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Risk Assessment

Food Safety Management Systems: The Role of Cognitive and Cultural Biases in Determining What is 'Safe Enough'

Louise Manning, Jack H. Grant. *Trends in Food Science & Technology*. Vol. 156, Feb 2025. doi.org/10.1016/j.tifs.2024.104811. [Article link](#)

Background: Food safety management systems (FSMS) are designed and implemented to control, and where possible eliminate, the potential food safety hazards associated with a product, and how food is produced, to ensure compliance with food safety legislation, retailer standards and/or private third-party certification standards. However, the design, validation, implementation and verification of FSMS can be subject to both conscious and unconscious bias that inform risk management and risk acceptance. **Scope and Approach:** The aim of this structured review is to firstly consider existing hazard analysis and risk assessment approaches to developing and implementing FSMS, and approaches to defining what is "safe enough" and, secondly to explore the role of cognitive and cultural biases in decision-making. **Key Findings and Conclusions:** Cognitive and cultural biases can influence food safety assessment, FSMS design and perceptions, management and acceptance of food safety risk. A better understanding of their influence and how this informs scientific and lay approaches to hazard analysis and food safety risk assessment could provide more insight into how regulators, food business operators, staff and consumers assess and accept food safety risk.

Foodborne Pathogens

Phytochemicals as Natural Antimicrobials: A Promising Strategy for Food Safety and Foodborne Pathogens Control

Mahmoud Elafify, Amr M. Bakry, Hailong Tian, Jihong Huang. *Jrnl of Food Safety*. 5 February 2025. Vol. 45, Issue 1. doi.org/10.1111/jfs.70013. [Article link](#)

Foodborne pathogens are critical concerns in the food safety sector and for regulatory agencies due to their high morbidity and mortality rates. They also significantly impact the economy, particularly in countries with limited financial resources. Furthermore, the rapid progression of microbial resistance to antibiotics and the hazards associated with chemical preservatives are global challenges. This underscores the importance of developing natural antimicrobial additives for the food industry. Plants offer a promising source of effective antimicrobial agents with significant activity against foodborne pathogens. In particular, phytochemicals demonstrate significant potential for improving food safety due to their broad antimicrobial properties. In this context, we reviewed the classification and extraction processes of phytochemicals, their antimicrobial activities, mechanisms of action, factors influencing their antimicrobial efficacy, and their applications in food safety. Additionally, we explored the current challenges associated with the industrial application of phytochemicals as natural preservatives. Phytochemicals have demonstrated substantial antimicrobial effects against a variety of foodborne pathogens through diverse mechanisms. Thus, they represent a promising solution for advancing the food industry and enhancing food safety.

Foodborne Illness

Preparation Methods and Perceived Risk of Foodborne Illness Among Consumers of Prepackaged Frozen Vegetables – United States, September 2022

Michelle Canning, Michael Ablan, Tamara N. Crawford, Amanda Conrad, Alexandra Busbee, Misha Robyn, Katherine E. Marshall. *Journal of Food Protection*. Vol. 88, Issue 2, 3 Feb 2025. [Article link](#)

Listeria monocytogenes causes listeriosis, a serious infection with a high mortality rate for persons at higher risk for listeriosis. The first *Listeria* outbreak linked to frozen vegetables occurred in 2016 and resulted in three deaths. Many frozen vegetables are intended to be consumed after cooking. However, data on consumer behavior are sparse. We characterized consumers' perceptions of contamination of prepackaged frozen vegetables, and preparation methods of prepackaged frozen vegetables to help inform prevention strategies. During September 1–24, 2022, Porter Novelli Public Services conducted the FallStyles survey using the Ipsos KnowledgePanel. Data were weighted to be representative of the U.S. population. Point estimates and 95% CIs were calculated, and differences between respondents were determined using Wald chi square tests. Among 3,008 respondents reporting a preparation and consumption method for frozen vegetables, 8.7% (95% CI = 7.4–10.0%) reported ever consuming the product raw. Respondents who reported having children < 18 years old were more likely to report ever consuming frozen vegetables raw compared with respondents who did not (12.5% vs. 7.4%, $p < 0.01$). The most reported raw preparation method was adding them directly to a blender for smoothie or juice (5.6%; 95% CI = 4.6–6.7%). Among respondents who reported eating frozen vegetables, 59.6% (95% CI = 57.6–61.6%) reported following package instructions. A third (34.1% [95% CI = 32.2–35.9%]) of respondents agreed that frozen vegetables can be contaminated with germs (like *Salmonella*, *E. coli*, and *Listeria*), with a greater proportion of people with cancer disagreeing compared to those without cancer (32.5% vs 23.4%, $p = 0.041$). These findings show that some consumers may not be cooking frozen vegetables before eating them. Second, consumers might not be reading instructions on packaging. Both findings highlight the critical importance of preventive controls in the production of frozen vegetables prior to reaching the consumer.

Food Classification

How a Junk-Food Splurge Can Change Your Brain Activity

Nature Metabolism, News, 21 Feb 2025. Julian Nowogrodzki. doi.org/10.1038/d41586-025-00549-7. [News Article link](#)

Five days of indulging in chocolate bars, crisps and other junk foods can lead to lingering changes in brain activity, a study shows. The resulting brain patterns are similar to those seen in people who have obesity. A junk-food splurge shifted brain patterns in healthy young men despite their body weight and composition remaining unchanged, according to the peer-reviewed study below.

A Short-Term, High-Caloric Diet has Prolonged Effects on Brain Insulin Action in Men

Kullmann, S., Wagner, L., Hauffe, R. et al. *Nature Metabolism* (21 Feb 2025). doi.org/10.1038/s42255-025-01226-9. [Article link](#)

Brain insulin responsiveness is linked to long-term weight gain and unhealthy body fat distribution. Here we show that short-term overeating with calorie-rich sweet and fatty foods triggers liver fat accumulation and disrupted brain insulin action that outlasted the time-frame of its consumption in healthy weight men. Hence, brain response to insulin can adapt to short-term changes in diet before weight gain and may facilitate the development of obesity and associated diseases.

Heavy Metals

Metal Contamination – A Global Environmental Issue: Sources, Implications & Advances in Mitigation

Gabrijel Ondrasek, Jonti Shepherd, Santosha Rathod, Ramesh Dharavath, Muhammad Imtiaz Rashid, Martin Brtnicky, Muhammad Shafiq Shahid, et. al. *RSC Adv.*, 11 Feb 2025, 15, 3904-3927. DOI: 10.1039/D4RA04639K. [Article link](#)

Metal contamination (MC) is a growing environmental issue, with metals altering biotic and metabolic pathways and entering the human body through contaminated food, water and inhalation. With continued population growth and industrialisation, MC poses an exacerbating risk to human health and ecosystems. Metal contamination in the environment is expected to continue to increase, requiring effective remediation approaches and harmonised monitoring programmes to significantly reduce the impact on health and the environment. Bio-based methods, such as enhanced phytoextraction and chemical stabilisation, are being used worldwide to remediate contaminated sites. A systematic plant screening of potential metallophytes can identify the most effective candidates for phytoremediation. However, the detection and prediction of MC is complex, non-linear and chaotic, and it frequently overlaps with various other constraints. Rapidly evolving artificial intelligence (AI) algorithms offer promising tools for the detection, growth and activity modelling and management of

metallophytes, helping to fill knowledge gaps related to complex metal-environment interactions in different scenarios. By integrating AI with advanced sensor technologies and field-based trials, future research could revolutionize remediation strategies. This interdisciplinary approach holds immense potential in mitigating the detrimental impacts of metal contamination efficiently and sustainably.

Food Packaging

Investigation into the Presence of Alkaloids in *Areca Catechu*-Based Single-Use Food-Contact Articles

J. Brad Mangrum, Lowri DeJager, Tim Begley. *Food Additives & Contaminants*. 28 Feb 2025. Vol. 42, Issue 3. doi.org/10.1080/19440049.2025.2469271. [Article link](#)

In this work, we have developed a method to investigate the presence of four alkaloids and their migration potential from single-use, biodegradable *Areca catechu*-derived dinnerware. The seeds of *Areca catechu* palm, commonly referred to as the betel nut, are known to contain high concentrations of four alkaloids: arecoline, guvacoline, arecaidine, and guvacine. Migration of these alkaloids into a food simulant was determined using a single-sided migration cell. The results indicate that carboxylic acid alkaloids, arecaidine, and guvacine, preferentially migrate under the experimental conditions which mimic the conditions of use for dinnerware.

Chemical Contaminants

Advanced Food Contaminant Detection through Multi-Source Data Fusion: Strategies, Applications and Future Perspectives

Selorm Yao-Say Solomon Adade, Hao Lin, Nana Adwoa Nkuma Johnson, Xorlali Nunekpeku, Joshua Harrington Aheto, John-Nelson Ekumah, Bridget Ama Kwadzokpui, et. al. *Trends in Food Science & Technology*. Vol. 156, Feb 2025, doi.org/10.1016/j.tifs.2024.104851. [Article link](#)

Background: The globalization of food supply chains and increasing demands for food safety assurance have highlighted the limitations of traditional analytical methods in detecting contaminants. These conventional approaches often struggle to capture the inherent complexities of food matrices, which are characterized by heterogeneity and dynamic processes. Multi-source data fusion (MSDF) has emerged as a promising solution, offering enhanced capabilities for comprehensive food safety analysis through the integration of multiple analytical techniques. **Scope and Approach:** This review provides a systematic examination of MSDF strategies and applications in food contaminant detection, focusing on the integration of key analytical techniques including spectroscopic methods (near-infrared, mid-infrared, Raman), chromatographic analysis, hyperspectral imaging, electronic noses, and chemical analyses. It analyzes various fusion architectures and levels, preprocessing requirements, and advanced data analysis techniques, including machine learning and chemometrics. Through detailed case studies and comparative analyses, the review evaluates MSDF's effectiveness across different applications in food safety monitoring. **Key Findings and Conclusion:** MSDF demonstrates superior performance compared to single-sensor approaches, achieving enhanced sensitivity, specificity, and reliability in detecting various contaminants including pesticides, mycotoxins, pathogens, and adulterants. The review identifies critical challenges including data integration complexity, computational demands, sensor drift, and model interpretability. Emerging solutions through artificial intelligence, edge computing, and IoT technologies show promise in addressing these limitations. The successful implementation of MSDF requires standardized protocols and cross-disciplinary collaboration. As food supply chains become increasingly complex, MSDF's role in ensuring food safety will become more crucial, supported by continuous innovations in sensing technologies, data analytics, and artificial intelligence.

Caffeine

Valorization of Spent Coffee Grounds and their Applications in Food Science

Uyory Choe. *Curr Res in Food Sci*, Vol. 10, 28 Feb 2025. doi.org/10.1016/j.crfs.2025.101010. [Article link](#)

Spent coffee grounds are generated in large quantities as a byproduct of coffee consumption. While often discarded as waste, spent coffee grounds still contain valuable bioactive compounds, including caffeine, chlorogenic acids, and polyphenols, along with dietary fiber, proteins, and essential minerals. Because of these nutritional properties, current research using spent coffee grounds includes fermented beverages, baked goods such as muffins and cookies, and ice

cream cones. This graphical review explores the chemical composition and potential health benefits associated with spent coffee grounds. Additionally, the integration of spent coffee grounds in food products including fermented beverages and baked goods, food packaging, as well as food safety concerns, is explored. Utilizing spent coffee grounds as a functional ingredient in food not only contributes to sustainability by reducing waste but also enhances the nutritional profile of spent coffee grounds integrated products. Future research should not only focus on the effective utilization of spent coffee grounds but also address potential safety concerns, such as acrylamide formation and heavy metal contamination, to ensure food safety and consumer acceptability.

Food Allergens

Recent Insights in Cow's Milk Protein Allergy: Clinical Relevance, Allergen Features and Influences of Food Processing

Jianhua Zeng, Qingfei Wang, Huaxi Yi, Chunxu Chen, Chuanlai Du, Guoyuan Xiong, Baoshi Wang, et. al. *Trends in Food Science & Technology*, Vol. 156, February 2025. doi.org/10.1016/j.tifs.2024.104830. [Article link](#)

Background: Milk allergy, particularly in infants and young children, is primarily triggered by cow's milk proteins. The prevalence of milk allergy is on the rise globally, posing significant health risks to affected individuals. Despite the increasing incidence, effective treatment options remain limited, making the development of low- or non-allergenic dairy products crucial. **Scope and Approach:** This review synthesizes recent advancements in understanding the structural characteristics and epitopes of major milk protein allergens and their sensitization mechanisms. It also critically evaluates the association between food processing and allergenicity, including traditional methods such as heat treatment and enzymatic hydrolysis, as well as emerging technologies like high-pressure processing, ultrasound, electromagnetic waves, and cold plasma. The primary objective is to systematically compare the effectiveness of these techniques in mitigating cow's milk protein allergenicity, with an emphasis on identifying the most efficacious methods. **Key Findings and Conclusions:** Notable advancements in food processing technologies, paired with a comprehensive understanding of milk protein structures, underscore the potential of innovative, targeted processing techniques to effectively mitigate allergenicity. Among these, microwave-assisted targeted enzymatic hydrolysis emerges as a promising technology that can be scaled up for industrial applications. The insights provided aim to support the development of novel processing methods that can eliminate the immunoreactivity of milk proteins, thereby contributing to the creation of low- or non-allergenic dairy products crucial.

Emerging Science Areas

Emerging Science Areas: Microplastics

Bioaccumulation of Microplastics in Decedent Human Brains

Alexander J. Nihart, Marcus A. Garcia, Eliane El Hayek, Rui Liu, Marian Olewine, Josiah D. Kingston, Eliseo F. Castillo, Rama R. Gullapalli. *Nat. Med.* 3 Feb 2025. doi.org/10.1038/s41591-024-03453-1. [Article link](#)

Rising global concentrations of environmental microplastics and nanoplastics (MNPs) drive concerns for human exposure and health outcomes. Complementary methods for the robust detection of tissue MNPs, including pyrolysis gas chromatography–mass spectrometry, attenuated total reflectance–Fourier transform infrared spectroscopy and electron microscopy with energy-dispersive spectroscopy, confirm the presence of MNPs in human kidney, liver and brain. MNPs in these organs primarily consist of polyethylene, with lesser but significant concentrations of other polymers. Brain tissues harbor higher proportions of polyethylene compared to the composition of the plastics in liver or kidney, and electron microscopy verified the nature of the isolated brain MNPs, which present largely as nanoscale shard-like fragments. Plastic concentrations in these decedent tissues were not influenced by age, sex, race/ethnicity or cause of death; the time of death (2016 versus 2024) was a significant factor, with increasing MNP concentrations over time in both liver and brain samples ($P = 0.01$). Finally, even greater accumulation of MNPs was observed in a cohort of decedent brains with documented dementia diagnosis, with notable deposition in cerebrovascular walls and immune cells. These results highlight a critical need to better understand the routes of exposure, uptake and clearance pathways and potential health consequences of plastics in human tissues, particularly in the brain.

Engage with IAFNS

Workshop on Science-Based Principles for Food Classification Focused on Processing and Formulation to Support Public Health

April 15, 2025. Washington DC and Virtual

The IAFNS Working Group on Food Classification has initiated a project focused on the development of Science-Based Principles for Classifying Foods Based on Processing and Formulation to Support Public Health. The goal of this effort is to deliver statements (Principles) which researchers can agree are representative of the evidence required to classify foods based on processing and formulation.

- We are pleased to offer an opportunity for an expanded audience to participate in the Workshop by supporting remote attendee/online attendee options.

- <https://iafns.org/event/workshop-on-science-based-principles-for-food-classification/>

IAFNS June 10-11, 2025, Annual Meeting – Save the Date!

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June 10-11, 2025
National Press Club

- <https://iafns.org/event/iafns-2025-annual-summer-science-symposium/>



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