

Food Processing: Salmonella

Introduction

There are approximately 2,000 different serotypes of *Salmonella* bacteria. One of the more common food contaminants is Salmonella bacteria, specifically, *Salmonella enteritidis* (SE). This bacteria can be found in raw meats, fish, poultry, milk and dairy products, shrimp, frogs' legs, yeast, coconut, sauces and salad dressings, cake mixes, and other sources. However, the source of most concern is shell eggs. While poultry, meat, fresh produce, and other raw foods can also carry SE, shell eggs lead the list. In addition to SE, *Salmonella* Typhimurium DT104 is an emerging pathogen and a highly virulent strain of *Salmonella* that is resistant to several antibiotics. This organism is now the second most prevalent strain of *Salmonella* after SE. Since 1996, the incidence of SE infection in humans has decreased greatly, although many cases and outbreaks due to SE contaminated eggs continue to occur.

The Human Factor

A key factor enabling the egg to be an efficient vehicle for human infection is the manner in which people handle and eat eggs. Eggs are one of the few animal products that are frequently eaten raw or undercooked. Raw eggs are often components of homemade and restaurant-produced ice creams, salad dressings, mayonnaise, and beverages such as egg nog and special diet or health drinks. Other types of foods contain eggs that are only lightly cooked, such as mousse and hollandaise sauce. Breakfast eggs are often cooked such that, when eaten, the egg white and yolk are soft or runny.

Infection with SE is also associated with eating outside the home. In a review of outbreaks of SE infection from 1985-1999, 62% of outbreaks of SE infection occurred in restaurants or other commercial establishments. One reason that commercial or other large-scale food preparation settings may be more frequently associated with illness is the practice of pooling large numbers of eggs for use in scrambled egg dishes and omelets or as a component of batters. When pooling eggs, one or a few contaminated eggs can contaminate a large amount of food in conditions that may accelerate proliferation, and thus expose a large number of consumers to high quantities of SE contaminated egg dishes.

How Salmonella Causes Illness

Salmonella is commonly found in the intestinal tracts of animals, especially birds and reptiles. *S. typhi* and the paratyphoid bacteria are septicemics (blood toxins) which can produce typhoid or typhoid-like fever in humans. Other forms of salmonellosis generally produce milder symptoms.

LOSS CONTROL TIPS

Acute symptoms. Nausea, vomiting, abdominal cramps, minimal diarrhea, fever, and headache.

Chronic consequences. Arthritic symptoms may follow three to four weeks after onset of acute symptoms.

Onset time. 6 to 48 hours.

Duration of symptoms. Acute symptoms may last for 1 to 2 days or may be prolonged, depending on such things as the ingested dose and the characteristics of the particular strain of bacteria.

Cause of the disease. Penetration and passage of Salmonella organisms from gut lumen (inner open space of the intestine) into epithelium (membrane) of the small intestine where inflammation occurs. There is evidence that an enterotoxin (intestinal poison) may be produced, perhaps within the enterocyte (organism).

Complications. *S. typhi* and *S. paratyphi* A, B, and C produce typhoid and typhoid-like fever in humans. Various organs may be infected, leading to lesions. The fatality rate of typhoid fever is 10%, compared to less than 1% for most forms of salmonellosis. *S. dublin* has a 15% mortality rate when septicemic in the elderly, and *S. enteritidis* is demonstrating approximately a 3.6% mortality rate in hospital/nursing home outbreaks, with the elderly being particularly affected. Salmonella septicemia has been associated with subsequent infection of virtually every organ system.

Target populations. All age groups are susceptible, but symptoms are most severe in the elderly, infants, and the infirm. AIDS patients frequently suffer salmonellosis (estimated 20-fold more than the general population) and suffer from recurrent episodes.

What else is being done?

Government agencies and the egg industry have taken steps to reduce SE outbreaks. These steps include the difficult task of identifying and removing infected flocks from the egg supply and increasing quality assurance and sanitation measures.

The Centers for Disease Control has advised state health departments, hospitals, and nursing homes of specific measures to reduce SE infection. Some states now require refrigeration of eggs from the producer to the consumer. The U.S. Department of Agriculture is testing the breeder flocks that produce egg-laying chickens to ensure that they

are free of SE. Eggs from known infected commercial flocks will be pasteurized instead of being sold as grade A shell eggs. The U.S. Food and Drug Administration has issued guidelines for handling eggs in retail food establishments and will be monitoring infection in laying hens. Research by these agencies and the egg industry is addressing the many unanswered questions about SE, the infections in hens, and contaminated eggs. Informed consumers, food-service establishments, and public and private organizations are working together to reduce, and eventually eliminate, disease caused by this infectious organism.

Risk Management Controls

The pending proposals from the U.S. Food and Drug Administration (FDA) and U.S. Food Safety and Inspection Service (FSIS), and any other possible action they may take, will help unify or supplement efforts already under way to prevent the spread of SE in eggs. For example, most states now require refrigeration of eggs at the retail level. A number of states, along with the United Egg Producers, have established voluntary quality assurance programs for egg producers. Participants agree to follow certain practices, including:

- cleaning and disinfecting hen houses between flocks
- adopting strict rodent control measures
- washing eggs properly
- refrigerating eggs between transport and storage
- putting in place biosecurity measures
- monitoring mortality of chickens
- using SE-free chicks and pullets (young chickens)

The risk management control that can have the greatest effect in controlling Salmonella contamination (or any other potential source of contamination) is the implementation of a good Hazard Analysis Critical Control Point (HACCP) program at all levels of the food processing continuum. Recognizing that Salmonella contamination can occur in foods other than shell eggs, each of the potential sources may require unique controls to eliminate/reduce the exposure.

Summary

Salmonella contamination is one of the more common foodborne bacteria. It can be found in a significant number of foods; however, it is most prevalent in shell eggs. The bacteria can cause illness in all age groups, but the symptoms are most severe in the elderly, infants, and the infirm. The FDA and the FSIS are proposing regulations to reduce the hazard. HACCP programs can also reduce the potential for foodborne illness. Each of these efforts is important,

because the egg is one of the cheapest, yet most nutritious, foods and is consumed by a large portion of the population. Eggs provide an excellent source of protein and substantial amounts of vitamins A and B12, folate, thiamin, riboflavin, phosphorous, and zinc.

For more information, contact your local Hartford agent or your Hartford Loss Control Consultant. Visit The Hartford's Loss Control web site at <http://www.thehartford.com/corporate/losscontrol/>

References

1. Paula Kurtzweil, "Safer Eggs: Laying the Groundwork," U.S. Food and Drug Administration, *FDA Consumer*, September-October 1998.
2. *Bad Bug Book*, U. S. Food and Drug Administration, Center for Food Safety & Applied Nutrition, Foodborne Pathogenic Microorganisms and Natural Toxins Handbook, *Salmonella* ≥ spp.
3. Food Safety Objectives Healthy People 2000 Current Status, U. S. Food and Drug Administration, Center for Food Safety & Applied Nutrition, National Health Promotion and Disease Prevention Objectives, September 1995
4. Christopher R. Braden, "*Salmonella enterica* Serotype Enteritidis and Eggs: A National Epidemic in the United States." Center for Disease Control and Prevention, *Clinical Infectious Diseases* – August 15, 2006.
5. Center for Disease Control and Prevention, Coordinating Center for Infectious Diseases/Division of Bacterial and Mycotic Diseases. October 13, 2005

The information provided in these materials is intended to be general and advisory in nature. It shall not be considered legal advice. The Hartford does not warrant that the implementation of any view or recommendation contained herein will: (i) result in the elimination of any unsafe conditions at your business locations or with respect to your business operations; or (ii) will be an appropriate legal or business practice. The Hartford assumes no responsibility for the control or correction of hazards or legal compliance with respect to your business practices, and the views and recommendations contained herein shall not constitute our undertaking, on your behalf or for the benefit of others, to determine or warrant that your business premises, locations or operations are safe or healthful, or are in compliance with any law, rule or regulation. Readers seeking to resolve specific safety, legal or business issues or concerns related to the information provided in these materials should consult their safety consultant, attorney or business advisors. All information and representations herein are as of March 2009.