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North America

Food Safety Briefs

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Foodborne Pathogens

Foodborne Bacterial Pathogens in Retail Prepacked Ready-to-Eat Mixed Ingredient Salads

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Link to full text: [Click here](#)

Significance: Even during a short shelf life (3 to 5 days), storage of ready-to-eat mixed ingredient salads at 8°C can enable growth of psychrotrophs such as *L. monocytogenes* and *Y. enterocolitica*.

In this study, the microbiological safety of 141 ready-to-eat mixed ingredient salads (RTE salads) containing chicken, ham, or smoked salmon was investigated. Salad samples were collected at retail and analyzed using standard methods for *Listeria monocytogenes*, Shiga toxin-producing *Escherichia coli* (STEC), pathogenic *Yersinia enterocolitica*, *Salmonella*, and *Campylobacter* spp. *L. monocytogenes* was isolated from two (1.4%) of the RTE salad samples. Seven (5.0%) of the samples were positive for the *ail* gene (present in all human pathogenic *Y. enterocolitica* isolates) and three (2.1%) of the samples were positive for the Shiga toxin genes *stx 1* and/or *stx 2*. However, no strains of pathogenic *Y. enterocolitica* or STEC were isolated. Thus, pathogens were found or suspected in almost 1 of 10 RTE salads investigated, and pathogenic bacteria probably are present in various RTE salads from retail premises in Sweden. Because RTE salads are intended to be consumed without heat treatment, control of the ingredients and production hygiene are essential to maintain consumer safety. The recommended maximum storage temperature for RTE salads varies among countries but can be up to 8°C.

Efficacy of Instant Hand Sanitizers Against Foodborne Pathogens Compared With Hand Washing With Soap and Water in Food Preparation Settings: A Systematic Review

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Significance: Water and soap appear to be more effective than waterless products for removal of soil and microorganisms from hands.

The aim of this systematic review was to collate scientific information on the efficacy of hand sanitizers compared with washing hands with soap and water for the removal of foodborne pathogens from the hands of food handlers. An extensive literature search was carried out using three electronic databases: Web of Science, Scopus, and PubMed. Twenty-eight scientific publications were ultimately

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included in the review. Analysis of this literature revealed various limitations in the scientific information owing to the absence of a standardized protocol for evaluating the efficacy of hand products and variation in experimental conditions. However, despite conflicting results, scientific evidence seems to support the historical skepticism about the use of waterless hand sanitizers in food preparation settings. Alcohol-based products achieve rapid and effective inactivation of various bacteria, but their efficacy is generally lower against nonenveloped viruses. The presence of food debris significantly affects the microbial inactivation rate of hand sanitizers.

Evaluation of a Cross Contamination Model Describing Transfer of *Salmonella* spp. and *Listeria monocytogenes* During Grinding of Pork and Beef

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Significance: The risk estimates and the Total Transfer Potential revealed that the risk of disease may be reduced when the grinding of meat is performed in a grinder made of stainless steel using a well-sharpened knife and holding at room temperatures lower than 4°C.

In a previous study, a model was developed to describe the transfer and survival of *Salmonella* during grinding of pork. The robustness of this model is now evaluated by studying its performance for predicting the transfer and survival of *Salmonella* spp. and *Listeria monocytogenes* during grinding of different types of meat (pork and beef), using two different grinders, different sizes and different numbers of pieces of meats to be ground. A total of 19 grinding trials were collected. Acceptable Simulation Zone (ASZ), visual inspection of the data, Quantitative Microbiological Risk Assessment, and Total Transfer Potential were used as approaches to evaluate model performance and to assess the quality of the cross contamination model predictions. Using the ASZ approach and considering that 70% of the observed counts have to be inside a defined acceptable zone of $\pm 0.5 \log_{10}$ CFU per portion, it was found that the cross contamination parameters were not able to describe all 19 trials. However, for each of the collected grinding trials, the transfer event was well described when fitted to the model structure. Parameter estimates obtained by fitting observed trials performed at different conditions, such as size and number of pieces of meat to be ground, may not be applied to describe cross contamination of unlike processing.

Salmonella

Influence of Temperature Differential Between Tomatoes and Postharvest Water on *Salmonella* Internalization

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Significance: The temperature differential between tomatoes and water beyond the initial packinghouse may be less important than submersion time in *Salmonella* internalization.

This study evaluated *Salmonella* internalization into mature green and red tomatoes with ambient (21°C) and refrigeration (4°C) pulp temperatures when they were submerged into water at various temperature differentials, simulating repacking and fresh-cut operations. Red (4°C and 21°C) and mature green (21°C) tomatoes were submerged (6 cm) into a six-strain *Salmonella* cocktail (6 log CFU/ml) and maintained at ± 5 and 0°C temperature differentials for varying time intervals, ranging from 30 s to 5 min. Following submersion, tomatoes were surface sterilized using 70% ethanol, the stem abscission zone and blossom end epidermis were removed, and cores were recovered, separated into three segments, and analyzed. Internalized populations were not significantly different across temperature differentials. *Salmonella* internalization was seen in tomatoes under all treatment conditions and was highest in the segment immediately below the stem abscission zone. However, populations were low (typically >1 log most probably number per segment) and varied greatly across temperature differentials.

Qualitative and Quantitative Determination and Resistance Patterns of *Salmonella* From Poultry Carcasses

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Significance: This study demonstrates the need to improve sanitary conditions in slaughterhouses.

A qualitative and quantitative *Salmonella* detection method was utilized in a poultry slaughterhouse in São Paulo State, Brazil; 33 samples from different batches of carcasses were collected. Each sample was analyzed at three process points: postbleeding, postdefeathering, and postchilling. A fourth point, retail simulation, was added to simulate retail market storage at 5°C for 72 h. The qualitative methods revealed 100% (33 samples) contamination at postbleeding, 39% (13 samples) contamination at postdefeathering, 58% (19 samples) contamination at postchilling, and 30% (10 samples) contamination at the retail simulation. The quantitative results, determined by the most-probable-number (MPN) technique, ranged from <0.03 to >2,400 MPN/g. We identified 23 *Salmonella* serovars; the most prevalent were Mbandaka, Senftenberg, and Enteritidis. Resistance to nalidixic acid was significantly more common than resistance to other antimicrobial agents. Five multidrug-resistant strains were identified.

E. coli

Survival and Persistence of Nonpathogenic *Escherichia coli* and Attenuated *Escherichia coli* O157:H7 in Soils Amended with Animal Manure in a Greenhouse Environment

M. Sharma, P.D. Millner, F. Hashem, M. Camp, C. Whyte, L. Graham, et al.

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Link to full text: [Click here](#)

Significance: Poultry litter-amended soils in both small and large containers supported *E. coli* survival at higher populations compared with dairy manure liquids, horse manure or unamended soils.



Three separate studies were conducted to evaluate survival of nonpathogenic *Escherichia coli* (gEc) and attenuated *E. coli* O157:H7 (attO157) inoculated at either low (4 log CFU/ml) or high (6 log CFU/ml) populations over 56 days. Studies involved two pot sizes (small, 398 cm³; large, 89 liters), three soil types (sandy loam, SL; clay loam, CL; silt loam, SIL), and four amendments (poultry litter, PL; dairy manure liquids, DML; horse manure, HM; unamended). Study 1, conducted in regularly irrigated small containers, showed that populations of gEc and attO157 (2.84 to 2.88 log CFU/g) in PL-amended soils were significantly greater than those in DML-amended (0.29 to 0.32 log CFU/g [dry weight] [gdw]) or unamended (0.25 to 0.28 log CFU/gdw) soils; soil type did not affect *E. coli* survival. Results from study 2, in large pots with CL and SIL, showed that PL-amended soils supported significantly higher attO157 and gEc populations compared with HM-amended or unamended soils. Study 3 compared results from small and large containers that received high inoculum simultaneously. Overall, in both small and large containers, PL-amended soils supported higher gEc and attO157 populations compared with HM-amended and unamended soils. Populations of attO157 were significantly greater in small containers (1.83 log CFU/gdw) than in large containers (0.65 log CFU/gdw) at week 8, perhaps because small containers received more regular irrigation than large pots. Regular irrigation of small pots may have affected *E. coli* persistence in manure-amended soils.



Synergistic Bactericidal Action of Phytic Acid and Sodium Chloride Against *Escherichia coli* O157:H7 Cells Protected by a Biofilm

N.H. Kim, M.S. Rhee

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Link to full text: [Click here](#)

Significance: A sanitizer that combines these two naturally occurring antimicrobial agents may be useful to food safety managers who encounter thick biofilm formation in food processing environments.

This study examined the bactericidal action of phytic acid (PA), a natural extract from rice bran and the hulls/peels of legumes, against *Escherichia coli* O157:H7 biofilms. The synergistic bactericidal effects of PA plus sodium chloride (NaCl) were also examined. *E. coli* O157:H7 biofilms were allowed to form on stainless steel coupons by culture in both rich (tryptic soy broth, TSB) and minimal (M9) medium at 22°C for 6 days. Bacterial cells within biofilms grown in M9 medium were significantly more resistant to PA than those grown in TSB; thus M9 medium was selected for further experiments. The anti-biofilm effect of PA was significantly increased by addition of NaCl (2–4%); indeed, the combination of 0.4% PA plus 3–4% NaCl completely inactivated *E. coli* O157:H7 biofilms without recovery (a > 6.5 log CFU/cm² reduction). Neither PA nor NaCl alone were this effective (PA, 1.6–2.7 log CFU/cm² reduction; NaCl, < 0.5 log CFU/cm² reduction). Confocal laser scanning microscopy images of propidium iodide-treated cells showed that PA (0.4%) plus NaCl (2–4%) had marked membrane permeabilizing effects.

Food Allergy

The Component-Specific to Total IgE Ratios Do Not Improve Peanut and Hazelnut Allergy Diagnoses

L. Grabenhenrich, L. Lange, M. Härtl, B. Kalb, M. Ziegert, A. Finger, et al.

Journal of Allergy and Clinical Immunology, Vol. 137, No. 6; pp. 1751–1760.e8

doi: 10.1016/j.jaci.2016.01.043

Link to full text: [Click here](#)

Significance: Raw Ara h 2- and Cor a 14-specific IgE levels were the best single predictors for pediatric peanut and hazelnut allergies, suggesting the omission of challenges at very high levels.

Specific IgE measurement predicts the outcome of oral food challenges with considerable uncertainty when evaluating food allergy. Therefore, this multicenter study assessed whether accounting for the ratio of component- or allergen-specific to total IgE can improve this prediction. Blood samples were collected from children with suspected peanut or hazelnut allergy. Specific IgE to peanuts, hazelnuts, and their components (Ara h 1, Ara h 2, Ara h 3, Ara h 8, Cor a 1, Cor a 8, Cor a 9, and Cor a 14) and total IgE levels were determined. Specific to total IgE ratios were compared with raw IgE levels in terms of discrimination and prediction. Eighty-eight (43%) of 207 children with suspected peanut allergy and 44 (31%) of 142 children with suspected hazelnut allergy had symptoms during food challenge. Discrimination was similar for raw and ratio measures: areas under the curve of 0.93 for Ara h 2-specific IgE versus 0.92 for the Ara h 2-specific/total IgE ratio and 0.89 for Cor a 14-specific IgE versus 0.87 for the Cor a 14-specific/total IgE ratio. The probability for a positive peanut challenge with 0.35 kU/L Ara h 2-specific IgE was 16% when the total IgE level was >500 kU/L compared with 51%/48% for low/medium total IgE levels (<100/100-500 kU/L). A positive hazelnut challenge with 0.35 kU/L Cor a 14-specific IgE was estimated in 7% when total IgE levels were high compared with 34%/32% with low/medium total IgE levels.

Norovirus

In Vitro Antiviral Activity of Clove and Ginger Aqueous Extracts Against Feline Calicivirus, a Surrogate for Human Norovirus

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Significance: Aqueous extracts of clove and ginger hold promise for prevention of foodborne viral contamination.

In this study, aqueous extracts of six raw food materials (flower buds of clove, fenugreek seeds, garlic and onion bulbs, ginger rhizomes, and jalapeño peppers) were tested for antiviral activity against feline calicivirus (FCV) as a surrogate for human norovirus. The antiviral assay was performed using dilutions of the extracts below the maximum nontoxic concentrations of the extracts to the host cells of FCV, Crandell-Reese feline kidney (CRFK) cells. Pretreatment of FCV with nondiluted clove and ginger extracts inactivated 6.0 and 2.7 log of the initial titer of the virus, respectively. Also, significant dose dependent inactivation of FCV was seen when host cells were treated with clove and ginger extracts at the time of infection or postinfection at concentrations equal to or lower than the maximum nontoxic concentrations. By comprehensive two-dimensional gas chromatography–mass spectrometry analysis, eugenol (29.5%) and R-(-)-1,2-propanediol (10.7%) were identified as the major components of clove and ginger extracts, respectively. The antiviral effect of the pure eugenol itself was



tested; it showed antiviral activity similar to that of clove extract, which indicates that some other clove extract constituents, along with eugenol, are responsible for inactivation of FCV.

Food Packaging

Bisphenol A and Food Safety: Lessons From Developed to Developing Countries

S. Angubua Baluka, W.K. Rumbelha

Food and Chemical Toxicology, Vol. 92, June 2016; pp. 58–63

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Significance: Human bisphenol A exposure in developing countries is similar to that in developed countries.

Modern lifestyles and changes in the socio-economic characteristics of households have stimulated current developments in food technology, processing and packaging. Chemicals such as bisphenol A (BPA) are known to migrate from food packaging into the food, resulting in human exposure to these chemicals. Similarly, BPA can migrate from baby feeding bottles into milk. BPA has been associated with adverse effects attributed to its estrogenic properties in various animal models. This review analyzed peer-reviewed publications in the English literature on human BPA exposure and regulations in developing countries compared to developed countries. BPA has been reduced or eliminated from food packaging and contact materials such as baby bottles in developed countries either voluntarily or by legislation. With minor exceptions, BPA restriction, voluntary or legal, is virtually absent in developing countries of Africa, SE Asia, and South and Central America.



Risk Assessment

Production of Insecticide Degradates in Juices: Implications for Risk Assessment

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Link to full text: [Click here](#)

Significance: Caution should be taken when using urinary insecticide metabolites to assess exposure and risk.

This study was designed to observe the production of degradates of two organophosphorus insecticides and one pyrethroid insecticide in beverages. Purified water, white grape juice, apple juice, and red grape juice were fortified with 500 ng/g malathion, chlorpyrifos, and permethrin, and aliquots were extracted for malathion dicarboxylic acid (MDA), 3,5,6-trichloro-2-pyridinol (TCPy), and 3-phenoxybenzoic acid (3-PBA) several times over a 15 day period of being stored in the dark at 2.5 °C. Overall, first-order kinetics were observed for production of MDA, and statistically significant production of TCPy was also observed. Statistically significant production of 3-phenoxybenzoic acid was not observed. Results indicate that insecticides degrade in food and beverages, and this degradation may lead to preexisting insecticide metabolites in the beverages.

Mycotoxins

Fate of Free and Conjugated Mycotoxins Within the Production of Distiller's Dried Grains With Solubles (DDGS)

Z. Dzuman, M. Stranska-Zachariasova, M. Vaclavikova, M. Tomaniova, Z. Veprikova, P. Slavikova, et al.

Journal of Agricultural and Food Chemistry, Vol. 64, No. 24; pp. 5085–5092

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Link to full text: [Click here](#)

Significance: Approximately two-thirds of the original content of mycotoxin was lost during the drying step.

The present paper provides comprehensive knowledge about the fate of mycotoxins during the production of distiller's dried grains with solubles (DDGS). The study was carried out using naturally infected maize material in five repetitions. For mycotoxin analysis, a QuEChERS-like ("Quick, Easy, Cheap, Effective, Rugged, and Safe") isolation approach and ultrahigh-performance liquid chromatography coupled with tandem mass spectrometry was used. A significant increase of deoxynivalenol (DON) and its glycosylated form, DON-3-glucoside (DON-3-Glc), was observed during the first part of fermentation, when hydrolytic enzymes were added. After yeast addition, the total DON content rapidly decreased. An opposite trend was observed for fumonisin B1 (FB1), in which yeast addition contributed to increase of its content.

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