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Risk Assessment

A Safety Risk Assessment Method Based on Conditionally Constrained Game Theory and Adaptive Ensemble Learning: Application to Wheat Flour and Rice

Wanbao Sheng, Huawei Jiang, Zhen Yang, Like Zhao, Junwei Jin. *Food Res Intl.* Jan 28, 2025. doi.org/10.1016/j.foodres.2025.115835. [Article link](#)

Food safety risk control and comprehensive assessment are crucial measures to ensure food safety. However, existing food safety risk assessment methods face challenges, such as unreasonable weight distribution of hazard factors and poor adaptability. Therefore, a safety risk assessment model based on conditionally constrained game theory and adaptive ensemble learning is proposed in this paper. Firstly, new constraints are established on the traditional game theory combination weighting method and solved using the augmented Lagrange multiplier method to obtain the optimal linear combination coefficients and actual composite risk values of the samples, which are taken together with the hazard factor detection data as inputs to the adaptive ensemble learning model. Then, an adaptive ensemble learning model is constructed, which prefers the base learner based on the combined measure of stability and accuracy, and predicts the composite risk value by using robust weighted random forest as the meta-learner. Finally, the model's validity was verified using wheat flour and rice hazard factor detection data. The experimental results indicate that the model's fit on the two datasets is 0.996 and 0.991, respectively, demonstrating strong generalization ability and high prediction accuracy. Meanwhile, unqualified products in wheat flour and rice can be effectively identified through risk thresholds, which helps to provide early warning of potential safety risks.

Foodborne Pathogens

Models for the Inactivation of Foodborne Pathogens in Salad Dressing from Challenge Studies

Donald W Schaffner, W. Clifton Baldwin. *Jrnl of Food Prot.* Vol. 87, Issue 12, Dec 2024. doi.org/10.1016/j.jfp.2024.100384. [Article link](#)

The Association for Dressings and Sauces' (ADS) members have conducted challenge studies on salad dressing products to assess pathogen survival. Data from 79 different challenge studies provided by ADS were used in this analysis. The acid-moisture ratio, pH, incubation temperature, and ingredient details were provided for each study. Linear regression models were used to predict the time to 3-log, 4-log, and 5-log reduction as a function of study parameters. A statistically based approach also was used to estimate the concentration of pathogens in ingredients based on testing history. This was combined with decline modeling to estimate pathogen concentration over time. The time-to-five log reduction for each of the target pathogens were highly skewed. A logarithmic transformation of time to 5 log reduction resulted in approximately normal distributions. Incubation temperature and formulation pH were highly significant ($p < 1E-6$), in predicting the number of days to a five-log reduction of *Escherichia coli* O157:H7, while the percentage of spices in the formulation is also quite significant ($p = 0.01$). *Salmonella* modeling showed that the most highly significant parameter was the percentage of water ($p < 1E-8$). Other parameters in order of descending significance include the percent fruit ($p = 0.00032$), incubation temperature ($p = 0.00268$), followed by percent sugar ($p = 0.02161$) and percent vegetables ($p = 0.03149$). The most significant parameter in predicting *Listeria monocytogenes* reduction was incubation temperature ($p = 0.000687$), followed by acid moisture ratio ($p = 0.012423$). The next two significant parameters in the *Listeria* model were percent lipid ($p = 0.023772$) and percent water ($p = 0.025701$). The least significant parameter that meets the minimum criteria for inclusion in the *Listeria* model ($p < 0.05$) was percent fruit ($p = 0.047074$). Our analysis will be useful in developing risk-based approaches to continue to assure the safety of commercially prepared salad dressings.

Foodborne Illness

Demographic Characteristics and County-level Indicators of Social Vulnerability in Salmonellosis Outbreaks Linked to Ground Beef—United States, 2012–2018

Michelle A. Waltenburg, Zainab Salah, Michelle Canning, Kelly McCain, David Rickless, Michael Ablan, Tamara N. Crawford. *Jrnl of Food Prot.* Vol. 88, Issue 1, 2 Jan 2025. doi.org/10.1016/j.jfp.2024.100411. [Article link](#)

Ground beef is a common source of US *Salmonella* illnesses and outbreaks. However, the demographic and socioeconomic factors that are related to risk in ground beef-associated outbreaks of *Salmonella* infections are poorly understood. We describe the individual-level demographic characteristics and county-level indicators of social vulnerability for people infected with *Salmonella* linked to outbreaks associated with ground beef in the United States during 2012–2018. Non-Hispanic (NH) White and NH American Indian/Alaska Native persons, and people living in nonmetropolitan areas, were overrepresented among people in salmonellosis outbreaks linked to ground beef. Case patients disproportionately resided in counties with high social vulnerability, suggesting that one or more community social risk factors may contribute to or be associated with some food safety risks. Collecting and analyzing socioeconomic and demographic characteristics of people in outbreaks can help identify disparities in foodborne disease, which can be further characterized and inform equity-focused interventions.

Food Classification

Fifteen Years of NOVA Food-Processing Classification: “Friend or Foe” Among Sustainable Diet Indicators? A Scoping Review

Orsolya Tompa, Anna Kiss, Sándor Soós, Zoltán Lakner, Ana Raner, Gyula Kasza et. al. *Nutr. Rev.* 23 Jan 2025, doi.org/10.1093/nutrit/nuae207. [Article link](#)

It has been 15 years since the introduction of the NOVA food-processing classification. While it was designed to identify ultra-processed foods linked to noncommunicable diseases, the NOVA system has a holistic concept that fits with sustainable nutrition. However, NOVA’s connection to other sustainable diet indicators has not been thoroughly explored. The aim was to summarize the research and methodological context of using the NOVA system with other sustainable diet indicators and to investigate NOVA’s synergies and discordance with them. A scoping review was conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses—Extension for Scoping Reviews (PRISMA-ScR). Studies published between 2009 and 2023 were collected from the Web of Science, Scopus, and PubMed databases. 1612 studies were initially screened; in the selected studies (n = 77), the NOVA system was applied in addition to other sustainable diet indicator(s). The studies were analyzed within a qualitative data analysis framework. 77 studies were analyzed in which healthiness (n = 66), environmental pressure (n = 9), affordability (n = 11), other processing classifications (n = 6), and other sustainable diet indicators (n = 10) were applied with NOVA. Among them, the identified relationships between the NOVA system and other healthfulness indicators were synergistic in the majority of studies (n = 70/93). For environmental pressure indicators, a mixed picture was observed; the NOVA classification was predominantly synergistic with greenhouse gas emissions (n = 8/13), while it was mostly discordant with fresh water use (n = 8/12). Economic affordability was also found to be discordant with the NOVA classification in the majority of studies (n = 10/16). To complete the NOVA classification with nutrient profiling would be beneficial to identify healthy diets. In the case of the integration of NOVA into sustainable nutrition research, environmental pressure and economic affordability indicators should be controlled to reach optimal trade-offs for more sustainable diets. The application of NOVA is gaining relevance; thus, its methodological adaptation to sustainable nutrition research is necessary.

Heavy Metals

Heavy Metal Contamination and its Impact on the Food Chain: Exposure, Bioaccumulation, and Risk Assessment

B. Raksha Shetty, Pai B. Jagadeesha, S. A. Salmataj. *Journal of Food*, Vol. 23, Jan 2025, Issue 1. doi.org/10.1080/19476337.2024.2438726. [Article link](#).

Non-essential heavy metals (HMs) are one of the most toxic substances released into the environment, affecting the food chain and posing a threat to food security. The research data was collated after carefully observing some of the studies conducted on commonly consumed food products and highlighting heavy metal exposure pathways to crops and techniques

adapted to the quantification of HMs in the food chain. The tools developed to estimate the ecological and health risks induced via ingestion of HM-contaminated food products in both children and adults in India are discussed. It is observed that Cd, Cr, Cu, Pb, and Zn are the most commonly studied heavy metals in food products. Bioaccumulation indices in Indian crops revealed varying heavy metal intake. Children suffer more from consuming food contaminated with HMs than adults. This review summarizes the distribution of HMs, their pollution, and the correlation between each HM concentration.

Food Packaging

Food Contamination from Packaging Material with Special Focus on the Bisphenol-A

Agarwal, A., Gandhi, S., Tripathi, A. D., Gupta, A., Iammarino, M., Sidhu, J. K. *Critical Reviews in Biotechnology*, 45(1), 69–79, Jan 2025. doi.org/10.1080/07388551.2024.2344571. [Article link](#)

Additives, such as bisphenol A (BPA) that are added to packaging material to enhance functionality may migrate into food products creating a concern for food safety. BPA has been linked to various chronic diseases, such as: diabetes, obesity, prostate cancer, impaired thyroid function, and several other metabolic disorders. To safeguard consumers, BPA migration limits have been defined by regulatory bodies. However, it is important to address the underlying factors and mechanisms so that they can be optimized in order to minimize BPA migration. In this review, we determine the relative importance of the factors, i.e. temperature, contact time, pH, food composition, storage time and temperature, package type, cleaning, and aging, and packaging damage that promote BPA migration in foods. Packaging material seems to be the key source of BPA and the temperature (applied during food production, storage, can sterilization and cleaning processes) was the critical driver influencing BPA migration.

Chemical Contaminants

Endemic Dietary Herb Extracts Reduce Acrylamide and Enhance Sensory Characteristics of Potato Chips

Daniel Assefa, Engida Dessalegn, Kebede Abegaz. *JFP*. Vol. 88, Issue 1, 2 Jan. 2025, doi.org/10.1016/j.jfp.2024.100427. [Article link](#)

This study evaluated the impact of soaking potato slices in water containing extracts from three endemic herbs, *Lippia adoensis* var. *adoensis* (kesse), *Lippia adoensis* var. *koseret* (koseret), and *Thymus schimperi* Ronninger (tosign), on acrylamide content and sensory attributes of fried potato chips. The total phenolic content (TPC) and total flavonoid content (TFC) of the extracts were measured using the Folin-Ciocalteu and aluminum chloride colorimetric methods, respectively. Antioxidant activity was assessed using ferric-reducing antioxidant power (FRAP) and ferrous chelating activity (FICA). Acrylamide levels were quantified using high-performance liquid chromatography (HPLC), while sensory attributes, including taste, color, odor, crispiness, and overall acceptability, were assessed. Kesse extract exhibited the highest TPC (30.20 ± 1.23 mg GAE/g) and TFC (15.87 ± 1.06 mg QE/g), FRAP (63.95 ± 1.53 μ g/mL), and FICA (110.15 ± 3.27 μ g/mL). Potato chips treated with kesse extract reduced acrylamide levels to 0.576 mg/kg (63.4%), followed by tosign (0.654 mg/kg, 58.5%) and koseret (0.870 mg/kg, 44.8%), while butylated hydroxytoluene (BHT) achieved a reduction to 1.097 mg/kg (30.4%) compared to the control (1.58 mg/kg). A significant negative correlation was observed between TPC ($R^2 = 0.9956$) and TFC ($R^2 = 0.8802$) with acrylamide levels ($p < 0.05$). Sensory evaluation revealed that potato chips treated with kesse extract scored significantly higher in taste, odor, and color, leading to enhanced overall acceptability. These findings demonstrate the potential of these endemic dietary herbs as natural antioxidants to mitigate acrylamide formation and improve the sensory quality of potato chips, suggesting practical applications in food processing and health-conscious diets.

Food Allergens

Household Food Allergen Exclusion Practices and Food Allergy-Related Psychosocial Functioning

Hana B. Ruran, Gabrielle D'Ambrosi, Roxanne Dupuis, et. al. *JAMA Netw Open*. Dec. 27, 2024;7(12): doi:10.1001/jamanetworkopen.2024.52646. [Article link](#)

Food allergy (FA) affects 10% of children worldwide. FA causes stress and quality of life (QOL) concerns associated with accidental exposure and emergency treatment. Some parents manage their child's FA by excluding allergens from their home. We sought to determine the proportion of households excluding allergens by specific FA and its association with this practice and FA-related psychosocial functioning.

Caffeine

An Update on Beverage Consumption Patterns and Caffeine Intakes in a Representative Sample of the US Population

Mitchell DC, Trout M, Smith R, Teplansky R, Lieberman HR. *Food & Chemical Tox.* Vol. 196, February 2025, doi.org/10.1016/j.fct.2025.115237. [Article link](#).



This research was supported by IAFNS [Caffeine Committee](#).

Caffeine is a popular stimulant, predominantly consumed from beverages. The caffeinated beverage marketplace is continually evolving resulting in considerable interest in understanding the impact caffeinated beverages have on levels of intakes. Therefore, estimates of caffeine intakes in the U.S. population were calculated using a recent 2022 beverage survey, the Kantar Worldpanel Enhanced Beverage Service. A nationally representative sample of 49,700 consumers (aged ≥ 2 years) completed a 1-day beverage intake survey which collected data on beverage type/category, amount and brand. Approximately 69% of the U.S. population consumed at least one caffeinated beverage per day. The mean (\pm SE) daily caffeine intake of caffeine consumers (age >2 years) from all beverages was 210 ± 1.5 mg. Caffeine intake was highest in consumers aged 50–64 years (246 ± 4.5 mg/day) and lowest in children aged 2–5 (42 ± 2.4 mg/day). At the 90th percentile intake was 520 mg/day for all ages combined. Coffee was the largest contributor (69%) to caffeine intake across all age groups followed by carbonated soft drinks (15.4%), tea (8.8%), and energy drinks (6.3%). This study indicates that an increase in caffeine intake has occurred with a corresponding shift in beverage consumption patterns compared to previous surveys.

Emerging Science Areas

Emerging Areas: Avian Flu

Testing of Retail Cheese, Butter, Ice Cream, and Other Dairy Products for Highly Pathogenic Avian Influenza in the US

David L. Suarez, Iryna V. Goraichuk, Lindsay Killmaster, Erica Spackman, Nicole J. Clausen, Tristan J. Colonius, Cynthia L. Leonard, et. al. *Jrnl of Food Prot.* Vol. 88, Issue 1, 2 Jan 2025. doi.org/10.1016/j.jfp.2024.100431. [Article link](#)

The recent outbreak of highly pathogenic avian influenza (HPAI) in dairy cows has created public health concerns about the potential of consumers being exposed to live virus from commercial dairy products. Previous studies support that pasteurization effectively inactivates avian influenza in milk and an earlier retail milk survey showed viral RNA, but no live virus could be detected in the dairy products tested. Because of the variety of products and processing methods in which milk is used, additional product testing was conducted to determine if HPAI viral RNA could be detected in retail dairy samples, and for positive samples by quantitative real-time RT-PCR (qRT-PCR) further testing for the presence of live virus. Revised protocols were developed to extract RNA from solid dairy products including cheese and butter. The solid dairy product was mechanically liquified with garnet and zirconium beads in a bead beater diluted 1–4 with BHI media. This preprocessing step was suitable in allowing efficient RNA extraction with standard methods. Trial studies were conducted with different cheese types with spiked-in avian influenza virus to show that inoculation of the liquified cheese into embryonating chicken eggs was not toxic to the embryos and allowed virus replication. A total of 167 retail dairy samples, including a variety of cheeses, butter, ice cream, and fluid milk were collected as part of a nationwide survey. A total of 17.4% (29/167) of the samples had detectable viral RNA by qRT-PCR targeting the matrix gene, but all PCR-positive samples were negative for live virus after testing with embryonating egg inoculation. The viral RNA was also evaluated by sequencing part of the hemagglutinin gene using a revised protocol optimized to deal with the fragmented viral RNA. The sequence analysis showed all viral RNA-positive samples were highly similar to previously reported HPAI dairy cow isolates. Using the revised protocols, it was determined that HPAI viral RNA could be detected in a variety of dairy products, but existing pasteurization methods effectively inactivate the virus assuring consumer safety.

Engage with IAFNS

Emerging Leaders Award

We are establishing an IAFNS Emerging Leaders Award to promote excellence in the food safety and nutritional sciences as evidenced by research, leadership, initiative, collaboration, and communication. There are two awards, one for food safety and one for nutritional science.

- Applications are due February 14, 2025
- <https://iafns.org/iafns-emerging-leaders-award/>

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

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/>



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