E. coli

**UV Tolerance of Spoilage Microorganisms and Acid-Shocked and Acid-Adapted Escherichia coli in Apple Juice Treated With a Commercial UV Juice-Processing Unit**

J. Usaga, O.I. Padilla-Zakour, R.W. Worobo


**Significance:** The high UV tolerance of spoilage microorganisms supports the need to use a hurdle approach (e.g., coupling of refrigeration, preservatives, and/or other technologies) to extend the shelf life of UV-treated beverages.

This study was conducted to evaluate the effects of strain (Escherichia coli O157:H7 strains C7927, ATCC 35150, ATCC 43895, and ATCC 43889 and E. coli ATCC 25922) and physiological state (control-unadapted, acid adapted, and acid shocked) on the UV tolerance of E. coli in apple juice treated under conditions stipulated in current FDA regulations. A significant effect of strain (P < 0.05) was observed, but the physiological state did not influence pathogen inactivation (P ≥ 0.05). The UV sensitivity of three spoilage microorganisms (Aspergillus niger, Penicillium commune, and Alicyclobacillus acidoterrestris) was also determined at UV doses of 0 to 98 mJ/cm². Alicyclobacillus was the most UV sensitive, followed by Penicillium and Aspergillus. Because of the nonsignificant differences in UV sensitivity of E. coli in different physiological states, the use of an unadapted inoculum would be adequate to conduct challenge studies with the commercial UV unit used in this study at a UV dose of 14 mJ/cm².

**Evaluation of Detection Methods for Non-O157 Shiga Toxin-Producing Escherichia coli From Food**


**Significance:** The acid treatment procedure proved especially useful for the isolation of shiga toxin-producing Escherichia coli from sprouted soy bean samples.

In this study the detection and isolation of four non-O157 shiga toxin-producing Escherichia coli (STEC) strains (O26, O103, O111, O145) from ground (minced) beef, cattle carcass swab, lettuce mix and sprouted soy beans were evaluated. Low amounts of STEC were used (0.25–1.40 cfu/g) to spike the samples. All samples were enriched in parallel in Buffered Peptone Water (BPW) and Brila broth. After
enrichment, detection was performed using real-time PCR (qPCR), and isolation using two chromogenic agar media, CHROMagar™ STEC and ChromID™ EHEC. Inoculation on the agar media was performed either directly after enrichment or after the use of an acid treatment procedure. Although the qPCR Cycle Threshold (Ct) values were lower after enrichment in Brila broth, no significant differences in recovery were observed between both enrichment broths. Both agar media were equally suitable for the isolation of STEC, although a significantly higher recovery was obtained when using both agar media in parallel. For samples with a Ct value above 25, an acid treatment step prior to isolation ensured a significant improvement in the recovery of STEC due to the reduction in background microbiota.

Salmonella

The Isolation and Identification of Pantoea dispersa Strain JFS as a Non-Pathogenic Surrogate for Salmonella Typhimurium Phage Type 42 in Flour

J. Fudge, M. Dunn, O. Pike, R. Robison, F. Steele
doi: 10.1016/j.ijfoodmicro.2015.11.012
Link to full text: Click here

**Significance:** This strain of P. dispersa (strain JFS) can be used as a conservative, slightly more heat resistant, surrogate for Salmonella.

In this study, a surrogate, which closely matches the thermal death rate of Salmonella in flour, has been isolated. The surrogate was identified following an evaluation of thermal death curves of ten different strains of bacteria isolated from heat-treated flour and two nonpathogenic surrogates used in other commodities. Flour samples were inoculated with Salmonella or one of the twelve bacterial isolates, and then subjected to heat (70, 75, and 80 °C) for 12–60 min. The heat tolerance for each organism was determined by plating out at least four different time points for each temperature and comparing the death curve to those from Salmonella. The death curve from Pantoea dispersa was not statistically different (p < 0.05) than the death curve of Salmonella.

Thermal Inactivation of Salmonella spp. in Pork Burger Patties

P.M. Gurman, T. Ross, G.L. Holds, R.G. Jarrett, A. Kiermeier
International Journal of Food Microbiology, Vol. 219, 16 February 2016; pp. 12–21
doi: 10.1016/j.ijfoodmicro.2015.11.014
Link to full text: Click here

**Significance:** This predictive model can be applied to estimate the reduction in Salmonella in pork burgers after cooking to a specific endpoint temperature and hence to assess food safety risk.

In this study, “Extra Lean” and “Regular” fat pork minces were inoculated with Salmonella spp. (Salmonella 4,[5],12:i:-, Salmonella Senftenberg and Salmonella Typhimurium) and formed into pork burger patties. Patties were cooked on an electric skillet to one of seven internal temperatures (46, 49, 52, 55, 58, 61, 64 °C) and Salmonella enumerated. It was estimated that in pork mince with a fat content of 6.1%, Salmonella survival will be decreased by – 0.2407 log10 CFU/g for a 1 °C increase in internal endpoint temperature, with a 5-log10 reduction in Salmonella concentration estimated to occur when the geometric centre temperature reaches...
63 °C. The fat content influenced the rate of Salmonella inactivation (P = 0.043), with Salmonella survival increasing as fat content increased, though this effect became negligible as the temperature approached 62 °C. Fat content increased the time required for patties to achieve a specified internal temperature, indicating that reduced fat pork mince may reduce the risk of salmonellosis from consumption of pork burgers. Salmonella serovar did not significantly affect the model intercepts (P = 0.86) or slopes (P = 0.10) of the fitted logistic curve.

**Development of a Quantitative Fluorescence Single Primer Isothermal Amplification-Based Method for the Detection of Salmonella**

_J. Wang, R. Li, L. Hu, X. Sun, J. Wang, J. Li_

doi: 10.1016/j.ijfoodmicro.2015.12.005

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

**Significance:** This study showed high sensitivity and specificity of single primer isothermal amplification in the detection of Salmonella, comparable to real time PCR.

A quantitative fluorescence single primer isothermal amplification (SPIA)-based method for the detection of Salmonella was developed. Using Salmonella Typhimurium genomic DNA as template and a primer targeting Salmonella invA gene, the detection limit of SPIA was 2.0 × 101 fg DNA. Its successful amplification of different serotypic Salmonella genomic DNA but not non-Salmonella bacterial DNA demonstrated the specificity of SPIA. Furthermore, this method was validated with artificially contaminated beef. SPIA is faster and more cost-effective (non-use of expensive cyclers), making it a potential alternative for field detection of Salmonella in resource-limited settings that are commonly encountered in developing countries.

**Listeria**

**Modeling the Impact of Ingoing Sodium Nitrite, Sodium Ascorbate, and Residual Nitrite Concentrations on Growth Parameters of Listeria monocytogenes in Cooked, Cured Pork Sausage**


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

**Significance:** Ingoing nitrite concentration influences _L_. monocytogenes growth in ready-to-eat products, yet residual nitrite concentration contributes to the antimicrobial impact of nitrite as well.

This study was designed to elucidate the relationship between chemical factors (ingoing nitrite, ascorbate, and residual nitrite) and _Listeria monocytogenes_ growth in ready-to-eat meats. Treatments of cooked, cured pork sausage were based on response surface methodology with ingoing nitrite and ascorbate concentrations. At one of two time points after manufacturing (days 0 and 28), half of each treatment was surface inoculated to target 3 log CFU/g of a five-strain _L_. monocytogenes cocktail, vacuum packaged, and stored at 7°C for up to 4 weeks. Growth of _L_. monocytogenes was measured twice per week. Residual nitrite concentrations were measured on days 0, 4, 7, 14, 21, and 28, and nitrite depletion rate was estimated by using first-order kinetics. The response surface methodology
was used to model L. monocytogenes lag time and growth rate based on ingoing nitrite, ascorbate, and the residual nitrite remaining at the point of inoculation. Modeling results showed that lag time was impacted by residual nitrite concentration remaining at inoculation, as well as the squared term of ingoing nitrite, whereas growth rate was affected by ingoing nitrite concentration but not by the remaining residual nitrite at the point of inoculation.

Various Ready-to-Eat Products From Retail Stores Linked to Occurrence of Diverse Listeria monocytogenes and Listeria spp. Isolates
K. Vongkamjan, J. Fuangpaiboon, M.P. Turner, V. Vuddhakul
Link to full text: Click here

Significance: The 3M molecular detection assay for L. monocytogenes is a rapid and reliable technique for detecting L. monocytogenes in various ready-to-eat foods.

This study investigated the prevalence and diversity of Listeria monocytogenes and Listeria spp. in ready-to-eat products and evaluated the performance of a rapid detection method, the 3M molecular detection assay for L. monocytogenes (MDA-LM), for detection of L. monocytogenes. Assay results were compared with those obtained using the FDA standard culture method. Products (n=200) were purchased from retail stores: 122 aquatic products, 22 products of animal origin, 18 vegetarian products, 15 deli meat products, 13 salad and vegetable products, 4 desserts, 2 egg-based products, and 4 other products. L. monocytogenes prevalence was comparable with both methods. Overall, 15 (7.5%) of 200 samples were positive for L. monocytogenes: 3% of aquatic products, 1.5% of products of animal origin, 1% of vegetarian products, and 2% of deli meat products. Compared with the standard culture method, the sensitivity, specificity, and the accuracy of the MDA-LM were 86.7% (95% CI, 58.4 to 97.7%), 98.4% (95% CI, 95.0 to 99.6%), and 97.5%, respectively. Using the culture-based method, 18 (9%) of 200 samples were positive for Listeria species other than L. monocytogenes.

Older Adult Consumer Knowledge, Attitudes, and Self-Reported Storage Practices of Ready-to-Eat Food Products and Risks Associated with Listeriosis
E.W. Evans, E.C. Redmond
Link to full text: Click here

Significance: Older adults’ food safety cognition may affect their behaviors; understanding consumer food safety cognition is essential for developing targeted food safety education.

This study aimed to ascertain older adults’ cognition and behavior in relation to domestic food handling and storage practices that may increase the risks associated with listeriosis. Older adults (≥60 years) (n=100) participated in an interview and questionnaire to determine knowledge, self-reported practices, and attitudes toward recommended practices. Although the majority (79%) had positive attitudes toward refrigeration, 84% were unaware of recommended temperatures (5°C) and 65% self-reported “never” checking their refrigerator temperature. Although most (72%) knew that “use-by” dates indicate food safety and 62%
reported “always” taking note, neutral attitudes were held, with 67% believing it was safe to eat food beyond use-by dates and 57% reporting doing so. Attitudes toward consuming foods within the recommended 2 days of opening were neutral, with 55% aware of recommendations and 84% reporting that they consume ready-to-eat (RTE) foods beyond recommendations. Although knowledgeable of some key practices, older adults self-reported potentially unsafe practices when storing RTE foods at home.

Validation of a Previously Developed Geospatial Model That Predicts the Prevalence of Listeria monocytogenes in New York State Produce Fields


Link to full text: Click here

**Significance:** Geographic information systems and geospatial models can be used to accurately predict L. monocytogenes prevalence on farms and can be used prospectively to minimize the risk of preharvest contamination of produce.

This study was performed to test and refine the rules associated with a previously developed geospatial model that predicts the prevalence of Listeria monocytogenes in produce farms in New York State (NYS). Produce fields for each of four enrolled produce farms were categorized into areas of high or low predicted L. monocytogenes prevalence using rules based on a field’s available water storage (AWS) and its proximity to water, impervious cover, and pastures. Drag swabs (n = 1,056) were collected from plots assigned to each risk category. Logistic regression validated the rules based on water and pasture. Samples collected near water (OR, 3.0) and pasture (OR, 2.9) showed a significantly increased likelihood of L. monocytogenes isolation compared to that for samples collected far from water and pasture. Proximity to wetlands also increased likelihood of L. monocytogenes isolation.

Differential Internalin A Levels in Biofilms of Listeria monocytogenes Grown on Different Surfaces and Nutrient Conditions

N. Gilmartin, M.S. Gião, C.W. Keevil, R. O’Kennedy

doi: 10.1016/j.ijfoodmicro.2015.12.004

Link to full text: Click here

**Significance:** A greater understanding of the factors that affect the levels of internalin A (In1A) on the surface of L. monocytogenes is essential in the appreciation of the role of InlA in the persistence of biofilms containing L. monocytogenes and their potential to cause food borne disease.

The main aim of this work was to investigate internalin A levels (a surface protein in Listeria monocytogenes) in different L. monocytogenes strains in both planktonic and sessile states using an anti-InlA antibody. This study demonstrated that InlA levels varied greatly between strains and serotypes of L. monocytogenes. However, the serotypes 1/2a, 1/2b and 4b, associated with the largest number of outbreaks of listeriosis consistently showed the highest InlA levels, regardless of nutrient content or planktonic or sessile state. Differences in InlA levels were also observed in biofilms grown on different surfaces such as glass, stainless steel
and polytetrafluoroethylene (PTFE), with a significant reduction in InlA levels observed in biofilms on PTFE. Interestingly, although a large number of the total cells observed in biofilms formed in tap-water were non-cultivable, the virulence factor, InlA, was expressed at levels between 78 and 85%, thus indicating that these cells may still be virulent.

**Norovirus**

**Efficacy of Oxidizing Disinfectants at Inactivating Murine Norovirus on Ready-to-Eat Foods**

*M. Girard, K. Mattison, I. Fliss, J. Jean*


doi: 10.1016/j.ijfoodmicro.2015.11.015

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

*Significance:* In this study, a surprising increase in the efficacy of sodium hypochlorite was found on surfaces fouled with artificial feces.

The aim of this study was to evaluate the efficacy of oxidizing disinfectants (sodium hypochlorite, chloride dioxide and peracetic acid) at inactivating noroviruses on fruits and vegetables, using murine norovirus 3. Based on plaque assay, solutions of peracetic acid (85 ppm) and chlorine dioxide (20 ppm) reduced the infectivity of the virus in suspension by at least 3 log10 units after 1 min, while sodium hypochlorite at 50 ppm produced a 2-log reduction. On the surface of blueberries, strawberries and lettuce, chlorine dioxide was less effective than peracetic acid and sodium hypochlorite, which reduced viral titers by approximately 4 logs.

**Foodborne Pathogens**

**Inactivation of Escherichia coli, Listeria monocytogenes, and Salmonella Enteritidis by Cymbopogon citratus D.C. Stapf. Essential Oil in Pineapple Juice**


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

*Significance:* Cymbopogon citratus D.C. Stapf. essential oil could be used as an alternative antimicrobial compound to ensure the safety of pineapple juice.

The efficacy of Cymbopogon citratus D.C. Stapf. essential oil (CCEO) to provoke a 5-log CFU/ml (5-log) inactivation in a mixed composite of Escherichia coli, Listeria monocytogenes, and Salmonella enterica serovar Enteritidis in pineapple (Ananas comosus (L.) Merril) juice (4°C) was assessed. The effects of CCEO on the physicochemical and sensory quality parameters of pineapple juice were also evaluated. For L. monocytogenes and E. coli inoculated in juice containing CCEO (5, 2.5, and 1.25 μl/ml), a ≥5-log reduction was detected after 15 min of exposure. This same result was obtained for Salmonella Enteritidis incubated alone in pineapple juice containing CCEO at 5 and 2.5 μl/ml. Overall, Salmonella Enteritidis was the most tolerant and L. monocytogenes was the most sensitive to CCEO. The physicochemical properties (pH, titratable acidic and soluble solids) of pineapple juice containing CCEO (2.5 and 1.25 μl/ml) were maintained. Juice containing
CCEO (2.5 and 1.25 μl/ml) exhibited similar scores for odor, appearance, and viscosity compared with juice without CCEO. However, unsatisfactory changes in taste and aftertaste were observed in juices containing CCEO.

Antimicrobial Activity of Individual and Combined Essential Oils Against Foodborne Pathogenic Bacteria

F. Reyes-Jurado, A. López-Malo, E. Palou


Link to full text: Click here

Significance: The essential oil mixtures examined have the potential to inhibit microbial growth and preserve foods; however, their effect on sensory quality in selected foods compatible with their flavor needs to be assessed.

The antimicrobial activities of essential oils from Mexican oregano (Lippia berlandieri Schauer), mustard (Brassica nigra), and thyme (Thymus vulgaris) were evaluated alone and in binary combinations against Listeria monocytogenes, Staphylococcus aureus, or Salmonella Enteritidis. Chemical compositions of the essential oils were analyzed by gas chromatography–mass spectrometry. The MICs of the evaluated essential oils ranged from 0.05 to 0.50% (vol/vol). Mustard essential oil was the most effective. Furthermore, mustard essential oil exhibited synergistic effects when combined with either Mexican oregano or thyme essential oils (fractional inhibitory concentration indices of 0.75); an additive effect was obtained by combining thyme and Mexican oregano essential oils (fractional inhibitory concentration index = 1.00).

Clostridium botulinum

Thermal and Pressure-Assisted Thermal Destruction Kinetics for Spores of Type A Clostridium botulinum and Clostridium sporogenes PA3679


Link to full text: Click here

Significance: Clostridium sporogenes PA3679 spores were generally more resistant to combinations of high pressure and high temperature than were the spores of the C. botulinum strains tested in this study.

The purpose of this study was to determine the inactivation kinetics of the spores of the most resistant proteolytic Clostridium botulinum strains (Giorgio-A and 69-A) and of Clostridium sporogenes PA3679, and to compare the thermal and pressure-assisted thermal resistance of these spores. Using laboratory-scale and pilot-scale pressure test systems, spores of Giorgio-A, 69-A, and PA3679 suspended in ACES [N-(2-acetamido)-2-aminoethanesulfonic acid] buffer (pH 7.0) were exposed to various combinations of temperature (93 to 121°C) and pressure (0.1 to 750 MPa) to determine their resistance. More than a 5-log reduction occurred after 3 min at 113°C for spores of Giorgio-A and 69-A and after 5 min at 117°C for spores of PA3679. A combination of high temperatures and pressures yielded greater log reductions of spores of Giorgio-A, 69-A, and PA3679 compared with reduction obtained with high temperatures alone. Thermal D-values of Giorgio-A, 69-A, and PA3679 spores decreased as the temperature increased from 97 to 117°C. Pressure-assisted thermal D-values of Giorgio-A, 69-A,
and PA3679 also decreased as temperature increased. At higher temperatures (117 or 121°C), increasing pressure from 600 to 750 MPa had an effect on pressure-assisted thermal D-values of PA3679, but pressure had no effect on pressure-assisted thermal D-values of Giorgio-A and 69-A.

**Mycotoxins**

**Diversity of Mycotoxin-Producing Black Aspergilli in Canadian Vineyards**  
T.F. Qi, J.B. Renaud, T. McDowell, K.A. Seifert, K.K.-C. Yeung, M.W. Sumarah  
doi: 10.1021/acs.jafc.5b05584  
Link to full text: Click here

**Significance:** Fumonisin-producing Aspergilli can occur in Ontario vineyards but, at present, the risk of contamination of grapes appears low.

A multiyear survey of black Aspergilli in Niagara, ON, vineyards was conducted to determine the diversity of species present and to assess the risk of ochratoxin A (OTA) and fumonisins contamination of wine grapes from this region. From 2012 to 2014, 253 black Aspergilli were isolated from soil samples and the fruits of 10 varieties of grapes. The isolates were identified by DNA sequencing: *Aspergillus* *welwitschiae* (43%), *A. uvarum* (32%), *A. brasiliensis* (11%), *A. tubingensis* (9%), and *A. niger* (4%). *A. carbonarius*, the primary OTA producer on grapes in other parts of the world, was isolated only once, and this is the first report for it in Canada. All 10 *A. niger* strains produced fumonisins, but, in contrast, only 26% of the 109 *A. welwitschiae* isolates were producers, and no strains of either species produced OTA. Grape samples were analyzed for OTA and fumonisins from sites where strains with mycotoxigenic potential were isolated. Fumonisin B2 (FB2) was detected in 7 of 22 (32%) of these grape samples in the 1–15 ppb range, but no OTA was detected. Additionally, the recently reported nonaminated fumonisins were detected in 3 of 22 grape samples.

**Influence of Environmental Parameters on Mycotoxin Production by Alternaria Arborescens**  
S. Vaquer, A. Patriarc, V. Fernández Pinto  
doi: 10.1016/j.ijfoodmicro.2015.12.003  
Link to full text: Click here

**Significance:** High water activity (aw) levels and high temperatures were favorable for mycotoxin production with the greatest accumulation of all four toxins occurring at 0.975 aw and 30 °C.

The objective of this study was to determine the effect of water activity (aw, 0.995, 0.975, 0.950) and temperature (6, 15, 20, 25 and 30 °C) on mycotoxin production by *Alternaria arborescens* on a synthetic tomato medium. The optimum production of Alternariol (AOH) and alternariol monomethyl ether (AME) occurred at 0.975 aw after 40 days of incubation at 30 °C. The maximum tenuazonic acid (TeA) accumulation was observed at 0.975 aw and 25 °C and at 0.950 aw and 30 °C. AAL toxins (*Alternaria alternata* f. sp. lycopersicum toxins) were produced in higher quantities at 0.995 aw and 30 °C. At 6 °C no quantifiable levels of AOH or AME were detected, but significant amounts of TeA were produced at 0.975 aw.
A Review of Mycotoxins in Food and Feed Products in Portugal and Estimation of Probable Daily Intakes
doi: 10.1080/10408398.2012.720619
Link to full text: Click here

Significance: This work reviews the occurrence and levels of mycotoxins in Portuguese food and feed to provide a global overview of this issue in Portugal.

Mycotoxins are toxic secondary metabolites produced by filamentous fungi that occur naturally in agricultural commodities worldwide. Aflatoxins, ochratoxin A, patulin, fumonisins, zearalenone, trichotheccenes, and ergot alkaloids are presently the most important for food and feed safety. These compounds are produced by several species that belong to the Aspergillus, Penicillium, Fusarium, and Claviceps genera and can be carcinogenic, mutagenic, teratogenic, cytotoxic, neurotoxic, nephrotoxic, estrogenic, and immunosuppressant. Human and animal exposure to mycotoxins is generally assessed by taking into account data on the occurrence of mycotoxins in food and feed as well as data on the consumption patterns of the concerned population. This evaluation is crucial to support measures to reduce consumer exposure to mycotoxins.

Food Allergy

Polymorphisms Affecting Vitamin D–Binding Protein Modify the Relationship Between Serum Vitamin D (25(OH)D3) and Food Allergy
Journal of Food Allergy and Clinical Immunology, Vol. 137, No. 2; pp. 500–506, 2016
doi: 10.1016/j.jaci.2015.05.051
Link to full text: Click here

Significance: Polymorphisms associated with lower vitamin D–binding protein level attenuated the association between low serum 25(OH)D3 level and food allergy, consistent with greater vitamin D bioavailability in those with a lower DBP level.

This study investigated whether polymorphisms that lower the vitamin D–binding protein (DBP) could compensate for adverse effects of low serum vitamin D on food allergy risk. From a population-based cohort study (n=5276), the association between serum 25-hydroxyvitamin D3 (25(OH)D3) levels and food allergy at age 1 (338 challenge-proven food-allergic and 269 control participants) and age 2 (55 participants with persistent and 50 participants with resolved food allergy) was investigated. Analyses were stratified by genotype at rs7041 as a proxy marker of DBP levels (low, the GT/TT genotype; high, the GG genotype). Low serum 25(OH)D3 level (≤50 nM/L) at age 1 was associated with food allergy, particularly among infants with the GG genotype (OR, 6.0; 95% CI, 0.9-38.9) but not in those with GT/TT genotypes (OR, 0.7; 95% CI, 0.2-2.0; P interaction = .014). Maternal antenatal vitamin D supplementation was associated with less food allergy, particularly in infants with the GT/TT genotype (OR, 0.10; 95% CI, 0.03-0.41). Persistent vitamin D insufficiency increased the likelihood of persistent food allergy (OR, 12.6; 95% CI, 1.5-106.6), particularly in those with the GG genotype.