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[1] IAFP 2006, Calgary, Alberta, Canada, Technical Symposium: Detection of *Salmonella* in Chicken Carcass Rinses Using a Chromogenic Agar Plating Medium, Julian Cox, The University of New South Wales, Sydney, Australia & Stan Bailey, ARS-USDA, Athens, GA.

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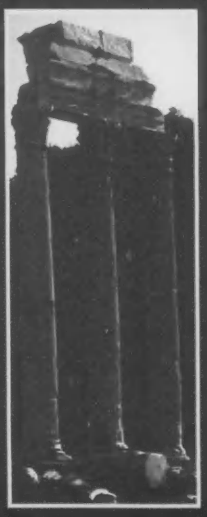

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VOLUME 27, NO. 7

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Web site: www.foodprotection.org

FPT JOURNAL STAFF

David W. Tharp, CAE: *Executive Director*
E-mail: dtharp@foodprotection.org

Lisa K. Hovey, CAE: *Managing Editor*
E-mail: lhovey@foodprotection.org

Donna A. Bahun: *Production Editor*
E-mail: dbahun@foodprotection.org

Pam J. Wanninger: *Proofreader*

INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION STAFF

David W. Tharp, CAE: *Executive Director*
E-mail: dtharp@foodprotection.org

Lisa K. Hovey, CAE: *Assistant Director*
E-mail: lhovey@foodprotection.org

Donna A. Bahun: *Design and Layout*
E-mail: dbahun@foodprotection.org

Farrah L. Benge: *Accounting Assistant*
E-mail: fbenge@foodprotection.org

Julie A. Cattanach: *Membership Services*
E-mail: jcattanach@foodprotection.org

Tamara P. Ford: *Communications Coordinator*
E-mail: tford@foodprotection.org

Donna Gronstal: *Senior Accountant*
E-mail: dgronstal@foodprotection.org

Karla K. Jordan: *Order Processing*
E-mail: kjordan@foodprotection.org

Didi Loynachan: *Administrative Assistant*
E-mail: dloynachan@foodprotection.org

Leilani K. McDonald: *Association Services*
E-mail: lmcdonald@foodprotection.org

Pam J. Wanninger: *Proofreader*

ADVERTISING

David Larson
Phone: 515.440.2810
Fax: 515.440.2809
E-mail: larson6@mchsi.com

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WTI manufactures dry and liquid ingredients for use by food manufacturers to enhance finished product performance and inhibit a broad range of bacteria, yeast and molds. All ingredients manufactured and sold by World Technology Ingredients are approved for use in USDA and FDA regulated products. All WTI ingredients are Generally Recognized As Safe (GRAS), nonallergenic and safe for direct contact.

WTI opened its new state of the art production facility in Jefferson, Georgia in December 2005 with additional capacity to do Custom Blending and Contract Packaging. The facility, carefully designed to exceed all Good Manufacturing Practices (GMP's) requirements received a SUPERIOR rating by the AIB on its very first inspection.

WTI is committed to providing safe, new and innovative solutions for its customers. Through leading edge research and technical initiatives, WTI is able to meet the needs of its customers, both large and small. Our goal is simple – to continuously identify and develop new ingredients/technology which provides our customers the tools to profitably succeed.

WTI Products Portfolio

World Technology Ingredients manufactures five different brands of product, each designed to profitably enhance selected performance attributes of a wide variety of foods. The product lines are: *IONAL, Myosol, MOstatin, TenderIn, Marinal and FlavorIn.*

IONAL Products

The *IONAL* brands of antimicrobials consist of three basic product lines: *IONAL, IONAL Plus* and *IONAL LC* – all based upon blends of buffered citrates alone or in combination with diacetate or acetate. Since it's approval as an antimicrobial for meats and poultry in 1995 extensive research has been conducted into the use of buffered citrates to inhibit the growth of pathogenic and nonpathogenic bacteria in/on raw and ready to eat meats and poultry.

IONAL is straight buffered sodium or potassium citrate. As the name implies it increases ionic strength. In muscle protein systems this equates to increased marinade/brine retention and yield during processing with less moisture migration and purge in the finished package.

IONAL Plus products are buffered citrates with diacetate or acetate. It primarily is used to increase the shelf life of perishable foods, especially raw marinated meats, fish and poultry. Typically incorporation of *IONAL Plus* into a food system will double the products shelf life.

IONAL LC products are buffered citrates with diacetate or acetate which have been specifically formulated to inhibit the growth of pathogenic bacteria such as *Listeria monocytogenes* in/on foods, especially ready to eat meats. Studies have also shown it to be an effective means of inhibiting the outgrowth of *Clostridium perfringens*.

Myosol Products

Myosol branded liquid phosphates; Myosol and *Myosol Plus* are performance enhanced functional ingredients designed to improve product/process yield and meat tenderness. *Myosol* brand phosphates are supersaturated tetrapotassium pyrophosphate solutions which are pH optimized to meet your specific needs. They are readily soluble in cold water and instantaneously reactive in meat systems.

MOstatin Products

MOstatin brand products are all natural, consumer friendly, clean label ingredients designed to enhance the retention qualities of marinades in muscle foods and inhibit the growth of pathogens and spoilage microorganisms in a wide array of food systems. MO for microorganism; statin for stasis or no growth. There are four basic product lines of *MOstatins*: *MOstatin LV, MOstatin V, MOstatin VE, and MOstatin LVE. MOstatins* have been successfully used as a CCP for *Listeria* in ham. They have also performed successfully against this pathogen of public health significance in refrigerated salads and soups.

MOstatin LV

MOstatin LV is an all natural blend of lemon juice concentrate and vinegar designed to enhance the organoleptic properties of foods while inhibiting a broad spectrum of bacteria, yeast and molds. *MOstatin LV* increases the water holding capacity of muscle protein systems. At low concentrations *MOstatin LV* does not have any flavor impact on the finished product. At higher concentrations, its slight citric taste enhances the natural flavors of meats, fish, poultry and vegetables.

MOstatin V

MOstatin V is a buffered vinegar product designed to inhibit a broad spectrum of bacteria, yeast and molds in foods. At low concentrations *MOstatin V* does not have any flavor impact on the finished product. At higher concentrations it yields a slight vinegar taste and odor.

MOstatin VE

MOstatin VE is a buffered vinegar system with native tapioca or potato starch designed to enhance/increase marinade retention in ready to eat muscle foods while inhibiting a broad spectrum of bacteria, yeast and molds. At low concentrations *MOstatin VE* does not have any flavor impact on the finished product. At higher concentrations it yields a slight vinegar taste and odor.

MOstatin LVE

MOstatin LVE is on all natural blend of lemon juice concentrate, vinegar and native tapioca or potato starch. It is designed to increase cook yield of ready to eat muscle foods while inhibiting pathogen and nonpathogenic bacteria, yeast and molds.

Marinal Products

Marinal brand marinades are customized systems designed to deliver maximum performance at an affordable cost. They are specially formulated to maximize the interactions between substrate, process and packaging in order to achieve the customers' desired performance objectives.

TenderIns

TenderIns are all natural, consumer friendly, clean label alternatives to phosphates for use in muscle foods. *TenderIns* are derived from fruit juices and vegetable bi-products. They are species specific products – each formulated to accommodate the different functional characteristics encountered by different muscle foods: a.k.a. beef, chicken, pork, turkey or fish.

TenderIn L

TenderIn L is the liquid form of *TenderIns*, each custom blended to meet the specific performance requirements of a wide range of food systems.

TenderIn DL

TenderIn DL is processed lemon juice concentrate dried onto a rice flour carrier designed to increase the cook yield of ready to eat meats and overall viscosity of food systems. The rice flour is a specialty blend formulated to deliver the optimum amylose and amylopectin concentrations. Its unique properties in cooked systems make *TenderIns* a viable alternative to phosphates.

FlavorIns

FlavorIns are all natural flavor systems derived from fruit, vegetable and vinegar based ingredients designed to enhance to organoleptic attributes of food systems throughout the shelf life of a product. They are available in both a dry and liquid form depending upon the desired functionality in the finished product.

FUTURE ANNUAL MEETINGS

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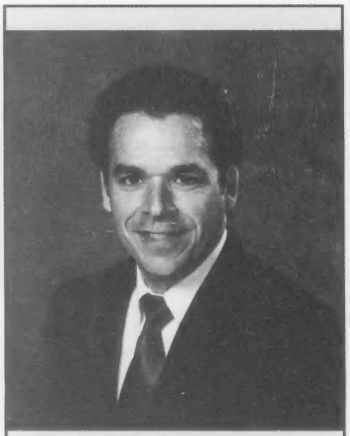

By FRANK YIANNAS
PRESIDENT

"I am humbled to have served you as IAFP's 92nd president"

The wise prophet who wrote, "To everything there is a season, and a time to every purpose under the heaven," certainly knew what he was talking about. Well, my fellow colleagues and friends, it is with this thought in mind that I inform you that my season as president of IAFP officially comes to an end.

There are no words to adequately express my gratitude for the great honor that you have bestowed upon me. I am humbled to have served you as IAFP's 92nd president and to have my name added to those who have served the association before me in this manner.

During this past year, I have observed firsthand that the greatness of IAFP is much bigger than any one person. Presidents and executive boards come and go, but the ideals that IAFP represents endure over time. It is our rich heritage and the collective efforts of all of our members and staff that truly make IAFP the wonderful association it is.

With this transition, the business of IAFP will continue. However, before we look to the future, I think it is fitting that we spend a moment reviewing a few of our association's accomplishments during the past year.

Rapid Response Symposium – in October of 2006, IAFP held its first ever Rapid Response Symposium entitled, "Fresh Leafy Greens, Are They Safe Enough?" The symposium was developed in response to the fresh bagged spinach outbreak in the US. Our goal was to bring key leaders and stakeholders together to have a science-based discussion on what happened, lessons learned, and what can be done to prevent similar occurrences in the future. By all accounts, our first Rapid Response Symposium was a great success. The meeting held in Arlington, Virginia only three short weeks after the outbreak was announced, was attended by 119 professionals representing academia, industry, and regulatory. The comments we received were overwhelmingly positive and we remain prepared to hold another Rapid Response Symposium should the need arise.

European Symposium – on November 30 and December 1, 2006, IAFP held its 2nd European Symposium, entitled "Innovations in Food Safety Management," in Barcelona, Spain. In attendance were over 140 professionals representing academia, industry, and regulatory. This represented a 100% increase in attendance as compared to our 1st European meeting held in Prague, Czech Republic in 2005. While most of the attendees came from various countries within the European Union, some came from as far away as New Zealand and Brazil. Based on our success, plans are already underway for IAFP's 3rd European Symposium to be held in Rome, Italy later this year.

Record-setting Annual Meeting – IAFP's 2007 Annual Meeting, held at *DISNEY'S CONTEMPORARY* Resort on July 8–11, turned out to be a smashing success. We had a record number of attendees, exhibitors, and sponsors gather to hear the latest scientific findings, network with leading experts from around the world, and hear first-hand about tomorrow's food safety solutions. Special thanks to Lee-Ann Jaykus, Program Committee Chairperson, and the entire Committee for organizing an outstanding lineup of symposia, roundtables, technical presentations, and poster sessions. I also would like to thank the Florida Association for Food Protection, and its Local Arrangements Committee, for hosting the 2007 Annual Meeting and for all their hard work in making IAFP 2007 a memorable experience for all attendees.

Membership Dues Restructure – in January, IAFP introduced a restructuring of our annual membership dues and membership categories to offer new and existing members more choice. We also introduced a new, less expensive base membership category that includes an electronic monthly publication called the *IAFP Report*. Our goal is simple. We are not interested in numbers or simply increasing our membership. However, we are interested in offering our members more choice, meeting our members' needs, and making IAFP as inclusive as possible to food safety professionals all over the world. Early indications are that the new dues restructure is making a difference. For the first few months, our membership renewal rates were at a record high level as well as our overall membership.

International Focus – having an international focus has always been part of our heritage. In fact, our very first members' list of 1912 included members from the USA, Canada, and Australia. This past year, in addition to already well-established international programs, such as the distribution of our journals to 69 different countries around the world and our annual meeting that truly has international attendance, we placed even greater emphasis on our international focus. The Executive Board developed and approved guiding principles for holding international meetings. Our plans are to hold international meetings on a more frequent basis, wherever and whenever they make sense, to allow for even greater regional participation. In addition to our plans for a 3rd European Symposium later this year, IAFP will be part of a fall meeting in Beijing, China and we are planning to hold a meeting in South America next year. More importantly, in everything we do, we have adopted a global mindset in hopes of maximizing our worldwide reach.

Publications – in addition to the continued strong showing of the *Journal of Food Protection*® (which now has a readership exceeding 11,000 scientists in 69 countries) and *Food Protection Trends*, with the help of Jack Guzewich and Ewen Todd, this year we released the *2007 Revision of Procedures to Investigate Foodborne Illness, Fifth Edition*, to include consideration of intentional contamination issues.

Financial Condition – and last, but not least, due to wise stewardship, the financial condition of our Association has never been stronger. Although we are still working towards achieving our long-term financial goals, we now have a positive fund balance and with the continued support from our sponsors and members, we are in a better position to more broadly fulfill our mission.

As you can see, it has been a very busy and productive year for IAFP. And although I am very pleased with what we were able to accomplish, I remain even more excited about what we have yet to do. Under the leadership of Gary Acuff as the Incoming President, a wonderful Executive Board, an outstanding Executive Director (David Tharp), a professional and dedicated office staff, and most importantly – you – our members, our future looks very bright. Never before in history have we, as a profession, been so well suited to advance food safety through innovation, leadership, research, and collaboration.

In closing, I will leave you with the wise words of Margaret Mead, who said, "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it is the only thing that ever has."

Working together my colleagues and friends, we are making a difference and…

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Until our paths cross again.
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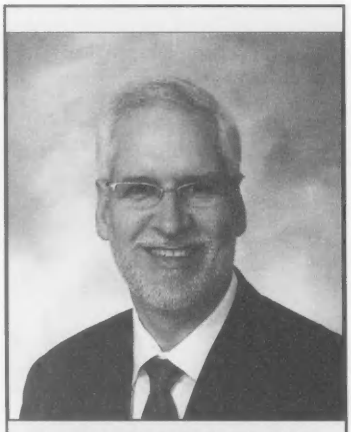
"COMMENTARY"
FROM THE EXECUTIVE DIRECTOR



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"It has been a busy time for the Board and staff of IAFP"

As you might imagine, it has been a busy time for the Board and staff of IAFP. Over the last couple of months, we completed the final stages of planning for the Association's 94th Annual Meeting held this month at *Disney's Contemporary* Resort along with establishing details for the Third European Symposium on Food Safety titled "Advancements in Food Safety." These plans take place as other "business" of IAFP continues, such as producing two monthly journals and our new Online newsletter, the *IAFP Report*.

First, let's talk about the Annual Meeting. There are so many details that need to be planned and confirmed for a meeting like IAFP 2007 that it is sometimes overwhelming. I want to first and foremost commend the IAFP staff for their attention to detail in the planning process. We meet weekly; all year-round, to plan for IAFP's showcase conference. During each of these meetings, we review the timeline of items that must be completed in order for our Annual Meeting to take place. I am proud of our staff and the enthusiasm in which they approach these tasks at hand.

As the months tick by and the meeting dates come closer, our list grows longer as to what needs to be done. For instance, for each of the meeting rooms we use during the Annual Meeting, specific hours must be provided to the hotel along with what audiovisual equipment is needed and if food or beverage will be provided. We work closely with the hotel to assure they know what our needs are for each room and event.

Communication with presenters, convenors and organizers is ongoing up to the actual start of the Annual Meeting. Scheduling begins months in advance to make our best attempt at placing sessions in the appropriate-sized rooms. With the assistance of the Program Committee, sessions are positioned, speakers are cross-checked and schedules are firmed up for the best program possible. We also need to be assured that we have student volunteers to assist with audiovisual and other issues that may arise in the session rooms. This schedule is coordinated by the Student PDG leaders each year.

When it comes to the social events, we need to be sure we have enough volunteers to assist with moving attendees from the hotel, to busses, to the event site, and back to the hotel. This year, the Florida Association for Food Protection (FAFP) provided the volunteer staff to help at registration, with social events and other essential functions to make IAFP 2007 run smoothly. The hospitality provided by FAFP members was an integral part of IAFP 2007. Thanks to all who helped out!

The exhibit portion of IAFP Annual Meetings has also become a large part of why food safety professionals attend our Annual Meeting. With the opportunity to learn of the latest products and services available to the industry, the IAFP Exhibit Hall attracts leading companies, educational institutions and governmental agencies from around the globe. We are fortunate to have a large number of supporters who are with us year after year providing their products and services for your review. This year, we even recognized five 20-year exhibitors. We truly appreciate the support and participation provided by our exhibitors.

As Frank Yiannas reported in his "Point of View" President's column, we set new records of attendance for an IAFP Annual Meeting this year. We are still counting for a final number to report, but we are assured it has reached to new heights this year! We are proud to be the leading food safety conference and are elated to have your continued support!

In all the excitement about IAFP 2007, I want to be sure you do not overlook the Third European Symposium on Food

Safety titled "Advancements in Food Safety." This stimulating symposium will be held October 18–19 in Rome, Italy at the Sheraton Roma Hotel and Conference Center. We distributed registration information in program materials at IAFP 2007. If you were unable to be with us in Florida, we will mail a conference brochure to all IAFP Members or you may review the details on our Web site.

This year's European Symposium promises to be a great gathering of food safety professionals from Europe and beyond. Presentations will be delivered by speakers from Italy, Germany, France, United Kingdom, Canada, Ireland, United States and Switzerland. This symposium is developing into a "must attend" for not only European Members and food safety professionals, but many of our IAFP Members from around the globe.

We look forward to further developing the European Symposium on Food Safety in the coming years and hope to see you in Rome this October!

I want to conclude with a "thank you" to the organizing committee who helped to form the program for our European Symposium. In addition, back to IAFP 2007, I want to thank all of our speakers, organizers, convenors, exhibitors, sponsors and volunteers. Without help from everyone, we would not be able to produce these high-quality, educational presentations and symposia.

ARTICLES

Food Protection Trends, Vol. 27, No. 7, Pages 524–529

6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864

International Association for Food Protection.

Central Nervous System Tissue Contamination of the Circulatory System Following Humane Cattle Stunning Procedures

PABLO J. ROVIRA,[1] JOHN A. SCANGA,[1]* TEMPLE GRANDIN,[1] KIM L. HOSSNER,[1] ROBERT S. YEMM,[2] KEITH E. BELK,[1] J. DARYL TATUM,[1] JOHN N. SOFOS,[1] and GARY C. SMITH[1]

[1]Dept. of Animal Sciences, Colorado State University, Fort Collins, CO 80523, USA;

[2]Warren Analytical Laboratories, Inc., 650 "O" St., Greeley, CO 80631, USA

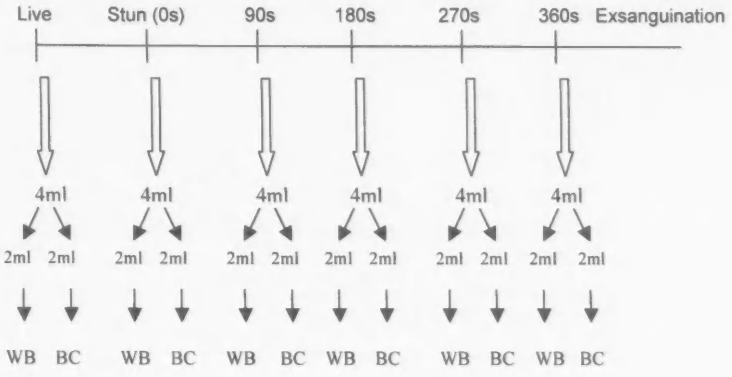
SUMMARY

Two studies were conducted to assess the risk of central nervous system (CNS) material dissemination to edible tissues via blood circulation, following stunning of cattle with non-air injecting penetrating captive bolt (PCB) devices. In one study, an electric shock was applied with a heart defibrillator (HD), after rendering cattle insensible by use of a cartridge-fired PCB gun, to stop heart activity and subsequently blood circulation. In a second study, baseline levels of CNS tissue-marker Glial Fibrillary Acidic Protein (GFAP) were established in blood from cattle following pneumatic-PCB stunning and Kosher slaughter (without stunning) in twelve and one commercial beef packing plants, respectively. Electric shock after stunning produced heart fibrillation, which reduced heart rate and therefore blood circulation between stunning and sticking. The marker GFAP was not detected in the blood of cattle before or after stunning with or without HD. GFAP was detected in the blood of 1 (.28%) and 0 carcasses out of 360 (pneumatic-PCB) and 30 (Kosher) carcasses, respectively. Post-stunning mitigation practices to reduce the likelihood of CNS tissue dissemination in blood would not be necessary, as the risk of CNS tissue being present is low when non-air injecting PCB stunning protocols are employed.

A peer-reviewed article

*Author for correspondence: 970. 491.6244; Fax: 970.491.0278
E-mail: John.Scanga@CSUmeats.com

FIGURE 1. Experimental blood sampling protocol (WB: Whole Blood; BC: Buffy Coat)



INTRODUCTION

Contamination of edible carcass portions with infectious Bovine Spongiform Encephalopathy (BSE) prions (PrP^{Sc}) is suspected to increase the risk of human infection with new variant Creutzfeldt-Jakob disease (vCJD) *(11)*. Although the removal of Specified Risk Materials (SRMs) such as brain and spinal cord, which have been shown to transmit BSE, serves as the single most important food safety risk-mitigation intervention *(12)*, there are other possible sources of infectious prions that may reach the human food supply. Brown et al. *(3)* affirmed that cerebral vascular emboli, created by use of cranial stunning instruments to immobilize cattle before killing by exsanguination, could result in PrP^{Sc} dissemination. These stunning methods may cause clots in blood vessels, that if they remain fixed, are known as thrombi; however, if the clot becomes dislodged and floats freely in the bloodstream, it is known as an embolus *(2)*.

Most cattle within the United States (US) are stunned with pneumatic non-air injection penetrating captive bolt stunning devices before exsanguination, and these devices may damage intracranial blood vessels and dislodge central nervous system (CNS) tissue *(1)*. It has been reported that air-injection penetrating captive bolt stunning results in CNS tissue entering the blood *(1)*, passing through the right side of the heart *(17)*, and lodging in the lungs *(7)*, potentially entering the arterial circulation *(4)* even though dissemination throughout the carcass has not been reported. For that reason, the USDA-Food Safety and Inspection Service (FSIS) prohibited the use of penetrating captive bolt (PCB) devices that deliberately inject air into the cranial cavity of cattle *(19)*. Nonetheless, there is international concern about the continual use of non-air injection PCB stunning of cattle based on the evidence that such devices also can result in CNS tissue dissemination in the blood *(5)*.

A reliable analytical test for CNS tissue is essential to ensure consumer confidence of beef and reduce consumer fears of BSE in meat products *(17)*. One of the ways to detect and measure presence and concentration of CNS materials following stunning is by quantifying markers for CNS tissue in the blood of animals. Schmidt et al. *(18)* developed a simple, safe, sensitive, and specific assay for the detection of CNS tissue in blood and meat products with a Fluorescent-ELISA test based upon the immunological detection of Glial Fibrillary Acidic Protein (GFAP). Glial Fibrillary Acidic Protein is an antigen that is highly, but not completely, restricted to astrocytes in the CNS *(18)*. It thus provides an excellent marker for the presence of CNS tissue in blood and meat products. The objectives of this study were: (1) to determine the necessity for BSE risk mitigation practices associated with stunning or immobilization of slaughter cattle by quantifying the concentration of GFAP in blood from living animals and from animals exsanguinated following non-air injection stunning before exsanguination or from animal slaughter using ritual practices (Kosher), and (2) to evaluate heart fibrillation as a potential post PCB-stunning intervention to prevent CNS dissemination.

MATERIALS AND METHODS

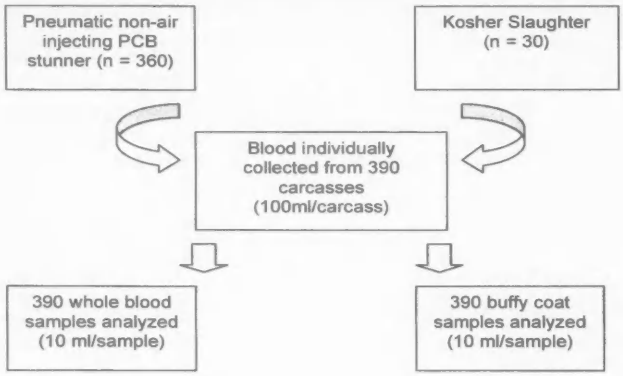
Evaluation of heart fibrillation as an intervention to prevent CNS dissemination

Intravenous catheters were inserted into the jugular veins of 10 market-ready heifers (average weight 505 kg) at the Colorado State University Agricultural Research Development and Educational Center (ARDEC, Fort Collins, CO) (ACUC Protocol Number 05-049A-01). Following a 48-hour withdrawal period for Lidocaine, two defibrillator and three electrocardiogram (ECG) pads were firmly affixed to each heifer externally on the brisket and thoracic wall (2 on the left side and 1 on the right side), respectively. Cattle were then transported and harvested at the Colorado State University Meat Laboratory. Cattle were stunned using a cartridge-fired, non-air injection, penetrating captive bolt (PCB) stunning device (Schermer Model ME) and all were rendered insensible following a single shot. Animals were considered insensible when the head was completely limp, the tongue was fully extended, and the eyes had a blank stare *(9)*. Five of the cattle were immediately shackled, hoisted, and exsanguinated (Treatment 1). The remaining five cattle were shackled and hoisted, after which an electrical shock generated by a commercial hands-free heart defibrillator (Hewlett Packard Code Master XL+) charged to 360 Joules was administered (HD) (Treatment 2). Electrocardiograms of animals were recorded pre- and post-stunning by use of three-wire electrodes. The electrodes were firmly applied such that two electrodes were on the left thoracic wall (black and red leads) and one was positioned on the right thoracic wall (white lead). Amperage (amount of electrical current that reaches the heart) and Impedance (body resistance to the flow of electrical current) were recorded by the defibrillator for each shock. Voltage, which is required to push the electrical current from the defibrillator to the animal, and duration of the shock were calculated based on the following equations:

$$\text{Voltage} = \text{Amperage (Amps)} * \text{Impedance (Ohms)}$$

$$\text{Duration of the shock (milliseconds)} = \frac{\text{Energy (Joules)}}{\text{Amperage (Amps)} * \text{Voltage (Volts)}}$$

FIGURE 2. Commercial blood sampling protocol



Six blood samples were collected from the jugular catheters of each animal (n = 60) to determine if CNS tissue was present in circulatory blood following stunning with and without heart defibrillation. The blood sampling protocol is summarized in Fig. 1. The first blood sample was collected before PCB stunning, and five samples were collected immediately following stunning, at approximately 90-second intervals, during the 6 minutes following stunning. In one instance, all samples were collected during exsanguination because the jugular cannula was damaged during handling and stunning.

At each sampling interval, 4 ml of blood were collected and divided into 2 Vacutainer™ tubes, one containing K_2EDTA anticoagulant and the other containing Sodium Heparin anticoagulant. Samples were immediately refrigerated at 2°C. Heparinized tubes were centrifuged at 800 × g for 30 minutes at 4°C to separate the sample into serum, white blood cells (buffy coat) and red blood cell fractions. Buffy coat (cellular fraction) was removed using Pasteur pipettes and transferred to 5 ml capped tubes (BD Falcon). These fractions were collected and analyzed in order to increase the sensitivity of the test, as cells of the CNS will tend to pellet together with the same density of cells in the buffy coat fraction. Both buffy coat (n = 60) and whole blood (n = 60) samples were kept refrigerated and transported the following day, in an insulated box with ice packs, to Warren Analytical Laboratories Inc. (Greeley, Colorado) for F-GFAP analysis.

A capture Fluorescent – Enzyme Linked Immunosorbent Assay for Glial Fibrillary Acidic Protein (F-ELISA GFAP) was used to detect CNS tissue contamination in whole blood and buffy coat. The protocol followed was previously described in detail by Schmidt et al. *(18)*. A standard curve was developed by use of serially diluted commercial Bovine GFAP. Standard curves were utilized to quantify the concentration of GFAP in whole blood and buffy coat samples. An aliquot of each blood sample, before (whole blood) and after (buffy coat) centrifugation, were analyzed at Warren Analytical Laboratories (Greeley, CO) to detect presence of CNS tissue. Two antibodies were used to detect the presence of GFAP (antigen). The first (polyclonal anti-GFAP) was used to coat the wells and to capture GFAP. The second (monoclonal anti-GFAP) was coupled to a peroxidase enzyme to detect GFAP. Finally, the reaction was detected by the addition of a peroxidase substrate that produced fluorescence upon reaction with the enzyme. The detection limit for this assay was 0.3 ng/well or 0.006 ng/mg for whole blood and buffy coat, as each well contained 50 microliters (ul) of sample. A result of < 0.006 ng/mg denoted a non-detectable level of GFAP in whole blood or buffy coat. Inter and intra-assay coefficients of variation were 3.9% (five different assay dates) and 3.3% (12 wells in one assay date), respectively, indicating that this test is repeatable both within and across sample tests.

Commercial survey of GFAP in circulating blood of cattle stunned in the United States

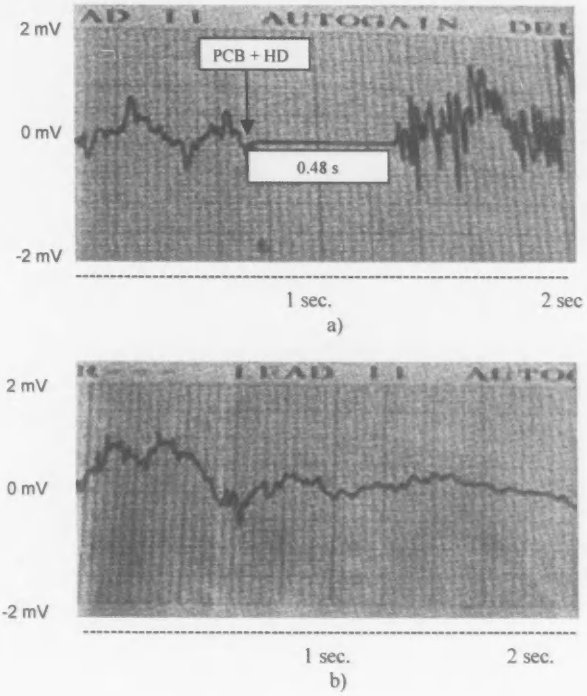
Between July and October 2005, blood samples (N = 390) from random cattle in thirteen commercial beef processing facilities were collected as soon as possible following exsanguination. Twelve of the plants utilized a pneumatic non-air injection PCB device. The remaining plant employed ritual (Kosher) slaughter techniques, immediately followed by pneumatic non-air injection PCB stunning. When possible, cattle that required more than one shot to be rendered unconscious were omitted from the study. However, in two plants, blood samples were collected in a location from which the stunning restrainer was not visible, and we were not assured that samples from these facilities were from single-shot stunned cattle. Blood was aseptically collected in large disposable cups (150 ml) and then transferred to two Vacutainer™ tubes, one containing K_2EDTA (10 ml) and the other containing Sodium Heparin (10 ml) anticoagulant. This resulted in blood samples being collected from 360 pneumatic-PCB stunned cattle and 30 Kosher slaughtered cattle (Fig. 2).

After collection, all samples were refrigerated, placed in coolers with ice packs, and shipped to Warren Analytical Laboratories, Inc. (Greeley, CO) for F-GFAP analysis. After arriving at the Laboratory, heparinized tubes were immediately centrifuged at 800 × g for 30 minutes at 4° C and the buffy coat fraction was collected for analysis. Whole blood and buffy coat samples were analyzed by use of the same F-GFAP ELISA test previously described, again with a detection limit of 0.006 ng/mg.

Statistical analysis

Independent two-sample Student's *t*-test was used for comparisons of heart rates between treatments, as samples had been collected independently of one another. For each treatment, a paired Student's *t*-test was performed to determine the significance of difference in heart rate before and after each stunning protocol, as measurements had been taken from the same animal (correlated samples). The prevalence of GFAP was analyzed statisti-

FIGURE 3. ECG from cattle (a) immediately (1–2 s) following stunning with heart defibrillation (HD), and (b) immediately (1–2 s) following stunning without HD



cally considering a binomial distribution (GFAP detected or not detected in blood circulation). The two blood fractions, whole blood and buffy coat, were analyzed independently. A 95% one-side upper exact binomial confidence limit for GFAP presence was established.

RESULTS AND DISCUSSION

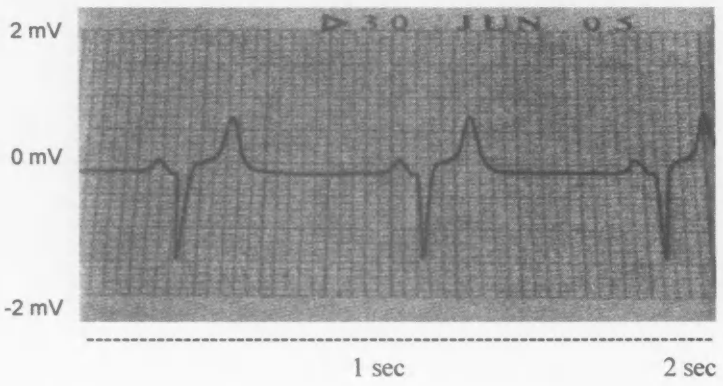
Evaluation of heart fibrillation as an intervention to prevent CNS dissemination

Results of the ELISA test showed that GFAP was not detectable (< 0.006 ng/mg) in whole blood and buffy coat samples collected before and after PCB stunning with or without HD. Absence of detectable levels of GFAP in the whole blood and buffy coat of animals before stunning confirms that GFAP is a protein highly restricted to the CNS (spinal cord and brain) and not found in the normal blood circulation of live animals. For that reason, GFAP is an appropriate protein marker for CNS tissue dissemination/presence in blood. Tests based on protein markers generally are more sensitive than gross tissue examination or microscopic analysis, because stunning may cause leakage of neural tissue across the blood-brain barrier without actual embolization of intact tissue fragments *(14)*.

Electrocardiogram recordings were successfully obtained from 9 of 10 animals before stunning. Mean heart rate of cattle before stunning was 126 (SD = 32) beats per minute (bpm), ranging between 89 and 188 bpm. Gay and Radostits *(8)* reported that the mean heart rate for adult cattle ranges between 60 and 80 bpm and that it is not uncommon for resting heart rate to be accelerated because of acute stress or unfamiliar surroundings. Electric shock delivered using the heart defibrillator charged to 360 Joules following insensibility, created by PCB stunning, delivered an average of 32 Amps (SD = 4) and 3,833 Volts (SD = 219) for 3 milliseconds (SD = 0.2). Animal resistance to the flow of current (Impedance) was 120 ohms (SD = 23). Heart defibrillation (HD) did not permanently render the heart electrically silent (Fig. 3a), yet it resulted in a short electrically silent period (0.48 s) with average heart rate following HD returning to 23 bpm (SD = 8), ranging from 16 to 35 bpm (Fig. 3b), which was lower than the heart rate before PCB stunning ($P < 0.05$). Even though the heart was still beating, cattle were completely insensible because of the PCB stunning applied before HD. Conversely, after PCB stunning without HD (Fig. 3b), animals showed a chaotic heart rhythm (as shown immediately following PCB and HD in Fig. 3a) followed by a tendency to recover and return to a normal heart rate and rhythm. Immediately following PCB stunning, the mean heart rate was 165 bpm (SD = 23); this was higher than the heart rate before PCB stunning ($P < 0.05$), although the heart rate from 2 animals was not recorded because of a very abnormal ECG output. Heart rate immediately following HD was lower than heart rate following PCB stunning without HD ($P < 0.05$). Heart rate of one animal measured three minutes after PCB stunning showed a normal heart activity with 85 bpm (Fig. 4), which reflected normal resting heart rate.

Wotton et al. *(20)* successfully induced ventricular fibrillation and cardiac arrest in adult cattle when >1.51 A sinusoidal AC at 50 Hz was applied for five seconds between the nose and brisket electrodes. According to the description of the defibrillation shock in our study (32 Amps and 3, 833 Volts for 3 milliseconds), the limiting factor that did not allow electrical stoppage of the heart with only one discharge was the short duration of the shock. Increasing the duration of the shock will decrease the animal impedance; therefore, more electrical current will reach the heart, increasing the efficiency of the electric discharge. Although heart fibrillation following PCB stunning did not result in permanent electrical silence, heart rate was reduced and heart rhythm was altered, potentially reducing the blood circulation between stunning and sticking (although blood volume flow was not measured). When there is such incoordinate twitching of the heart, the diastolic period is so short that filling of the ventricles is limited, the blood pressure falls precipitously, and the animal dies within a minute or two of onset as the result of failure of blood perfusion into tissues *(15)*. Conversely, heart rate tended to be normal after PCB stunning without heart fibrillation. Thus, if CNS contamination of the blood were to occur during PCB stunning, the interval be-

FIGURE 4. ECG from an animal 3 minutes after PCB stunning (before sticking)



tween stunning and sticking would result in potential CNS dissemination through the circulatory system if CNS tissue is not trapped in the lungs or heart. Although animal unconsciousness may last up to 10 minutes after PCB stunning *(6)*, and CNS contamination of blood occurs at very low frequencies and at extremely low levels, a best practice would be to complete exsanguination as quickly as possible to reduce any potential organ exposure.

Commercial survey of GFAP in circulating blood of cattle stunned in the United States

Of the 360 samples collected from commercial processing facilities, one sample contained detectable levels of GFAP following pneumatic-PCB stunning. Glial Fibrillary Acidic Protein was detected in both whole blood and buffy coat fractions, with a concentration of 0.010 and 0.015 ng/mg of GFAP, respectively. These values were equivalent to 5.8 and 17 ng of spinal cord tissue per mg of whole blood and buffy coat, respectively, and to 8.7 and 26 ng of brain tissue per mg of whole blood and buffy coat, respectively, considering the concentration of GFAP in CNS as reported by Schmidt et al. *(18)* on a wet weight basis as determined by use of a Fluorescent-GFAP ELISA test. These CNS tissue concentrations were very low, especially when compared to the oral infective dose (150 g of BSE-infected CNS) reported by Lasmezas et al. *(13)*. According to these results, prevalence of CNS tissue in circulating blood was 0.28% of the cattle stunned with pneumatic-PCB protocols. In addition, there was a 95% confidence level that prevalence of CNS tissue in the blood of cattle after pneumatic-PCB is less than 1.31% based on an exact binomial confidence limit. Coore et al. *(5)* reported elevated levels of GFAP in venous blood samples (collected with balloon-catheters) from 4% (95% Confidence Interval: 1.6 to 9.8%) of anesthetized cattle stunned with a cartridge-fired PCB (Cow Puncher™). Limitations of that study included use of anesthetized cattle and balloon catheters, which are inflated to assist in collection of blood, thus blocking venous blood circulation and altering the intracranial pressure. These conditions are not found under commercial stunning protocols and results of that study do not agree with the low GFAP prevalence found in commercial processing facilities in the US in our investigation.

Although all of the plants evaluated in this study used a similar PCB stunning device (Jarvis pneumatic stunner) and processed steers and heifers (variable related to thickness of the skull and bolt penetration), potential differences between plants were observed, such as operator, chain speed (from 150 to 400 animals/hour), interval between stunning and sticking, and interval between stunning and the collection of blood samples. In the plant in which the single positive GFAP result was obtained, blood samples were collected farther from the point of stunning (after electrical stimulation) than in other facilities. Consequently, it was not possible to assure that sampled animals were rendered unconscious on the first stun. However, Grandin *(10)* reported that, during a 4-year period, 97.2% (SD = 6.21) of the cattle slaughtered in the US were correctly stunned on the first attempt. Thus, further research is needed to determine if re-stunning animals, instead of single-shot stunning animals could result in CNS dissemination.

We did not detect GFAP or CNS tissue in the blood of animals following Kosher slaughter protocols (without stunning prior to sticking). In the one plant that we visited, animals were driven to a restraining device that was equipped with a head-catch, and then a shochet (rabbi performing the ritual slaughter) made an incision in the front of the neck of the live animal with a chalaf (knife employed during kosher slaughter). After the shochet had cut the neck of the animal, animals were stunned by use of a pneumatic-PCB device to ensure insensibility of the animals before dressing. Blood samples were collected after pneumatic-PCB stunning, at which time the blood already was flowing because of the previous cut. Although religious slaughter may cause congestion and some microscopic hemorrhages, brain injury is extremely unlikely and of lower risk compared to the PCB-stunning techniques *(16)*, and the circulatory system between the brain and heart are severed before cranial penetration.

CONCLUSIONS

This study indicates that the heart activity and function of cattle after PCB stunning is normal. For that reason, the interval between stunning and sticking is the period of highest risk for organ contamination, as blood circulation remains normal. Even though heart activity of the animals was not permanently stopped by applying an electric shock to the heart with a human heart defibrillator, heart activity was reduced between stunning and sticking as a result of heart fibrillation, which reduced the heart rate of the animals and therefore, presumably, blood circulation. We found a very low prevalence of GFAP in the blood of animals after pneumatic non-air inject PCB stunning in 12 commercial beef slaughter plants in the US, and we did not detect brain tissue in the blood of animals after Kosher protocol in one beef slaughter plant.

Results affirmed the safety of non-air inject PCB stunning protocols used in the United States. For that reason, post-stunning mitigation practices to reduce the likelihood of CNS tissue dissemination would not be necessary when penetrating captive bolt protocols are employed. However, further research is needed to quantify the impact of repeat PCB stunning on CNS tissue dissemination.

ACKNOWLEDGMENTS

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6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864

Consumer Storage Practices for Refrigerated Ready-to-Eat Foods: Results of a Web-enabled Survey

SHERYL C. CATES,[1*] KATHERINE M. KOSA,[1] SHAWN A. KARNS,[1] SANDRIA GODWIN,[2] and DELORES CHAMBERS[3]

[1]RTI International, 3040 Cornwallis Road, P.O. Box 12194, Research Triangle Park, NC 27709, USA;
[2]Tennessee State University, 3500 John A. Merritt Blvd., Nashville, TN 37209, USA;
[3]Kansas State University, 143E Justin Hall, Manhattan, KS 66506, USA

SUMMARY

Proper storage of refrigerated ready-to-eat (RTE) foods by consumers can reduce their risk of listeriosis and other foodborne illnesses. To characterize consumer storage practices for refrigerated RTE foods, we conducted a nationally representative Web-enabled survey of pregnant women, seniors, and the remaining population. The survey collected information on refrigerator storage time for smoked seafood, cooked crustaceans, bagged salads, precut fresh produce, soft cheeses, frankfurters, deli/luncheon meats, and deli salads. We found that improvements are most warranted in consumers' storage practices for soft cheeses, deli/luncheon meats, and deli salads. Relatively less-educated individuals were more likely to follow the recommended storage time guidelines for freshly sliced deli meats and soft cheeses compared with individuals with more education. Also, there were regional differences in storage practices for some foods. Consumers' failure to store some RTE foods safely may be caused by their unawareness of government-recommended storage time guidelines. Educators can use the survey findings to characterize consumers' storage practices for RTE foods and to target educational efforts. Additionally, risk assessors can use the survey data to evaluate the exposure potential and health risks associated with *L. monocytogenes*.

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*Author for correspondence: 919.541.6810; Fax: 919.541.6683
E-mail: scc@rti.org

INTRODUCTION

Consumption of food contaminated with *Listeria monocytogenes* can cause listeriosis, a potentially fatal disease in susceptible populations *(17)*. The US Department of Agriculture (USDA) and the Food and Drug Administration (FDA) have a zero tolerance policy for *L. monocytogenes* in ready-to-eat (RTE) foods *(18)*; however, complete elimination of *L. monocytogenes* remains a challenge *(4)*. In the United States, approximately 2,500 individuals contract listeriosis each year; of these, approximately 500 die from the illness, making *L. monocytogenes* the second most common cause of death among foodborne pathogens *(3, 9)*. Pregnant women, their fetuses, neonates, older adults, and individuals with weakened immune systems are most susceptible to contracting listeriosis *(12)*.

Refrigerated RTE foods, such as frankfurters, deli meats, deli salads, soft cheeses, and smoked salmon, have been associated with human listeriosis, and some products support the growth of *L. monocytogenes (6, 13, 14, 16)*. *L. monocytogenes* is more resistant than most foodborne pathogens to the treatments and conditions generally used to control pathogens and can grow in some foods when stored at refrigeration temperatures *(14)*. Additionally, with the exception of frankfurters, many refrigerated RTE foods are frequently consumed without reheating, so there is not a lethality treatment by the consumer. A quantitative risk assessment for foodborne *L. monocytogenes* among selected categories of RTE foods found that keeping refrigerated foods stored at 40°F (4.4°C) or lower and consuming refrigerated RTE foods as soon as possible can reduce the risk of illness from *L. monocytogenes* by more than 50% *(24)*.

USDA and FDA recommend that consumers store refrigerated foods at 40°F or lower for short, but safe, time limits to help keep foods from spoiling or becoming dangerous to eat *(22)*. The government has established recommended storage time guidelines for specific RTE foods; for example, it recommends a storage time of two weeks for unopened packages of frankfurters and one week for opened packages of frankfurters. Likewise, for smoked seafood it recommends a storage time of 14 days from date of purchase. Little research has been conducted to characterize the extent to which consumers adhere to the recommended storage time guidelines for RTE foods *(11)*. Thus, better data are needed to understand consumers' storage practices for refrigerated RTE foods.

This study was conducted to characterize consumer storage practices for a variety of refrigerated RTE foods among pregnant women and seniors, who are at relatively high risk for listeriosis, and the remaining population. We conducted a nationally representative Web-enabled survey to collect information on home refrigeration storage times for unopened and opened packages of various RTE foods. We estimated the prevalence of consumers storing RTE products within government-recommended storage time guidelines and compared the prevalence estimates for seniors and pregnant women with those for the remaining population. Additionally, we assessed the demographic characteristics of respondents who did not follow government–recommended storage time guidelines for products in which adherence to the guidelines was relatively low.

MATERIALS AND METHODS

A national survey of United States adults was conducted by use of a Web-enabled panel survey approach. RTI International's (RTI's) Committee for the Protection of Human Subjects, which serves as RTI's Institutional Review Board, reviewed and approved the study protocol. The survey data are available through the Exclusives page of the Joint Institute for Food Safety and Applied Nutrition (JIFSAN) Web site at http://www.foodrisk.org/.

Sample

We selected the sample from a Web-enabled panel developed and maintained by Knowledge Networks (Menlo Park, CA), a survey research firm. The panel, constructed by use of a list-assisted, random-digit-dial (RDD) sample selected from all 10-digit telephone numbers in the United States, is designed to be representative of the US population *(5)*. Coverage is not provided for households without telephones (approximately 2.4 percent of US households) *(21)*. Households participating on the panel are provided with free hardware (an Internet appliance that connects to a television) and free Internet access. New panel members complete an initial survey that collects information on demographic characteristics to create a member profile. At the time of sample selection, there were approximately 28,000 panel members.

Samples of the following subpopulations were surveyed:

- pregnant women between the ages of 18 and 40 years,
- seniors aged 60 years or older, and
- the remaining population (i.e., men aged 18 to 59 years, nonpregnant women aged 18 to 40 years, and women aged 41 to 59 years).

We sent an E-mail to the approximately 5,000 female panel members between the ages of 18 and 40 years to collect information on whether they were currently pregnant and took a census of the 296 females who reported they were pregnant. We randomly selected 1,059 seniors and 1,073 adults from the remaining population to participate in our survey, for a total sample of 2,428 adults.

Questionnaire

The questionnaire collected information on storage times for unopened and opened packages of smoked seafood (e.g., hot or cold smoked salmon, trout, clams, oysters); cooked crustaceans (boiled or steamed shrimp or crab legs); bagged salads (precut, prewashed lettuce, spinach, mixed greens, or salads); precut fresh fruit; precut, prewashed fresh vegetables; soft cheeses (e.g., feta, Brie, Camembert, blue cheese, queso fresco); frankfurters; vacuum-packed luncheon meats; freshly sliced deli meats; and deli salads made with a creamy or mayonnaise-based dressing (e.g., potato salad, chicken salad, or egg salad). These foods were included in the *L. monocytogenes* risk assessment *(24)*. For each product, we collected information on the last time the product was purchased for home consumption; whether the product was still in the refrigerator; whether the product had been opened; the storage time for the

TABLE 1. Analysis procedures, by type of product

Product	Analysis Procedures
Precut fresh fruit, precut fresh vegetables, frankfurters, vacuum-packed luncheon meats, bagged salads	
Unopened product	Respondents were included in the analysis if the product was stored in the refrigerator and subsequently opened before the survey (includes product still in the refrigerator at the time of the survey). Bagged salads were excluded from this analysis because a storage time guideline was not available.
Opened product	Respondents were included in the analysis if the product was stored in the refrigerator and subsequently opened and consumed and/or discarded before the survey (excludes product still in the refrigerator at the time of the survey because the full storage period could not be evaluated).
Smoked seafood, cooked crustaceans, soft cheeses, freshly sliced deli meats, deli salads	
Total storage time (combined unopened and opened)	Respondents were included in the analysis if the product was stored in the refrigerator and subsequently opened and consumed and/or discarded before the survey (excludes product still in the refrigerator at the time of the survey because the full storage period could not be evaluated).
Products that can be frozen—frankfurters, vacuum-packed luncheon meats, freshly sliced deli meats, cooked crustaceans	Refrigerated storage time was evaluated for respondents who initially stored these foods in the freezer and subsequently moved the entire package to the refrigerator. Additionally, for frankfurters and cooked crustaceans, respondents who initially stored these products in the freezer and removed a portion from the package and left the remaining product in the freezer were considered to be following the recommended storage time guidelines because the product was kept frozen until consumed. We did not ask about this practice for vacuum-packed luncheon meats and freshly sliced deli meats.

unopened product; and, for opened items, the storage time for the opened product. To collect information on storage times, we used closed-ended questions in which respondents selected the storage time from a list of responses (more than 28 days, 22 to 28 days, 15 to 21 days, 8 to 14 days, 6 to 7 days, 2 to 5 days, 1 day or less). To encourage respondents to report their actual behavior rather than their usual behavior, the questionnaire asked about respondents' storage practices for the last time the product was purchased for home consumption. For cooked crustaceans, frankfurters, and deli/luncheon meats, we also collected information on whether the product was initially stored in the freezer as well as unopened and opened storage times for frozen product subsequently moved to the refrigerator.

To minimize respondent burden, we developed two versions of the questionnaire. Version 1 collected information on smoked seafood, bagged salads, soft cheeses, frankfurters, and precut fresh fruit. Version 2 collected information on cooked crustaceans, precut fresh vegetables, deli/luncheon meats, and deli salads. Pregnant women received both versions of the questionnaire. Seniors and the remaining population were randomly assigned to receive one of the two versions of the questionnaire. Prior to survey administration, the survey instrument was evaluated by interviewing 12 individuals, using cognitive interviewing techniques *(26)*, and subsequently refined.

Survey procedures and response

We e-mailed the questionnaire to selected panel members and sent two e-mail reminders to nonrespondents to

TABLE 2. Demographic characteristics of respondents

	Pregnant Women (n = 249)		Older Adults (n = 946)		Remaining Population (n = 865)		All Respondents (n = 2,060)	
	Number of Respondents	Weighted %	Number of Respondents	Weighted %	Number of Respondents	Weighted %	Number of Respondents	Weighted %
Gender								
Male	0	0.0	420	44.4	405	50.2	825	48.3
Female	249	100.0	526	55.6	460	49.8	1,235	51.7
Age								
18–29	118	62.8	0	0.0	221	27.2	339	21.7
30–44	131	37.2	0	0.0	314	37.4	445	29.2
45–59	0	0.0	0	0.0	330	35.4	330	27.1
60–69	0	0.0	546	48.8	0	0.0	546	10.8
70+	0	0.0	400	51.2	0	0.0	400	11.3
Education								
Less than high school (HS)	15	14.7	167	22.7	103	14.9	285	16.6
HS graduate or GED	34	27.2	357	36.3	269	29.8	660	31.2
Some college	87	29.1	216	19.5	238	28.8	541	26.8
Bachelor's degree or higher	113	28.9	206	21.4	255	26.4	574	25.4
Marital status								
Married	199	68.2	627	59.7	476	50.7	1,302	52.9
Single	43	30.1	39	4.5	255	33.1	337	26.7
Divorced	6	1.6	121	12.6	98	12.6	225	12.4
Widowed	0	0.0	147	20.9	17	1.4	164	5.7
Separated	1	0.2	12	2.3	19	2.3	32	2.3
Household size								
One	22	10.6	227	27.8	151	18.6	400	20.6
Two	88	29.8	598	58.9	270	28.7	956	35.4

TABLE 2. Demographic characteristics of respondents *(continued)*

	Pregnant Women (n = 249)		Older Adults (n = 946)		Remaining Population (n = 865)		All Respondents (n = 2,060)	
	Number of Respondents	Weighted %	Number of Respondents	Weighted %	Number of Respondents	Weighted %	Number of Respondents	Weighted %
Three or four	104	46.0	108	11.3	346	40.1	558	33.8
Five or more	35	13.7	13	2.0	98	12.6	146	10.3
Race/ethnicity								
White, non-Hispanic	199	61.6	818	80.5	608	66.8	1,625	69.7
Black, non-Hispanic	13	7.6	63	8.7	78	11.6	154	11.0
Other, non-Hispanic	8	3.6	14	2.0	35	3.2	57	3.0
Hispanic	24	23.6	29	6.4	110	14.6	163	12.9
Multiracial, non-Hispanic	5	3.5	22	2.4	34	3.8	61	3.5
Household income								
Less than $15,000	27	21.0	135	16.7	145	20.0	307	19.3
$15,000 to $34,999	46	21.2	298	32.1	179	22.5	523	24.7
$35,000 to $74,999	110	43.0	379	38.3	355	39.3	844	39.1
$75,000+	66	14.6	134	12.9	186	18.2	386	17.0
MSA status								
Nonmetro	28	11.2	193	21.1	151	16.5	372	17.4
Metro	221	88.8	753	78.9	714	83.5	1,688	82.6
Region								
Northeast	33	13.8	189	20.1	170	18.4	392	18.7
Midwest	78	20.5	222	22.6	193	22.3	493	22.3
South	81	42.6	336	36.4	309	35.9	726	36.1
West	57	23.1	199	20.9	193	23.4	449	22.8
At-risk individual in household								
60 years or older	3	2.2	946	100.0	73	8.6	1,022	28.8
Pregnant	249	100.0	2	0.2	9	1.4	260	2.4
Diagnosed with diabetes or kidney disease	16	6.1	195	21.6	94	11.9	305	14.0
Diagnosed with condition that weakens immune system	4	1.4	54	5.0	22	2.6	80	3.1

TABLE 3. Number and weighted percentage of respondents who purchased each product

	Pregnant Women (n = 249)		Older Adults (n = 946)		Remaining Population (n = 865)		All Respondents (n = 2,060)	
	Number of Respondents	Weighted %	Number of Respondents	Weighted %	Number of Respondents	Weighted %	Number of Respondents	Weighted %
Frankfurters	213	89.0	405	86.2	368	86.3	986	86.3
Bagged salads	234	93.0	379	79.4	362	84.1	975	83.4
Precut fresh vegetables	175	60.4	354	73.6	346	78.8	875	77.2
Vacuum-packed luncheon meats[a]	105	51.4	206	48.9	218	48.3	529	48.4
Precut fresh fruit	142	57.9	187	39.3	201	47.6	530	46.0
Deli salads	106	39.8	243	47.9	205	45.4	554	45.8
Cooked crustaceans	81	33.9	189	37.2	180	44.2	450	42.4
Freshly sliced deli meats[a]	115	38.5	218	39.4	174	42.1	507	41.4
Soft cheeses	101	34.0	138	26.7	141	32.5	380	31.2
Smoked seafood	65	23.3	114	23.1	110	25.4	289	24.9

[a]Respondents indicated whether they purchased deli/luncheon meats and then specified the type purchased the last time (vacuum-packed or freshly sliced).

encourage participation. Because of the small sample size, we offered pregnant women a $10 honorarium for completing the survey. We received 249 completed surveys from pregnant women (84% completion rate), 946 surveys from seniors (89% completion rate), and 865 surveys from the remaining population (81% completion rate).

Weighting procedures

Respondents from the three subpopulations were combined and the data were weighted to reflect the selection probabilities of sampled units and to compensate for differential nonresponse and undercoverage *(8)*. The weights were based on the inverses of their overall selection probabilities, with adjustments for undersampling of telephone numbers for which an address was not available during panel recruiting; households with multiple telephone lines; oversampling of certain geographic areas, African American and Hispanic households, and households with computer and Internet access; and households not covered by MSN TV. Using a raking or iterative proportional fitting technique, data on age, gender, race/ethnicity, geographic region, education, Internet access, and metropolitan statistical area (MSA) status were used in a poststratification weighting adjustment to make the sample reflect population benchmarks, controlling for the demographics within the three subpopulations as well as the proportion of the three subpopulations. The benchmarks of pregnant/nonpregnant women and the proportion of pregnant/nonpregnant women among those aged 18 to 40 years came from the e-mail screener. The benchmarks and proportions of the other subpopulations came from the December 2002 Current Population Survey *(21)*. The final weights were trimmed and scaled to sum to the total United States population aged 18 years and older.

Analysis procedures

For precut fresh fruit, precut fresh vegetables, frankfurters, and vacuum-

TABLE 4. Weighted percentage of respondents who stored an unopened product, by storage time

Food/Subpopulation	Number of Days					Total
	≤ 5	6–7	8–14	15–21	22+	
Frankfurters						
Pregnant women	77.0	12.4	6.6	1.7	2.4	100.0
Seniors	83.2	9.6	5.2	1.3	0.8	100.0
Remaining population	85.8	8.6	4.5	0.7	0.3	100.0
All respondents	85.0	8.9	4.7	0.9	0.5	100.0
Precut fresh fruit						
Pregnant women	86.9	10.4	2.1	0.6	0.0	100.0
Seniors	92.6	5.6	0.7	0.8	0.2	100.0
Remaining population	92.3	5.7	1.5	0.0	0.6	100.0
All respondents	92.2	5.8	1.3	0.2	0.5	100.0
Precut fresh vegetables						
Pregnant women	71.5	13.6	6.7	6.7	1.5	100.0
Seniors	87.3	6.7	2.9	1.6	1.4	100.0
Remaining population	82.7	8.0	5.2	2.0	2.1	100.0
All respondents	83.4	7.8	4.8	2.0	2.0	100.0
Vacuum-packed luncheon meats						
Pregnant women	74.9	15.9	4.2	4.9	0.0	100.0
Seniors	86.5	10.7	1.9	0.9	0.0	100.0
Remaining population	74.6	14.0	6.6	0.0	4.8	100.0
All respondents	77.2	13.3	5.5	0.3	3.6	100.0

packed luncheon meats, we estimated the weighted percentage of respondents who stored unopened and opened product by time period (e.g., ≤ 5 days, 6 to 7 days). We then compared respondents' reported storage times for unopened and opened packages with government-recommended storage times *(22, 25)* to estimate the percentage of respondents who stored the product within the storage time guidelines. For bagged salads, we analyzed opened packages only because a storage time guideline was not available for unopened packages *(23)*.

Separate guidelines were not available for unopened and opened packages for smoked seafood, cooked crustaceans, soft cheeses, freshly sliced deli meats, and deli salads, so for these products we computed the total storage time (combined unopened and opened) for each respondent and estimated the weighted percentage of respondents who stored the product by time period (e.g., ≤ 5 days, 6 to 7 days). We used the midpoint of the unopened storage time and opened storage time to compute the total storage time. We then compared respondents' reported storage times with government-recommended storage times *(22, 23, 25)* to estimate the percentage of respondents who stored the product within the storage time guidelines. Table 1 provides additional information on our analysis procedures.

We performed a chi-square test for the relationship between adherence to government-recommended storage time guidelines and subpopulation (pregnant women versus remaining population and seniors versus remaining population). Additionally, for products in which adherence to the guidelines was relatively low, we compared the characteristics of respondents who stored the product within government-recommended storage time guidelines with those who did not. We included the following sociodemographic variables in the analysis: gender, age, education, marital status, household size, race/ethnicity, household income, MSA status, and whether a household member is at risk for foodborne illness (aged 60 years or older, pregnant, diagnosed with diabetes or kidney disease, or diagnosed with a condition that weakens the immune system). We conducted all analyses with the Stata release 8.2 software package *(20)*.

RESULTS

Table 2 provides the demographic characteristics of respondents by subpopulation. Of the 2,060 respondents, 52% were women. The majority of respondents were married (53%), were white, non-Hispanic (70%), and lived in a metropolitan area (83%). About 39% of all respondents reported that at least one individual in the household was at risk for foodborne illness. Table 3 shows the number of respondents by subpopulation that reported purchasing each food product. At least 77% of all respondents purchased

TABLE 5. Weighted percentage of respondents who stored an opened product, by storage time

Food/Subpopulation	Number of Days					Total
	≤ 5	6–7	8–14	15–21	22+	
Frankfurters						
Pregnant women	69.8	7.8	9.4	5.6	7.4	100.0
Seniors	74.2	10.9	5.9	5.2	3.7	100.0
Remaining population	76.3	11.2	4.6	4.8	3.0	100.0
All respondents	75.6	11.1	5.1	4.9	3.3	100.0
Precut fresh fruit						
Pregnant women	92.8	5.3	1.8	0.0	0.0	100.0
Seniors	92.9	5.6	0.5	0.9	0.0	100.0
Remaining population	90.3	3.9	2.7	3.1	0.0	100.0
All respondents	90.9	4.3	2.2	2.6	0.0	100.0
Precut fresh vegetables						
Pregnant women	71.5	7.8	13.5	2.0	5.2	100.0
Seniors	72.9	12.4	10.5	3.2	0.9	100.0
Remaining population	69.5	18.3	6.0	3.5	2.8	100.0
All respondents	70.2	17.0	7.0	3.4	2.4	100.0
Vacuum-packed luncheon meats						
Pregnant women	59.9	14.1	8.2	10.9	6.9	100.0
Seniors	62.2	22.2	9.9	5.0	0.7	100.0
Remaining population	54.8	21.5	15.9	4.2	3.6	100.0
All respondents	56.6	21.5	14.4	4.5	3.0	100.0
Bagged salads						
Pregnant women	77.5	10.5	3.4	8.6	0.0	100.0
Seniors	91.1	5.2	3.7	0.0	0.0	100.0
Remaining population	86.7	7.9	5.4	0.0	0.0	100.0
All respondents	87.4	7.4	4.9	0.3	0.0	100.0

bagged salads, precut fresh vegetables, and frankfurters; at least 41% purchased cooked crustaceans, precut fresh fruit, vacuum-packed luncheon meats, freshly sliced deli meats, and deli salads; and less than one-third purchased smoked seafood and soft cheeses.

Tables 4 and 5 present the weighted percentage of respondents who stored unopened and opened packages of frankfurters, precut fresh fruit, precut fresh vegetables, vacuum-packed luncheon meats, and bagged salads (opened packages only), by storage time. Table 6 presents the weighted percentage of respondents who stored smoked seafood, cooked crustaceans, deli salads, freshly sliced deli meats, and soft cheeses, by storage time (combined unopened and opened time). Most respondents stored these products for ≤ 7 days. Few respondents stored these products, with the exception of soft cheeses, for longer than two weeks.

Tables 7 and 8 present the weighted percentage of respondents who stored unopened and opened packages of frankfurters, precut fresh fruit, precut fresh vegetables, vacuum-packed luncheon meats, and bagged salads (opened packages only) within government-recommended storage time guidelines by subpopulation. Most respondents reported storing unopened packages of frankfurters, precut fresh fruit, precut fresh vegetables, and vacuum-packed luncheon meats within the storage time guidelines (see Table 7). However, fewer respondents reported storing opened packages of these products within the storage time guidelines (see Table 8). Approximately 70 to 90% of all respondents stored opened packages of precut fresh fruit, bagged salads, frankfurters, and precut fresh vegetables within the storage time guidelines. Fewer respondents followed the storage time guidelines for opened packages of vacuum-packed luncheon meats; 62% of seniors and 60% of pregnant women stored opened packages of vacuum-packed luncheon meats for the recommended time (≤ 5 days).

TABLE 6. Weighted percentage of respondents who stored the product, by storage time for combined unopened and opened time

Food/Subpopulation	Number of Days					
	≤ 5	6–7	8–14	15–21	22+	Total
Smoked seafood						
Pregnant women	52.3	14.2	8.2	14.9	10.4	100.0
Seniors	58.2	19.9	8.2	7.6	6.2	100.0
Remaining population	68.0	14.5	12.1	2.3	3.2	100.0
All respondents	65.4	15.6	11.1	3.8	4.0	100.0
Cooked crustaceans						
Pregnant women	71.7	2.3	14.4	4.8	6.9	100.0
Seniors	85.0	1.4	4.8	1.5	7.3	100.0
Remaining population	78.2	6.4	8.9	3.1	3.4	100.0
All respondents	79.3	5.4	8.2	2.8	4.2	100.0
Deli salads						
Pregnant women	63.4	21.1	10.3	4.0	1.3	100.0
Seniors	70.8	15.2	11.5	1.3	1.2	100.0
Remaining population	61.4	20.0	14.0	1.6	3.0	100.0
All respondents	63.8	18.8	13.3	1.6	2.5	100.0
Freshly sliced deli meats						
Pregnant women	41.2	22.7	23.5	0.8	11.9	100.0
Seniors	57.6	27.9	9.0	5.1	0.4	100.0
Remaining population	48.4	19.3	23.2	6.8	2.4	100.0
All respondents	50.1	21.2	20.2	6.3	2.2	100.0
Soft cheeses						
Pregnant women	14.2	7.2	37.6	11.8	29.2	100.0
Seniors	18.8	12.4	25.3	27.1	16.4	100.0
Remaining population	28.5	23.1	19.5	17.4	11.4	100.0
All respondents	26.7	21.1	20.9	18.7	12.6	100.0

We compared the storage practices for pregnant women and seniors with the remaining population. The prevalence of storing unopened packages of frankfurters for the recommended time (≤ 14 days) was lower among pregnant women than in the remaining population ($P = 0.0384$). The prevalence of storing unopened packages of vacuum-packed luncheon meats for the recommended time (≤ 14 days) was higher among seniors than in the remaining population ($P = 0.0092$).

Table 9 presents the weighted percentage of respondents, by subpopulation, who stored smoked seafood, cooked crustaceans, deli salads, freshly sliced deli meats, and soft cheeses within government recommended storage time guidelines. Many respondents (approximately 70% to 90%) stored smoked seafood and cooked crustaceans within the storage time guidelines. Fewer respondents followed the storage time guidelines for deli salads, freshly sliced deli meats, and soft cheeses. About 70% of seniors and 63% of pregnant women stored deli salads for the recommended time (≤ 5 days), and 58% of seniors and 41% of pregnant women

TABLE 7. Weighted percentage of respondents who stored an unopened product within storage time guidelines

Food	Storage Time (≤ x days)[a]	Pregnant Women	Seniors	Remaining Population	All Respondents
Frankfurters	14	96.0	97.9	98.9	98.6
Precut fresh fruit	7	97.3	98.2	98.0	98.0
Precut fresh vegetables	14	91.8	97.0	95.9	96.0
Vacuum-packed luncheon meats	14	95.1	99.1	95.2	96.0

[a]The storage times are based on recommendations from FDA and USDA *(22, 23, 25)*.

TABLE 8. Weighted percentage of respondents who stored an opened product within storage time guidelines

Food	Storage Time (≤ x days)[a]	Pregnant Women	Seniors	Remaining Population	All Respondents
Precut fresh fruit	5	92.8	92.9	90.3	90.9
Bagged salads	5	77.5	91.1	86.7	87.4
Frankfurters	7	77.6	85.1	87.6	86.7
Precut fresh vegetables	5	71.5	72.9	69.5	70.2
Vacuum-packed luncheon meats	5	59.9	62.2	54.8	56.6

[a]The storage times are based on recommendations from FDA and USDA *(22, 23, 25)*.

TABLE 9. Weighted percentage of respondents who stored a product within storage time guidelines (combined unopened and opened storage times)

Food	Storage Time (≤ x days)[a]	Pregnant Women	Seniors	Remaining Population	All Respondents
Smoked seafood	14	74.7	86.2	94.6	92.2
Cooked crustaceans	4	56.4	75.2	71.2	71.6
Deli salads	5	63.4	70.8	61.4	63.8
Freshly sliced deli meats	5	41.2	57.6	48.4	50.1
Soft cheeses	7	21.4	31.3	51.7	47.8

[a]The storage times are based on recommendations from FDA and USDA *(22, 23, 25)*.

stored freshly sliced deli meats for the recommended time (≤ 5 days). Less than one-third of seniors and pregnant women stored soft cheeses for the recommended time (≤ 7 days).

We compared the storage practices for pregnant women and seniors with those for the remaining population. The prevalence of storing smoked seafood for the recommended time (≤ 14 days) was lower among pregnant women ($P = 0.0065$) than in the remaining population. The prevalence of storing soft cheeses for the recommended time (≤ 7 days) was lower among pregnant women ($P = 0.0006$) and seniors ($P = 0.0324$) than in the remaining population.

Table 10 compares the characteristics of respondents who stored opened packages of vacuum-packed deli meats, freshly sliced deli meats, deli salads, and soft cheeses within government-recommended storage time guidelines with the characteristics of those who did not. Individuals who have attended college were more likely than those with a high school education to store freshly sliced deli meats ($P = 0.0287$) and soft cheeses ($P = 0.0127$) outside the recommended guidelines. White, non-Hispanics were more likely than individuals of other races/ethnicities to store soft cheeses outside the recommended guidelines ($P = 0.0216$). Individuals living in the Midwest and West regions were more likely to store freshly sliced deli meats outside the recommended guidelines ($P = 0.0480$). Although not significant at the $P = 0.05$ level, the findings suggest that there may be similar regional differences in storage practices for deli salads and soft cheeses. Notably, respondents with an at-risk individual in the household were more likely to store freshly sliced deli meats within the recommended guidelines. Although not significant at the $P = 0.05$ level, the same finding was observed for vacuum-packed luncheon meats ($P = 0.0635$).

DISCUSSION

USDA and FDA advise consumers to store refrigerated RTE foods at 40°F or lower and to consume refrigerated RTE foods within recommended storage time guidelines to help prevent listeriosis. More than 95% of respondents safely stored unopened packages of frankfurters, precut fresh fruit, precut fresh vegetables, and vacuum-packed luncheon meats. However, fewer respondents safely stored opened packages of the RTE foods included in the analysis. Some consumers may neglect storing some refrigerated RTE foods safely because of unawareness of government-recommended storage time guidelines. We found that improvements are most warranted in consumers' storage practices for opened, vacuum-packed luncheon meats, freshly sliced deli meats, deli salads, and soft cheeses. Of particular concern is the finding that approximately 80% of pregnant women and 70% of seniors stored soft cheeses for longer than recommended times. USDA and FDA advise pregnant women and seniors to avoid consuming soft cheeses made from unpasteurized milk. Thus, because soft cheeses may not be pasteurized, it is important for at-risk consumers to read product labels carefully when purchasing soft cheeses, especially those that are imported or sold at farmers' markets. Furthermore, for several RTE foods we found that the prevalence of following the recommended storage time guidelines was lower among pregnant women than in the remaining population. Thus, pregnant women need more information on recommended storage times for RTE foods to help prevent possible miscarriages and stillbirths caused by listeriosis.

We found that relatively less-educated individuals were more likely than individuals with more education to follow the recommended storage time guidelines for freshly sliced deli meats and soft cheeses. This is consistent with the findings of other researchers that the prevalence of risky food handling and food consumption practices generally increase with education *(1, 10)*. We also observed regional differences in storage practices for some RTE foods. Additional research is needed to understand why storage practices vary based on these demographic characteristics.

For several RTE foods, we found that individuals with an at-risk individual in the household were more likely to store freshly sliced deli meats within the recommended time. It is not known whether this difference is attributable to increased education about food safety or to other factors.

Few data are available on home refrigeration storage times for RTE foods; thus, most risk assessments have relied on expert opinion for data on home refrigeration storage times for RTE foods. Several of the authors for this study had conducted a separate survey on storage, handling, and preparation practices for deli/luncheon meats and frankfurters, also by use of a Web-enabled panel survey *(2)*. With the exception of storage time for freshly sliced deli meats, the earlier survey yielded very similar findings to the current survey. In the current survey, 50% of all respondents stored freshly sliced deli meats within the recommended guidelines; however, more respondents (66%) stored freshly sliced deli meats within the recommended guidelines in the previous survey. We do not know whether this difference is due to sampling error or some other factor.

The strengths of the present study include the large sample size, nationally representative survey design, and results for specific at-risk populations. Limitations of the study include the small number of respondents for foods that are not frequently consumed, such as smoked seafood, soft cheeses, and cooked crustaceans. Also, our study used self-reported behaviors that may not reflect actual practices *(11)*. When completing surveys, people tend to report their usual behavior rather than their exact behavior *(7)*. For example, when reporting dietary intake, people generally report what they think they usually eat, rather than recalling what they actually ate *(19)*. To help minimize self-reporting bias, we asked respondents to consider what they actually did the last time they purchased the product; thus, we were more likely to elicit respondents' actual behavior instead of their knowledge of recommended storage times or their usual practice.

This study identified the need to educate consumers about government-recommended storage times for refrigerated RTE foods. Educators can use the survey findings to characterize consumers' storage practices for refrigerated RTE foods and to target educational efforts on foodborne illness prevention. Because both storage time and temperature control are important, education programs should also include information on the recommended refrigerator temperature (40°F

TABLE 10. Comparison of respondents who stored an opened product within versus outside recommended storage time guidelines

	Vacuum-Packed Luncheon Meats[a]			Freshly Sliced Deli Meats[b]			Deli Salads[c]			Soft Cheeses[d]		
	% Within	% Outside	P[e]	% Within	% Outside	P	% Within	% Outside	P	% Within	% Outside	P
All Respondents	56.6	43.4		50.1	49.9		63.8	36.2		47.8	52.2	
Gender												
Male	58.4	41.6		43.3	56.7		57.8	42.2		60.1	39.9	
Female	54.8	45.2	0.6979	58.4	41.6	0.1061	69.9	30.1	0.0870	40.5	59.5	0.0803
Age												
18–29	50.6	49.4		34.5	65.5		67.2	32.8		42.9	57.1	
30–44	53.3	46.7		54.3	45.7		62.5	37.5		50.8	49.2	
45–59	61.1	38.9		53.3	46.7		57.0	43.0		56.3	43.7	
60–69	57.5	42.5		54.9	45.1		59.3	40.7		34.2	65.8	
70+	66.3	33.7	0.7795	59.7	40.3	0.3324	83.7	16.3	0.1838	27.7	72.3	0.4608
Education												
HS graduate or less	61.3	38.7		61.9	38.1		64.3	35.7		65.7	34.3	
Some college or college degree	50.7	49.3	0.2538	41.7	58.3	0.0287	63.3	36.7	0.8987	39.2	60.8	0.0127
Marital status												
Married	58.4	41.6		51.5	45.8		69.1	30.9		50.5	49.5	
Not married	54.6	45.4	0.6905	48.5	51.5	0.7523	57.6	42.4	0.1088	44.9	55.1	0.6111
Household size												
One	58.3	41.7		48.9	51.1		58.8	41.2		61.3	38.7	
Two or more	56.1	43.9	0.8433	50.5	49.5	0.8795	64.9	35.1	0.4828	44.6	55.4	0.1964
Race/ethnicity												
White, non-Hispanic	57.0	43.0		47.2	52.8		67.3	32.7		38.8	61.2	
Other race/ethnicity	55.7	44.3	0.8960	59.4	40.6	0.3071	55.8	44.2	0.1572	66.0	34.0	0.0216
Household income												
Less than $32,500	63.4	36.6		50.9	49.1		59.3	40.7		53.2	46.8	
$32,500+	50.0	50.0	0.1592	49.4	50.6	0.8797	65.8	34.2	0.3841	43.9	56.1	0.4314

TABLE 10. Comparison of respondents who stored an opened product within versus outside recommended storage time guidelines *(continued)*

	Vacuum-Packed Luncheon Meats[a]			Freshly Sliced Deli Meats[b]			Deli Salads[c]			Soft Cheeses[d]		
	% Within	% Outside	P[e]	% Within	% Outside	P	% Within	% Outside	P	% Within	% Outside	P
MSA status												
Nonmetro	68.1	31.9		59.0	41.0		75.7	24.3		37.2	62.8	
Metro	53.8	46.2	0.2521	48.6	51.4	0.3921	61.2	38.8	0.0875	49.5	50.5	0.4835
Region												
Northeast	83.3	16.7		61.6	38.4		79.6	20.4		66.2	33.8	
Midwest	56.0	44.0		40.0	60.0		54.4	45.6		37.8	62.2	
South	54.2	45.8		57.1	42.9		67.0	33.0		53.6	46.4	
West	50.6	49.4	0.1951	29.5	70.5	0.0480	57.7	42.3	0.0913	28.3	71.7	0.0766
At-risk individual in household												
Yes	66.2	33.8		60.9	39.1		65.0	35.0		36.3	63.7	
No	49.6	50.4	0.0635	41.8	58.2	0.0343	62.8	37.2	0.7565	54.4	45.6	0.1187

[a]USDA recommends storing opened packages of vacuum-packed luncheon meats for ≤ 5 days.

[b]USDA recommends storing freshly sliced deli meats for ≤ 5 days (combined unopened and opened storage time).

[c]USDA recommends storing deli salads for ≤ days (combined unopened and opened storage time).

[d]FDA recommends storing soft cheeses for ≤ 7 days (combined unopened and opened storage time).

[e]P of χ^2 text.

or lower) and the importance of using a refrigerator thermometer to monitor refrigerator temperature. Risk assessors can use the survey data on storage times to evaluate the exposure potential and health risks associated with *L. monocytogenes*.

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6200 Aurora Ave., Suite 200W, Des Moines, IA 50322-2864

Critical Control Points for Home Prepared 'Chicken and Salad' in Puerto Rican Households

JIGNA MORARJI DHAROD,[1*] RAFAEL PÉREZ-ESCAMILLA,[2] STEFANIA PACIELLO,[3] KUMAR VENKITANARAYANAN,[4] ANGELA BERMÚDEZ-MILLÁN,[5] and GRACE DAMIO[6]

[1]IPSI, Muskie School of Public Service, University of Southern Maine, Augusta, ME 04330, USA; [2]Connecticut NIH Export Center of Excellence for Eliminating Health Disparities among Latinos, and Dept. of Nutritional Sciences, University of Connecticut, 3624 Horsebarn Hill Road, Storrs, CT 06269-4017, USA; [3]Celebration Foods Inc./ Carvel Ice Cream, 175 Capital Blvd., Rocky Hill, CT 06067-3914, USA; [4]University of Connecticut, Dept. of Animal Science, 3636 Horsebarn Hill Road, Storrs, CT 06269, USA; [5]University of Connecticut, Dept. of Nutritional Sciences, 3624 Horsebarn Hill Road, Storrs, CT 06269-4017, USA; and [6]Center for Community Nutrition, and Center for Women and Children's Health, Hispanic Health Council, Inc., 175 Main St., Hartford, CT 06106, USA

ABSTRACT

Hazard Analysis and Critical Control Point (HACCP) has been effective in identifying and controlling foodborne hazards at different stages of the consumer food chain. In this study the HACCP model was applied at the household level to identify sanitation and food handling 'Critical Control Points' (CCPs) in the preparation of a 'Chicken and Salad' (CS) meal. A total of 60 Puerto Rican women were provided spices in addition to the main ingredients such as chicken breasts (CB) and lettuce and tomatoes (LT) to prepare CS in their home kitchens. Food and kitchen surface samples were collected at various stages of food preparation for total and coliform counts and to test for the presence of *Listeria, Campylobacter, Salmonella* genus and *S. aureus*. In addition, various food-handling behaviors such as thawing methods, hygiene practices, and use of cutting boards were observed and recorded to: (a) compare with the microbial testing results, and (b) identify CCPs in the CS meal preparation. Based on the microbiological and observation results, the following stages of meal preparation were identified as CCPs: (1) CB Thawing; (2) Cutting CB; (3) Hand washing after handling CB and before handling LT, and (4) Washing LT. Of the pathogens tested, *S. aureus* was present most commonly in all the food and surface samples. Five percent of LT samples or prepared salad were found positive for *Listeria* genus.

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*Author for correspondence: 860.486.5073; Fax: 860.486.3674
E-mail: rafael.perez-escamilla@uconn.edu

INTRODUCTION

Surveillance statistics suggest that the occurrence of foodborne illness of household origin is higher than reported. Sporadic cases or small outbreaks, typical characteristics of home foodborne illness, are often not identified by public health authorities *(12)*. It has been estimated that 20% of reported outbreaks in the United States between 1993 and 1997 were of household origin *(17)*. Consumer surveys have been useful for estimating household food safety practices and for understanding the risk factors and possible causes of foodborne illnesses. Unfortunately, there is a lack of information on kitchen microbiology and of directly observed food-handling practices at home.

Hazard Analysis and Critical Control Point (HACCP) is a systematic preventive approach to the identification, assessment and control of the physical, chemical or biological hazards associated with any particular food production process or practice *(13)*. The application of HACCP at the household level has been recommended by the World Health Organization (WHO), especially in developing countries, where water and foodborne pathogens are the major cause of childhood diarrhea *(16)*. Various studies, particularly in developing countries, have applied HACCP principles in the home environment, on the basis of microbial testing of surfaces, water and food ingredients *(4, 5, 9, 15, 22)*.

In the United States, application of HACCP at the household level has involved consumer interviews or analysis of recipe steps to identify critical control points in the preparation of common meal dishes *(3, 24)*. However, there is a dearth of information concerning the microbiology of the kitchen and food-handling practices in the actual home environment. A kitchen simulation study conducted by Gorman et al. in Ireland documented a 16% cross-contamination rate among different kitchen items and food preparation areas, as well as dish cloth, hands, refrigerator/oven handle and counter *(10)*. Similar results were seen in a study conducted by Redmond et al. in the United Kingdom, where the same *Campylobacter* strains were found in or on raw chicken, kitchen surfaces, wash cloth and final dish, yielding a cross-contamination rate of 29% *(20)*.

In the United States, the Latino population is growing at a fast rate, among this population, Puerto Ricans experience the highest level of poverty and poor health *(1)*. According to the 2000 US Census Bureau, Hartford is the second poorest medium-size city and Latinos account for 40% of the population, with Puerto Ricans representing the great majority of this ethnic group. Our previous studies have documented risky food safety behaviors in this community. A home observation study conducted with Puerto Rican women (n = 10) preparing a family meal showed that only one (10%) participant washed her hands with soap and water, 80% rinsed their hands with only water, and one participant did not wash or rinse her hands before cooking. Four participants left the uncooked meat sitting at room temperature for one to two hours and, finally, none of the participants used a meat thermometer to check the cooking temperature *(2)*.

From July to October 2000, a post FightBAC! Campaign survey was conducted in 250 Latino households in inner city areas of Hartford. In a self-reported survey, 14% reported thawing meat in the refrigerator and 10% reported using the same plate to place meat before and after cooking. Furthermore, only 30% reported being aware of the term cross contamination *(7)*. A comparison of food safety practices by socio-demographic variables indicated that food safety behavioral risks were higher among Latinos than among whites, and among those with lower levels of education *(6)*.

The HACCP approach developed for the food industry tests for physical, chemical and biological hazards. This study applied HACCP principles at the household level to identify critical control points for common microbial contamination. The household kitchen is unregulated and, unlike the industrial setting, where sanitation and production processes can be tightly regulated and monitored, it does not lend itself to the inclusion of precise and continuous monitoring systems, especially among low-income households. Hence, this study at the household level defines 'Critical Control Points' (CCPs) as key meal preparation steps where inadequate meal preparer(s) food safety behaviors can increase the risk of microbial contamination of the foods consumed. The main objective of this study was to apply HACCP principles and identify CCPs for home prepared 'Chicken and Salad' using objective measurements such as direct observations and microbiological indicators.

MATERIALS AND METHODS

This study was approved by the Institutional Review Boards of the University of Connecticut and the Hispanic Health Council, Inc. (Hartford, Connecticut). The study's inclusion criteria were: (1) Puerto Rican female, (2) main meal preparer of the household, and (3) living in Hartford. After the study consent form had been signed, the dates for the household visits and observation were decided in full consultation with the study participant. A bilingual (English/Spanish) and bicultural community outreach worker was trained by a Puerto Rican research staff member with expertise in food safety on how to recruit the participants and conduct the household observation.

Pilot study

In order to test, streamline, and standardize the microbiological testing and sample collection procedures, a pilot study *(18)* was conducted in ten households prior to collecting the data for the main study. The pilot study was also used to develop a household observation checklist and for testing the protocols and procedures for the eight-month-long main study. In addition, during the pilot study, ten simulation studies were conducted to rule out secondary microbial contamination during the delivery of ingredients (Chicken Breasts, Lettuce, Tomatoes) to the household and collection of samples from households to microbiology laboratory.

Main study

A total of sixty Puerto Rican women, none of whom had participated in the pilot study, were recruited through local schools, grocery stores, the Food Supplementary Program for Women, Infants and Children (WIC) offices, and neighborhoods of inner city Hartford, Connecticut.

For each household, two visits were conducted in three days to deliver the food ingredients, observe food preparation and collect the food and surface samples for microbial testing.

First visit (First day): A pack of chicken breasts (CB) with skin and bones, one head of iceberg lettuce and tomatoes (LT), oil, salad dressing and common Puerto Rican spices (adobo, sazòn, sofrito) were purchased at the local grocery store to be delivered to each participant. From purchasing to household delivery, spices were kept at room temperature while food ingredients (CB/LT) were maintained at ≤ 4°C in ice coolers. After purchase, food ingredients were taken to the microbiology laboratory and sampled (CB/LT - 25 g) to determine the presence of any pathogenic species and establish baseline total and coliform counts. After removing the sample for microbial testing, the CB and LT were re-packed and returned to the ice coolers to be delivered to the participant.

Once the foods had arrived at the household, the refrigerator and freezer temperatures were measured by use of calibrated mercury thermometers (Fisher Scientific, Fairlawn, NJ). On delivery of the food ingredients, participants were asked to freeze the CB and refrigerate the LT. Participants were also asked to have the CB defrosted for the dinner preparation two days after delivery of ingredients.

Second visit (Third day): On the second visit, participants were asked to follow their own recipe but to use only the food ingredients and spices provided by the study. The kitchen counter, refrigerator/freezer handles, knife and cutting board surface were sampled before meal preparation. The whole surface of the refrigerator/freezer handles and knife and 30 cm^2 (template area 6.5 × 4.5 cm) surface areas of the counter and cutting board were swabbed, using sterile templates and prepackaged sterile swabs (Difco) dipped in Tryptic Soy Broth (TSB, Difco) + 0.6% Yeast Extract (YE, Difco). A defrosted CB sample was collected after the participant had handled the CB (i.e., cutting, removing skin and bones and washing), or just before the participant started cooking the CB. Knives and cutting surfaces (i.e., counter or cutting board) were swabbed after they were used to cut/clean the CB. A LT sample was obtained once the vegetables were washed (if done) and cut or once they were ready to serve. Sterilized tongs were used to collect the food samples (two samples of CB/Lettuce/Tomato - 25 g/each). An extensive household observation was also conducted during the participants' preparation of the 'Chicken and Salad' meal. The pre-coded checklist was used to record the participant food safety practices. In addition, once the participant declared that the CB was cooked, the CB temperature was measured by inserting a digital thermometer (AccuTuff 340, Atkins, USA) sideways into the CB, without touching the bottom of the cooking pan. A cooked CB sample was taken for microbiological analyses only if the temperature measured was ≤ 165°F, or 75°C. The refrigerator and freezer temperatures were also measured at the end of meal preparation. As had been done in the delivery of ingredients, collected household samples were transported in ice coolers maintained at ≤ 4°C.

Microbiological testing

All the collected food and counter/cutting board samples were tested for total bacterial and coliform counts, and for the presence of *Campylobacter, Salmonella*, *Listeria* genus, and *S. aureus*. Microbial procedures were performed using standard procedures *(11)*. Refrigerator/freezer handles and knife samples were tested only for the presence of pathogenic genus.

For total bacterial and coliform counts, food samples (~ 25 g) were placed in 100 ml TSB + 0.6% YE and homogenized in a stomacher (Tekmar, OH) for one min. For surface samples (50 cm^2), swabs were placed in fifty ml TSB + 0.6% YE. The samples were then serially diluted in 0.1% Peptone Buffer, spread plated (Tryptic Soy Agar for total bacterial load; Violet Red Bile Agar for coliforms) and incubated (37°C) for twenty-four hours. The remaining samples, placed in TSB + 0.6% YE, were enriched by incubating at 37°C for twenty-four hours and streaked on the respective agar to identify the presence of *Salmonella* (Xylose Lactose Tricholate Agar, Difco), *Listeria* (Oxford Agar, Difco), and *S. aureus* (Mannitol Salt Agar, Difco).

To detect the presence of *Campylobacter*, food samples were placed in *Brucella* broth + 0.5% sheep's blood, after which they were incubated at 42°C under micraerophillic conditions (85% N_2, 10% CO_2, 5% O_2) for forty-eight hours in an anaerobic incubator (Nuaire, MA). After incubation, the broth with sample was streaked on Karmali agar (Oxoid) to be incubated at similar microaerophillic condition as before. If positive colonies were observed, the following confirmatory tests were conducted for each species: *Salmonella*: Agglutination test (Oxoid, NY), API-20 E test (bioMérieux, MO); *Listeria*: Gram staining, hemolysis test on blood agar, API *Listeria* test (bioMérieux, MO); *S. aureus*: Gram staining, hemolysis test on blood agar, Staphytec Plus test (Oxoid, NY); and *Campylobacter*: microscopic motility test, Gram staining, API Campy (bioMérieux, MO).

STATISTICAL ANALYSES

The 12.0 version of SPSS (Chicago, IL) was used to enter and analyze the microbiological and direct observation data. Descriptive statistics and frequencies were used to assess percentage of samples testing positive for pathogenic species. Analysis of Covariance (ANCOVA) was used to determine the changes in total and coliform counts by various food-handling practices. A cross-contamination model was developed based on significant Pearson Correlation coefficient between different stages of meal preparation. The non-parametric MacNemar test was conducted to estimate the statistical significance of the difference in the presence of pathogenic species in food at the retail level and after participants' handling.

RESULTS

In all the main study households (n = 60), chicken preparation preceded salad preparation. Participants handled the CB first and started preparing the salad while the CB was being cooked or once the CB was cooked.

HOUSEHOLD OBSERVATION

Storage

The refrigerator and freezer temperatures measured at the household were compared with the USDA-Food Safety Inspection Service recommended temperatures (Refrigerator: 4°C; Freezer: -18°C). The minimum refrigerator tem-

TABLE 1. Association between participants' behavior and total bacterial and coliform counts in chicken breast[a] (CB) sample collected in the household (n = 60)

Participants' Behavior	Total Counts (log CFU/g)	p[e]	Coliform Counts (log CFU/g)	p[e]
Thawing Method				
In refrigerator	3.71 ± .89	.500	1.92 ± 1.56	.681
On counter	4.01 ± .99		1.98 ± 1.65	
In cold/hot water	4.32 ± .83		2.64 ± 1.24	
Combination	3.87 ± .67		1.96 ± 1.22	
Hand Washing[b]				
Did not wash hands	4.06 ± .85	.532	2.16 ±1.65	.869
Water only	3.99 ± 1.09		1.92 ±1.50	
Water and soap	3.74 ± .70		2.09 ±1.33	
Use of Cutting Surface				
Cutting board	3.85 ± .88	.015	1.74 ± .90	.051
Counter	4.81 ± .84		3.22 ± .80	
Plate	3.34 ± .15		1.71 ± .68	
Package itself	3.43 ± .79		1.91 ± 1.05	
Washing of Cutting Surface[c]				
Did not wash	4.14 ± .97	.089	2.30 ± 1.42	.654
Wipe it	4.55 ± 1.04		2.26 ± 2.23	
Wash with water only	3.80 ± .68		1.81 ± 1.48	
Wash with soap and water	3.23 ± 1.00		1.74 ± 1.89	
Washing of Knife[c]				
Did not wash	4.00 ± .72	.400	1.89 ± 1.57	.777
Wash with water only	3.99 ± 1.03		2.18 ± 1.41	
Wash with soap and water	3.69 ± .70		1.93 ± 1.86	

[e]ANCOVA – Total bacterial counts or coliform counts at the retail/baseline level as covariate, total bacterial counts or coliform counts after participant handling as a dependent variable and observed participants' behavior as an independent variable; log CFU/g- Logarithmic colony forming unit per gram

[a]CB sample collected after: freezing, thawing, washing (if done), removing skin and bones (if done) and cutting

[b]Washing hands before handling chicken or before starting meal preparation since all participants handled chicken first

[c]Washing cutting surfaces/knife before using to cut chicken

perature noted was 1°C while the maximum was 14°C. Fifty-three percent of the refrigerator temperatures ranged from 0 to 4°C; 42% from 5 to 10°C and 5% from 11 to 14°C. The freezer temperature ranged from -4 to -20°C with 65% of the freezers having sub-optimal or higher-than-recommended temperature.

Thawing

Our direct observations showed that the CB was thawed mostly (43%) on the counter (5 h on average). For the remaining households, 28% thawed CB in the refrigerator, 15% in water, and 14% using a combination of methods (i.e., initially in the refrigerator and later in cold/hot water or on the counter). Among participants who thawed the CB in water, 46% kept the CB in stagnant water and did not change the water for more than two hours.

Handling

Before handling the CB, 25% washed their hands with soap and water. A cutting board was used by the majority (72%), although kitchen counters (13%) were the second most common surfaces used to cut CB. After handling the CB and before handling the vegetables, most (75%) of the participants did not wash their hands or washed them with water only. Thirteen percent of the participants did not wash the LT. Seventy-six percent used a cutting board, 7% used the counter, and 17% used a plate to cut the LT. Among those who used the same cutting board to cut CB and LT, only 55% washed the cutting board with soap and water in between use. Similarly, we observed that 13% of households used the same knife for cutting CB and LT without washing it in between, thus increasing the risk of cross contamination.

Cooking

None of the participants used a thermometer to check whether the CB was adequately cooked. The most common methods used by the participants for determining doneness were the cooking time and visual checking of the change in texture and color of the meat. Some participants (20%) tasted the meat to determine if it was done or not. Temperature measurements on the CB by

TABLE 2. Association between participants' behavior and total bacterial and coliform counts in lettuce/tomato[a] (LT) sample collected in the household (n = 60)

Participants' behavior	Total Count (log CFU/g)	p*	Coliform Count (log CFU/g)	p*
Hand Washing[b]				
Did not wash hands	4.35 ± .58	.042	2.96 ± .43	.054
Water only	4.12 ± .99		2.32 ± .30	
Water and soap	3.57 ± .60		2.18 ± .35	
LT Washing				
Did not wash	4.72 ± 1.15	.029	3.40 ± 1.15	.003
Wash whole in water	4.19 ± .66		2.93 ± 1.06	
After cutting washing in a vegetable drainer	3.88 ± .75		2.47 ± 1.32	
Use of Cutting Surface				
Counter/dining table	4.32 ± 1.31	.421	2.92 ± 1.00	.233
Plate	4.25 ± .73		3.06 ± .84	
Cutting board	4.01 ± .81		2.28 ± 1.44	
Washing of Cutting Surface[c]				
Did not wash	4.61 ± .68	.108	2.97 ± .80	.426
Wipe it	4.79 ± .76		2.63 ± .18	
Wash with water only	4.05 ± .92		1.24 ± 1.51	
Wash with soap and water	3.96 ± .72		2.64 ± 1.26	
Washing of Knife[c]				
Did not wash	4.25 ± 1.31	.751	2.74 ± 1.58	.871
Wash with water only	4.17 ± .72		2.49 ± 1.11	
Wash with soap and water	3.93 ± .75		2.36 ± 1.50	

*ANCOVA–Total bacterial counts or coliform counts at the retail/baseline level as covariate, total bacterial counts or coliform counts after participant handling as a dependent variable and observed participants' behavior as an independent variable; log CFU/g- Logarithmic colony forming unit per gram

[a]LT sample collected after refrigeration, washing (if done) and cutting

[b]Observation on washing hands after handling chicken and before handling LT since all participants handled chicken first

[c]Washing cutting surfaces/knife before using it to cut LT

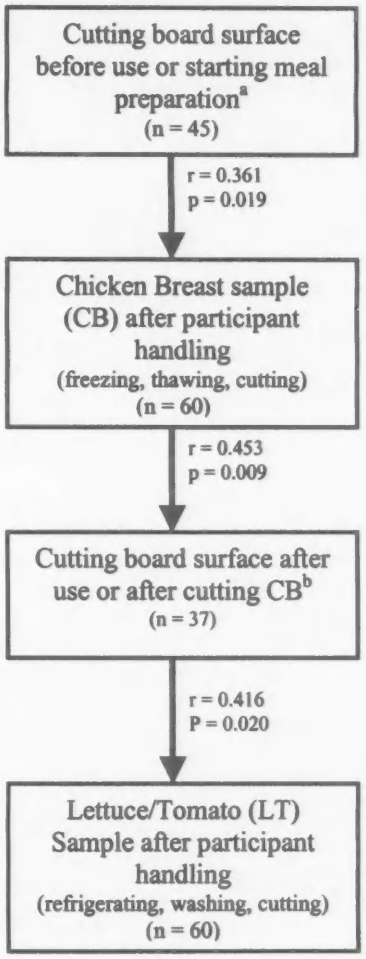
research staff showed that 93% of the participants cooked the CB to an adequate temperature (≥ 165°F, or 75°C). The lowest temperature of the cooked CB noted was 150°F, or 65°C.

Comparison between observation and microbiological results

The participants' food-handling behaviors were compared with the total and coliform counts of CB and LT samples. Total bacterial and coliform counts of CB were significantly higher if the participant had used the counter as a cutting surface. Total bacterial count of CB was also significantly higher when the CB was thawed on the counter rather than with other thawing methods (Table 1).

For LT, a difference in total bacterial and coliform count was seen with differences in hand washing. The total and coliform count was significantly higher if hands were not washed before handling LT or after handling 'CB' and before handling LT. A significant difference was also seen by LT washing behavior. The total and coliform counts were significantly higher for unwashed LT (whole or after cutting) than for the washed samples (Table 2).

FIGURE 1. Total coliform counts cross-contamination model for home prepared 'Chicken and Salad'



r: Pearson Correlation coefficient

Diagram represents flow of the meal preparation and microbial sample collection protocol; all participants handled vegetables after chicken was cooked or was placed in the oven.

Microbiological sampling Protocol:

[a]Samples were taken before participants handled food or started the meal preparation (Cutting board n = 45)

[b]Cutting board sample was taken immediately after it was used to cut chicken; sample taken only if participant used same cutting board to cut lettuce and tomatoes, n = 37

Cross-contamination model

Correlation analyses, across stages of meal preparation, identified possible routes of cross contamination (Fig. 1). We developed a cross-contamination model based on the sampling protocol and on the observed sequence of meal preparation stages (i.e., all participants handled CB before handling LT). There was a significant positive correlation in coliform count between: (1) the cutting board sample collected before meal preparation and the CB sample taken after participant handling (thawing/cutting/washing (if done)); (2) CB sample after participant handling and cutting board sample taken once it was used to cut the CB; (3) Cutting board sample after its use and LT sample collected after handling (cutting/washing (if done) (Fig.1). This correlation strongly suggests that during meal preparation there was transfer of coliforms, especially from one food to another.

Presence of tested pathogen genus in food and surface samples

Among the tested pathogens, *S. aureus* was found most commonly in tested food and surface samples. MacNemar's test results showed that there was no significant decrease in the incidence of *S. aureus* in any food samples as a result of participants' handling (Table 3).

The incidence of CB *Listeria* decreased significantly at the household level in relation to the retail level ($P < 0.05$), while it remained almost the same in the LT samples. With regard to kitchen surfaces, 9% of cutting board and knife samples collected after the CB had been cut tested positive for *Listeria* (Table 3). At the household level, *Listeria monocytogenes (L. monocytogenes)* was found on 5% of CB, 2% of LT, and 5% of cutting board or counter samples. All the household CB samples that tested positive for *L. monocytogenes* were also positive at the retail level. The following were the instances in which LT samples were found positive for *L. monocytogenes*: (1) CB at baseline and after handling by participants; (2) Same cutting board was used to cut CB and LT without washing in between, and; (3) LT was not washed. The cutting board or counter was positive for *L. monocytogenes* when a positive CB was either cut or kept

TABLE 3. Presence of tested pathogenic genus in food and food preparation surfaces at different stages of meal preparation

Pathogens	Chicken Breasts (CB)		Lettuce/ Tomatoes (LT)		Refrigerator/ Freezer		Counter		Cutting		Knife	
n	60		60		60		48[a]	8[b]	45[c]	37[d]	60	45[e]
	BE %	AF %	BE %	AF %	BE %	AF %	BE %	AF %	BE %	AF %	BE %	AF %
Salmonella	8	5	0	0	0	3	0	0	0	0	0	0
Campylobacter	7	5	0	0	0	0	0	0	0	0	0	0
S. aureus	27	37	23	23	33	41	32	33	32	25	25	24
Listeria	28	10 **	8	5	0	2	0	0	6	9	2	9

**MacNemar's test: significant decrease in incidence of *Listeria* genus was seen at the household level

Note: MacNemar's test was conducted for all the food and surface samples; however, only significant results are reported

For Food Samples – BE: at retail level; AF: after participant handling

For Surface Samples – BE: before meal preparation; AF: after first use or after cutting CB

[a]Counter sample was taken if cutting board was not seen and if there was an empty surface on the kitchen counter, n = 48

[b]Counter sample taken was analyzed if same surface used to cut CB and LT, n = 5

[c]45 participants used cutting board to cut CB or LT

[d]Cutting board sample taken was analyzed if same cutting board was used to cut CB and LT, n = 37

[e]Knife sample taken was analyzed only if same knife was used to cut CB and LT

for thawing on the particular surface. The incidence of *Salmonella* in the retail or baseline CB samples reflected the results of 2000 PR/HACCP report where 9% of broilers were found positive for *Salmonella (19)*.

At the household level, 5% of CB tested positive for *Campylobacter* and *Salmonella* genus with no LT sample yielding these bacteria at the household or retail level.

DISCUSSION

The application of HACCP principles at the household level based on microbiological indicators and direct observation was useful in understanding the impact of various food handling practices. In this study, the following stages of meal preparation were identified as CCPs: (1) CB thawing; (2) Cutting CB; (3) Hand washing after handling CB and before handling LT, and (4) Washing of LT or fresh produce. Consistent with our findings, previous studies conducted in developing countries have identified washing practices of hands and cooking containers as CCPs *(4, 5, 9, 15, 22)*. However, contrary to the findings of previous studies, in our study, which as far as we know is the first one examining CCPs in low-income United States households, the food safety risk factors were associated not with lack of key amenities (e.g., refrigerator, cooking devices) but perhaps with lack of knowledge or negative attitudes toward food safety risks.

Our cross-contamination model showed that inadequate washing of hands and cutting surfaces increases the risk of cross contamination. Similar to the results of the study conducted by Gorman et al. *(10)*, pathogenic species found on the CB were also recovered from the refrigerator/ freezer handles at the end of meal preparation. This shows that the risk of cross contamination may extend to meals prepared later The previous observational study in this community *(2)* found that using a counter to cut food items and inadequate washing of cutting surface were common practices. Most of the participants cooked the CB adequately; however, universal lack of thermometer use indicates that consumers are not benefiting from the use of this tool.

Results also showed that the populations of coliforms and tested pathogenic species increased more on the unwashed than on washed fresh produce. Thus, the washing practice at the household level may not avoid but can at least reduce the risk of foodborne illness that occurs with use of ready-to-eat vegetables. Hence, in addition to the recommendations provided by Medeiros et al. *(14)*, this study also identifies as a priority the need for consumer education regarding the

proper washing of fresh produce before consumption.

Comparison of this study's results with those of consumer food safety surveys shows that there is a wide gap between self-reported and observed practices *(8)*. The results of consumer food safety surveys show that hand washing with soap and water is a common practice (> 50%) *(21)*. In our previous food safety knowledge, attitudes and behavior (KAB) survey in the target community, the majority (97%) reported washing hands with soap and water before cooking *(7)*. In contrast, in this study only 25% were observed washing hands adequately (soap and water). In a food safety survey by Wenrich et al., participants were asked to report food safety practices in a range from 1 as 'Never' to 4 as 'Always' *(23)*. Results showed that the practice of washing cutting board/plate with soap and water between uses was more frequently performed (Mean: 3.6 + 0.8) than other food safety practices. Inter and intra comparisons of food safety studies by Redmond et al. identified inconsistencies between food safety knowledge, attitudes and behaviors. Indeed, there were two to three fold differences between food safety knowledge and reported food safety practices *(21)*.

Besides identifying the CCPs, this study opens the path for developing and testing educational materials targeting the consumers' microenvironment through the formulation of recipes with instructions on CCPs. Future studies should involve designing and testing recipes with adequate food safety information for the consumer. Substantial differences between reported and observed food safety practices indicate the need for home-based observational studies to estimate the true food safety risks at the household level, which are likely to have been strongly underestimated thus far.

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Gale Prince Retires After 40 Years

Thanks…

After 40 years in the retail food industry I have decided to retire at the end of July. The day that I was given the assignment for product safety at Jewel Companies in 1967, I can't say I recognized that I was a pioneer in the area of retail product safety. I look back at the past 40 years with special pride and joy. I am indebted to The Kroger Co. for giving me the opportunity and support over the past 28 years to practice my profession and love for food safety. Working for a top company like Kroger has also given me the privilege of getting to know many of the best and brightest in food safety – ranging from dedicated public servants in government agencies to talented staff in industry associations to hard working colleagues in private industry and the researchers in academia who have provided us with the science.

My greatest regret about retirement is leaving these wonderful people who have been so much more than just colleagues and friends over our many years of working together. Your dedication and hard work have always inspired me to live up to your examples. Together, I think we made a real difference in food safety programs in this country and beyond and most importantly for the benefit of the consumer. I struggle to find words that can express how much I appreciate all you have done to help me over the years. I will forever be in debt for that help and guidance.

Thank you for your support over these 40 years and for allowing me to be a part of your life. Thanks for your support of IAFP and the IAFP Foundation as this organization is key to meeting food safety challenges not only today but also in the future.

Gale Prince
Director of Regulatory Affairs
The Kroger Co.
1014 Vine Street
Cincinnati, OH 45202

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Gehaka Ltd.
São Paulo

Christian C. Kaufmann
Gehaka Ltd.
São Paulo

Renato Santos
Jacarei, São Paolo

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Cargill Foods
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Fraser Health Authority
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Fraser Health Authority
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Surrey, British Columbia

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Corri L. Rekow
Texas Tech University
Lubbock

Colista A. Yates
Carlson Restaurants Worldwide
Carrollton

VIRGINIA

Jacqulyn F. Poon
Performance Food Group
Richmond

WASHINGTON

Karla Celada
BioControl Systems, Inc.
Bellevue

Andrea Johnson-Ross
BioControl Systems, Inc.
Bellevue

NEW SILVER SUSTAINING MEMBER

Mary C. Nowinski
BSI Management Systems
Reston, Virginia

UPDATES

Sargento Promotes Three in Consumer Products Division

Sargento Foods Inc. has announced three promotions in the consumer products division to help position the family-owned company for sustained long-term growth.

Steve Foerstner, Ed Finnie and Brad Deckard have been promoted to divisional sales managers and will report to John Bottomley, director of sales for Sargento.

"The changes will enable us to capitalize on the strengths and skill sets of our sales team," said Louie Gentine, president of the consumer products division at Sargento. "It also allows us to continue to meet the needs of our customers with a greater focus on national accounts."

Mr. Foerstner has been elevated to divisional sales manager in the Midwest region. Since joining Sargento in 1991, the resident of Westlake, OH has held the following positions — national accounts sales manager and national customer business manager. The married father of three earned a bachelor's degree in marketing from Xavier University.

Mr. Finnie has been promoted to divisional sales manager for the Northeast and Eastern Great Lakes regions. Previously, Mr. Finnie has held the positions of regional sales manager — Boston, national accounts sales manager and national customer business manager. Mr. Finnie earned his bachelor's degree in marketing from Western New England College.

Mr. Deckard will now assume the role of divisional sales manager, and is responsible for sales management of the Southeastern region. Prior to this move, he held the title of national customer business manager. Mr. Deckard earned a bachelor's degree in advertising from the University of Florida. He also holds a master's degree in business administration from Florida Metropolitan University.

Food Safety 'Icon' New Chair of Food Safety Information Council

Dr. Michael Eyles is the new chair of the Food Safety Information Council.

In announcing Dr. Eyles' election to the position, immediate past council chair, Professor Tom McMeekin, of the University of Tasmania's Australian Food Safety Centre of Excellence, said "It is a coup to have a scientist, administrator and a person of Michael's calibre to take on the role of leading the Council into its second decade."

"Michael is an icon in the food-safety world both through his outstanding scientific contribution and his ability to translate his and others' findings into messages easily adaptable to the food industry, as well as the home kitchen," he said.

The Food Safety Information Council's charter is to promote key food safety messages to consumers in order to counteract the 5.4 million cases of foodborne disease suffered in Australia each year.

Dr. Eyles is currently director, leadership and cross-organization development with CSIRO. Previous CSIRO positions have included group executive for agribusiness and health, chief executive of Food Science Australia, and chief of the division of food science and technology.

He is a fellow of the Australian Academy of Technological Sciences and Engineering, the Australian Society for Microbiology, and the Australian Institute of Food Science and Technology.

Professor McMeekin said, "Michael's scientific credentials are outstanding, as is his experience in improving the quality of Australia's food products and responding to new and emerging threats to food safety which began when he did his Ph.D. in the early '70s on viruses in oysters following a large Norovirus outbreak in Sydney. His later research in food microbiology ranged from trouble-shooting food industry problems, to investigations into growth of bacteria in vacuum packed foods."

"Added to this is his approach to leadership which is underpinned by a belief in the importance of teams and partnerships within the scientific community and strong engagement with its stakeholders."

"His promotion of food safety has included a range of innovations including as a member of the Australian Institute of Food Science and Technology's Food Microbiology Group, devising courses in food hygiene for retailers and restaurateurs in local councils. These were the first attempts in Australia, outside of TAFE colleges, to train such people in food hygiene. Later, he was a key player in the production of a video kit called 'Don't Poison Your Patrons' targeted at the restaurant industry — again a breakthrough activity."

"He will be a tremendous asset to the Food Safety Information Council," Professor McMeekin said.

UPDATES

FMI Appoints Christina Kelly to the SQF Institute Team

Christina Kelly will be responsible for the technical aspects of the SQF Program, which will include supporting the SQFI Technical Committees, servicing and supporting SQF Training Centers and Certification Bodies, overseeing the registration of SQF Auditors and Consultants, and coordinating reviews of all SQF training courses and other program documents.

Ms. Kelly comes to us from Kellogg's and prior to that Tyson Foods, Inc. She has had extensive experience in the development of prerequisite and HACCP-based food safety programs for a wide range of product types.

Dr. Trevor Ames Appointed Interim Dean at University of Minnesota College of Veterinary Medicine

Dr. Trevor R. Ames has been appointed interim dean of the University of Minnesota College of Veterinary Medicine by Dr. Frank Cerra, senior vice president for health sciences, effective June 18. Dr. Ames will take over for Dr. Jeffrey S. Klausner, who has resigned to become president and chief executive officer of the Animal Medical Center in New York City.

Dr. Ames joined the college faculty in 1981 and has been the chair of Veterinary Population Medicine Department for the past 10 years. A diplomate of the American College of Veterinary Internal Medicine, Dr. Ames received his D.V.M. in 1978 from the Western College of Veterinary Medicine at the University of Saskatchewan and his master of science degree in 1981 from the University of Minnesota. His research interests include infectious diseases of horses and cattle, bovine respiratory disease complex, and equine and bovine vaccines. His clinical interests include large animal internal medicine diseases, and his teaching responsibilities include lectures in virology, large animal multi-systemic diseases, and large animal respiratory diseases.

"Interim Dean Ames will provide outstanding leadership for the College as it pursues its strategic goals and directions and is a proven leader in veterinary medicine," said Dr. Cerra. He will serve us well in representing the college inside and outside the University.

During his tenure as interim dean, Dr. Ames will serve with all the rights, privileges, responsibilities, and authority of the permanent dean. He will serve in this position for nine to twelve months until a permanent dean has been appointed and begun work. Interim Dean Ames will be eligible to be considered for the permanent dean position.

Nilfisk-Advance America Promotes Kim Kanis to Eastern Region Sales Manager

Nilfisk-Advance America, has promoted district manager Kim Kanis to Eastern region sales manager. In his new position, Ms. Kanis will be responsible for the management of nine Eastern Region District Sales Managers and all sales and business development activities within the Eastern Region of the United States.

Prior to this promotion, Ms. Kanis served as district sales manager for New York and New Jersey, where for 7 years he oversaw direct sales to a variety of dust-sensitive industries, including many pharmaceutical industry leaders such as OrthoVita and Bristol-Meyers Squib.

During his time at Nilfisk-Advance America, Ms. Kanis has been recognized for his many accomplishments and is the recipient of the Million Dollar Year Award and the Salesman of the Year Award.

Kaye Tillman Trains for Computerway Food Systems

Kaye Tillman has been promoted to project management and training at Computerway Food Systems.

In her role, she uses her extensive computer systems experience and skill as a trainer while assisting with project management. Most recently, Ms. Tillman headed up a major customer implementation of the Computerway R5z system in Texas. She now is heading up implementation of the new Computerway Process Management application at a customer site in North Carolina.

Ms. Tillman works closely with the CFS Help Desk in trouble-shooting. She also works closely with CFS programmers on new developments and is actively involved in maintaining documentation for all Computerway system manuals.

NEWS

No Crumbine Award Winner for 2007

For the fourth time in its fifty-two year history, a jury of leading environmental health officials and public health sanitarians has decided not to select a recipient for the 2007 Samuel J. Crumbine Consumer Protection Award.

The Crumbine Award, named for one of the most renowned public health sanitarians, is usually presented each year to a local public health unit that demonstrates excellence in food protection. Crumbine winners serve as models for other public health and safety programs across the nation. Among environmental and public health circles, the Crumbine Award is the most prestigious recognition that a public health unit can receive.

"The jury was faced with a very difficult decision this year," said Tony Hiller senior consumer health specialist at the Fort Worth Public Health Dept., Consumer Health Division, and chair of the 2007 Crumbine Jury. "We only received one application this year and felt that while it was a good program, it did not meet — or exceed — the four key criteria required of a Crumbine Award winner. We concluded that the integrity of the award would be better served if no recipient was chosen this year."

Trevor Hayes, executive director of the Conference for Food Protection and one of the sponsors of the Crumbine Award explained that the lone application was not the problem — applications are not judged against each other but against the criteria. "For several years, the number of applications has decreased. We will take this opportunity to make changes to the criteria and increase our outreach to local public health units."

New Food Imports Program for New Zealand

Government this week approved the release of information on the New Zealand Food Safety Authority's (NZFSA) new imported food program.

The new program will be implemented over the next two years and brings the process of importing food more into line with the proposed new domestic food regime.

The changes, which will give consumers more assurance about the food they are eating, follow on from an extensive review into New Zealand's food and food-related products' importing system. That review recommended NZFSA update controls on imported foods.

Since then, NZFSA has been developing options and working with representatives from the importing industry to design the new imports program.

The principles of the new program's design are to manage risks at the appropriate point in the food chain, to be flexible, and to ensure adequate, scientific-based controls on imported food and food related products.

The new imports program will group foods into one of three levels of regulatory interest, each of which will have differing import requirements related to the product's potential risk.

Part of the new Food Bill being developed as a response to the Domestic Food Review will include requirements relating to imports. Importers will need to comply with general obligations as well as specific requirements applying to higher risk foods, register with NZFSA, keep records and, on request, report this information to NZFSA.

It is expected that importers will use some of the same tools, such as Food Control Plans, proposed for local food operators under the new Bill. Local operators who also import foods will be able to cover both their domestic and importing operations under one Food Control Plan.

Once implemented, the new imports program will provide greater confidence that imported food is safe and suitable, and complies with the relevant standards.

Joint FAO/WHO Project to Assess the Benefits and Risks of the Use of "Active Chlorine" in Food Production and Food Processing

The Codex Alimentarius Commission has requested FAO and WHO for scientific advice on the assessment of the benefits and risks of the use of "active chlorine" in food production and food processing. The advice will be elaborated through the implementation of an expert meeting during 2007. At WHO, the Departments of Food Safety, Foodborne Diseases and Zoonoses, and of Public Health and the Environment are collaborating on this project, together with the FAO Departments of Agriculture and Consumer Protection, Fisheries and Aquaculture.

The main goals of this project are to consider the risk of chemical residues in products (excluding environmental impact), following the use of active chlorine for disinfection purposes in food production versus the benefit of lowering the risk of microbial hazards. The efficacy of active chlorine treatment needs to be considered, taking into account different treatment scenarios, different chlorine-containing substances and different pathogens and pathogen/food combinations. These considerations need to be based on current practices, as well as take into account proposed new practices, including the relevance and feasibility of potential alternative approaches.

The term 'active chlorine' as it is used here includes aqueous solutions of hypochlorous acid and its conjugate base, hypochlorite ion, chlorous acid and its conjugate base chlorite ion, chlorine gas or chlorine dioxide. Chloramine and dichloroisocyanurate may be included if of relevance in the food processing industry. Although technically not fully correct, this term 'active chlorine' is used throughout for ease of reference.

The main areas to be considered relate to the treatment of irrigation water (only as it relates to hydroponic production systems and production of sprouts but not for agricultural field use), processing water, food-contact surfaces as well as direct treatment of foods, with fresh produce, fish and seafood, meat and poultry as main food categories.

The effects of various treatments on the nutritional components of foods as well as organoleptic and quality changes will be reviewed.

The impact of the use of active chlorine in the different steps in the food chain, in accordance with nationally authorized practices, in the control of microbiological hazards will be considered as well as the level of chemical residues in or on the foods.

The work that has been carried out at international level in the framework of WHO Drinking-water Quality Guidelines will be taken into account. Previous evaluations by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) and by the Joint FAO/WHO Expert Meeting on Microbial Risk Assessment (JEMRA) will also be considered

FMI Consumer Trends 2007: Confidence in Food Safety Down, Energy Costs Changing How People Shop

Foodborne illness outbreaks and high energy costs are significantly changing consumer shopping behavior and attitudes, according to the Food Marketing Institute (FMI) U.S. Grocery Shopper Trends, 2007. The number of consumers "completely" or "somewhat confident" in the safety of supermarket food declined from 82 percent in 2006 to 66 percent — the lowest point since 1989 when the issues of pesticides in apples and contaminated grapes were widely reported. Consumer confidence in restaurant food is even lower at 43 percent. "These findings send a strong message to the entire food industry," said FMI President and CEO Tim Hammonds. "All of us need to work together to be sure our consumers continue to receive the high quality, affordable food they have every right to expect."

The Trends survey found that safety concerns prompted 38 percent of consumers to stop purchasing certain foods in the past 12 months — up from 9 percent in 2006. Among those who stopped buying products, the items most often mentioned were spinach (71 percent), lettuce (16 percent), bagged salad (9 percent) and beef (8 percent). The survey was conducted in January 2007, when the outbreak linked to spinach was still in the news and illnesses associated with other foods were starting to make headlines. In fact, the impact extends beyond shopping to cooking and dining. For example, consumers:

- Cook more and eat out less, cited by 69 percent of those surveyed.
- Eat more leftovers or use leftovers to make other meals, 62 percent.
- Purchase more grocery store brand items as opposed to national brand items, 56 percent.
- Purchase fewer food items overall, 40 percent.
- Buy more canned, frozen or boxed food as opposed to fresh food, 30 percent.
- Purchase more prepared meals from the grocery store rather than going out, 21 percent.

Prevention of Foodborne Disease: Five Keys to Safer Food

Each day millions of people become ill and thousands die from a preventable foodborne disease. Proper food preparation can prevent many foodborne diseases. WHO has developed a global food hygiene message with five key steps that promote health, the Five Keys to Safer Food.

The Five Keys to safer food

- Keep clean
- Separate raw and cooked
- Cook thoroughly

- Keep food at safe temperatures
- Use safe water and raw materials

Five Keys to safer food poster:

- Introduced in 2001, the poster is made of simple headings, specific suggestions for improvement and reasons behind the suggested measures. Now available in more than 40 languages.

Five Keys to safer food manual:

- The manual elaborates the food safety information provided in the WHO Five Keys to safety food poster and suggest ways to communicate the message.

Implementation of the Five Keys:

- WHO has long been aware of the need to educate all food handlers, including professionals and ordinary consumers, about their responsibility for food safety. After nearly a year of consultations with food safety experts and risk communicators, WHO introduced in 2001 the Five Keys, simple rules elaborated to promote safer food handling and preparation practices.

WHO actively promotes the adaptation of the Five Keys food hygiene message to the local level. Educational projects for high-risk groups, including children and women and others involved in food preparation and handling, such as street-food vendors, are being implemented at the local level in countries.

WHO adapted the Five Keys messages to specifically address the health concerns associated with handling and preparation of poultry and poultry products potentially infected with highly pathogenic Avian influenza (HPQI) virus and also to healthy market settings.

WHO continues to seek partners and collaborators to continue this important work.

WHO already collaborates with a wide range of partners in different fields of activities (national and international organizations, NGOs, public health institutions, the tourism sector, consumers associations, local communities, industries and academia). However, lowering the burden of foodborne disease requires a renewed effort on the part of governments, scientists, food industry and consumers. WHO offers materials, expertise, technical support and the credibility of an internally recognized public health organization.

Individuals and groups interested in working with WHO to disseminate this important food hygiene message should contact Françoise Fontannaz: fontannazf@who.int. For regional food safety contacts please go to our contact us page.

Who Has Time to Cook? How Family Resources Influence Food Preparation

Households participating in the Food Stamp Program are increasingly headed by a single parent or two working parents. As this trend continues, more low-income households may find it difficult to allocate the time needed to prepare meals that fit within a limited budget and meet dietary requirements. Using Tobit analysis of the 2003–04 American Time Use Survey (ATUS), this study finds that household time resources significantly affect how much time is allocated to preparing food. In fact, working full-time and being a single parent appear to have a larger impact on time allocated to food preparation than an individual's earnings or household income do. The results are relevant for the design of food assistance programs as well as for improving our understanding of how different family time resources affect consumption behavior. The entire report can be found at http://www.ers.usda.gov/publications/ERR40/err40.pdf.

Herpes Infection May Be Symbiotic, Help Beat Back Some Bacteria

Mice with chronic herpes virus infections can better resist the bacterium that causes plague and a bacterium that causes one kind of food poisoning, researchers report in this week's *Nature*.

Scientists at Washington University School of Medicine in St. Louis attributed the surprising finding to changes in the immune system triggered by the long-term presence of a latent herpes virus infection. In latent viral infections, the virus is present for the lifetime of the host in a relatively quiescent form that does not cause overt symptoms.

While presenting their results, researchers stressed that they did not want to minimize or in any way disregard the human suffering and health risks caused by disease-causing herpes infections. But they noted that several strains of herpes viruses found in much of the human population remain symptom-free throughout the host's lifetime.

"Our results suggest that we should look at whether humans receive similar advantages from these and other chronic infections that do not cause active disease," says senior author Herbert W. "Skip" Virgin, M.D., Ph.D., head of the

Department of Pathology and Immunology. "If so, that has public health implications because we would want to very carefully weigh the risks and benefits of eliminating a virus that our bodies have established a symbiotic relationship with."

Scientists previously used vaccination to eliminate the deadly and highly contagious smallpox virus. Vaccines are currently in use or in clinical trials for several disease-causing strains of herpes.

Human herpes viruses include oral and genital herpes, the chickenpox virus, cytomegalovirus, Epstein-Barr virus and Kaposi's sarcoma-associated herpes virus. During an initial period of acute infection, many of these viruses cause symptoms, such as fever, cold sores or blisters. They then enter periods of latency. Sometimes symptoms never recur; sometimes they flare up periodically before becoming quiescent again. In addition, less infamous herpes viruses like HHV6 and HHV7 permanently infect most humans without ever producing any significant symptoms.

The results have potentially wide-reaching implications for immune research. Humans and other mammals have spent millions of years living and evolving with latent viral infections, Dr. Virgin notes, and the new results imply that infections may have altered our immune systems at a fundamental level. This could mean the virus-free animal models scientists use to study vaccines, autoimmune diseases, and other immune system issues have the potential to produce misleading results.

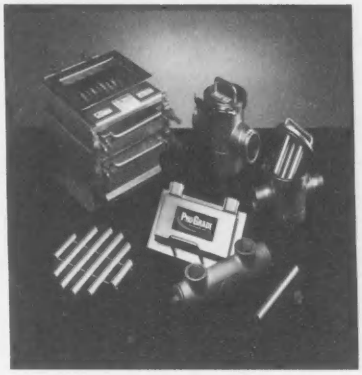
"Chronic virus infections may in part define what a normal human immune response is," says Dr. Virgin, who is the Edward Mallinckrodt Professor of Pathology and Immunology. "We may need to think about that as we consider the implications animal model results hold for human diseases."

Scientists have recognized for years that many types of bacteria and other microorganisms live in the human gut to the advantage of both the microbes and their human hosts. The results from Dr. Virgin's lab are among the first to suggest the potential for symbiotic benefits from viral infections that live in areas beyond epithelial surfaces like the skin, throat or intestines.

For the new research, Dr. Virgin's group worked with strains of mouse herpes virus closely related to human Epstein-Barr virus, Kaposi's sarcoma-associated herpes virus and cytomegalovirus. During studies of how mouse herpes viruses transition from acute to latent infections, Dr. Virgin made a discovery that piqued his interest in the possibility that latent infections might confer unrecognized benefits.

"We found evidence that the mouse immune system controls latent herpes infections in part by increasing production of a protein hormone called interferon gamma," Dr. Virgin says. "This is a signaling hormone that in effect puts some immune system soldiers on yellow alert, causing them to patrol for invaders with their eyes wide open and defense weapons ready."

INDUSTRY PRODUCTS



Eriez Magnetics

Eriez® *ProGrade*™ Series Magnetic Separators Offer Premium Performance at a Low Price for Sanitary Applications

Eriez Magnetics introduces its *ProGrade*™ series of Magnetic Separators. The ProGrade line features high quality magnetic plates, grates, traps and tubes that are expertly designed and affordably priced for sanitary applications in the food, pharmaceutical and chemical industries.

"By embracing a singular brand for this range of products, consumers can better understand where the brand fits in the market. Additionally, utilizing the *ProGrade* brand enables Eriez to establish a new price position in the commodity end of the market by offering superior products at a low-end price," explains Charlie Ingram, Eriez' vice president of sales and marketing.

The *ProGrade* line includes professional grade magnets and assemblies at three different degrees of magnetic strength, allowing customers to choose the level of protection that is right for their particular application.

ProGrade Rare Earth series is designed for sanitary-grade assemblies. These products prevent contamination and tramp metal damage. Assemblies are designed with demanding attention to welds and finish and feature stainless steel construction and high power magnets.

ProGrade Xtreme™ series is designed for pharmaceutical-grade assemblies. These products offer the ultimate in process purity, the finest materials and construction techniques and the industry's most powerful magnetic circuits.

Eriez Magnetics
888.300.ERIEZ
Erie, PA
www.eriez.com

IDEXX Supports US Beef Industry with a BSE/Mad Cow Testing Solution

IDEXX Laboratories, Inc. announced that it is prepared to support the country's meatpackers in response to a recent federal court decision that could change meat industry BSE-testing protocols. On March 26, 2007, the US District Court for the District of Columbia ruled that the United States Department of Agriculture (USDA) does not have authority to regulate testing for bovine spongiform encephalopathy (BSE, or mad cow disease). The USDA had until June 1 to appeal the ruling.

IDEXX Laboratories is working with industry leaders to determine the potential impact of this ruling. "If the ruling stands, US meat processors will have the option of testing in private laboratories, and we want to make sure they're aware of the testing options available to them," said IDEXX Corporate Vice President Quentin Tonelli, Ph.D. "IDEXX has been working to provide the US livestock industry with high-quality diagnostic products for many years. Our BSE-testing method, used worldwide for identifying at-risk cattle, will provide an important solution for US meatpackers if the ruling stands."

IDEXX is prepared to support a potential increase in US BSE testing with its IDEXX HerdChek® BSE Antigen Test Kit. IDEXX can provide the kits, equipment and technical support required to establish a private laboratory capable of meeting the throughput needs of any customer. "This test is the fastest growing BSE test in the world," said Tom Mikulka, director of production animal commercial operations, Americas. "In Europe, the IDEXX test has been used with millions of cattle. The largest BSE lab in Europe — running over 300,000 tests per year—selected the IDEXX BSE kit because of its ease of use and speed to results, and IDEXX's quality of service."

The IDEXX BSE test takes less than two and one-half hours from sample preparation to result, making it the fastest USDA-licensed kit available. This is an important advantage when speed and accuracy of results are critical for smooth operations in packing facilities.

IDEXX Laboratories, Inc.
800.548.9997
Westbrook, ME
www.idexx.com

Be sure to mention, "I read about it in *Food Protection Trends*"!

E-Control Systems Inc. Releases Its Software Development Kit for Its IntelliProbe Wireless Temperature Probe

E-Control Systems, Inc. releases its new Software Development Kit (SDK) for its IntelliProbe™ Wireless Temperature Probe at the National Restaurant Association (NRA) show in Chicago, IL.

The SDK allows easy customization of the IntelliProbe™ for your own applications. The SDK utilizes Microsoft.NET Compact Framework and is immediately available.

The IntelliProbe™, E-Control Systems' new Bluetooth Wireless Temperature Probe, is the only completely wireless temperature logging solution on the market. The IntelliProbe™ is a wireless Bluetooth® temperature acquisition device designed for applications requiring quick and accurate temperature recording. It features a Bluetooth 2.0 radio with support for Serial Port Profiles (SPP) and a 12 bit A/D converter for accurate measurements.

The IntelliProbe™ can communicate with a PDA or any other Bluetooth® enabled device for a significant range. Low power requirements and a Lithium Ion battery combine to provide several days of use without recharging.

The IntelliProbe™ makes taking temperatures easy with one-touch temperature acquisition and convenient unit status LED alerts.

The IntelliProbe™ also features an iButton™ reader at its base for reading compatible iButton™ ID tags and data loggers. The iButton™ coin-sized ID tags can be easily installed at any station requiring inspection. Operators checking that station simply touch the base of the IntelliProbe™ to the iButton™ to upload the station's data to the application. The iButton™ gives you unmatched efficiency and assurance that your operators are performing their functions at the right station and time.

The IntelliProbe™ can be used by OEMs in the Food Processing and Food Service Industry for implementation of HACCP and food inventory control.

The IntelliProbe™ is part of a complete family of products for all your temperature monitoring needs, including IntelliCheck™ Intelli PDA HACCP Inspection System and IntelliSense™ temperature monitoring and wireless sensors.

Control Systems, Inc.
888.384.3274
Chatsworth, CA
www.eControlSystems.com

Strategic Diagnostics Announces Success in Demonstrating Utility of Its Proprietary Genomic Antibodies® Reagents

Strategic Diagnostics Inc. has announced the successful use of a number of its antibody reagents on clinical samples in studies being conducted by the Swedish Human Protein Atlas (HPA) program of the Human Proteome Resource (HPR) Center located in Stockholm, Sweden. The reagents, produced using SDI's proprietary Genomic Antibodies® technology, specifically target a selection of cancer-associated proteins. The antibodies were studied in the HPA's tissue-profiling program and generated high-resolution immunohistochemistry images across a wide spectrum of normal and cancerous tissues. Analyses of immunohistochemistry images are standard tests performed by pathology laboratories to diagnose disease. For each antibody, 576 spots of human tissue from 360 different individuals were treated and stained.

Images created in the analysis clearly demonstrated the ability of antibodies generated by SDI's high throughput Genomic Antibodies® technology to differentially stain cancer-associated proteins in patient tissue samples. The antibodies are created by using a proprietary system that produces recombinant protein inside the host animal, thereby activating an immune response to the encoded protein. This allows the production of antibodies generated against the protein's native structure, rather than traditional methods that produce antibodies to synthesized surrogates. Among the advantages of the Genomic Antibodies® technology is its ability to enable the development of reagents against traditionally difficult cellular targets, such as highly conserved and transmembrane proteins. The system is highly scaleable, allowing the generation of custom libraries consisting of hundreds of antibodies for use in the drug discovery, diagnostic, and research markets. SDI is currently developing a significant number of these innovative reagents to be offered via a web-based catalog.

Matthew H. Knight, the company's president and chief executive

officer, commented, "The demonstrated advantages of our Genomic Antibodies® technology continue to produce real-world data to differentiate our antibody reagents from antibody reagents generated by traditional means. The HPA data is more evidence that our antibodies can perform under rigorous study conditions."

Strategic Diagnostics offers custom-service access to its Genomic Antibodies® technology for polyclonal and monoclonal products.

Strategic Diagnostics Inc.
302.456.6789
Newark, DE
www.sdix.com

Redefine Spring Cleaning with Nilfisk-Advance America's 08 Series Vacuums: The Ultimate Workhorse

When it comes to the food industry, hygiene and sanitation are of paramount importance. QA and plant managers need a dependable solution for keeping contaminants out of their plants *and* product, and in 2005 Nilfisk-Advance America gave food manufacturers the ultimate work horse—the 08 Series vacuum, a high-performance, durable, easy-to-maintain vacuum, engineered to make the food manufacturing process more productive.

The three-phase 08 series, which includes the CFM 3308, CFM 3508, CFM 3508W, and CFM 3558, gives users the cleaning muscle they need for continuous duty applications, effectively collecting and retaining contaminants such as dust, bacteria, food scraps, and more. Designed to meet customers' needs, the 08 vacs are ideal for process-integration systems, central systems or for general maintenance, and are more accessible, adaptable, transportable and comfortable to operate, with the following features:

- Nilfisk's efficient graduated filtration system with HEPA and optional ULPA filters that trap up to 99.999% of all ultra-fine particles, preventing cross contamination and improving employee health concerns. Optional downstream (after the motor) HEPA/ULPA filter can also be strategically positioned in the exhaust chamber preventing dust and debris from being released back into the environment.
- An ergonomic filter shake that allows the user to safely purge filters to prevent clogging and downtime. Reverse purge and electric filter shakers are also available.
- Despite being the ultimate workhorse, all of the 08 vacs have a portable design; equipped with extra-large wheels and a wrap-around handle; users can push, pull, or maneuver the vacuum with ease.
- The 08 series is quieter than ever, with a sound suppresor that reduces the speed of the exhaust air and muffles the sounds for increased worker comfort and safety.

In addition, the modular CFM 08 Series vacuums can be customized based on the type of materials being collected (i.e., fine dust/powders, debris, toxic materials, liquids, etc.) using hundreds of interchangeable CFM accessories, hoses, and filters — including those for overhead cleaning. The modular attachments are compatible with all CFM vacuums, allowing users to swap in what they need without searching for the attachments that match a particular vacuum — or investing in multiple sets of tools.

Nilfisk-Advance America, Inc.
610.232.5469
Malvern, PA
www.pa.nilfisk-advance.com

Onset Computer Corporation Introduces New Software Tool for HOBO® Data Loggers

Onset Computer Corporation has announced the alarm and readout tool, a plug-in software module for use with HOBOware Pro® software.

The new alarm and readout tool automatically notifies users via cell phone text messages or email when temperature, humidity and other conditions exceed user-defined limits. It also enables data from networked HOBO data loggers to be automatically offloaded and stored onto a centralized computer. This is particularly useful in applications where numerous locations are being monitored throughout a facility.

The alarm and readout tool is a plug-in to Onset's HOBOware Pro software package. HOBOware Pro, which runs on PC and Macintosh computers, features easy data-logger launch and readout functions, powerful data-plotting capabilities, and an intuitive graphical-user interface.

Onset Computer Corporation
800.564.4377
Bourne, MA
www.onsetcomp.com

New Accufill™ Bagging/ Bulking Systems from Gainco Provide Enhanced Safety, Accurary and Efficiency

New AccuFill™ bagging/bulking systems from Gainco, Inc. deliver heightened accuracy, versatility and cost-saving performance due to their special hygienic design. Completely engineered and built in the USA, these systems are ideal for the full range of poultry, meat and seafood applications including filets, drumsticks, tenders, wings and other products.

In contrast to conventional tubing designs for these systems, the open-frame design of Gainco's AccuFill™ bagging/bulking equipment promotes better food safety and ease of cleaning, making them perfectly suited for the food processing environment.

Beyond better cleanliness, the many productivity-enhancing features of AccuFill™ bagging/bulking systems include the ability to accommodate each user's specific wicketed bag requirements, such as adjusting weight set-points and lower/upper limits. A "quick change" wicket holder facilitates the rapid reloading of bags, while a check-weighing feature guards against overpacking.

Versatile controllers provide easy flexibility in program setup and operation, and a battery-backed memory has been designed into the system for recording the total number of bags, total weight, plus all setup parameters. A host PC can be connected to multiple bagging systems for centralized reporting, setup control, and yield analysis. The incorporation of "auto-zero" software automatically adjusts for any product accumulation on the hopper surfaces to ensure better weighing accuracy.

AccuFill™ bagging/bulking systems are engineered to operate in a variety of configurations, such as manual loading with either automatic or operator-selected product discharge, or conveyor loading with either automatic or operator-selected discharge. They are also ideal for positioning at the end of YieldPlus™ breast portioning or debone line operations.

Multiple system configurations are available. Dual-stage systems are particularly well-suited for conveyor-fed, high-volume product applications where varying customer requirements or floor space considerations are key factors. The bi-directional buffer hopper controls the flow of product to two weigh stations, thereby doubling the capacity and speed for a single product stream. Flexibility is enhanced with dual-station bagging/bulking systems by alternately filling different order specs, according to individual customer requirements.

All AccuFill™ bagging/bulking systems from Gainco feature rugged, sanitary stainless steel construction for long-life performance.

Gainco, Inc.
770.534.0703
Gainesville, GA
www.gainco.com

Milliken & Company Introduces New Packaging for Food Service Market

Milliken & Company has introduced two new paper-based tetrahedral packaging products for the portion-controlled liquid market, Nu-Twist™ and M-Pak® Plus.

The Nu-Twist package offers a pull-tab opening and straw insertion for easy consumption of 4 ounces of liquid. Designed for dispensing juice, Nu-Twist presents a fun-shaped package that helps drive juice consumption through enjoyment and ensures portion control for a healthy lifestyle.

M-Pak Plus is designed to contain liquids and provide barrier properties for sauces and condiments, salad dressings, and oil-based products. The package can also be used for non-food products such as lotions, shampoos, and other personal care products. M-Pak Plus is available in 1/3 ounce to 4 ounces providing convenient portions.

These two package options provide a portion controlled serving of products that work well with today's "on-the-go" lifestyles. Both Nu-Twist and M-Pak Plus minimize end-user waste because the package shape is the most efficient use of material per unit of volume and allows for complete dispensing of the product.

The paper-based packages utilize a renewable resource and Milliken can coat the packages with PLA to create a 100 percent renewable package for sustainability.

Milliken & Company
864.503.6503
Spartanburg, SC
www.millikenchemical.com

Be sure to mention, "I read about it in *Food Protection Trends*"!

COMING EVENTS

AUGUST

- **7–9, Using SPC for HACCP Verification in Poultry and Food Industry,** University of Georgia Food Science, UGA Campus, Athens, GA. For more information, contact Marian at 706.542.2574; E-mail: marianw@uga.edu.
- **13–17, Introduction to Food Microbiology Short Course,** Boise State University, Boise, ID. For more information, contact Paula Peterman at 208.364.6188; E-mail: paulap@uidaho.edu.
- **21–23, Developing & Implementing Food Safety Programs,** Atlanta, GA. For more information, contact AIB International at 800.633.5137 or go to www.aibonline.org.

SEPTEMBER

- **11–12, GMA/FPA Advanced HACCP: Verification and Validation Workshop,** GMA/FPA Conference Center, Washington, D.C. For more information, contact Jenny Scott at 202.639.5985 or go to http://www.fpa-food.org/content/FSW.asp.
- **11–12, Meat & Poultry HACCP Accredited Workshop,** University of Georgia Food Science, UGA Campus, Athens, GA. For more information, contact Marian at 706.542.2574; E-mail: marianw@uga.edu.
- **12, Ohio Association for Food and Environmental Sanitarians Annual Meeting,** Ohio Dept. of Agriculture, Reynoldsburg, OH. For more information, contact Gloria Swick-Brown at 614.466.7760; E-mail: gloria.swick-brown@odh.ohio.gov.
- **12–13, China International Food Safety and Quality Conference and Expo,** The Landmark Tower Hotel, Beijing, China. *Program assistance provided by IAFP.* For more information, go to www.chinafoodsafety.com.
- **16–20, 121st AOAC Annual Meeting and Exposition,** Anaheim, CA. For more information, call 301.924.7077 ext 112, 124, and 146 or go to www.aoac.org/meetings.
- **18–20, New York State Association for Food Protection 84th Annual Conference,** E. Syracuse, NY. For more information, contact Janene Lucia at 607.255.2892; E-mail: jgg3@cornell.edu.
- **19–21, Washington Association for Food Protection Annual Meeting,** Campbell's Resort and Conference Center, Lake Chelan, WA. For more information, contact Stephanie Olmsted at 206.660.4594; E-mail: Stephanie.Olmsted@safeway.com.
- **24–26, Indiana Environmental Health Association Fall Conference,** Radisson Hotel, Merrillville, IN. For more information, contact Pat Minnick at 765.483.4458; E-mail: pminnick@co.boone.in.us.
- **24–27, Dairy Technology Workshop,** Randolph Associates, Inc., Birmingham, AL. For more information, call 205.595.6455; E-mail: Henry.Randolph@raiconsult.com.
- **25–27, Wyoming Environmental Health Association Annual Educational Conference,** Little America Hotel & Resort, Cheyenne, WY. For more information, contact Doug Evans at 307.686.8036; E-mail: devans2@state.wy.us.

OCTOBER

- **3–4, Advanced HACCP for Meat & Poultry Processors Workshop,** University of Georgia Food Science, UGA Campus, Athens, GA. For more information, call 706.542.2574; E-mail: marianw@uga.edu.
- **7–10, AACC International Annual Meeting,** San Antonio Convention Center, San Antonio, TX. For more information, go to http://meeting.aaccnet.org.
- **9–11, North Dakota Environmental Health Association Educational Conference,** Bismarck, ND. For more information, contact Debra Larson at 701.328.1291; E-mail: djlarson@state.nd.us.
- **10–11, Associated Illinois Milk, Food and Environmental Sanitarians Annual Meeting,** Stoney Creek Inn, East Peoria, IL. For more information, contact Steve DiVincenzo at 217.785.2439; E-mail: steve.divincenzo@illinois.gov.
- **11–12, GMA/FPA HACCP for Juice and Other Beverages Workshop,** GMA/FPA Conference Center, Washington, D.C. For more information, contact Jenny Scott at 202.639.5985 or go to http://www.fpa-food.org/content/FSW.asp.
- **15–17, GMA/FPA Prerequisite Programs and Sanitary Design Workshop,** Cornell University's Statler Hotel, Ithaca, NY. A workshop to formalize your HACCP foundation. For more information, contact Bob Gravani at 607.255.3262; or go to http://www.fpa-food.org/content/FSW.asp.
- **15–17, 2nd Food Processing Suppliers Association,** Las Vegas Convention Center, Las Vegas, NV. For more information, call 703.761.2600 or go to www.fpsa.com.
- **18–19, IAFP 3rd European Symposium,** Sheraton Roma Hotel & Conference Center, Rome, Italy. For more information, call 800.369.6337 or go to www.foodprotection.org.
- **21–24, UWRF 27th Food Microbiology Symposium and Workshop,** *Current Concepts in Foodborne Pathogens and Rapid and Automated Methods in Food Microbiology,* University of Wisconsin-River Falls, River Falls, WI. For

IAFP UPCOMING MEETINGS

AUGUST 3-6, 2008
Columbus, Ohio

JULY 12-15, 2009
Grapevine, Texas

COMING EVENTS

more information, call 715.425.3704 or go to www.uwrf.edu/foodscience, click on workshops, then the link to the food microbiology symposium.

- **24–27, Worldwide Food Expo,** McCormick Place, Chicago, IL. For more information, call 703.934.5514 or go to www.worldwidefoodexpo.com.

NOVEMBER

- **3–7, APHA 135th Annual Meeting and Expo,** Washington, D.C. For more information, call 202.777.APHA (2742) or go to www.apha.org.
- **6–7, 2nd Annual International Conference for Food Safety/Quality,** San Francisco, CA. For more information, go to www.foodhaccp.com.
- **8, Ontario Food Protection Association 49th Annual Meeting,** Mississauga Convention Centre, Mississauga, Ontario. For more information, contact Gail Seed at 519. 463.5674; E-mail: seed@golden.net.

DECEMBER

- **3–5, HTST Workshop,** Randolph Associates, Inc., Murfreesboro, TN. For more information, call 205.595.6455; E-mail: Henry.Randolph@raiconsult.com.

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Research responsibilities include the development of a creative, independent and productive research program in microbial food safety is a fundamental and indispensable requirement of the position, including publication of results in professional/scientific journals. The successful candidate will be expected to develop an on-going research program in food-borne pathogens at the molecular, organismal or host-population level. Individual will provide leadership in directing research projects of graduate students.

Service: The successful candidate is expected to work with state agencies and campus groups in identifying research needs in food safety and to be a consultative resource for those agencies. University and public service through committee work, participation in professional organizations, continuing education and other appropriate means is required. To receive fullest consideration, applications must be received by August 31, 2007; position open until filled. Interested applicants should submit (1) a letter of intent outlining special interest in the position, overall related qualifications and experience and career goals; (2) curriculum vitae; and (3) the names and addresses of four professional references to: Dr. P.H. Kass, Chair, Attn: Debra Amundson, MSO, Department of Population Health and Reproduction, School of Veterinary Medicine, University of California, Davis, CA 95616.

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Research Notes

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THOUGHTS
ON TODAY'S FOOD SAFETY...

What's Your Score, Mate?

Douglas Powell
Kansas State University
Manhattan, Kansas

Sydney, Australia is a great city. And it'd be even better if restaurants and regulators provided the public with information about the safety of the city's restaurants.

Restaurants and food service establishments are a significant source of the foodborne illness that strikes up to 30 per cent of citizens in so-called developed countries each and every year.

Sydney officials are now being pressured to release information about the safety of local restaurants and bolster restaurant safety in general.

After watching the mish-mash of federal, state and local approaches to restaurant inspection in a number of western countries for the past decade, I can draw two broad conclusions:

- Anyone who serves, prepares or handles food, in a restaurant, nursing home, day care center, supermarket or local market needs some basic food safety training; and,
- the results of restaurant and other food service inspections must be made public.

Here's why.

Parenting and preparing food are about the only two activities that no longer require some kind of certification in Western countries. For example, to coach little girls playing ice hockey in Canada requires 16 hours of training. To coach kids on a travel team requires an additional 24 hours of training.

It's unclear how many illnesses can be traced to restaurants, but every week there is at least one restaurant-related outbreak reported in the news media somewhere. Cross contamination, lack of handwashing and improper cooking or holding temperatures are all common themes in these outbreaks — the very same infractions that restaurant operators and employees should be reminded of during training sessions, and are judged on during inspections. Some jurisdictions — such as the city of Fort Worth, Texas — place so much importance on teaching these lessons they require mandatory food-handler licenses and have invested in an infrastructure of training that demonstrates the city's commitment to public health. Other cities and states have no training requirement.

There should be mandatory food-handler training, for say, three hours, that could happen in school, on the job, whatever. But training is only a beginning. Just because you tell someone to wash the poop off their hands before they prepare salad for 100 people doesn't mean it is going to happen; weekly outbreaks of hepatitis A confirm this. There are a number of additional carrots and sticks that can be used to create a culture that values microbiologically safe food and a work environment that rewards hygienic behavior. But mandating basic training is a start.

Next is to verify that training is being translated into safe food-handling practices through inspection. And those inspection results should be publicly available.

A philosophy of transparency and openness underlies the efforts of many local health units across North America in seeking to make available the results of restaurant inspections. In the absence of regular media exposes, or a reality TV show where camera crews follow an inspector into a restaurant unannounced, how do consumers — diners — know which of their favorite restaurants are safe?

Cities, counties and states are using a blend of Web sites, letter or numerical grades on doors, and providing disclosure upon request. In Denmark, smiley or sad faces are affixed to restaurant windows.

Publicly available grading systems rapidly communicate to diners the potential risk in dining at a particular establishment and restaurants given a lower grade may be more likely to comply with health regulations in the future to prevent lost business.

More importantly, such public displays of information help bolster overall awareness of food safety amongst staff and the public — people routinely talk about this stuff. The interested public can handle more, not less, information about food safety.

Lots of cities still do not disclose restaurant inspection results, worried about the effect on business, but they aren't great cities.

Sydney is.

And instead of waiting for politicians to take the lead, the best restaurants, those with nothing to hide and everything to be proud of, will go ahead and make their inspection scores available — today.

Douglas Powell is scientific director of the International Food Safety Network at Kansas State University, foodsafety.ksu.edu; Phone: 785.317.0560; dpowell@ksu.edu.

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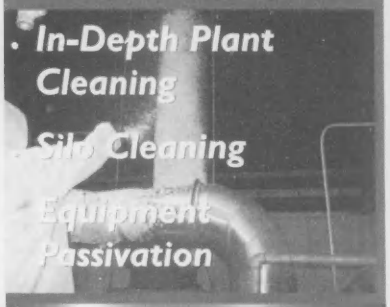

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