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## Risk Assessment

### **Risk Assessment and Impact Prediction of Associated Heavy Metal Pollution in Selenium-Rich Farmland**

Yuanzhe Ma, Fuxing Guo, Haode Zhu, Yunmei Wu, Baocheng Guo, Jing Yang, Fuyong Wu. *Sci Total Environ.* 2024 Aug 5:950:175321. doi: 10.1016/j.scitotenv.2024.175321. [Article link](#)

Selenium (Se)-rich farmland is a valuable and nonrenewable resource for addressing the global challenge of Se deficiency. However, frequent warnings of heavy metal pollution have threatened the safety and legitimacy of Se-rich functional agriculture, eventually damaged public health security. Definitive and judgmental quantitative studies on this hazardous phenomenon are still missing. Relevant reviews published in the past have summarized textual descriptions of the problem, lacking the support of the necessary statistical analysis of the data. Based on the collected publications, the present study evaluated and analyzed the sources, risks and impacts of heavy metal pollution in Se-rich farmland. Concentrations of cadmium (Cd), arsenic, lead and zinc in Se-rich farmland were significantly higher than those in non-Se-rich farmland, especially Cd. Pollution source analyses indicated that Se enrichment and heavy metal pollution occurred simultaneously in farmland, related to Se-heavy metal homology in rocks. According to environmental risk assessment, both serious Cd pollution and the narrow Se concentration range of safety utilization limited the availability of Se-rich farmland. Pollution impact predictions showed that the pollution in Se-rich farmland would result in serious human health risks to consumers and economic losses of 4000 yuan/hm<sup>2</sup> on production side. Tackling Cd pollution was anticipated to recover economic losses (81 %) while lowering the carcinogenic (60 %) and non-carcinogenic (10 %) health risks. Our study also provided recommendations to address heavy metal pollution in Se-rich farmland. The two criteria should be followed by pollution control strategies applied to Se-rich functional agriculture including (i) not affecting the original Se enrichment in plant and (ii) not being interfered by Se in soil-plant systems. This will provide valuable information for Se-rich functional agriculture and public health security.

## Foodborne Pathogens

### **Inhibition of *Clostridium perfringens* and *Bacillus cereus* by Dry Vinegar and Cultured Sugar Vinegar During Extended Cooling of Uncured Beef and Poultry Products**

Kathleen A Glass, Cynthia B Austin, Melissa A Bohn, Max C Golden, Kristin M Schill, Steven C Ricke, Subash Shrestha. *J Food Prot.* 2024 Aug;87(8):100317. doi: 10.1016/j.jfp.2024.100317. [Article link](#)

The 2021 FSIS Stabilization Guidelines for Meat and Poultry Products (Appendix B) Option 1.2 limits Phase 1 cooling from 48.8 to 26.7 °C in uncured meats to 1 h. However, this time restriction is impractical to achieve in large-diameter whole-muscle products. The objective of this study was to compare the inhibitory effect of commercial dry vinegars (DVs) and

cultured sugar-vinegar blends (CSVs) on *Clostridium perfringens* and *Bacillus cereus* in uncured beef and poultry products during extended cooling. Treatments (beef: 72-73% moisture, pH 6.2-6.3, 0.85-0.95% NaCl; turkey: 76-77% moisture, pH 6.5-6.7, 1.3-1.6% NaCl) included Controls without antimicrobials, and four DV and four CSV, each tested at 0.75 and 1.25%. Batches were inoculated with 2.5-log *C. perfringens* or *B. cereus* spores, vacuum-packaged, and cooked to 73 °C. Packages were cooled from 48.8 to 27 °C (Phase 1) in 3, 4, or 5 h; Phase 2 (27-12.8 °C) and Phase 3 (12.8-4 °C) were standardized for 5-h cooling each. Pathogens were enumerated on selective agar in triplicate samples assayed at precook, postcook, and at the end of Phase 1, 2, and 3 cooling. Experiments were conducted twice. *B. cereus* did not grow (<0.5-log increase) in any treatment when Phase 1 cooling was extended to 5 h. *C. perfringens* grew rapidly (2.5 to >4.5 log) in Control treatments when Phase 1 cooling was extended to ≥3 h. All 1.25% DV ingredients limited *C. perfringens* growth to ≤1-log when Phase 1 cooling was extended to 3 h but supported a >1-log increase when Phase 1 cooling was extended to 5 h. All 1.25% CSV inhibited growth under 3-h Phase 1 cooling; 1.25% CSV-A and ≥0.75% CSV-D inhibited growth in turkey during 5-h Phase 1 cooling, but inhibition with 1.25% CSV-C was inconsistent in beef. This study revealed that formulating uncured meats with 1.25% DV or certain CSV can extend Phase 1 cooling to 3 h. Although all ingredients inhibited growth when used at 0.75% or greater compared to a control, greater variability of inhibition was observed among CSV than for DV.

## Foodborne Illness

### Review: Impact of Food Safety on Global Trade

Abebe Tibebe, Habtamu Tamrat, Adane Bahiru. *Vet Med Sci.* 2024 9;10(5):e1585. doi: 10.1002/vms3.1585. [Article link](#)

Food safety encompasses the supply and assurance of safe, high-quality food for consumers. It is a crucial aspect of food security, gaining greater global attention due to the increasing number of widespread foodborne incidents. International trade is expanding as countries increasingly rely on each other to secure a sufficient and diverse food supply. Beyond this, concerns about food safety have become more prevalent due to various factors. Therefore, this review aims to investigate the effects of food safety-associated risks on the international trade of food and related products. A total of 37 published studies retrieved using different search engines were included in this review. This review revealed that because of rapid population growth and rising food demand in developing nations, agricultural intensification is growing. It has been found that foodborne illnesses and associated discrepancies can impede the international trade of food commodities. Trade bans due to the fear of foodborne illnesses are growing. The consequences of foodborne diseases are multifaceted and include financial losses from trade restrictions, medical costs for prevention or control, resource depletion and a decline in food production. The overall effects are increased international trade tensions and livelihood vulnerability to poverty, notably for small-scale livestock producers. Potential food contaminants include microbes, pesticides, pharmaceutical residues, heavy metals and fraudulent such as improper food processing, mislabelling, poor packaging, adulteration and substitution. Hence, countries are encouraged to harmonize the rights and duties set by the World Trade Organization under sanitary and phytosanitary to maximize their advantages in global markets. Based on this evidence, we recommend that each country develop and integrate regulations that would ensure the safety of both domestic and international food production systems. Furthermore, the global community should either revise the current functioning food regulatory and monitoring body or establish a more genuine collaborative network.

## Mycotoxins

### Advances in Aptamer-Based Biosensors for the Detection of Foodborne Mycotoxins

Yangyang Li, Dan Zhang, Xiaoyuan Zeng, Cheng Liu, Yan Wu, Cuicui Fu. *Molecules.* 2024 Aug 22;29(16):3974. doi: 10.3390/molecules29163974. [Article link](#)

Foodborne mycotoxins (FBMTs) are toxins produced by food itself or during processing and transportation that pose an enormous threat to public health security. However, traditional instrumental and chemical methods for detecting toxins have shortcomings, such as high operational difficulty, time consumption, and high cost, that limit their large-scale applications. In recent years, aptamer-based biosensors have become a new tool for food safety risk assessment and monitoring due to their high affinity, good specificity, and fast response. In this review, we focus on the progress of single-mode and dual-mode aptasensors in basic research and device applications over recent years. Furthermore, we also point out some problems in the current detection strategies, with the aim of stimulating future toxin detection systems for a transition toward ease of operation and rapid detection.

## Heavy Metals

### Unintended Food Safety Impacts of Agricultural Circular Economies, with Case Studies in Arsenic and Mycotoxins

Christian Kelly Scott 1, Felicia Wu. *NPJ Sci Food*. 2024 Aug 13;8(1):52. doi: 10.1038/s41538-024-00293-8. [Article link](#)



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For millennia, food systems worldwide have employed practices befitting a circular economy: recycling of agricultural and food waste or byproducts, environmentally sustainable production methods, and food preservation to reduce waste. Many modern-day agricultural practices may also contribute to a circular economy through the reuse of waste products and/or reducing agricultural inputs. There are, however, food safety impacts. This paper describes two sustainable agricultural practices that have unintended positive and negative impacts on food safety: alternative rice cultivation practices and no-till agriculture. We highlight how alternative rice cultivation practices have intended benefits of water conservation and economic savings, yet also unintended effects on food safety by reducing foodborne arsenic levels while increasing cadmium levels. No-till agriculture reduces soil erosion and repurposes crop residues, but can lead to increased foodborne mycotoxin levels. Trade-offs, future research, and policy recommendations are discussed as we explore the duality of sustainable agricultural practices and food safety.

### Association Between Arsenic Exposure and Melanoma: A Meta-Analysis

Wenlong Shuai, Qing Huang, Liuli Xu, Yunzhu Mu. *Int J Dermatol*. 2024 9;63(9):1155-1163. doi: 10.1111/ijd.17192. [Article link](#)

**Background:** Melanoma is a highly malignant tumor. Moreover, its prevalence is increasing at a rapid rate year after year. Currently, UV light is the leading cause of melanoma, although numerous other risk factors exist, including arsenic. The link between arsenic and the likelihood of developing melanoma has long been debated. As a result, we conducted a meta-analysis of the available data to investigate the association between arsenic exposure and melanoma. **Methods:** We identified seven non-randomized controlled studies with 41,949 participants by searching the Chinese CNKI, Embase, PubMed, and Cochrane Library databases. We then used random-effects or fixed-effects models to evaluate the pooled odds ratios (OR) and their 95% confidence intervals (CI). Subgroup analyses were also carried out with different included regions. **Results:** Participants in the study who were exposed to arsenic had a somewhat higher chance of developing melanoma than those who were not (OR = 1.47, 95% CI 1.01-2.13). A subgroup analysis was also carried out for the US region, and the findings were not statistically significant (OR = 1.40, 95% CI 0.94-2.07). **Conclusion:** This meta-analysis shows that arsenic exposure relates to an increased risk of melanoma.

## Food Packaging

### Materials Based on Biodegradable Polymers Chitosan/Gelatin: A Review of Potential Applications

Aref Yarahmadi, Behrooz Dousti, Mahdi Karami-Khorramabadi, Hamed Afkhami. *Front Bioeng Biotechnol*. 2024 Aug 2;12:1397668. doi: 10.3389/fbioe.2024.1397668. [Article link](#)

Increased mass manufacturing and the pervasive use of plastics in many facets of daily life have had detrimental effects on the environment. As a result, these worries heighten the possibility of climate change due to the carbon dioxide emissions from burning conventional, non-biodegradable polymers. Accordingly, biodegradable gelatin and chitosan polymers are being created as a sustainable substitute for non-biodegradable polymeric materials in various applications. Chitosan is the only naturally occurring cationic alkaline polysaccharide, a well-known edible polymer derived from chitin. The biological activities of chitosan, such as its antioxidant, anticancer, and antimicrobial qualities, have recently piqued the interest of researchers. Similarly, gelatin is a naturally occurring polymer derived from the hydrolytic breakdown of collagen protein and offers various medicinal advantages owing to its unique amino acid composition. In this review, we present an overview of recent studies focusing on applying chitosan and gelatin polymers in various fields. These include using gelatin and chitosan as food packaging, antioxidants and antimicrobial properties, properties encapsulating biologically active substances, tissue

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engineering, microencapsulation technology, water treatment, and drug delivery. This review emphasizes the significance of investigating sustainable options for non-biodegradable plastics. It showcases the diverse uses of gelatin and chitosan polymers in tackling environmental issues and driving progress across different industries.

## Chemical Contaminants

### Food Contaminants: Impact of Food Processing, Challenges and Mitigation Strategies for Food Security

Arumugam Vignesh, Thomas Cheeran Amal, Krishnan Vasanth. *Food Res Int.* 2024 9:191:114739. doi: 10.1016/j.foodres.2024.114739. [Article link](#)

Food preparation involves the blending of various food ingredients to make more convenient processed food products. It is a long chain process, where each stage posing a risk of accumulating hazardous contaminants in these food systems. Protecting the public health from contaminated foods has become a demanding task in ensuring food safety. This review focused on the causes, types, and health risks of contaminants or hazardous chemicals during food processing. The impact of cooking such as frying, grilling, roasting, and baking, which may lead to the formation of hazardous by-products, including polycyclic aromatic hydrocarbons (PAHs), heterocyclic amines (HCAs), acrylamide, advanced glycation end products (AGEs), furan, acrolein, nitrosamines, 5-hydroxymethylfurfural (HMF) and trans-fatty acids (TFAs). Potential health risks such as carcinogenicity, genotoxicity, neurotoxicity, and cardiovascular effects are emerging as a major problem in the modern lifestyle era due to the increased uptakes of contaminants. Effects of curing, smoking, and fermentation of the meat products led to affect the sensory and nutritional characteristics of meat products. Selecting appropriate cooking methods include temperature, time and the consumption of the food are major key factors that should be considered to avoid the excess level intake of hazardous contaminants. Overall, this study underscores the importance of understanding the risks associated with food preparation methods, strategies for minimizing the formation of harmful compounds during food processing and highlights the need for healthy dietary choices to mitigate potential health hazards.

## Caffeine

### The Complexity of Coffee and its Impact on Metabolism

Huanan Zhang, John Speakman. *J Endocrinol.* 2024 9:1:JOE-24-0075. doi: 10.1530/JOE-24-0075. [Article link](#)

Coffee is one of the three most consumed beverages in the world. It is made by first roasting coffee beans and then grinding and boiling or steeping the roasted beans in water (brewing). The process of roasting and brewing produces a complex mix of bioactive compounds which include methylxanthines (caffeine, theobromine, theophylline), diterpenes, chlorogenic acid, trigonelline, flavonoids and hydroxycinnamic acid. In the body these compounds may be metabolized to produce other bioactive compounds. For example, caffeine is primarily (80%) broken down by demethylation to produce paraxanthine. In the post ingestion period levels of paraxanthine may be higher than caffeine due to its slower elimination. Hence, while paraxanthine is not found in coffee itself, it has many of the same properties of caffeine and may be a major contributor to its metabolic effects. The impacts of caffeine and paraxanthine on metabolism relate to their impact on adenosine receptors (notably the A2A receptor). It has been known for almost 100 years that intake of coffee stimulates metabolism by between 5 and 20% for at least 3 hours. About half of the increase in metabolic rate after drinking coffee is due to caffeine and derivatives, but the source of the other half is unclear. There are large differences in the response to the same amount of coffee in different individuals, which may be related to caffeine clearance rates, effects of other unknown pathways, genetic polymorphism, age, sex and body composition.

## Food Allergens

### New Evidence in Food Allergies Treatment

Chiara Ghelli, Giovanni Costanzo, Giorgio Walter Canonica, Enrico Heffler, Giovanni Paoletti. *Curr Opin Allergy Clin Immunol.* 2024 Aug 1;24(4):251-256. doi: 10.1097/ACI.0000000000000999. [Article link](#)

**Purpose of review:** To acknowledge, the newly available treatments for food allergy described in the latest scientific literature, such as oral immunotherapy (OIT), biologics and the combination of them in managing patients with IgE-

mediated food allergies. **Recent findings:** Recent studies suggest that OIT and biologics, alone or together, can have a role as disease-modifying treatments for food allergies. The FDA has recently approved omalizumab as a treatment for food allergy. Other biologics are currently under evaluation and further studies are needed to assess the efficacy and safety of these therapies. **Summary:** The allergology scenario is rapidly evolving, the recent introduction and approval of new therapeutic strategies such as biotechnological drugs and allergen immunotherapy is changing the therapeutic paradigm: we are witnessing a shift from a strategy based on avoiding the trigger and reversing an allergic reaction already in progress, to one that aims to modify the natural history of the disease by acting on the immunological mechanisms that determine it. This approach is consistent with the modern perspective of a personalized patient-tailored medicine. In this opinion review, we will provide a brief analysis of current and future therapeutic options for IgE-mediated food allergy, focusing on OIT, biologics and their combination.

## Engage with IAFNS

### **Low- and No-Calorie Sweeteners and Body Weight: How Systematic Reviews on Low Calorie Sweeteners Produce Disparate Results**

September 10, 2024, Virtual Event

This webinar will decipher how systematic review methodologies influence the findings produced when investigating the association between LNCS consumption and body weight.

[Register here](#)

### **IAFNS Food Microbiology Research Roundtable**

September 11, 2024, Washington, DC

In advance of setting priorities for a new research cycle, IAFNS Food Microbiology Committee will hold a research roundtable with representatives from food safety agencies and organizations.

[Register here](#)

### **Nutritional Considerations for Anti-Obesity Medications: Evidence-Based Guidance**

September 12, 2024, Virtual Event

Join IAFNS as Dr. Jaime Almandoz presents recent work translating the clinical experience with 'new' obesity medications into practical nutritional considerations and guidance that can support effective use.

[Register here](#)

### **Towards More Rigorous and Informative Nutrition Epidemiology**

September 25, 2024, Virtual, Event

This IAFNS meeting will discuss approaches for stronger designs, measurements, analyses, execution, and reporting to navigate the space between the differences between randomized trials and ordinary nutrition epidemiology.

[Register here](#)

### **Low- and No-Calorie Sweeteners Stakeholder Exchange**

October 15, 2024, Washington, DC

IAFNS will host its annual Low- and No-Calorie Sweeteners Stakeholder Exchange to elicit input.

[Register here](#)



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