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North America

Food Safety Briefs

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E. coli

Improving the Enrichment and Plating Methods for Rapid Detection of Non-O157 Shiga Toxin–Producing *Escherichia coli* in Dairy Compost

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

Significance: Low levels of non-O157 Shiga toxin–producing *Escherichia coli* can be detected within 2 days from dairy compost by using a culture method with an optimized enrichment procedure followed by immunomagnetic bead separation.

A culture method to detect non-O157 Shiga toxin–producing *Escherichia coli* (STEC) was optimized in this study. The finished dairy compost with 30% moisture content was inoculated with a cocktail of six non-O157 STEC serovars at initial concentrations of 1 to 100 CFU/g. Afterward, non-O157 STEC cells in the inoculated dairy compost were enriched by four methods, followed by plating onto cefixime-tellurite sorbitol MacConkey agar supplemented with 5 mg/liter novobiocin (CTNSMAC) and modified Rainbow agar containing 5 mg/liter novobiocin, 0.05 mg/liter cefixime trihydrate, and 0.15 mg/liter potassium tellurite (mRBA). Immunomagnetic bead separation (IMS) was used to compare the cell concentration of individual non-O157 STEC serotypes after enrichment. There was no significant difference between CTN-SMAC and mRBA for non-O157 STEC enumeration. The single-step selective enrichment recovered ca. 0.54 log CFU/g more cells (ca. 0.41 log CFU/g for compost-adapted cells) compared with the two-step enrichment. Among six non-O157 STEC serotypes, serotypes O111, O45, and O145 reached the highest cell density after enrichment in dairy compost, and the cell populations reached 7.3, 7.4, and 7.8 log CFU/g within 16 h of incubation, respectively. In contrast, without an enrichment step, the IMS detection limit of individual non-O157 STEC serovars ranged from 3.15 to 4.15 log CFU/g in dairy compost.

Salmonella

Inactivation of *Salmonella* in Shell Eggs by Hot Water Immersion and Its Effect on Quality

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Significance: The hot water immersion process inactivated heat resistant *Salmonella* *Enteritidis* in shell eggs, but also significantly affected several egg quality characteristics.

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Thermal inactivation kinetics of heat resistant strains of *Salmonella Enteritidis* (SE) in shell eggs processed by hot water immersion were determined and the effects of the processing on egg quality were evaluated. Shell eggs were inoculated with a composite of heat resistant SE strains PT8 C405, 2 (FSIS #OB030832), and 6 (FSIS #OB040159). Eggs were immersed in a circulating hot water bath for various times and temperatures. SE was reduced by 4.5 log at both hot water immersion treatments of 56.7 °C for 60 min and 55.6 °C for 100 min. Decimal reduction times (D-values) at 54.4, 55.6, and 56.7 °C were 51.8, 14.6, and 9.33 min, respectively. The z-value was 3.07 °C. Following treatments that resulted in a 4.5 log reduction (56.7 °C/60 min and 55.6 °C/100 min), the surviving population of SE remained static during 4 wk of refrigerated storage. After processing under conditions resulting in 4.5 log reductions, the Haugh unit and albumen height significantly increased and yolk index significantly decreased. The shell dynamic stiffness significantly increased, while static compression shell strength showed no significant difference. Vitelline membrane strength significantly increased but vitelline membrane elasticity did not.

Prevalence, Level, and Types of Salmonella Isolated from North American In-Shell Pecans over Four Harvest Years

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Significance: Salmonella prevalence and level on in-shell pecans is comparable to that on other nuts.

In-shell pecan samples (500 g) were collected over four harvest seasons (2010 to 2014) from seven pecan-shelling facilities located in five U.S. states and samples (100 g) were sent to a third party laboratory for initial Salmonella screening. Four varieties of pecans were analyzed: Mexican Improved, Native Seedlings, Southern Improved, and Western Improved. When a sample was positive for Salmonella, the pathogen level was determined by the most-probable-number (MPN) method (25, 2.5, and 0.25 g). Two sample preparation strategies were used for the MPN analysis, and both strategies were combined for the reported MPN values. Forty-four (0.95%) of 4,641 in-shell pecan samples were positive for Salmonella during initial screening; prevalence by year was 0.47 to 1.4%. Prevalence was not significantly different between varieties. Salmonella was not isolated from 31 of 44 samples upon retesting during MPN analysis (<0.47 MPN/100 g). When Salmonella was detected, the levels were 0.47 to 39 MPN/100 g, with a mean of 2.4 MPN/100 g. Thirty-one Salmonella serotypes were obtained from 42 Salmonella-positive pecan samples; Enteritidis was the most common (12% of samples) followed by Javiana (9%) and Braenderup (7%). Pulsed-field gel electrophoresis analysis (XbaI) revealed within-serotype diversity, indicating introduction of contamination from a variety of sources. Most (64%) of the isolates were resistant to streptomycin or tetracycline, and 13% were resistant to three or more antibiotics.

Strain-Specific Survival of *Salmonella enterica* in Peanut Oil, Peanut Shell, and Chia Seeds

K. Fong, S. Wang

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Significance: This research emphasizes the adaptable nature of Salmonella to low-water activity food ingredients.

The survival characteristics of Salmonella serotypes Enteritidis, Typhimurium, Tennessee, Hartford, and Thompson were evaluated in three low-water activity (aw) food ingredients with varying aw: peanut oil (aw = 0.521 ± 0.003), peanut shell (aw = 0.321 ± 0.20), and chia seeds (aw = 0.585 ± 0.003). The survival of individual Salmonella strains on each food matrix was monitored for a maximum of 150 days by spreading the bacterial cells onto Luria-Bertani and/or xylose lysine deoxycholate agar. Overall, Salmonella survived for the longest periods of time in peanut oil (96±8 days), followed by chia seeds (94±46 days). The survival period was substantially reduced on the surface of peanut shell (42±49 h), although PCR after 70 days of incubation revealed the presence of Salmonella cells. Salmonella Hartford was identified as highly persistent in all low-aw food matrices, whereas Salmonella Typhimurium was the least persistent.

Listeria

Controlling *Listeria monocytogenes* and *Leuconostoc mesenteroides* in Uncured Deli-style Turkey Breast Using a Clean Label Antimicrobial

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Significance: Cultured sugar-vinegar blend was found to be an effective antilisterial antimicrobial, while having little effect on a spoilage microorganism.

Interest in natural/organic meat products has resulted in the need to validate the effectiveness of clean label antimicrobials to increase safety and shelf life of these products. A Response Surface Methodology (RSM) was used to investigate the effects of varying levels of moisture, pH, and a commercial “clean-label” antimicrobial (cultured sugar-vinegar blend; CSVB) on the growth rate of *Listeria monocytogenes* and *Leuconostoc mesenteroides* in uncured turkey stored at 4 °C for 16 wk. Twenty treatment combinations of moisture, pH, and CSVB were evaluated during phase I to develop growth curves for both microbe types, whereas the interactive effects of pH and CSVB were tested in 16 treatment combinations during Phase II at a single moisture level using *L. monocytogenes* only. CSVB inhibited *L. monocytogenes* growth in 14 of the 20 treatments tested in Phase I and in 12 of the 16 treatments in Phase II through 16 and 8 wk, respectively. CSVB had little effect on *L. mesenteroides*. Significant interactions of the RSM design coefficients yielded a predictive model for *L. mesenteroides* growth rate, but due to lack of growth, no growth rate model was developed for *L. monocytogenes*.

Clostridium botulinum

Quantification of Nonproteolytic *Clostridium botulinum* Spore Loads in Food Materials

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Applied Environmental Microbiology, Vol. 82, No. 6; pp. 1675–1685, 2016

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



Significance: Probability distributions for spores of *Clostridium botulinum* are represented in a convenient form that can be used for numerical analysis and risk assessments.

This study produced data and developed analysis to build representations for the concentration of spores of nonproteolytic *Clostridium botulinum* in materials that are used during the manufacture of minimally processed chilled foods in the United Kingdom. Food materials are categorized into homogenous groups, which include meat, fish, shellfish, cereals, fresh plant material, dairy liquid, dairy nonliquid, mushroom and fungi, and dried herbs and spices. Models are constructed in a Bayesian framework and represent a combination of information from a literature survey of spore loads from positive-control experiments that establish a detection limit and from dedicated microbiological tests for real food materials. The detection of nonproteolytic *C. botulinum* employed an optimized protocol that combines selective enrichment culture with multiplex PCR, and the majority of tests on food materials were negative. Posterior beliefs about spore loads center on a concentration range of 1 to 10 spores kg⁻¹. Posterior beliefs for larger spore loads were most significant for dried herbs and spices and were most sensitive to the detailed results from control experiments.



Mycotoxins

Mycotoxins in Bovine Milk and Dairy Products: A Review

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Significance: A thorough investigation of the occurrence of mycotoxins as well the adoption of measures to minimize their contamination of milk is essential since milk is widely consumed.

This paper presents a review of the occurrence of several mycotoxins in bovine milk and dairy products. Under favorable growth conditions, toxigenic fungi produce mycotoxins, which contaminate the lactating cow's feedstuff. During metabolism, these mycotoxins undergo biotransformation and are secreted in milk. Data show that there is a seasonal trend in the levels of mycotoxins in milk, with these being higher in the cold months probably due to the prolonged storage required for the cattle feeds providing favorable conditions for fungal growth. Good agricultural and storage practices are therefore of fundamental importance in the control of toxigenic species and mycotoxins. Although aflatoxins (especially aflatoxin M₁) are the mycotoxins of greater incidence in milk and dairy products, this review shows that other mycotoxins, such as fumonisin, ochratoxin A, trichothecenes, zearalenone, T-2 toxin, and deoxynivalenol, can also be found in these products.

Estimated Exposure to Zearalenone, Ochratoxin A and Aflatoxin B1 Through the Consume of Bakery Products and Pasta Considering Effects of Food Processing

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

Significance: The exposure to aflatoxin B1 related to pasta and bakery products represents a risk to consume health, but the exposure to zearalenone and ochratoxin has not represented a risk.

This study estimated the processing effect on mycotoxins levels and the exposure to zearalenone (ZEA), ochratoxin (OTA), and aflatoxin B1 (AFB1) through the consumption of pasta and bakery products. The higher reduction percentage of mycotoxins was observed in cake production (95, 90, and 70% for ZEA, OTA and AFB1, respectively). Bread and biscuit showed similar reduction in mycotoxins levels (89 and 90% for ZEA; 80 and 85% for OTA; 36 and 40% for AFB1, respectively). The lower reduction in the levels of mycotoxins has been observed for pasta (75, 65, and 10% for ZEA, OTA and AFB1, respectively). The consumption of these products could represent 12.6% of the maximum tolerable daily intake of ZEA and 30.5% of the tolerable weekly intake of OTA. The margin of exposure value related to the exposure to AFB1 was 24.6.

Outbreaks of Foodborne Illness

Foodborne Outbreaks Reported to the U.S. Food Safety and Inspection Service, Fiscal Years 2007 through 2012

K. Robertson, A. Green, L. Allen, T. Ihry, P. White, W-S. Chen, et al.

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Significance: Meat and poultry products commercially sold as raw were linked to the majority of outbreaks.

To provide insight into outbreaks associated with meat and poultry, outbreaks reported to the USDA's Food Safety and Inspection Service (FSIS) during fiscal years 2007 through 2012 were evaluated. Outbreaks were classified according to the strength of evidence linking them to an FSIS-regulated product and by their epidemiological, etiological, and vehicle characteristics. Of the 163 reported outbreaks eligible for analysis, 55% were identified as possibly linked to FSIS-regulated products and 45% were definitively linked to FSIS-regulated products. Overall, these outbreaks were associated with 4,132 illnesses, 772 hospitalizations, and 19 deaths. Shiga toxin-producing *Escherichia coli* was associated with the greatest proportion of reported outbreaks (55%), followed by *Salmonella enterica* (34%) and *Listeria monocytogenes* (7%). Meat and poultry products commercially sold as raw were linked to 125 (77%) outbreaks, and of these, 105 (80%) involved beef. Over the study period, the number of reported outbreaks definitively linked to FSIS-regulated products ($P = 0.03$) declined, while the proportion of culture-confirmed cases ($P = 0.0001$) increased.

Foodborne Pathogens

Effect of Nonthermal, Conventional, and Combined Disinfection Technologies on the Stability of Human Adenoviruses as Fecal Contaminants on Surfaces of Fresh Ready-to-Eat Products

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Significance: The sequential use of UV light and ultrasound were found to be more effective compared with when the treatments were used separately.

This study focuses on viral inactivation by both conventional and alternative nonthermal disinfection technologies on different fresh ready-to-eat food products. The use of chlorine, as well as that of nonthermal technologies such as UV light and ultrasound (US), was tested for different treatment times. UV nonthermal technology was found to be more effective for the disinfection of human adenoviruses (hAdVs) compared with US, achieving a log reduction of 2.13, 1.25, and 0.92 for lettuce, strawberries, and cherry tomatoes, respectively, when UV treatment was implemented for 30 min. US treatment for the same period achieved a log reduction of 0.85, 0.53, and 0.36, respectively. The sequential use of US and UV was found to be more effective compared with when the treatments were used separately, for the same treatment time, thus indicating a synergistic effect. Human adenoviruses were inactivated sooner, when chlorine treatment was used. Therefore, the effect of each disinfection method was dependent upon the treatment time and the type of food.

Food Allergy

Prioritisation of Allergenic Foods With Respect to Public Health Relevance: Report From an ILSI Europe Food Allergy Task Force Expert Group

G. Houben, P. Burney, C-H. Chan, R. Crevel, A. Dubois, R. Faludi, et al.

Food and Chemical Toxicology, Vol. 89; pp. 8–18, 2016

doi: 10.1016/j.fct.2015.12.028

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Significance: This paper proposes a framework that allows categorisation and prioritization of allergenic foods, based on generic risk analysis principles, according to their public health importance.

Regulators and risk managers in general need to decide whether an allergenic food or ingredient is of such public health importance that it needs to be actively managed. There is therefore a need to scale the relative allergenicity of foods and ingredients according to the hazards they pose. Objective criteria increase transparency and trust in this decision-making process and its conclusions. The challenge is to find a basis on which the allergenicity of foods can best be described and a method to combine the relevant measures of allergenicity into a scoring system that prioritises allergenic foods on the basis of their public health relevance. The framework is designed in accordance with the generic risk analysis principles used in food safety and can be used by regulators to decide whether or not a specific allergenic food or ingredient is of sufficient public health importance that it warrants regulation (i.e. mandatory labelling) when used in the production of food products.

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