



A Basic Look at Salmonella

BEEF FACTS Safety Research

The beef industry has been cited as a model for other commodities to follow in addressing food safety challenges. Beef producers and processors know that without a safe product consumers can feel confident in, the marketplace for beef would not exist. That's why cattle ranchers and farmers and beef processors have devoted millions of dollars to improving beef safety. In fact, since 1993, the beef industry has spent more than \$28 million on beef safety research, outreach and education through The Beef Checkoff. Including private industry efforts, collectively, the industry spends more than \$350 million annually on improving beef safety.

Much of that work has focused on reducing the incidence of *E. coli* O157:H7 contamination in beef products. However, other foodborne pathogens exist that, while not as commonly associated with beef, do pose risks to consumer safety. Like *E. coli* O157:H7, *Salmonella* is a formidable foe that continues to adapt. Ongoing research efforts are focusing on how to reduce the incidence of *Salmonella* in ground beef, as well as addressing emerging trends such as multi drug-resistant bacteria.

Background

Salmonella bacteria are the most frequently reported cause of foodborne illness. The *Salmonella* family includes over 2,300 serotypes of bacteria. *Salmonella Typhimurium*, *S. Enteritidis*, and *S. Newport* are four common serotypes implicated in human infections and *S. Dublin* is a common cause of cattle *Salmonella* infections. An American scientist, Dr. Daniel E. Salmon, discovered that *Salmonella* bacteria cause illness more than 100 years ago.

According to the Centers for Disease Control and Prevention (CDC) salmonellosis, which is the infection caused by the bacteria *Salmonella*, causes an estimated 1.4 million cases of foodborne illness and more than 500 deaths annually in the United States. Most people with salmonellosis experience diarrhea, abdominal cramps, and fever within 8 to 72 hours after the contaminated food was eaten. Additional symptoms may be chills, headache, nausea and vomiting. Many people with salmonellosis recover without treatment and may never see a doctor. *Salmonella* infections, however, can be life-threatening for certain people with compromised immune systems such as infants, young children, pregnant women and their unborn babies, or the elderly.

Salmonella live in the intestinal tract of various animal species, including cattle, swine and especially poultry. Once infected, the animals shed *Salmonella* in their feces. *Salmonella* can also be found in the feces of some pets, especially those with diarrhea. Reptiles are particularly likely to harbor *Salmonella*. Strains that cause no symptoms in animals can make people sick, and vice versa.

Salmonella, and *E. coli* O157:H7, as well as *Campylobacter jejuni* and *Listeria monocytogenes* share several epidemiological characteristics. Research supports the idea that animals are infected and the bacteria then continue to amplify in their animal hosts. Animals then shed the bacteria through their feces, which leads to re-infection and infection of other animals. The pathogens can eventually reach the human population by direct contact or through ingestion of raw, contaminated food. *Salmonella* bacteria can survive several weeks in a dry environment, and several months in water.

The Future of Preventing *Salmonella* Contamination

Processing establishments producing certain classes of food are required to meet performance standards for *Salmonella*. In addition to company sampling protocols, the U.S. Department of Agriculture (USDA) Food Safety Inspection Service (FSIS) also collects random samples to ensure industry safety intervention systems are effective in controlling *Salmonella*.

Existing safety intervention strategies have primarily focused on the harvest and beef-processing sectors as these production stages offer the greater potential for improving food safety. With the advent of Hazard Analysis Critical Control Point (HACCP)-based inspection in the 1990s, the concept of applying “multiple hurdle” interventions gained momentum and significant safety improvements were achieved.

While we know a lot more about *Salmonella* incidence in cattle than just a decade ago, more work needs to be done to understand this pathogen and what pre-harvest strategies will be effective. Researchers are examining both management practices and intervention technologies that could reduce fecal shedding of *Salmonella*.

To increase the efficacy of post-harvest safety technologies, and to apply another layer of safety, researchers have for some time been examining the application of pre-harvest interventions at the production level to reduce pathogen loads on cattle presented for slaughter.

Salmonella can be present on livestock operations in the absence of clinical disease. Poultry is considered one of the primary sources of *Salmonella*, but the bacteria are also present in cattle populations. Research on the incidence of *Salmonella* at the production level in cattle is limited, but

USDA-sponsored studies detected *Salmonella* on 38 of 100 feedlots, 21 of 187 beef cow-calf operations and 48 of 121 dairy operations. Healthy animals can become carriers and shed *Salmonella* for long time periods.

Similar to *E. coli* O157:H7, fecal shedding plays an important role in the contamination and spread of *Salmonella*. Reducing fecal shedding of *Salmonella* in livestock is important to reducing this pathogen’s impact on human health. Poultry and swine operations have experienced some success in reducing *Salmonella* fecal shedding through changes in management practices. Identifying infected and carrier animals and culling them has also been shown to be a means of reducing fecal shedding, but because *Salmonella* can be widespread, this practice is often not practical.

Similar to *E. coli* O157:H7, research to date has not identified specific management strategies or interventions that consistently reduce fecal shedding of *Salmonella* in cattle. Several occurrences can impact *Salmonella* prevalence rates at the farm and ranch level, including exposure to human effluent, contaminated feed, birds or rodents. All of these factors complicate the ability to develop control strategies.

Efforts to reduce *Salmonella* at the pre-harvest level are a priority for the industry, as it will ensure post-harvest interventions continue to be effective. Ongoing research to address *Salmonella* at the pre-harvest level include better understanding pathogen ecology, the impact of management practices on reducing shedding, live-animal interventions, emerging strains and resistance development.

For more information about pre-harvest beef safety research, visit www.bifsc.org or www.beefresearch.org.

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