



Abattoir holding pens as a source of *Salmonella* for swine.

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Summary: This study was designed to determine if rapid *Salmonella* infection is possible during the pre-slaughter holding period at swine abattoirs. For 24 groups of pigs studied in 2 high capacity abattoirs, pooled fecal samples were collected from the transport trailer right after pigs were unloaded (pre-holding samples). Holding pens were sampled prior to the entry of study pigs for the pre-slaughter holding. After slaughter, cecal contents and ileocecal lymph nodes were collected from 30 pigs in each studied group (post-holding samples). From all holding pens sampled (100%) at least one *Salmonella* serovar was isolated. All groups of pigs were *Salmonella*-positive in the post-holding sampling, including those groups *Salmonella*-negative in the pre-holding sampling. Some groups had *Salmonella* serovars that matched serovars isolated from the holding pens, but not with serovars isolated from the pre-holding samples. Results indicate that the abattoir holding pens constitute an important source of *Salmonella* infections for swine.

Keywords: *Salmonella*, Swine, Abattoir, Pre-slaughter holding

Introduction: A significant increase in the proportion of *Salmonella*-positive pigs when comparing prevalences at the farm and after slaughter has been demonstrated by several studies (Morrow et al.,1999; Mckean et al.,2001). Transportation and holding of pigs prior to slaughter have been linked to increased *Salmonella* prevalence at the abattoir. However, this has been attributed to effect of stress, increased stocking density, and reoccurrence of shedding. The effect of pre-slaughter holding, where close contact with other pigs and environmental exposure occur may also be important determinants of *Salmonella* prevalence at slaughter. A Recent study demonstrated that *Salmonella* can infect market age pigs exposed to a contaminated environment in a period of time as short as 2 hours (Hurd et al.,2001). Therefore, this study was designed to determine if rapid *Salmonella* infection constitute a phenomena that routinely occurs during the pre-slaughter holding period at swine abattoirs, and consequently, determine the role of the pre-slaughter holding as a risk factor for *Salmonella* infections in swine.

Materials and Methods: Three repetitions of the experiment were executed at 2 high capacity abattoirs (16,000 pigs/day). Each repetition included 4 groups of pigs (~150 animals/group). For

each group studied, pooled fecal samples were collected from the transport trailer right after the pigs were unloaded (pre-holding samples). The holding pens were sampled prior to the pigs entering for the pre-slaughter holding (holding samples). After slaughter, cecal contents and ileocecal lymph nodes were collected from 30 pigs in each studied group (post-holding samples). All samples were processed by conventional bacteriological methods for the isolation and identification of *Salmonella*, including pre-enrichment in Tetrathionate (48h,37°C) or GN-Hajna broths (24h,37°C), enrichment in Rappaport-Vassiliadis broth (24h,37°C), and plating on Brilliant Green Sulfa (BGS) and Xylose-Lysine-Tergitol-4 (XLT-4) agars (24h,37°C). Suspect colonies were identified through biochemical reactions in Triple Sugar Iron agar (TSI) and Lysine Iron Agar (LIA), serogrouping and serotyping.

Results: From the 24 transport trailers sampled (pre-holding samples), 20 (83.3%) were *Salmonella*-positive. All holding pens sampled (24/24) were contaminated with *Salmonella*, and in 8 (33.3%) of these holding pens, water samples from the water fountain were *Salmonella*-positive. All groups of pigs studied (24/24) were *Salmonella*-positive in the post-holding samples, including those from *Salmonella*-negative transport trailers. From the 24 groups of pigs studied, 25% were infected with *Salmonella* serovars that matched serovars isolated from the respective holding pens, 25% were infected with serovars that matched with serovars isolated from the transport trailers, and 45.8% were infected with serovars that matched with serovars simultaneously isolated from the transport trailers and holding pens. The average number of *Salmonella* serovars found was 1.6 serovars/transport trailer, 3 serovars/holding pen and 3.7 serovars/group of pigs. This result represents the *Salmonella* serovar diversity found in the pre-holding, holding and post-holding samplings, respectively. It was observed that 15.7% of the isolates from post-holding samples matched with isolates from pre-holding samples, 25.8% matched with isolates from holding samples, and 7.9% matched with isolates from pre-holding and holding samples simultaneously. Interestingly, 50.6% of post-holding isolates did not corresponded to any found in pre-holding and holding samples.

Discussion: Results from this study demonstrate that abattoir holding pens are frequently contaminated with a variety of *Salmonella* serovars. Swanenburg et al.(2001) also found high levels of contamination with *Salmonella* in holding pens from two abattoirs in Europe. Williams and Newell (1968) also found the abattoir holding pen and water fountain contaminated before the entrance of a group of studied pigs, and suggested that the contaminated abattoir environment contributed to the greatest number of positive samples analyzed. The matchings of post-holding isolates with serovars isolated from the holding pens samples observed in our study demonstrated that the abattoir holding pens are a risk factor for *Salmonella* infections in pigs prior to slaughter. It is possible that pigs harbor *Salmonella* while on the farm, but they do not shed the organism into feces. The stress of pre-slaughter events may then induce these non-shedding infected pigs to start shedding. However, it is also possible that pigs become infected during transportation and pre-slaughter holding, through cross-infections and exposure to a contaminated environment. Our results indicate that the contaminated environment of the holding pens is probably the major source for *Salmonella* infections for swine prior to slaughter. This study identifies an important critical control point for *Salmonella* contamination in the pork production chain.

References:

- Hurd, H.S.;Gailey,J.K.;Rostagno,M.H.(2001) Rapid infection in market swine following exposure to a *Salmonella* contaminated environment. Am. J. Vet. Res.(in press).
- Mckean,,J.D.;Hurd,H.S.;Rostagno,M.H.;Griffith,R.D.;Wesley,I.V.(2001) Transport and holding at the abattoir: A critical control point for *Salmonella* in market swine? 4th International Symposium on Epidemiology and Control of *Salmonella* and Other Foodborne Pathogens in Pork. Leipzig.
- Morrow,W.E.M.;Davies,P.R.;See,T.;Eisemann,J.;Zering,K.;Kihlstrom,S.;Karli,K. (1999) Prevalence of *Salmonella* spp. in the feces on farm and ceca at slaughter for a cohort of finishing pigs. 3rd International Symp. on the Epidemiology and Control of *Salmonella* in Pork.Washington:155-157.
- Swanenburg,M.;Urlings,H.A.P.;Keuzenkamp,D.A.;Snijders,J.M.A. *Salmonella* in the lairage of pig slaughterhouses.(2001) J. Food Prot., 64:12-16.

Williams,L.P.;Newell,K.W.(1968) Sources of Salmonellas in market swine. J. Hyg., 66:281-293.