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Salmonella enteritidis Infection

National Center for Infectious Diseases, Division of
Bacterial and Mycotic Diseases

Publication date: 03/01/1992

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Salmonella enteritidis Infection

Egg-associated salmonellosis is an important public health problem in the United States and several European countries. A bacterium, *Salmonella enteritidis*, can be inside perfectly normal-appearing eggs, and if the eggs are eaten raw or undercooked, the bacterium can cause illness. During the 1980s, illness related to contaminated eggs occurred most frequently in the northeastern United States, but now illness caused by *S. enteritidis* is

increasing in other parts of the country as well. Consumers should be aware of the disease and learn how to minimize the chances of becoming ill.

A person infected with the *Salmonella enteritidis* bacterium usually has fever, abdominal cramps, and diarrhea beginning 12 to 72 hours after consuming a contaminated food or beverage. The illness usually lasts 4 to 7 days, and most persons recover without antibiotic treatment. However, the diarrhea can be severe, and the person may be ill enough to require hospitalization.

The elderly, infants, and those with impaired immune systems may have a more severe illness. In these patients, the infection may spread from the intestines to the blood stream, and then to other body sites and can cause death unless the person is treated promptly with antibiotics.

How Eggs Become Contaminated

Most types of *Salmonella* live in the intestinal tracts of animals and birds and are transmitted to humans by contaminated foods of animal origin. Stringent procedures for cleaning and inspecting eggs were implemented in the 1970s and have made salmonellosis caused by external fecal contamination of egg shells extremely rare. However, unlike eggborne salmonellosis of past decades, the current epidemic is due to intact and disinfected grade A eggs. The reason for this is that *Salmonella enteritidis* silently infects the ovaries of healthy appearing hens and contaminates the eggs before the shells are formed.

Although most infected hens have been found in the northeastern United States, the infection also occurs in hens in other areas of the country. In the Northeast, approximately one in 10,000 eggs may be internally contaminated. In other parts of the United States, contaminated eggs appear less common. Only a small number of hens seem to be infected at any given time, and an infected hen can lay many normal eggs while only occasionally laying an egg contaminated with the *Salmonella* bacterium.

Who Can Be Infected

Healthy adults and children are at risk for egg-associated salmonellosis, but the elderly, infants, and persons with impaired immune systems are at increased risk for serious illness. In these persons, a relatively small number of *Salmonella* bacteria can cause severe illness. Most of the deaths caused by *Salmonella enteritidis* have occurred among the elderly in nursing homes. Egg-containing dishes prepared for any of these high-risk persons in hospitals, in nursing homes, in restaurants, or at home should be thoroughly cooked and served promptly.

What is the Risk

In affected parts of the United States, we estimate that one in 50 average consumers could be exposed to a contaminated egg each year. If that egg is thoroughly cooked, the *Salmonella* organisms will be destroyed and will not make the person sick. Many dishes made in restaurants or commercial or institutional kitchens, however, are made from pooled eggs. If 500 eggs are pooled, one batch in 20 will be contaminated and everyone who eats eggs from that batch is at risk. A healthy person's risk for infection by *Salmonella enteritidis* is low, even in the northeastern United States, if individually prepared eggs are properly cooked, or foods are made from pasteurized eggs.

What You Can Do to Reduce Risk

Eggs, like meat, poultry, milk, and other foods, are safe when handled properly. Shell eggs are safest when stored in the refrigerator, individually and thoroughly cooked, and promptly consumed. The larger the number of *Salmonella* present in the egg, the more likely it is to cause illness. Keeping eggs adequately refrigerated prevents any *Salmonella* present in the eggs from growing to higher numbers, so eggs should be held refrigerated

until they are needed. Cooking reduces the number of bacteria present in an egg; however, an egg with a runny yolk still poses a greater risk than a completely cooked egg. Undercooked egg whites and yolks have been associated with outbreaks of Salmonella enteritidis infections. Both should be consumed promptly and not be held in the temperature range of 40 degrees to 140 degrees for more than 2 hours.

Reducing the Risk of Salmonella Enteritidis Infection

- Keep eggs refrigerated.
- Discard cracked or dirty eggs.
- Wash hands and cooking utensils with soap and water after contact with raw eggs.
- Eat eggs promptly after cooking.
- Do not keep eggs warm for more than 2 hours.
- Refrigerate unused or leftover egg-containing foods.
- Avoid eating raw eggs (as in homemade ice cream or eggnog). Commercially manufactured ice cream and eggnog are made with pasteurized eggs and have not been linked with Salmonella enteritidis infections.
- Avoid restaurant dishes made with raw or undercooked, unpasteurized eggs. Restaurants should use pasteurized eggs in any recipe (such as Hollandaise sauce or caesar salad dressing) that calls for pooling of raw eggs.

What Else is Being Done

Government agencies and the egg industry have taken steps to reduce Salmonella enteritidis 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 Salmonella enteritidis 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 Salmonella enteritidis. 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 Salmonella enteritidis, 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.

Further information on this and other food borne diseases

Available from the Division of Bacterial and Mycotic Diseases, Office of the Director, National Center for Infectious Diseases, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, Georgia 30333

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This page last reviewed: Wednesday, January 27, 2016

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