ILSI North America

Food Safety Briefs

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E. coli

Growth of Stressed Strains of Four Non-O157 Shiga Toxin–Producing Escherichia coli Serogroups in Five Enrichment Broths

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Journal of Food Protection, Vol. 78, No. 11, pp. 1960–1966, 2015

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Link to full text: Click here

Significance: Irrespective of the effect of background flora, buffered peptone water is still recommended for resuscitation of non-O157 Shiga toxin–producing Escherichia coli.

This study evaluated (i) the behavior of several strains of non-O157 Shiga toxin–producing Escherichia coli (STEC) serogroups (O26, O103, O111, and O145) exposed to different stress conditions and (ii) the growth dynamics of stressed and nonstressed non-O157 STEC cells in five enrichment media. STEC strains were exposed to acid, cold, and freeze stresses. Freeze stress (8 days, 20°C) caused the most lethal (95.3% ± 2.5%) and sublethal (89.1% ± 8.8%) injury in the surviving population. Growth of stressed and nonstressed pure cultures of non-O157 STEC on modified tryptic soy broth, buffered peptone water (BPW), BPW with sodium pyruvate, Brila, and STEC enrichment broth (SEB) was determined using total viable counts. To compare growth capacities, growth after 7 and 24 h of enrichment was measured; lag phases and maximum growth rates were also calculated. In general, growth on BPW resulted in a short lag phase followed by a high maximum growth rate during the enrichment of all tested strains when using all three stress types. The two selective media, Brila and SEB, were less efficient than BPW, but Brila's enrichment performance was remarkably better than that of SEB.

Salmonella

Salmonella Levels in Turkey Neck Skins, Drumstick Bones, and Spleens in Relation to Ground Turkey

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Significance: Salmonella was detected internally in drumstick bones and spleens at low levels, whereas Salmonella presence at higher levels in neck skin may indicate a flock with greater potential for Salmonella contamination of ground turkey.

This study determined Salmonella levels (presence and numbers) in turkey drumstick bone, spleen, and neck skin samples in relation to Salmonella contamination levels in ground turkey at the flock level. Over a 10-month period, a total of 300

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samples of each turkey part from 20 flocks were collected at a commercial turkey processing plant after the evisceration step. Turkey flocks included in this study were classified as "targeted" (originated from a turkey farm that had previously produced one or more flocks with ≥20% Salmonella prevalence in ground turkey) (n=13) and "nontargeted" (remaining seven flocks with <20% prevalence) based on the company's historical ground turkey contamination data. The overall Salmonella prevalence in neck skin, drumstick bone, spleen, and ground turkey samples was 42.0, 9.3, 6.7, and 14.5%, respectively. Salmonella prevalence in neck skin, spleen, drumstick bone, and ground turkey from the targeted flocks was significantly higher than those from nontargeted flocks. There was a significant relationship between Salmonella presence in neck skin (when most probable numbers were ≥2 log) and Salmonella-positive ground turkey lot.

Survival of Salmonella during Drying of Fresh Ginger Root (Zingiber officinale) and Storage of Ground Ginger

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Significance: A relationship between temperature and water activity and the survival of Salmonella was found during both drying and storage of ginger.

The survival of Salmonella on fresh ginger root (Zingiber officinale) during drying was examined using both a laboratory oven at 51 and 60°C with two different fan settings and a small commercially available food dehydrator. The survival of Salmonella in ground ginger stored at 25 and 37°C at 33% (low) and 97% (high) relative humidity (RH) was also examined. To inoculate ginger, a four-serovar cocktail of Salmonella was collected by harvesting agar lawn cells. For drying experiments, ginger slices (1 ± 0.5 mm thickness) were surface inoculated at a starting level of approximately 9 log CFU/g. Higher temperature (60°C) coupled with a slow fan speed to promote a slower reduction in the water activity (aw) of the ginger resulted in a 3- to 4-log reduction in Salmonella populations in the first 4 to 6 h with an additional 2- to 3-log reduction by 24 h. Higher temperature with a higher fan speed resulted in significantly less destruction of Salmonella throughout the 24-h period. Survival appeared related to the rate of reduction in the aw. During storage at 97% RH, the maximum aw values were 0.85 at 25°C and 0.87 at 37°C; Salmonella was no longer detected after 25 and 5 days of storage, respectively, under these conditions. At 33% RH, the aw stabilized to approximately 0.35 at 25°C and 0.31 at 37°C. Salmonella levels remained relatively constant throughout the 365-day and 170-day storage periods for the respective temperatures.

Antimicrobial Efficacy of a Sulfuric Acid and Sodium Sulfate Blend, Peroxyacetic Acid, and Cetylpyridinium Chloride against Salmonella on Inoculated Chicken Wings

B.R. Scott, X.Y. Yang, I. Geornaras, R.J. Delmore, D.R. Woerner, J.O. Reagan, et al.

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Significance: Sulfuric acid and sodium sulfate applied at pH 1.1 for 20 s was an effective antimicrobial intervention to reduce Salmonella contamination on chicken wings.

Studies were conducted to evaluate the efficacy of a commercial blend of sulfuric acid and sodium sulfate (SSS) in reducing Salmonella on inoculated whole chilled chicken wings and to compare its efficacy to peroxyacetic acid (PAA) and cetylpyridinium chloride (CPC). Wings were spot inoculated (5 to 6 log CFU/ml of sample rinsate) with a five-strain mixture of novobiocin- and nalidixic acid–resistant Salmonella and then left untreated (control) or treated by immersing individual wings in 350 ml of antimicrobial solution. Inoculated wings were treated with SSS (pH 1.1; 20 s), PAA (700 ppm, 20 s), or CPC (4,000 ppm, 10 s) and analyzed for survivors immediately after treatment (0 h) and after 24 h of aerobic storage at 4°C. Recovery of Salmonella survivors following treatment with SSS (10 or 20 s) was not affected by the type of cell recovery rinse solution; however, there was an effect of SSS treatment time. Immersion of samples for 10 or 20 s in SSS resulted in pathogen reductions of 0.8 to 0.9 and 1.1 to 1.2 log CFU/ml, respectively. Efficacy against Salmonella at 0 h increased in the order CPC, SSS, PAA; however, after 24 h of aerobic storage, pathogen counts of SSS- and PAA-treated wings did not differ.

Norovirus

Stability of Secondary and Tertiary Structures of Virus-Like Particles Representing Noroviruses: Effects of pH, Ionic Strength, and Temperature and Implications for Adhesion to Surfaces

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Applied and Environmental Microbiology, Vol. 81, No. 22; pp. 7680–7686, 2015

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Significance: Norovirus adhesion mediated by hydrophobic interaction may depend on hydrophobic residues normally exposed on the capsid surface at pH 3, pH 8, physiological ionic strength, and low temperature.

The aim of this work was to study the stability of norovirus secondary and tertiary structures and its implications for viral adhesion to fresh foods and agrifood surfaces. The pH, ionic strength, and temperature conditions studied correspond to those prevalent in the principal vehicles of viral transmission and in the food processing and handling environment. The structures of virus-like particles representing GI.1, GII.4, and feline calicivirus (FCV) were studied using circular dichroism and intrinsic UV fluorescence. Heating to 65°C caused losses of β-strand structure, notably in GI.1 and FCV, while at 75°C the α-helix content of GII.4 and FCV decreased and tertiary structures unfolded in all three cases. Combining temperature with pH or ionic strength caused variable losses of structure depending on the particle type. Regardless of pH, heating to pasteurization temperatures or higher would be required to increase GII.4 and FCV adhesion, while either low or high temperatures would favor GI.1 adhesion. Regardless of temperature, increased ionic strength would increase GII.4 adhesion but would decrease GI.1 adhesion. FCV adsorption would be greater at refrigeration, pasteurization, or high temperature combined with a low salt concentration or at a higher NaCl concentration regardless of temperature.

Foodborne Pathogens

Survival and High-Hydrostatic Pressure Inactivation of Foodborne Pathogens in Salmorejo, a Traditional Ready-to-Eat Food

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Journal of Food Science, Vol. 80, No. 11; pp. M2517–M2521, 2015
doi: 10.1111/1750-3841.13067
Link to full text: Click here

Significance: High hydrostatic pressure treatment at 600 MPa for 8 min can be an efficient nonthermal method for industrial-scale preparation of preservative-free salmorejo with improved safety against transmission of foodborne pathogens.

In this study, 3 cocktails consisting of Escherichia coli O157, Salmonella enterica serovar Enteritidis, and Listeria monocytogenes strains were inoculated in freshly prepared salmorejo, a traditional tomato-based creamy product. The food was treated by high hydrostatic pressure (HHP) at 400, 500, or 600 MPa for 8 min, or left untreated, and stored at 4 °C for 30 d. In control samples, L. monocytogenes viable cells decreased by 2.4 log cycles at day 7 and were undetectable by day 15. S. enterica cells decreased by 0.5 or 2.4 log cycles at days 7 and 15 respectively, but still were detectable at day 30. E. coli O157 cells survived much better in salmorejo, decreasing only by 1.5 log cycles at day 30. Treatments at pressures of 400 MPa or higher reduced viable counts of L. monocytogenes and S. enterica to undetectable levels. HHP treatments significantly reduced E. coli counts by approximately 5.2 to 5.4 log cycles, but also yielded surviving cells that apparently were sublethally injured. Only samples treated at 600 MPA for 8 min were devoid of detectable E. coli cells during storage.

Growth Potential of Listeria Monocytogenes and Staphylococcus Aureus on Fresh-Cut Tropical Fruits

K. Feng, W. Hu, A. Jiang, Y. Xu, Sarengaowa, X. Li, et al.

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Significance: Fresh cut pitaya, mango, papaya, and pineapple should be stored at low temperature to extend shelf life as well as to ensure the safety of the fruits.

This study evaluated the fate of Staphylococcus aureus, Listeria monocytogenes, and natural microbiota on fresh-cut tropical fruits (pitaya, mango, papaya and pineapple) with commercial PVC film at different storage temperature (5, 13, and 25 °C). The results showed that S. aureus, L. monocytogenes, and natural microbiota increased significantly on fresh-cut tropical fruits at 25 °C. Both pathogen and natural microbiota were able to grow on fresh-cut tropical fruits at 13 °C. The maximum population of L. monocytogenes was higher than that of S. aureus on fresh-cut tropical fruits. L. monocytogenes and S. aureus could survive without growth on fresh-cut pitaya, mango, and papaya at 5 °C. The population of L. monocytogenes declined significantly on fresh-cut pineapple at all temperature, indicating composition of fresh-cut pineapple could inhibit growth of L. monocytogenes. However, S. aureus was still able to grow on fresh-cut pineapple at storage temperature.

Infant Formulas

Enzymatic Synthesis of Refined Olive Oil-Based Structured Lipid Containing Omega -3 and -6 Fatty Acids for Potential Application in Infant Formula

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Significance: The structured lipids produced have the potential for use in infant formulas.

Structured lipids (SLs) containing palmitic, docosahexaenoic (DHA), and gamma-linolenic (GLA) acids were produced using refined olive oil, tripalmitin, and ethyl esters of DHA single cell oil and GLA ethyl esters. Immobilized lipozyme TL IM lipase was used as the biocatalyst. The SLs were characterized for fatty acid profile, triacylglycerol (TAG) molecular species, solid fat content, oxidative stability index, and melting and crystallization profiles and compared to physical blend of substrates, extracted fat from commercial infant formula (IFF), and milk fat. 49.28 mol% of palmitic acid was found at the sn-2 position of SL TAG and total DHA and GLA composition were 0.73 and 5.00 mol%, respectively. The total oleic acid content was 36.13 mol%, which was very close to the 30.49% present in commercial IFF. Comparable solid fat content profiles were also found between SLs and IFF.

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