



February 2024

www.iafns.org

Risk Assessment

In silico Environmental Risk Assessment Improves Efficiency for Pesticide Safety Management

Yang-Yang Gao, Wei Zhao, Yuan-Qin Huang, Vinit Kumar, Xiao Zhang, Ge-Fei Hao. *Sci Total Environ.* 2024 Jan 15:908:167878. doi: 10.1016/j.scitotenv.2023.167878. [Article link](#)

Pesticides are indispensable to maintain crop quality and food production worldwide, but their use also poses environmental risks. Pesticide risk assessment involves a series of complex, expensive and time-consuming toxicity tests. To improve the efficiency and accuracy for assessing the environmental impact of pesticides, numerous computational tools have been developed. However, there is a notable deficiency in critical analysis or a systematic summary of environmental risk assessment tools and their applicable contexts. Here, many of the current approaches and tools for assessing environmental risks posed by pesticides are reviewed, and the question of whether these tools are fit for use on complex multicomponent scenarios is discussed. We analyze the adaptations of these tools to aquatic and terrestrial ecosystems, followed by the provision of resources for predicting pesticide concentrations in environmental media, including air, soil and water. The successful application of computational tools for risk assessment and interpretation of predicted results is also discussed. This assessment serves as a valuable resource, enabling scientists to utilize suitable models to enhance the robustness of pesticides risk assessments.

Foodborne Pathogens

A Review of Food Safety in Low-Moisture Foods with Current and Potential Dry-Cleaning Methods

Veeramani Karuppuchamy, Dennis R Heldman, Abigail B Snyder. *J Food Sci.* 2024 Feb;89(2):793-810. doi: 10.1111/1750-3841.16920. [Article link](#)

Food is one of the basic needs of human life. With the increasing population, the production and supply of safe and quality foods are critical. Foods can be classified into different categories including low moisture, intermediate moisture, and high moisture content. Historically, low-moisture foods have been considered safe for human consumption due to the limited amount of moisture for microbial activity. Recalls of these foods due to pathogens such as Salmonella and undeclared allergens have brought attention to the need for improved cleaning and sanitization in dry food manufacturing facilities. In the food industry, cleaning and sanitation activities are the most efficient methods to prevent microbial contamination; however, water is most often required to deliver cleaning and sanitation agents. A well-written and properly implemented sanitation standard operating procedure can take care of microbial and allergen cross-contamination. Nevertheless, there are unique challenges to cleaning and sanitation processes for low-moisture food manufacturing facilities. The introduction of moisture into a low-moisture food environment increases the likelihood of cross-contamination by microbial pathogens. Hence, the use of water during cleaning and sanitation of dry food manufacturing facilities should be limited. However, much less research has been done on these dry methods compared to wet sanitation methods. This review discusses recent foodborne outbreaks and recalls associated with low-moisture foods the accepted methods for cleaning and sanitation in dry food manufacturing facilities and the limitations of these methods. The potential for air impingement as a dry-cleaning method is also detailed.

Paving the Way Forward: Escherichia coli Bacteriophages in a One Health Approach

Ana Oliveira, Carla Dias, Ricardo Oliveira, Carina Almeida, Pablo Fuciños, Sanna Sillankorva, Hugo Oliveira. *Crit Rev Microbiol.* 2024 Feb;50(1):87-104. doi: 10.1080/1040841X.2022.2161869. [Article link](#)

Escherichia coli is one of the most notorious pathogens for its ability to adapt, colonize, and proliferate in different habitats through a multitude of acquired virulence factors. Its presence affects the food-processing industry and causes food poisoning, being also a major economic burden for the food, agriculture, and health sectors. Bacteriophages are emerging as an appealing strategy to mitigate bacterial pathogens, including specific *E. coli* phages, without exerting a deleterious effect on humans and animals. This review globally analyzes the applied research on *E. coli* phages for veterinary, food, and human use. It starts by describing the pathogenic *E. coli* pathotypes and their relevance in human and animal context. The idea that phages can be used as a One Health approach to control and interrupt the transmission routes of pathogenic *E. coli* is sustained through an exhaustive revision of the recent literature. The emerging phage formulations, genetic engineering and encapsulation technologies are also discussed as a means of improving phage-based control strategies, with a particular focus on *E. coli* pathogens

Foodborne Illness

From Field to Plate: How do Bacterial Enteric Pathogens Interact with Ready-to-Eat Fruit and Vegetables, Causing Disease Outbreaks?

Gareth A Thomas, Teresa Paradell Gil, Carsten T Müller, Hilary J Rogers, Cedric N Berger. *Food Microbiol.* 2024 Feb;117:104389. doi: 10.1016/j.fm.2023.104389. [Article link](#)

Ready-to-eat fruit and vegetables are a convenient source of nutrients and fibre for consumers, and are generally safe to eat, but are vulnerable to contamination with human enteric bacterial pathogens. Over the last decade, *Salmonella* spp., pathogenic *Escherichia coli*, and *Listeria monocytogenes* have been linked to most of the bacterial outbreaks of foodborne illness associated with fresh produce. The origins of these outbreaks have been traced to multiple sources of contamination from pre-harvest (soil, seeds, irrigation water, domestic and wild animal faecal matter) or post-harvest operations (storage, preparation and packaging). These pathogens have developed multiple processes for successful attachment, survival and colonization conferring them the ability to adapt to multiple environments. However, these processes differ across bacterial strains from the same species, and across different plant species or cultivars. In a competitive environment, additional risk factors are the plant microbiome phyllosphere and the plant responses; both factors directly modulate the survival of the pathogens on the leaf's surface. Understanding the mechanisms involved in bacterial attachment to, colonization of, and proliferation, on fresh produce and the role of the plant in resisting bacterial contamination is therefore crucial to reducing future outbreaks.

Mycotoxins

Toxicity of the Emerging Mycotoxins beauvericin and enniatins: A Mini-Review

Amanda Lopes Hasuda, Ana Paula F R L Bracarense. *Toxicon.* 2024 Feb 23:239:107534. doi: 10.1016/j.toxicon.2023.107534. [Article link](#)

Beauvericin and enniatins, emerging mycotoxins produced mainly by *Fusarium* species, are natural contaminants of cereals and cereal products. These mycotoxins are cyclic hexadepsipeptides with ionophore properties and their toxicity mechanism is related to their ability to transport cations across the cell membrane. Beauvericin and enniatins are cytotoxic, as they decrease cell viability, promote cell cycle arrest, and increase apoptosis and the generation of reactive oxygen species in several cell lines. They also cause changes at the transcriptomic level and have immunomodulatory effects in vitro and in vivo. Toxicokinetic results are scarce, and, despite its proven toxic effects in vitro, no regulation or risk assessment has yet been performed due to a lack of in vivo data. This mini-review aims to report the information available in the literature on studies of in vitro and in vivo toxic effects with beauvericin and enniatins, which are mycotoxins of increasing interest to animal and human health.

Heavy Metals

Neurotoxic Effects of Heavy Metal Pollutants in the Environment: Focusing on Epigenetic Mechanisms

Guangxia Yu, Lingyan Wu, Qianqian Su, Xianqi Ji, Jinfu Zhou, Siying Wu, Ying Tang, et al. *Environ Pollut.* 2024 Feb 13:345:123563. doi: 10.1016/j.envpol.2024.123563. [Article link](#)

The pollution of heavy metals (HMs) in the environment is a significant global environmental issue, characterized by its extensive distribution, severe contamination, and profound ecological impacts. Excessive exposure to heavy metal pollutants can damage the nervous system. However, the mechanisms underlying the neurotoxicity of most heavy metals are not completely understood. Epigenetics is defined as a heritable change in gene function that can influence gene and subsequent protein expression levels without altering the DNA sequence. Growing evidence indicates that heavy metals can induce neurotoxic effects by triggering epigenetic changes and disrupting the epigenome. Compared with genetic changes, epigenetic alterations are more easily reversible. Epigenetic reprogramming techniques, drugs, and certain nutrients targeting specific epigenetic mechanisms involved in gene expression regulation are emerging as potential preventive or therapeutic tools for diseases. Therefore, this review provides a comprehensive overview of epigenetic modifications encompassing DNA/RNA methylation, histone modifications, and non-coding RNAs in the nervous system, elucidating their association with various heavy metal exposures. These primarily include manganese (Mn), mercury (Hg), lead (Pb), cobalt (Co), cadmium (Cd), nickel (Ni), silver (Ag), toxic metalloids arsenic (As), and etc. The potential epigenetic mechanisms in the etiology, precision prevention, and target therapy of various neurodevelopmental disorders or different neurodegenerative diseases are emphasized. In addition, the current gaps in research and future areas of study are discussed. From a perspective on epigenetics, this review offers novel insights for prevention and treatment of neurotoxicity induced by heavy metal pollutants.

Food Packaging

Recent Advances in Reinforced Bioplastics for Food Packaging - A Critical Review

Shahida Anusha Siddiqui, Xi Yang, Ram Kumar Deshmukh, Kirtiraj K Gaikwad, Nur Alim Bahmid, Roberto Castro-Muñoz. *Int J Biol Macromol.* 2024 Feb 23;263(Pt 2):130399. doi: 10.1016/j.ijbiomac.2024.130399. [Article link](#)

Recently, diversifying the material, method, and application in food packaging has been massively developed to find more environment-friendly materials. However, the mechanical and barrier properties of the bioplastics are major hurdles to expansion in commercial realization. The compositional variation with the inclusion of different fillers could resolve the lacking performance of the bioplastic. This review summarizes the various reinforcement fillers and their effect on bioplastic development.

In this review, we first discussed the status of bioplastics and their definition, advantages, and limitations regarding their performance in the food packaging application. Further, the overview of different fillers and development methods has been discussed thoroughly. The application of reinforced bioplastic for food packaging and its effect on food quality and shelf life are highlighted. The environmental issues, health concerns, and future perspectives of the reinforced bioplastic are also discussed at the end of the manuscript. Adding different fillers into the bioplastic improves physical, mechanical, barrier, and active properties, which render the required protective functions to replace conventional plastic for food packaging applications. Various fillers, such as natural and chemically synthesized, could be incorporated into the bioplastic, and their overall properties improve significantly for the food packaging application.

Chemical Contaminants

Dietary Acrylamide: A Detailed Review on Formation, Detection, Mitigation, and Its Health Impacts

Indira Govindaraju, Maidin Sana, Ishita Chakraborty, Md Hafizur Rahman, Rajib Biswas, Nirmal Mazumder. *Foods*. 2024 Feb 12;13(4):556. doi: 10.3390/foods13040556. [Article link](#)

In today's fast-paced world, people increasingly rely on a variety of processed foods due to their busy lifestyles. The enhanced flavors, vibrant colors, and ease of accessibility at reasonable prices have made ready-to-eat foods the easiest and simplest choice to satiate hunger, especially those that undergo thermal processing. However, these foods often contain an unsaturated amide called 'Acrylamide', known by its chemical name 2-propenamide, which is a contaminant formed when a carbohydrate- or protein-rich food product is thermally processed at more than 120 °C through methods like frying, baking, or roasting. Consuming foods with elevated levels of acrylamide can induce harmful toxicity such as neurotoxicity, hepatotoxicity, cardiovascular toxicity, reproductive toxicity, and prenatal and postnatal toxicity. This review delves into the major pathways and factors influencing acrylamide formation in food, discusses its adverse effects on human health, and explores recent techniques for the detection and mitigation of acrylamide in food. This review could be of interest to a wide audience in the food industry that manufactures processed foods. A multi-faceted strategy is necessary to identify and resolve the factors responsible for the browning of food, ensure safety standards, and preserve essential food quality traits.

Caffeine

Caffeine Intake and Anxiety: A Meta-Analysis

Chen Liu, Licheng Wang, Chi Zhang, Ziyi Hu, Jiayi Tang, Junxian Xue, Wenchun Lu. *Front Psychol*. 2024 Feb 1;15:1270246. doi: 10.3389/fpsyg.2024.1270246. [Article link](#)

The results from studies on relationship between caffeine intake and risk of anxiety remains controversial, so we conducted a meta-analysis to summarize the evidence about the association between caffeine intake and risk of anxiety. Relevant articles were identified by researching PubMed, Web of Science, Cochrane library, Embase, CNKI, WANFANG DATA, SinoMed and VIP from the inception to December, 2022. Three investigators independently sifted through the literature, extracted the data, and evaluated the quality of the included studies based on predetermined selection criteria and assessed articles with Risk of bias assessment tool for Cochrane systematic reviews and analytical cross-sectional study quality assessment tool from JBI PACES. After assessing the quality of the literature, meta-analysis was performed using Revman 5.4 and Stata 12.0. Data were obtained from eight articles, and 546 participants from 14 studies in eight articles from healthy populations were included in the caffeine-anxiety analyses. As the scales used to assess anxiety vary in the literature, we chose standardized mean difference as the outcome indicator. In terms of overall effect, the results of the meta-analysis showed that caffeine intake increased the risk of anxiety [SMD = 0.94, 95% CI = (0.28, 1.60), $p < 0.05$]. After suspecting that dose size might be responsible for the heterogeneity by sensitivity analysis, we performed subgroup analysis according to dose size and found that low-dose caffeine intake moderately increased the risk of anxiety [SMD = 0.61, 95%CI = (0.42, 0.79), $p < 0.05$], whereas high-dose caffeine intake had a highly significant increase in the risk of anxiety [SMD = 2.86, 95%CI = (2.50, 3.22), $p < 0.05$]. The results confirm that caffeine intake is associated with an elevated risk of anxiety in healthy individuals without psychiatric disorders, especially when the intake dose is greater than 400 mg.

Food Allergens

Research Gaps and Future Needs for Allergen Prediction in Food Safety

A Fernandez, E Danisman, M Taheri Boroujerdi, S Kazemi, F J Moreno, M M Epstein. *Front Allergy*. 2024 Feb 19;5:1297547. doi: 10.3389/falgy.2024.1297547. [Article link](#)

The allergenicity and protein risk assessments in food safety are facing new challenges. Demands for healthier and more sustainable food systems have led to significant advances in biotechnology, the development of more complex foods, and the search for alternative protein sources. All this has increased the pressure on the safety assessment prediction approaches anchored into requirements defined in the late 90's. In 2022, the EFSA's Panel on Genetically Modified Organisms published a scientific opinion focusing on the developments needed for allergenicity and protein safety assessments of new products derived from biotechnology. Here, we further elaborate on the main elements described in this scientific opinion and prioritize those development needs requiring critical attention. The starting point of any new recommendation would require a focus on clinical relevance and the development of a fit-for-purpose database targeted for specific risk assessment goals. Furthermore, it is imperative to review and clarify the main purpose of the allergenicity risk assessment. An internationally agreed consensus on the overall purpose of allergenicity risk assessment will accelerate the development of fit-for-purpose methodologies, where the role of exposure should be better clarified. Considering the experience gained over the last 25 years and recent scientific developments in the fields of biotechnology, allergy, and risk assessment, it is time to revise and improve the allergenicity safety assessment to ensure the reliability of allergenicity assessments for food of the future.

Emerging Science Areas

Emerging Area: New Chemical Contaminants

A Pilot Study of Chlormequat in Food and Urine from Adults in the United States from 2017 to 2023

Alexis M. Temkin, Sydney Evans, Demetri D. Spyropoulos & Olga V. Naidenko. *Journal of Exposure Science & Environmental Epidemiology* (15 Feb 2024). [Article link](#)

Chlormequat chloride is a plant growth regulator whose use on grain crops is on the rise in North America. Toxicological studies suggest that exposure to chlormequat can reduce fertility and harm the developing fetus at doses lower than those used by regulatory agencies to set allowable daily intake levels. Here we report, the presence of chlormequat in urine samples collected from people in the U.S., with detection frequencies of 69%, 74%, and 90% for samples collected in 2017, 2018–2022, and 2023, respectively. Chlormequat was detected at low concentrations in samples from 2017 through 2022, with a significant increase in concentrations for samples from 2023. We also observed high detection frequencies of chlormequat in oat-based foods. These findings and chlormequat toxicity data raise concerns about current exposure levels, and warrant more expansive toxicity testing, food monitoring, and epidemiological studies to assess health effects of chlormequat exposures in humans.

Engage with IAFNS

Year of Open Science

March 21, 2024 – March 22, 2024

Virtual, Event

The Center for Open Science (COS), in collaboration with the National Aeronautics & Space Administration, is hosting a no-cost, online culminating conference on March 21 and 22, 2024.

[Read more](#)

Host-Microbiota Interactions: A Personalized Point of View

April 18, 2024

Virtual, Event

Join IAFNS as we hear from Dr. Benoit Chassaing, Team Leader at INSERM located at Institut Pasteur in Paris, where his laboratory focuses on mucosal microbiota in chronic inflammatory diseases.

[Read more](#)

Canadian Nutrition Society: Pre-Conference – Food for Health Workshop

May 2, 2024

AI in Food, Nutrition and Health: Technologies, Use, Opportunities and Challenges

Edmonton, Canada and on-line

[Read more](#)

Registration Open!

IAFNS 2024 Annual Summer Science Symposium

June 4, 2024 – June 5, 2024

Join us and connect with scientists across government, industry and academia. Sessions and speakers will highlight actionable science in this unique gathering of scientific and regulatory experts.

National Press Club, Washington, DC

[Read more](#)



<https://www.linkedin.com/company/iafns-science>



<https://www.youtube.com/@IAFNS/videos>