



RESEARCH AND EXTENSION

PROGRAM UPDATES AND HIGHLIGHTS

FOOD SAFETY

SITUATION

The goal of food safety programs is to prevent food-borne illnesses. Millions of illnesses and thousands of deaths in the United States each year can be traced to contaminated food. Between 6.5 million and 81 million cases of food-borne illnesses and as many as 9,100 deaths occur each year. Experts believe the risk of food-borne illnesses has been increasing over the last 20 years.

Food-borne illnesses generally cause temporary disorders of the digestive tract, but they also can lead to serious long-term health consequences. In a small percentage of cases, food-borne infections spread through the bloodstream to other organs, resulting in serious long-term disability or death. For example, *E. coli* 0157:H7 can cause kidney failure. Salmonella can lead to reactive arthritis, serious infections, and deaths. Listeria can cause meningitis and stillbirths. *Campylobacter* may be the most common factor leading to Guillain-Barre syndrome, which is now one of the leading causes of paralysis from disease in the United States. Estimates of the cost of food-borne illnesses range from over \$5 billion to \$22 billion annually. At least 30 pathogens (harmful organisms) are associated with food-borne illnesses.

Bacterial pathogens are the most commonly identified causes of outbreaks of food-borne illnesses. They can be transmitted and can multiply rapidly in food. The Centers for Disease Control and Prevention (CDC) has targeted four causes of greatest concern: *E. coli* 0157:H7, *Salmonella enteritidis*, *Listeria monocytogenes*, and *Campylobacter jejuni*. Many people associate food-borne illnesses

primarily with meat, poultry, eggs, and seafood products, but many other foods—including milk, cheese, ice cream, orange and apple juices, cantaloupes, and vegetables—were involved in outbreaks during the last decade.

It is well known that food-borne illnesses are under reported, so the amounts in the chart below probably do not come close to the actual number of illnesses.

HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP)

Hazard Analysis and Critical Control Points (HACCP) is a food-safety system that can be applied across the food system: in food production, food processing/manufacturing, distribution, retail markets, foodservice operations, and in the home. HACCP focuses on preventing hazards, relies on a scientific base, permits more efficient and effective government oversight, and places responsibility for ensuring food safety on the various food operations.

HACCP calls for a science-based analysis of potential hazards (microbiological, physical, and chemical), determinations of where problems can occur, taking measures to prevent them, and taking corrective actions if they do occur. Detailed HACCP records allow the food operation and government inspectors to monitor how well the operation is performing on a continual basis. In Kansas, HACCP training programs are in progress for meat processors and foodservice people.

Microorganisms are everywhere and often contaminate raw agricultural food products. Some microbes survive preservation treatments. Humans also may contaminate foods during

KANSAS DATA - 1995

Disease	N of Cases	Counties where reported
Botulism	1	Cheyenne
Campylobacteriosis	238	Allen, Atchison, Clark, Cheyenne, Chase, Clay, Douglas, Dickinson, Edwards, Elk, Ford, Franklin, Grant, Harvey, Jackson, Jefferson, Johnson, Leavenworth, Montgomery, Marion, Morris, Nemaha, Neosho, Osage, Pratt, Pottawatomie, Rice, Riley, Reno, Saline, Stafford, Sedgwick, Sherman, Shawnee, Stanton, Trego, Wabaunsee, Wilson, Wyandotte
<i>E. coli</i> 0157:H7	29	Geary, Greenwood, Johnson, Leavenworth, Pawnee, Sedgwick, Shawnee, Wyandotte
Hepatitis A	162	Anderson, Bourbon, Coffey, Cherokee, Cowley, Douglas, Ellis, Finney, Ford, Franklin, Grant, Gray, Hodgeman, Harper, Harvey, Johnson, Kiowa, Leavenworth, Lyon, Montgomery, McPherson, Marshall, Ness, Riley, Reno, Saline, Sedgwick, Shawnee, Sumner, Seward, Wyandotte
Salmonellosis	363	Atchison, Bourbon, Barton, Butler, Clark, Cherokee, Crawford, Chase, Clay, Douglas, Dickinson, Elk, Ellis, Ellsworth, Finney, Ford, Franklin, Geary, Greenwood, Harvey, Jefferson, Johnson, Kearny, Labette, Lane, Leavenworth, Lyon, Montgomery, Miami, Marion, McPherson, Morris, Marshall, Nemaha, Neosho, Norton, Osborne, Osage, Phillips, Pawnee, Pratt, Pottawatomie, Rice, Riley, Reno, Rush, Saline, Scott, Sedgwick, Sherman, Shawnee, Sumner, Seward, Trego, Wyandotte

production, processing, distribution, and preparation. Any food, whether raw or processed, may carry some level of risk for food-borne illness if not handled properly before consumption.

Everyone in the food system — from the production of raw commodities to the consumption of food in foodservice operations or homes—must take responsibility for proper food handling to control microorganisms and prevent food-borne illnesses. Each part of the system and each individual has a significant role in food safety during acquisition, storage, preparation, and servicing and handling.

RESEARCH

Research efforts at K-State Research and Extension this past year have focused on improved technologies for slaughter and processing as well as microbiological and chemical residue testing.

Knife trimming, steam/hot water vacuuming, and steam pasteurization. Research has shown that trimming on beef carcasses improves their microbiological and physical cleanliness. Additionally, when coupled with proper carcass washing, knife trimming produces a clean carcass. This finding is relevant for gross deposits of contamination. Also, smaller deposits of contamination can be effectively removed by steam/hot water vacuuming. These findings provided the bulk of the evidence used by USDA/Food Safety Inspection Service (FSIS) to approve the trim/vacuum procedure under the zero-tolerance policy. Scientific evidence about the effectiveness of steam pasteurization of beef carcasses convinced industry, consumer, and government groups to collectively support this technology. Because the research results were quickly communicated to the industry by KSU researchers, these three technologies have been rapidly implemented.

Processed meat validation studies. KSU has specially designed microbiology laboratories that mimic commercial processing and include state-of-the-art meat processing equipment (fermentation, smoking, cooking, and drying chambers). Utilizing a biohazard pilot plant, the meat processing can be tested by inoculation studies using *E. coli* 0157:H7, salmonella, or other pathogens under controlled conditions. Currently, research projects are evaluating dry and semi-dry sausage processes to determine whether they control *E. coli* 0157:H7. Other research involves evaluating post-slaughter microbiological intervention technologies for beef trimmings and developing critical control points for ground beef manufacturers.

Slaughter process validation studies. KSU is planning a dedicated slaughter facility to allow intentional inoculation of carcasses for the purpose of evaluating emerging technologies. If a particular technology is shown to be effective in a controlled inoculation study, then it would be verified in full-scale plant trials under normal processing conditions. This approach would provide scientific validation that:

- 1) The technology is effective in controlling specific pathogens
- 2) The technology works well in a commercial plant environment
- 3) The technology does not result in adulteration or misbranding.

This comprehensive approach, with support from consumer groups, labor groups, and industry trade associations, will help to facilitate the USDA regulatory approval process.

Microbiological and chemical testing. On several occasions in recent years, the National Academy of Sciences (NAS) has recommended that FSIS “intensify its current efforts to control and eliminate contamination with microorganisms that cause disease in humans.” The NAS has further advised that “scientifically valid microbiological data must be the foundation of a ‘sound...scientifically based’” inspection program. Microbiological testing, therefore, will play an increasingly important role in meat inspection and in the future implementation of HACCP. Daniel Y. C. Fung, Professor of Animal Sciences and Industry, has been actively engaged for many years in research on Rapid Methods and Automation in Microbiology. He is working to improve methods in the isolation, early detection, characterization, and enumeration of microorganisms and their products in clinical, food, industrial, and environmental samples. Such methods can greatly reduce the time, money, space, and labor in performing routine microbiological tests, thus making an impact on food safety evaluations and improvement of quality of food supplies. The most recent chemical residue detection studies have focused on *Fusarium* mycotoxins, dioxins, and heterocyclic amines in beef tissues. K-State is evaluating the impact of processing on these compounds and the formation of other compounds during processing.

Prevalence of *E. coli* 0157:H7 in beef cattle herds from farm to feedlot. This is the first year of an on-farm survey of the incidence and prevalence of the food-borne human pathogen *E. coli* 0157:H7 in large (more than 200 cows) and small (fewer than 100 cows) beef cow-calf herds in the Flint Hills. Fecal samples are collected from at least 10 percent of each of the cow herds at regular intervals throughout a complete production cycle (three-year period). Preliminary results suggest that this pathogen is shed by a small percentage of cattle in several of the 22 herds being studied. There would appear to be some circumstances on farms, including the calving period, when the incidence of the shedding of the pathogen increases. Comprehensive management data is being collected for each farm operation so that a correlation can be made between management practices and incidence of *E. coli* 0157:H7. The aim is to find economical management practices that will decrease or eliminate the incidence of this pathogen in cattle going into the food chain.

Inter-institutional study of the prevalence of salmonella human pathogens in cull dairy cattle at slaughter sites in four regions in the United States. The first phase of this study has been completed. Fecal samples were collected from cull dairy cattle just prior to their entering slaughter plants in five states, and carcass swabs were collected from these same animals in the slaughter plants. The samples and swabs were cultured for salmonella human-pathogen species. Preliminary data show there is wide spread of salmonella human-pathogens in both the fecal samples and on the carcasses of these animals in the slaughter

plant. Results from this investigation suggest that changes in plant management and inspection procedures could affect a reduction in the incidence of these pathogens on the cull-cow carcasses. There was no correlation between body-condition score and incidence of salmonella human-pathogens collected from these cows. There is strong interest in the dairy industry to expand this investigation to develop an Industry-Wide Total Quality Assurance Program. Federal funds will be needed to continue this research program and the development of that program.

Consumer perceptions of HACCP and the price of meat.

Four consumer focus groups have been conducted by K-State Research and Extension. Consumers completed a questionnaire to assess their overall food safety knowledge, then they were asked questions about meat quality and safety, including their reactions to meat safe-handling labels. Consumers viewed a 12-minute video segment on HACCP that briefly described HACCP in food processing environment. Then, the focus group participants responded to a "willingness to pay" simulation activity where they chose and determined the price of ground beef prepared with or without a HACCP system in place. Eighty percent of participants were willing to pay more for the HACCP-processed meat, but many questioned why meat was not already being processed utilizing that system. They reacted positively to information about HACCP and perceived it to add to the safety of meat. They indicated current meat handling labels are vague.

EXTENSION

Getting a Jumpstart on HACCP. Five one-day introductory HACCP training workshops were conducted throughout Kansas for foodservice operators and for meat and food processors, with 175 participants attending. They learned basic food safety behaviors and evaluated their knowledge of HACCP principles and ability to implement HACCP. They also rated their level of intended implementation of a HACCP system (from 1—will not implement to 5—will implement immediately). Mean scores ranged from 3.8 for monitoring critical control points to 3.3 for implementing a complete HACCP system. Reasons for not implementing the HACCP system were lack of time, lack of training, and cost. Significant differences were found between foodservice scores and processor scores for all phases of intended implementation, with processors scoring higher.

Food safety checklist for training and evaluation. The one-page, easy-to-use Food Safety Checklist is a guide to improving food-safety practices in a foodservice operation. The checklist can be used in training foodservice employees and in evaluating food-safety practices before and after training. The checklist incorporates HACCP principles and Food Code temperatures. Extension agents, sanitarians, and foodservice directors in commercial and noncommercial foodservice operations have used the checklist in a variety of ways. Extension agents used the checklist with food-safety training programs of school foodservice, health care, and retail operations. Sanitarians utilized the checklist dur-

ing routine inspections to educate foodservice operators about new food-safety actions/behaviors. Foodservice directors used it to train employees and to evaluate food-safety procedures within the operation. Those who have used it state that it is easy to read, concise, and applicable to HACCP practices, and that it is an excellent tool for training and monitoring day-to-day food-safety practices in a foodservice operation.

Food Safety on the Web. A nationally broadcast satellite video conference was produced by K-State Research and Extension to promote awareness and use of USDA's Food Safety Education Databases as critical resources in food-safety educational programming. Three databases were featured. Targeted audiences were Extension educators, public health educators, classroom teachers, foodservice personnel, and others who provide food-safety education. Program marketing was via the Internet and through the development of a special Web site and listserv. Two hundred fifty sites in 43 states were registered and down-linked to the video conference. Forty-eight site coordinator evaluations and 176 participant evaluations were received and analyzed. There was favorable response concerning content and presentation of the video conference and knowledge gained from the conference. Mean scores were higher than average on all questions. Two questions determined site coordinator and participant knowledge about and use of the databases before the video conference. Fifty percent of the site coordinators knew about the databases, but only 10 percent to 15 percent had used them. Only 20 percent of participants knew about the databases, and only 10 percent had used them. Respondents indicated they would use the databases following the video conference. Use of all three databases increased in the months following the video conference. The video conference was produced in cooperation with Michigan State University and the University of Wisconsin.

Benefits of food safety training in Kansas. Forty-seven (63 percent) Extension agents who had received SERVSAFE certification training responded to a survey about their local teaching/training activities. Sixty-two percent had conducted follow-up training in their communities. Programs had been conducted with community groups (29 percent), 4-H clubs (22 percent), foodservice operators (28 percent), and other groups (21 percent). Each agent had conducted 3.4 food safety training programs, with a mean time of 51 hours. Approximately 3,400 persons had attended these programs. Examples include a Kids Safety Fair at a local hospital where 300 youth and 75 parents learned correct hand-washing procedures; safe-food seminars for churches and community meals that targeted groups serving congregate meals; 10-hour to 12-hour short courses for school district foodservice personnel; elementary school classroom instruction using the Glo-Germ kit; and a 16-hour SERVSAFE certification course to university foodservice managers and supervisors. Extension agents indicated that approximately 55 percent of participants had made behavioral changes (based on follow-up and observation). These included better hand-washing and food-handling practices (thawing and cooling of foods and taking internal temperatures of cooked foods). An agent who had presented

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hand-washing demonstrations in schools returned and found hand washing signs posted. Child-care providers became concerned about their own food-safety practices and changed them by placing thermometers in refrigerators, using clean dish cloths and towels, keeping foods safer by reducing the time spent in the temperature danger zone, and not serving reheated leftovers. Through observation, extension agents determined that 4-H groups were using better sanitary practices at county fair food stands.

Food Safety Training for KanWork. This pilot project was conducted in seven counties to provide food-safety and job-skills training to KanWork (public assistance recipients) in cooperation between the Kansas Department of Social and Rehabilitative Service (SRS) and K-State Research and Extension. Local employment staff and county agents conducted food-safety and job-skills training. KanWork participants received 12 hours of food-safety training and 30 hours to 40 hours of job skills. A total of 31 participants received jobs, nine in foodservice. Participants increased their self-confidence and their knowledge of safe-food handling to apply at home as well as at work, and they had positive group experiences. Cooperation between the two agencies also was enhanced.

Shelf-life studies. A K-State Research and Extension laboratory offers the only comprehensive shelf-life studies for FDA-regulated products and includes chemical, physical, microbiological, and sensory testing during the shelf-life study. The shelf life of a product determines how long it will retain minimum quality characteristics before flavor, odor, visual, or other properties become less than satisfactory and prevent a customer from repeat purchases or from buying the product at all. Products with a short shelf life can limit production and storage capacities, distribution capabilities, and retail display time and eventually lead to increased economic loss with throwaways and discards. In the laboratory, parameters for individual products are discussed with clients and recommendations are made for lengthening a product's shelf life.

Processing authority for testing acidified foods. This service was developed in response to the need by Kansas manufacturers of condiments, pickles, salsas, sauces (including barbecue sauces), and/or salad dressings to provide proof of testing to FDA for products entering interstate commerce. FDA closed down several Kansas companies in the spring of 1996 until testing could be completed by a Processing Authority to show that the product characteristics or processing techniques would not support food pathogens. The laboratory investigated the regulations, potential risks, and liabilities associated with becoming a Processing Authority and began offering acidified food testing for Kansas companies in late spring 1996.

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