

Mycotoxin

Correlation of Mycotoxin Fumonisin B₂ Production and Presence of the Fumonisin Biosynthetic Gene *fum8* in *Aspergillus niger* from Grape

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Significance: The absence of fumonisin B₂ production in grape isolates of *Aspergillus niger* can result from the absence of at least one gene essential for production.

This study examined 48 strains of *Aspergillus* section *Nigri* for the presence of the fumonisin biosynthetic gene *fum8* in relation to fumonisin B₂ (FB₂) production. The *fum8* gene was detected in only 11 *Aspergillus niger* strains, 9 of which also produced FB₂. Maximum parsimony analysis based on the calmodulin gene sequence indicated that the presence/absence of *fum8* is not correlated with the phylogenetic relationship of the isolates. This is the first report correlating the presence of a fumonisin biosynthetic gene with fumonisin production in *A. niger* from an important food crop.

Bisphenol A

Sources of Low Concentrations of Bisphenol A in Canned Beverage Products

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Significance: Migration from can coatings is likely the source of bisphenol A in canned beer products.

This study analyzed 22 soft drink samples and 16 beer samples in both cans and plastic and/or glass bottles for bisphenol A (BPA). BPA was not detected in any of the soft drink samples in either plastic or glass bottles except for one product with a BPA concentration (0.018 µg/liter) close to the limit of quantification (0.015 µg/liter). BPA was detected in all of the corresponding soft drink products in cans, indicating that migration from can coatings is the likely source for BPA in canned products. Because considerable interference with ions *m/z* 213 and *m/z* 228 from sample matrices was observed for all beer samples, BPA concentrations in beer samples were measured using the ion *m/z* 270 instead.

Ochratoxin A

Food-Grade Antioxidants and Antimicrobials To Control Growth and Ochratoxin A Production by *Aspergillus* Section *Nigri* on Peanut Kernels

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Significance: Propyl paraben is more appropriate than butylated hydroxyanisole for controlling growth and ochratoxin A production by *Aspergillus* section *Nigri* species in peanut kernels.

This study determined the effect of the antioxidant butylated hydroxyanisole (BHA) and the antimicrobial propyl paraben (PP) on the lag phase before growth, growth rate, and ochratoxin A (OTA) production by *Aspergillus* section *Nigri* strains in peanut kernels under different conditions of water activity (a_w) and temperature. At 20 mM/g BHA, 18°C, and 0.93 a_w , complete inhibition of growth occurred. For PP, there was no growth at 20 mM/g, 18°C, and 0.93, 0.95, and 0.98 a_w . BHA at 20 mM/g inhibited OTA production in peanuts by *Aspergillus carbonarius* and *Aspergillus niger* aggregate strains at 0.93 a_w and 18°C. PP at 20 mM/g completely inhibited OTA production at 18°C.

Food Allergy

A Population-based Questionnaire Survey on the Prevalence of Peanut, Tree Nut, and Shellfish Allergy in 2 Asian Populations

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The Journal of Allergy and Clinical Immunology, Vol. 126, No. 2; pp. 324-331, 2010

Link to full text: [http://www.jacionline.org/article/S0091-6749\(10\)00899-7/fulltext](http://www.jacionline.org/article/S0091-6749(10)00899-7/fulltext)

Significance: Peanut and tree nut allergy is relatively low in Asian children, and instead shellfish allergy predominates.

The prevalence of peanut, tree nut, and shellfish allergy in 23,425 schoolchildren in Singapore (local and expatriate [4-6 and 14-16 years old] and the Philippines (14-16 years old) was evaluated. The prevalence of convincing peanut and tree nut allergy were similar in both local Singapore (4-6 years, 0.64%, 0.28%; 14-16 years, 0.47%, 0.3%, respectively) and Philippine (14-16, 0.43%, 0.33%, respectively) schoolchildren, but was higher in the Singapore expatriates (4-6 years, 1.29%, 1.12%; 14-16 years, both 1.21%, respectively; 4-6 years, expatriates vs local Singaporeans: peanut, $P=0.019$; tree nut, $P=0.0017$; 14-16 years, $P>.05$). Shellfish allergy was more common in the local Singapore (4-6 years, 1.19%; 14-16 years, 5.23%) and Philippine (14-16 years, 5.12%) schoolchildren compared with expatriate children (4-6 years, 0.55%; 14-16 years, 0.96%; $P<.001$). When data were pooled, respondents born in Western countries were at higher risk of peanut (adjusted OR [95% CIs]: 4-6 years, 3.47 [1.35-

8.93]; 14-16 years, 5.56 [1.74-17.76]) and tree nut allergy (adjusted OR [95% CIs]: 4-6 years, 10.40 [1.61-67.36]; 14-16 years, 3.53 [1.00-12.43]) compared with those born in Asia.

Nanotechnology

Electrospinning of Poly(vinyl alcohol) Nanofibers Loaded with Hexadecane Nanodroplets

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Significance: The manufacture of solid matrix containing nanodroplets could be of substantial interest for manufacturers wishing to develop an encapsulation system for lipophilic functional compounds.

The feasibility of producing poly(vinyl alcohol) (PVA) nanofibers containing fine-disperse hexadecane droplets by electrospinning a blend of hexadecane-in-water emulsions and PVA was investigated. Hexadecane oil-in-water nanoemulsions ($d_{10}=181.2\pm 0.1$ nm) were mixed with PVA at pH 4.5 to yield polymer-emulsion blends containing 0.5-1.5 wt% oil droplets and 8-wt% PVA. Solutions were electrospun and the morphology and thermal properties of deposited fiber mats characterized by scanning electron microscopy and differential scanning calorimetry. Analysis of dry fiber mats and their solutions showed that emulsion droplets were indeed part of the electrospun fiber structures. Depending on the concentration of hexadecane in the initial emulsion-polymer blends, droplets were dispersed in the fibers as individual droplets or in form of aggregated flocs of hexadecane droplets. Nanofibers with spindle-like perturbations or nanofibers containing bead-like structures with approximately 5 times larger than the size of droplets in the original nanoemulsion were obtained.

E. Coli

Detection of *E. coli* O157:H7 from Ground Beef Using Fourier Transform Infrared (FT-IR)

Spectroscopy and Chemometrics

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Significance: The Filtration-FT-IR and immunomagnetic separation (IMS)-FT-IR methods could be useful for rapid detection and differentiation of pathogens in complex foods.

FT-IR spectroscopy methods for detection, differentiation, and quantification of *E. coli* O157:H7 strains separated from ground beef were developed. Filtration and immunomagnetic separation (IMS) were used to extract live and dead *E. coli* O157:H7 cells from contaminated ground beef prior to spectral acquisition. Experiments using ground beef inoculated with fewer cells (10^1 to 10^2 CFU/g) reached the detection limit at 6 h incubation. Better PLS predictions were obtained for quantifying live *E. coli* O157:H7 strains ($R^2\geq 0.9955$, $RMSEE\leq 0.17$, $RPD\geq 14$) and

different ratios of live and dead *E. coli* O157:H7 cells ($R^2=0.9945$, RMSEE=2.75, RPD=13.43) from ground beef using Filtration-FT-IR than IMS-FT-IR methods. Discriminant analysis and canonical variate analysis (CVA) of the spectra differentiated various strains of *E. coli* O157:H7 from an apathogenic control strain. CVA also separated spectra of 100% dead cells separated from ground beef from spectra of 0.5% live cells in the presence of 99.5% dead cells of *E. coli* O157:H7.

Listeria

Inactivation of a Cold-Induced Putative RNA Helicase Gene of *Listeria monocytogenes* Is Accompanied by Failure To Grow at Low Temperatures but Does Not Affect Freeze-Thaw Tolerance

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Significance: The transposon insertion in the putative helicase gene does not affect the ability of *L. monocytogenes* to cope with cold-related stresses encountered during repeated freezing and thawing.

Freeze-thaw tolerance (cryotolerance) of *Listeria monocytogenes* is markedly influenced by temperature of growth of the bacteria, and may involve responses to low-temperature stresses encountered during freezing and thawing. A cold-sensitive *mariner*-based transposon mutant of *L. monocytogenes* F2365 was found to harbor a single insertion in LMOF2365_1746, encoding a putative RNA helicase, and also shown to be induced during 4°C growth of *L. monocytogenes*. The mutant had normal growth at 37°C but completely failed to grow at either 4 or 10°C, and had impaired growth and reduced swarming on soft agar at 25°C. However, the mutation had no discernible influence on the ability of the bacteria to tolerate repeated freezing and thawing after growth at either 25 or 37°C.

Removal of *Listeria monocytogenes* Biofilms with Bacteriophage P100

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Significance: Phage P100 is active against a wide range of *L. monocytogenes* strains in biofilm conditions.

The ability of bacteriophage P100 to reduce *Listeria monocytogenes* cell populations under biofilm conditions by using 21 *L. monocytogenes* strains representing 13 different serotypes was determined. There were considerable differences in the ability of various strains of *L. monocytogenes* to form biofilms, with strains of serotype 1/2a showing maximum biofilm formation. Irrespective of the serotype, growth conditions, or biofilm levels, the phage P100 treatment significantly reduced *L. monocytogenes* cell populations under biofilm conditions. On the stainless steel coupon surface, there was a 3.5- to 5.4-log/cm² reduction in *L. monocytogenes* cells by phage treatment.

Salmonella

Transcriptomic Responses of *Salmonella enterica* Serovars Enteritidis and Typhimurium to Chlorine-Based Oxidative Stress

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Applied and Environmental Microbiology, Vol. 76, No. 15; pp. 5013-5024, 2010

Link to full text: <http://aem.asm.org/cgi/content/full/76/15/5013>

Significance: The oxidative-stress response may render *S. enterica* resistant or susceptible to environmental stresses, which promotes the development of more effective hurdle interventions to reduce the risk of *S. enterica* contamination in the food supply.

A custom bigenome microarray that consists of 385,000 60-mer oligonucleotide probes and targets 4,793 unique gene features in the genomes of *Salmonella enteric serovars* Enteritidis strain PT4 and *Salmonella enteric serovars* Typhimurium strain LT2 was designed. The transcriptomic responses of both strains to two different chlorine treatments (130 ppm of chlorine for 30 min and 390 ppm of chlorine for 10 min) in brain heart infusion broth were explored. The researchers identified 209 *S. enterica* core genes associated with Fe-S cluster assembly, cysteine biosynthesis, stress response, ribosome formation, biofilm formation, and energy metabolism that were differentially expressed (>1.5-fold; $P < 0.05$). In addition, they found that serovars Enteritidis and Typhimurium differed in the responses of 33 stress-related genes and 19 virulence-associated genes to the chlorine stress.

Pulsed UV Light Inactivation of *Salmonella* Enteritidis on Eggshells and Its Effects on Egg Quality

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Significance: Pulsed UV light has potential to decontaminate eggshell surfaces.

The effectiveness of pulsed UV light was evaluated for the decontamination of eggshells. Eggs inoculated with *Salmonella* Enteritidis on the top surface at the equator were treated with pulsed UV light 1 to 30s, at a distance of 9.5 and 14.5cm from the UV lamp in a laboratory-scale, pulsed UV light chamber. A maximum log reduction of 5.3 CFU/cm² was obtained after a 20-s treatment at 9.5cm below the UV lamp at a total dose of 23.6±0.1 J/cm², without any visual damage to the egg. After a 30-s treatment at 9.5 and 14.5cm, the temperature of eggshell surfaces increased by 16.3 and 13.3°C, respectively. Energy usage increased up to 35.3±0.1 and 24.8±0.1 J/cm², after 30-s treatments at 9.5 and 14.5cm, respectively. The effect of pulsed UV light treatments on egg quality was also evaluated. Pulsed UV-light treatments for 3, 10, and 20s at either 9.5 or 14.5cm did not change the albumen height, eggshell strength, or cuticle presence significantly ($P < 0.05$).

Modeling the Growth of *Salmonella* in Cut Red Round Tomatoes as a Function of Temperature

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Significance: The modeling program underpredicted growth of *Salmonella* in cut red round tomatoes at low temperatures and overpredicted growth at high temperatures.

This study developed a mathematical model to describe the growth of *Salmonella* on cut tomatoes at various temperatures. Four *Salmonella* serotypes (Typhimurium, Newport, Javiana, and Braenderup) obtained from previous tomato-linked cases of salmonellosis were cultured separately, combined into a cocktail, and inoculated onto whole red round tomatoes and allowed to dry overnight. The tomatoes were then cut into pieces and incubated at 10, 12.5, 15, 17.5, 20, 22.5, 25, 27.5, 30, and 35°C. The growth rates of *Salmonella* were calculated using DMFit and used to build a mathematical model to illustrate the relationship between the growth rates of *Salmonella* on tomatoes and incubation temperatures from 10 to 35°C. The resulting model compared favorably with a *Salmonella* growth model for raw poultry. ComBase predicted consistently slower growth rates than were observed in tomatoes but showed parallel increases in growth rate with increasing temperature.

Survival of *Salmonella* on a Polypropylene Surface under Dry Conditions in Relation to Biofilm-Formation Capability

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Significance: *Salmonella* strains with high biofilm productivity may be a greater risk to human health via food contamination by surviving for longer periods compared with strains with low biofilm productivity.

This study was conducted to gain insights into the survival of *Salmonella* on a polypropylene surface in relation to the ability of these bacteria to form a biofilm. The biofilm-forming *Salmonella* strains survived longer on the plastic disc surface than did biofilm-deficient strains and they remained at over 10⁴ CFU/plate until day 175, whereas the biofilm-deficient strains decreased to below 10² CFU/plate on day 20 or below 10⁴ CFU/plate on day 108. Extracellular materials on the polypropylene surface were observed by scanning electron microscopy and crystal violet staining for the biofilm-forming strains but not for the biofilm-deficient strains. The extracellular polymeric materials on the polypropylene surface may have protected the bacterial cells from dryness, although the possibility of some inherent resistance to environmental stresses linked to biofilm formation could not be excluded.

Scientific and Technical Factors Affecting the Setting of *Salmonella* Criteria for Raw Poultry: A Global Perspective

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Significance: Risk assessment provides a more meaningful approach to salmonellosis than a zero tolerance philosophy, and new metrics should be utilized to help define risk and identify ways to reduce adverse effects on public health.

An international group of scientific experts from 16 countries convened to discuss the scientific and technical issues that affect the setting of a microbiological criterion for *Salmonella* contamination of raw chicken. A particular concern for the group was the use of criteria implying a zero tolerance for *Salmonella* and suggesting complete absence of the pathogen. The notion can be interpreted differently by various stakeholders and was considered inappropriate because there is neither an effective means of eliminating *Salmonella* from raw poultry nor any practical method for verifying its absence. Therefore, it may be more useful at present to set food safety metrics that involve reductions in hazard levels. Such terms as "zero tolerance" or "absence of a microbe" in relation to raw poultry should be avoided unless defined and explained by international agreement.

Foodborne Pathogens

Incidence and Behavior of *Salmonella* and *Escherichia coli* on Whole and Sliced Zucchini Squash (*Cucurbitapepo*) Fruit

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Significance: Squash may be an important factor contributing to the endemicity of *Salmonella* in Mexico.

The incidence of coliform bacteria (CB), thermotolerant coliforms (TC), *Escherichia coli*, and *Salmonella* was determined for zucchini squash. In addition, the behavior of four serotypes of *Salmonella* and a cocktail of three *E. coli* strains on whole and sliced zucchini squash at 25±2°C and 3-5°C was tested. CB, TC, *E. coli*, and *Salmonella* were detected in 100, 70, 62, and 10% of the squash, respectively. The concentration ranged from 3.8-7.4 log CFU/sample for CB, and >3 to 1,100 for TC and *E. coli*. After 15 days at 25±2°C, the *Salmonella* serotypes had decreased from an initial inoculum level of 7 log CFU to <1 log, and at 3-5°C they decreased to approximately 2 log. Survival of *E. coli* was significantly greater than the *Salmonella* strains at the same times and temperatures; after 15 days at 25±2°C, *E. coli* cocktail strains had decreased to 3.4 log CFU/fruit and at 3-5°C they decreased to

3.6 log CFU/fruit. Both the *Salmonella* serotypes and *E. coli* strains grew when inoculated onto sliced squash: after 24-hr at 25±2°C, both bacteria had grown to approximately 6.5 log CFU/slice.