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FROM THE EDITOR

Food safety is a central subject for those regulatory officials at both Federal and state levels who are charged with protecting our food supply from farm to fork. Maintaining a high level of awareness on such matters as the sanitation of food contact surfaces is key to assuring that our food is kept free of the pathogenic organisms that are part of our environment. Also important is the food safety knowledge of those who handle food on the way to our table. Our food service industries are more and more populated by workers whose first language is something other than English. Professor Fraser from North Carolina State University in Raleigh offers us some interesting thoughts on the dimensions of this problem and how it can be addressed. This is an important step toward keeping our food safe for consumers and well worth reading by all of us who have a role in maintaining the safety of our food that is so critical to our health and well-being. We are in debt to all of our authors for their willingness to contribute to our better understanding of food safety issues and problems.

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Dr. Eifert received his graduate degrees in food science and technology from Virginia Tech and his B.S. degree in biology from Loyola Marymount University. Previously, he worked as a laboratory manager for the Nestlé USA Quality Assurance Laboratory in Dublin, Ohio, and as an analytical chemist for the U.S. Food and Drug Administration in Los Angeles, California.

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Wayne Zeimer is an employee of the USDA/FSIS. His present duties are in the FSIS, FERN National Program Office (NPO) working on developing systems to coordinate local, state and Federal laboratory activities in preparing and responding to food emergencies. He has recently been appointed as Senior Staff to coordinate activities in the FERN Southeast Regional Coordination Center. His responsibilities have included coordinating activities for accreditation of the three Field Laboratories and Special Projects and Outbreaks laboratory against ISO 17025, coordinating the update of quality procedures, reviewing method updates, instituting corrective actions, and auditing laboratories.

Mr. Ziemer was employed at the Minnesota Department of Agriculture. He was a Chemist/Analytical Laboratory Specialist. His responsibilities included meat analysis (proximate composition and additives), mycotoxin analysis for food and feed, method development, and verification of procedures used in regulatory work. He was a QA Officer responsible for Food Microbiology and Food Chemistry. His work included accreditation of dairy microbiology by the FDA, food chemistry by FSIS, Recognized Egg Laboratory Salmonella by FSIS and contract laboratory by USDA, AMS for microbiology, and chemistry of egg and poultry products. Mr. Ziemer obtained a Bachelor of Arts, Chemistry Major, Math Minor, from the University of Minnesota, Minneapolis.

ENVIRONMENTAL SURFACES - MANURE COMPOSTING

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Presentation made at the "*Food Safety: From the Surface Up*" Conference held in Myrtle Beach, SC, February 23-25, 2005.

Abstract

Composting is a practical manure pathogen-reduction treatment, but complete destruction of pathogens may not be necessarily assured by this process. In this study, we conducted a survey of three small farms in South Carolina for composting practices and microbiological safety of compost. About 500 g of each compost sample were collected aseptically from different locations of the composting piles. Selected variables such as moisture content, pH, temperature, mesophilic and thermophilic bacterial counts, *E. coli*/coliform counts, and the presence of *Salmonella* spp., *E. coli* O157:H7 and *Listeria* spp. were determined according to standard methods. Results of our study indicate that moisture content, pH, temperature, and bacterial counts of compost varied greatly at different locations throughout the composting pile. Total bacterial counts were in the range of 10^4 to 10^{10} cfu/g, and coliform counts were from <25 to 10^6 cfu/g. A few composting samples were tested positive for *E. coli*, *Salmonella* or *Listeria*, and the majority of *E. coli* and *Salmonella* isolates were from the surface samples of compost. Our study provided some very relevant information regarding the microbiological aspects during composting under farm conditions, and also suggested that the compost surface should be a critical control point to ensure the safety of compost products.

Introduction

Animal manure is frequently used as a fertilizer or as a soil amendment among farmers and produce growers, and the demand for manure is projected to increase as organically grown vegetables and fruits gain in popularity. However, animal manure frequently contains enteric pathogenic microorganisms, and land application can lead to pathogen entry to the food chain if microbial contamination in manure is not properly controlled (Pell, 1997).

Many cases of foodborne illnesses have been associated with the consumption of fresh vegetables in part likely contaminated by manure from ruminants or poultry (CDC, 1997; Cieslak et al., 1993; Schlech et al., 1983). Both *Escherichia coli* O157:H7 and *Salmonella* spp. are carried by ruminants, especially cattle, and are shed in their feces (Doyle et al., 1997; Hosek et al., 1997). *Listeria monocytogenes* is widely distributed in the environment, and is associated with decaying vegetation, soil, sewage and feces of animals (Swaminathan, 2001). Recent outbreaks of *E. coli* O157:H7, *Salmonella* spp., and *L. monocytogenes* infections have been associated with lettuce, cabbage, and alfalfa sprouts (CDC, 1997; Cieslak et al, 1993; Schlech et al., 1983).

Composting is used on many farms as a managed treatment in which the heat generated by microbial action in the process may kill weeds, insects, and many microorganisms (including pathogens) (Rynk, 1992). According to the United States Department of Agriculture (USDA) guidelines, composts based on animal manures should reach internal temperatures of 55^{o}C for a minimum interval of 3 days (USDA, 2000). Most small farmers and organic growers adopt "passive" composting techniques with little or no inputs (Granberry, 2003). However, a static manure pile with little to no turning does not consistently and uniformly produce sufficiently high temperatures for pathogen inactivation. Our previous study based on the composting of bovine manure in a laboratory-scale bioreactor also found that the compost temperature, moisture content, and pH, the inactivation of *E. coli* O157:H7 varied significantly at various locations inside the bioreactor (Jiang et al., 2003).

Current on-farm composting practices vary considerably in terms of how closely they adhere to recommended practices for pathogen destruction in manure (Rangarajan et al., 2002). Therefore, a comprehensive survey of the pathogen and indicator microorganism profiles of compost and composting practices on small farms will provide baseline information on the prevalence of human pathogens in compost and help to identify strategies that reduce risks from improperly composted manure application.

Materials and Methods

Sample preparation: Samples were taken from six compost piles at three small poultry farms in upstate South Carolina. Duplicate samples were taken at the surface, 60- and 90-cm depths in the compost piles from Farms A & G, and at the surface, 40- and 60-cm depths in the compost of Farm M. At each location, portions of the sample were taken aseptically from different spots to obtain a composite sample representative of the pile. Both temperature and oxygen level at each location were recorded during sampling using the OT-21 probe (Demista Instruments, IL).

Bacterial enumeration: Serial dilutions of the compost samples were made using 0.1% peptone water. The dilutions were then plated on Trypticase soy agar (TSA) (Difco, Detroit, MI), and incubated at 30 and 42^{o}C overnight for enumeration of mesophilic and thermophilic bacteria, respectively. Both *E. coli* and coliforms were enumerated by plating serial dilutions of the sample on 3M^{TM} Petrifilm^{TM} *E. coli*/coliform count plates (3M Microbiology, St. Paul, MN).

Pathogen detection: Twenty five grams of the sample were mixed with 225 ml of universal pre-enrichment broth (UPB) (Difco, Detroit, MI), and were incubated at 35°C for 24 hrs. with shaking. The pre-enrichment culture was inoculated into Fraser, Tetrathionate (TT), modified TSB broth (mTSB) with novobiocin broths for *Listeria*, *Salmonella*, and *E. coli* O157:H7detection, respectively. Anti-*Listeria*, anti-*Salmonella*, and anti-*E. coli* O157 Dynabeads® (Dynal Biotech, Oslo, Norway) were used to concentrate those pathogens from the selective broths, and the samples were plated on appropriate selective agars. The suspected colonies were picked, purified by quadrant streaking, then preserved in TSB with 20% glycerol at –80°C for further analysis.

Other analysis: pH determination — Compost sample (1 g) was added to 50 ml of distilled water in an Erlenmeyer flask. The suspension was stirred for 5 min, and then allowed to settle for 5 min. The pH of the liquid was determined with an Accumet Basic pH meter (Fisher Scientific); Moisture content — Compost sample (1 g) was weighed and dried at 105°C for 24 h in a Precision oven (Precision Scientific), then weighed.

Results and Discussion

Three poultry farms in upstate South Carolina were recruited in this study for providing us with compost samples periodically (Fig. 1). Windrow, static pile, and bin composting systems were used on those farms to deal with poultry mortality or chicken litter. Each composting pile was monitored monthly throughout this study. The composting practice operated on those farms is quite different (Table 1). Farm A has the windrow operation, and the compost piles are bigger but are turned weekly. Both Farms M and G compost dead chicken carcasses in small static piles, and new materials were added to the existing piles periodically. Except for Farm M, there was a lack of temperature monitoring during the composting process on the farms. None of these farms tested for moisture, oxygen or pH of those compost piles.

Table 1 summarized the results of moisture content, pH, temperature, and bacterial counts of each compost pile on those farms. Results from Farm A were presented in detail in Figures 2-5. Pile I was the initial mix of one part chicken litter with two parts of pine shaving, whereas pile P consisted of one part of initial mix (1.5 months into composting) and two parts of pine shaving. Both piles were started in mid-October, 2004, and the piles were turned mechanically once every week.

Figure 2 shows that, over the sampling times, the temperature inside Piles I ranged in value from 28 to 65°C, with the highest temperature being found at the 60-cm depth. Except for on the March 21 sampling date, the temperatures inside

Pile P at both 60- and 90-cm depths were lower than those in Pile I, suggesting that the Pile I mix was favorable for microbial activities. Inside both piles, the 90-cm depth sample site was closer to the ground as compared with 60-cm depth. The lower temperatures observed at 90-cm depths may be due to heat loss to the environment through the ground, especially during winter months when ambient temperatures drop to 0-10^{o}C. In addition, at the deeper location, the microbial activity may be slower since the materials were packed tight with a low oxygen level. According to the USDA guidelines, compost must achieve a minimum temperature of at least 55^{o}C and remain there for a minimum interval of 3 days for static pile, and for 15 consecutive days with the materials turned at least five times for windrow composting (USDA, 2000). Since the temperature stratified throughout the compost pile, the recommended minimum temperature may not ever be reached in some locations, especially at or near the surface or ground.

The moisture content ranged from a maximum of 51.8% to a minimum of 5.0% in those compost piles (Table 1). Obviously, most piles had moisture contents much lower than the optimal 40-65% moisture contents required for active composting (Rynk, 1992). The data from Figure 3 shows that moisture contents were lower initially in both piles; however, after the addition of new materials prior to the Feb. 18, 2004 sampling date, the moisture contents of the compost were adequate inside the piles but not at the surface. The pH ranged from a maximum of 8.9 to a minimum of 4.7, which varied significantly among types of compost mixture (Table 1). The pH was generally low in samples collected from Farm A as compared with Farms G and M, which compost dead birds routinely. Inside the piles, the oxygen level was depleted to less than 3% at both 60- and 90-cm depths, near anaerobic condition (Fig. 5). For effective composting, the minimum oxygen level inside the pile is recommended as 5%, which may be achieved by frequent turning, the addition of bulking agents, and the forced air into the pile. As for Farm A, weekly pile-turning seems not sufficient to maintain the aerobic environment inside the piles.

The population of mesophilic microorganisms was kept relatively constant during the period we monitored (Fig. 5). The number of mesophilic microorganisms was about 1~2 log cfu/g higher at the surface than at both 60- and 90-cm depths (Table 2). A similar trend was observed for thermophilic microorganisms in both compost piles (data not shown). As the temperature increased throughout the composting system, thermophilic bacteria were present in higher levels than mesophilic bacteria, which is to be expected.

Coliforms were detected in 72%, 43%, and 73% of compost samples taken from farms A, G, and M, respectively (Table 2). The coliform populations were in the range of <25 to >10^{6} cfu/g (data not shown). Among 101 compost samples analyzed, there were seven samples positive for *E. coli*, a fecal indicator microorganism, with the highest count of CA. 10^{5} cfu/g in one surface sample. *E.*

coli was detected most often on the surface at which the compost temperature was the lowest throughout the composting pile (Table 2). The presumptive *Salmonella* was detected in three surface samples and one sample at the 60-cm depth on Farm M only, where some dead birds were added to the composting bin prior to our sampling. In addition, thirteen compost samples were tested presumably positive for *Listeria* spp. Unlike *E. coli* and *Salmonella*, 8 out of 13 *Listeria*-positive samples were taken from the inside piles. For all compost samples, *E. coli* O157:H7 was not detected, which is expected due to low prevalence of this pathogen in the poultry environment. In straw and pig manure, *E. coli* was inactivated at 55^{o}C within 2 h in a lab setting, but grew in the compost heap when the compost was conducted at mesophilic temperatures outdoor (Turner, 2002). Mote et al. (1988) reported that coliform bacteria in static compost piles of dairy waste solids decreased to low or undetectable populations early in the composting period, but populations increased as the composting process proceeded. This regrowth of coliforms was probably due to a small population of the bacterium that survived the composting process. These results were based on the microbiological analysis of a composite sample of the compost pile. In our study, the detection of fecal indicator microorganisms and human pathogens from surface samples suggests that the surface samples may not reach the temperatures needed in order to inactivate microorganisms. Apparently, the compost surface should be a critical control point to ensure the microbiological safety of compost products.

Our results demonstrated that moisture content, pH, temperature, and bacterial counts of compost varied greatly on the surface vs. at different locations within the composting pile. In general, the mesophilic bacterial counts were higher but the temperatures and moisture contents were lower on the surface than those inside the composting pile. The heterogeneous nature of the composting systems may have an effect on the safety of the resulting product, as not all locations are able to reach temperatures high enough to eliminate the presence of pathogens. Survival of pathogens can pose a potential health risk, especially if the inadequately composted product is applied to agricultural products such as fresh produce. It is important that those who are operating compost systems on small farms ensure that the compost is turned thoroughly and the temperature and moisture of the compost are monitored routinely. Furthermore, additional control methods may be applied to the compost surface to ensure the safety of compost products.

Acknowledgements

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Figure Legends

Figure 1. Pictures of composting piles on Farms A, G , and M.
Figure 2. Temperature profiles of two composting piles on Farm A.
Figure 3. Moisture content profile of two composting piles on Farm A.
Figure 4. Oxygen profiles of two composting piles on Farm A.
Figure 5. Mesophilic bacterial profile of two composting piles on Farm A.

Figure 1.

Farm A **Farm G** **Farm M**

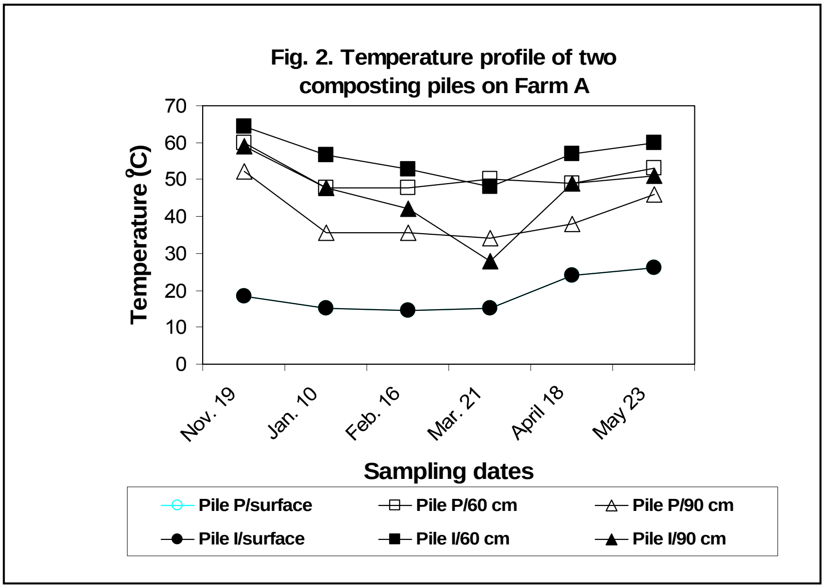
Fig. 2. Temperature profile of two composting piles on Farm A
Temperature °C)
70
60
50
40
30
20
10
0
Nov. 19
Jan. 10
Feb. 16
Mar. 21
April 18
May 23
Sampling dates
Pile P/surface
Pile P/60 cm
Pile P/90 cm
Pile I/surface
Pile I/60 cm
Pile I/90 cm

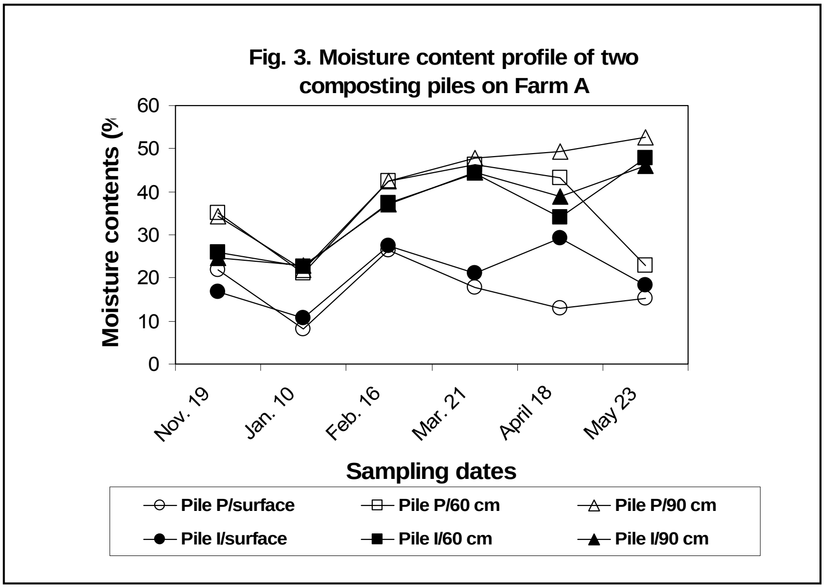
Fig. 3. Moisture content profile of two composting piles on Farm A
Moisture contents (%
60
50
40
30
20
10
0
Nov. 19
Jan. 10
Feb. 16
Mar. 21
April 18
May 23
Sampling dates
Pile P/surface
Pile P/60 cm
Pile P/90 cm
Pile I/surface
Pile I/60 cm
Pile I/90 cm

Fig. 4. Oxygen profile of two composting piles on Farm A

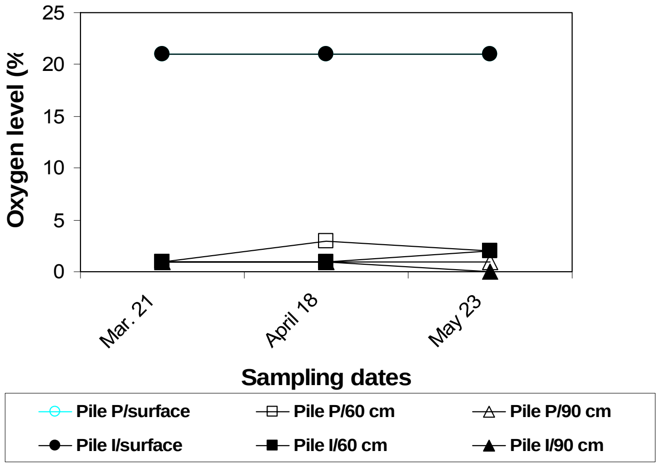

Fig. 5. Mesophilic bacterial profile of two composting piles on Farm A

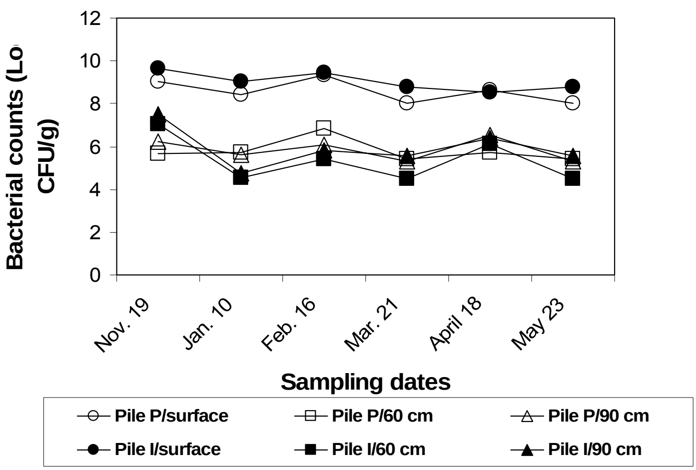

Table 1: Summary of six composting piles on three poultry farms

Farm	Temp. range (°C) (inside pile)	pH range	Moisture content (%)	Bacterial counts (cfu/g)	Compost mixture (N source)
A	28~65	4.7~7.2	8.1~44.6	$3x10^4$~$2x10^{10}$	Poultry litter
G	36~55	8.3~8.9	9.0~27.0	$7x10^4$~$5x10^8$	Poultry litter, dead chickens
M	5.5~43	6.0~8.9	5.0~50.8	$2x10^5$~$4x10^8$	Poultry litter, dead chickens

Table 2. Samples positive for *E. coli*/coliform and presumptive pathogens

Farm	Depth from surface (cm)	Coliform	*E. coli*	Presumptive *Salmonella* spp.	Presumptive *Listeria*. spp.
A (n=36)[a]	0	10	3	0	2
	60	8	0	0	1
	90	8	0	0	1
G (n=35)	0	9	1	0	2
	60	4	0	0	4
	90	2	1	0	1
M (n=30)	0	9	2	3	1
	40	7	1	0	1
	60	6	0	1	0

[a]: total samples tested.

AN UPDATE OF FOOD EMERGENCY RESPONSE NETWORK (FERN) ACTIVITIES

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The Food Emergency Response Network (FERN) integrates the nation's food-testing laboratories at the local, state, and Federal levels into a network that is able to respond to emergencies involving biological, chemical, or radiological contamination of food. The FERN structure is organized to ensure federal and state interagency participation and cooperation in the formation, development, and operation of the network. Organizations with representatives on the FERN Steering Committee include state agriculture, environmental, public health, and veterinary diagnostic laboratories as well as federal partners from HHS (FDA, CDC), USDA (FSIS, APHIS, AMS, GIPSA), US Customs, DOD, FBI, EPA, and DHS. The FERN Steering Committee is co-chaired by senior executives from the USDA Food Safety and Inspection Service and HHS Food and Drug Administration.

The FERN plays a number of critical roles related to foodborne terrorism. These include:

1. Prevention. FERN provides a national surveillance program that will offer early means of detecting threat agents in the American food supply;
2. Preparedness. FERN prepares the nation's laboratories to be able to respond to food-related emergencies;
3. Response. FERN offers significant surge capacity that will allow the nation to respond to widespread complex emergencies related to agents in food; and
4. Recovery. The FERN network of laboratories enhances the ability of the country to restore confidence in the food supply either after an emergency or in response to threats.

As of July 2005, there are 114 laboratories representing 48 states and Puerto Rico that have successfully completed the FERN Laboratory Qualification Checklist for participation in the network, including eight Federal agencies, thus providing a framework to build upon. Participation continues to grow. Once completed, FERN will encompass a nationwide network of Federal, state, and local laboratories capable of testing the safety of thousands of food samples, thereby enhancing the nation's ability to swiftly respond to a terrorist attack.

The operational structure of FERN consists of National Program Offices (NPO) located in Rockville, Maryland, and Athens, Georgia, and five Regional Coordination Centers (RCCs) located across the U.S. FDA and FSIS are holding FERN Regional Coordination Center (RCC) meetings to establish operational/communication guidelines within each FERN region, communicate FERN objectives, policies and current activities, enhance collaboration between FERN laboratories within a region, and provide an opportunity for individual regions to tailor response plans to their state policies and regional needs for interaction. Regional meetings for the Northeast, Southwest, and Southeast regions were held in 2004. Regional meetings for the Central and Pacific regions are planned for August 2005.

The FERN National Program Office coordinates support program activities in the following areas; Method Development and Validation, Training, Proficiency Testing, Surveillance, and Electronic Communication.

The Methods Development and Validation Committee has identified a limited number of analytes (and appropriate methods if available) and food commodities that are the focus of initial FERN efforts. Initial training, proficiency, and surveillance activities will focus on these targeted analytes. As the FERN develops and as resources become available, the scope and complexity of the support programs will broaden, and laboratory capabilities and capacity will be expanded to include a comprehensive list of biological, chemical, and radiological threat agents.

The objectives of the FERN Training Committee are to construct and implement an effective training curriculum for FERN member labs, to enhance lab capabilities to detect intentional biological, chemical, and radiological food contaminants, and to develop and promote the use of standard methods among member labs. These objectives are accomplished by utilizing a blended learning approach of e-learning modules, face-to-face training, on the job training, and proficiency and training practice samples. Training courses have been planned for all FERN analytical disciplines (chemical, microbiological, radiological).

The training courses for 2005 included:

- FERN Real-Time PCR training held at the Virginia Consolidated Laboratory facility in Richmond, VA
- FERN Screening Methodologies for Detection of *Bacillus anthracis* and *Yersinia pestis* held in Laurel, Maryland
- FERN Radiological Workshop was held in Winchester, Massachusetts
- FERN Chemistry Training (two courses covering GC/MS and LC/MS), scheduled to be held in Cincinnati, Ohio

For fiscal year 2006, there will be a minimum of five face-to-face sessions starting sometime after October 1st. These sessions will be identified after the training committee meets later this summer and discusses training needs. After the needs are identified, courses will be developed in conjunction with FERN member laboratories. Web-based training is being developed. General information related to the FERN as well as advanced analytical techniques and analyses will be taught via Web-based training.

The goal of the Proficiency Testing committee is to provide proficiency testing for FERN laboratories for the chemical, radiological and microbiological analysis of counter-terrorism food samples. The committee has developed Standard Operating Procedures (SOPs) for the FERN Proficiency Testing Program that will evaluate the capability of laboratories to detect contaminants and ensure the FERN laboratories can demonstrate the ability to successfully conduct the analysis of counter-terrorism samples. The Laboratory Quality Assurance Branch of the Division of Compliance at CFSAN is overseeing and managing the microbiology testing program. The FDA's Winchester Engineering and Analytical Center is overseeing and managing the radiological testing program. The FDA's Forensic Chemistry Center and the Division of Natural Products at CFSAN are overseeing and managing the chemistry testing program. Proficiency tests have been sent out in all FERN analytical areas. A microbiological proficiency sample for *Bacillus anthracis was* issued November 29, 2004. This was a joint proficiency sample with the Laboratory Response Network (LRN) involving 66 laboratories. A radiological proficiency sample for Cesium 137 was issued in December 2004 to 25 laboratories. A chemical proficiency sample for colchicine was issued February 2005 to 35 chemistry laboratories with LC/MS capabilities.

There have been several small-scale FERN surveillance activities that involved participation from FDA, FSIS, and state public health and agriculture laboratories. These assignments have included all analytical disciplines and have provided an opportunity for FERN to demonstrate the ability to function as an integrated network through federal-federal and federal-state interactions as well as through coordinated communication and data reporting. Future surveillance plans are being developed and will provide additional opportunities for FERN state laboratory participation.

The Electronic Laboratory Exchange Network (eLEXNET) is the communication tool for FERN. eLEXNET is a seamless, integrated, Web-based data exchange system for food testing information that allows multiple agencies engaged in food safety activities to compare, communicate, and coordinate findings of laboratory analyses. It enables health officials to assess risks and analyze trends, and it provides the necessary infrastructure for an early-warning system that identifies potentially hazardous foods. FERN member laboratories are encouraged to visit eLEXNET often to keep current on FERN information and activities. There are

FERN journals posted in eLEXNET that contain updated information on current activities. FERN lab members are given access to the following journals: FERN Documents, Interim FERN Chemistry Methods, and Interim FERN Microbiology Methods. eLEXNET journals have also been created for each region to share files and engage in communication. A regional coordinator for each region is responsible for adding new members to these journals. Laboratories participating in FERN Proficiency and Surveillance testing activities have reported results into eLEXNET and eLEXNET contractors are making changes to allow manual data entry to be easier and more efficient. The FERN NPO has created a database as a repository of information for each FERN lab, including, among other things, Point of Contact (POC) information. As the database contains some sensitive information, access is limited to FERN NPO employees and Regional Coordination Center staff.

Additionally, FERN chemistry and microbiology cooperative agreements were announced this year. Funding is available for state, local, and tribal FERN chemistry and microbiology laboratories. Funding is to support additional capacity for food analysis related to terrorism and to enhance state, local, and tribal food safety and security efforts. The microbiological cooperative agreement is being coordinated by FSIS and the chemical cooperative agreement is being coordinated by FDA. Announcements of the agreement awards will be made by the end of September 2005.

Future of Network Activities and Coordination

FDA and FSIS are also collaborating with CDC, DHS, EPA and many other Federal agencies to create a Memorandum of Agreement for an Integrated Consortium of Laboratory Networks (ICLN). The ICLN will be an integrated system of laboratory networks, such as FERN, to provide for early detection and effective consequence management of acts of terrorism and other events involving a variety of agents and more than one section or segment of the nation (i.e., humans, animals, plants, food, the environment). For further information on FERN, contact Terri McConnell at terri.mcconnell@fda.hhs.gov.

FOOD SAFETY TRAINING FOR LIMITED ENGLISH SPEAKERS WORKING IN THE FOODSERVICE INDUSTRY

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Cinq clefs pour des aliments plus sûrs

1. *Prenez l'habitude de la propreté*
2. *Séparez les aliments crus des aliments cuits*
3. *Faites bien cuire les aliements*
4. *Maintenez les aliments à bonne température*
5. *Utilisez de l'eau et des produit sûrs*

Most Americans would not be able to understand the above text - five simple ways to prevent foodborne illness (WHO, 2005). The reason is that it is in French. Even though the above text is written in very simple French, if one does not read or speak that language, one probably would not be able to understand the message. This is what many limited English speakers experience when they participate in food safety training. It does not matter how simple the presentation is, if one does not speak English or does not speak it well, one will not be able to understand (gain knowledge) and then apply what is taught.

As more limited-English speakers, as well as individuals who speak no English, work in the foodservice industry, it is critical that language barriers be addressed so that these individuals have access to safe food-handling information. The purpose of this paper is to examine the demographics of limited-English speakers in the U.S. and suggest how food safety educators can address their food safety training needs.

Food Safety Situation

Each year an estimated 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in the U.S. are attributed to microbial hazards in food (Mead et al., 1999). Although typically brief in duration, cases of foodborne illness can be serious for high-risk population groups, such as the elderly, pregnant women, children under 5, and immunocompromised individuals (McCabe-Sellers and Beattie, 2004).

According to the last two summary reports of foodborne illness prepared by the Centers for Disease Control and Prevention (CDC), nearly 50% of reported cases of foodborne illness are attributed to unsafe food-handling practices in the foodservice environment (Bean et al., 1996; Olson et al., 2000). A Food and Drug Administration (FDA) examination of foodborne illness risk factors among randomly selected foodservice establishments highlighted problems in safe food handling practices (FDA, 2004). Over 53% of fast food restaurants (n=104) and 72% of full service restaurants (n=99) were observed to be out of compliance with regard to adequate handwashing by workers. Over 41% of fast food restaurants (n=432) and 63% of full service restaurants (n=470) were found to be out of compliance with regard to holding time and/or temperature (FDA, 2004). Similarly, a survey of foodservice workers revealed high levels of self-reported, unsafe food-handling practices (Green et al., 2005).

Public exposure to unsafe food-handling practices is likely to increase as the popularity of eating food away from home continues to grow in the U.S. The National Restaurant Association (NRA) reports that U.S. restaurants will provide more than 70 billion meal and snack occasions in 2005 (NRA, 2005). The challenge of reducing unsafe food-handling practices in foodservice operations is of such concern that it has been included as one of the food safety objectives in *Healthy People 2010*, the nation's health initiative goals (U.S. Department of Health and Human Services, 2000).

In response to this situation, regulatory authorities have called for increased training of foodservice workers to improve practices in order to reduce the risk for foodborne illness to the public. In Chapter 2 of the FDA *2003 Food Code*, it explicitly supports such knowledge acquisition: *"the person in charge shall demonstrate knowledge of foodborne disease prevention, application of the Hazard Analysis Critical Control Point principles, and the requirements of the 1999 Food Code"* (FDA, 2003). One of the three ways a person in charge can accomplish this is by being a certified food protection manager. As a result, an increasing number of jurisdictions within the U.S. offer food safety training to prepare individuals to become certified.

In most areas of the U.S., the typical training format is to: provide training materials in English; teach the class in English; administer the certification exam in one of eight languages--Arabic, Chinese, English, French, Japanese, Korean, Spanish, and/or Vietnamese; and hope for the best (Dietary Managers Association, 2005; Food Marketing Institute, 2005; National Registry of Food Safety Professionals, 2005; NRA, 2005b; and Thompson Prometric, 2005). Unfortunately, this training format puts limited-English speakers at a disadvantage because they will presumably have difficulty understanding the information. While knowledge does not always translate into practices, it is still essential that all foodservice workers receive basic information about safe food-handling. Therefore, in order for food safety training to be effective, it needs to be offered in languages other than English.

While there is sometimes political and philosophical opposition to offering training in languages other than English, it is important to remember why we train foodservice workers. Foodborne illness is nearly 100% preventable if the food handler knows and then applies safe food handling practices. Lack of effective training about safe food handling is one reason foodborne illness is still believed to be a problem. Training foodservice workers has the potential to decrease the incidence of foodborne illness.

Worker Literacy and Language Skills

According to the 2000 U.S. Census, there were a reported 282,909,885 Americans (U.S. Census Bureau, 2000). Of these, 33.5 million (or 11.7%) are foreign-born. Most foreign-born Americans come from Latin America (53.3%), followed by Asia (25.0%), Europe (13.7%), and other regions (8.0%). English is the only language spoken by 82.1% of Americans; 17.9% speak a language other than English. Nearly 5% of the U.S. population is linguistically isolated (4,361,638 households of 11,893,572 people). Linguistically isolated means that no member of the household who is 14 years or older speaks English well or at all. Most linguistically isolated individuals speak Spanish (28.3%); other Indo-European languages (13.0%); Asian and Pacific Island languages (22.5%); and other languages (10.1%).

This situation is critical to the U.S. foodservice industry because it relies heavily on immigrant workers, many of whom have limited English-speaking abilities. According to the U.S. Department of Labor Bureau of Labor Statistics, 12% of all foodservice workers are foreign-born compared to 8% for all other occupations (U.S. Department of Labor, 2005).

According to the NRA, after English, Spanish and Chinese are the most commonly spoken languages in foodservice establishments. In 2005, an estimated 64.7% of foodservice workers who spoke a language other than English at home spoke Spanish. Spanish will continue as the top non-English language spoken by foodservice workers as the migration of Spanish-speakers continues to grow. Chinese is the only other language that reached double-digits among foodservice workers who speak a language other than English at home (estimated to be 15.6% in 2005) (NRA, 1999).

On a regional level, foodservice workers in the West are more likely to speak a language other than English at home. In 1998, an estimated 28% of foodservice workers in the West spoke a language other than English at home, compared to 22.6% in the Northeast, 14.6% in the South, and 10% in the Midwest.

Top Three Non-English Languages Spoken by Eating and Drinking Place Foodservice Workers by U.S. Region			
U.S. Region	**% of Pop. Non-English Speaking**	**Top Three Languages**	**% Who Speak** (Projected by 2005)
West	28%	1. Spanish 2. Chinese 3. Tagalog	63.0% 11.8% 6.1%
Northeast	22.6%	1. Spanish 2. Chinese 3. Greek	56.2% 21.1% 6.2%
South	14.6%	1. Spanish 2. Chinese 3. Creole	76.2% 13.3% 2.3%
Midwest	10.0%	1. Spanish 2. Chinese 3. German	60.4% 22.4% 3.6%

SOURCE: NRA, 1999.

These limited-English-speaking workers can experience problems when working in foodservice. When asked to attend a food safety training in English, "individuals may feel inhibited by their culture, lack of basic skills, or fear of enforcement authorities, and therefore may not admit" areas where there are problems or a lack of understanding (MacAuslan, 2004). Such workers may also have difficulty reading food safety notices or other instructions written in English. Even when materials are translated into languages other than English, workers with low literacy in their native language may still find it difficult to understand what is being conveyed. The problems could be further compounded if English-speaking managers are unprepared to help such workers apply what has been provided in training to the workplace. Suggestions for addressing this issue have ranged from bilingual or multilingual training interventions to self-paced Internet-based training (MacAuslan, 2001). In the context of worker health and safety more generally, Wallerstein (1992) discusses examples of innovative educational interventions for workers with low literacy or limited English skills.

Food Safety Training for Limited-English Speakers

Ideally, it is best to have a bilingual instructor who is competent in food safety principles provide food safety training. Sometimes this is not feasible or even practical because of the number of languages spoken within a community. In the U.S. there are 176 languages spoken (National Virtual Translation Center, 2005). At present, it is not known how many of these are spoken by large numbers of foodservice workers. Therefore, one imperfect but viable alternative to providing bilingual instruction is to:

- Keep training materials very simple. Use visual aids, such as signs, pictures, symbols, graphics, posters, and videos to convey principles. Use as many wordless support materials as possible.
- Demonstrate safe food-handling practices in class, such as handwashing steps, preparation of sanitizing solution, and monitoring of temperatures.
- Have all the training materials that are being used in a class available in other languages. While participants may not hear their own language, if they can read, they can follow along in their language.

At present the food protection certification exam is available in seven languages in addition to English -- Arabic, Chinese, French, Japanese, Korean, Spanish, and Vietnamese. It would be best to translate all English-language training materials that are currently used to prepare individuals to become certified into the seven languages in which the certification exam is available. While individuals may be attending English-language classes, which are the most common way food safety training is conducted in the U.S., they could follow the information presented in their own language.

In North Carolina, some of the existing English-language training materials are currently available in three other languages – Arabic, Chinese, and Spanish (Table 2). The goal is to have all materials available in all eight languages, and other languages, as deemed necessary. A description of each follows.

Table 2. Training Materials Currently Available in North Carolina

Language	**PowerPoin t Slides**	**Website Activities**	**Pre-class video**	**Print materials**	**Songs**
English	Yes	Yes	No	Yes	No
Arabic	Yes	No	No	No	No
Chinese	Yes	Yes	Yes	Yes	Yes
Spanish	Yes	No	No	No	No

PowerPoint Slides

Most food safety educators use a PowerPoint slide set as the basis of their training. A slide set comprised of 240 slides based on the 2003 *Food Code* was developed in English and is now available in Arabic, Chinese, and Spanish. While a class is taught in English, the educator can make a copy of the English-language slides he or she is using in one of these three languages and give it to the participant. While individuals may not be able to “hear” their language, they can read it.

Website

A website for Chinese speakers is currently under development. The site will include:

- *Interactive activities* for participants to practice what they have learned in food safety training. The activities will center on preventing common food safety violations in Chinese restaurants, such as keeping cooked rice at room temperature.
- *Summary of other online Chinese-language food safety materials*. A list of materials has been assembled and the documents reviewed to determine the quality of the translation.

Pre-class Video

Cultural beliefs can be a barrier to the adoption of food safety practices. Before attending class, Chinese-speaking participants will be encouraged to view a video that introduces cultural beliefs affecting the operation of a safe foodservice in the U.S., particularly those practices that might differ from those in Chinese food preparation. This video is currently in production and at this time will only be available in Mandarin and Cantonese Chinese.

Print Materials

At present, books to prepare individuals for certification are available in English, Chinese, and Spanish. However, literacy can be a problem for some population groups and so more simplified print materials might be needed. Simplified print materials are being developed to correspond with all sections of the PowerPoint slides that were described earlier.

Chinese-language Food Safety Songs

Music has widely been used in advertising to help consumers remember and/or recognize products. Food safety songs designed to help participants remember key food safety principles will be written, recorded in Chinese, and made available to food safety educators.

Conclusion

Limited-English speakers represent a significant segment of the labor force working in the foodservice industry. Therefore, it is important that these individuals language and literacy needs be addressed. While providing instruction in other languages is the ideal, it is not always practical. As an imperfect but viable alternative, training materials that are currently being used to prepare individuals to become certified food protection managers should be translated into the seven languages in which the certification exam is currently available. The bottom line is that "Knowledge about safe food-handling does not decrease the risk for foodborne illness - applying safe food-handling practices does."

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PRE-HARVEST INTERVENTIONS IN BEEF CATTLE AND CHALLENGES ASSOCIATED WITH IMPLEMENTATION

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Presentation made at the "*Food Safety: From the Surface Up*" Conference held in Myrtle Beach, SC, February 23-25, 2005.

E. coli O157 as a Pathogen

E. coli O157:H7 is a pathogenic strain of *E. coli* that causes a distinct bloody diarrheal disease. Shiga-like toxins/verotoxins are produced by the pathogen, which cause bloody diarrhea and sometimes hemolytic uremic syndrome in humans (Kaper, 1994). *E. coli* O157:H7 was first recognized as a foodborne pathogen in 1982 (Riley, 1983; Wells, 1983) when two outbreaks resulted from consumption of undercooked ground beef. Since then, several outbreaks of bovine origin have occurred, indicating that cattle are the most important reservoir for this pathogen in terms of human exposure. *Salmonella* spp. causes the most deaths of any bacterial foodborne pathogen annually and is prevalent in the pre-harvest environment.

Pathogens enter the food supply during slaughter from the hide, dust in the processing environment, or by direct contact with feces or digesta from the intestinal tract. Pathogens from food animals can also enter the food supply when manure is applied as a fertilizer to agricultural crops or when runoff enters a water supply that is used for irrigation of crops or for public recreation making cattle a source of contamination of both bovine and non-bovine outbreaks.

Over the past several years, research in pre-harvest food safety has grown, especially in the area of beef feedlot cattle. The prevalence of *E. coli* O157:H7 in the animal is greater than previously reported because of improved methodology. In addition, recent studies have reported that there is a direct correlation of positive animals to positive carcasses (Elder et al., 2000), indicating that the microbial status of the live animal has a direct impact on the final product. Other studies (Elder et al., 2000) have reported that the hide may be the primary source of contamination of the carcass.

Pathogen Prevalence in Cattle

Research in the area of pre-harvest food safety is relatively new, but many studies have been conducted to determine the prevalence of *E. coli* O157:H7 in cattle. *E. coli* O157:H7 was first isolated from a 3-week-old calf with colibacillosis in Argentina in 1977 (Orskov et al., 1987). Early studies reported 1.8% (Hancock et al., 1998), 3.4% (Rice et al., 1997), 7.5% (Van Donkergsoed et al, 1999), and an 8% (Wells et al., 1991) prevalence among adult animals. These early results were encouraging because it appeared that the prevalence of shedding by the adult animal was relatively low, which should result in a small risk of contamination of the food supply. However, in recent years, we and others have discovered that the prevalence of the pathogen in beef cattle is much greater than previously reported; this is likely a result of improved methodology used to isolate the organism. The improved methodology allows for detection of the pathogen when it is at low concentrations in the feces (i.e., the newer methods provide greater test sensitivity than the old ones).

As a result of these improved methods, recent studies have shown greater and presumably more accurate estimates of the prevalence of pathogen shedding. In 1997 *E. coli* O157:H7 was isolated from 15.7% of cattle tested over a 1-yr. sampling period (Chapman et al., 1993a). These authors also investigated the seasonal differences, observing that the highest prevalence occurred in late summer with a prevalence of 36.8%. Elder et al. (2000) reported similar results. They found that 72% of the 29 pens sampled had at least one positive test result for the pathogen immediately before slaughter. The overall animal-level prevalence was 28%. Similar results were reported by Smith et al. (2001), who surveyed five Midwestern feedlots to estimate prevalence. They found that 23% of the animals were positive for the pathogen, and 100% of the feedlots had at least one positive animal. Additionally, they reported that cattle in muddy pens had a greater prevalence than those in dryer pens. Brashears et al. (2002) followed cattle over the entire feeding period and found that up to 60% of the individual animals tested positive during feeding.

Pre-Harvest Interventions

Elder et al. (2000) reported that there was a positive correlation between carriage of *E. coli* O157 (either in the feces or on the hides) and subsequent contamination of the carcasses. Our observations also indicate that positive fecal or hide samples result in contamination of the carcass with *Salmonella*. Because the potential for direct contamination of the carcass from the animal exists, it is important to study interventions at the pre-harvest level to control pathogens. Although not all responsibility lies with the producer, for a “farm-to-table” approach to successfully reduce pathogen contamination of the food supply, it must include pre-harvest aspects.

Competitive exclusion, probiotics, and direct-fed microbials

The concept of competitive exclusion of pathogens is based on the idea that organisms compete for required nutrients or produce products that are inhibitory to other species of microorganisms. When used as direct-fed microbials in animal production, probiotics have been defined as "live microbial feed supplement(s) which beneficially affect the host animal by improving its intestinal microbial balance."

The theory of using direct-fed microbials to inhibit potentially foodborne pathogens was first established in poultry (Callaway et al., 2003). Controlling *E. coli* O157:H7 was introduced by Zhao et. al (1998). In that study, feeding probiotic bacteria (non-pathogenic *E. coli* and *Proteus mirabilis*) decreased carriage and fecal shedding among those cattle that were artificially inoculated with the pathogen. Specifically, *E. coli* O157:H7 was detected in the control animals for 32 d and in the treated animals for 9 to 17 d. Tkalcic et al. (2003) recently evaluated a three-strain mixture of non-pathogenic *E. coli* as a probiotic treatment in weaned calves.

These researchers reported that administration of the probiotic *E. coli* to the calves substantially reduced or eliminated *E. coli* O157:H7 in feces 8 to 30 d after treatment. Brashears et al. (2002) selected strains of *Lactobacillus acidophilus* isolated from cattle that were inhibitory to *E. coli* O157:H7 in manure and rumen fluid in a laboratory setting, based on the understanding that lactic acid bacteria can inhibit pathogenic organisms in food. Apart from being antagonistic toward *E. coli* O157, strains of *Lactobacillus acidophilus* were also selected based on acid tolerance and bile resistance, characteristics necessary to adapt and survive in the intestinal environment. Strains were also selected for the ability to grow rapidly and survive storage. Whether the strains were resistant to commonly used antibiotics was also a consideration because of concerns regarding the potential for transfer of resistance to human pathogens.

In a large field trial, cattle supplemented with two of these strains of *Lactobacillus acidophilus* as direct-fed microbials had reduced fecal shedding of *E. coli* O157 (Brashears et al., 2002). One particular strain, referred to as NPC 747 (later referred to as NP 51), was by far the most successful; the likelihood of fecal shedding of *E. coli* O157:H7 by cattle receiving NPC 747 was decreased by 50% during the course of the feeding period. Those cattle receiving the supplemented diets also had improved feed efficiency when final body weight was calculated from hot carcass weight and the overall average dressing percent. In this study, there was no evidence of detrimental effects of supplementing cattle with direct-fed microbials on animal performance, suggesting that *Lactobacillus*-based direct-fed microbials show promise as a practical and effective food safety intervention strategy.

Additional studies at Texas Tech have further evaluated the effect of DFM on *E. coli* O157 shedding. A second study indicated that 27% of control animals tested positive for the pathogen while only 13% of the treated animals tested positive ($P<.05$). On the day of slaughter, there were also significant reductions in the amount of hide contamination in the two treatment groups, with the control animals having 15% positive hides and the treated animals only having 5% positive hides. Again, a 50% reduction of *E. coli* O157 was observed (Younts-Dahl, 2004).

Another study was conducted in the summer of 2003 to evaluate the dose of the DFM needed to achieve the optimum reduction of the pathogen. Again, the pathogen was reduced by 50% in the feces when the dose of the DFM was supplied at 10^9 cfu/animal daily. Doses of 10^8 and 10^7 cfu/animal daily also resulted in significant reductions at the end of the feeding period, but were not as great as the higher dose. The same results were reported when animals were fed 10^9 cfu doses of the DFM during a study conducted in New Mexico. The use of this DFM has consistently reduced shedding of *E. coli* O157 in beef feedlot cattle without negatively impacting the performance of the animals.

Recently, CHR Hansen published company literature (Anonymous, 2004) that indicates a newly developed DFM, PROBIOS FS, consisting of *Enterococcus faecium,* significantly reduced shedding of *E. coli* O157 in challenged animals. They report a 1-2 log reduction of *E. coli* O157 in challenged animals after feeding. A dose-titration study indicated that 20 g/head/day of a culture containing 50 billion cells was the best treatment. They also indicated that the product significantly reduces the environmental loads of *E. coli* O157. The study has not been peer-reviewed and published in the scientific literature and only included 15 animals.

While some DFM that have been proven to reduce *E. coli* O157 are on the market, they are not sold on the basis to reduce the pathogen. Many cattle are fed this product, but the cost to the producer is the primary reason it is not more widely implemented. The total cost of feeding this product for the entire feeding period is $2.00 to $3.00/head. Other DFM are in the process of gaining approval from regulatory agencies.

Vaccination

Developing an effective vaccine to decrease *E. coli* O157 in cattle had been investigated as a potential intervention strategy that would be practical to implement (Jordan et al., 1999). Canadian researchers Potter and Finlay developed a vaccine based on two *E. coli* O157 surface antigens, Tir and EspA (Potter and Finlay, 2000). Preliminary studies indicated the vaccine was effective in reducing *E. coli* O157 (Bach and McAllister, 2001; Callaway et al., 2003). Two studies conducted in the United States have shown decreased prevalence in groups of cattle receiving the vaccine. Researchers at the University of Nebraska reported that the prevalence of cattle shedding *E. coli* O157 decreased from 21% before treatment with the vaccine to 8.8% after treatment (Anonymous, 2003b).

At Colorado State University, fecal and hide prevalence of *E. coli* O157 among cattle treated with a vaccine was 14.7% and 20%, respectively, whereas prevalence among the control cattle was 45.8% and 40.3%, respectively (Ransom and Belk, 2003).

Challenges associated with the implementation of vaccinations include regulatory approval. The vaccines are somewhat different from traditionally approved vaccines because most are related to an animal health issue. A vaccine to improve food safety is a new concept Additionally, the cost of the vaccine could be a challenge in implementing this product.

Sodium chlorate

Cattle given a small dose of sodium chlorate via drinking water had reduced amounts of *E. coli* O157:H7 in feces and various gastrointestinal tract locations by two to three logs (Callaway et al., 2002). This study was undertaken after previous studies indicated the bactericidal effect of sodium chlorate against *E. coli* O157:H7 and *Salmonella typhimurium* TD104 both *in vitro* and in the intestines of experimentally infected pigs (Anderson et al., 2000; Anderson et al., 2001b; Anderson et al., 2001a; Anderson et al., 2004), poultry (Byrd et al., 2003); sheep (Callaway et al., 2003; Edrington et al., 2003) and cattle (Anderson et al., 2003). Sodium chlorate is not yet approved by the FDA for use in food animals (Callaway et al., 2003).

A challenge associated with this product is that it has not been evaluated in a large-scale study using non-inoculated animals. Additionally, this product must gain regulatory approval and provide competitive pricing before it will be accepted by producers.

Neomycin sulfate

Antibiotic treatment may be effective against potential human pathogens in food animals. Neomycin sulfate is a broad spectrum antibiotic used to treat coli-bacillosis caused by *E. coli* in cattle, which researchers have proposed could effectively reduce *E. coli* O157:H7 populations (Callaway et al., 2003). Among naturally infected cattle, a therapeutic dose of neomycin sulfate administered through the feed reduced fecal shedding of *E. coli* O157 after 24 hours, with the presence of *E. coli* O157:H7 becoming undetectable in feces after 72 hours (Elder et al., 2002). The cattle in this trial receiving neomycin sulfate remained negative for a detectable level of *E. coli* O157:H7 7 day after treatment. Ransom and Belk (2003) recently reported that 0% of fecal samples and 8.5% of hide samples from cattle treated with neomycin sulfate were positive for *E. coli* O157, whereas among the control cattle 45.8% of fecal and 40.3% of hide samples were positive.

While neomycin appears to be very effective, there are regulatory issues associated with this product. It is labeled for use as a therapeutic agent for *E. coli* (not *E. coli* O157) clinical infections in cattle. Cattle must exhibit physical symptoms before it can be legally administered. Additionally, the use of antibiotics in the food chain could result in resistance. Further investigation is needed to determine if resistance is a real concern.

Brown seaweed

Brown seaweed extract derived from *Ascophyllum nodosum* has been used as a cattle feed additive to promote stress tolerance (Allen et al., 2001). Barham et al. (2001) found that feeding this brown seaweed supplement to feedlot cattle 14 day before harvest was associated with decreased prevalence of enterohemorragic *E. coli* in feces and on hides.

A study was conducted in a commercial setting to determine the effects of brown seaweed/ANOD on pathogenic bacterial shedding. Steers had 0%, 1% and 2% brown seaweed supplemented to their conventional grain-based diets on a dry-matter basis 2 weeks prior to slaughter. A significant decrease in the level of total of *E. coli* O157:H7 in fecal and hide samples of treated animals was found. However, these were single time-point samples collected following exsanguinations at the slaughter facility and were not compared to pre-supplementation samples. It was also found that there was a significantly lower level of *E. coli* O157:H7 in treated animals ($P < 0.01$) for both fecal samples and hide swipes. A follow-up trial of 580 steers and heifers received 2% ANOD supplementation in their commercial diets 14 days prior to slaughter. Prevalence of *E. coli* O157 on hides ($P < 0.01$) and *E. coli* O157:H7 on hides ($P < 0.01$) exhibited a significant reduction for cattle treated with brown seaweed 14 days prior to slaughter when compared to controls. However, this intervention has only been studied in commercial environments, and a well-controlled study is needed. Much of the control is lost and confounding factors are present in commercial environments, so a well-designed, controlled study is needed.

Brown seaweed may have detrimental impacts on cattle performance. In previous studies, animal feed intake was reduced when they were fed this product. Additional studies need to be conducted to ensure that the performance of the animal is not adversely effected by this product.

Dietary alterations

Studies by Kudva et al. (1995, 1997) reported that feeding sheep diets high in fiber resulted in large amounts of shedding of *E. coli* O157:H7 in experimentally inoculated animals. Shedding was decreased in animals fed a high-nutrient diet consisting of corn and pelleted alfalfa. Conversely, in a similar study with cattle, Diez-Gonzalez et al. (1998) reported that the amount of acid-tolerant *E. coli* shed by cattle fed hay was less than those fed a concentrate diet. In another study that examined the shedding of *E. coli* O157:H7, the authors reported that hay-fed cattle shed the pathogen for longer periods (39 to 42 d) than those fed a concentrate diet (4 d; Hovde et al. 1999), whereas another found no relationship between diet and the ruminal presence of *E. coli* O157:H7 (Tkalcic et al., 2000). Similarly, Magnuson et al. (2000) reported that there were no differences in the shedding of *E. coli* O157:H7 in heifers fed growing diets (typically lower concentrate) or finishing diets. The data in the area of dietary modifications is obviously not in agreement. Various factors within each study may have contributed to the variation, including methodology used to isolate the pathogen and the use of naturally infected or artificially infected animals.

Fasting and feed withdrawal did not affect the amount of shedding of *E. coli* O157:H7 or the numbers in the rumen (Harmon et al., 1999). Nonetheless, Cray et al. (1998) reported that diet-stressed calves were more susceptible to infection with *E. coli* O157:H7 than those that were well fed. Current studies indicate that fasting animals just before slaughter will have little effect on the amount of shedding of the pathogens; however, it might make a difference in the quantity of contents in the gastrointestinal tract, which might ultimately affect carcass contamination. At this time no dietary alteration has been identified that would be consistently acceptable in reducing pathogens in the live animal.

Conclusion

Several pre-harvest interventions are in the early stages of development and show promise in reducing *E. coli* O157 in cattle prior to slaughter. At this time no intervention eliminates the pathogen, but some offer significant reductions. There are several challenges to implementing these interventions. Among these challenges are cost, regulatory approval, and the impact on the animal performance. Research needs to continue in this area to overcome the challenges we face in pre-harvest food safety and to further ensure the safety of the food supply.

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QUANTITATIVE MICROBIAL RECOVERY FROM FOOD SURFACES

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Numerous species of pathogenic or spoilage microorganisms can be present on the surfaces of raw and processed foods and food contact surfaces. Food microbiologists are increasingly attempting to identify these organisms and to determine the microbial concentration of one or more species on these surfaces. If present, the number of cells of any particular microbial species on one of these surfaces could exceed one million per square centimeter.

For many raw and ready-to-eat foods, the majority of the microbial contamination is on outer surfaces. Pathogenic or spoilage organisms may be difficult to remove, inactivate or enumerate since the surface texture and surface area of foods can be highly variable and irregular. Microorganisms may be able to attach themselves to food or food contact surfaces in a manner that hinders their removal. Researchers are increasingly working to develop improved ways to inactivate or remove these organisms from surfaces and analytical methodology for optimizing the qualitative and quantitative recovery of microorganisms from foods or food contact surfaces. This paper will discuss how food surfaces become contaminated with microorganisms, surface sampling methods for recovery and enumeration of microorganisms, surface area measurement to facilitate quantitative estimates of surface microbial concentration, and the value of improved estimates of surface microbial concentrations for enhancing microbial food safety.

Food Surface Contamination

Raw foods can be contaminated with undesirable bacteria, fungi, viruses or protozoa prior to consumption. These organisms could be introduced in a variety of locales and stages of processing such as during growth, harvesting, packing, transport, further processing or preparation for consumption. Contamination of raw fruits, vegetables, meat, poultry or seafood is more likely to occur on the surface of these food commodities. Some foods undergo thermal or non-thermal processes to reduce or eliminate pathogenic microorganisms. These processes may be sufficient to make these foods safe to eat or "ready-to-eat" without additional cooking. Unfortunately, in many cases there are opportunities for these products to become contaminated after processing but before final packaging, distribution and preparation. Contamination could occur by product contact with processing equipment and utensils, worker hands or gloves, and air or moisture condensation in a packaging room or a kitchen. The transfer of microorganisms to and from food surfaces, food contact surfaces, and food handlers has received greater attention in recent years. Food processing and food preparation industries and food safety regulatory authorities are working to understand and to reduce these types of contamination or cross-contamination events.

Microbial Attachment and Removal

Many important species of bacteria are able to attach to many types of food or food contact surfaces. A significant number of bacteria can attach to a surface in just a few minutes. The physical and chemical properties of contact surfaces, such as geometry, porosity, roughness, composition, and hydrophobicity dictate the strength of adhesion. Bacteria may secrete or produce extracellular polymeric substances (EPS) that enable them to adhere to surfaces, form larger aggregates or colonies, and protect them from adverse environmental conditions—which all facilitate the formation of a biofilm. Biofilms are predominantly composed of microcolonies of bacteria and other microorganisms that grow adherent to surfaces along with organic and inorganic components derived from their environment that form in response to sheer force of the environment and other stress. The complexities of biofilms are dependent on their surroundings. The microorganisms within these biofilms are typically more resistant to cleaning and sanitation efforts by food processors.

Any process interventions that target surface microorganisms must consider the ability of or mechanism for attachment, biofilm formation, retention on food or material surfaces, and ease of detachment from surfaces. Some antimicrobial efforts may try to inactivate organisms on a surface, while others are used to remove (and possibly inactivate) organisms from a surface. For some foods and food contact surfaces, antimicrobial processes (e.g., ultraviolet radiation, hydrodynamic pressure, electromagnetic radiation) may be appropriate for use. In other cases, antimicrobial chemical applications (e.g., chlorine solutions, lactic acid) may be more effective. Antimicrobial chemicals may also be applied on packaging films to target food surface microorganisms. Modified atmospheres or gas mixtures in food packages are also used to reduce or limit the growth of surface bacteria. Finally, physical processes such as scrubbing, washing, filtering, etc., can be used to remove microorganisms from a food surface.

Physical Characteristics of Food and Food Contact Surfaces

A wide variety of surface textures are found on raw and processed foods. Some of these are readily apparent to the eye (e.g., whole cantaloupe), while other variable textures may only be noticed by microscopic examination (e.g., grapes). Not only can the surface texture or roughness vary greatly, but also the surface area of raw or processed foods. During growth, harvesting and processing, these physical surface characteristics may alter due to injuries or scarring to the surface and changes in environmental conditions, such as storage temperature and humidity. The roughness and available surface area of a food product could affect the affinity of microorganism attachment. In addition, the presence of moisture or residual sanitizers may be important. Furthermore, contact surfaces with a high degree of wear may present areas of variable roughness and a change in surface area. In many cases, the changes in surface texture or surface area may only be noticed when observed with a microscope.

Surface Sampling Methods for Recovery and Enumeration

Microbiologists employ a variety of techniques to remove and identify organisms from the surface of foods. In some cases, the analyst is also interested in counting or quantifying the numbers of organisms on a sampled surface. Food product surfaces are usually sampled by rinsing the surface or soaking the product with an appropriate solution, or swabbing or sponging a specific portion of the surface. Each technique may present advantages or disadvantages for a particular food commodity or desired analysis. In any case, the proportion of viable microorganisms recovered from a surface is affected by numerous other analytical variables including how the sample is agitated (shake, vortex, blend, sonicate, etc.), sample size, collection/dilution media used, sample temperature, swab/sponge pressure, and organism release from swab/sponge. In addition to variable performance of methods, the competence of laboratory analysts to perform these tasks can vary greatly. Since foodborne organisms of public health significance (pathogens) are often present at relatively low levels on foods, some sampling procedures may not always recover enough viable organisms for identification or enumeration. As a result, the assay is not sensitive enough for an accurate determination of the level of contamination and, consequently, the safety of the food. The presence of pathogenic bacteria on food contact surfaces may present great health risks, since as few as ten cells of certain pathogens can lead to illness. Furthermore, in many research studies where pathogenic organisms are inoculated onto food surfaces, the maximum recovery of cells is only 1–10%.

Estimating Surface Microbial Concentrations

Even though common sampling and analytical methodologies may not lead to accurate determinations of the number of microbial cells on a food or food contact surface, quantitative estimates of surface organism concentrations can be extremely valuable to food industries and food regulators. First, improved quantitative estimates of microbial surface concentrations can be used to determine and compare the effectiveness of antimicrobial treatments. Second, quantitative estimates of foodborne pathogen concentrations, whether on the surface or interior, are an important aid to developing microbial risk assessments.

Food microbiological risk assessments can be used to establish the ability or likelihood that a foodborne pathogen can be consumed, produce an infection and cause disease. Consequently, the risk assessment can be used to identify interventions that lead to public health improvements and to identify research and education needs. To optimize quantitative microbial recovery from food surfaces, we believe that we need 1) improved methods for recovery and enumeration from surfaces; and 2) to incorporate surface area and surface texture measurement for reporting and comparing concentrations of recovered microorganisms.

After microbiological analysis of a food surface, the recovered microbial concentrations are typically reported on a per volume diluent or per-product weight basis. For example, if a sample surface is rinsed with 100 mL of a solution, a quantitative analysis may report that 12 *E. coli* bacteria (colony-forming units {CFU}) were recovered per mL of diluent. As another example, some or all of a tomato surface could be sampled with a sponge or swab. Any organisms recovered could be reported as a concentration per tomato, per weight of tomato, or per unit area that was sponged or swabbed. If the total surface area of the tomato was known, and if its entire surface could be sampled (rinsed, soaked, sponged), then a microbial concentration on the tomato could be reported as CFU per unit area of the tomato. Unfortunately, the surface area of many food products is not well known or easily measured.

Determination of the Surface Area of Raw Foods

The surface area or volume of foods or other objects can be more easily estimated if their shape approximates a sphere or ellipsoid. The following equations have been used to determine volume and surface area of these shapes:

$$\text{Volume} = 4/3\,\pi\,ab^2 \quad \text{(a and b are axis dimensions)}$$

$$\text{Area} = KV^{2/3} \quad \text{(K=1.21 for a sphere)}$$

Unfortunately, the shape and size of some foods, such as strawberries or squash, can vary greatly from one sample to the next. Should we assume that a product approximates a particular shape and use known mathematical relationships to determine surface area, or should we try to measure the total surface area of each food unit or sample? Food microbiologists currently lack rapid or convenient methods to measure or estimate the surface area of a three-dimensional object.

A few researchers have developed methods to measure surface area of specific raw foods, and correlated these measurements with product weight. For example, Frechette and Zahradnik (1966) developed equations to predict surface area from weight and density for McIntosh apples. To predict surface area from weight they developed the relationship: A = 7.82 + 0.11W, where A is the area in square inches, and W is the weight in grams. Thomas (1978) developed statistical relationships between poultry carcass surface area and weight for two weight categories. For turkey carcasses weighing less than 7 kg, the relationship is: Surface area (sq. cm.) = 0.45 x Weight (g) + 1293. For turkey carcasses weighing more than 7 kg, the relationship is: Surface area (sq. cm.) = 0.13 x Weight (g) + 3480. Eifert, et al. (2005), using a machine vision system, developed the following equation to predict strawberry surface area: A (sq. cm.) = 9.4 + 1.58 W (g). These and other efforts to enable estimation of product surface area based on weight measurement provide food microbiologists with a new tool for quantitative analysis of the microbial quality of the surface of irregularly shaped food products. A measurement of whole product weight is much more convenient for surface area prediction than is determination of the surface area of each sample or restricting sample size to a portion of edible tissue. If the surface area can be estimated using product mass, then this would facilitate reporting and comparing microbial concentrations on a per-surface area basis.

Fine Scale Surface Area Measurement

Surface characteristics or changes in the surface of the texture of food and food contact surfaces can be measured at the scale of 1 micrometer (µm) or less. Most microorganism cells have a dimension that is similar. An average coccus (bacteria) has a diameter of approximately 0.5-1.0 µm. An average bacillus is 0.5-1.0 µm wide by 1.0-4.0 µm long. Many viruses are less than 0.1 µm in diameter. A variety of microscopes have been used to observe and count bacteria on food or food contact surfaces. For fine-scale surface observation and area measurement, light microscopy and scanning electron microscopy have been used. For quantitative topography data, confocal laser scanning microscopy, white-light interferometry, and atomic force microscopy have been successfully used.

A microscopic examination of food and food contact surfaces may indicate a rough or irregular texture. If the microscopically viewed surface is highly irregular, pitted or scarred, the total surface area may be much higher than that which can be visibly observed. Measurements of surface area may correlate to the magnitude of the scale used. In other words, measurement of food surfaces on a small scale, rather than a large scale (mm), may lead to different estimates of microbial concentrations if the microbial yield remains constant while the reported surface area varies due to the measurement scale used. These small-scale surface features are important because they may provide areas where bacteria could attach and propagate and be out of reach of recovery or decontamination efforts. Fine-scale (near 1 µm) surface area measurement techniques may allow food microbiologists to quantify surface area on a scale corresponding to the dimensions of many microorganisms, or to estimate the area available for bacterial attachment. Quantitative estimates of changes in food surface area, available for bacterial attachment, would be beneficial for evaluating the effectiveness of various manufacturing processes, antimicrobial interventions or environmental storage conditions.

Summary

Food microbiologists have many opportunities for optimizing the quantitative recovery of microorganisms from food or food contact surfaces. Surface area measurement of raw or processed foods can lead to improved quantitative estimates of surface microbial contamination or the area available for bacterial attachment. Estimates of surface microbial concentrations can be used to study or prevent microbial attachment or biofilm formation, transfer of microorganisms to and from foods, and decontamination of foods and contact surfaces.

Currently, there are considerable industry and regulatory efforts toward reducing the level of hazardous microorganisms on raw meat and produce products. Regulatory authorities are moving toward a greater reliance upon the application of risk assessments for evaluating and managing foodborne microbiological health risks. We believe that improved sampling techniques and quantitative analytical procedures can provide a better characterization of the microbial quality of these foods and food contact surfaces.

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SAFE PRODUCE: APPLYING GOOD AGRICULTURAL PRACTICES TO THE PRODUCTION AND HANDLING OF FRESH FRUITS AND VEGETABLES

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Historically, illness was not associated with eating fruits or vegetables. Very little attention was given to the idea of preventing microbiological contamination of produce. Of particular importance was the indiscriminate use of animal manure as fertilizer. The industry has changed dramatically in the past decade. The family farm has all but disappeared in the United States. Corporate production is the norm. To maintain a consistent year-round supply of the commodities we want, we source our food from most continents on the globe. The National Geographic Society today recognizes 191 independent nations and USDA statistics indicate that we import food from approximately two-thirds of those countries. In some parts of the world, fresh fruits and vegetables are still produced and handled in a primitive fashion. Food safety is not just a local concern. It is a worldwide affair that impacts every consumer.

Approximately 20 years ago, fresh produce began to be more widely implicated as a potential carrier of human pathogens. Growers and handlers were reluctant to accept the idea that consumption of their products could potentially cause illness. Outbreaks of illness were sporadic, isolated, usually small, and seldom linked to consumption of fresh produce. Industry was slow to adopt safer handling practices. Only the companies that were directly impacted by an outbreak were inclined to take proactive steps to implement food safety programs.

In 1998, the US-FDA released formal guidance for reducing microbial risks on fresh produce. Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs) were specifically defined as a means of reducing the risk of illness (US-FDA, 1998). This marked the beginning of the modern era in fresh produce safety. Today that guidance document is our primary point of reference. Seven broad areas were identified for the implementation of food safety principles: water for production and processing; use of animal manures and municipal bio-solids; worker health and hygiene; sanitary facilities for workers; field sanitation; pacing facility sanitation; and transportation. Development and implementation of specific safety practices relative to each of these broad areas are processes that are ongoing.

An overriding factor for industry in the adoption of any new practice is cost. The cost was reasonable for the implementation of a food safety program in the early 1990s following two outbreaks of salmonellosis associated with consumption of fresh-market tomatoes, considering that no additional outbreaks have been associated with that specific company (Rushing, 2001). In contrast, the cost of an apparent failure of a program for green onions has been enormous due to outbreaks of hepatitis in 2003 (Calvin, et al., 2004). In both of these cases, evidence that fresh produce was the source of illness was circumstantial, although epidemiological reports are convincing. The costs of repeated outbreaks, such as those associated with imported cantaloupes resulting in a detention order on Mexican suppliers, are enormous and disastrous for the associated industries (US-CDC, 2002; US-FDA, 2002).

Some growers and packers have made sincere, focused efforts to implement GAP-GMO in all steps of their operations. Others continue to show a lack of interest and poor understanding of food safety practices. Of special concern is the attention, or lack of attention, to training programs for workers to ensure that the awareness of the importance of safe practices permeates every level of activity within a company. Social issues play a critical role in effective communication between management and the work force. The degree of sensitivity to the cultural background of workers can determine the success or failure of any training program.

Processing water quality management is absolutely critical to food safety. In rare cases, employees have an in-depth understanding of the scientific principles involved in maintaining the quality of processing water. But, more commonly, workers have had little or no formal training and there is a tendency to “cookbook” the adjustment and regulation of sanitizers in water. The importance of water chemistry, particularly pH, to the efficacy of some sanitizers is seldom understood and is frequently ignored. Industry managers often do not understand the benefits or the limitations of technology that is available for managing water quality. Proper management at this step can reduce decay as well as help ensure food safety.

Keeping records of GAP-GMP practices is perhaps the greatest challenge within any company. Failure to keep adequate records suggests a lack of due diligence and good faith on the part of management and may result in liability issues if people become ill. Those companies that do it well often do it to excess. Others regard it as a nuisance and may take only a casual approach to record-keeping if in fact it is done at all.

Reliance upon third-party auditors may give companies a false sense of security about the effectiveness of their food safety programs. While auditors have a valuable role in the industry, managers must recognize that an audit is only a snapshot of the activity in the company on the day of the audit. Food safety is a constant process, not simply a preparation for an inspection. In a case study of a wholesale restaurant supplier (Rushing, unpublished), end users each demanded their own audits of the wholesaler's facilities at the wholesaler's expense, imposing a tremendous cost to the wholesaler and demonstrating the excess that can occur in auditing requirements.

Public agencies, both state and federal, have made invaluable contributions to the advancement of safe production and handling practices in the fresh fruit and vegetable industries. Numerous training programs have been developed and the educational materials made available to all interested parties (JIFSAN, 2002; Osborne, et al., 2003; Rangarajan, et al., 2003). The private sector has responded, in general, in a positive manner, but deficiencies remain. We in government and academia can do much to help develop effective policy and regulations, but it is business that drives change. The industry responds most quickly when it realizes that practices that help ensure food safety usually help ensure better quality of fresh produce and thus enhance profitability. Teachers and trainers should attempt to integrate the concepts of safe handling practices with routine business activities to minimize the likelihood that contamination of food will occur, ensuring that the U.S. will continue to have the safest and most abundant food supply in the world.

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GENDER DIFFERENCES IN WEIGHT PREOCCUPATION AND MANAGEMENT AMONG COLLEGE STUDENTS IN THE UNITED STATES

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Abstract

We lack normative data about the extent of weight preoccupation in college students aged 18-23, including how such concerns vary by gender. In a sample of 475 respondents, 86% of women thought about their weight and/or weight goals at least once per day compared to 64% of men. Nearly one third of women (32%) were preoccupied with weight (thinking about it four or more times per day), compared to 11% of males. Most of the women (59%) were trying to lose weight (versus 32% of men), primarily to improve their appearance rather than for health reasons. Women also were more subject to pressures from friends and family members to monitor their weight. These data indicate that weight concerns disproportionately affect female college students.

Although obesity is epidemic in the United States (Critser, 2003; Mokdad et al., 1999; Silventoinen et al., 2004), and a growing problem worldwide (IASO, 2004), we lack normative data about the extent of weight preoccupation in college students and know surprisingly little about how the majority of this population thinks about weight-related issues. While concern about weight may be seen as primarily a concern of female adolescents who are college-aged, we in fact do not know if females are indeed more preoccupied with their weight than males, or whether this is an unfounded "common knowledge" assumption, perpetuated by the media. In addition, although the media is often blamed for what is assumed to be women's greater obsession with their weight, we lack sufficient data about whether women are more subject to direct and indirect feedback from those around them to achieve or maintain a desirable weight, and if such pressures, whatever their source, result in a greater emphasis on beauty over health (Wolf, 1991). Such data about weight loss behavior and goals can provide insight into pressures on college-aged adolescents that are assumed to vary by gender as well as supply baseline data for those designing services for young people striving to achieve or maintain a healthy weight.

Methods

In May 2003, two student volunteers distributed a two-page anonymous survey entitled Diet and Body Image to undergraduate students living in dormitories at a mid-Atlantic liberal arts college of 1,600 students where most (96%) of the undergraduate students are of traditional age (17-23 years old), and enrolled full-time (98%); eighty percent (80%) are white and 57% are women. Since the college's population is primarily residential (77%), data were collected from living areas to avoid the bias likely to occur by distributing the survey to certain classes. No data were obtained about students' majors or their race. Student volunteers reported that the racial distribution of the survey mirrored that of the college's (20% nonwhite). Most of the students (74%) have meal plans in the college cafeteria. Volunteers were told to attempt to distribute 550 copies of the survey to an equal number of males and females. Five-hundred and two surveys were returned by the students (response rate: 91%). Although the students spanned a number of different age groups, about 95% were aged 18-23. Therefore, to increase the validity of the results, students who did not fall in this age group were excluded, yielding a final sample size of 475 students aged 18-23 years old.

Results

The sample of 475 undergraduate students was almost equally distributed by sex (49% male and 51% female). Most were either in a committed relationship (44%) or dating casually (40%). Very few of the students (16%) were *not* trying to either lose or maintain their weight. Only 30% felt guilty when they ate more than they should. Half of the respondents had binged on a certain type of food (as opposed to just having overeaten generally) (see Table 1). Of these, 12% binged daily or almost daily, 16% binged a couple of times per week, 50% binged about weekly, and the remaining 22% binged no more than monthly. Of those who binge, 42% usually binge on sweets (29% of males and 54% of females). Of those who binge on sweets, 32% binge on chocolate (7% males and 44% of females). Males also commonly binge on protein (15% compared to 2% of females) and pizza (8% compared to 2% of females).

Table 1

Respondent Characteristics N=475 students aged 18-23 years old
Sex: 49% male; 51% female
Relationship type: committed: 44%; date casually: 40%;
single: 15%; married: 1%

Respondents who:

	Total	male	female	p
Are trying to lose weight	46%	32%	59%	.00
Are trying to maintain their weight	38%	46%	31%	.00
Are **not** trying to lose or maintain their weight	16%	22%	10%	.00
Feel guilty when they overeat	30%	22%	38%	.00
Overeat/binge on a certain type of food	50%	50%	50%	.53

Although 11% of males and 33% of females thought about their weight or weight goals four or more times per day (weight-preoccupied) (Table 2a), only 10% of males and 7% of females weighed themselves daily (Table 2b). Those more preoccupied with their weight were more likely to be trying to lose weight, to be doing so to improve their appearance, to binge on certain foods, to feel guilty for overeating, and to have those around them telling them they should lose weight. Only 12% of those who were more preoccupied with their weight identified themselves as the right weight, while 27% of those who believed themselves to be slightly overweight were preoccupied (see Table 3).

Table 2a

How many times/day respondents thought about their weight and/or weight goals

	Total	Males	Females
Less than daily	25%	36%	14%
Once/day	18%	22%	15%
Twice/day	20%	20%	20%
Three times/day	15%	11%	18%
Four or more times/day	22%	11%*	33%**

*26% of males trying to lose weight and 4% of males not trying to lose weight think about weight 4+ times per day.

**46% of females trying to lose weight and 13% of females not trying to lose weight think about weight 4+ times per day.

(overall male/female differences: p=.00)

Table 2b

How often respondents weigh themselves

	Total	Males	Females
Daily	9%	10%	7%
Several times/week-weekly	21%	28%	15%
A few times/month	38%	36%	41%
A few times/year or less	32%	26%	37%

(overall male/female differences: p=.00)

Table 3

Differences by whether respondent is more or less preoccupied with weight status

(Weight-preoccupied: thought about their weight or weight goals 4+ times per day; more preoccupied category: 11% of males and 33% of females)

	More preoccupied with weight	**Less** preoccupied with weight
If trying to lose weight P=.00	81%	36%
Reason for desire to lose weight P=.02		
Appearance	70%	56%
Health	9%	23%
Both	21%	21%
If binges/overeats a certain food P=.00	60%	47%
If feels guilty after overeating P=.00	66%	20%

Weight loss strategy P=.00		
Diet and exercise	45%	34%
Exercise	31%	48%
Diet	24%	18%
Weighing frequency P=.00		
Daily	21%	5%
Several times/week	20%	22%
A few times/month	28%	42%
A few/times/year or less	31%	31%
Relationship type P=.27		
Committed	48%	44%
Dates casually	33%	42%
Single	19%	14%
Comments from others about losing weight		
If mother says to lose weight P=.00	34%	13%
If father says to lose weight P=.00	26%	7%
If close friends say to lose weight P=.00	18%	7%
If significant other says to lose weight	18%	10%
Self-reported weight status p=.00 Proportion within weight category that are weight-preoccupied [horizontal summing] (Proportion within if weight-preoccupied who are different weight categories [vertical summing])		

Proportion who identify themselves as the right weight	12% (23%)	88% (50%)
Proportion who identify themselves as the slightly overweight	27% (39%)	73% (30%)
Proportion who identify themselves as up to 20 lbs overweight	52% (23%)	48% (6%)
Proportion who identify themselves as >20 lbs overweight	34% (14%)*	66% (8%)*

* The remainder in each group to total 100% were those self-designating as too thin.

Table 4

Reactions to overeating among those who ever binge on a certain food (50% of sample)

	Total	male	female	p
Increase exercise	70%	74%	67%	.20
Eat less in the next day or two	43%	24%	65%	00
Throw up food	5%	4%	5%	.57

*Only one respondent claimed to use laxatives (who did not identify his or her sex).

Of those who ever binged on a certain food (half of the sample, both males and females), most responded by increasing their exercise. Women (65%) and to a much lesser extent men (24%) made an effort to eat less in the subsequent day or two following their overindulgence. Throwing up food after overeating was apparently infrequent (4% of males and 5% of females) (see Table 4).

Respondents were asked to classify their weight according to five categories and to classify how *others* perceived their weight according to four categories (since assessing others' general opinion of oneself would be harder to pinpoint as accurately as one's own assessment). Fewer than half (44%) deemed themselves about the right weight, 32% claimed they were slightly overweight, 10% said they were more than slightly overweight by up to 20 pounds, 9% identified themselves as very overweight (by 20+ pounds), and 5% (all males) indicated they were too thin. In general, respondents felt that others were more likely to see them as about the right weight (65% versus 44%, mentioned above) (see Tables 5a and 5b).

Table 5a

How Respondents Characterize Their Weight by Sex

	about the right weight		very slightly overweight		up to 20 lbs overweight		very overweight by 20+ lbs		too thin	
Perception of own weight	44%		32%		10%		9%		5%	
male/female p=.00	48%	40%	28%	35%	4%	15%	10%	9%	9%	0%

Table 5b

How Respondents Characterize Others' Perceptions of Their Weight by Sex

Perception of how others assess one's weight	65%		21% (somewhat overweight)		2%		12%	
male/female p=.00	65%	66%	18%	24%	1%	3%	16%	7%

Of those trying to lose weight, most (61%) cited improved appearance as the primary reason for doing so. Of those attempting to maintain their weight, appearance was also the most frequently designated primary reason motivating them (46%) (Table 6).

Although relatively few respondents had those around them (family, friends, and acquaintances) telling them they should lose weight (6% of acquaintances up to as many as 18% of mothers), a significant number had others telling them to either maintain their weight or mentioned that they should not be concerned about their weight (49% of acquaintances up to 66% of significant others). In addition, as indicated in the last column of Table 7, with the exception of comments by students' fathers, fewer women indicated that various persons around them refrained from comments about their weight (Table 7).

Table 6

Why respondents wish to lose weight or maintain weight:

	lose weight (total)	male/female	maintain weight (total)	male/female
Appearance	61%	54%/65%	6%	43%/49%
Health	18%	23%/15%	32%	32%/30%
Both	21%	23%/20%	22%	25%/20%
		p=.18		p=.63

Table 7

Others' Reactions to Respondent's Weight

	Should lose weight Total Male/female		Should maintain weight Total Male/female		Should NOT be concerned about weight Total Male/female		Doesn't comment on my weight Total Male/female	
Significant other	12%		27%		39%		22%	
P=.00	11%	12%	28%	26%	31%	47%	30%	14%
Mother	18%		26%		35%		22%	
P=.09	15%	22%	26%	25%	33%	36%	26%	17%
Father	12%		21%		32%		36%	
P=.57	10%	14%	22%	18%	32%	31%	36%	37%
Siblings	14%		19%		29%		38%	
P=.00	9%	18%	19%	19%	24%	35%	49%	28%
Close friends	10%		26%		36%		28%	
P=.00	11%	9%	23%	28%	27%	45%	39%	18%
Acquaintances	6%		19%		30%		45%	
P=.07	5%	7%	16%	22%	27%	33%	52%	38%

*Those for whom one of the above relationships was not applicable (e.g., those without a significant other or only children) were excluded from the analysis of that variable.

Males were significantly more likely to believe that exercise alone was the key to losing and maintaining weight (Table 8). In fact, most males (75%) as well as females (67%) claimed that they rarely or never dieted (Table 9). Those females identifying themselves as very overweight were either in a committed relationship (43%), (a proportion almost identical to females who were about the right weight), or single (43%), while few dated casually. In contrast, half of very overweight males dated casually (see Table 10). Last, women were seen as more critical of other women's weight (70% of respondents) as well as men's weight (46% of respondents), results that did not vary by whether respondents were male or female.

Discussion

Given the influence of a dieting industry estimated to be worth $50 billion per year (Fraser, 1998) and the perception that most women are dissatisfied and obsessed with their weight (Bordo, 1993; Brown and Jasper, 1993; Brownmiller, 1984; Schwartz, 1986; Wolf, 1991), we need to assess the extent to which college women are in fact preoccupied with their weight. Most (59%) were trying to lose weight at the time of the survey (a proportion higher than the 46% reported by Lowry et al, 2000), and an additional 31% were consciously striving to maintain their weight. Therefore, only a tenth were not weight-conscious. Approximately twice as many college men (22%) were not weight-conscious (see Table 1).

Three times as many women as men, equal to a third of women, thought about their weight or weight goals four or more times per day (see Table 2a). Interestingly, however, women weigh themselves much less frequently, perhaps because they dread the scale-provided evidence that they have gained weight: 78% of women weighed themselves less often than weekly (versus 62% of men) (Table 2b).

Compared to others who thought less about their weight, this weight-preoccupied group was focused on losing weight to improve their appearance, perhaps as a result of the feedback to do so from those around them as well as broader societal pressures (see Table 3). Those who were weight-preoccupied included a substantial segment (23%) who said they were the right weight while another 39% claimed they were slightly overweight (a group who, as stated earlier, is likely not overweight). Thus, 62% of those more obsessive about their weight were not substantially overweight. There were no statistically significant differences by gender in relationships reported in Table 3.

Although men and women were equally likely to binge, more women (38%) felt guilty than men (22%) (Table 1), perhaps because they are more likely to indulge in sweets (see Wansink, Cheney and Chan, 2003). In addition, while increasing exercise was the most common response to overeating in both sexes (about 70% for males and females), eating less in the days subsequent to the overindulgence was much more common among females (65% versus 24%) (see Table 4). These findings are likely a reflection of the expectation that women be able to control their urge to eat (Chernin, 1980, 1986). Some believe that indulgent eating has replaced sexual promiscuity as the most sinful, shame-inducing behavior (Kilbourne, 1999). Indeed, restrained eating has long been associated with both increased social class and femininity (Brumberg, 1988).

Females were slightly more likely than males to think that others saw them as weight-proportioned when they did not see themselves in that way. Of those who described themselves as very overweight (i.e., 9%), very few (2%) thought others perceived them as such (Tables 5a and 5b). These results indicate that respondents saw themselves as more critical of their own weight than their perceptions of how others viewed them.

We have some reason to believe that how respondents thought others perceived them is more accurate: while only 44% thought they were about the right weight, 65% said others likely perceived them as about the right weight, a proportion nearly identical to the 64% of college students found in one study to have an acceptable body mass index (BMI) (Debate, Topping and Sargent, 2001). Similarly, Haberman and Luffey (1998) found that half of students whose BMI classified them as underweight labeled themselves as overweight. In addition, data collected by Miller et al. (1980) indicate that while 55% of college men were generally accurate in their self-perception of body size, 63% of the women saw themselves as being in the weight category one greater than they really were. In other words, the feeling of dissatisfaction with weight has been internalized, inculcated perhaps by exposure to rampant body-perfect images in the media (Kilbourne, 1999; Posavac and Posavac, 2002; Thomsen et al., 2002). So rather than feeling that they needed to live up to others' expectations of weight attainment, they instead based their assessments on their own desires to attain a certain weight.

No women thought of themselves as too thin (Table 5a) (and only 7% said others likely perceived them as such [Table 5b]) bringing to mind the adage "You can't be too rich or too thin." This saying is validated in other research in which women have lower BMI goals (Anderson et al., 2003), and in which the only women satisfied with their weight were those who were ten pounds underweight (Birtchnell et al, 1987). Other research indicates 46% of college women studied wanted to be underweight or slightly underweight (Miller et al., 1980), a reflection of the high value ascribed to thinness among American women (Garner et al., 1980). In addition, women think men prefer a body type that is thinner than what men actually prefer (Rozin and Fallon, 1988).

In contrast to efforts to maintain weight, the desire to lose weight was driven primarily by the expectation of improved appearance, especially for women. Only 18% were motivated for reasons that excluded appearance (Table 6). This proportion drops by half (to 9%) when looking at those who are weight-preoccupied (Table 3).

Women were much more likely to have others comment on their weight (including comments to lose, maintain or to not worry about their weight) with the exception of fathers, who did not distinguish between their sons and daughters in whether they commented on their weight. It is important to note, however, that men and women were equally likely to be told by their significant other that they should lose weight (11% and 12% respectively) (see Table 7), comparable to data reported elsewhere (5% and 7%: Sheets and Ajmere, 2005). For both males and females, mothers were most likely to specifically articulate that their children should lose weight, a phenomenon noted by others (e.g., Abramowitz, 2000; Kichler and Crowther, 2001). In addition, those who were weight-preoccupied were significantly more likely to have others telling them to lose weight, even though 62% had normal or only slightly elevated weight, which demonstrates how weight anxiety extends to many who should not worry. A greater proportion of those up to 20 pounds overweight (52%) than those more than 20 pounds overweight (34%) were weight-preoccupied, revealing that the pressure on this group may be greater than those who are very overweight, who may have resigned themselves to their status.

Relatively few of the respondents thought diet alone was the best strategy to lose (20%) or maintain weight (24%) (Table 8), a view also reflected in the finding that the majority of students rarely or never diet (75% of males and 67% of females) (Table 9). Females, however, were twice as likely to believe dieting alone was effective for losing weight (25% versus 12% of males) (see Table 8). This may be a result of the recent emphasis on the importance of regular exercise and/or increasing familiarity with findings that show that many weight-loss diets do not result in long-term weight loss (see e.g., Fraser, 1998). These data, however, do not tell us if the respondents actually follow this strategy. Yet our numbers of 44% of females and 30% of males who believed both diet and exercise was the best strategy are similar to what Lowry et al. (2000) found that undergraduates actually used to lose weight: 54% of females and 41% of males. Despite knowledge that diet and exercise are keys to weight control, many turn to unregulated weight loss supplements without first attempting to achieve their goals with dietary changes and exercise programs (Witte and Dundes, 2003).

The popularity of untested weight loss products and services may be related to an association of weight status with relationship status. Consistent with other research about the adverse impact of being overweight on dating (e.g., Gortmaker, 1993; Rothblum, 1992; Sheets and Ajmere, 2005; Sobal and Bursztyn, 1998), we found that very overweight women (by 20+ pounds) were more than twice as likely to be single as women who were less overweight or weight-proportionate; they were also approximately two and a half times less likely to be dating casually than other women. In contrast, males in the heaviest weight group were most distinct in that they had the *highest* proportion that dated casually (see Table 10). Those who are single are most likely to feel guilty when they overeat (42% versus 28% of the other two groups: p=.02). It is unclear whether this association is due to these women's self-doubts keeping them from taking the initiative in relationships or whether their weight results in others rejecting them as dates. Finally, women were considered to be much more critical of others' weight, especially of other women (see Table 11), a phenomenon likely related to women being subject to greater pressures to be thin (Stice et al., 2003; Tiggemann and Slater, 2004).

Limitations

Our results apply only to college students who are aged 18-23. We did not collect data about respondents' actual weight appropriateness (which would have relied on self-reporting). Instead, we relied on asking students for a general categorical placement, which may be more accurate in cases where sensitive information is sought. In addition, our survey did not distinguish between two types of dieting behavior: careful monitoring of consumption versus dietary changes to induce weight loss (Nichter et al., 1995).

Conclusions

Most college women in our sample (86%) thought about their weight and/or weight goals at least once/day, compared to 64% of college men. Nearly one third (32%) were preoccupied with weight (thinking about it 4+ times/day) compared to 11% of males. Most (59%) were trying to lose weight (versus 32% of men) even though only 24% classified themselves as more than slightly overweight, primarily in an attempt to improve their appearance (65% versus 54% of men).

Therefore, healthy and overweight women alike are burdened with worries about weight, perhaps due in part to the frequency with which those around them comment in some way about the issue of their weight (to at least half of them). While efforts to avoid obesity are warranted, college women's attention to weight control likely exceeds the self-vigilance necessary to keep this problem in check.

Table 8

Best strategy to lose weight (maintain weight)

	Total	Males	Females
Diet and exercise	39% (28%)	30% (31%)	44% (24%)
Exercise	41% (48%)	58% (55%)	31% (39%)
Diet	20% (24%)	12% (14%)	25% (36%)

Male/female: losing weight: p=.00; (maintaining weight: p=.01)

Table 9

Which pattern best describes your dieting (over the past 2 years)?

	Males	Females
Always on or breaking a diet	6%	9%
Start a new diet at least once a month	7%	11%
Start a new diet a few times a year	12%	13%
Rarely/never diet	75%	67%

(overall male/female differences: p=.20)

Table 10

Of those identifying themselves as in a particular weight group, the proportion who are in different relationship categories

	about the right weight		very slightly overweight		more than slightly overweight (up to 20 lbs overweight)		very overweight (by 20+ lbs)		Too thin	
Committed relationship	44%		49%		36%		37%		50%	
m/f	44%	44%	51%	48%	24%	39%	32%	43%	50%	0%
Date casually	44%		38%		41%		33%		25%	
m/f	45%	43%	44%	34%	38%	42%	**50%**	**14%**	25%	0%
Single	12%		13%		23%		30%		25%	
m/f	11%	13%	5%	18%	38%	19%	18%	**43%**	25%	0%

p=.10

Table 11

Which sex is more critical of weight?

	Of women's weight	Of men's weight
Women more critical	70%	46%
Men more critical	19%	27%
No difference	11%	27%
	100%	100%
	p= .05	p= .12

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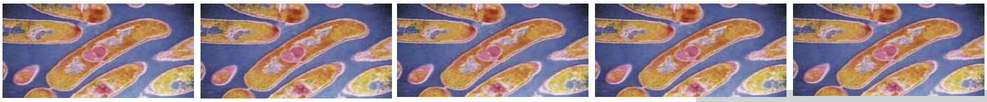
IN CONJUNCTION WITH THE AFDO PRODUCT RECALL WORKSHOP



Intervention Strategies for the Control of Listeria Monocytogenes

October 4, 2005
Holiday Inn Inner Harbor
Baltimore, Maryland

According to the Centers for Disease Control (CDC), more than 2,000 people in the United States report serious illness from Listeriosis each year. Of these, 25% will tragically die from the disease. The bacterium responsible for this illness -- *Listeria monocytogenes* — has become one of the most pertinent food safety issues of our time. During the past year, the Association of Food and Drug Officials (AFDO) has worked very closely with the United States Department of Agriculture's Food Safety and Inspection Service (FSIS), the U.S. Food and Drug Administration (FDA), our industry partners, and academia to develop intervention strategies for dealing with this organism. AFDO, through Cooperative Agreements with the FSIS, established work groups to evaluate State Food Safety Surveillance on *Listeria monocytogenes* and to develop education and training materials. Now, AFDO is offering this training program for the purpose of providing new insight into current and suggested strategies for eliminating or controlling *Listeria monocytogenes*. Attendees to this full-day program will receive:

An Instructional Videotape and an Educational Booklet on Controlling *Listeria* at Retail

An Educational Booklet on How to Address *Listeria* in Small Meat or Poultry Facilities

The AFDO Document "AFDO Cured, Salted, and Smoked Fish Model GMP" Containing the *Listeria* Control Manual Developed by the Smoked Seafood Working Group of the Food Processors Association (FPA) and National Fisheries Institute (NFI)

WHO SHOULD PLAN TO ATTEND:

FOOD SAFETY CONSULTANTS

GOVERNMENT OFFICIALS (FEDERAL, STATE, & LOCAL)

REGULATED INDUSTRY (MANUFACTURING & RETAIL)

QUALITY ASSURANCE (TECHNICAL & SAFETY)

MANUFACTURING PLANT OPERATORS & MANAGERS

GENERAL MANAGERS

CORPORATE REGULATORY AFFAIRS STAFF

LEGAL (CORPORATE & OUTSIDE COUNSEL)

CUSTOMER & PUBLIC RELATIONS STAFF

ACADEMIA (PROFESSORS & INSTRUCTORS)

CONSUMER ADVOCATES

DON'T MISS YOUR OPPORTUNITY TO...

Learn New Technology and Help Your Company Identify Useful Strategies to Combat *Listeria Monocytogenes*

Dialogue with Top U.S. Food Safety Officials

Participate in a Collaborative Learning Experience with Government, Industry, and Consumers

Learn What Responsibilities Retail vs. Manufacturers Have in Regard to the Issue

ADDITIONAL DETAILS AND REGISTRATION INFORMATION WILL BE AVAILABLE SHORTLY. VISIT WWW.AFDO.ORG.

IN CONJUNCTION WITH THE AFDO LISTERIA WORKSHOP

INTERACTIVE, "HANDS-ON" TRAINING

Product Recall Workshop

October 5-6, 2005
Holiday Inn Inner Harbor
Baltimore, Maryland

Now is the time to discuss product recalls in light of possible bioterrorist events. In the five years following 9/11, The Association of Food and Drug Officials (AFDO) has been working very closely in conjunction with the U.S. Food and Drug Administration (FDA), the United States Department of Agriculture's Food Safety and Inspection Service (FSIS), and with regulated industry and academia to develop a comprehensive Product Recall Manual. This information will be presented as part of a day-and-a-half Product Recall Workshop that combines informative speaker sessions with a series of "hands-on" event simulation exercises.

DON'T MISS YOUR OPPORTUNITY TO...

- Help your Organization Understand what Actions They Need to Take to Minimize the Overall Impact of a Product Recall
- Learn New Advances in the Area of Recalls and New Responsibilities since 9/11
- Assist your Company in Strengthening Your Internal Recall Strategy by Identifying Potential Areas of Weakness
- Dialogue with Top U.S. Recall Officials and Participate in a Collaborative Learning Experience with Government, Industry, and Consumers
- Learn What Responsibilities Retail vs. Manufacturers Have in Regard to the Issue

WHO SHOULD PLAN TO ATTEND:

GOVERNMENT OFFICIALS (FEDERAL, STATE, & LOCAL)

REGULATED INDUSTRY (MANUFACTURING, RETAIL, DISTRIBUTORS & IMPORTERS)

QUALITY ASSURANCE (TECHNICAL & SAFETY)

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VISIT WWW.AFDO.ORG.

AFDO MISSION STATEMENT

The Association of Food and Drug Officials (AFDO), established in 1896, successfully fosters uniformity in the adoption and enforcement of science-based food, drug, medical devices, cosmetics and product safety laws, rules, and regulations.

AFDO and its six regional affiliates provide the mechanism and the forum where regional, national and international issues are deliberated and resolved to uniformly provide the best public health and consumer protection in the most expeditious and cost-effective manner.

AFDO Accomplishes Its Mission by:

♦ Promoting education, communication and cooperation among government, industry and consumers.

♦ Fostering understanding and cooperation between industry, regulators and consumers.

♦ Promoting the adoption and uniform enforcement of laws and regulations at all levels of government.

♦ Providing guidance and training programs for regulatory officials and the regulated industry to promote nationally and internationally uniform inspections, analyses, interpretations and investigations.

♦ Identifying and resolving inconsistencies in consumer and public health protection laws, regulations, standards and policies.

♦ Providing a permanent working committee structure to research current issues, obtain input from interested parties and produce recommendations for action.

♦ Developing model laws, regulations and guidance documents and seeking their adoption throughout the United States.

♦ Conducting an Annual Educational Conference, where for over a century, AFDO has provided the opportunity for individuals from government, industry, and the public to participate in, listen to, and learn valuable information and develop initiatives concerning food, drug, medical device, cosmetic and product safety issues.

CATEGORIES OF MEMBERSHIP
The Association of Food and Drug Officials

New Membership Dues Structure:

- **Individual membership** is designed for singular memberships. All individual members may choose to receive the quarterly journal on-line or by mail.
- **Group memberships** are designed for those agencies/organizations that would like reduced rates to enroll several members. One quarterly journal is provided for each group by mail; other group members may access the journal on-line.*
- **Contributing memberships** are designed for those agencies/ organizations that would like to support the ongoing activities of the Association of Food and Drug Officials through an "increased" level of contribution. Contributing members receive the quarterly newsletter and may choose to receive the quarterly journal via mail or on-line.*

Organization, group and contributing memberships must be received together and processed as a group.

JOURNAL OF THE ASSOCIATION OF FOOD AND DRUG OFFICIALS

Inquiries: For editorial matters, contact the Editor: Thomas (Bill) Brooks, PO Box 11280 Columbia, SC 29211-1280; Phone (803) 737-9700; Fax (803) 737-9703. For all other matters contact AFDO's office: 2550 Kingston Road, Suite 311, York, PA 17402; phone (717) 757-2888; fax (717) 755-8089; email afdo@afdo.org.

Subscription Rates For Non-Members: United States and Canada: $80; other countries: $90 (includes airmail); single issues: $20.

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Reprints and References: Reprints of articles may be obtained at standard rates. Most materials published in the *Journal* do not have references.

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ASSOCIATION OF FOOD AND DRUG OFFICIALS
MEMBERSHIP APPLICATION

MEMBERSHIP INFORMATION:

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Individual Members	On-line Journal	Journal
Alumni/Students	☐ $50	☐ $65
Regulatory	☐ $50	☐ $85
Consumers/Educational	☐ $50	☐ $85
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# of Group Members	Government	Non-Government
5-10	☐ $46 each	☐ $300 each
11-20	☐ $44 each	☐ $285 each
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Greater than 50	☐ $40 each	☐ $255 each

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ASSOCIATION OF FOOD AND DRUG OFFICIALS

COMMITTEE PREFERENCE FORM

Please use this form if you wish to serve on an AFDO committee

PART A: Member Information

Name: ____

Title: ____

Agency or Firm: ______________________________________

Telephone: ____________________ FAX: ____________________

Email: ____

Became an AFDO member in what year?________

Principal field of endeavor or interest ______________________________

PART B: Member's Preference for Assignment to Committees

Note: *Every effort will be made to assign you to the committee(s) in which you have expressed an interest. Committees are the backbone of AFDO, and your active participation and input are important! Please sign up only for those committees that you feel you will have time to actively serve on. Thank you!*

- ☐ Administration Committee
- ☐ Alumni Committee
- ☐ Associate Membership Committee (Industry Only)
- ☐ Awards Committee
- ☐ Drug, Devices & Cosmetics Committee
- ☐ Education and Training Committee
- ☐ Field Committee
- ☐ Food Committee
- ☐ Food Protection & Defense Committee
- ☐ Int'l. & Government Relations Committee
- ☐ Laboratory Science & Tech Committee
- ☐ Laws and Regulations Committee
- ☐ Meat and Poultry Committee
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- ☐ Resolutions Committee
- ☐ Retail Food Committee
- ☐ Seafood Committee

I am interested in:

- ☐ Contributing papers to the *AFDO Journal*
- ☐ Reporting on legislative initiatives in my state
- ☐ Assisting w/Local Affiliate Training Program
- ☐ Other:______________________________

When completed return this form to:

AFDO, 2550 Kingston Road, Suite 311, York, PA 17402, or
fax to 717-755-8089

AFDO COMMITTEES
WHO THEY ARE AND WHAT THEY DO

Administration Committee: Reviews the Association's constitution, by-laws, procedures, and policies; proposed recommended changes, additions, or deletions in an annual report; and identifies potential impacts to the Association.

Alumni Committee: Assists the AFDO Board and the President of AFDO in identifying and implementing meaningful opportunities for alumni to participate in the life and business of AFDO.

Associate Membership Committee: Serves AFDO membership by providing a link between regulatory and industry members. Associates provide input to the President through serving as associate advisors to committees and assist in identifying topics and speakers for the Annual Conference.

Awards Committee: Administers and oversees the awarding of the five AFDO awards and the AFDO Scholarship awards.

Drugs, Devices and Cosmetics Committee: Assists AFDO membership in establishing policies, posture and opinions related to Drug, Device and Cosmetic Safety Issues.

Education and Training Committee: Promotes and strengthens the technical and professional development of the members, which ultimately results in the development and enforcement of uniform food, drug, and consumer protection laws.

Field Committee: Involves food and drug safety professionals at the field level in assisting AFDO to develop policies and identify educational needs that can benefit field level employees.

Food Committee: Assist AFDO membership in establishing policies, postures, and opinions related to food safety issues.

Food Protection & Defense Committee: A forum for discussion on food security issues, and to coordinate member food security activities, as well as find a proactive role for the committee in protecting the food and agricultural sector critical infrastructure.

International & Government Relations Committee: Achieves a mutual working relationship between the Association and federal, state, and local governments in accomplishing the goals and objectives of AFDO in relation to consumer protection in the food, drug, and product safety fields.

Laboratory, Science and Technology Committee: Determines needs of laboratories supporting regulatory function and recommend the means of meeting those needs, provides information to regulatory and enforcement personnel to enhance knowledge and understanding of the changing and frequently complex scientific nature involved in regulatory work, promotes communications, coordination, and the mutual assistance of federal, state, and local government laboratories and industrial laboratories, and provides consulting and special project services to AFDO and regulatory agencies.

Laws and Regulations Committee: This Committee is responsible for the continuous review, up-dating, and development of model laws and regulations so that the AFDO goal of uniform food, drug and other consumer protection laws is achieved.

Meat and Poultry Committee: Assist AFDO with the development of policies and positions specific to meat and poultry safety issues. Additionally, the committee provides technical assistance and expertise in the development and delivery of meat and poultry training initiatives, in conjunction with other AFDO Committees.

Media and Public Affairs Committee: Assists in reviewing and developing marketing materials, develops and executes a media plan for conferences with press releases, scheduled interviews, etc., publicizes AFDO, develops recruitment materials to increase membership, develops special programs for new members, works with committees to help develop marketing strategies, and serves as consultants on public affairs issues.

Membership Committee: This committee will work to conserve membership levels and obtain new members. Emphasis is placed on coordinating membership efforts to incorporate affiliate and national initiatives.

Nominations and Elections Committee: Comprised of six regular members, one from each affiliate association, plus a chairperson, is responsible for submitting the name of three regular members, when qualifying candidates are available and willing to serve, as nominees to fill the expiring term of each director elected at large, the office of Vice-President and the Secretary-Treasurer of the Association.

Resolutions Committee: Serves AFDO membership by gathering together proposed resolutions pertinent to current issues and presenting these to the AFDO membership for a vote.

Retail Food Committee: Assists AFDO with food related issues specific to the retail environment. Assists with the development of retail food-related policies and positions, and contributes expertise to the improvement of the uniformity of retail food regulations, policies and procedures. Liaison to the Conference for Food Protection providing input to identify and develop proposed changes to the FDA’s retail Food Code.

Seafood Committee: This committee focuses on issues related specifically to seafood and assists AFDO with developing seafood related policies and positions and the development and delivery of seafood training programs.

ASSOCIATION OF FOOD AND DRUG OFFICIALS CONFERENCE SCHEDULE

2006
June 17–21, 2006
Crowne Plaza Hotel Albany City Center
Albany, NY

2007
June 16–20, 2007
Crowne Plaza Hotel San Antonio - Riverwalk
San Antonio, TX

2008
June 7–11, 2008
Crowne Plaza Anaheim Resort Hotel
Garden Grove, CA

ASSOCIATION OF FOOD AND DRUG OFFICIALS

Mission Statement

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* William Krueger (2005) .... North Central States
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