



Prevalence of *Salmonella* and *Listeria* in Bulk Tank Milk and In-line Filters on U.S. Dairies, 2007

In 2007, the U.S. Department of Agriculture's (USDA) National Animal Health Monitoring System (NAHMS) conducted the Dairy 2007 study. In all, 17 of the Nation's major dairy States* representing 79.5 percent of U.S. dairy operations and 82.5 percent of U.S. dairy cows participated in the study. One goal of Dairy 2007 was to estimate the prevalence of *Salmonella* and *Listeria* in bulk tank milk and in-line milk filters.

Salmonella and *Listeria* are bacteria commonly found in livestock and dairy environments and can cause disease in cattle and serious foodborne illness in humans. Bulk tank milk can become contaminated with *Salmonella* or *Listeria* directly from the udder or through contact with manure during milking. Consuming raw or improperly pasteurized milk or milk products can lead to illness in humans caused by *Salmonella*, *Listeria*, and other pathogens.

NAHMS first estimated the prevalence of *Salmonella* and *Listeria* in bulk tank milk during its Dairy 2002 study. The study reported that 1.7 percent of single bulk-tank-milk samples tested by culture were positive for *Salmonella* and 3.8 percent were positive for *Listeria monocytogenes*.

The Dairy 2007 study estimated the prevalence of *Salmonella* by Real Time Polymerase Chain Reaction (RT-PCR) and the prevalence of *Listeria* by culture. Samples were taken from bulk tank milk, in-line milk filters, or both. Samples positive for *Salmonella* via RT-PCR were subsequently cultured for *Salmonella* in selective culture media to determine serotype.

Salmonella

Infections caused by *Salmonella* in cattle (salmonellosis) are characterized by a wide variety of clinical signs, including: diarrhea in adult cattle and, in calves, severe blood infections (septicemia) resulting in diarrhea, pneumonia, and arthritis. It should be noted that many animals infected with *Salmonella* show no clinical signs of disease.

* **States/Regions:**

West: California, Idaho, New Mexico, Texas, and Washington

East: Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Vermont, Virginia, and Wisconsin

In humans, *Salmonella* is a primary cause of many cases of foodborne illnesses. Infections can be acquired by consuming contaminated meat or unpasteurized milk, or by coming into contact with animals shedding *Salmonella*. Some *Salmonella* strains isolated from cattle and human outbreaks have shown resistance to multiple antibiotics, which limits the spectrum of antimicrobial agents that can be used to successfully treat the infection.

During Dairy 2007, samples from 538 operations were tested by RT-PCR for the presence of *Salmonella* in bulk tank milk, in-line filters, or both. *Salmonella* was present in at least one sample on 28.1 percent of operations (see table below).

The percentage of *Salmonella*-positive operations did not differ between study regions*: 35.8 percent of operations in the West region and 27.3 percent in the East region had at least one sample positive for *Salmonella*. However, there were differences by herd size. *Salmonella* was present on a higher percentage of large operations compared with small operations (50.9 and 24.3 percent, respectively). Broken down by sample type, *Salmonella* was detected by RT-PCR in 10.8 percent of bulk-tank-milk samples and in 24.7 percent of in-line milk filters. In comparison, Dairy 2002 reported that 11.9 percent of bulk-tank-milk samples tested by RT-PCR were positive for *Salmonella*. Milk filters were not collected during the 2002 study.

Twenty-two *Salmonella* serotypes were identified from cultured samples during the 2007 study. The top five serotypes found were Cerro, Kentucky, Muenster, Anatum, and Newport.

Percentage of Operations in which Bulk Tank Milk and/or Milk Filters Tested RT-PCR Positive for *Salmonella*, by Herd Size

Herd size (Number of Dairy Cows)	Percent Operations
Small (fewer than 100 head)	24.3
Medium (100-499 head)	32.7
Large (500 or more head)	50.9
All Operations	28.1

Listeria

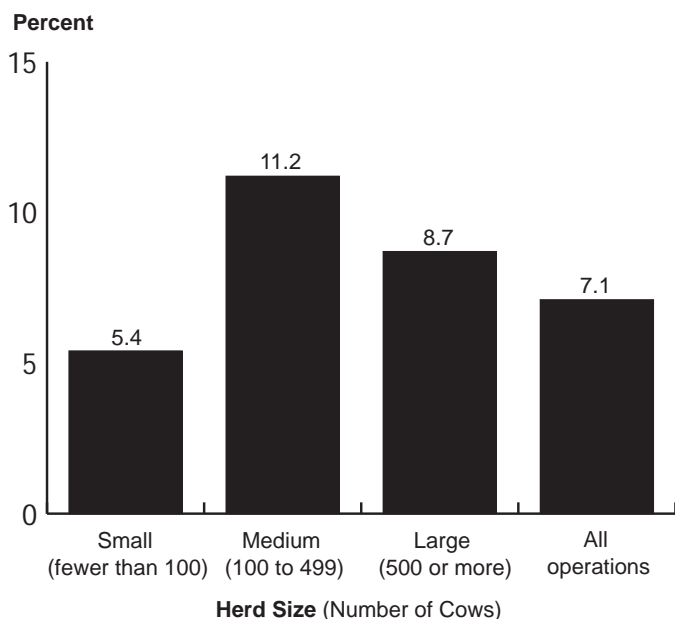
The genus *Listeria* is composed of several bacterial species and subspecies, most of which are nonpathogenic for animals and humans. However, *Listeria monocytogenes* can cause abortion, encephalitis, and septicemia in humans and animals. Numerous outbreaks of human listeriosis have been traced to milk and dairy products contaminated with *Listeria monocytogenes*. *Listeria monocytogenes* mainly affects immunocompromised individuals.

In 2007, nearly one-third of operations (32.1 percent) were positive for *Listeria* based on bulk tank milk or in-line milk filter cultures. By sample type, in-line milk filters had a higher percentage of samples test positive for *Listeria* species compared with bulk tank milk (28.3 and 9.0 percent, respectively)

Listeria monocytogenes was detected in samples from 7.1 percent of operations. By sample type, a similar percentage of samples from in-line milk filters (5.1 percent) tested positive for *Listeria monocytogenes* compared with 3.7 percent of bulk-tank-milk samples.

The difference in the percentages of operations in the West and East regions that tested positive for *Listeria monocytogenes* was not statistically significant (10.6 and 6.7 percent, respectively). Also, the apparent differences between the percentage of positive operations by herd size were not statistically significant (see figure below).

Percentage of Operations in which Bulk Tank Milk and/or Milk Filters Tested Positive for a *Listeria monocytogenes*, by Herd Size



Summary

In Dairy 2007, 10.8 percent of operations were positive for *Salmonella* in bulk-tank-milk samples tested by RT-PCR. In contrast, when in-line milk filters were

included for testing in addition to bulk-tank-milk samples, 28.1 percent of operations were positive for *Salmonella*.

In 2002, 10.4 percent of operations tested positive for *Listeria* species when a single bulk-tank-milk sample was cultured,¹ compared with 9.0 percent in 2007. With the addition of in-line milk filter testing in 2007, 32.1 percent of operations tested positive for *Listeria* species.

In 2002, 3.8 percent of U.S. dairies tested positive for *Listeria monocytogenes* in bulk tank milk compared with 3.7 percent of dairies in 2007. However, when in-line filters were added as part of the 2007 study, *Listeria* was detected on 7.1 percent of operations.

The above comparisons indicate that testing of in-line milk filters in addition to bulk tank milk increases the sensitivity of detecting *Salmonella* and *Listeria* species. In-line milk filters entrap and concentrate pathogens from gallons of milk in one sample, which makes them a more sensitive and suitable sample for screening pathogens compared to bulk tank milk alone.

Although the widespread distribution of *Salmonella* and *Listeria monocytogenes* in the dairy environment hampers the control of both bacteria, there are factors associated with their presence in bulk tank milk that dairy farmers should monitor in order to eliminate these bacteria from milking systems. Implementing recommended milking hygiene practices, such as ensuring that teats are clean and using a teat disinfectant prior to milking, should decrease contamination of milk with these pathogens. Additionally, testing new replacement heifers before they are incorporated into the herd, proper sanitation of maternity and calf rearing areas, and control of birds and rodents are practices that may help decrease *Salmonella* prevalence on dairy operations. Practices that help decrease the prevalence of *Listeria monocytogenes* include feeding cattle good quality silage, preventing contact with manure from infected animals, and thorough cleaning and disinfection of bulk tanks.²

References

1. *Salmonella* and *Listeria* in Bulk Tank Milk on U.S. Dairies. APHIS info sheet, 2003. Accessed December 2008: <http://www.aphis.usda.gov/vs/ceah/ncahs/nahms/dairy/dairy02/Dairy02bulkTank.pdf>
2. Hassan L, Mohammed HO, McDonough PL. 2000. Farm-management and milking practices associated with the presence of *Listeria monocytogenes* in New York State dairy herds. *Prev Vet Med* 51(1-2):63-73.

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