Salmonella prevalence in “first pull” versus “close out” market pigs

Rostagno, M.H.*(1), Hurd, H.S.(2), McKean, J.D.(2)

(1)USDA, ARS, Livestock Behavior Research Unit, West Lafayette, IN 47907, USA.
(2)Iowa State University, College of Veterinary Medicine, Ames, IA 50011, USA.
*corresponding author: rostagno@purdue.edu

Abstract

Identifying potential risk factors to direct intervention strategies is fundamental to reduce the risk of pork contamination with Salmonella. This study was designed to compare the Salmonella prevalence in the first group of pigs selected for slaughter (“First pull”) versus the last group of pigs selected for slaughter (“Close out”) from typical commercial finishing barns containing 800 - 1,000 animals. Nine finishing barns from two production sites were included in the study (4 paired samplings from site A, and 5 paired samplings from site B). Each paired sampling consisted in matched groups of pigs from the same barn as the “first pull” and the “close out” with a 4-week interval between groups. From each group, individual fecal samples (n = 45) and meat samples (n = 50) were collected, on-farm and at slaughter, respectively. In the laboratory, fecal samples were selectively enriched, and analyzed for the presence of Salmonella by a commercially available antigen-capture ELISA. Meat samples were kept frozen, and thawed for processing. The resulting liquid (“meat juice”) was collected and analyzed for the presence of antibodies against Salmonella by a commercially available ELISA. All lots of pigs housed in the finishing barns studied were Salmonella-positive, based on sampling from “first pull” and “close out”. In 7/9 (77.8%) of the studied barns, an increase in Salmonella prevalence was observed, based on both bacteriologic and serologic analysis. Overall, there was an increase of 9.3% (P<0.05) in bacteriologic prevalence, and 25.1% (P<0.05) in serologic prevalence from “first pull” to “close out” groups. This study demonstrates that a significant increase of Salmonella prevalence occurs between the first and the last group of pigs from a finishing barn shipped to slaughter. In conclusion, “close out” groups of finishing pigs constitute a higher risk for Salmonella contamination of pork products.

Introduction

Subclinical Salmonella infections in pigs constitute an important food safety problem as carrier animals pose a risk for pork products contamination. Determining the Salmonella status of pig herds as part of a monitoring and intervention program to reduce the risk of pork contamination is fundamental. However, potential risk factors should first be identified and quantified. Although intervention strategies to assure food safety can be applied at all levels of the pork production chain, increased emphasis has been placed on the potential reduction of meat contamination by reducing contaminants at the pre-harvest level (i.e., on-farm). Theoretically, reducing the number of animals infected at the farm can decrease contamination of final products. However, the on-farm ecology and epidemiology of Salmonella is still not fully understood. A variety of potential risk factors have been identified over the last years, including; drinker type, feed form, hygiene and biosecurity measures, and others (Lo fo Wong et al., 2004; Bahnson et al., 2006).

Due to the variation in body weight within groups of finishing pigs, it is common practice in many large swine production operations to remove animals for market over a period of time. Conventionally, the heaviest pigs would be removed first (“first pull”) thus allowing more time for the lighter pigs to reach an acceptable market weight (“close out”). Research has shown that by removing up to 50% of the heaviest pigs from a pen, growth performance of the remaining animals is increased (Bates and Newcomb, 1997; Woodworth et al.,2000; DeDecker et al.,2006). Removing pigs from a pen results in an increase in floor and feeder space for the remaining animals, but also changes the social dynamics of the group. There is some concern that this marketing strategy may serve as a potential stressor to the remaining animals causing the reactivation of dormant infections and/or increased predisposition to new infections. Therefore, this study was designed to compare the Salmonella enterica prevalence in the first group of pigs...
selected for slaughter (i.e., "First-pull") versus the last group of pigs selected for slaughter (i.e., "Close-out"), under commercial conditions.

Materials and Methods

Two finishing production sites previously identified as being Salmonella-positive were visited multiple times to conduct group-paired samplings (4 paired samplings from one site, and 5 paired samplings from another site). Each paired sampling consisted in matched groups of pigs from the same barn as the "first-pull" (i.e., the first group of pigs selected to slaughter) and the "close-out" (i.e., the last group of pigs selected to slaughter). Each sampling consisted of 45 individual fecal samples collected directly from the rectum (2-3 pigs were sampled per pen, allowing the sampling of at least 10 different pens within a building group). At the abattoir, the same groups of pigs were followed and individual meat samples (diaphragm, 40-70g) were collected (n=50 samples per group). Each fecal sample (10g) was sequentially enriched in Tetrathionate and Rappaport-Vassiliadis broths. An aliquot (1mL) of the last enrichment was analyzed for the presence of Salmonella using a commercially available antigen-capture ELISA (Assurance® Gold EIA Salmonella, Biocontrol), previously evaluated in our laboratory (Rostagno et al., 2001). Meat samples were kept frozen until processed. Samples were then thawed, and the resulting fluid ("meat juice") was collected for each sample (1mL) and analyzed for the presence of anti-Salmonella antibodies using a commercially available indirect ELISA (HerdChek® Swine Salmonella, IDEXX), based on lipopolysaccharide antigens (Camitz et al., 2001). The cut-off value (S/P ratio) applied was 0.25. Salmonella bacteriologic and serologic prevalence and respective 95% confidence interval were estimated for each group sampled, and overall. Proportions were compared by Chi-square test, and the statistical significance level applied for inferences was P<0.05.

Results

All lots of pigs housed in the finishing barns studied were Salmonella-positive, based on sampling from "first pull" and "close out", both bacteriologically and serologically. Based on fecal samples, the overall Salmonella prevalence estimates were 10.6% (95% C.I. 6.03% - 15.2%) and 19.8% (95% C.I. 11.3% - 28.2%) for "first pull" and "close out" groups, respectively. Based on "meat juice" samples, the prevalence estimates were 18.9% (95% C.I. 12.7% - 25.1%) and 50.2% (95% C.I. 26.8% - 73.6%) for "first pull" and "close out" groups, respectively.

In 7/9 (77.8%) of the finishing lots studied, an increase in Salmonella prevalence was observed, based on both bacteriologic and serologic analysis. Overall, there was an increase of 9.2% (P<0.05) in bacteriologic prevalence, and 31.3% (P<0.05) in serologic prevalence from "first pull" to "close out" groups. A bacteriologic prevalence increase from "first pull" to "close out" occurred in 7/9 (77.8%), whereas in only 1 group (11.1%) the prevalence decreased, and in 1 group (11.1%) the prevalence was the same for both groups. A serologic prevalence increase from "first pull" to "close out" occurred in 7/9 (77.8%), whereas in 2 groups (22.2%) the prevalence decreased.

Discussion

Potential explanations for the increase in Salmonella prevalence between "first pulls" and "close outs" are: 1) the reactivation of dormant/latent infections and subsequent increased transmission, due to the stress caused by the social disruption consequent to the removal of the heaviest pigs from the pens, and 2) mechanical transmission (i.e., dissemination or spread) of the bacteria by the personnel entering the barns to remove the heaviest pigs from the pens. Although no definitive evidence exists, it may also be possible that a concentration of infected animals may have occurred, if the growth performance of Salmonella-infected pigs was detrimentally affected by the bacteria. However, based on the serological increase in prevalence observed, it is more likely that new infections occurred due to the transmission of the bacteria between the pigs and/or through the personnel involved in the selection and removal of the heaviest pigs.
Conclusions

Our study demonstrates that a significant increase of Salmonella prevalence occurs between the first and the last group of pigs from a finishing barn shipped to slaughter when applying a split marketing strategy. Therefore, it is concluded that “close out” groups of finishing (or market) pigs constitute a higher risk for Salmonella contamination of pork products.

References


