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Preventing Foodborne Illness: *Salmonellosis*¹

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This is one in a series of fact sheets targeting the processing and retail sector of food science.

What causes a foodborne illness?

Bacteria, viruses, chemicals, and some other organisms can cause foodborne illnesses. *Salmonella* is a group of bacteria that can cause diarrheal illness in people. It has been known for over 100 years that *Salmonella* contaminated food can cause illness. The Centers for Disease Control and Prevention (CDC) in Atlanta, GA in 1999 estimated that there were about 1.5 million cases with some 500 deaths associated with the consumption of food contaminated with *Salmonella*. Estimates are necessary because not all cases of foodborne illness are reported. The Food and Drug Administration (FDA) estimated that in 1995, salmonellosis from foodborne sources resulted in economic losses of \$350 million to 1.5 billion dollars.

What is *Salmonella*?

Salmonella are motile (though some are non-motile), non-sporeforming and Gram-negative rod-shaped bacteria. They are widespread in the environment and are associated with all animal species including mammals, birds, reptiles, and

amphibians. *Salmonella* has been found in water, soil, insects, on factory and kitchen surfaces, animal feces, raw meats, poultry, and seafood. While these are common sources, *Salmonella* has been isolated from numerous other food sources.

What are the symptoms of salmonellosis?

The acute symptoms may include nausea, vomiting, abdominal cramps, diarrhea, fever, and headache. Typically, symptoms develop 12 to 72 hours after ingestion of contaminated food. Most persons infected usually recover without treatment after 4 to 7 days. As with many foodborne pathogens, young children, the elderly, and the immunocompromised are the most likely targets of *Salmonella* infections. Depending on host factors such as age and health of the host, the infective dose has been estimated to be as low as 15-20 cells for some strains.

In a small percentage of cases, persons infected with *Salmonella* can develop chronic, long-term problems associated with the illness. Reactive arthritis may begin 3-4 weeks after onset of acute

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symptoms, and the arthritic symptoms can be debilitating and last for 6 months or more.

Who is at Risk?

All age groups are susceptible to infections, but salmonellosis has a more severe effect on the elderly, infants, and infirm. The frequency of salmonellosis in AIDS patients is estimated to be 20-times higher than the general population. If you are supplying school lunch programs, nursing homes, or hospitals with food, a more rigorous quality assurance program might be necessary. This might include increased sanitation, stricter rules governing personal hygiene and/or increased microbial testing of finished product.

What foods have been commonly associated with *Salmonella*?

Salmonellosis outbreaks have occurred from a variety of foods including poultry, meats, eggs, milk products, fruit juice, fish, shrimp, frog legs, yeast, coconut, sauces and salad dressing, cake mixes, breakfast cereal, cream-filled desserts and toppings, dried gelatin, peanut butter, cocoa, chocolate, and dried spices.

The incidence of *Salmonella* is much higher in raw agricultural products (e.g. raw eggs, or uncooked poultry or meat) than in cooked or processed food products. However, *Salmonella* can occur in other foods as a result of cross-contamination with raw foods, or from contamination from humans, animals, birds, or reptiles. Further, due to the microorganisms ability to survive in wide range of environments, *Salmonella* has been found in dry and dehydrated foods (e.g. cocoa, chocolate, dry milk, spices, and cereal products) and in more acid food products (e.g. non-pasteurized orange juice). Thus, preventative measures are extremely important at all food handling and processing steps.

Good Practices for Food Product Receiving, Handling, Processing, and Storage

The FDA defines Current Good Manufacturing Practices for food (cGMPs) in 21 CFR, Part 110. These cGMPs outline minimally required general

sanitation requirements in FDA inspected food handling and processing facilities. It is recommended that more specific and stringent standard operating procedures (SOPs) be developed for individual facilities. In addition, the sanitation recommendations for food service and retail food facilities outlined in the FDA Food Code (FDA, 1999 and 2001) have been adopted into many state and local regulations. As there may be some variation in Food Code adoption, it is important that each facility check with the appropriate state and/or local regulatory authority. The Florida statues can be found at <http://www.flsenate.gov/statutes/>, Title 33: Chapter 509.

In addition to setting and adhering to strict sanitation requirements in the facility, a retail establishment should also develop SOPs for receiving and storage of food products and ingredients. If food processing is being done, appropriate controls and requirements should be established and strictly adhered to. FDA Food Code outlines appropriate processing and cooking requirements for many food products processed in a retail facility. However, if certain high-risk food products (such as sushi, fresh juice, specialty meats, and others) are processed in the retail establishment, rather than in a more traditional processing facility, additional controls and the issuance of a 'variance' by the regulatory authority is required before processing can occur (Food Code 3-502.11). The growing retail practice of cooking/preparing/packaging foods traditionally processed in controlled plant environments raises safety concerns. Any processing of food at the retail level needs to be closely monitored.

As an establishment becomes cleaner, it becomes harder to detect foodborne pathogens. At this point testing becomes more limited in its ability to prevent foodborne illness. This is why programs that promote and monitor the use of barriers and/or hurdles are so important. When instituted properly these activities will reduce the risk of a foodborne illness. Nothing can be done to completely eliminate bacterial contamination short of vacuum sealing, irradiating, and storing all your product frozen. Since most consumers prefer a fresh product, programs should be implemented that reduce the probability of illness to a point that it is minuscule.

Receiving

Specifications for receiving can be found in section 3-202.11 of the 2001 Food Code <http://www.cfsan.fda.gov/~dms/foodcode.html>. The following guidelines cover the basic points that should be addressed:

- Potentially Hazardous Food (PHF) should be at a temperature of 5°C or below when received, unless specified by law (e.g., milk, shellfish).
- Raw shell eggs should be received at an ambient air temperature of 7°C or less.
- PHFs that are received hot should be at a temperature of 60°C or above.
- PHF should be received with no evidence of temperature abuse such as evidence of thawing.

Processing

One of the easiest ways to prevent foodborne salmonellosis is ensuring that foods are cooked thoroughly. It should be noted that certain foods that are typically served uncooked such as raw eggs (used in Caesar salads, homemade mayonnaise, raw cookie dough, etc.) and fresh vegetables will obviously not benefit from the cooking process. For these items, other factors such as sanitation, worker hygiene, and proper storage take on much greater importance.

- When using raw eggs in your recipes, try to purchase a pasteurized egg product.
- Cook eggs, fish, meat, or foods containing these items to an internal temperature of 145°F or above for a minimum of 15 seconds.
- Cook ground meat products to an internal temperature of 155°F or above for a minimum of 15 seconds.
- Cook poultry to an internal temperature of 165°F or above for a minimum of 15 seconds.

- Reheating previously cooked material to an internal temperature to 165°F.

For recommendations that are more specific consult the 1999 or 2001 Food Code <http://www.cfsan.fda.gov/~dms/foodcode.html>.

Storage

Once a product has been received and/or processed, it now will be displayed or stored. There are some general guidelines governing these practices as well.

- Frozen food should remain frozen until it is used.
- If frozen food is displayed in a refrigerated case, the food should remain at 5°C or below.
- Frozen food should be thawed at a temperature of 5°C or below. Food can also be thawed under running water at a temperature of 21°C or below. Lastly, the product can be thawed as part of the cooking process.
- Product must be cooled adequately. Refer to sections 3-501.14 and 3-501.15 of the 1999 or 2001 Food Code <http://www.cfsan.fda.gov/~dms/foodcode.html>.
- Hold cooked product above 60°C while displaying and store under 5°C while storing.
- Properly label all stored product.

Personal Hygiene

Wash your hands! The major cause of foodborne illness in retail establishment comes from poor personal hygiene, particularly a lack of proper hand washing. Dirty hands can contaminate food. Although hands may look clean, the bacteria that cause illness are too small to be seen. Therefore, whenever you are preparing food and you come in contact with items that are not part of the assembly process, rewash your hands. The same is true even when wearing gloves. **THERE IS NO FIVE**

SECOND RULE WHEN IT COMES TO FOOD SAFETY! Millions of bacteria and other germs can be transferred on contact. Here is a list of times when should you wash your hands:

<http://www.cfsan.fda.gov/~dms/foodcode.html>

Robinson, R.K., C.A. Batt and P.D. Patel (eds.). 2000. Encyclopedia of Food Microbiology – Vol. 3. Academic Press, NY.

- Before handling, preparing food or serving food.
- Before handling clean utensils or dishware.
- After using the restroom.
- After touching your face, cuts or sores.
- After smoking/eating/drinking.
- After handling raw meat - especially poultry.
- After touching unclean equipment, working surfaces, soiled clothing, soiled wiping cloths, etc.
- After collecting and taking out the garbage.

What is the Proper Procedure for Hand Washing?

- Wet your hands with warm water.
- Apply soap and wash your hands for 20 seconds.
- Rinse and dry with a single-use paper towel.
- Use the the paper towel to shut off the water.

Resources:

USDA Center for Food Safety & Applied Nutrition, Foodborne Pathogenic Microorganisms and Natural Toxins Handbook

<http://www.cdc.gov/od/oc/media/fact/salmonella.htm>

McSwane, D., N. Rue and R. Linton. 2000. Essentials of Food Safety and Sanitation. Prentice-Hall, Inc., NY.

<http://www.salmonella.org>

<http://www.dupagehealth.org/safefood/industry/fs/hw.asp>