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Risk Assessment

Risk–Benefit Assessment of Foods and its Role to Inform Policy Decisions: Outcome of an International Workshop

Constanza De Matteu Monteiro, Jeanne-Marie Membré, Morten Poulsen, Theresa Thomsen, Sara Monteiro Pires. *Frontiers of Nutrition*, 9 2024, Vol. 11 – 2024, doi.org/10.3389/fnut.2024.1458531. [Article link](#)

Policy decisions in public health require consideration and evaluation of trade-offs for which transparency and science-based evidence is needed. Improvement of decision-support tools is essential to help guide food policy decisions that promote healthy diets and meet the challenges of food systems without compromising food security, food safety, and sovereignty. Risk–benefit assessment of foods (RBA) is an established methodological approach designed to inform policy decisions within the area of nutrition and food safety. Despite methodological developments, translation of RBA findings into policies is still limited. In this context, a stakeholder workshop held in May 2023 gathered RBA experts and food regulators from Europe to identify the challenges, obstacles and opportunities in using evidence generated through RBAs to inform food policy decisions. A structured process was implemented to collect their views through online surveys, breakout groups, and plenary discussions. As a secondary objective, food regulators' views on other approaches for holistic risk assessment fit for food systems analysis were also explored. This paper summarizes the main findings of the workshop and discusses policy implications and future perspectives to improve the area of RBA and its role in food policymaking.

Foodborne Pathogens

Cooling Uncovered Foods at a Depth of ~5.1 cm (2 in.) or Less Poses Little Risk of Pathogen Growth

Nicklaus Koreen, W. Clifton Baldwin, Donald W. Schaffner. *JFP*, Vol. 87, Issue 10, Oct. 2024, 100356. doi.org/10.1016/j.jfp.2024.100356. [Article link](#)

The U.S. Food and Drug Administration has guidelines for cooling cooked foods in retail operations. Data on foodborne illness risk factors in restaurants indicate that cooling is often out of compliance with these guidelines. We sought to identify factors under the control of the operator that had a significant effect on the cooling rates of cooked foods. Minneapolis

Minnesota Health Inspectors were trained in standardized operating procedures for cooling data collection. Data loggers set to appropriate time intervals and calibrated to ± 0.5 °C (~ 1 °F) were used in data collection. Analysis was performed using the R statistical computing language version 4.2.2. Preexisting pathogen models were used to predict Log CFU increases of *Clostridium perfringens* or *Bacillus cereus*. Data from 224 recipes were recorded by inspectors between October 2018 and October 2019. Food depth had a highly significant effect ($p = 8.90E-08$) on cooling rate. The use of an ice bath or ice wand was also significant ($p < 0.005$). There was a significant correlation between container material (metal or plastic) and food depth because foods with a greater depth are often being cooled in plastic containers. Foods at a depth greater than 5.1 cm (2 in.) that cooled faster than 0.23 log(°C)/h were often wholly or partially cooled in blast chillers or freezers, cooled using an ice bath or ice wand (or both), or were composed of protein pieces (e.g., chicken wings) that facilitated more rapid cooling due to air gaps in the food. Foods in shallow containers at a food depth of less than or equal to ~ 5.1 cm (2 in.) that cooled more slowly than 0.23 log(°C)/h were being cooled at temperatures greater than 5 °C (41°F) or were partially or wholly covered. These foods also showed little evidence of pathogen growth from predictive models. Our analysis shows that cooling foods in shallow containers at a food depth of less than or equal to ~ 5.1 cm (2 in.) poses little risk of significant pathogen growth.

Foodborne Illness

Strategic Manipulation of Biofilm Dispersion for Controlling *Listeria monocytogenes* Infections

Junyi Zhang, Jianxiong Hao, Jingyi Wang, Huiying Li, Dandan Zhao. *CRFSN*, 5 Oct. 2024. doi.org/10.1080/10408398.2024.2409340. [Article link](#)

Listeria monocytogenes (*L. monocytogenes*), a gram-positive foodborne pathogen that can easily cause listeriosis. It secretes extracellular polymers and forms biofilms that are highly resistant to disinfection methods, such as UV light and germicides, posing risks to food processing equipment and food quality. Dispersion of biofilm is the cycle of its formation in which the bacteria return to planktonic state and become susceptible to antimicrobials, the strategic manipulation of biofilm dispersion is thus heralded as a novel and promising approach for the effective control of biofilm-related infections. Compared to the traditional methods, it is more effective to start with the composition of biofilms, cut off the production of their constituent substances, and genetically reduce the probability of biofilm formation. Meanwhile, the dispersion of bacteria can be supplemented with exogenous substances, making long-term control possible. This paper provides a brief but comprehensive overview of the mechanisms of *L. monocytogenes* biofilms or cross-contamination and their resistance properties, and facilitates our understanding and control of the prevention and containment of *L. monocytogenes* biofilm contamination based on the biofilm's active and passive diffusion strategies. This work provides practical guidelines for the food industry to guard against the enduring threat to food safety due to *L. monocytogenes* biofilms.

Heavy Metals

Human Exposure through the Diet to Arsenic and Other Toxic Elements: A Literature Review of Scientific Studies Conducted in Catalonia, Spain, in the Current Century

Jose L. Domingo, *Toxics*, Vol. 12, Issue 10, 749. Oct. 2024. doi.org/10.3390/toxics12100749. [Article link](#)

Human exposure to arsenic and other toxic elements such as cadmium, lead and mercury may lead to a wide range of adverse health effects. In relation to this, it is well established that the diet is the main route of exposure to both essential and toxic trace elements. In recent years, the levels of toxic elements in foodstuffs have been measured in numerous studies conducted all over the world. Scientific databases show that, in the current century, China and Spain have been the countries where the most surveys on this topic have been carried out. Regarding Spain, Catalonia is the region where most studies aimed at determining the concentrations of trace elements in food have been performed. The objective of this paper was to review the studies carried out in Catalonia on the concentrations of As and toxic metals (including Cd, Hg and Pb) in food, as well as their estimated dietary intakes (EDIs). The results of total diet studies (TDSs) and duplicate diet (DD) studies have been included. For most toxic elements, a continued reduction in the EDI has been observed. This reduction is associated with a decrease in their concentrations in food, and with certain changes in dietary habits. Fish and seafood is the food group showing the highest content of toxic elements. However, none of the adult groups exceeded—in general—the safety thresholds for As, Cd, Hg and Pb established by the European Food Safety Agency (EFSA).

Food Packaging

Superhydrophobic Coatings Reduce Human Bacterial Foodborne Pathogen Attachment to Woods used in Fresh Produce Harvest and Postharvest Packing

Zachariah Vice, William de Florio, Joseph Masabni, Luis Cisneros-Zevallos, Alejandro Castillo, Chris R. Kerth, Mustafa Akbulut. *Food Microbiology*, Vol. 123, October 2024, 104586. doi.org/10.1016/j.fm.2024.104586. [Article link](#)

Wood is reportedly more difficult to maintain in hygienic condition versus other food contact materials, yet its use in produce packing and retail warrants efforts to reduce the risk of microbial pathogen contamination and attachment. This study characterized antifouling capabilities of fluorinated silanes applied to wood used in fresh edible produce handling to render the wood superhydrophobic and less supportive of bacterial pathogen attachment. Pine and oak cubic coupon surfaces were treated with 1% (w/w) silane or left untreated. Treated and untreated coupons were inoculated with *Salmonella enterica* or *Listeria monocytogenes* and held to facilitate pathogen attachment for 1, 4, or 8 h. Silane treatment of wood produced significant reductions in the proportions of strongly attaching cells for both pathogens versus loosely attaching cells ($P < 0.01$). *Salmonella* attachment demonstrated a dependency on wood treatment; silane-treated wood supported a lower fraction of strongly adhering cells (1.87 ± 1.24 log CFU/cm²) versus untreated wood (3.72 ± 0.67 log CFU/cm²). *L. monocytogenes* demonstrated significant declines in strongly attaching cells during extended exposure to silane-treated wood, from 7.59 ± 0.14 to 5.27 ± 0.68 log CFU/cm² over 8 h post-inoculation. Microscopic analysis demonstrated silane treatment increased the surface roughness of both woods, leading to superhydrophobic conditions on wood surfaces, consequently decreasing strong attachment of pathogenic bacteria.

Chemical Contaminants

Acrylamide Detection and Reduction in Meat Products Using Organic Acids, Fruit Extracts and Probiotics

Gamal M. Hamad, Mukhtar M.F. Abushaala, Sohayla M. Abushaala, Nasser T. Ehmeza, Essa Mohamed Hassan Ahmed, Samy E. Elshaer, Ehab Y. Abdelhiee. *Food & Chemical Tox*, Vol. 192, Oct. 2024, 114927 doi.org/10.1016/j.fct.2024.114927. [Article link](#)

Grilled foods are an important source of acrylamide, which has neurotoxic, genotoxic, and carcinogenic properties. The current study aims to evaluate the level of acrylamide in beef, chicken, and fish products, especially those requiring high cooking temperatures, using High Performance Liquid Chromatography (HPLC). Reduction of acrylamide by organic acids i.e., (citric acid, malic acid, tartaric acid, and lactic acid) and fruit extracts of lemon, apple, and grape has also been investigated. The results revealed that the highest mean acrylamide concentration was found in chicken products (grilled chicken) which recorded 8.32 µg/100 g, followed by beef products (beef grilled) with a concentration of 7.91 µg/100 g, and fish products (pan-fried fish burgers) which recorded 6.77 µg/100 g). Furthermore, the mixture of organic acid has the highest effect on reducing the level of acrylamide in a chemical model system. Moreover, the fruit extract mixture was more effective in reducing the percentage of acrylamide in the grilled chicken than organic acids mixture. Finally, the addition of fruit extract improved the sensory properties of grilled chickens. In sum, this study offers novel and promising natural strategies to decrease acrylamide in meat products toward further future application in meat industry to deliver safe food to consumers.

Caffeine

Habitual Coffee, Tea, and Caffeine Consumption, Circulating Metabolites, and the Risk of Cardiometabolic Multimorbidity

Xujia Lu, Xiaohong Zhu, Guochen Li, Luying Wu, Liping Shao, Yulong Fan, Chen-Wei Pan, Ying Wu, Yan Borné, Chaofu Ke. *JCEM*, dgae552, 9 2024, doi.org/10.1210/clinem/dgae552. [Article link](#)

Context: Cardiometabolic multimorbidity (CM) is an increasing public health concern. Previous observational studies have suggested inverse associations between coffee, tea, and caffeine intake and risks of individual cardiometabolic diseases; however, their associations with CM and related biological markers are unknown. **Methods:** This prospective study involved 172 315 (for caffeine analysis) and 188 091 (tea and coffee analysis) participants free of any cardiometabolic diseases at baseline from the UK Biobank; 168 metabolites were measured among 88 204 and 96 393 participants. CM was defined as the coexistence of at least 2 of the following conditions: type 2 diabetes, coronary heart disease, and stroke.

Results: Nonlinear inverse associations of coffee, tea, and caffeine intake with the risk of new-onset CM were observed. Compared with nonconsumers or consumers of less than 100 mg caffeine per day, consumers of moderate amount of coffee (3 drinks/d) or caffeine (200-300 mg/d) had the lowest risk for new-onset CM, with respective hazard ratios (95% CIs) of 0.519 (0.417-0.647) and 0.593 (0.499-0.704). Multistate models revealed that moderate coffee or caffeine intake was inversely associated with risks of almost all developmental stages of CM, including transitions from a disease-free state to single cardiometabolic diseases and subsequently to CM. A total of 80 to 97 metabolites, such as lipid components within very low-density lipoprotein, histidine, and glycoprotein acetyls, were identified to be associated with both coffee, tea, or caffeine intake and incident CM. **Conclusion:** Habitual coffee or caffeine intake, especially at a moderate level, was associated with a lower risk of new-onset CM and could play important roles in almost all transition phases of CM development. Future studies are warranted to validate the implicated metabolic biomarkers underlying the relation between coffee, tea, and caffeine intake and CM.

Food Allergens

Dining Out with Food Allergies: Two Decades of Evidence Calling for Enhanced Consumer Protection

Silvia Dominguez, Jérémie Théolier, Jennifer Gerdts, Samuel B. Godefroy. *IJHM*, Vol. 122, 9 2024, 103825. doi.org/10.1016/j.ijhm.2024.103825. [Article link](#)

Food allergic reactions in restaurant settings are regularly reported, including fatalities. The risk of dining out with food allergies is well documented and is in part attributed to insufficient regulatory oversight. The objectives of this review were to (i) present scientific evidence characterizing the risk of dining out with food allergies, (ii) describe advances in proposed management mechanisms to mitigate this risk, and (iii) outline gaps in existing practices and regulations related to food allergen management in foodservice operations. Scientific publications (n=60) and laws/regulations from different jurisdictions (n=20) related to food allergy and food allergens management in foodservice operations were systematically retrieved and reviewed. Although the inherent nature of these operations poses challenges to the implementation of allergen control measures, evidence suggests that food-allergic consumers will continue to be at risk unless more stringent regulatory requirements, particularly related to communication with diners and between staff members, are adopted.

Emerging Science Areas

Emerging Food Safety Topic: Engineered Nanomaterials

Engineered Nanomaterials Reduce Metal(loid) Accumulation and Enhance Staple Food Production for Sustainable Agriculture

Yini Cao, Chuanxin Ma, Jason C. White, Yuchi Cao, Fan Zhang, Ran Tong, Hao Yu, Yi Hao, Wende Yan, Melanie Kah, Baoshan Xing. *Nature Food*, ISSN 2662-1355. October 11, 2024. doi.org/10.1038/s43016-024-01063-1, [Article link](#)

Metal(loid) contaminants in food pose a global health concern. This study offers a global analysis of the impact of nanomaterials (NMs) on crop responses to metal(loid) stresses. Our findings reveal that NMs have a positive effect on the biomass production of staple crops (22.8%), while showing inhibitory effects on metal(loid) accumulation in plants (-38.3%) and oxidative damage (-21.6%) under metal(loid) stress conditions. These effects are influenced by various factors such as NM dose, exposure duration, size and composition. Here we introduce a method using interval-valued intuitionistic fuzzy values by integrating the technique for order preference by similarity to an ideal solution and entropy weights to compare the effectiveness of different NM application patterns. These results offer practical insights for the application of NMs in similar multi-criteria decision-making scenarios, contributing to sustainable agriculture and global food safety.

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