).
Conclusions While current fumonisin levels pose minimal risk to most consumers, vulnerable groups require targeted monitoring. The study highlights the need for specific regulations for traditional products and preventive measures along the production chain.
Topic Relevance This work provides crucial data from an Official Control plan for EU food safety policies, bridging gaps between regulatory frameworks and traditional food preservation. It supports the ALARA principle while addressing cultural dietary practices.

OC6 - Aflatoxin contamination in dairy production: implications for milk safety and quality

Greco D[1], D'Ascanio V[1], Abbasciano M[1], Brasca M[2], Trevisi E[3], Lopreiato V[4], **Avantaggiato G[1]**

[1]Institute of Sciences of Food Production, National Research Council, Via Amendola 122/O Bari, Italy. [2]Institute of Sciences of Food Production, National Research Council, Via Celoria 2-20133, Milano, Italy. [3]Department of Animal Science, Food and Nutrition, Università Cattolica del Sacro Cuore, Via Emilia Parmense, 84-29122 Piacenza, Italy. [4]Department of Veterinary Sciences, University of Messina, G. Palatucci Street, 13, 98168 Messina, Italy.
giuseppina.avantaggiato@cnr.it

Keywords: aflatoxin B1, aflatoxin M1, dairy cows, milk safety, feed additives, food security

Milk safety is a critical aspect of food security, particularly due to the contamination with aflatoxin M1 (AFM1), the hydroxylated metabolite of aflatoxin B1 (AFB1). Following ingestion of contaminated feed, AFB1 is rapidly absorbed in the gastrointestinal tract of dairy cows and converted into AFM1, which is then secreted into milk. Both toxins are classified as Group 1 carcinogens by the IARC, posing major public health risks and economic burdens due to rejected milk and dairy products.

This study assessed AFM1 contamination in milk from cows fed a Total Mixed Ration containing AFB1 and AFB2 at levels below the EU legal limit (5 µg/kg) set by Directive 2002/32/EC. An in vivo trial was performed on lactating dairy cows for 14 days. Two feed additives composed of authorized substances (smectite and lignin for additive 1; humic acid and plant extracts for additive 2) were also evaluated for their ability to reduce aflatoxin carry-over in milk and dairy products.

Despite compliance with the legal feed contamination limits, AFM1 levels in milk exceeded the EU regulatory threshold of 50 ng/kg (Regulation 2023/915), raising concerns about the adequacy of current legislation. Additionally, trace amounts of AFB1 (3.0 ± 0.2 ng/L) were also detected in milk. Although this level is low, it remains noteworthy considering the high toxicity and carcinogenicity of AFB1. Both additives significantly reduced AFM1 in milk (≈30%), lowering AFB1 carry-over below 2%. Interestingly, additives reduced AFM1 not only in bulk milk but also in dairy products such as mozzarella and grana-type cheese, keeping levels below recommended limits for soft (0.150 µg/kg) and hard cheeses (0.300 µg/kg). In addition, contaminated feed negatively affected milk quality, reducing total protein and casein. Additives restored these parameters. Altered mineral profiles (↑ sodium/chloride, ↓ potassium) suggested a mild mammary inflammation, reversed by additive inclusion. No adverse effects were observed on milk yield or cheese quality.

In conclusion, current EU limits for AFB1 in feed may not fully safeguard milk safety. The use of feed additives offers partial mitigation, but stricter control of feed contamination and preventive approaches are essential to protect consumer health and ensure sustainability in the dairy sector.

OC7 - Impact of cooking procedures on coccidiostats in poultry muscle

Pereira AMPT[1], Martins RR [1,2,3], Silva LJG[1], Duarte SCA[3], Freitas AD[4,5], Pena A[1]
[1]LAQV, REQUIMTE, Laboratory of Bromatology and Pharmacognosy, Faculty of Pharmacy, University of Coimbra, Polo III, Azinhaga de Santa Comba, 3000-548 Coimbra, Portugal. [2]Centre of Studies in Animal and Veterinary Science (CECAV), University of Trás-os Montes e Alto Douro (UTAD), Apartado 1013, 5001-801 Vila Real, Portugal. [3]Centro de Investigação Vasco da Gama, Escola Universitária Vasco da Gama (EUVG), Av. José R. Sousa Fernandes 197, Campus Universitário de Lordemão, 3020-210 Coimbra, Portugal. [4]National Institute for Agricultural and Veterinary Research (INIAV), I.P., Av. da República, Quinta do Marquês, 2780-157 Oeiras, Portugal. [5]Associated Laboratory for Green Chemistry of the Network of Chemistry and Technology, REQUIMTE/LAQV, R. D. Manuel II, Apartado 55142, 4051-401 Porto, Portugal.
andrepereira@ff.uc.pt

Keywords: Poultry meat; food contaminants, cooking methods; coccidiostats' residues; UHPLC-MS-MS.

Poultry meat is a popular and nutritious food, valued for its high protein content and healthy fat profile. However, like other animal products, it can contain pharmaceutical residues, including coccidiostats used to prevent parasitic infections. While most monitoring focuses on raw meat, it's important to understand how these compounds behave during cooking to assess potential health risks better and ensure food safety.
This study examined how five different cooking methods (roasting, grilling, and microwaving, beer and wine marinating) affect the levels of eight coccidiostat residues in poultry muscle. After applying different cooking procedures, ionophore and synthetic coccidiostats' residue levels were measured using solid–liquid extraction followed by ultra-high-performance liquid chromatography with tandem mass spectrometry (UHPLC-MS/MS). Results were expressed as percentages of the original concentrations: 100% indicates stability, values above 100% suggest a relative increase (often due to moisture loss), and values below 100% reflect a decrease, likely from heat degradation.
Roasting, grilling, and microwaving all increased residue concentrations—up to 198.5%, 180.1%, and 158.4%, respectively. In contrast, marinating meat in wine or beer before cooking reduced residues to 73.1% and 72.0%, suggesting a mitigating effect. The initial concentration also influenced the outcome: samples fortified at the maximum residue limit (MRL) had an overall higher mean concentration after cooking (148.3%,) than those fortified at twice the MRL (2MRL), which averaged 124.5%.
These results show that cooking can significantly alter coccidiostat residue levels, depending on the cooking procedures and initial concentration. Ongoing monitoring and further research are essential to understand better how cooking affects these residues and their by-products. This knowledge is key to improving food safety practices and refining consumer health risk assessments.

OC8 - Understanding brown spot disease in “Rocha” pear: fungal prevalence, resistance, and mycotoxin and phytotoxin production

Inês Mendonça[1,2], Joana Santos[2], Rui Azevedo[2], Miguel Leão[1], Armando Venâncio[2,3], **Sónia Silva**[2,3]
[1]INIAV - National Institute for Agrarian and Veterinarian Research, Vairão, Portugal. [2]CEB - Centre of Biological Engineering, University of Minho, Braga, Portugal. [3]LABBELS – Associate Laboratory, Braga/Guimarães, Portugal.
soniasilva@ceb.uminho.pt

Keywords: brown spot disease, Rocha pear, Stemphylium, Alternaria, mycotoxins.

The Rocha pear (Pyrus communis L. cv. Rocha) is a unique Portuguese fruit variety of significant economic importance [1]. It is mainly cultivated in the western region of Portugal. However, the emergence of brown spot of pear (BSP) disease has become a major concern, as the increasing prevalence of this disease has led to a considerable reduction in yield and subsequent economic losses [2].
In addition to Stemphylium spp. [3], our recent research has identified Alternaria spp. as an emerging pathogen impacting “Rocha” pear orchards, which may contribute to increased post-harvest losses.
Currently, BSP management primarily relies on synthetic fungicides [4]. However, our studies have shown that the effectiveness of these treatments is being undermined by the increasing prevalence of fungicide-resistant strains. This resistance, combined with growing environmental concerns, highlights the urgent need for more sustainable, eco-friendly strategies.
Our research has also demonstrated that the vast majority of phytopathogenic fungi isolated from pears exhibiting symptoms of BSP are capable of producing specific toxins (mycotoxins and/or phytotoxins). These toxins contribute to the fungi's pathogenicity and virulence, posing various health risks to humans and animals [5], [6].
The identification of the various pathogenic fungi affecting 'Rocha' pears, along with the associated risk of toxin production, highlights the complexity of disease management in this crop. These findings highlight the importance of continuous monitoring and the development of integrated BSP management strategies. Overall, our work improves understanding of the fungal threats to “Rocha” pear production, phytopathogenic resistance, and toxin production.
brown spot disease, Rocha pear, Stemphylium, Alternaria, mycotoxins.

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OC9 - Circular Packaging Solutions: Assessing Food-Contact Safety of Recycled-Layer Multilayer Systems

Freire CD[1]; Brotas G[2], Lopes C[1], Carmo B[1]; Barroso S[1], Gil MM[1,3], Pinto FR[1]
[1]MARE - Centro de Ciências do Mar e do Ambiente / ARNET - Aquatic Research Network, ESTM, Politécnico de Leiria, Peniche, Portugal. [2]Silvex, Indústria de plásticos e papéis S.A., Rua das Camélias nº 7, 2130-233 Benavente, Portugal. [3]Colab +Atlantic, Museu das Comunicações, Rua do Instituto Industrial 16, 1200-225 Lisboa, Portugal.
catarina.d.freire@ipleiria.pt

Keywords: Recycled Polyethylene; Multilayer packaging; Food Contact Materials; Overall Migration

Plastic waste from food packaging imposes a serious environmental challenge. Recycling post-consumer plastics can help close the loop, but food safety must be assured. This study explores whether recycled polyethylene (PE) can be safely used in the core layer of three-layer films - contained between virgin polymer layers so that recycled material never touches food directly. By validating overall migration, this study seeks to support the development of safe, circular solutions for food-contact materials through the integration of recycled content.

Fifteen multilayer packaging samples were produced in 3 thicknesses—thin (~22µm), medium (~30µm), and thick (~40µm)—and 3 material groups: all-virgin (samples 1–3), recycled-core (samples 4–9), and recycled-core with known contaminants (samples 10–15). Films were immersed in food simulant A, at 100 °C for 2 h (OM5), following EN 1186 protocols and EU Regulation 10/2011, considering that these are the most suitable conditions for foods with protective peels that are under study (potatoes, carrots and shelled peanuts). After exposure, simulant was evaporated, and the non-volatile residue was weighed. Migration was calculated in mg/dm² of film surface.

All measured migration values fell well below the EU limit of 10mg/dm². Virgin films released almost no residue: 0.02mg/dm² (thin), 0.14mg/dm² (medium) and 1.02mg/dm² (thick). Recycled-core films showed equally low migration. Films with contaminants ranged from 0 to 2.72mg/dm².

The incorporation of recycled PE in the core layer of multilayer food-contact materials demonstrates no significant compromise in terms of food safety, as evidenced by overall migration values that remain well below the legal limit of 10mg/dm² — with most results falling consistently between 0.5 and 1mg/dm². However, it is important to note that the use of recycled PE in direct or indirect food-contact applications is not authorized under existing EU legislation for non-closed and non-controlled loops, highlighting the need for further validation and regulatory development before such materials can be legally implemented in packaging for food applications. These results validate the concept of using recycled content in non-contact layers, supporting a more circular plastics economy in food packaging.

OC10 - Predicting endemic marine toxins in shellfish and identifying emerging threats in Portuguese waters

Costa PR[1,2], Lage S[2], Lopes M[3]
[1]IPMA - Instituto Português do Mar e da Atmosfera, Avenida Doutor Magalhães Ramalho, nº 6, 1495-165, Algés, Portugal.
[2]Centre of Marine Sciences (CCMAR/CIMAR LA), University of Algarve, Campus de Gambelas, 8005-139 Faro, Portugal.
[3]NOVA School of Science and Technology (FCT NOVA), Caparica, Portugal.
prcosta@ipma.pt

Keywords: marine toxins, harmful algal blooms, shellfish, seafood safety

Introduction Harmful algal blooms (HABs) are a recurring natural phenomenon along the Portuguese coast. Toxins produced by a small number of harmful algal species can accumulate in seafood, particularly in filter-feeding bivalve mollusks, such as mussels, oysters, and clams, posing a significant food safety risk. To minimize the risk of acute intoxication from consuming contaminated shellfish, a monitoring program is in place. When toxin levels exceed established safety thresholds, shellfish harvesting is temporarily suspended as a precautionary measure.

Objectives and methods This presentation will cover a range of studies that have been developed at IPMA for early hazard detection, enhanced food safety measures, and regulatory readiness related to seafood contamination by marine toxins.

Discussion and conclusions Although risks to consumers are now reduced due to the monitoring programs in place, impacts to shellfish industry can be high due to frequent occurrence of HABs and subsequent bans to shellfish harvesting. With the goal of supporting the portuguese shellfish production sector, forecasting models based on multiple autoregressive and artificial neural network (ANNs) have been developed to predict toxins concentration in shellfish up to four weeks in advance. In addition to the "classic" toxins, new threats are posed by the occurence of new toxins, as well as the emergence of toxins traditionally associated with other geographical regions now being detected in European waters, including Portugal. This is the case of ciguatoxins, tetrodotoxins and cyclic imines. Also, non-traditional vectors such as gastropods and fish are being evaluated as seafood risk species.

This presentation will show the developed ability to forecast interdictions to shellfish harvesting, and aims to highlight the recent findings of emerging toxins, namely ciguatoxins in fish, tetrodotoxins in gastropods, and cyclic imines in shellfish and seaweed.

OC11 - Microplastics-gut microbiota interactions in an in vitro model of the toddler colon

Fournier E[1], Mercier-Bonin M[2], Etienne-Mesmin L[1] and **Blanquet-Diot S**[1]
[1]Université Clermont Auvergne, INRAE, UMR 454 MEDIS, Microbiologie Environnement Digestif et Santé, 63000 Clermont-Ferrand, France. [2]Toxalim, Université de Toulouse, INRAE, ENVT, INP-Purpan, UPS, 31000 Toulouse, France.
stephanie.blanquet@uca.fr

Keywords: microplastics, in vitro gut models, toddler, microbiota, mucus.

Introduction Microplastics (MPs) have emerged as significant threat due to their widespread prevalence in environments and food chain. The human gastro-intestinal tract is the front door of MPs. However, research on their fate within the digestive system and their impact on resident gut microbes remains limited. This gap is even more pronounced for toddlers, who are characterized by an immaturity of the gut ecosystem and a high exposure to MPs through diet, dust and suckling. This study aimed to investigate, in vitro, the effects of chronic exposure to polyethylene (PE) MPs on the infant microbiota using the newly developed Toddler Mucosal Artificial COLon (Tm-ARCOL) model.
Methodology The Tm-ARCOL was set-up to reproduce the main physicochemical (pH, transit time, anaerobiosis), nutritional (ileal effluent composition) and microbial (mucus- and lumen-associated microbiota) parameters of the toddler large intestine. PE MPs (21 mg) were daily injected for 14 days into bioreactors inoculated with fecal samples (n=4 toddlers from 22 to 30 months). Gut microbiota composition was determined by 16S metabarcoding and microbial activities were evaluated through measurements of gas, short chain fatty acid and volatolomics analyses, prior and after exposure to PE MPs.
Results Exposure to PE MPs induced gut microbial shifts that were dependent on both the donor and the colon microenvironments. Overall, PE MPs exposure led to increased abundances of potentially harmful pathobionts, such as Dethiosulfovibrionaceae and Enterobacteriaceae, along with an unexpected rise in bacterial α-diversity. These structural alterations were associated with a decrease in butyrate production and significant changes in the abundances of VOCs, i.e., a decrease in 8 ester compounds and an overproduction of 7 hydrocarbons following PE MPs ingestion.
Conclusions This study provides the first evidence that exposure to PE MPs can induce perturbations in the gut microbiome of infants. Next steps will be dedicated to investigate the impact of MPs during additional at-risk situations associated with microbial dysbiosis (e.g infant obesity).
Topic relevance These data contribute to a deeper understanding of MPs interactions with toddler microbiome, which is an important step toward a better health risk assessment in this vulnerable population.

OC12 - A Roadmap for Investigating the Neurotoxicity of Food Chemical Contaminants: Cellular and Barrier-Level Effects Along the Gut–Brain Axis

Faria MA, Ramos H, Araújo AM, Melo A, Ferreira IMPLVO
LAQV-REQUIMTE, Laboratory of Bromatology and Hydrology, Faculty of Pharmacy, University of Porto, Portugal.
mfaria@ff.up.pt

Keywords: neurotoxicity, food contaminants, cocktail effects, intestinal barrier, enteroglia, blood brain barrier.

Despite ongoing efforts to reduce food chemical contaminants (FCCs) in the agrifood chain, widespread human exposure remains a major global concern due to their persistence and lifelong nature. Growing evidence links chronic FCC exposure to neurodegenerative diseases (NDs) through neurotoxic mechanisms. The complexity of chemical mixtures in food further heightens health risks, driving new EU initiatives to enhance monitoring and regulation. NDs, particularly Alzheimer's and Parkinson's, pose a serious global challenge, with dementia affecting 57 million people in 2019 and projected to nearly triple by 2050 [1]. Notably, up to 45% of dementia risk is linked to modifiable factors, including exposure to FCCs such as heavy metals, pesticides, mycotoxins, and food processing contaminants—many associated with NDs [2,3].

This work presents a roadmap for investigating the neurotoxicity of FCCs at the cellular and barrier levels along the gut–brain axis, as part of our recently funded project, neuroNAMix. The project employs innovative new approach methodologies (NAMs) using a multi-organ in vitro model that integrates key gut–brain cell types and barriers to assess toxicity along defined Adverse Outcome Pathways. The roadmap consists of two main components: (1) prioritizing FCCs by ranking 100 common compounds based on their ability to cross the intestinal and blood–brain barriers, addressing the complexity of chemical mixtures and emerging contaminants; and (2) investigating both isolated and combined effects of the top five FCCs on neurotoxicity pathways and barrier integrity to elucidate their role in ND disease processes. Our approach focuses on two critical interfaces: (A) the intestinal barrier/enteric glial cells, and (B) the blood–brain barrier/neurons—capturing the dynamic gut–brain interconnection. Ultimately, the project aims to deliver a user-friendly web-based tool to help consumers and stakeholders reduce neurotoxicity risks from dietary exposure.

Overall, neuroNAMix makes a valuable contribution to tackling the complex challenges of FCC exposure and its links to ND diseases. By applying innovative methodologies, filling key research gaps, and aligning with policy priorities, the project remains highly relevant in today's scientific and regulatory context.

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OC13 - Influence of short-term iron and copper exposure on cadmium and lead accumulation in Ulva spp.

Lopes C[1], Freire CD[1], Felício V[1], Barroso S[1], Mourato MP[2], Martins LL[2], Gil MM[1,3], Pinto FR[1]
[1]MARE - Centro de Ciências do Mar e do Ambiente / ARNET - Aquatic Research Network, ESTM, Politécnico de Leiria, Peniche, Portugal. [2]LEAF - Linking Landscape, Environment, Agriculture and Food, Associated Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Lisbon, Portugal. [3]Colab +Atlantic, Museu das Comunicações, Rua do Instituto Industrial 16, 1200-225 Lisboa, Portugal.
claudia.i.lopes@ipleiria.pt

Keywords: Iron; Copper; Cadmium detoxification; Lead detoxification; Seaweed food safety.

Ulva spp., a fast-growing edible seaweed, emerging as a valuable resource for sustainable aquaculture and human nutrition due to its high productivity and rich nutritional profile. Its potential for biofortification with essential trace elements like Fe and Cu is promising. However, seaweeds can also accumulate toxic elements such as Pb and Cd, raising significant food safety concerns. While the European Union has established maximum levels of 3.0 mg/kg dry weight (DW) for Pb and Cd in seaweed, regulatory coverage remains inconsistent, particularly for fresh and minimally processed forms of Ulva, limiting the safe commercialization of biofortified biomass.

This study evaluated how Fe and Cu supplementation influences the retention, mobilization, or elimination of pre-accumulated Pb and Cd in Ulva spp. collected from a coastal site. Algae were incubated for 24 h in artificial seawater supplemented with 1.7 mM or 3.4 mM of Fe or Cu. Samples were collected at 0, 0.5, 1, 2, 5, 12 and 24 h and analysed for Pb and Cd content using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES).

Fe supplementation, particularly at 3.4 mM, significantly reduced internal Pb levels to 0.3 0.5mg/kg DW and maintained Cd below 0.1 mg/kg DW. This indicates that Fe supports both micronutrient enrichment and detoxification. Conversely, Cu supplementation showed mixed effects: while Cd concentrations dropped to near-background levels, Pb concentrations increased, exceeding the European Commission Regulation 2023/915 of 25 April 2023U safety threshold and peaking at ~6.0 mg/kg DW, especially at higher Cu doses. Fe-based biofortification appears to be a safe and effective strategy for enhancing the nutritional profile of Ulva spp. while supporting detoxification of toxic metals. Cu biofortification, although beneficial for Cd removal, may compromise Pb safety if not carefully controlled. These outcomes highlight the potential for tailored biofortification protocols to minimize toxic metal risks.

Importantly, this work underscores the transformative potential of seaweed biofortification when guided by targeted, evidence-based protocols. By bridging nutritional enhancement with metal detoxification, this study lays the groundwork for regulatory innovation and the broader adoption of macroalgae as a next-generation, functional food resource.

OC14 - Brain on plastics: How surface-modified nanoplastics disrupt human neuronal cells

Araújo AM[1], Mota C[1], Enea M[2], Pereira E[2], Reis-Mendes A[1], Fernandes R[3], Pacheco S[3], Lúcio M[4], Martins Lopes C[5,6], Faria MA[1], Ferreira IMPLVO[1], Carvalho M[1,6]

[1]LAQV/REQUIMTE, Laboratory of Bromatology and Hydrology, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, 4050-313, Porto, Portugal. [2]LAQV/REQUIMTE, Laboratory for Green Chemistry, Departament of Chemistry and Biochemistry, Faculty of Sciences, University of Porto, 4169-007 Porto, Portugal. [3]HEMS-Histology and Electron Microscopy, Instituto de Investigação e Inovação em Saúde (I3S), University of Porto, Porto, Portugal. [4]CF-UM-UP, Center of Physics of the Universities of Minho and Porto; LaPMET, Laboratory of Physics for Materials and Emergent Technologies and CBMA, Center of Molecular and Environmental Biology, University of Minho, 4710-057 Braga, Portugal. [5]Associate Laboratory i4HB—Institute for Health and Bioeconomy; UCIBIO—Applied Molecular Biosciences Unit, MEDTECH, Laboratory of Pharmaceutical Technology, Department of Drug Sciences, Faculty of Pharmacy, University of Porto, Porto, Portugal. [6]RISE-Health, Faculty of Health Sciences, Fernando Pessoa University, Fernando Pessoa Teaching and Culture Foundation, 4200-150, Porto, Portugal.

amaraujo@ff.up.pt

Introduction Nanoplastics (NPs) are increasingly recognized as environmental pollutants due to their pervasive presence in food, water, and air. These particles can enter the human body via ingestion, inhalation, or dermal absorption, raising concerns about their potential interaction with biological systems, particularly the nervous system. Despite growing awareness, the neurotoxic effects of surface-functionalized NPs remain poorly characterized. Investigating their neurotoxicity is crucial for evaluating potential human health risks associated with environmental exposure.

Methodology This study investigated the cytotoxic and oxidative effects of three types of polystyrene nanoplastics (PS-NPs) – unmodified PS-NPs (100 nm) and amine- and carboxyl-functionalized PS-NPs (100 nm) — on human SH-SY5Y neuroblastoma cells. Prior to exposure, NP suspensions were characterized and assessed for stability in culture media. Cells were then treated with NP concentrations ranging from 1 to 500 µg/mL for 24 and 48 hours. Toxicity endpoints included cell viability, reactive oxygen/nitrogen species (ROS/RNS) production, NP internalization, and morphological and ultrastructural alterations via microscopy.

Results Functionalized NPs, particularly amine-modified ones, induced the highest-level cytotoxicity, with a clear concentration- and time-dependent reduction in cell viability, particularly at concentrations ≥200 µg/mL. ROS/RNS production was significantly elevated for unmodified and amine-modified NPs at concentrations of 200-500 µg/mL, especially after 48 hours. Transmission electron microscopy revealed distinct subcellular damage patterns, including endoplasmic reticulum dilation, mitochondrial impairment, and Golgi fragmentation, closely associated with NP size, concentration and surface chemistry. Functionalized NPs showed greater cellular uptake, with amine-modified particles exhibiting the highest internalization. Additional signs of autophagy and lysosomal stress were observed, especially in cells exposed to functionalized variants.

Conclusions Surface modification of NPs plays a decisive role in modulating their neurotoxic effects. Amine-modified particles exhibited enhanced cytotoxicity, oxidative stress and internalization, suggesting that surface chemistry is a determinant factor of NP-cell interactions. These findings highlight potential risks associated with exposure to modified NPs.

Topic relevance This research provides critical insights into the neurotoxicity of functionalized NPs, contributing to the broader understanding of foodborne contaminant risks. Given the increasing presence of NPs in the food chain, these findings are directly relevant to public health and food safety regulation.

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POSTERS

P1 - Under the Magnifying Glass: Investigating Aflatoxin B1 and Efavirenz in Mycotoxin-Drug Interactions

Lootens O[1,2,3,4], Vermeulen A[2], De Boevre M[1,3,4], De Saeger S[1,3,4,5]
[1]Centre of Excellence in Mycotoxicology and Public Health, Ghent University, Department of Bioanalysis, Ghent, Belgium. [2]Laboratory of Medical Biochemistry and Clinical Analysis, Ghent University, Department of Bioanalysis, Ghent, Belgium. [3]MYTOX-SOUTH®, International Thematic Network, Ghent, Belgium. [4]Cancer Research Institute Ghent (CRIG), Ghent, Belgium. [5]Department of Biotechnology and Food Technology, University of Johannesburg, Gauteng, South Africa.
orphelie.lootens@ugent.be

Keywords: mycotoxins – pharmacokinetics – aflatoxin B1- efavirenz – PBPK

Introduction Mycotoxins, such as aflatoxin B1 (AFB1), are toxic secondary metabolites produced by fungi that frequently contaminate food in Sub-Saharan Africa (SSA), posing significant health risks. Co-exposure to AFB1 and pharmaceutical compounds, particularly antiretroviral drugs like efavirenz (EFV), is common in this region due to high HIV prevalence. This study investigates the metabolic and pharmacokinetic (PK) interactions between AFB1 and EFV, aiming to better understand potential health implications for exposed populations.
Methodology A liquid chromatography-tandem mass spectrometry (LC-MS/MS) method was developed and validated in accordance with International Council for Harmonisation (ICH) M10 guidelines to detect AFB1, EFV, cytochrome P450 (CYP450) probe substrates, and their metabolites with high specificity and sensitivity. In vitro experiments were conducted to assess the metabolism of AFB1 via key human CYP450 enzymes, primarily CYP1A2 and CYP3A4. Enzyme kinetics parameters, including the Michaelis-Menten constant (Km) and maximum reaction velocity (Vmax), were determined to estimate metabolic clearance of AFB1. A physiologically based pharmacokinetic (PBPK) model was developed and verified to perform simulations between AFB1 and EFV.
Results Using PBPK modeling, the study simulated chronic exposure to AFB1 and its interaction with EFV. The models predicted that EFV, a known inducer of CYP3A4, can significantly alter AFB1 metabolism, potentially increasing the formation of toxic metabolites such as the epoxide intermediate implicated in carcinogenicity. These interactions underscore the potential for altered toxicity in individuals undergoing HIV treatment who are simultaneously exposed to AFB1 through their diet.
Conclusion The findings emphasize the importance of considering drug-mycotoxin interactions in pharmacokinetic risk assessments, especially in regions like SSA where both exposures are prevalent. Induction of metabolizing enzymes by EFV may alter AFB1 toxicity, highlighting a critical need for integrated toxicological and pharmacological evaluations.
Topic relevance This work contributes valuable insight into the complex interplay between mycotoxins and drugs. It underscores the need for more comprehensive co-exposure assessments to inform public health strategies, particularly in resource-limited settings with high mycotoxin and HIV burdens.

P2 - The NATURIST Project: Carbon Paper-based Sensors as Novel Green Detection Tools for Emerging Contaminants

Morais S, Tavares M, Dibo V, Delerue-Matos C, Torrinha A
REQUIMTE-LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida, 431, 4249-015 Porto, Portugal
sbm@isep.ipp.pt

Keywords: Pharmaceutical pollutants, Electroanalysis, Fish, Sensors.

Consumption of fish has been increasing worldwide due to its recognized health benefits with Portugal having the highest in the EU, which also demonstrates its high socioeconomic significance. Conversely, the high population growth worldwide leads to sustainability issues with release of pollutants that may undermine food safety. Pharmaceutical pollutants are of concern due to their rising use in aquaculture, in humans and other anthropogenic activities, inefficient treatment at disposal, and potential bioaccumulation and toxicity.
NATURIST is a multidisciplinary project that aims to develop sensing platforms (miniaturized, portable) to determine pharmaceutical pollutants in environmental matrices and assess food security of the most relevant European aquatic species.
Carbon paper (CP) is used as transducer due to its adjustable size, porosity and high surface/volume ratio. Its combination with nanotechnology to prepare nanostructured surface modifications assure ultrahigh sensitivity, good stability and selectivity, low detection limit, fast response time, and miniaturization of the sensing platforms. Initially, cyclic voltammetry studies are conducted to characterize the electrochemical activity of the pharmaceutical pollutants under scrutiny (bisphenol A, 17α-ethinylestradiol, metformin, among others). After thorough optimization of square-wave voltammetry and/or differential pulse parameters (amplitude, frequency, step potential, analyte electrochemical accumulation, etc.), the as prepared sensors are validated in fish samples, reaching acceptable recoveries and precision.
CP-based sensors emerge as efficient electroanalytical tools while answering technological, socioeconomic, and environmental challenges that are clearly outlined in the 2030 Agenda for Sustainable Development.

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P3 - EFSA's updated risk assessments of arsenic in food

Steinkellner H[1], Schwerdtle T[2]
EFSA Working Group on Arsenic in Food, EFSA Panel on Contaminants in the Food Chain
[1] European Food Safety Authority (EFSA), Parma, Italy. [2] Max Rubner-Institut, Karlsruhe, Germany.
hans.steinkellner@efsa.europa.eu

Keywords: Arsenic, dietary risk assessment

The European Commission asked EFSA to update its 2009 risk assessment on arsenic in food. Three opinions on arsenic were delivered by EFSA in 2024.
In the first opinion on inorganic arsenic (iAs) it was shown that intake of iAs causes a series of adverse health outcomes such as skin, lung or bladder cancer. A reference point (RP) of 0.06 µg iAs/kg body weight (bw) per day was identified based on increases of skin cancer in humans. Main contributors to dietary exposure are rice and drinking water. Comparison of this RP with the estimated exposures showed that the margins of exposure (MOEs) are low (between 2 and 0.2 for) and raise a health concern.
In the second opinion on small organoarsenic species, for monomethylarsonic acid MMA(V), a RP of 18.2 mg/kg bw per day based on reduced bw in rats was identified. For MMA(V), calculated MOEs of ≥ 500 do not raise a health concern. All MOEs were > 500. For dimethylarsinic acid DMA(V) a RP of 1.1 mg/kg bw per day was identified based on bladder tumours in rats. For DMA(V), a genotoxic carcinogen, a MOE of ≥ 10,000 is of low health concern. MOEs were < 10,000 in different age groups and raise a health concern. Main contributors to dietary exposure to MMA(V) and DMA(V) are rice and fish.
In the third opinion, on complex organoarsenic species, an RP for arsenobetaine could not be derived because of a lack of data. But comparing the highest doses in animal studies causing no adverse effects with exposures, resulted in a MOE of ≥ 340 and does not raise a health concern. For glycerol arsenosugar a RP of 3.7 mg/kg bw per day was derived based on neurotoxicity in mice. Comparing highest exposures for seaweed consumers resulted in a MOE of > 1000 indicating no health concern for glycerol arsenosugar. Main contributors to exposures are fish (arsenobetaine), and algae (glycerol arsenosugar). No risk characterisation could be conducted for other complex organoarsenic species, due to the lack of data.

P4 - Acrylamide analysis and risk assessment in ready-to-eat chips marketed in Italy from traditional and novel food matrices

Navarré A[1]; Izzo L[1]; Martínez-Alonso C[2]; Berrada H[2]; **Rodríguez-Carrasco Y**[2]

[1]Department of Pharmacy, Faculty of Pharmacy, University of Naples "Federico II", Via Domenico Montesano 49, 80131, Naples, Italy. [2]Laboratory of Food Chemistry and Toxicology, Faculty of Pharmacy and Food Sciences, University of Valencia, Av. Vicent Andrés Estellés s/n, 46100, Burjassot (Valencia), Spain.
yelko.rodriguez@uv.es and abel.navarredopazo@unina.it

Keywords: Acrylamide, chips, toxic compound, risk assessment.

Acrylamide (AA) is a toxic compound, classified as probably carcinogenic (group 2A) by the International Agency for Research on Cancer (IARC), generated during the cooking of certain foods at high temperatures (>120 ºC), mainly through the Maillard reaction from reducing sugars and amino acids, especially asparagine (AA precursors). Ready-to-eat chips are foods that have traditionally been made with potato, a food with high amounts of AA precursors, although in recent years chips have been marketed with novel matrices such as legumes, vegetables or fruits, and whose cooking process (frying) can generate AA. Therefore, the European Food Safety Authority (EFSA) for European Union, have established benchmark levels for this contaminant in foods (EC Regulation 2017/2158), setting a value of 750 µg/kg in case of potato chips.

Thirty-six samples of ready-to-eat chips made from potato, corn, lentils, vegetable mix and banana marketed in Italy, were investigated to determine their AA content by QuEChERS extraction and analysis by UHPLC-Q-Orbitrap HRMS. These occurrence values were combined with the Italian consumption data (INRAN SCAI IV study) and the margins of exposure (MoE) with the maximum, mean and minimum AA concentrations found in each food matrix were calculated for risk assessment.

Method showed an AA average recovery of 98.7%, a limit of detection (LOD) of 0.98 µg/kg and a limit of quantification (LOQ) of 1.95 µg/kg. The AA concentration was found between <LOQ and up to 730.65 µg/kg, with potato samples containing the highest AA content (177.83 µg/kg), followed by corn (57.07 µg/kg). Any sample exceeded the benchmark level of 750 µg/kg established by EC Regulation 2017/2158. The risk assessment conducted on Italian population data showed a potential health concern for infant population below 3 years, with a MoE <50 (cancer-related effects) for average AA content found in potato, corn and vegetable mix samples, and MoE <126 (neurotoxic effects) for average AA in potato and vegetable mix samples, that could be higher if the total dietary intake of AA, which is not only provided by chips, is taken into account.

P5 - Mercury dichloride and chlorpyrifos induce oxidative stress in neuronal cells

Baños-Doménech L[1], Taroncher M[2], Rodríguez-Carrasco Y[2], Martínez-López E[1], Ruiz MJ[2]
[1]Área de Toxicología. Departamento de Ciencias Sociosanitarias. Grupo de Investigación Oceanosphera. Facultad de Veterinaria. Universidad de Murcia, Campus de Espinardo, 30110, Murcia, España. [2]Área de Toxicología, Departamento de Medicina Preventiva y Salud Pública, Grupo de Investigación RiskTox, Facultad de Farmacia y Ciencias de la Alimentación, Universidad de Valencia, Av. Vicent Andrés Estellés S/N, Burjassot, 46100, Valencia, España.
Yelko.rodriguez@uv.es

Keywords: oxidative stress, mercury dichloride, chlorpyrifos, combination, neurotoxicity

Introduction Pesticides and metals are compounds derived from industrial, agricultural and livestock activities, among others, that persist and accumulate in the environment, remaining within the reach of all types of organisms. Moreover, given their lipophilic characteristics, these compounds bioaccumulate in animal tissues for a long time. Therefore, the study of the toxicity of metals and pesticides is very important, since they carry a high risk to mammals. The mercury dichloride (HgCl2) is a metal that alters neuronal metabolism. Moreover, chlorpyrifos (CPF) is an organophosphate pesticide that irreversibly inhibits acetylcholinesterase and induces various mechanisms of cytotoxicity.
Methodology In this study, the cytotoxicity and oxidative stress of HgCl2 and CPF were evaluated individually and in combination. Cytotoxicity was evaluated by methylthiazoltetrazolium salt (MTT assay). To determine oxidative stress reactive oxygen species (ROS) and membrane mitochondrial potential (MMP) have been assayed in neuroblastoma cells (SH-SY5Y). The concentrations tested were 5, 11 and 22 µM for HgCl2 and 20, 41 and 82 µM for CPF.
Results The IC50 values were 22 µM for HgCl2 and 82 µM for CPF. The interaction between HgCl:CPF (in a 1:3.75 ratio, equivalent to an equipotent concentration) exhibited an antagonistic effect on all fractions affected. Moreover, an increase in ROS was observed at the highest concentration of both compounds individually tested. However, when they were combined, an increase in ROS production was observed at all concentrations and exposure times (120 min) that were tested. Regarding stability of the MMP, alterations were observed at all concentrations of HgCl2 tested. Nevertheless, after exposure to CPF and the combination exposure, the MMP was only affected at the highest concentration. Conclusions: the exposure neuronal cells to HgCl2 and CPF affect decreasing the viability and increasing the oxidative stress.
Topic relevance The impact of chemical and biological contaminants on health.

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P6 - In vitro evaluation of lactic acid bacteria and yeast for fumonisins adsorption

Freire LGD[1], D'Ascsnio V[2], Greco D[2], Abbasciano M[2], Campanale C[2], Cifarelli V[2], Valerio F[2], Oliveira CAF[1], Avantaggiato G [2].
[1]Department of Food Engineering, School of Animal Science and Food Engineering, University of São Paulo, Pirassununga, SP, Brazil. [2]Institute of Sciences of Food Production (ISPA), National Research Council (CNR), Bari, Italy.
lucasgdfreire@usp.br

Keywords: mycotoxin; adsorption; microorganism

Several decontamination methods have been developed to address health issues from mycotoxin contamination in food. Biological methods using microorganisms show promise for reducing mycotoxins' impacts on human and animal health. This study evaluated the efficacy of eight microbial strains in adsorbing fumonisin B1 (FB1) and fumonisin B2 (FB2) in vitro.
In the first trial, the adsorption ability of viable or inactivated strains of Lacticaseibacillus rhamnosus (LR40 and LR100) and Saccharomyces cerevisiae (SC) were tested with 2.5 µg/mL of FB1 and FB2 in microtubes containing live or inactivated microorganisms (109 cells/mL), along with 1 mL of citrate buffer (CIT) at pH 3 and phosphate buffer (PBS) at pH 7. In the second trial, live strains of Leuconostoc mesenteroides (C43.2M and ITEM 19426) and L. citreum (C2.27, LG6, and LP10) had their adsorption capacity evaluated in CIT (pH 3). After two hours of incubation at room temperature in a shaker at 150 rpm, samples were centrifuged, and supernatants were analyzed by HPLC-FLD for residual mycotoxin content.
In the first trial, at pH 3, inactivated microorganisms exhibited significantly higher adsorption ability for FB2, compared with FB1. Adsorption percentages for FB1 and FB2 among the strains tested were, respectively, 0 and 56.0±0.3% (LYO40), 8.9±6.0% and 52.2±11.4% (LYO100), and 6.1±2.0% and 62.3±1.7% (SC). These differences persisted in viable microorganisms under the same pH. However, at pH 7, the differences disappeared, indicating a strong influence of pH on the adsorption percentages. In the second trial, significant differences in adsorption rates between FB1 and FB2 were observed across various microorganisms. Adsorption rates for FB2 and FB1 were, respectively: C43.2M (74.1±1.9% and 31.8±5.1%), C2.27 (74.7±1.9% and 26.4±4.6%), LG6 (70.2±1.1% and 19.4±2.7%), ITEM 19426 (74.4±1.9% and 33.7±2%), and LP10 (75.6±1.3% and 38.5±7.3%). Nevertheless, significant differences among microorganisms were observed only in the adsorption rates of FB1.
This study confirmed that lactic acid bacteria and yeasts can effectively absorb FB2 onto their cell walls, particularly at low pH values.
Microorganisms able of adsorbing fumonisins in vitro can be selected for subsequent in vivo testing, offering a promising strategy to prevent fumonisin-induced toxicity in animals and humans.

P7 - Occurrence of mycotoxins in infant foods traded in Ribeirão Preto, Brazil

Ullah S, Ali S, Pinardi AR, Jager AV, Rosim RE, Oliveira CAF*
Department of Food Engineering, Faculty of Animal Science and Food Engineering, University of São Paulo at Pirassununga, SP, Brazil
Sana Ullah: sanaullah@usp.br (Ullah, S) and *carlosaf@usp.br (Oliveira, C.A.F.)

Keywords: Infant foods, mycotoxins, occurrence, dietary exposure, LC-MS/MS

Mycotoxins are secondary toxic metabolites produced by certain fungi species, whose prevalence in food products poses health risks, particularly to infants due to their lower body weight and immature immunity. This preliminary study was conducted to identify the co-occurrence of mycotoxins in infant foods marketed in Ribeirão Preto, Brazil. Sampling was conducted in May 2024 in several supermarkets for the collection of food products intended for infants and young children, such as infant cereal (n = 20), infant and follow-on formula (n = 12), and dairy products (n = 39). Mycotoxin analysis was achieved using liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS), for determination of aflatoxins (B1, B2, G1, and G2), ochratoxin A (OTA), deoxynivalenol (DON), zeralenone (ZEN), and fumonisins (FBs) FB1 and FB2 in the given samples.

A high occurrence of FBs was observed in 53.5% (38/71) of the analyzed food samples, followed by ZEN (33.8%, 24/71), DON (11.2%, 8/71), OTA (11.2%, 8/71), and AFs (11.2%, 8/71). FBs were detected in nine infant cereals, five infant formulas, and 24 dairy products, at levels ranging from 13.65 to 2,819 µg/kg, 2.17-13.81 µg/kg, and 2.3-76.26 µg/kg, respectively. ZEN range levels of 1.97–9.39 µg/kg, 4.24–22.68 µg/kg, and 2.02–39.66 µg/kg were found in three infant formulas, six infant cereals, and 15 dairy products, respectively. Similarly, DON was reported in three infant cereals (range: 264.03–1265.6 µg/kg) and four dairy products (7.01–31.02 µg/kg), whereas total AFs were determined in five infant cereals (2.62–16.16 µg/kg) and three dairy products (0.63–5.85 µg/kg). OTA occurred in two infant cereals, two infant formulas, and four dairy products, at a range of 32.85–86.77 µg/kg, 0.66–1.15 µg/kg, and 0.29–1.23 µg/kg, respectively. The highest mycotoxin levels of 2,818 µg/kg for FBs, 1,265 µg/kg for DON, 86.7 µg/kg for OTA, and 16.1 µg/kg for AFs were detected in infant cereals, exceeding Brazilian regulatory limits.

These findings indicate that certain infant foods may pose health risks to children in Brazil, highlighting the need for preventive and regulatory measures to minimize mycotoxin contamination during manufacturing.

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P8 - Mitigating Food Contaminants through Biochar Application in Peri-Urban Agriculture: A Case Study with Lettuce Crops in Barcelona

Sánchez, E[1], Carazo, N[1], Matamoros, V[2].
[1] Department of Agri-Food Engineering and Biotechnology, Universitat Politècnica de Catalunya, Barcelona, Spain.
[2] Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain
elena.sanchez.sanchez@upc.edu

Keywords: Biochar; Emerging contaminants; Food Safety; Peri-urban Agriculture; Lettuce

Introduction Peri-urban agriculture plays a key role in supplying fresh produce to cities, but it is increasingly exposed to environmental pollution from nearby human activities, such as traffic, industry, and wastewater discharges. Contaminants transported through irrigation water, including pharmaceuticals, pesticides, and industrial by-products, may accumulate in edible crops, representing a direct threat to food safety and human health. Therefore, effective and sustainable strategies are urgently needed to mitigate the entry of these pollutants into the food chain.

Methodology This study assessed the effect of enriched biochar on the productivity and contaminant uptake of lettuce (Lactuca sativa) cultivated in a peri-urban farm near Barcelona. Over three growing cycles in 2023, two treatments were compared: "Control" (conventional soil with 100 $kg \cdot ha^{-1}$ nitrogen fertilizer) and "Biochar" (soil amended with 10% v/v enriched biochar composed of 70% biochar and 30% eco-compost, with 70 $kg \cdot ha^{-1}$ nitrogen fertilizer). Total fresh weight (TFW) and water content (WC) were recorded to evaluate productivity. Chemical analysis of irrigation water and lettuce tissues focused on the detection of organochlorine compounds, volatile organic compounds, and emerging contaminants, using liquid chromatography–mass spectrometry (LC-MS/MS).

Results Biochar significantly enhanced crop performance, with a 19.7% increase in TFW and a 0.85% increase in WC in biochar treatment compared to control ($p = 2.1e^{-}7$ and $2.96e^{-}13$, respectively). Nineteen contaminants were detected in irrigation water, but only carbamazepine was found above detection limits in lettuce leaves. Concentrations in control averaged 0.19 ± 0.11 ng/g fresh weight, while biochar samples showed non-detectable levels, indicating biochar's effectiveness in reducing contaminant uptake.

Conclusions The application of enriched biochar not only enhanced lettuce productivity but also reduced contaminant uptake in edible tissues. These findings highlight the dual role of biochar in improving soil quality and acting as a sustainable mitigation strategy to reduce food contamination in peri-urban agricultural systems.

Topic relevance This work aligns with ICFC 2025's focus on food contaminants by providing practical evidence of how biochar mitigates the presence of chemical pollutants in food crops, while simultaneously enhancing productivity. It contributes to strategies for risk reduction and sustainability in urban-edge farming systems.

P9 - Optimized digestion protocol for microplastic detection in edible macroalgae using micro-Raman spectroscopy

Rede D[1], Mirón GV[1], Fernandes VC[1,2,3], Vilarinho R[4,5], Moreira JA[4,5], **Delerue-Matos C[1]**
[1]REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernandino de Almeida 431, 4249-015 Porto, Portugal. [2]Ciências Químicas e das Biomoléculas, Escola Superior de Saúde, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida 400, 4200-072 Porto, Portugal. [3]RISE-Health, Centro de Investigação em Saúde Translacional e Biotecnologia Médica (TBIO), Escola Superior de Saúde, Instituto Politécnico do Porto, R. Dr. António Bernardino de Almeida, 400, 4200-072, Porto, Portugal. [4]Departamento de Física e Astronomia, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre s/n, 4169–007 Porto, Portugal. [5]IFIMUP - Instituto de Física dos Materiais Avançados, Nanotecnologia e Fotónica, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal.
cmm@isep.ipp.pt

Keywords: microplastics, macroalgae, Raman spectroscopy, contaminants, food safety

Macroalgae are increasingly consumed for their nutritional and sustainable benefits. However, contamination by microplastics (MPs) poses a concern for food safety [1,2]. Reliable MP detection in these complex matrices requires sample preparation methods that efficiently remove organic matter (OM) while preserving MP integrity for accurate identification [3].

A series of oxidation protocols were tested using commercial Gracilaria gracilis to remove OM. Two oxidative treatments were evaluated: hydrogen peroxide (H_2O_2, 30%) and a 3:1 mixture of H_2O_2 (30%) and potassium hydroxide (KOH, 10%). The parameters tested included algae mass, fractionated or whole oxidant addition, incubation temperature (40-50 °C), incubation time, flask sealing, and addition of propanol to control foam. After optimizing the conditions, 0.250 g of G. gracilis was treated with 10 mL of each oxidant at 40 °C for 15 days. The selected digestion method was then applied to pristine MPs to assess their physical integrity and potential chemical alterations using micro-Raman spectroscopy. Nine polymers were analysed: polypropylene (PP), polystyrene (PS), ethylene-vinyl acetate (EVA), low-density polyethylene (LDPE), unplasticized polyvinyl chloride (uPVC), polyethylene terephthalate (PET), polytetrafluoroethylene (PTFE), polymethyl methacrylate (PMMA), and polyamide 6 (PA6).

Preliminary results showed that H_2O_2 achieved an organic matter (OM) removal efficiency of 96.1% with only one filter required, indicating effective digestion and minimal residues. In contrast, the 3:1 mixture of H_2O_2 and KOH resulted in a lower removal efficiency of 67.2%, requiring filtration through three separate filters, which increased the analysis time via micro-Raman spectroscopy. Regarding MPs integrity, H_2O_2 treatment did not cause structural alterations in PP, PS, LDPE, uPVC, PET, PTFE, PMMA, and PA6. Although some isolated fluorescence changes were observed, no structural damage was detected. Results for EVA were inconclusive due to its yellow coloration.

These findings demonstrate that H_2O_2-based oxidative digestion effectively reduces OM in algae samples while preserving MPs for reliable identification by micro-Raman spectroscopy, which is crucial for monitoring food safety and environmental contamination.
This work presents an optimized digestion protocol for edible macroalgae, preserving MP integrity and enabling micro-Raman detection. It ensures accurate polymer identification and enhances monitoring of marine food contaminants.

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P10 - Polycyclic Aromatic Hydrocarbons in River Water: Assessing Contamination Risks for the Irrigation of Food Crops

Paíga P, Delerue-Matos C, **Ramalhosa, MJ**
REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida 431, 4249-015 Porto, mjr@isep.ipp.pt

Keywords: Environmental pollution; Irrigation water quality; Liquid chromatography (LC); Polycyclic aromatic hydrocarbons (PAHs); Solid-phase extraction (SPE).

The intensification of industrialization and urbanization has led to increased anthropogenic pressure on the environment, resulting in the release of various pollutants. Among these, polycyclic aromatic hydrocarbons (PAHs) are of particular concern [1]. These persistent organic pollutants primarily enter aquatic systems through industrial discharges, urban runoff, waste incineration and the use of petroleum-derived products [2]. In peri-urban areas, where agriculture and urban development are closely intertwined, the quality of irrigation water is crucial for ensuring crop safety and productivity. Using contaminated water for irrigation can lead to harmful substances accumulating in vegetables, posing risks to human health [3]. The aim of this study was to assess PAH concentrations in river water used for irrigation in peri-urban regions and to evaluate the potential risk of crop contamination.

Solid-phase extraction (SPE) was optimized to analyze four target PAHs in river water: benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene and chrysene. The focus of the optimization was on sample preparation parameters, including cartridge type and sample volume. Due to the low aqueous solubility of PAHs, particularly late-eluting compounds, previous studies [4, 5] have suggested adding an organic solvent to enhance solubility and extraction efficiency. Accordingly, the effect of adding an organic solvent prior to extraction was evaluated. Two SPE sorbents (Strata PAH and Strata-X) were tested using sample volumes of 100 and 250 mL. PAH quantification was performed using liquid chromatography with fluorescence detection (LC-FLD).

The Strata PAH cartridge yielded higher recovery rates than the Strata-X cartridge for all target compounds. Adding 25% acetonitrile to water samples prior to SPE significantly enhanced extraction efficiency, with recovery rates around 60% to 100%. Sample volume (100 mL vs 250 mL) had little influence on recovery performance. Following method optimization, the procedure was applied to river water samples.

The optimization of the extraction process was essential to develop an effective method for extracting the target PAHs. The detected PAHs in the analyzed samples were below the limit of detection.

Assessing the presence of PAHs in irrigation water is essential in the context of increasing concerns about food safety, environmental pollution, and human health risks.

Acknowledgments

This work received financial support from the PT national funds (FCT/MCTES, Fundação para a Ciência e Tecnologia and Ministério da Ciência, Tecnologia e Ensino Superior) through the project UID/50006 - Laboratório Associado para a Química Verde - Tecnologias e Processos Limpos.

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P11 - Biogenic Amines Contamination in Fishery Coproducts: A Safety Screening Approach

Moreira MM[1], Ramalhosa MJ[1], Oliveira H[2,3], Pires C[2,3], Delerue-Matos C[1]
[1]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Rua Dr. António Bernardino de Almeida 431, 4249-015 Porto, Portugal.
[2]IPMA, IP - Portuguese Institute for the Sea and Atmosphere, Division of Aquaculture, Upgrading and Bioprospection, 1495-165 Algés, Portugal.
[3]CIIMAR/CIMAR-LA - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, 4450-208 Matosinhos, Portugal.
mmdsm@isep.ipp.pt

Keywords: Aquatic by-products; histamine; safety; chromatographic analysis.

Aquatic products have a rich nutritional composition but are highly susceptible to microbial contamination during storage, which accelerates spoilage. Certain microorganisms present in these products produce amino acid decarboxylases that convert free amino acids into biogenic amines (BAs) [1]. Excessive BAs intake can lead to food poisoning and other adverse health effects [2]. Among them, histamine (HIS) is a primary cause of foodborne illness, while cadaverine (CAD), putrescine (PUT), and tyramine (TYR) can enhance its toxicity [2]. Thus, evaluating BAs formation in aquatic products is essential to ensure food safety. This study investigated the presence of eight BAs — tryptamine (TRP), phenylethylamine (PHE), PUT, CAD, HIS, TYR, spermidine (SPD), and spermine (SPM) — in fishery coproducts to assess their safety incorporation into new products. High-performance liquid chromatography with fluorescence detection (HPLC-FLD) was used to analyse BA levels in five samples, namely salmon heads, hake trimmings and "sawdust", and black scabbardfish heads and bones.

The results revealed significant variability in BAs content across the different fishery by-products. HIS levels were below the legal limit established for fish products (<50 mg/kg) in all samples, except black scabbardfish heads, which showed a concentration of 162 ± 8 mg/kg. TYR levels were also notably high in this sample (134 ± 7 mg/kg). Among the remaining by-products, total BA concentrations were highest in hake "sawdust" (196 mg/kg), followed by salmon heads (98 mg/kg) and hake trimmings (16 mg/kg).

These findings underscore the importance of assessing the safety of fishery by-products before their incorporation into value-added products in the seafood industry. Elevated HIS and TYR levels in black scabbardfish heads, and high total BAs content in hake flour and salmon heads, raise potential safety concerns.

With increasing focus on circular economy and reuse of fishery by-products, this study exposes a gap in food safety regulations. Legal limits exist for histamine in some fish, but thresholds for other biogenic amines and by-products are lacking. Further research and regulatory updates are needed to ensure safe and sustainable reuse of these materials.

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P12 - Chemical contaminant profiling of basil-derived biochar intended for agricultural use: implications for food safety and soil health

Motta T[1], Marques ME[1], **Soares, C**[1], Puga A[1], Alves AR[1], Delerue-Matos C[1]
[1]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Porto, Portugal.
cds@isep.ipp.pt

Keywords: basil, biochar, PAHs, food safety, circular bioeconomy

Biochar is increasingly utilized as a sustainable soil amendment due to its ability to enhance nutrient retention and sequester carbon. However, thermal conversion of plant biomass can produce unwanted chemical by-products, including potentially hazardous contaminants such as polycyclic aromatic hydrocarbons (PAHs) and heavy metals. This study explores the contaminant profile of biochar produced from basil (*Ocimum basilicum* L.), an aromatic herb, to evaluate its safety for use in agricultural systems and its potential implications for food safety and soil health.

Basil biomass was subjected to slow pyrolysis at 500°C (14h) in the absence of an external gas supply, relying solely on the oxygen inherent in the biomass to generate biochar.

The resulting material was analyzed for 16 priority polycyclic aromatic hydrocarbons (PAHs), as listed by the US EPA, using high-performance liquid chromatography (HPLC) with a fluorescence detector after extraction using a mixture of 50:50 acetone:acetonitrile (v:v). Contaminant concentrations were compared against threshold values established in the European Biochar Certificate (EBC) guidelines for soil improvers. Potential risk pathways through soil application and food chain transfer were considered to contextualize findings within a planetary health framework.

Some low- and mid-molecular weight PAHs were detected, including phenanthrene, fluoranthene, and pyrene, with total PAH concentrations below 5.1 mg/kg, complying with the European Biochar Certificate (EBC) threshold for *Premium* quality ($\leq 6.0 \pm 2.4$ mg/kg for $\sum$16 PAHs). Although the contaminant levels did not exceed most regulatory limits, the presence of multiple PAHs emphasizes the importance of consistent quality control, particularly for biochars intended for use in food crop production.

Basil-derived biochar may be a viable soil amendment under controlled production conditions. However, the detection of PAHs — even at moderate levels — highlights the importance of monitoring chemical risks associated with biochar use. This work points out the dual role of biochar as both a tool for circular economic practices and a potential vector for environmental contaminants.

This study addresses the ICFC2025 topics of the Impact of Chemical Contaminants on Health, providing new data on biochar contaminant profiles and their potential implications for sustainable agriculture and food system safety.

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P13 - Method Validation for the Determination of Total Mercury in Foodstuffs by Direct Mercury Analysis (DMA)

Nascimento, Ana C[1]; Santiago, Susana[1]; Santos, Mariana[1]
[1] Food and Nutrition Department, National Institute of Health Doutor Ricardo Jorge, Lisbon, Portugal.
ana.nascimento@insa.min-saude.pt

Key words: Mercury, DMA, foodstuffs, method validation, rapid and precise.

Mercury is a toxic metal that can be transformed by bacteria into methylmercury, a more harmful and bioavailable form, which accumulates in the food chain, particularly in fish and shellfish. Monitoring mercury levels is essential for ensuring food safety, especially to protect vulnerable groups, such as pregnant women, due to its potential impact on foetal development and neurological function. As it is well known, most of the total mercury present in aquatic food is in the form of methylmercury, which reinforces the importance of accurate and reliable analysis, as it's the form most concerning to human health.
The purpose of this study was to validate a method for mercury measurements in food samples, to ensure its accuracy, reliability, and suitability, for applications in food safety, quality control, and regulatory compliance.
A method for total mercury determinations in food matrices was validated, using a Direct Mercury Analyser (DMA-80), based on thermal decomposition, amalgamation, and atomic absorption spectrometry (AAS).
The validated method covers two calibration ranges: from 2.5-15 ng and 30-1000 ng, using two separate calibration curves. Trueness, repeatability and intermediate precision (within-laboratory precision) were assessed using a certified reference material (CRM), NIST 1566b Oyster Tissue, and through interlaboratory comparison tests. Trueness, repeatability, and intermediate precision showed uncertainty values of 11%, 5%, and 8%, respectively. The detection and quantification limits were determined as 0.0014 $mg.Kg^{-1}$ and 0.0038 $mg.Kg^{-1}$. These levels are significantly lower than the maximum levels stablished by Regulation (EU) 2023/915, which sets mercury limits of 0.1 $mg.Kg^{-1}$for food supplements and salt, 0.3 or 0.5 $mg.Kg^{-1}$ for most fish, molluscs and bivalves, and 1.0 $mg.Kg^{-1}$ for large predatory fish. Quality control tools included blanks for contamination checks and two standards measured in each curve, during every experiment, to verify calibration accuracy. Additionally, CRMs must be within their established reference values, and interlaboratory test results must meet a z-score between -2 and 2 to be considered acceptable.
In conclusion, the analysed method is rapid and precise, requires minimal sample preparation, and is suitable for several matrices, with low detection limits and strong analytical performance.

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P14 - Exposure to mycotoxins in the Portuguese adult population

Maris E[1,2], Namorado S[3,4], Chen A[1], Pero-Gascon R[1,5], De Boevre M[1], De Saeger S[1], Silva MJ[3,4], Alvito P[3,6]
[1]Centre of Excellence in Mycotoxicology and Public Health, Faculty of Pharmaceutical Sciences, Ghent University, Belgium. [2]Laboratory of Molecular Bacteriology, Department of Microbiology and Immunology, Rega Institute, KU Leuven, Leuven, Belgium. [3]National Institute of Health Doutor Ricardo Jorge, Lisbon, Portugal. [4]Comprehensive Health Research Center (CHRC), NOVA University of Lisbon, Lisbon, Portugal. [5]Department of Chemical Engineering and Analytical Chemistry, Institute for Research on Nutrition and Food Safety (INSA-UB), University of Barcelona, Spain. [6]Centre for Environmental and Marine Studies (CESAM), University of Aveiro, Aveiro, Portugal.
Elias.Maris@UGent.be

Keywords: mycotoxins, deoxynivalenol, tenuazonic acid, human biomonitoring, chemical exposure, Portugal.

Mycotoxins are toxic fungal metabolites commonly found in food, posing health risks such as immunosuppression, carcinogenicity, and endocrine disruption. Despite regulatory limits, chronic low-level exposure remains a concern. Understanding real-life exposure in populations is essential for effective risk assessment. This study aims to investigate mycotoxin exposure among young adults in Portugal, contributing to evidence-based public health interventions.

This study leveraged data and biospecimens from the INSEF-ExpoQuim survey, a cross-sectional study nested within the Portuguese National Health Examination Survey (INSEF). Data was collected via REDCap-assisted telephone interviews, covering sociodemographic and exposure-relevant variables. A subset of 295 first morning urine samples was collected from adults aged 28–39 years between May 2019 and March 2020. Urine samples were analyzed by a newly optimized and validated LC-MS/MS method targeting 40 mycotoxins and/or their corresponding metabolites in urine. Urinary creatinine was measured using a validated colorimetric method to allow adjustment and standardization of mycotoxin concentrations, ensuring accurate exposure assessment and comparability. This methodological approach enabled a robust characterization of mycotoxin exposure in a representative Portuguese population cohort.

The study included 58% females and 42% males. Most participants had medium to high education, and urbanization was nearly evenly split between towns/suburbs (36.9%) and rural areas (35.9%), with fewer living in cities (27.1%). The majority were employed, and sampling was primarily conducted in summer and autumn. The number of mycotoxin co-exposures in the Portuguese population ranged from 0 to 5, with two simultaneous exposures being most common (n = 160). Among the 40 mycotoxins analysed, deoxynivalenol and tenuazonic acid were most frequently detected, with frequency of detection of 85% and 96%, respectively.

This study offers robust biomonitoring data on mycotoxin exposure in Portuguese young adults using a validated LC-MS/MS method. The high prevalence of deoxynivalenol and tenuazonic acid suggests low-level dietary contamination. These findings support the need for continued monitoring and the integration of

human biomonitoring into national food safety strategies. Detailed sociodemographic analyses are planned to further clarify exposure patterns and enable targeted public health interventions.

P15 - Green extraction strategies for biosensor-based detection of ochratoxin A in feed matrices: a sustainable approach from the *OTASens project*

Campanale C[1], Greco D[1], Santovito E[1], D'Ascanio[1], Sanzani M[2], Lentini G[2], **Avantaggiato G[2]**
[1] Institute of Sciences of Food Production, National Research Council, Via Amendola 122/O Bari, Italy. [2] University of Bari "Aldo Moro", Via G. Amendola 165/A Bari, Italy
giuseppina.avantaggiato@cnr.it

Keywords: mycotoxins, ochratoxin A, deep eutectic solvents, biosensors, aptamers, biomonitoring, feed/food safety

Climate change is significantly impacting food safety by increasing the occurrence of mycotoxin contamination in new geographical areas. Among these, ochratoxin A (OTA) poses a major threat to human and animal health due to its toxicological profile. Rapid, affordable, and sustainable detection methods are needed to monitor OTA along the food and feed chain.

The OTASens project focuses on the development and validation of a DNA aptamer-based biosensor for the fast detection of OTA in the pork production chain. To improve the eco-compatibility and field applicability of the method, special attention has been given to replacing conventional organic solvents with green alternatives for sample preparation.

In this context, we developed and optimized a green extraction protocol using deep eutectic solvents (DES), composed of natural, biodegradable, and non-toxic components. Several DES formulations were tested for their ability to extract OTA from artificially contaminated feed and feed ingredients. One formulation, in particular, achieved extraction efficiencies up to 90%. The extracts were analyzed using HPLC-FLD, confirming that DES-based extraction provided high performance: good linearity ($R^2 \geq 0.99$), low limits of detection (LOD: 0.2 ng/mL) and quantification (LOQ: 0.7 ng/mL), acceptable recovery rates (80–102%), and good precision (RSDr: 2–7%). No matrix effects or interferences were observed.

This green extraction strategy will be integrated into the OTA biosensor workflow for the analysis of real feed samples, ingredients, and biological matrices (e.g., blood) collected from pigs at farms and feed mills in Southern Italy. The combined system aims to provide a user-friendly, on-site, and environmentally sustainable tool for OTA monitoring.

Overall, the replacement of organic solvents with DES represents a significant step forward in making biosensor-based mycotoxin detection more sustainable and accessible, ultimately contributing to improved food safety and risk assessment in animal production systems.

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P16 - The role of a Novel Yeast Cell Wall-Based Product in Preventing Gastrointestinal Disorders caused by exposure to mycotoxins in farm animals

Greco D[1], D'Ascanio V[1], Maqoud F[2], Tricarico D[3], Abbasciano M[1,3], Orlando A[2], Zizzo N[4], Russo F[2], Avantaggiato G[1]
[1]Institute of Sciences of Food Production, National Research Council (CNR-ISPA), Italy. [2]Functional Gastrointestinal Disorders Research Group (IRCCS "Saverio de Bellis), Italy. [3]Section of Pharmacology, Department of Pharmacy-Pharmaceutical Sciences, University of Bari "Aldo Moro", Bari, Italy. [4]Section of Veterinary Pathology and Comparative Oncology, Department of Veterinary Medicine, University of Bari "Aldo Moro", Valenzano, Italy.
donato.greco@cnr.it

Keywords: mycotoxins, yeast cell walls, animal health, feed additives, food security

Mycotoxins, toxic compounds produced by fungi such as Fusarium, Aspergillus, and Penicillium, are prevalent across the feed and food chain and pose significant public health risks due to their carcinogenic, immunosuppressive, and hormone-disrupting effects. Strategies to mitigate these risks include the use of multi-mycotoxin adsorbents as feed additives to limit gastrointestinal absorption and systemic distribution.
This study was aimed to develop novel multi-mycotoxin detoxifying agents (MMDAs) to decontaminate feed and mitigate mycotoxin exposure, following EFSA guidelines. We screened the *in vitro* efficacy of different yeast cell walls-based materials (YCW) in adsorbing some of the regulated mycotoxins with the highest prevalence in feed i.e., aflatoxin B1 (AFB1), zearalenone (ZEA), fumonisin B1 (FB1), and ochratoxin A (OTA). The material with the highest adsorbent performance was then tested *in vivo* on rats. *In vivo* experiments were carried out by administering target mycotoxins (single exposure) to rats (N=9 for each group) with and without YCW co-treatment.
In vitro tests demonstrated YCW's effectiveness in adsorbing AFB1, ZEA, OTA and FB1, though they were ineffective against trichothecenes. *In vivo* results showed that oral administration of YCW to mycotoxins-exposed rats significantly ($p<0.05$) reduced gastrointestinal absorption and urinary excretion of ZEA, OTA, and FB1 approximately by 25%, 30%, 45%, respectively. Toxicokinetic assessments demonstrated a decrease of the area under the curve (AUC_{0-t}) for ZEA, OTA, and FB1, as well as reduction in peak urinary concentrations (C_{max}) of ZEA and FB1, underscoring the product's protective potential. Histopathological examination indicated that YCW alleviated mycotoxin-induced damage to the intestines and liver. Furthermore, biochemical analysis showed that YCW treatment restored serum enzyme levels to normal ranges.
In conclusion, the YCW-based product effectively reduced urinary mycotoxin excretion and alleviated mycotoxin-induced damage. These findings highlight the potential of YCW-based detoxifiers to enhance animal health, limit mycotoxin transfer along the food chain, and ultimately contribute to improved human health by reducing mycotoxin exposure through animal-derived products.

P17 - Systematizing the Diagnostic Approach to Fish-Related Reactions. A Single-Center Experience (2020-2024)

Câmara R.[1], Cosme Ferreira S.[1], Gouveia N.[2]
[1] Serviço de Imunoalergologia, Hospital Central do Funchal – Dr. Nélio Mendonça, Funchal, Portugal.
[2] Direção de Serviços dos Laboratórios Agricolas e Agroalimentares, Secretaria Regional de Agricultura e Pescas
ritacamara@sesaram.pt

Keywords: Fish, Climate change, Allergy, Scombroidosis, Histamine, Ciguatoxin

Introduction Reactions to fish have been increasing globally, with climate change and fish handling proposed as contributing factors. This trend underscores the critical need for a standardized diagnostic methodology for these events.
Methodology We systematically investigated suspected fish reactions using a protocol encompassing detailed epidemiological data (ingested fish species and size, capture location, preservation, cooking methodology, symptom onset interval, and clinical characteristics).
Laboratorial diagnostic workup included total IgE, specific IgE, molecular components, prick and prick-to-prick tests with the implicated fish, and specific IgE for *Anisakis*, alongside its isolation from ingested fish when possible. While intended, histamine concentration measurements in fish and patient serum were often not feasible. Ciguatoxin poisoning was diagnosed by exclusion of other etiologies, supported by epidemiological evidence of toxin-carrying fish, acknowledging that human toxin quantification was not possible yet.
Results From 2020 to 2024, our allergology clinic received 470 patients with suspected food reactions. Of these, 187 (39.8%) were seafood-related, with 65 (13.8%) confirmed as IgE-mediated fish allergy. Scombroidosis was diagnosed in 10 patients (2.1%), and *Anisakis* allergy in only 4 patients (0.9%). Ciguatoxin poisoning was assumed in 2 patients (0.4%). These findings highlight the diverse etiologies and diagnostic challenges of fish-related reactions.
Conclusion The implementation of this comprehensive protocol facilitated a more systematic and specific diagnostic approach to the diverse etiologies of fish-related reactions, which often present with ambiguous clinical pictures. Recent years have seen an increase in both the incidence and precocity of these reactions, potentially linked to evolving eating habits and global warming. While challenges remain in directly confirming histamine or ciguatoxin concentrations, this systematized approach enables more accurate clinical management and the implementation of balanced preventive measures.
Topic Relevance Systematizing the diagnostic approach to an emerging public health issue.

P18 - Intestinal Permeability Studies using a more realistic barrier: performance of co-cultures of Caco-2/HT29-MTX cells

Figueira, CS[1,2], Gravato, C[2], Alvito, P[1,3]
[1]Instituto Nacional de Saúde Doutor Ricardo Jorge, Avenida Padre Cruz, 1649-016 Lisboa, Portugal. [2]Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal. [3]Centro de Estudos do Ambiente e do Mar, Universidade de Aveiro, 3810-193 Aveiro, Portugal.
paula.alvito@insa.min-saude.pt and fc62905@alunos.ciencias.ulisboa.pt

Keywords: *in vitro* transport; intestinal absorption; permeability.

The intestinal barrier, essential for overall health, can have its permeability affected by certain food compounds and additives. Among various models, *in vitro* cellular monolayers are the most commonly used to study this process. Among these, Caco-2 cells—representing enterocytes—are commonly used, though they lack complexity to mimic some properties of the intestinal barrier. This limitation can be overwhelmed by co-culturing it with HT29-MTX cells, which allows the secretion of mucus and mimics goblet cell functioning.

This study aimed to evaluate the intestinal permeability by assessing the paracellular and transcellular transport of lucifer yellow (LY) and propranolol (PR), two intestinal permeability markers, respectively, using a 9:1 co-culture of Caco-2/HT29-MTX cells.

Cells were cultivated separately in complete medium. Functional monolayer formation was monitored over 28 days using transepithelial electrical resistance (TEER) measurements in triplicate plates, with values ranging from 450.6 to 1287.3 Ω·cm². Transport assays were conducted on day 21 by applying LY and PR to the apical compartment and measuring their passage to the basolateral side. Apparent permeability coefficients (Papp) and basal recovery values were estimated by fluorescence quantification.

Statistical analyses were conducted to evaluate variability in TEER, Papp, and basal recovery results. The Shapiro-Wilk test was used to assess normality, and comparisons used one-way ANOVA followed by Tukey's test or the Kruskal-Wallis test followed by Dunn's test when requisites of ANOVA were not met. Significant differences in TEER values were observed between days 8–20 ($p = 5.8e-11$), 22–28 ($p = 2.3e-09$), and before vs. after transport on day 21 ($p < 2.2e-16$). For day 21 transport assays, a significant difference was found in LY basal recovery for two out of three plates ($p = 0.03$). As for the PR Papp values, there is a significant difference between duplicate plates ($p = 0.005$), as one plate was excluded due to a poor calibration curve fit.

These findings will inform improvements to the protocol for assessing intestinal permeability using co-culture models. Thus, Caco-2/HT29-MTX co-culture appears to be a promising model for evaluating the impact of food components and additives on the intestinal barrier.

P19 – Levels of emerging brominated flame retards in food

Pietroń W, Pajurek M, Mikołajczyk S, Warenik-Bany M, Baran M, Jedziniak P
Department of Chemical Research of Food and Feed, National Veterinary Research Institute, Pulawy, 24-100, Poland
wojciech.pietron@piwet.pulawy.pl

Keywords: eBFR, food, pollution, GC-HRMS

Introduction Brominated flame retardants (BFRs), organobromine compounds used to inhibit or slow the ignition of consumer products, have seen a shift in demand following the ban on polybrominated diphenyl ethers (PBDEs). This has led to increased use of emerging BFRs (eBFRs), prone to release from consumer goods. These compounds persist in the environment, biomagnify the food chain, and possess toxic potential. This study aimed to quantify eight eBFRs (TBX, PBT, PBEB, HBB, EH-TBB, BTBPE, BEH-TBPH, DBDPE) in food of animal origin.

Methodology Between 2020 and 2021, 81 food samples were collected, including milk (n=20), farm animal meat (n=21), marine fish (n=18), river fish (n=13), and chicken eggs (n=9). The analytical procedure was based on the isotopic dilution method and gas chromatography–high-resolution mass spectrometry (GC-HRMS).

Results At least one eBFR was detected in all analyzed samples. PBT and HBB were ubiquitous, found in every sample, while PBEB remained below the limit of quantification (LOQ = 0.005 ng/g wet weight) in all cases. The median ∑eBFR content was lowest in river fish (0.0134 ng/g w.w.) and highest in farm animal meat (0.379 ng/g w.w.). Their concentrations ranged from 0.007 ng/g w.w. in herring to 6.70 ng/g w.w. in chicken meat.

Conclusions and topic relevance The presence of eBFRs in food of animal origin highlights environmental contamination, food chain transfer, and potential consumer exposure. Monitoring eBFR concentrations in food is crucial, as their widespread use in commercial products could elevate consumer risk.

P20 - Polycyclic aromatic hydrocarbons in honey from the Natural Park of Montesinho: A tool to assess environmental contamination

Soares, D[1], Fernandes, V[1], Oliveira, M[1], Soares, S[1], **Delerue-Matos, C**[1], Ramalhosa, MJ[1]
[1]REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Porto, Portugal
cmm@isep.ipp.pt

Keywords: Honey, Natural Park of Montesinho, Environmental contamination, Polycyclic aromatic hydrocarbons, Food safety.

Honey is a highly valued natural product with significant nutritional and health properties [1]. However, environmental contamination and climate change increasingly impact its quality and authenticity. As a result, honey is gaining attention as a potential bioindicator of environmental quality [2].

This study aims to assess the presence of polycyclic aromatic hydrocarbons (PAHs) in honey samples from the Natural Park of Montesinho (NPM), a protected area in northern Portugal characterized by its rich biodiversity and relatively preserved ecosystems. A total of nine honey samples were collected from different apiaries within the park. PAH extraction was carried out using the method QuEChERS (Quick, Easy, Cheap, Effective, Rugged and Safe) and quantification were performed using High-Performance Liquid Chromatography (HPLC).

Total PAH concentrations ranged from 1.24×10^{-2} to 5.83×10^{-2} µg/g of honey. The most abundant compounds were naphthalene, phenanthrene, fluorene, and anthracene. The presence of these PAHs is likely associated with nearby sources such as vehicular emissions and agricultural activities. These results suggest that even honey produced in relatively preserved ecosystems may be vulnerable to contamination from diffuse anthropogenic sources.

The detection of PAHs in honey from the NPM highlights the potential of this matrix as a sentinel for environmental pollution. It also raises awareness about the need for regular monitoring of contaminants in honey, even in protected areas.

This research advances the determination methods for emerging contaminants by demonstrating the effectiveness of QuEChERS coupled with HPLC as a sensitive analytical approach for detecting trace-level PAHs in complex biological matrices. The methodology provides a cost-effective and reliable tool for monitoring these persistent organic pollutants, contributing to both environmental quality assessment and food safety protocols. These analytical advances enable better identification of pollution pathways and support the development of targeted mitigation strategies for protecting both natural ecosystems and regional food products.

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“Honey+-New reasons to care honey from the Natural Park of Montesinho: A bioindicator of environmental quality & its therapeutic potential” and received financial support.

P21 - Global assessment of fusarium mycotoxins, HT2 and T2 occurrence

Edwards, S. G.
Harper Adams University, Newport, Shropshire, UK TF10 8JH

Keywords: Fusarium mycotoxins, HT-2 toxin, T-2 toxin, cereals, oats, global occurrence

Introduction The fusarium mycotoxin type A trichothecenes, HT2 and T2 are produced on small grain cereals predominantly by Fusarium langsethiae, they are produced on the same metabolic pathway, and as T2 is rapidly metabolized into HT2 after ingestion the combined concentration (HT2+T2) is assessed with regards exposure. HT2 and T2 were first identified at high concentrations in cereal grains in the late 1990s during studies on Norwegian oat crops.
Methodology A global survey of occurrence was conducted by JECFA (Joint WHO/FAO Expert Committee on Food Additives and contaminants) in 2020 (JECFA, 2023). The survey considered submissions to the GEMS/Food database for HT2 and T2 from 2000 to 2019. After data cleaning and calculation of the combined concentration of HT2+T2 there were ca. 50,000 samples analysed from 2000 to 2019.
Results Comparison of analyses for HT2 and T2 across global regions identified stark differences in the number of tests reported, the distribution of foodstuffs analysed and the analytical results. Most of the analytical records were submitted by the European Region, with limited numbers submitted by a few countries within the other regions. HT2 and T2 levels reported in Europe were much higher in cereals and any food category that may contain cereals. More detailed analysis of the European dataset showed that the highest levels were detected in oat, maize, barley and wheat grain (LB mean concentrations of 241, 24, 17 and 5 µg/kg, respectively).
Conclusions The global occurrence of HT2 and T2 is largely restricted to European cereals and in particular oats. In a subsequent meeting, the JECFA Committee set a group Tolerable Daily Intake for HT2, T2 and diacetoxyscirpenol of 25 ng/kg body weight/day and estimated the lower bound mean range of exposure of 0.3 – 53 ng/kg body weight/day indicating a possible health concern (JECFA, 2024).

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P22 - Biodegradation of Ochratoxin A for Enhanced Food Safety

Santos J[1], Oliveira C[1,2], Teixeira F[2], Venâncio A[1,3], Silva C[1,3]
[1]Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal. [2]Centre of Chemistry, University of Minho, Campus of Gualtar, 4710-057 Braga, Portugal. [3]LABBELS - Associate Laboratory, 4710-057 Braga, 4800-058 Guimarães, Portugal.

Keywords: ultrapure water; enzymatic degradation; ochratoxin A; lipase; food detoxification

Ochratoxin A (OTA) is a mycotoxin commonly found in food, posing serious health risks. Its removal is a priority of public health, and enzymatic degradation has emerged as a promising mitigation strategy [1,2]. Among the enzymes studied, Porcine Pancreatic Lipase (PPL) stands out for its catalytic efficiency and lower cost compared to other commercial lipases [3]. However, most studies have used phosphate-buffered solutions, overlooking the solvent's impact on enzymatic activity. Considering that phosphate intake has been associated with cardiovascular risk [4], safer and greener alternatives such as ultra-pure water should be explored.

This study evaluated PPL activity in ultra-pure water compared to buffered systems. In vitro degradation assays were conducted using OTA as the target compound, under controlled temperature and pH. The enzyme's structural integrity and conformational behavior were assessed using molecular modelling and circular dichroism. Additional model compound studies using p-nitrophenyl octanoate (p-NPO) were included to evaluate general catalytic trends.

PPL achieved complete OTA degradation in ultra-pure water within 7 hours at 44 °C, while only partial degradation occurred in phosphate buffer. After 4 hours, 91% of OTA was degraded in water, compared to 12% in buffer. PPL also showed greater stability in water, with a half-life of 4h 4min versus 2h 30min in phosphate. Experiments with acetate, citrate, and borate buffers confirmed that OTA degradation is more effective in low-conductivity, acidic conditions like those of ultra-pure water. Interestingly, degradation of p-NPO was faster in buffer, possibly due to a salting-out effect. Structural analysis revealed that PPL adopts a more favorable conformation in water, enhancing OTA binding and catalytic efficiency.

Ultra-pure water improves both the stability and activity of PPL, making it a viable alternative to traditional buffers. The choice of solvent plays a critical role in the enzymatic degradation of OTA.

This work supports greener, safer methods for food detoxification and aligns with sustainable practices in industrial mycotoxin mitigation.

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P23 - LC-MS/MS Analysis for the detection of bisphenols in marine bivalves

Kvrgić K[1], Bogdanović T[2], Listeš E[2], Listeš I[2], Petričević S[2], Jažo Z[2], di Giachinto F[3], Sokolić D[4], Pleadin J[5]
[1]Croatian Veterinary Institute, branch Rijeka, Rijeka, Croatia; [2]Croatian Veterinary Institute, branch Split, Split, Croatia; [3]Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale", Water Biology Unit, Teramo, Italy; [4]Croatian Agency for Agriculture and Food, Osijek, Croatia; [5]Croatian Veterinary Institute, Zagreb, Croatia
kvrgic.vzr@veinst.hr

Keywords: bisphenols, LC-MS/MS, bivalves, matrix effect

Bivalve shellfish are of both nutritional and economic importance and serve as valuable bioindicators of environmental pollution due to their water-filtering capabilities and their capacity to bioaccumulate pollutants. Among anthropogenic pollutants, bisphenols (BPs) - especially bisphenol A (BPA) - have emerged as substances of concern due to their high reproductive toxicity and endocrine disrupting potential, jeopardising both human health and the environment.

Robust analytical methods such as liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS) are essential for the accurate quantification of BPs in various bivalve species, which represent a highly complex biological matrix. Such methods support a standardised and reliable approach to the use of bivalves as model organisms for the assessment of xenobiotic pollution, in light of the importance and necessity of continuous monitoring of BPs in the marine environment. In method development, the matrix effect is a critical parameter that needs to be thoroughly investigated. LC-MS/MS, an analytical technique where coeluting matrix components can affect ionisation efficiency, can lead to inaccurate quantification. As part of the Plasticshell project, the matrix effect was assessed by comparing calibration standards prepared in 15% aqueous methanol with matrix-matched standards. Blank extracts of five bivalve species — Mytilus galloprovincialis, Ostrea edulis, Chlamys varia, Callista chione and Venus verrucosa — were subjected to solid phase extraction (SPE) and spiked with a standard solution containing BPA, BPB, BPF, BPAF and BPS.

The slopes of the calibration curves in pure solvent were compared with the slopes of the matrix-matched curves. The results showed significant ion suppression for all BPs when using LC-MS/MS in negative ionisation mode, even with SPE purification. The degree of suppression ranged from 53% for BPB in C. chione to 92% for BPAF in C. varia.

These results show that the analytical method needs to be further refined to ensure reliable detection and quantification of BPs in bivalves from the eastern coast of the Adriatic Sea, which has implications for the assessment of environmental and human exposure to these contaminants.

P24 - Food and Nutritional Literacy for school-aged children don't address food toxicology domains – a narrative minireview

Trivedi V[1], Gonçalves C[2], Bento A[3], and **Carrola SJ[2]**

[1]Student of Nutrition Science, School of Life and Environmental Science (ECVA), University of Trás-os-Montes and Alto Douro (UTAD), Vila Real, Portugal.
[2]Centre for the Research and Technology of Agro-Environmental and Biological Sciences (CITAB, INOV4Agro), University of Trás-os-Montes and Alto Douro (UTAD), Vila Real, Portugal.
[3]National Health Institute Doutor Ricardo Jorge (INSA), Department of Food and Nutrition (DAN), Portugal.
joao@utad.pt

Key-words: food literacy, nutritional literacy, food toxicology, school-aged children, Portugal, food safety, contaminants, health education

Food and nutritional literacy (FNL) has become an essential educational strategy to promote healthy eating behaviors and informed food choices among children [1, 2]. While several interventions targeting school-aged children have been implemented in Portugal, they have predominantly focused on nutrition, food groups, and healthy eating guidelines [3, 4]. This narrative minireview critically examines the extent to which existing FNL programs in Portugal address food toxicology domains, including cooking-derived toxicants (e.g., acrylamide, heterocyclic amines), contaminants from packaging materials (e.g., bisphenol A, phthalates), and other chemical hazards such as pesticide residues, mycotoxins, and heavy metals.

A narrative literature search was conducted in PubMed to identify food literacy programs and educational interventions targeting Portuguese children aged 6–18. A total of 4 programs and initiatives were included for analysis [5 - 8].

The findings reveal a significant gap: none of the identified FNL interventions explicitly addressed food toxicology or included modules that raised awareness about potential risks associated with food contaminants, cooking practices, or packaging materials. While some programs touched on food safety in general terms (e.g., hygiene, expiration dates), critical toxicological concepts were absent. This omission suggests a narrow interpretation of food literacy, primarily limited to nutritional knowledge and behavioral components, overlooking the broader competencies needed to assess food safety risks in modern food environments.

Given the increasing exposure of children to processed foods, environmental contaminants, and potentially harmful food-handling practices, integrating toxicology-related content into FNL programs is both timely and necessary. Enhancing children's capacity to critically understand not only the nutritional value but also the toxicological risks of food can empower healthier and safer food choices, support regulatory literacy, and foster long-term food citizenship.

This review highlights the urgent need to expand the scope of food and nutritional literacy to include food toxicology domains, particularly in school-based curricula and public health interventions targeting younger populations in Portugal.

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P25 - When 1 + 1 ≠ 2: modelling non-additive neurotoxic effects of food contaminant mixtures in SH-SY5Y cells

Ramos H, Araújo AM, Ferreira IMPLVO, Faria MA
LAQV-REQUIMTE, Laboratory of Bromatology and Hydrology, Faculty of Pharmacy, University of Porto, Porto, Portugal
mfaria@ff.up.pt

Keywords: neurotoxicity, SH-SY5Y cells, food contaminants, interactions, Chou-Talalay method, CISNE model, aflatoxin B1, cadmium, acrylamide, combination index

Neurodegenerative diseases (NDs), particularly Alzheimer's (AD) and Parkinson's (PD) diseases, are a pressing global health challenge, with dementia affecting 57 million people in 2019 and expected to nearly triple by 2050 [1]. Despite NDs multifactorial nature, up to 45% of dementia risk is linked to modifiable factors, including environmental exposures [1]. Diet represents a major exposure route to environmental and food-related chemical contaminants (FCCs), such as heavy metals, pesticides, mycotoxins, food processing contaminants, many of which are associated with NDs [2,3]. Traditional toxicology has focused on single-compound evaluations, overlooking the complexity of real-life exposure to mixtures.

This study reports in vitro interactions between different FCCs classes through cytotoxicity studies in SH-SY5Y neuroblastoma human cells, using the combination index (CI) method via the Chou-Talalay (CT) model and CISNE model [4,5]. These models differ in how they fit experimental data to the median-effect equation. Cytotoxicity of isolated FCCs, acrylamide (ACR; 0.08-10 mM), aflatoxin B1 (AFB1; 0.8-100 μM), cadmium (0.8-100 μM) and cypermethrin (CYP; 1.95-250 μM), and binary, ternary and quaternary FCCs mixtures was evaluated via MTT assay after 72 hours of exposure.

Individual exposure to contaminants reduced SH-SY5Y viability in a concentration-dependent manner, presenting the following toxicity rank: Cd > AFB1 > CYP > ACR. Globally, CISNE adjusts experimental data better than CT specially at extreme effects. At pertinent levels for food exposure (IC05), most binary combinations were evaluated as antagonistic (CI>1) in both CT and CISNE model, though some yielded divergent results. ACR/AFB1 was deemed additive by CT and moderately synergistic by CISNE (DRI: 4.79 for ACR, 1.89 for AFB1). AFB1/Cd yielded contrasting outcomes: CT indicated synergy (CI=0.51), while CISNE indicated moderate antagonism (CI=1.38). Additionally, a complex mixture of FCCs at realistic dietary ratios induced a 10% inhibition of cell viability.

Limited information is available on the adverse effects of long-term exposure to complex, food-relevant chemical mixtures at low, realistic levels. These findings help address this critical gap by revealing non-additive – and sometimes unexpected – neurotoxic effects from combined FCC exposure, underscoring urgent need for improved models and regulatory guidance that account for interactive effects in risk evaluations.

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P26 - In vitro gut models are helpful for microplastic–microbiome interactions

Fournier E[1], Mercier-Bonin M[2], Blanquet-Diot S[1], Etienne-Mesmin L[1]
[1] Université Clermont Auvergne, INRAE, UMR 454 MEDIS, Microbiologie Environnement Digestif et Santé, 63000 Clermont-Ferrand, France
[2] Toxalim, Université de Toulouse, INRAE, ENVT, INP-Purpan, UPS, 31000 Toulouse, France
lucie.etienne-mesmin@uca.fr

Keywords: microplastics, in vitro models, mucus, gut microbiota, age

Introduction Microplastics (MPs) are recognized as a global threat due to their prevalence in environments and food chain. The gastro-intestinal tract (GIT) is the front door of MPs, but to date, the fate and potential effects of MPs in the human digestive environment remain largely unknown. This study aimed to investigate the effects of chronic ingestion of virgin MPs of polyethylene (PE), the most manufactured plastic polymer worldwide, on the gut microbiota using in vitro systems reproducing the colonic environment of adults (Mucosal Artificial COLon, M-ARCOL) and infants (Toddler Mucosal Artificial COLon, Tm-ARCOL).
Methodology These in vitro models reproduce the main physicochemical (pH, transit time, anaerobiosis), nutritional (ileal effluent composition) and microbial (mucus- or lumen-associated microbiota) parameters of the human colon. Bioreactors were inoculated with fecal samples (n=4 adults, n=4 infants) and PE MPs (21 mg) were daily injected for 14 days. The activity (gaz, SCFA) and composition (16S sequencing) of the gut microbiota were determined prior and after exposure to PE MPs. The indirect impact of gut microbe metabolites after exposure to PE MPs on the intestinal barrier was evaluated using a co-culture (Caco-2 and mucus-secreting HT29-MTX cells).
Results We report that PE MP impact on gut microbiota was donor-dependent and resulted in an increase abundance of potential pathobionts, like Enterobacteriaceae, regardless of age conditions. Exposure to PE MPs was associated with a significant decrease in butyrate production in infants, while skatole levels were significantly increased in adults. Conversely, no significant impact of PE MPs on the intestinal barrier, as mediated by changes in gut microbial metabolites, was evidenced.
Conclusions This pioneering work provided significant insights into PE MPs interactions with human gut microbiota and intestinal barrier of two age groups, under relevant human colonic conditions. Next steps will be dedicated to study the impact of MPs on at-risk populations such as pathological situations associated with gut microbial dysbiosis (e.g obesity).
Topic relevance These data will enhance understanding of MPs interactions with physicochemical and microbial parameters in the human GIT, supporting better human health risk assessment.

P27 - Contaminant chemical elements in marine invertebrates from frozen fishery industries and bivalve production areas in Portugal

Gonçalves, S[1], Silva, J[1], Bandarra, NM[1,2], Lourenço, HM[1,2]
[1]Portuguese Institute for the Sea and Atmosphere, Av. Dr. Alfredo Magalhães Ramalho, 1495-165 Algés, Portugal.
[2]Interdisciplinary Center for Marine and Environmental Research (CIIMAR), 4450-208, Matosinhos, Portugal.
sgoncalves@ipma.pt

Keywords: marine invertebrates, cadmium, total mercury, lead, total and inorganic arsenic.

Marine invertebrates are much appreciated in Portugal. However, contaminant chemical elements as arsenic (As), cadmium (Cd), lead (Pb) or mercury (Hg), can occurred in these organisms due to anthropogenic or natural sources, constituting a hazard to human wealth. Thus, the aim of this work was to evaluate these four chemical elements in some marine invertebrates.
Cephalopods and crustacean samples analyzed in this study came from frozen fishery industries in Portugal. Bivalves were collected in several production areas on the Portuguese mainland within the scope of National Bivalve Mollusc Monitoring System (SNMB) of IPMA.
Mercury, Cd and Pb were analyzed by atomic absorption spectrometry (AAS) according to EPA method 7473:1998 and NP EN 14083:2003, respectively. Total As was determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS), using the method described in EN 17851:2023. Inorganic As (iAs) was determined by HPLC-ICP-MS based on EN16802:2016.
All total Hg levels found in this work were below the permitted limit of 0.50 mg/kg by EU regulation 2023/915. Regarding Cd and Pb, the samples showed a range of levels, but the limits allowed by the EU were never exceeded. In what concerns As, although total As was sometimes higher than 5 mg/kg, iAs values were considered low and sometimes were lower than the quantification limit (0.010 mg/kg).
As a general conclusion, this work reinforces that most marine invertebrates marketed by the frozen product industries (cephalopods and crustaceans) or bivalves produced in various production areas in mainland Portugal do not represent a danger to human consumption. Greater efforts must be made to analyse iAs given that European legislation will soon be issued with limits for some fishery and aquaculture products.

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P28 - Determination of ochratoxin A in newly regulated matrices: preparing the inter-laboratory validation study

Debegnach F[1], Lucchetti D[2,3], De Santis B[1], Grieco ME[1], Scialò G[1], Droghei B[2,3], Delfino D[2,3], Mauti T[2], Mancuso M[2], Nicolini V[2] and Russo K[2]
[1]Italian Reference Laboratory for mycotoxins, Istituto Superiore di Sanità (ISS), Rome, Italy. [2]Direzione Operativa Chimica, Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "M. Aleandri", Rome. Italy. [3]School of Specialization in Food Science, University of Tor Vergata, Rome, Italy.
francesca.debegnach@iss.it

Introduction Over the past five years, mycotoxin regulations have advanced significantly, introducing new provisions for maximum levels, sampling, and analysis. Among mycotoxins, ochratoxin A (OTA) has received particular attention due to its widespread occurrence in a wide range of foods. The availability of standardized analytical methods is essential for official laboratories conducting regulatory controls. However, a gap remains for validated multi-matrix methods, especially for certain foods of animal origin and nuts.
Methodology This study aimed to address this gap by developing and validating a method for the determination of OTA in cheese and pistachios. OTA contamination can arise either directly from fungal infection of plant substrates or during the curing process of animal-derived foods. Notably, OTA has been detected in cured pork products and hard cheeses. The Italian National Reference Laboratory (NRL), in collaboration with Istituto Zooprofilattico Sperimentale (IZS) of Lazio and Tuscany, have developed and validated in-house a method for the LC-MS/MS determination of OTA in cheese and pistachio samples. The method was applied for homogeneity and stability checks on selected batches of contaminated cheese and pistachios and the characterized materials were used in a multi-matrix inter-laboratory validation study (IVS).
Results The single-laboratory validation demonstrated satisfactory performance across the working range tested for both cheese and pistachio matrices. Homogeneity and stability tests confirmed the suitability of the selected materials for the IVS. In May 2025, the IVS was launched, engaging 16 public laboratories from nine different EU countries.
Conclusions The developed method provides a robust and validated option for OTA determination in cheese and pistachios, addressing a critical gap in official control capabilities. The successful launch and participation in the IVS highlight the method's applicability and the importance of collaborative validation efforts.
Topic Relevance This work is highly relevant to food safety authorities and official control laboratories to support harmonized mycotoxin monitoring and enforcement across the EU. The study also underscores the need for continued development and validation of multi-matrix methods to keep pace with evolving regulatory requirements and food safety challenges.

P29 - Occurrence of relevant mycotoxins in Italian pet food

De Santis B[1], Lucchetti D[2,3], Debegnach F[1], Grieco ME[1], Scialò G[1], Droghei B[2,3], Delfino D[2,3], Nicolini V[2] and Russo K[2]
[1]Italian Reference Laboratory for mycotoxins, Istituto Superiore di Sanità (ISS), Rome, Italy. [2]Direzione Operativa Chimica, Istituto Zooprofilattico Sperimentale del Lazio e della Toscana "M. Aleandri", Rome, Italy. [3]School of Specialization in Food Science, University of Tor Vergata, Rome, Italy.
barbara.desantis@iss.it

Introduction Feeding pets with commercially prepared pet foods is a widespread habit and it represents a simple and economical way to satisfy their nutritional needs. For animal feed safety, EU legislation has set maximum limit for AFB1 and recommended values for OTA, DON, FBs, T-2 and HT-2 toxins and ZEN. The aim of this study is to investigate the presence of the most relevant mycotoxins in pet foods for dogs and cats, commercially available in Italy.
Methodology Forty-eight samples of pet food were purchased from large retailers and pet stores and categorized into three price ranges: high, medium, and low. The homogenized samples were analyzed using an accredited multi-mycotoxins screening method. Positive samples (>LOQ) were subjected to confirmation by a LC-MS/MS method with immunoaffinity column purification. Fourteen mycotoxins were quantified, with instrumental LOQs set at 0.5 µg/kg for AFB1 and AFs, 100 µg/kg for FB1 and FB2, 6 µg/kg for T-2 and HT-2 toxins, 1.5 µg/kg for OTA, 250 µg/kg for DON and its metabolites, and 25 µg/kg for ZEA.
Results Mycotoxins co-occurrence was observed in 42% of the analyzed samples, with different prevalence rates across the three price categories (20% of the high-price, 50% of the medium-price, and 64% of the low-price samples). The most commonly detected toxins were FBs, T-2 and HT-2 toxins, DON, and AFB1. One high-price sample exceeded the recommended value for T-2 and HT-2 (0.050 mg/kg for the sum), with confirmed concentrations of 0.070 mg/kg for T-2 and 0.293 mg/kg for HT-2 (sum=0.362 mg/kg).
Conclusions This kind of monitoring is of up most interest for the animal health purpose to deepen the problem of the simultaneous exposure to multiple mycotoxins for animals in addition to humans.
Topic Relevance Pets are often fed the same type of diet for relatively long periods of their lives. Therefore, it is important to verify contamination trends and plan periodic monitoring of mycotoxins in pet food to survey the health risks of dogs and cats arising from possible exposure to mycotoxins, even at low levels of contamination.

P30 - Phenolic compounds profile and chemometrics analysis for adulteration markers identification in roasted and ground coffee

Couto, CC[1], Chávez, DWH[2], Nascimento, LSM[3], Santiago, MCPA[3], Jesus, MSC[3], Pacheco, S[3], Borguini, RG[3], **Freitas-Silva, O**[3]

[1]Universidade Federal do Estado do Rio de Janeiro, Av. Pasteur, 296 – 22290-240 – Rio de Janeiro, RJ – Brasil. [2]Universidade Federal Rural do Rio de Janeiro – Depto. De Ciência e Tecnologia de Alimentos, Rod. BR 465, km 7- 23890-000 – Seropédica, RJ – Brasil. [3]Embrapa Agroindústria de Alimentos, Av. das Américas, 29501 – 23020-470 – Rio de Janeiro, RJ – Brasil.

otniel.freitas@embrapa.br

Keywords: authenticity, fraud, chromatography, cereal, hierarchical clustering, syringic acid

Introduction The food supply chain involves various agents that work across multiple sectors in a coordinated effort to deliver food that meets the standards for human consumption. Coffee has a highly complex production chain and considerable commercial value, being one of the most widely consumed beverages globally. As such, it has frequently been subjected to fraudulent practices. Consequently, detecting impurities and adulterants in coffee is crucial, as these factors can significantly impact the quality of the beverage, leading to economic damage and posing public health concerns. Numerous studies have applied other analytical techniques to detect and control food fraud, and to contribute to new approaches in this area, this work aimed to identify potent markers of adulteration in roasted and ground coffee through the determination of flavonoids and phenolic compounds with high-performance liquid chromatography (HPLC).

Methodology Pure samples of Coffea arabica and C. canephora, processed at dark and very dark roasts, were analyzed alongside common adulterants, including coffee by-products (husks, twigs, and leaves) and low-cost matrices (maize, barley, wheat, and assai seed). Chromatographic profiling was performed in conjunction with chemometrics tools, including Tukey's test and partial least squares discriminant analysis (PLS-DA).

Results it was possible to identify 4-hydroxybenzoic acid in the free and bound fractions as a marker for assai seed. Additionally, vanillic and syringic acids also stand out in the bound fractions as potential markers for twigs. The PLS-DA and its coordinates clustering revealed that coffee by-products (husks and twigs) and low-cost raw materials (maize, barley, and wheat) were grouped closely with C. arabica, indicating similarity in their phenolic compound profiles.

Conclusions HPLC combined with chemometric approaches demonstrated promising potential for discriminating genuine C. arabica and C. canephora from adulterants such as assai seeds and coffee husks.

Topic relevance Employing accurate and sensitive analytical methods is crucial for identifying and quantifying adulterants in roasted and ground coffee, as this represents an illegal practice that undermines consumer trust and public health concerns.

P31 - Removal of patulin by Lacticaseibacillus casei BGP 93 during apple juice storage

Pereira, CB[1], Anjos, MR[2], **Freitas-Silva, O**[2], Rosenthal, A[2], Ferreira, EHR[1]
[1]Food Technology Department, Technology Institute, Federal Rural University of Rio de Janeiro, Rodovia BR 456, km 7, Seropédica, RJ, Brazil. [2]Embrapa Food Technology, Avenida das Américas, 29501, Rio de Janeiro (RJ) 23020-470, Brazil.
otniel.freitas@embrapa.br

Keywords: patulin, Lacticaseibacillus casei, mycotoxin, apple juice

Introduction Patulin (PAT) is a heat-resistant mycotoxin frequently detected in apple juices even after pasteurization, representing a global food safety concern. Physical and chemical methods for PAT removal are often ineffective, costly, or environmentally unsafe, making the development of viable and safe alternatives urgently needed. Biological control has demonstrated effectiveness as an eco-friendly strategy for reducing or eliminating PAT contamination in food. Certain microorganisms, like Lactobacillus spp., have shown promising potential in degrading PAT.
Therefore, this study aimed to evaluate the ability of Lacticaseibacillus casei to reduce PAT contamination in apple juice.
Materials and Methods Apple juice was artificially contaminated with 200 µg/L of PAT and subjected to three treatments: (i) pasteurization, (ii) addition of viable Lacticaseibacillus casei BGP93 with incubation at 37 °C for 24 h, and (iii) addition of heat-inactivated bacterial cells. A control sample (juice with and without PAT) was used for comparison. The residual concentrations of PAT were measured using HPLC at 0 h, 48 h, and 15 days after spiking.
Results and Discussion Pasteurization did not significantly reduce PAT levels compared to the control ($p > 0.05$), confirming the thermal resistance of the mycotoxin. After 15 days of storage, the sample treated with L. casei showed a 47.7% reduction, while the inactivated cells reduced PAT by 46.5%, with no significant difference between treatments ($p > 0.05$). These findings indicate that the primary mechanism by which L. casei reduces PAT is through the adsorption of the toxin to the bacterial cell wall. Although viable cells have the potential to degrade or biotransform PAT through specific enzymatic activities, the data obtained in this study do not indicate a significant contribution of metabolic activity under the tested conditions (time, temperature, pH). Similar results have been observed in the literature, where structural components such as peptidoglycan and surface proteins remain active even after cell inactivation.
Conclusion Lacticaseibacillus casei was effective in removing patulin from apple juice, primarily through passive adsorption. These results support the use of bacterial cultures as a natural, safe, and efficient strategy for mycotoxin mitigation in minimally processed foods.

P32 - Chemical and microbiological contamination in marine invertebrates from the Portuguese coast

Lourenço, HM[1,2], Esteves, C[1], Bettencourt, F[1], Silva, J[1], Gonçalves, S[1], Pedro, S[1,2]
[1]Portuguese Institute for the Sea and Atmosphere, Av. Dr. Alfredo Magalhães Ramalho, 1495-165 Algés, Portugal. [2]Interdisciplinary Center for Marine and Environmental Research (CIIMAR), 4450-208, Matosinhos, Portugal.
helena@ipma.pt

Keywords: Mercury, lead, cadmium, E. coli, marine invertebrates.

Marine invertebrates, in particular bivalves, provide relevant ecosystem services, including water filtration and nutrient cycling, and contribute significantly to the national socioeconomic development. Due to their feeding behaviour and habitat, they can concentrate several contaminants, representing a risk to the consumer. According to the legislation, these species can only be captured in classified production areas, which are monitored to ensure compliance with chemical and microbiological criteria. As part of IPMA's mission, marine invertebrates such as bivalves, echinoderms and gastropods, from production areas located in Portuguese mainland are regularly monitored for levels of mercury (Hg), lead (Pb) and cadmium (Cd); some species are also regularly monitored for faecal contamination (E. coli). Therefore, the objective of this work is to present the results obtained from 2020 to 2024 regarding the levels of chemical and microbiological contaminants in the various groups of marine invertebrates from coastal production areas. Metals were determined by atomic absorption spectrometry, according to the standardized methods NP EN 14084 (2003) and EPA method 7473 (2007). The determination of E. coli was quantified according to ISO 16649-3 (2015).
Overall, the levels of Hg, Cd and Pb in almost all species studied in coastal production areas did not reach the limits established in 2023 by the European Union, 0.30 or 0.50 mg/kg for Hg, 1.0 mg/kg for Cd and 1.5 mg/kg for Pb. As for E. coli levels, some bivalve species presented levels higher than those acceptable for direct human consumption.
This work highlights that most marine invertebrates produced in coastal production areas do not pose a danger to human consumption. However, the capture of limpets (Patela spp) and brandyfish (Bolinus brandaris) is not permitted in several of these production areas, given that high concentrations of Cd have been recorded.

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P33 - Pharmaceuticals as Food Contaminants – Occurrence and Impacts on Human Health – mini-review

Ribeiro, O[1,2,3], Cláudia Ribeiro2 and **Carrola, JS[1]**
[1]Centre for the Research and Technology of Agro-Environmental and Biological Sciences (CITAB), Institute for Innovation, Capacity Building and Sustainability of Agri-food Production (Inov4Agro), University of Trás-os-Montes and Alto Douro (UTAD), Vila Real, Portugal
[2]UCIBIO – Applied Molecular Biosciences Unit, Translational Toxicology Research Laboratory, University Institute of Health Sciences (1H-TOXRUN, IUCS-CESPU), 4585-116 Gandra, Portugal
[3]Centre for Functional Ecology, Associated Laboratory TERRA, Department of Life Sciences, University of Coimbra, Coimbra, Portugal
joao@utad.pt

Keywords: pharmaceuticals, emerging contaminants, food chain, human health

Pharmaceuticals are increasingly recognised as emerging contaminants in the terrestrial and aquatic environment, posing concerns about their biological activity and potential to contamination of the food chain and elicit adverse effects on human health. This minireview was based on the search done in PubMed database. Antibiotics, analgesics, antidepressants, among others pharmaceuticals enter the environment primarily through human and livestock excretion, improper disposal, and agricultural runoff. The widespread use of pharmaceuticals, coupled with the inefficiency of wastewater treatment plants in fully removing pharmaceutical residues, allows them to persist in water bodies and soils, and subsequently accumulate in food crops, livestock, and fauna that inhabit contaminated ecosystems.

Recent studies have documented the presence of pharmaceutical residues and metabolites in food matrices, including vegetables irrigated with reclaimed water, fish from contaminated water bodies, meat/dairy products from animals exposed to medicated feed, and even in drinking water. While the detected concentrations are generally low, chronic exposure at trace levels raises concerns due to the potential for bioaccumulation, disruption of endocrine systems, development of antimicrobial resistance, and other sub-lethal biological effects. Susceptible populations, such as infants, children, young and pregnant women may be particularly at risk, and one health concept should be considered. Moreover, the long-term health implications of consuming low doses of multiple pharmaceutical residues in combination are still poorly understood, highlighting a significant gap in current risk assessment frameworks. The complexity of pharmacologically active compounds and their metabolites, as well as their interactions within the human body, increase the challenge of evaluating their impact.

To effectively manage risks, a multi-pronged approach is essential, including stricter regulations on pharmaceutical use, advanced wastewater treatment technologies, and enhanced monitoring and control of food products. Public awareness and interdisciplinary collaboration among environmental scientists, toxicologists, food safety authorities, and policymakers are also crucial. Addressing pharmaceutical contamination in food is vital not only for protecting public health but also for ensuring the sustainability and safety of global food systems.

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P34 - Microplastics and nanoplastics in foods as a major concern for human health

Ferreira J[1], Alves R[1], Gonçalves C[2], Bento A[3], Torre-Ruiz M[4] and **Carrola SJ**[2]
[1]Student of Environmental Science, School of Life and Environmental Science (ECVA), University of Trás-os-Montes and Alto Douro, (UTAD), Vila Real, Portugal. [2]Centre for the Research and Technology of Agro-Environmental and Biological Sciences (CITAB, INOV4Agro), University of Trás-os-Montes and Alto Douro (UTAD), Vila Real, Portugal. [3]INSA- Instituto Nacional de Saúde Doutor Ricardo Jorge, Departamento de Alimentação e Nutrição (DAN), Portugal. [4]CNSA-Centro Nacional de Sanidad Ambiental, Instituto de Salud Carlos III (ISCIII), España.
joao@utad.pt

Keywords: health, food toxicology, food chain, sustainability, safety

Microplastics and nanoplastics (MNP) are ubiquitous contaminants (soil, water and air) and are also detected in foods and beverages. This mini-review was conducted by searching papers in the PubMed and ScienceDirect databases, with 20 scientific articles selected. Several surveys have detected MPs in a wide range of food sources, including seafood—particularly filter-feeding shellfish and small fish— table salt, drinking water, use of tea bags, fruits, vegetables, meat, and milk. Estimates suggest that individuals may ingest tens to hundreds of thousands of MNP particles per year, depending on dietary habits and regional environmental factors. In addition, MNPs also can adsorbed/absorbe diverse pollutants (pesticides, PCBs, heavy metals) in addition to being carriers of their own additives (plasticizers, flame-retardants, bisphenols, phthalates, etc.), promoting bioaccumulation in the food chain and increasing the final uptake of toxic MNP by the human body reaching many important organs and have been detected in human feces, blood and lung tissues, and recently in the cerebrum and a risk factor for cardiovascular diseases.
In vitro and in vivo studies demonstrate that MNP induce oxidative stress and inflammation by disrupting cell membranes and mitochondria, which elevates reactive oxygen species and pro-inflammatory cytokines. Also, some studies have reported hepatic inflammation, immune dysregulation, granuloma formation, neurotoxicity, early puberty, fertility issues, increased rates of miscarriage and preterm birth. Chemical components of MNP act as endocrine-disruptors (mimicking, altering or blocking hormones and metabolic signalling) affecting all hormonal systems, including the reproductive. Although direct causation is still under investigation this review points out that chronic MNP exposure could underlie gastrointestinal inflammation, and immune dysfunction and even increase risks of conditions like colorectal cancer, diabetes and neurodegeneration.
In conclusion, MNP in food and beverages raise toxicological health problems and precautionary global measures such as reducing plastic production/use, single-use plastic, plastic cutting boards, plastics for food packaging (mainly with hot food or beverages), plastic cutlery usage, etc. are vital to decrease plastics in feed and foods. These measures and fundamental to lessen total MNP exposure and protect public health, mainly during critical stages of early development (infants, young children) and also young and pregnant women reducing long-term health outcomes.

P35 - CIGUATERA IN MADEIRA ARCHIPELAGO: DIAGNOSIS AND NOTIFICATION

Barreto, F[1]; Faria, T[1]; Vieira, R[1]; Melim, M[1]; Ferreira, L[2]; Sousa, R[2] and Ideia, P[2]
[1]Serviço Regional de Saúde da Região Autónoma da Madeira, SESARAM EPERAM, Funchal, Madeira, Portugal.
[2]Direção Regional de Pescas da Secretaria Regional de Agricultura e Pescas, Funchal, Madeira, Portugal.
fbarreto.medinterna@gmail.com

Ciguatera is the disease caused by the ingestion of fish contaminated with ciguatoxins (CTXs). CTXs are marine biotoxins produced by dinoflagellates of the genera Gambierdiscus and Fukuyoa. CTXs are bioaccumulated in the trophic chain through the process of bioaccumulation. Because they are thermostable, colorless and odorless, freezing or cooking contaminated fish does not reduce the risk of poisoning and their presence does not alter the organoleptic properties of the fish.
Ciguatera can manifest itself through gastrointestinal, neurological and cardiovascular symptoms that can occur hours after consumption of contaminated fish. Some of the symptoms can be persistent for weeks or months, and exacerbations or relapses may occur by the presence of certain triggers. In Madeira, the first confirmed cases date back to 2009, when the crew of a fishing vessel presented symptoms after consuming a amberjack (Seriola spp.) caught off the coast of Selvagens.
Currently, in the Autonomous Region of Madeira, there is a recommendation not to comercialize amberjack fishes with a total weight greater than 10 kg, due to the potential risk of ciguatoxin poisoning.
The Chemistry and Biochemistry Laboratory of the Regional Directorate for Fisheries is implementing methodologies for the extraction and detection of ciguatoxins by cellular bioassay.
The authors through the Regional Secretariat for Health and Civil Protection and the Regional Secretariat for Agriculture and Fisheries, are preparing an action protocol for reporting and monitoring ciguatera cases in the region. The aim is to increase notification of probable ciguatera cases and subsequent clinical follow up of the patients and to make ciguatera a notifiable disease in the region.

P36 - Towards safer edible insects: evaluating the bioaccumulation of metals and mycotoxins in Tenebrio molitor

Cardoso DN[1], **Alvito P**[1,2], De Boevre M[3], Detavernier C[3], Andrade M[2,4], Silva ARR[1], Pinto JN[1], Eduardo Rodrigues A[1], Prodana M[1], Silva PV[1], Mostafaie A[1], Loureiro S[1]
[1]CESAM - Centre for Environmental and Marine Studies, Department of Biology, Campus Universitário de Santiago, University of Aveiro, 3810-193 Aveiro, Portugal. [2]National Institute of Health Dr. Ricardo Jorge (INSA), Department of Food and Nutrition, Lisboa, Portugal. [3]Centre of Excellence in Mycotoxicology and Public Health, Department of Bioanalysis, Ghent University, Ghent, Belgium. [4]REQUIMTE/LAQV, R. D. Manuel II, Apartado, 55142 Oporto, Portugal.
dfilipe@ua.pt

Keywords: Tenebrio molitor, insect safety, metals, mycotoxins, bioaccumulation, depuration, food security, circular economy

The integration of insects into circular food and feed chains requires robust safety evaluations concerning contaminant uptake. However, following this, understanding how insects eliminate contaminants over time is equally critical. Toxicokinetic assessments provide insights into uptake rates, internal regulation, and depuration dynamics, offering a more accurate and predictive basis for food and feed safety decisions in insect farming.
In this study, the yellow mealworm Tenebrio molitor larvae, already approved for human food, were exposed to substrates contaminated at the EU maximum levels for feed of metal(loid)s (arsenic, cadmium and lead) and mycotoxins (aflatoxin B1, ochratoxin A, deoxynivalenol, zearalenone). They were monitored for 21 days of exposure, followed by 21 days of elimination on clean substrate.
Results revealed distinct accumulation patterns among the three metals tested. Arsenic showed the highest accumulation potential, peaking at the last day of exposure (21d) (~7 mg/kg DW), followed by a gradual decline during elimination. However, according to the current EU legislation, internal concentrations did not reach safe levels for food/feed. Cadmium accumulated steadily (~2.5 mg/kg), and although these concentrations exceeded the legal limit for insects intended as feed, just one day of depuration was sufficient to reduce cadmium levels below the regulatory threshold. Lead accumulated to a lesser extent and was rapidly eliminated, with tissue concentrations consistently remaining below the maximum levels allowed for feed use. Conversely, mycotoxins were not bioaccumulated, as all measured concentrations for aflatoxin B1, ochratoxin A, deoxynivalenol, zearalenone, and related metabolites remained below detection limits. Only four samples showed traces of ochratoxin A, yet still below the quantification threshold.
These findings reinforce the species' differential ability to accumulate and depurate contaminants, highlighting the importance of depuration periods prior to harvest for safer insect consumption by animals or humans. While metals pose a potential risk, especially arsenic, T. molitor appears to efficiently eliminate most of the metals if given appropriate elimination periods and conditions. The absence of mycotoxin and respective metabolite accumulation further supports the safety of this insect species when reared on substrates that comply with current feed legislation.

P37 - Total Diet Studies: A Comprehensive Tool for Dietary Exposure Assessment

Vasco Elsa, Dias M. Graça, Oliveira Luísa
Food and Nutrition Department, National Institute of Health Doctor Ricardo Jorge, IP (INSA), Avenida Padre Cruz, 1649-016, Lisboa, Portugal
elsa.vasco@insa.min-saude.pt

Key words Contaminants, Food, Whole Diet, Monte Carlo Risk Assessment, FoodEx2 classification system

Introduction Total Diet Studies (TDS) are a cost-effective, scientifically robust approach recommended by the World Health Organization (WHO) to estimate long-term population exposure to dietary chemical contaminants. Unlike traditional monitoring, TDS analyses food- "as consumed," and considers the overall diet, offering realistic insights into chronic risks and supporting public health policy. Standardized methods, such as those from TDS-Exposure and EFSA/FAO/WHO, enhance data quality and cross-country comparability.

Methodology The study involves two main stages: planning and fieldwork. During planning, key food items are selected based on national dietary data, classified using the FoodEx2 system, and organized into TDS samples. Sampling considers factors such as origin, market share, season, and cooking habits. In fieldwork, food samples are collected from retail outlets, prepared according to culinary practices, and combined into composite samples for laboratory analysis. Chemical analysis uses validated methods (e.g., ICP-MS, GC-MS, LC-MS/MS); speciation is essential for certain contaminants like arsenic and mercury. Dietary exposure is estimated by combining contamination levels with food consumption data using probabilistic models. Results can be stratified by age, gender, etc. Exposure is compared to health-based reference values (e.g., TDI, TWI) or assessed via the Margin of Exposure (MOE). Uncertainty is addressed using methods such as sensitivity analysis and Monte Carlo simulations.

Results TDS provides a national overview of dietary exposure to chemical contaminants. Results typically include identification of major dietary sources of exposure (e.g., rice for arsenic, fish for mercury), demographic exposure profiles (e.g., higher intake in children due to body weight), and baseline exposure data for trend tracking and policy evaluation.

Conclusions TDS are an essential tool in modern food safety. By integrating consumption and contaminant data in a realistic, whole-diet population-wide context, it supports risk assessment and evidence-based regulation. TDS are highly effective for chronic dietary exposure assessment, helping authorities prioritize risks and protect public health.

Topic Relevance Amid growing concerns over food contamination, climate change, and evolving diets, TDS play a valuable role in supporting international food safety standards, informing national programs, and contributing to Sustainable Development Goals.

P38 - Development of national recommendations for fish consumption in Portugal considering methylmercury exposure

Fernandes P[1], Afonso C[3], Bico P[2], Bandarra N[3], Borges M[2], Carmona P[5], Carvalho C[4], Correia D[4], Gonçalves S[3], Lopes C[4], Lourenço H[3], Monteiro S[5], Nabais P[5], Oliveira L[1], Santiago S[1], Severo M[4], Torres D[6], Dias MG[1]
[1]Departamento de Alimentação e Nutrição, Instituto Nacional de Saúde Doutor Ricardo Jorge, Lisboa, Portugal. [2]Direcção-Geral de Alimentação e Veterinária, Lisboa, Portugal. [3]Instituto Português do Mar e da Atmosfera, Lisboa, Portugal. [4]Instituto de Saúde Pública da Universidade do Porto, Porto, Portugal. [5]Autoridade de Segurança Alimentar e Económica, Lisboa, Portugal. [6]Faculdade de Ciências da Nutrição e Alimentação, Universidade do Porto, Porto, Portugal.
paulo.fernandes@insa.min-saude.pt

Keywords: Methylmercury, fish consumption, dietary recommendations, risk-benefit assessment, vulnerable populations

Introduction Fish is an important part of the Portuguese diet and a major source of long-chain omega-3 fatty acids. However, it also represents the main dietary source of methylmercury (MeHg), a neurotoxic compound especially harmful during critical stages of development such as pregnancy and early childhood. In response to European Commission Recommendation EU 2022/1342, Portugal undertook a national initiative to assess MeHg exposure and derive population-based consumption guidelines.
Methodology A multidisciplinary working group comprising six public institutions and coordinated by the Directorate-General for Food and Veterinary (DGAV) was established in 2018. The team performed a quantitative risk–benefit assessment (RBA) combining national data on MeHg, EPA, and DHA levels in commonly consumed fish species with food consumption data from the National Food and Physical Activity Survey (IAN-AF 2016). The assessment considered both the toxicological risks of MeHg and the nutritional benefits of omega-3 fatty acids.
Results The RBA showed that, for the general population, the benefits of fish consumption outweigh the risks of MeHg exposure. However, for vulnerable groups—pregnant and breastfeeding women and children under 10 years—the risks were more significant. As a result, differentiated dietary recommendations were developed. For the general population, a frequency of 4–7 servings per week of any fish species was advised. For vulnerable groups, 3–4 servings per week of fish species with medium to low MeHg levels were recommended, while species with high MeHg content (e.g., fresh tuna, swordfish, shark) should be avoided.
Conclusions The resulting recommendations were disseminated through a multilingual infographic, public presentation, and press release. Additional outreach actions targeting health professionals and school meal providers are planned to increase awareness among at-risk populations.
Topic relevance This work exemplifies a science-based approach to public health policy, combining food safety and nutrition to inform national dietary guidelines, with direct implications for risk communication and health promotion.

P39 - The presence of spirolide marine toxin 13-desmethyl spirolide C in edible seaweed Fucus vesiculosus as determined by LC-MSMS

Costa PR[1,2], Pereira A[1,3], Cereja R[1,4], Chainho T[1], Oliveira I[5], Marques A[1,3]
[1]IPMA - Instituto Português do Mar e da Atmosfera, Avenida Doutor Magalhães Ramalho, nº 6, Lisboa, 1495-165. [2]Centre of Marine Sciences (CCMAR/CIMAR LA), University of Algarve, Campus de Gambelas, 8005-139 Faro, Portugal. [3]CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Matosinhos, Portugal. [4]MARE - Marine and Environmental Science Centre, ARNET—Aquatic Research Network, Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal. [5]ALGAplus SA, Produção e Comercialização de Algas e seus derivados SA. PCI-Via do Conhecimento, 3830-352 Ílhavo, Portugal.
prcosta@ipma.pt

Keywords: seaweed, marine toxins, cyclic imines, spirolids,

Introduction Seaweed is an important food item due to its high nutritional value, richness in vitamins, minerals such as iodine, antioxidants, proteins and dietary fiber, while being low in calories. It is increasingly popular globally as a sustainable superfood. In aquaculture, seaweed plays a crucial role in integrated multi-trophic aquaculture (IMTA) systems, where it helps absorb excess nutrients (like nitrogen and phosphorus) from surrounding waters, thus reducing environmental impacts. However, this role may also favour the accumulation of contaminants. This study investigated the presence of marine biotoxins in seaweed, which may either be accumulated during blooms of toxic microalgae or be produced by the seaweed itself.
Methods Analysis based on liquid chromatography were carried out to assess the presence of all regulated biotoxins in the EU directives (ASP, PSP and DSP toxins, yessotoxins, azaspiracids), as well as cyclic imines (spirolids, pinnatoxins, gymnodimines) that are considered emerging toxins. Samples of three seaweed species, Ulva sp., Gracilaria sp., and Fucus vesiculosus, were seasonally collected in a seaweed farm and in the natural environment in the Aveiro Lagoon, between November 2023 and January 2025.
Results Liquid chromatography with mass spectrometry detection (LC-MSMS) analysis revealed the presence of the cyclic imine 13-desmethyl spirolide C (SPX1) in samples of F. vesiculosus, both farmed and wild caught. The levels of SPX1 varied from not detected to 1.8 $ng.g^{-1}$ of seaweed (d.w). No other toxins were found in F. vesiculosus, nor were any detected in the other seaweed species analyzed.
Conclusions While the levels observed in this study do not indicate a risk to consumers, they do suggest a new potential source of spirolides. It remains to be determined whether SPX1 is a metabolite produced by the algae or accumulated from the surrounding environment.

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P40 - Exposure assessment of enteric viruses in different water sources

Rodrigues R[1], Gil D[1], **Valério E**[1,2]
[1]Department of Environmental Health, National Institute of Health Doutor Ricardo Jorge, 1649-016 Lisboa, Portugal.
[2]cE3c – Center for Ecology, Evolution and Environmental Changes & CHANGE - Global Change and Sustainability Institute, Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal.
raquel.rodrigues@insa.min-saude.pt

Keywords: Enteric viruses; Norovirus; HAV; HEV; water; seafood; fresh food

Introduction Enteric viruses are a group of viruses that primarily infect the intestinal tract and are typically transmitted via the fecal-oral route. Common examples include norovirus, rotavirus, adenovirus, astrovirus and enteroviruses, and also hepatitis A and E viruses. They often cause gastroenteritis and are resistant to some water treatments, e.g. chlorination. Several enteric viruses are highly infectious, since even a very small number of viral particles can cause disease.
Their presence in waters can be a direct source of contamination, or it may lead to accumulation in food, eg. seafood or fresh vegetables and fruits thus also entering the human body through this route.
Methodology We have been screening the presence of enteric viruses (Norovirus NoV GI and GII; Hepatitis A, Hepatitis E and Enterovirus), using RT-qPCR based on the international standard method for the determination of viruses in foods ISO/TS 15216-1:2017. Several water sources: drinking water (with and without treatment), underground water, surface waters and sea water.
Results The results obtained allow us to perform an exposure assessment though the different water sources analyzed.
Conclusions With this work we contribute to the creation of more solid evidence about the dispersion of enteric viruses in different water sources, which is of crucial importance to insure safeguarding Public Health.
Topic relevance Enteric viruses are the main cause of acute gastroenteritis, knowing its distribution can help to raise awareness to develop an integrated approach for monitoring water resources and also monitor the proper application of water treatments before consumption or use for irrigation purposes.

P41 - Tracking the presence of azoles in water and food and Predicted No Effect Concentrations (PNECs) of antifungals for water management and agricultural use

José S[1]; Gil D[1]; Cruz C[2]; Brandão J[1,2]; **Valério E**[1,2]
[1]Department of Environmental Health, National Institute of Health Doutor Ricardo Jorge, 1649-016 Lisboa, Portugal. [2]cE3c – Center for Ecology, Evolution and Environmental Changes & CHANGE - Global Change and Sustainability Institute, Faculdade de Ciências da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal.
elisabete.valerio@insa.min-saude.pt

Keywords: antifungals, azoles, water, food, antifungal resistance

Introduction Fungicides, namely azoles, are used to treat pathogenic fungi in humans, animals and plants. Some of the products used can end up dispersed in the environment and appear in water systems. Monitoring studies carried out at water treatment plants have revealed the presence of azole antifungals in effluents, despite their low concentrations, this may lead to surface-water contamination. These compounds are also commonly used in agriculture. Considering that most fungal infections originate from the environment, introducing antifungals through water or agriculture will inevitably potentiate the emergence of further antifungal resistance. Antifungal resistance is a growing public health concern due to the difficulty to manage or treating medical conditions, thus favoring possible fatal fungal infections outcomes.
Methodology In this study, we made a systematic literature review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), using three international databases: Pubmed, Science Direct, Web of Science and the national repository RCAAP.
Results Hundreds of articles were initially identified. After a detailed manual refinement analysis, considering only articles between 2000 and 2024 and that presented results of antifungals concentrations in water and food samples.
Conclusions As a result of this systematic literature review, we can conclude that azole antifungals are frequently present in surface water, food, wastewater effluents and sludge. The current treatments applied in water treatment plants are incapable of completely removing azole antifungals. It is therefore possible for them to re-enter the environment through discharges of contaminated effluents or by direct application to the soil as natural fertilizers. Due to the lack of PNEC values using fungi as model organisms in this review, PNECs for most relevant antifungals were computed.
Relevance of the topic The proven occurrence of azole antifungals, in several countries, dispersed in the environment, particularly in water, represents a danger to public health, exacerbated by the fact that there is no legislation imposing legal limits on their presence. In addition to the toxicity they represent for living organisms, there is also the possibility that they may lead to the acquisition or transmission of antimicrobial resistance to antifungals.

P42 - Are Food Supplements Safe? What is known.

Campos, Maria João; Silva, Liliana; Pereira, André; Pena, Angelina
LAQV-REQUIMTE, Laboratory of Bromatology, Pharmacognosy and Analytical Sciences, Faculty of Pharmacy, University of Coimbra, 3000-295 Coimbra, Portugal
mcampos@ff.uc.pt

Keywords: Food Supplements, Contaminants, Human Health.

Introduction: Food supplements (FS) are widely used by adults, pregnant women and children and are generally considered safe. However, a potential risk of exposure to hazardous substances exists, including both declared natural constituents and undeclared toxic compounds such as plant toxins. Ensuring FS safety is, therefore, a key public health issue. In the European Union (EU), FS must comply with Commission Regulation (EU) No 2023/915, which sets maximum levels for contaminants such as heavy metals, polycyclic aromatic hydrocarbons, and mycotoxins. Additional regulations cover pyrrolizidine alkaloids. The Rapid Alert System for Food and Feed (RASFF) also monitors issues such as ethylene oxide residues and unauthorised pharmaceutical substances.
Methodology: A comprehensive review of the scientific literature, regulatory sources, websites, and health institutions was conducted to assess FS safety, focusing on contamination risks and relevant European legislation. The work aimed to synthesise existing knowledge and evaluate regulatory measures.
Results: Maximum levels for key contaminants, such as lead, cadmium, and mercury, are established for all FS. For botanical-containing FS and related products, limits are established for benzo(a)pyrene and the sum of four key PAHs. Mycotoxins, specifically citrinin, have been found in red yeast rice FS, and pyrrolizidine alkaloids are also a concern with defined maximum levels. RASFF reports 2023 highlighted the presence of ethylene oxide and undeclared pharmaceutical ingredients in some FS.
Conclusions: Rigorous quality control of ingredients and final products is essential. The presence of contaminants in FS is a critical concern since it poses significant public health risks, especially for vulnerable groups like the elderly, pregnant women, and children, with an increased ingestion relative to body weight. However, significant gaps in analytical control and adherence to European legislation have been identified.
Topic relevance: Limited data on FS use and contamination may hinder the assessment of human health risks. Given the role of FS in nutrition and health sciences, ensuring their safety is paramount for safeguarding human health. Establishing a robust quality control framework across all facets of FS production and monitoring is essential for maintaining public trust and preventing potentially harmful products from reaching consumers.

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P43 - Survey of zearalenone in commercialised beer in Portugal – preliminary results

Ferreira F[1]; Duarte SC[1,2]; Paiva A[2], Silva LJG[1], Pereira AMPT[1], Lino C[1] and **Pena A**[1]
[1]LAQV, REQUIMTE, Laboratório de Bromatologia e Farmacognosia, Faculdade de Farmácia da Universidade de Coimbra, Polo III, Azinhaga de Sta Comba, 3000–548 Coimbra, Portugal. [2]Centro de Investigação Vasco da Gama (CIVG)/Departamento de Ciências Veterinárias, Escola Universitária Vasco da Gama (EUVG), Campus Universitário, Av. José R. Sousa Fernandes, 3020–210 Coimbra, Portugal.
apena@ci.uc.pt

Keywords: Beer; zearalenone; exposure; risk assessment; human health.

Introduction Beer is one of the most popular and widely consumed beverages in the world, along with water and coffee. Despite the hundreds of varieties, one of the central ingredients in beer production is grains. Grain-based products are considered highly susceptible to mycotoxin contamination, which are natural contaminants with a wide range of toxic effects. One of the most significant mycotoxins is zearalenone (ZEA), which primarily acts as an endocrine disruptor. This study primarily aimed to evaluate the occurrence of ZEA in beer samples sold in Portugal, and secondarily to evaluate the exposure and risk of consumers.
Methodology: The first 84 samples analysed were collected in the central region of Portugal, encompassing commercial and artisanal beers, both national and foreign, with and without alcohol, representing various fermentation styles. The analytical determination of ZEA was performed using a competitive ELISA enzyme immunoassay (R-Biopharm, AG, Darmstadt, Germany), with samples run in duplicate (LOD, 250 ng/l). The deterministic method was employed to assess exposure and risk. The annual per capita beer consumption of 58 L was considered, according to the most up-to-date data.
Results: Of the 84 beer samples analysed, 34 (40.48%) showed detectable levels of ZEA, with an average value of 737.68+/-361.76 ng/L. Positive ZEA samples ranged from 289.06 to 1679.90 ng/L. In the exposure assessment, the average ZEA content resulted in an exposure of 658.2 ng/kg bw/day, which reached up to 1499 ng/kg bw/day in the worst-case scenario. In the risk assessment, the hazard quotient exceeded 1 in the worst-case scenario (HQ=6) and medium scenario (HQ=2.6). In the best-case scenario, the HQ equalled 1.
Conclusions: Beer cannot be neglected as a contributor to ZEA exposure in the adult population. A health risk associated with exposure through beer consumption was identified in the adult Portuguese population, particularly among those with an average consumption level.
Topic relevance: Considering the scarcity of similar surveys in Portugal regarding mycotoxin analysis in beer, this pilot study highlights the importance of further research.

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