Estimation of the on-farm *Salmonella enterica* prevalence in market swine

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Abstract: The objective of this study was to compare fecal culture, meat juice ELISA, and culture of abattoir collected tissues for their ability to accurately estimate the on-farm prevalence of *Salmonella enterica* in market swine. Six herds, depopulated in the Accelerated Pseudorabies Eradication Program, were used. One-half of study pigs (50) were necropsied on-farm; the other half (50) at a commercial abattoir. The true farm prevalence (TFP), based on positive ileocecal lymph nodes, cecal contents, or fecal samples was estimated at 5.3%. This estimate was higher than any provided by a single sample type cultured. The seroprevalence (meat juice ELISA) was estimated at 20% using a cutoff of OD% > 40. Prevalence estimates from abattoir collected samples were much higher than the TFP; 39.9% of pigs were culture positive. This study shows that a single round of fecal collections will underestimate the true *Salmonella* status of a herd and that samples collected at the abattoir will overestimate the on-farm prevalence.

Introduction: Accurate *Salmonella* prevalence estimation in food animals is important for research, producer feedback, and risk assessment. The objective of this study was to compare fecal culture, meat juice ELISA, and culture of abattoir collected tissues for their ability to accurately estimate the on-farm prevalence of *Salmonella enterica* in market swine.

Materials and Methods: Six herds enrolled in the Accelerated Pseudorabies Eradication Program (APEP) provided a unique opportunity to test and necropsy a large number (600) of market weight pigs on the farm and at the abattoir. Three days before the scheduled depopulation, study pigs were individually identified and
a 1 g ante-mortem fecal sample was collected (AFEC). On the day of depopulation, the study pigs were randomly divided. One-half (50) were to be necropsied on-farm; the other half (50) at a commercial abattoir.

The pigs chosen to be necropsied at the abattoir were transported, in disinfected commercial vehicles. At the abattoir, study pigs were held for about 2.5 hours. After stunning and exsanguination, they were diverted from the line for necropsy. Samples of the following were aseptically collected: ileocecal lymph nodes (ILC), ∼10 g cecal contents (CC), superficial inguinal lymph nodes (SIL), and 1 g feces. Additionally, a ∼10 g section of gluteal muscle was collected for the Danish mixed-ELISA analysis on the serum exudate. The following day, pigs selected to remain on-farm were euthanized. The same samples were collected in an identical manner as at the abattoir.

For analysis, a pig was considered positive if it was positive on any one of the sample types. The true farm prevalence (TFP) was defined as the *Salmonella* prevalence estimated when combining the culture results from all sample types. The relative sensitivity (RSE) for a particular sample type was calculated as the number of samples positive by that sample type divided by the number of pigs positive on any of the sample types.

**Results:** The estimate provided by the AFEC (1.1%, CI = 0% to 2.3%) was similar to that from the NFEC samples collected 4 days later (0.7%, CI = 0% to 1.7%). The prevalences were similar but came from different positive pigs. No SIL nodes were positive on-farm. The point estimate from ILC node culture (3.2%, CI = 1.1% to 5.2%) was three times higher than the necropsy fecal prevalence estimate, although not significantly different at p< 0.05. The defined TFP was 5.3% (CI = 2.7% to 8.0%) This estimate was higher than any provided by a single sample type. It was significantly higher (p < 0.05) than the AFEC and NFEC samples.

The relative sensitivity (RSE) of the 1 g fecal sample collected at necropsy (NFEC) was low. On-farm, the NFEC only detected 13% (2 of 15) of infected pigs. It missed all 10 of the pigs with positive ILC nodes. When results from on-farm and abattoir necropsies were combined, the relative sensitivity of NFEC improved. The overall RSE of the NFEC was 57.4% (74 of 129). However, NFEC still only detected 12.2% (9 of 74) pigs with infected lymph nodes (ILC and SIL combined).

The ELISA serology consistently overestimated the true farm prevalence at all OD% levels (Table 1). At an OD% > 40, the seroprevalence was estimated at 20% (CI = 15% to 25%), compared to a true farm prevalence of 5.3%.
At the abattoir, 39.9% of pigs (114 of 286; CI = 34.2% to 45.5%) were positive on at least one sample type. The estimates are significantly higher \((p < 0.05)\) than farm collected samples for all types, except lymph nodes which was 9.1% \((CI = 5.8\% \text{ to } 12.4\%)\) at the abattoir. The abattoir prevalence estimate from the 1 g fecal was 25.2% \((CI = 20.1\% \text{ to } 30.2\%)\); from cecal contents it was 13.6% \((CI = 9.7\% \text{ to } 17.6\%)\).

**Discussion:** This study has shown that a single 1 g fecal sample severely underestimates the true on-farm prevalence of *Salmonella*. The use of a 10 g sample could have increased the sensitivity. The TFP was higher than the fecal sample partly due the fact that it included the results of three samplings, thus increasing the chance of finding a positive. It is likely that three rounds of antemortem fecal collections, sampling with replacement, might have also increased the farm prevalence estimate.

Samples collected at the abattoir provided a much higher *Salmonella* prevalence estimate than samples collected at the farm. This observation raises the question whether abattoir collected samples can be useful for preharvest *Salmonella* research. Possible reasons for this increase are discussed elsewhere in this proceedings.