Salmonella

Isolation of *Salmonella* spp. from Lettuce and Evaluation of Its Susceptibility to Novel Bacteriocins of *Bacillus thuringiensis* and Antibiotics

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Link to full text: http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000002/art00014

Significance: *Salmonella* strains isolated from lettuce are susceptible to bacteriocins produced by the most important bioinsecticide worldwide.

In this study, 13% of fresh lettuce (*Lactuca sativa*) samples collected from markets and supermarkets in two cities of Mexico were contaminated with *Salmonella* spp. From those samples, amplicons of ~300 base pairs (bp) were amplified, corresponding to the expected size of the invasion (invA) and internal transcribed spacer regions of the 16S and 23S rRNA genes of *Salmonella* spp. Additionally, *Salmonella* strains were isolated and harbored plasmids ranging from ~9 to 16 kbp. From these strains, 91% were resistant to ampicillin and nitrofurantoin, whereas 55% were resistant to cephalothin and chloramphenicol. When *Salmonella* isolates were tested against novel bacteriocins (morricin 269, kurstacin 287, kenyacin 404, entomocin 420, and tolworthcin 524) produced by five Mexican strains of *Bacillus thuringiensis*, 50% were susceptible to these antimicrobial peptides.

Development and Validation of a Predictive Microbiology Model for Survival and Growth of *Salmonella* on Chicken Stored at 4 to 12°C

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Significance: The general regression neutral network model can be used with confidence to help assess and manage the survival and growth of Salmonella on chicken during refrigerated storage.

This study developed and validated the first predictive microbiology model for survival and growth of a low initial dose of *Salmonella* on chicken during refrigerated storage. Chicken skin was inoculated with a low initial dose (0.9 log) of a multiple antibiotic-resistant strain of *Salmonella* Typhimurium DT104 (ATCC 700408) and then stored at 4 to 12°C for 0 to 10 days. A general regression neural network (GRNN) model that predicted log change of *Salmonella* Typhimurium DT104 as a function of time and temperature was developed. Survival but not growth of *Salmonella* Typhimurium DT104 was observed at 4 to 8°C. Maximum growth of *Salmonella* Typhimurium DT104

during 10 days of storage was 0.7 log at 9°C, 1.1 log at 10°C, 1.8 log at 11°C, and 2.9 log at 12°C. Performance of the GRNN model for predicting dependent data (n=163) was 85% acceptable predictions, for predicting independent data for interpolation (n=77) was 84% acceptable predictions, and for predicting independent data for extrapolation (n=70) to *Salmonella* Kentucky was 87% acceptable predictions.

E. Coli

Multiplex PCR Detection of Shiga Toxin-Producing *Escherichia coli* Strains Belonging to Serogroups O157, O103, O91, O113, O145, O111, and O26 Experimentally Inoculated in Beef Carcass Swabs, Beef Trim, and Ground Beef

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Significance: This study could provide industry and government agencies with a tool to evaluate the prevalence and incidence of Shiga toxin-producing *Escherichia coli* in beef products and their processing environments.

A multiplex PCR assay enabling simultaneous detection of Shiga toxin-producing *Escherichia coli* (STEC) O103, O91, O113, O145, O111, O157, and O26 was developed and evaluated in artificially contaminated beef carcass swabs, beef trim, and ground beef after overnight enrichment. Individual serogroups were experimentally inoculated at low (1-10 CFU/ml) and high (11-100 CFU/ml) levels, and with a cocktail of strains belonging to two, four, and six serogroups. When strains were combined, there were significant differences in detection of all cocktail isolates in some of the beef products. To address this issue, four serogroups were experimentally inoculated together at three different estimated levels (10, 10^2, and 10^3 CFU/ml) in all three beef products. Results yielded no significant difference in detecting STEC at the three inoculation levels (10, 10^2, and 10^3 CFU/ml) in trim and carcass swabs, but there was a significant difference in detecting STEC at the lowest levels (10 and 10^2 CFU/ml) in the 80:20 nonirradiated ground beef, and in the detection of STEC in irradiated ground beef.

Survival of *Escherichia coli* O157:H7 and *Campylobacter jejuni* in Bottled Purified Drinking Water under Different Storage Conditions

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Significance: Microbial examination of bottled water must be done carefully, otherwise false-negative results or underestimation of bacterial numbers could pose a health risk when low levels of pathogens are present.

Survival of *Escherichia coli* O157:H7 and *Campylobacter jejuni* that were separately inoculated into bottled purified drinking water was investigated during storage at 22, 4, and -18°C for 5, 7, and 2 days, respectively. Two

inoculation levels were used, 1 and 10 CFU/ml (10^2 and 10^3 CFU/100 ml). In samples inoculated with 10^2 CFU/100 ml, *C. jejuni* was not detectable (>2-log reduction) after storage. *E. coli* O157:H7 was detected on nonselective and selective media at log reductions of 1.08-1.25 after storage at 22°C, 1.19-1.56 after storage at 4°C, and 1.54-1.98 after storage at -18°C. When the higher inoculation level of 10^3 CFU/100 ml was used, *C. jejuni* was able to survive at 22 and 4°C, with 2.25- and 2.17-log reductions, respectively, observed on nonselective media. At these higher inoculation levels, *E. coli* O157:H7 was detectable at 22, 4, and -18°C, with log reductions of 0.76, 0.97, and 1.21, respectively, achieved on nonselective media. Additionally, *E. coli* O157:H7 showed significant differences in culturability ($P<0.05$) on the nonselective and selective culture media under the different storage conditions, with storage at -18°C for 2 days being the treatment most inhibiting. The percentage of sublethal injury of *E. coli* O157:H7 ranged from ~33 to 75%.

Modeling the Effects of Sodium Chloride, Acetic Acid, and Intracellular pH on Survival of *Escherichia coli* O157:H7

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Applied and Environmental Microbiology, Vol. 77, No. 3; pp. 889-895, 2011

Link to full text: http://aem.asm.org/cgi/content/full/77/3/889

Significance: Comparing intracellular pH with Weibull model predictions showed that decreases in intracellular pH were significantly correlated with the corresponding times required to achieve a 5-log reduction in the number of bacteria.

Microbiological safety has been a critical issue for acid and acidified foods since it became clear that acid-tolerant pathogens such as *Escherichia coli* O157:H7 can survive in a pH range of 3-4, which is typical for these classes of food products. The primary antimicrobial compounds in these products are acetic acid and NaCl, which can alter the intracellular physiology of *E. coli* O157:H7, leading to cell death. For combinations of acetic acid and NaCl at pH 3.2 (a pH value typical for non-heat-processed acidified vegetables), survival curves were described by using a Weibull model. The data revealed a protective effect of NaCl concentration on cell survival for selected acetic acid concentrations. The intracellular pH of an *E. coli* O157:H7 strain exposed to acetic acid concentrations of up to 40 mM and NaCl concentrations between 2 and 4% was determined. A reduction in the intracellular pH was observed for increasing acetic acid concentrations with an external pH of 3.2.

Listeria

Nisin Treatment To Enhance the Efficacy of Gamma Radiation against *Listeria monocytogenes* on Meat

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Link to full text: http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000002/art00003

Significance: A combination of nisin and gamma radiation are potentially effective in eliminating *L. monocytogenes* in meat.

This study used nisin for enhancing the lethality of gamma radiation against *Listeria monocytogenes*, so that moderate doses of radiation can effectively eliminate the pathogen on meat. Cubes of raw meat (10g each) were inoculated with *L. monocytogenes* (10^7CFU/g) and treated with nisin (10^3 IU/g), gamma radiation (0.25-1.5 kGy), or combinations of these treatments. Meat was analyzed for *L. monocytogenes* survivors immediately after treatment and during storage at 4°C for up to 72h. Nisin treatment alone inactivated *L. monocytogenes* by 1.2 log CFU/g. Gamma radiation caused dose-dependent inactivation of the pathogen. Treatment with combinations of nisin and gamma radiation resulted in an additive antimicrobial effect when inoculated meat was tested during the first 24 h and in a synergistic effect when tested after 72h of storage at 4°C. When *L. monocytogenes* was inoculated onto meat at low levels (4×10^3CFU/g), treated with nisin (10^3 IU/g), and then irradiated (1.5 kGy) and stored at 4°C for 72h, the pathogen's most probable number was <0.03/g.

Foodborne Pathogens

Growth of *Salmonella enterica* and *Staphylococcus aureus* in No-Knead Bread Dough during Prolonged Yeast Fermentation

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Link to full text: http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000002/art00016

Significance: Because prolonged fermentation permits substantial growth of infectious and/or toxin-producing foodborne pathogens, the making of slow-rise, no-knead bread may compromise consumer kitchen sanitation and food safety.

The microbial safety of no-knead dough made with a 375:325:5:1 weight ratio of flour, water, salt, and bread yeast was investigated. Three brands of dehydrated yeast were used for this study. The growth of inoculated *Salmonella enterica* and *Staphylococcus aureus* in no-knead dough during fermentation was significant ($P<0.05$), regardless of yeast brand. The multiplication rates of *S. enterica* in the initial 12h and *S. aureus* over the entire 24h of fermentation were positively correlated with fermentation temperatures of 21-38°C ($P<0.005$; $r \geq 0.996$). Mean counts of *S. enterica* increased by 0.5, 1.5, 1.9, and 2.4 log CFU/g, respectively, after 6, 12, 18, and 24 h of fermentation at 21°C. The level of *S. aureus* increased by 0.4, 1.1, 1.7, and 2.2 CFU/g, respectively, after 18h of fermentation at 21, 27, 32, and 38°C.

Norovirus

Inactivation of Murine Norovirus 1, Coliphage ΦX174, and *Bacillus fragilis* Phage B40-8 on Surfaces and Fresh-Cut Iceberg Lettuce by Hydrogen Peroxide and UV Light

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Applied and Environmental Microbiology, Vol. 77, No. 4; pp. 1399-1404, 2011

Significance: Vaporized hydrogen peroxide (2.52%) in combination with UV light is promising for decontamination of fresh produce with much less consumption of water and disinfectant.

Link to full text: http://aem.asm.org/cgi/content/full/77/4/1399

The inactivating properties of liquid hydrogen peroxide (L-H_2O_2), vaporized hydrogen peroxide (V-H_2O_2), UV light, and a combination of V-H_2O_2 and UV light were tested on murine norovirus 1 (MNV-1) and bacteriophages (ΦX174 and B40-8) as models for human noroviruses. A mixture of the viruses was inoculated onto shredded iceberg lettuce and treated after overnight incubation at 2°C. L-H_2O_2 (2.1%) was able to inactivate MNV-1 and ΦX174 on stainless steel discs (SSD) by approximately 4 $\log_{10}$ units within 10 min of exposure, whereas for B40-8, 15% of L-H_2O_2 was needed to obtain a similar reduction in 10 min. Only a marginal reduction (≤1 $\log_{10}$ unit after 5 min of exposure) by V-H_2O_2 (2.52%) was achieved for the tested model viruses, although in combination with UV light, a 4-$\log_{10}$-unit decrease within 5 min of treatment was observed on SSD. These results demonstrated that both L-H_2O_2 and a combination of V-H_2O_2 and UV light can be used for norovirus inactivation on surfaces.

Food Allergy

Liquid Chromatography and Mass Spectrometry in Food Allergen Detection

Significance: A brief overview of the principles of proteomic procedures, various chromatographic set ups, and mass spectrometry instrumentation used in allergenomics are presented.

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Food allergy is an important issue in the field of food safety because of the hazards for affected persons and the hygiene requirements and legal regulations imposed on the food industry. Consumer protection and law enforcement require suitable analytical techniques for the detection of allergens in foods. Immunological methods are currently preferred; however, confirmatory alternatives are needed. The determination of allergenic proteins by liquid chromatography and mass spectrometry has greatly advanced in recent years, and gel-free allergenomics is becoming a routinely used approach for the identification and quantitation of food allergens. A compendium of published liquid chromatography methods, proteomic analyses, typical marker peptides, and quantitative assays for 14 main allergy-causing foods are included in this review.

Acrylamide

Implementation of Acrylamide Mitigation Strategies on Industrial Production of French Fries: Challenges and Pitfalls

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Link to full text: http://pubs.acs.org/doi/full/10.1021/jf1042486

Significance: French fries upon final frying presented acrylamide contents below the limit of detection (12.5 µg kg^{-1}) with no effects on the sensorial properties of the final product.

This study evaluated various additives or process aids on the industrial production of French fries, based on their acrylamide mitigation potential and other quality parameters. The application of acetic and citric acid, calcium lactate and asparaginase was investigated on the production of frozen par-fried French fries at the beginning and end of the 2008 and 2009 potato storage season. Despite the fact that some of these treatments significantly reduced acrylamide content of the final product in preliminary laboratory experiments, their application on the industrial production of French fries did not result in additional acrylamide reductions compared to the standard product. Asparaginase was additionally tested in a production line of chilled French fries (not par-fried). Since for this product a longer enzyme-substrate contact time is allowed, total asparagine depletion was observed for the enzyme treated fries after 4d of cold storage.

Nanotechnology

Nanotechnology for Food Applications: More Questions Than Answers
J.C. Buzby
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Link to full text: http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6606.2010.01182.x/full

Significance: The scientific evidence to date on a variety of nanotechnology issues important to consumers with a focus on food applications is reviewed in this article.

Nanotechnology is technology at the atomic or macromolecular levels on the scale of approximately 1–100 nm. There are unlimited potential applications of nanotechnology for food, dietary supplements and food contact materials. However, there are more questions than answers about the safety risks of nanotechnology, its environmental, health and other impacts, and its costs and benefits. Benefits and costs will likely be specific to the nanomaterials used, the application and other conditions (e.g., temperature).