

Special Reports

Integrating the Totality of Food and Nutrition Evidence for Public Health Decision Making and Communication

Navia JL, Byers T, Djordjevic D, Hentges E, King J, Klurfeld D, Llewellyn C, Milner J, Skrypec D, Weed D.

Critical Reviews in Food Science and Nutrition

Supported by the ILSI North America [Committee on Food and Chemical Safety](#), [Committee on Carbohydrates](#), and [Committee on Dietary Lipids](#)

For open-access: <http://www.informaworld.com/smpp/content~db=all~content=a930670477~frm=abslink>

Significance: This supplement includes a summary paper and expanded abstracts from an ILSI North America Workshop during which participants representing the nutrition and food safety communities in academia, industry, and government shared current practices in the interpretation of weak epidemiological associations, and explored avenues for appropriate interpretation and integration of animal study data, human intervention, and epidemiological data in the formulation of dietary advice for the public.

The interpretation and integration of epidemiological studies detecting weak associations ($RR < 2$) with data from other study designs (e.g., animal models and human intervention trials) is both challenging and vital for making science-based dietary recommendations in the nutrition and food safety communities. The 2008 ILSI North America “Decision-Making for Recommendations and Communication Based on Totality of Food-Related Research” workshop provided an overview of epidemiological methods, and case-study examples of how weak associations have been incorporated into decision making for nutritional recommendations. Based on the workshop presentations and dialogue among the participants, three clear strategies were provided for the use of weak associations in informing nutritional recommendations for optimal health. First, enable more effective integration of data from all sources through the use of genetic and nutritional biomarkers; second, minimize the risk of bias and confounding through the adoption of rigorous quality-control standards, greater emphasis on the replication of study results, and better integration of results from independent studies, perhaps using adaptive study designs and Bayesian meta-analysis methods; and third, emphasize more effective and truthful communication to the public about the evolving understanding of the often complex relationship between nutrition, lifestyle, and optimal health.

Feeding the World Today and Tomorrow: The Importance of Food Science and Technology

J.D. Floros, R. Newsome, W. Fisher, G.V. Barbosa-Cánovas, H. Chen, C.P. Dunne, et al.

Comprehensive Reviews in Food Science and Food Safety, Vol. 9, No. 5, pp. 572–599, September 2010

Link to full text: <http://www.ift.org/knowledge-center/read-ift-publications/science-reports/ift-scientific-review-feeding-the-world-today-and-tomorrow.aspx>

Significance: This report takes a historical look at the food system, the many challenges ahead, and the crucial role of food science and technology in meeting the needs of a growing world population.

The Institute of Food Technologists produced a scientific report to inform the public about the advances in food science and technology that are necessary to meet the needs of an evolving society, which today has much greater access to an abundant, diverse food supply that is largely safe, flavorful, nutritious, convenient, and less costly than ever before. This report summarizes the historical developments of agriculture and food technology, details various food manufacturing methods, and explains why food is processed. This report also describes and stresses why further advancements in food science and technology are needed—to more equitably meet growing world population food needs with enhanced food security in developing countries and solutions to complex diet-and-health challenges in industrialized countries. This report states that scientific and technological advancements must be accelerated and applied in developed and developing nations alike, if we are to feed a growing world population.

Salmonella

Effects of Nutritional and Environmental Conditions on *Salmonella* sp. Biofilm Formation

B. Speranza, M.R. Corbo, M. Sinigaglia

Journal of Food Science, Vol. 76, No. 1; pp. M12–M16, 2011

Link to full text: <http://onlinelibrary.wiley.com/doi/10.1111/j.1750-3841.2010.01936.x/full>

Significance: This study extends knowledge about the effects of different environmental conditions on *Salmonella* sp. adherence to stainless steel food-processing equipment.

This investigation focused on the study and quantification of the effects of temperature (20 to 40°C), pH (4.5 to 7.5), and medium composition (0.5 to 2.5 g/L of peptone) on biofilm formation by *Salmonella* sp. on stainless steel through surface response modeling. Results highlighted that the target strain was able to adhere on stainless steel, under all the conditions tested. To assess potential differences, the aptitude to biofilm formation (ABF), defined as the time necessary to start adhesion on the surface, was calculated by using the Gompertz equation. This parameter was modeled through a stepwise regression procedure and experimental conditions resulting in the greater ABF were growth in poor media (1.0 to 1.5 g/L of peptone), incubation temperature of about 30°C, and pH close to 6.0.

E. coli

Inactivation of *Escherichia coli* O157:H7 in Moisture-Enhanced Nonintact Beef by Pan-Broiling or Roasting with Various Cooking Appliances Set at Different Temperatures

C. Shen, I. Geornaras, K.E. Belk, G.C. Smith, J.N. Sofos

Journal of Food Science, Vol. 76, No. 1; pp. M64–M71, 2011

Link to full text: <http://onlinelibrary.wiley.com/doi/10.1111/j.1750-3841.2010.01882.x/full>

Significance: This study should be useful for developing cooking recommendations to enhance the safety of non-intact beef products, and for use in risk assessments of such products.

Inactivation of *Escherichia coli* O157:H7 in moisture-enhanced restructured non-intact beef cooked to 65°C using different cooking appliances set at different temperatures was evaluated. Batches (2 kg) of coarse-ground beef were mixed with an 8-strain composite (100mL) of rifampicin-resistant *E. coli* O157:H7 (6.4±0.1 log CFU/g) and a solution (100mL) of sodium chloride plus sodium tripolyphosphate to yield concentrations (wt/wt) of 0.5% and 0.25%, respectively, in the final product. Beef portions of 2.54 cm thickness were prepared and were vacuum-packaged and frozen (−20°C, 42 h). Partially thawed portions were pan-broiled or roasted to 65°C. The appliances were set at, and preheated before cooking to 149 or 204°C (electric skillet), 149 or 218°C (grill), 149 or 232°C (toaster oven), and 149, 204, or 260°C (kitchen oven). Temperatures of 204 to 260°C resulted in greater pathogen reductions (3.3-5.5 log CFU/g) than those obtained at 149°C (1.5-2.4 log CFU/g). The highest reduction (5.5 log CFU/g) was obtained in samples cooked in the kitchen oven set at 260°C.

Comparative Evaluation of a Phage Protein Ligand Assay with Real-Time PCR and a Reference Method for the Detection of *Escherichia coli* O157:H7 in Raw Ground Beef and Trimmings

F. Savoye, P. Feng, C. Rozand, M. Bouvier, A. Gleizal, D. Thevenot

Journal of Food Protection, Vol. 74, No. 1; pp. 6-12, 2011

Link to abstract: <http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000001/art00002>

Significance: Sensitive and rapid detection methods for *E. coli* O157:H7 are essential for the meat industry to ensure a safe meat supply.

This study compared the sensitivity of the VIDAS ultraperformance *Escherichia coli* test (ECPT UP) with a noncommercial real-time (RT) PCR method and the USDA Food Safety and Inspection Service (FSIS) reference method for detecting *E. coli* O157:H7 in raw ground beef. Optimal enrichment times and the efficacy of testing different types of raw meat, either as individual samples (25-g) or as composites (375-g), were examined. For 25-g samples of each type of raw ground beef tested, 6 h of enrichment was sufficient for both the VIDAS ECPT UP and RT-PCR methods, but for 375-g samples, 24 h of enrichment was required. Both the VIDAS ECPT UP and RT-PCR methods produced results similar to those obtained with the USDA-FSIS reference method after 18-24 h of enrichment. The primer specificity of the RT-PCR assay and the highly specific phage ligand used in the VIDAS ECPT UP for target recognition enabled the detection of low levels of *E. coli* O157:H7 in 25-g of various types of

raw ground beef. The tests also allowed the detection of *E. coli* O157:H7 in composite raw ground beef and trimmings in samples of up to 375-g.

Relationship between *eae* and *stx* Virulence Genes and *Escherichia coli* in an Agricultural Watershed: Implications for Irrigation Water Standards and Leafy Green Commodities

D.R. Shelton, J.S. Karns, C. Coppock, J. Patel, M. Sharma, Y.A. Pachepsky

Journal of Food Protection, Vol. 74, No. 1; pp. 18-23, 2011

Link to abstract: <http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000001/art00004>

Significance: The Leafy Greens Marketing Agreement standards might not adequately address the issue of waterborne contamination, and that alternative criteria might be required.

This monitoring study in an agricultural watershed was conducted to evaluate spatial and temporal fluctuations in *Escherichia coli* populations and virulence genes associated with pathogenic *E. coli* and to investigate whether a relationship could be established between *E. coli* and virulence genes. The virulence genes targeted for analysis were the *eae* and *stx* genes, encoding for intimin and Shiga-like toxins, respectively; they were detected with PCR methods. *E. coli* concentrations and *eae* and *stx* prevalence varied both spatially and temporally; both were higher in agricultural than in forested areas and were higher in the summer and fall seasons than in winter. The *eae* and *stx* genes were prevalent throughout the watershed. No correlation was observed between *E. coli* concentrations and virulence genes; lower *E. coli* concentrations were not necessarily associated with decreased prevalence of *eae* and *stx* genes.

Inactivation of *Escherichia coli* Inoculated onto Fresh-Cut Chopped Cabbage Using Electron-Beam Processing

M. Grasso, R.M. Uribe-Rendon, K. Lee

Journal of Food Protection, Vol. 74, No. 1; pp. 115-118, 2011

Link to abstract: <http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000001/art00017>

Significance: E-beam irradiation is a viable nonthermal treatment that extends the shelf life and increases the safety of fresh cabbage by reducing or eliminating indigenous microflora and unwanted pathogens.

This study examined the efficacy of electron-beam (e-beam) irradiation in decreasing indigenous microflora on fresh-cut cabbage and determined the optimal dosage to pasteurize fresh-cut cabbage inoculated with *Escherichia coli* K-12. Fresh-cut cabbage (100-g) was inoculated with ~8 log *E. coli* K-12 and e-beam irradiated at doses of 0, 1.0, 2.3, or 4.0 kGy. At 2.3 kGy, there was <1.0 log indigenous microflora remaining, indicating >4.0-log reduction by e-beam. At a 4.0-kGy dose, there was >7-log reduction of *E. coli* K-12 in the fresh-cut cabbage. The D_{10} -value for *E. coli* K-12 in fresh-cut cabbage was 0.564 kGy.

Commensal Effect of Pectate Lyases Secreted from *Dickeya dadantii* on Proliferation of *Escherichia coli*

O157:H7 EDL933 on Lettuce Leaves

A. Yamazaki, J. Li, W.C. Hutchins, L. Wang, J. Ma, A.M. Ibekwe, et al.

Applied and Environmental Microbiology, Vol. 77, No. 1, pp. 156-162, 2011

Link to full text: <http://aem.asm.org/cgi/content/full/77/1/156>

Significance: The pectinolytic activity of *Dickeya dadantii* 3937 is the dominant determinant of enhanced EDL933 proliferation on the lettuce leaves.

The influence of virulence mechanisms of *Dickeya dadantii* 3937, a broad-host-range phytopathogen, on the proliferation of the human pathogen *Escherichia coli* O157:H7 EDL933 (EDL933) on postharvest lettuce by coinoculation of EDL933 with *D. dadantii* 3937 derivatives that have mutations in virulence-related genes was examined. A type II secretion system (T2SS)-deficient mutant of *D. dadantii* 3937, A1919 ($\Delta outC$), lost the capability to promote the multiplication of EDL933, whereas Ech159 ($\Delta rpoS$), a stress-responsive σ factor RpoS-deficient mutant, increased EDL933 proliferation on lettuce leaves. A spectrophotometric enzyme activity assay revealed that A1919 ($\Delta outC$) was completely deficient in the secretion of pectate lyases (Pels), which play a major role in plant tissue maceration. In contrast to A1919 ($\Delta outC$), Ech159 ($\Delta rpoS$) showed more than 2-fold-greater Pel activity than the wild-type *D. dadantii* 3937. Increased expression of *pelD* (encodes an endo-pectate lyase) was observed in Ech159 ($\Delta rpoS$) *in planta*.

Virulence Characterization of Shiga-Toxigenic *Escherichia coli* Isolates from Wholesale Produce

P.C.H. Feng, T. Councell, C. Keys, S.R. Monday

Applied and Environmental Microbiology, Vol. 77, No. 1; pp. 343-345, 2011

Link to full text: <http://aem.asm.org/cgi/content/full/77/1/343>

Significance: The presence of two Shiga-toxigenic *E. coli* strains in ready-to-eat produce may pose a health problem.

The 13 Shiga-toxigenic *Escherichia coli* (STEC) strains isolated from wholesale spinach and lettuce consisted mostly of serotypes that have not been implicated in illness. Among these strains, however, were two O113:H21 that carried virulence genes common to this pathogenic serotype (*stx₂*, *ehxA*, *saa*, and *subAB*), suggesting that their presence in ready-to-eat produce may be of health concern.

Listeria

Synergistic Effect of Nisin and Cone Essential Oil of *Metasequoia Glyptostroboides* Miki Ex Hu Against *Listeria Monocytogenes* in Milk Samples

J.I. Yoon, V.K. Bajpai, S.C. Kang

Food and Chemical Toxicology, Vol. 49, No. 1; pp. 109-114, 2011

Link to full text: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6P-516970D-4&_user=10055541&_coverDate=01%2F31%2F2011&_alid=1642865865&_rdoc=5&_fmt=high&_orig=search&_origin=search&_zone=rslt_list_item&_cdi=5036&_sort=r&_st=13&_docanchor=&_view=c&_ct=18&_acct=C000050221&_version=1&_urlVersion=0&_userid=10055541&md5=c1f0ad288541f68e64a2c67002de9436&searchtype=a

Significance: The cone essential oil of *Metasequoia glyptostroboides* might be a useful candidate for use in the food industry to control the growth of pathogenic microorganisms.

This study was undertaken to evaluate the effect of nisin and cone essential oil of *Metasequoia glyptostroboides* against *Listeria monocytogenes* ATCC 19116 inoculated in whole (8%), low (1%) and skim (no fat content) milks. Essential oil at the concentrations of 2% and 5% revealed strong anti-listerial effect against *L. monocytogenes* ATCC 19116 in all categories of milks. Nisin at the concentrations of 250 and 500 IU/ml displayed a remarkable anti-listerial effect as compared to the control group. Also, the synergistic combinations of cone essential oil (1% and 2%) and nisin (62.5, 125, 250 and 500 IU/ml) had a remarkable anti-listerial activity in all categories of whole, low and skim milks after 14 days.

Control of *Listeria Monocytogenes* on Cold-Smoked Salmon Using Chitosan-Based Antimicrobial Coatings and Films

Z. Jiang, H. Neetoo, H. Chen

Journal of Food Science, Vol. 76, No. 1; pp. M22–M26, 2011

Link to full text: <http://onlinelibrary.wiley.com/doi/10.1111/j.1750-3841.2010.01925.x/full>

Significance: Chitosan-based edible coatings and films hold promise and can potentially assist fishery industries in their efforts to control *Listeria monocytogenes*.

This study evaluated the efficacy of chitosan-based edible coatings and films incorporating 3 generally recognized as safe (GRAS) antimicrobials, sodium lactate (SL), sodium diacetate (SD), and potassium sorbate (PS), against *Listeria monocytogenes* on cold-smoked salmon. Salmon samples were surface-inoculated with a 5-strain cocktail of *L. monocytogenes* to a final concentration of 4.4 log CFU/cm² and then either coated with chitosan solutions or wrapped with chitosan films with or without the 3 antimicrobials. The samples were then vacuum packaged and stored at 4°C for 30 d. The chitosan coatings with or without the antimicrobials consistently showed higher efficacy against *L. monocytogenes* than chitosan films having the same compositions. The most effective film treatments, chitosan films containing 1.2% SL/0.25% SD or 2.4% SL, achieved ≥ 1.3 log reductions of *L. monocytogenes* during the 30 d of refrigerated storage, while the most effective coating treatments, chitosan coatings containing 1.2% SL/0.25% SD or 0.15% PS/0.125% SD, achieved ≥ 2.8 log reductions.

Foodborne Pathogens

Role of Incubation Conditions and Protein Fraction on the Antimicrobial Activity of Egg White against *Salmonella* Enteritidis and *Escherichia coli*

M. Alabdeh, V. Lechevalier, F. Nau, M. Gautier, M-F. Cochet, F. Gonnet, et al.

Journal of Food Protection, Vol. 74, No. 1; pp. 24-31, 2011

Link to abstract: <http://www.ingentaconnect.com/content/iafp/jfp/2011/00000074/00000001/art00005>

Significance: Under experimental conditions, *Salmonella* Enteritidis was more resistant to inactivation by egg white than was *E. coli*.

This study determined the effects of temperature, pH, inoculum size, and egg white protein concentration on egg white antimicrobial activity, and investigated the putative interactions among these factors by conducting a complete factorial design analysis. The behavior of *Salmonella* Enteritidis and *Escherichia coli* were studied after precultivation in tryptic soy broth and Luria-Bertani broth, respectively, using three different egg white protein concentrations (0, 10, and 100%), five temperatures (37, 40, 42, 45, and 48°C), two pHs (7.8 and 9.3), and six inoculum levels (3-8 log CFU/ml). An inverse relationship was observed between bacterial growth and temperature. The role of egg white proteins was clearly demonstrated. In the absence of egg white proteins, bacterial growth occurred under most incubation conditions, whereas the presence of 10 and 100% protein produced bacteriostatic or bactericidal effects. The interaction between temperature and protein concentration was significant. At the highest tested temperatures, proteins were less involved in the bactericidal effect. Bacterial destruction was higher at pH 9.3 than at pH 7.8.

Antimicrobial Activity of Plant Extracts Against *Salmonella* Typhimurium, *Escherichia coli* O157:H7, and *Listeria monocytogenes* on Fresh Lettuce

S-Y. Kim, D-H. Kang, J-K. Kim, Y-G. Ha, J.Y. Hwang, T. Kim, et al.

Journal of Food Science, Vol. 76, No. 1; pp. M41–M46, 2011

Link to full text: <http://onlinelibrary.wiley.com/doi/10.1111/j.1750-3841.2010.01926.x/full>

Significance: Clove extract is a useful antimicrobial agent to reduce the microbial level of foodborne pathogens on fresh lettuce.

Antimicrobial activity of 12 plant extracts against *Salmonella* Typhimurium, *Escherichia coli* O157:H7, and *Listeria monocytogenes* was evaluated by using a disk diffusion assay, and *Syzygium aromaticum* (clove) showed the highest inhibitory effect. To investigate the efficacy of clove extract that inactivates pathogens on lettuce, inoculated lettuce with *S. Typhimurium*, *E. coli* O157:H7, and *L. monocytogenes* was treated with diluted clove extracts or distilled water for 0, 1, 3, 5, and 10 min. Clove extract treatment significantly reduced populations of the 3 tested pathogens from the surface of lettuce.