

BACON BITS

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Salmonella in Swine

Background

Salmonella spp. can be found in livestock, pets, wildlife, and birds. Pigs and other livestock that carry *Salmonella* spp. are often healthy and show no disease. *Salmonella* spp. are also commonly found in the environment. They can survive for several weeks or months in wet, cool environments.

Salmonella spp. has been detected in slurry, barn dust, and even on pen surfaces after cleaning. All strains, or serotypes, of *Salmonella* bacteria may have the potential to cause disease in humans, but only some generally do. Likewise, only certain serotypes usually produce disease in livestock. Several different serotypes of *Salmonella* may be found in the same barn.

Salmonella spp. are recognized as one of the most common causes of food-borne disease in humans. Outbreaks are often associated with poultry or cattle. Although, pork is not generally believed to be a major source of *Salmonella* spp. infections in humans, some authors estimate that contaminated pork and pork products may cause from 10 to 30 percent of human cases. High levels of *Salmonella* spp. on farms in Denmark have contributed to an increased risk of carcass contamination during slaughter and processing.

To date there have been no major food safety problems linked to *Salmonella* spp. (species) contamination of pork in North America. However, growing concern over food safety and antimicrobial resistance has spurred the development of on-farm food safety research programs into the prevalence of *Salmonella* spp. in swine units. This research will help identify the factors associated with the occurrence of *Salmonella* spp. on the farm and develop intervention practices to keep *Salmonella* at low levels.

International trends

Food processors are facing increased pressure to keep *Salmonella* spp. contamination of food products to a minimum. Denmark's control program targets both the farm and the processor level and has reduced the incidence of *Salmonella* spp. in Danish pork to one percent. Other pork exporting countries are trying to match their success. Prior to export, the USA now requires all Canadian slaughter plants to test carcasses for *Salmonella* spp. contamination. As Canadian processors implement HACCP (Hazard Analysis Critical Control Points) programs (i.e. quality assurance) and control contamination in their plants, the pressure to keep the numbers of *Salmonella* bacteria low has shifted to the farm.

Antimicrobial resistance is an increasing concern with some *Salmonella* spp. One strain, *Salmonella typhimurium* DT104, is resistant to multiple antibiotics, making infections in humans difficult to treat. Its occurrence has been increasing in the

USA and Europe, and it has been linked to use of antibiotics in livestock production. As a result, surveillance and monitoring of *Salmonella* spp. in both animals and humans has increased in many countries.

Detection

Culturing fecal samples has traditionally been used to detect *Salmonella* infected animals on farms. However, culture will not identify all infected animals as the bacteria are shed intermittently in the feces. Serology (testing blood or meat juice samples for antibodies) has been recently developed as a newer, more sensitive method of detecting *Salmonella* spp. Antibodies to *Salmonella* spp. last approximately three months and are present if the animal has been exposed to the bacterium. Since the levels of *Salmonella* spp. in a barn are dynamic, testing on several consecutive occasions may be necessary to get an accurate picture.

Control

Eradication of *Salmonella* spp. from barns or maintaining a "zero prevalence" in pig herds appears not to be practical or possible in most environments. The focus of existing on-farm control programs is on keeping levels of *Salmonella* spp. low. Certain management and environmental factors have been associated with higher levels of *Salmonella* spp. infection. Examples of these factors are inadequate cleaning and disinfection, rodents, continuous pig flow, mixing of pigs, a pig source with a high prevalence of *Salmonella*, pelleted feed, and larger operation size. The factors involved are still poorly understood and may vary in different climates or countries.

Many swine units where *Salmonella* spp. have been detected may never experience disease due to this bacteria. However, certain conditions such as stress, other diseases, poor nutrition or hygiene can trigger clinical disease (salmonellosis). Diarrhea, septicemia, and mortality may occur. Antibiotics are useful to a limited extent. The most efficient control approach is to provide a good clean warm environment for pigs.

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Alberta Study on *Salmonella* in Finishing Operations

Objectives

The Food Safety Division, with the assistance of 10 veterinary practitioners and 89 producers, is studying the prevalence of *Salmonella* spp. (species) in selected finishing barns in Alberta. We are also investigating the infection pattern of *Salmonella* spp. over time, distribution within the farm environment, the serotype distribution, and the association between some potential risk factors and *Salmonella* infection in finishing pigs.

Procedure

Finishing barns shipping over 2,000 pigs per year were selected and sampled by 10 veterinary practitioners during the summer 2000. Samples were collected from 89 finishing barns. Most were part of farrow-to-finish operations (86.5%), while the rest were part of multi-site operations (6.7%) or individual finishing farms (6.7%). Selected barns represent approximately 25 per cent of the annual market pig production in Alberta.

Five fecal samples were collected from each barn on three occasions, thirty days apart. Similarly, ten blood samples were collected three times, thirty days apart. Five environmental samples were taken throughout the study. Our Agri-Food Laboratory Services Branch in Edmonton tested all the samples. The operators of the sampled farms, with their veterinary practitioner, documented farm management practices. Statistical analysis of the collected data is in progress.

Preliminary findings

Overall, 275 of the 1,751 (15.7%) fecal and environmental samples cultured positive for *Salmonella* spp. Furthermore, *Salmonella* spp. was recovered from 14.3 per cent of the pooled fecal samples and 20.1 per cent of the environmental samples. *Salmonella* spp. antibodies were detected in 12.1 per cent of tested sera (Table 1).

Table 1

Salmonella spp. apparent prevalence in the 89 finishing barns

Type of sample	Number tested	Number positive (%)
Feces (pen pools)	1,334	191 (14.31)
Environment	417	84 (20.14)
Serum	2,663	321 (12.05)

Finishing barns with no positive *Salmonella* spp. samples on one sampling occasion may be positive on other occasions. This demonstrates that sampling once may not be sufficient to understand the status of *Salmonella* in a herd. Classifying a herd as positive based on finding one positive sample does not adequately describe the status of the herd.

Salmonella spp. were found in at least one pen fecal pool in 46 (51.6%) of the barns. The number of positive pen fecal pools per barn ranged from 1 to 15. Many barns had no positive (48.3%) or from one to three positive pen fecal pools (29.2%). Twenty barns (22.4%) had four or more positive pen fecal pools.

A good correlation existed between serology and fecal culture at the barn level (Table 2). Barns with higher numbers of positive fecal cultures also had higher numbers of positive serology samples.

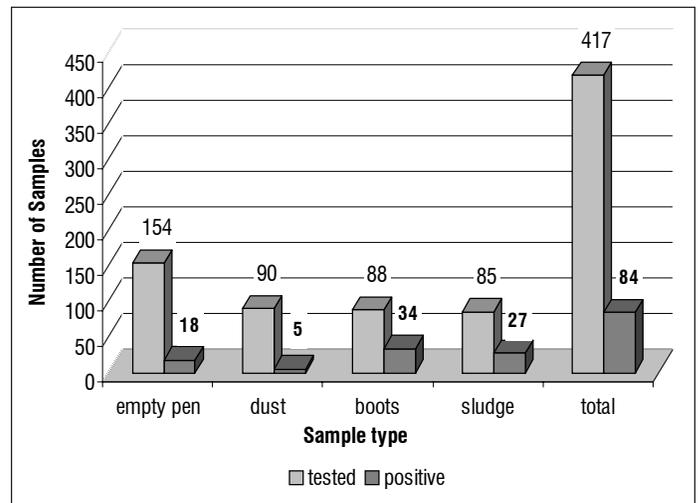
Table 2

Within barn prevalence of *Salmonella* spp. in the 89 finishing barns

Within barn prevalences	Number of barns (%)	
	Fecal culture	Serology
0 to 10%	59 (66.29)	57 (64.04)
11 to 20%	10 (11.23)	13 (14.60)
More than 20%	20 (22.47)	18 (20.22)

Among environmental samples, *Salmonella* spp. was most frequently recovered from boots (34 isolates) and main drain samples (27 isolates). Distribution of *Salmonella* spp. within the environment is described in Figure 1. High recovery rates from environmental samples suggested that an environment contaminated with *Salmonella* spp. might contribute to the persistence of *Salmonella* spp. within a barn.

Figure 1. *Salmonella* Distribution in the Environment of 89 Finishing Barns in Alberta



Serotyping was done on only 104 isolates to date. That is about 10 per cent of the total number we want to do. The most frequent serotypes of the 14 found so far are *S. derby*, *S. infantis* and *S. typhimurium*-phage type 104.

Since most barns had low or zero levels of *Salmonella* spp., these findings suggest that efforts targeted at barns with a higher prevalence may help reduce the risk of potential carcass contamination. The next step in the study will be the analysis of housing and management practices in participating barns. This approach should provide information on factors important in keeping low levels of *Salmonella* spp. on farms.

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Prairie Swine Centre's Focus on the Future Conference 2001

Theme: Optimizing the Production System

Dates: Feb 20 (noon - 9 pm) and Feb 21 (8 am to noon)

Place: Red Deer Lodge, Red Deer, Alberta

Cost: by Feb 2 – \$50/person, after – \$65/person

Registration: Ken Engele
 Telephone: (306) 373-9922 Fax: (306) 955-2510

E-mail: engelek@sask.usask.ca **Website:** prairieswine.com

Topics: Factors Driving Improvement of ADG, Group Housing of Sows, Diet Manipulation to Reduce Nutrients in Manure, Recent Advances in Reproductive Biotechnology, Threonine Requirements of the Lactating Sow, Manipulating the Market (Grid Comparisons), The 21st Century Consumer, Positively Impacting the Carcass by Adding Fat to the Diet, and On-Farm Mixing: Compliance in the 21st Century