MONITORING AND SURVEILLANCE

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Salmonella in pigs from weaning to slaughter

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Introduction

Salmonella continues to be one of the most important causes of foodborne gastrointestinal illness in humans. Food producing animals are the main cause of human salmonellosis (1). *Salmonella* reduction at the farm level is important to mitigate *Salmonella* transmission from pigs to humans. Some pigs shed *Salmonella* in feces despite appearing healthy. The subclinical carriers can exacerbate levels of *Salmonella* in the barn and slaughterhouse and infect pigs with no previous exposure during transportation and lairage. The presence of intermittent shedders and the variable nature of *Salmonella* infection over time present limitations to point-prevalence studies (2). A clear understanding of the shedding patterns over the entire production stage on commercial pig farms is crucial for implementing effective monitoring and control measures. The objective of this study was to examine the *Salmonella* status in pigs from birth to slaughter.

Material and Methods

Pig selection. Fourteen groups of pigs from eight farrowing sources were studied; six farrowing sources contributing two cohorts each. Piglets in Cohort One were born between May and August, and piglets in Cohort Two between October and January. For each cohort, 4-8 piglets were selected from each of 8-10 sows within 96 hours of birth and identified with an ear tag.

Sample collection. Fecal or rectal swab samples were collected from piglets prior to 4 days of age (only in seven groups), and form all pigs at weaning, at the end of the nursery, grower, and finisher periods. At slaughter, palatine tonsils and submandibular lymph node samples were collected from a subset of pigs.

Salmonella isolation. Ten grams of fecal or tissue samples was transferred into a stomacher bag and homogenized in 50 mL of tetrathionate broth (TTB), and incubated for 24 h at 37 °C. Then, 0.1 mL of TTB culture was inoculated into 9.9 mL of Rappaport Vassiliadis (RV) broth and incubated at 42 °C for 24 h. Finally, a loopful of RV culture was streaked onto xylose-lysine-tergoitol 4 agar (XLT4) and incubated at 37 °C for 24 h to 72 h. *Salmonella* isolates were confirmed with *Salmonella* O Antiserum Poly A-I & Vi.

Data analysis. A multilevel mixed-effects logistic regression method was used to analyze *Salmonella* shedding in feces across the stages of production, as well as to analyze the associations between the presence of *Salmonella* in tissue samples and fecal shedding.

Results

Salmonella was cultured from 12.6% of 3339 fecal samples collected from 809 pigs; 35.1 and 12.1% of pigs shed *Salmonella* at least once or more, respectively. The proportion of pigs positive at each stage of production and at slaughter is shown in Figure. Overall, *Salmonella* was recovered from 4.9% of pigs at 1-4 days of age, 10.5% at weaning, 12.6% at the end of the nursery period, 12.3% in the grower period, and 20.2% of pigs at the finisher stage. *Salmonella* shedding increased over time with older pigs more likely to test positive (P=0.01). At slaughter, *Salmonella* could be isolated at least from one tissue sample in 23.1% of pigs. Out of the 100 pigs that shed *Salmonella* in feces at the finisher stage, only 50% of pigs tested positive in tissues at slaughter. Out of 463 pigs negative for *Salmonella* shedding at the finisher stage, 17.5% tested positive in tissues at slaughter. The presence of *Salmonella* in tissue samples collected at slaughter was not associated with fecal shedding at the finisher stage. However, the number of times a pig shed *Salmonella* on the farm was only borderline significant with presence of *Salmonella* in tonsils (P=0.06).

Discussion and Conclusion

In this study there was an increase in *Salmonella* shedding from early life until the finisher stage. This is similar to previous study reporting the proportion of pigs shedding *Salmonella* increased from the end of the nursery period until slaughter (3). It is possible that as time progressed, pigs have become infected to *Salmonella*, while previously infected pigs may have been infected by a new serotype (4). Further, pigs in the present study were shipped to an off-site weaning barn which might provide an opportunity for exposure to *Salmonella* during transportation to a second facility (5,6). Therefore, it may be prudent from a food safety perspective to evaluate risk factors and interventions that help mitigate *Salmonella* shedding at later stages of production. Presence of *Salmonella* in tissues at slaughter was not significantly associated with on-farm fecal shedding. It is likely that non-shedder pigs could have become infected with *Salmonella* during transportation and lairage. The presence of repeat shedders and the lack of association between

Salmonella shedding on farm and its presence in tissues at slaughter is a food safety concern that warrants attention to implement control measures at the slaughter level.

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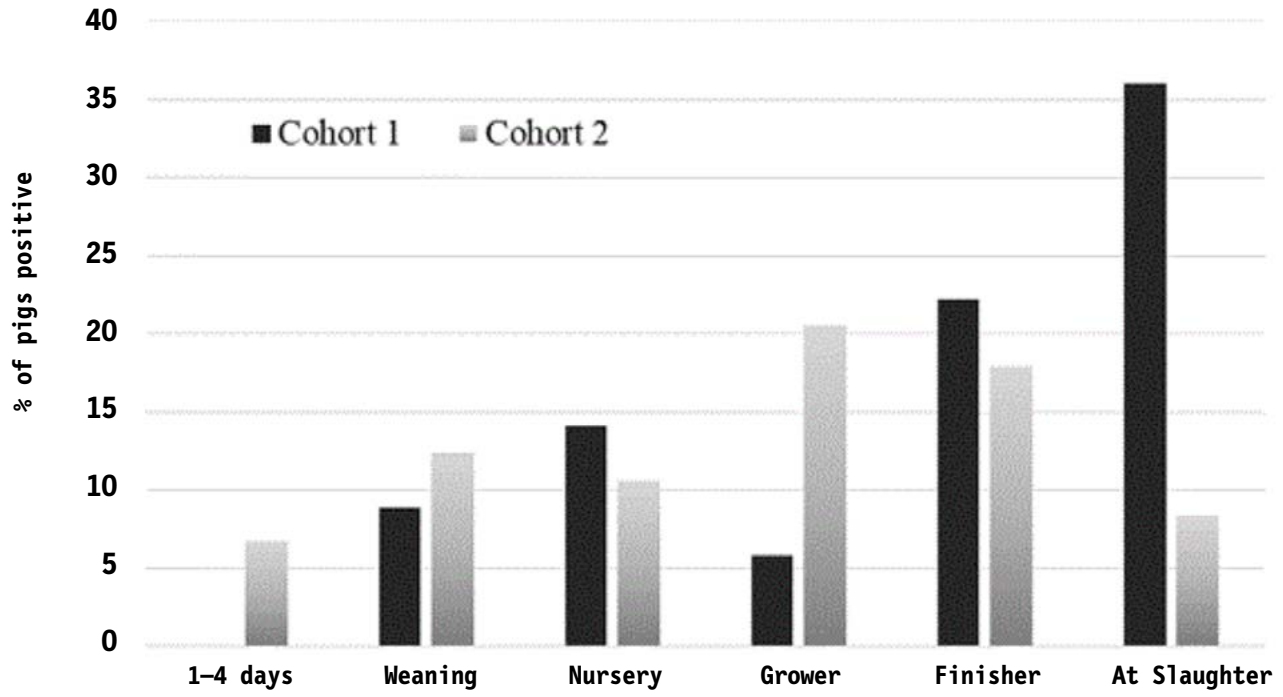

Figure 1: Proportion of pigs testing positive for Salmonella in feces on farm and in tissues at slaughter