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# Food Safety

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## INTRODUCTION

Food safety could be broadly defined as ensuring that food is produced, processed, distributed, and prepared in a fashion that will prevent consumers from harm when the food is consumed. Food safety is closely related to food law, as many of the laws and regulations governing food were enacted to address issues of food safety issues. For example, one of the major aspects of the 1906 Pure Food and Drug Law addressed adulteration of food. In many instances, adulteration could be linked to increased risks of foodborne illness among consumers. Subsequently, additional federal laws have been enacted that address food safety as it pertains to for foods in interstate commerce. These laws include the Federal Food, Drug and Cosmetic Act of 1938, Miller Pesticide Amendment of 1954, Food Additive Amendment of 1958, Color Additive Amendment of 1960, Food Allergy Labeling and Consumer Protection Act of 2006, Good Manufacturing Practices (cGMPs), Good Agricultural Practices (GAP), Hazard Analysis Critical Control Point (HACCP) regulations for the seafood, meat and poultry, and fruit- and vegetable-juice processing industries, and most recently the U.S. Food and Drug Administration (FDA) Food Safety Modernization Act of 2011. Foods sold in intrastate commerce are regulated by state laws. In Maine, the agencies involved would include the Department of Agriculture, Food and Rural Resources (DOA), Department of Marine Resources (DMR) and the Department of Health and Human Services (DHHS).

Even with the current regulations, numerous foodborne illness outbreaks are reported in the U.S. each year. The Centers for Disease Control and Prevention (CDC) estimates that foodborne diseases cause about 76 million illnesses, 350,000 hospitalizations, and 5,000 deaths annually in the United States (Mead et al. 1999). In the past two years, products implicated in foodborne illness range from meat and poultry to fruits and vegetables, nuts and seafood. To reduce the instances of foodborne illness, particularly those resulting from microorganisms, an approach that addresses food safety from the farm to the fork is being implemented. This approach will rely on providing food-safety education for producers, processors, distributors, wholesalers, and retailers and also the consumer.

## HISTORY

Food safety dates back to biblical times even though there was no scientific understanding of why consuming certain foods could make one ill or even cause death. Scientists first isolated bacteria as a source of illness in the 1600s, and it wasn't until the 1800s that research conducted by Nicolas Appert and Louis Pasteur provided the first evidence that thermal processing could preserve foods by reducing the number and type of microorganisms that caused many foodborne illness cases. Nicholas Appert's research on canning remains the food-safety standard for the canning industry. Pasteur's research in the 1860s on pasteurization is also still used today to produce safe foods such as dairy products and fruit juices. Many of the currently existing federal and state regulations are in place to aid in providing a safe food supply for all consumers. Many of these regulations are concerned with and address controlling hazards that can be associated with food.

## HAZARDS

A hazard is defined as a condition or contaminant, in or on food, which can cause illness or injury. Hazards can be biological, chemical, or physical in nature (Table 1).

Most cases of foodborne illness can be traced back to failure to control one or more of these hazards. Failure to control hazards can occur at any point within the food chain from the farm or boat to the table.

TABLE 1: **Types of Hazards**

| Hazard Type | Examples |
|---|---|
| Biological | Pathogenic bacteria, parasites, viruses |
| Chemical | Shellfish toxins, food additives, pesticides, natural food toxins |
| Physical | Metal, glass, plastic |

### *Controlling Hazards*

The primary purpose of food-processing technology is to control potential hazards that may be present on or in foods. Safe food processing applies to food processors and also to individual(s) preparing food for the family. Food processors must follow methods for controlling or reducing hazards through cGMPs, sanitation standard operating procedures (SSOPs), GAP, and/or HACCP during food processing and distribution. Consumers should be educated on proper food handling and preparation via detailed directions on food labels. Older processing technologies such as drying, salting, pasteurization, canning, refrigeration, and freezing are still effective methods to provide a safe food supply. Consumer demand for fresh, minimally processed foods has increased, and newer technologies have been developed to safely produce these foods. High hypobaric pressure processing and irradiation are two examples of these types of processing methods.

Because food-distribution systems have expanded from a national to a global basis, traceability of foods is a growing concern for food safety. For example, a Salmonella Saintpaul outbreak occurred in 2008 and was associated with fresh salsa. In this one outbreak, approximately 1,500 individuals were infected and there were two deaths (Behravesh et al. 2011). Contaminated tomatoes were first thought to be the causative agent, but subsequent analyses implicated hot peppers as the source of the Salmonella. This one outbreak involved 43 states, Canada, and the District of Columbia. The peppers were grown and packed in Mexico and then distributed in the U.S. Because the food-distribution system is widening and becoming more global, processors should be more vigilant with coding sample food batches for traceability purposes and keeping adequate records so that foods can be tracked in the event of an outbreak of foodborne illness.

## COMPLEXITY OF FOOD SAFETY REGULATIONS

Several food regulatory agencies may be involved, depending on the type of food product (meat and poultry, seafood, fruits and vegetables), where the product(s) will be sold (interstate or intrastate commerce), and whether the foods will be sold to retail or foodservice.

To illustrate this complexity, Table 2 includes the regulatory agencies (federal and state) that could potentially be involved working with a Maine company that wanted to process seafood chowder to be sold as a frozen product for both retail and foodservice.

Since this is a seafood product, it must be processed in a facility that is operating under a HACCP plan (21 CFR Part 123), whether this product is sold in intra- or interstate commerce. Thus, the FDA regulations would apply even though the Maine DOA, Quality Assurance and Regulations Division may perform the inspection of the processing facility under a Memorandum of Understanding. Prior to initiation of a HACCP plan, the processor must be operating under cGMPs and have in place SSOPs. One or more of the company's employees will be required to have completed the seafood HAACCP certification course, which in Maine is offered by a consortium consisting of the FDA, DMR, DOA, the seafood industry, and the University of Maine Cooperative Extension. Also, as a result of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, the processing facility must also be registered with the FDA. The company can register on line at the FDA web site (www.fda.gov). (In Maine, home-based food processors are exempt from this act and do not have to register their home kitchens.)

Upon completion of these steps, the processor would establish the HACCP plan for processing the frozen seafood chowder. HACCP is a food-safety system based on identifying hazards and establishing a process control(s) to eliminate or reduce hazards to an acceptable risk level. In developing the HACCP plan, the processor would establish a flow diagram for

processing the seafood chowder. The flow diagram would then be used by the processor to address the seven principles of HACCP, which include conducting a hazard analysis, determining critical control points, establishing critical limits for the critical control points, establishing monitoring procedures for the critical control points, establishing corrective actions if critical limits are exceeded, establishing verification procedures that the HACCP plan is working, and establishing record-keeping and documentation procedures.

If the chowder contains shellfish, there is another step. The DMR regulates shellfish harvesting. Upon receiving shellfish, the processor must have a written guarantee that they were harvested from approved waters. The shellfish must be accompanied by harvester and/or dealer tags that provide information relating to the harvester/dealer, license/certificate number, harvest date and area, and type and quantity of shellfish. This information ensures the processor of the safety of the shellfish.

The seafood chowder would likely contain at least two of the eight most common food allergens (milk and crustacean shellfish), and the processor must comply with the Food Allergen Labeling and Consumer Protection Act when preparing the ingredient statement. While the label of nutrition facts is not directly related to food safety, it does provide the consumer with information on nutrients (cholesterol, trans fats, sodium, among others) that have been demonstrated to have negative health implications.

Finally, at the receiving end (restaurant or other foodservice establishment), the state and federal food codes will provide the foodservice establishment with recommendations for ensuring the safety of the product during receiving, storing, thawing, and preparation.

## FUTURE OF FOOD SAFETY

The passage of the Food Safety Modernization Act of 2011 provides the FDA with greater authority in dealing with food safety issues. Provisions in this Act give the FDA authority to initiate mandatory recalls. It increases inspection rates and would require all facilities to have a food-safety plan. Essentially, this would make some form of HACCP mandatory for all segments of the food-processing industry not just seafood, meat, and poultry, and fruit- and vegetable-juice processing. Thus, there will be food safety challenges that must be addressed at all levels of food processing from multinational corporations to Maine's small home-based food processors.

A major challenge facing Maine's small food industry is the lack of infrastructure and/or capital to increase production to meet growing market demands. Additional obstacles are faced by Maine's meat and poultry producers, as described in the article by Henrietta Beaufait in this issue. All of Maine's food processors are faced with challenges associated with the costs of raw ingredients, packaging, energy, and transportation. For small and home-based food processors, there is a need for co-packers who will process 10- to 30-case lots of product(s). An alternative being explored in several locations in Maine would be the establishment of shared-use facilities. Food-safety information and training for processors using these facilities would be a collaborative effort involving the staff at the facilities, faculty at the University of Maine Department of Food Science and Human Nutrition and University of Maine Cooperative Extension, and

TABLE 2: **Regulatory Agencies Involved in the Processing of Frozen Seafood Chowder**

| Step | Regulatory Agency |
|---|---|
| Prerequisite Programs for HACCP | • Good Manufacturing Practices (FDA)<br>• Sanitation Standard Operating Procedures (FDA) |
| Plant Registration | • Public Health Security and Bioterrorism Preparedness and Response Act of 2002 |
| HACCP Plan | • FDA<br>• DOA Food and Rural Resources Division of Quality Assurance and Regulations |
| Harvesting of shellfish | • DMR Shellfish Laws and Regulations Revised April 2011<br>• National Shellfish Sanitation Program (NSSP). The cooperative state-FDA-industry program |
| Labeling | • Nutrition Labeling and Education Act (FDA)<br>• Food Allergen Labeling and Consumer Protection Act (FDA) |
| Foodservice—Intrastate | • State of Maine Food Code 2001 |
| Foodservice—Interstate | • Federal Food Code 2009 |

state and federal regulatory agencies. For the foodservice industry, which traditionally has a high turnover rate, the challenge is to provide continuous food safety and sanitation training for personnel.

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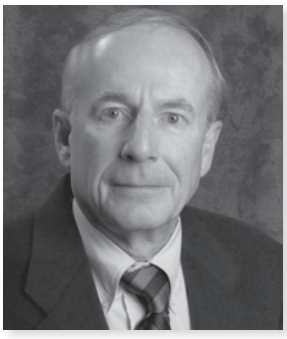

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**Jason Bolton** is an assistant extension professor and statewide food safety educator with the University of Maine Cooperative Extension and is pursuing a Ph.D. in food science and human nutrition. He is co-founder and president of Yo Bon, LLC, whose product, Yo Bon Blueberry Bites, won the Institute of Food Technologists' product-development competition in 2006.