



Loss Control Department
Technical Information Paper Series

Food Processing: *Salmonella*

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Food Processing: Salmonella

One of the more common food contaminants is Salmonella bacteria, specifically, *Salmonella enteritidis*. 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 Salmonella enteritidis (SE), shell eggs lead the list. According to a study in the 1994 *Journal of Infectious Diseases*, 82 percent of SE outbreaks between 1985 and 1991, in which the vehicle for transmission was known, were traced to contaminated shell eggs. Recent incidents of Salmonella contamination include:

- Washington, D.C. - 1994: A total of 56 persons who ate at a Washington, D.C. hotel had onset of diarrhea; 20 persons were hospitalized. It was determined that 27 of 29 persons who were analyzed had Salmonella enteritidis (SE). The culprit was determined to be hollandaise sauce.
- Indiana - 1995: Approximately 70 residents and staff of a nursing home were stricken with symptoms of Salmonella contamination which was traced to baked eggs which had been served for breakfast. Three residents died from complications of SE infection.
- Greenport, New York - 1995: Following a wedding reception, 28 of 76 attendees became ill with Salmonella contamination. All of the persons who became ill had eaten Caesar salad with dressing that had been prepared with raw shell eggs.

Hazard

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

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.

Government Intervention

The U. S. Food and Drug Administration (FDA) and the U. S. Department of Agriculture's Food Safety and Inspection Service (FSIS) announced in May 1998 that they would seek to identify "farm-to-table actions" to decrease the food safety risks associated with shell eggs. The agencies said they would consider regulations or guidance to cover egg handling on the farm, in transit, and at the retail level, and asked for public comment.

In the advance notice of rulemaking (May 19, 1998), FDA and FSIS announced that they would propose regulations to improve the safety of eggs. The FSIS proposal would require eggs packed for consumer use to be refrigerated during distribution at a temperature not to exceed 45°F (7°C) and to include a label on packages indicating that refrigeration is needed. FDA's proposals would require:

- retail food stores and food service establishments to hold shell eggs at a refrigeration temperature of 45°F (7°C)
- safe handling instructions on the package labels of shell eggs that have not been treated to kill Salmonella. The instructions might say: "*Raw eggs may contain harmful bacteria known to cause serious illness, especially in children, the elderly, and people with weakened immune systems. Consumers should be advised to keep eggs refrigerated and cook them thoroughly before eating.*"

Risk Management Controls

The pending proposals from FDA and 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, 38 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)

Newer technologies in egg production are currently being explored, including processes for in-shell pasteurization, irradiation, and spraying newly hatched chickens with Preempt, a

biotechnology product FDA approved last March. Preempt contains 29 bacteria that reduce Salmonella colonization in the chicks' intestines. The chicks ingest Preempt when they peck at their wet feathers.

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. In addition, several new technologies may also mitigate 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.

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

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Controlling Salmonella

The Salmonella bacteria is found in many foods, including: raw meats, poultry, fish, 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. The egg is one of the cheapest yet most nutritious foods. Eggs provide an excellent source of protein and substantial amounts of vitamins A and B12, folate, thiamin, riboflavin, phosphorous, and zinc. Even so, eggs, when not stored or prepared properly, can be a source of Salmonella contamination. Salmonella infection can cause serious illness—and even death—in vulnerable individuals. To prevent infection with Salmonella enteritidis, follow these rules when buying, storing, preparing, serving and eating eggs:

- Don't eat raw eggs. This includes so-called "health-food" beverages made with raw eggs, and foods traditionally made with raw eggs, such as Caesar salad; hollandaise sauce; homemade mayonnaise, ice cream, or eggnog; and raw cookie or cake dough, unless the dish was made with a pasteurized liquid egg product or pasteurized in-shell eggs. Egg mixtures made with an egg-milk base cooked to an internal temperature of 160° Fahrenheit (71° Celsius) are safe, too. Use a thermometer to make sure the mixtures reach the correct temperature.
- Buy eggs only from a grocer's refrigerated case. Open the carton and check to see that the eggs are clean and uncracked.
- Store eggs in their carton in the coldest part of the refrigerator, not in the door, and use them within three to five weeks. The refrigerator should be set at 40°F (5°C) or slightly below.
- Keep hard-cooked eggs, including dyed Easter eggs, in the refrigerator, not at room temperature. Use them within one week.
- Do not freeze eggs in their shells. To freeze whole eggs, beat yolks and whites together. Egg whites also can be frozen separately. Use frozen eggs within one year.
- Wash hands, utensils, equipment, and work areas with warm, soapy water before and after contact with eggs and egg-rich foods.
- Don't leave cooked eggs out of the refrigerator for more than two hours. When baking or cooking, take out the eggs you need, and then return the carton to the refrigerator.
- Cook eggs until yolks are firm.

Source: Paula Kurtzweil, "Safer Eggs: Laying the Groundwork," U.S. Food and Drug Administration, *FDA Consumer*, September-October 1998.