EFFECT OF GROUP SIZE AND CHLORTETRACYCLINE ON SALMONELLA IN SWINE

Julie A. Funk*, Andrew Bowman, Andrew Mack, Jeffrey T. LeJeune, Thomas E. Wittum
Department of Veterinary Preventive Medicine, College of Veterinary Medicine, The Ohio State University, 1920 Coffey Road, Columbus, OH 43210, Ph: 614-247-6635, Fax: 614-292-4142, Email: funk.74@osu.edu

Abstract The objective of this study was to evaluate the effect of stocking density and subtherapeutic chlortetracycline on Salmonella prevalence in swine. From one farm, four finisher barns with eight pens per barn were selected for entry into the study. Two barns received subtherapeutic chlortetracycline in the diet, and 2 rooms received the same diet without antimicrobials. Within each barn, alternate pens were assigned to high or low stocking density. Overall 6% of all fecal samples were positive. Salmonella was cultured from all barns. Of the 30 pens included in the study, 21 (70%) were positive at least once. Preliminary data suggests that there was no difference in the proportion of pen samples positive or the odds of a pen to be positive associated with stocking density. There were increased overall proportion of positive samples and increased odds of a pen to be Salmonella positive if it was in a barn that received chlortetracycline.

Introduction Animal stocking density has been proposed as a potential risk factor for Salmonella shedding in swine. Stocking density has known impacts on growth performance in swine (Hyun and Ellis, 2001; Hyun et al., 1998), but data regarding animal density and marketing group as risk factors for shedding of salmonellae are sparse. In a study of US swine, groups of finisher pigs categorized as having high Salmonella prevalence were more likely to be stocked at higher pig densities (ie, less space allowance per pig) at the time of sampling, compared to low prevalence groups. (Funk et al., 2001) The association with stocking density itself was unclear, as the variation at the time of finishing sampling was accounted for by the number of pigs that had been marketed prior to sampling. Linton et al. (1970) identified higher prevalence of infection in pens with higher pig density, but this result was not confirmed on subsequent sampling in the same herd.

Subtherapeutic antimicrobial use, in particular for the purpose of growth promotion, is under increasing scrutiny regarding its contribution to antimicrobial resistance in human pathogens. It is currently unclear what the effect of subtherapeutic antimicrobial use has on the prevalence of Salmonella. Few on-farm clinical trials evaluating the effect of subtherapeutic antimicrobials on Salmonella prevalence have been conducted.

The objective of this study was to evaluate the effect of group size/stocking density and subtherapeutic chlortetracycline on Salmonella prevalence in swine.

Materials and Methods One farrow to finish swine herd was recruited for the study. Inclusion criteria were all-in, all-out pig flow, history of Salmonella isolation from the farm, and willingness to alter antimicrobial inclusion in the diet and stocking density of the finisher phase. Four finisher barns that were placed weekly were included in the study. Each barn contained eight pens. Two of the barns (placed on weeks one and three of the study) received 50g/ton of chlortetracycline in the ration. The other 2 barns (placed on weeks 2 and 4) received no antimicrobials in the feed. In each barn, alternate pens were assigned to either high group size/stocking density (targeted at 31 pigs per pen, ~6.5 ft²/pig) or low group size/stocking density (targeted at 25 pigs per pen, ~8.0 ft²/pig). Pigs were placed in the finisher barns at approximately 10 weeks of age and for each room of pigs the study was conducted for 6 weeks.

Every week, 10 individual fresh fecal samples (~10g each) were collected from the floors of each pen (a total of 80 per room). Fecal samples were cultured by a standard protocol. Briefly, samples were transported to the laboratory at ambient temperature and stored at 4°C overnight and cultured the next day. For each sample, 10g ± 2g of feces were weighed and diluted in 90 ml of tetrathionate broth (TTB) and incubated at 37°C for 48 hours. 100µl of the incubated TTB mixture was inoculated into 10 ml of Rappaport Vassiliadis broth (RV) and incubated at 42°C for 24 hours. A loopful (10 µl) was then struck onto Xylose Lysine Tergitol4 agar (XLT4) and incubated at 37°C overnight. Colonies with morphology typical of Salmonella were then tested with biochemical tests and submitted to the National Veterinary Services Laboratory, Ames, IA for serotyping.

The proportion of positive samples was calculated for each pen weekly. A preliminary comparison of the overall prevalence of positive samples between treatment groups was estimated...
using the Wilcoxon Signed Rank test for each treatment (CTC inclusion or stocking density) individually. A multilevel logistic regression model (MLwiN v 2.1) was constructed to evaluate the association between pen status and treatments (CTC or stocking density). The dependent variable was *Salmonella* status of a pen (yes/no). For the variance structure pen, week and barn were designated levels to account for data clustering. Pending analysis includes a multilevel logistic model to assess the association between individual sample status and treatments (stocking density and chlortetracycline).

**Results** A total of 1800 fecal samples (30 pens x 10 samples/pen x 6 weeks of sampling) were collected. Thirty-two pens were targeted for inclusion, but 2 pens were removed as a result of early sales. Overall, 108 (6%) of fecal samples were positive. *Salmonella* was isolated in all barns, and of the 30 pens sampled, 21 (70%) were positive at least once during the six week period. Pen level prevalence ranged from 0 to 50%.

Preliminary data analyses suggest that there is no association between *Salmonella* status (overall sample prevalence) or pen *Salmonella* status) and stocking density. Conversely barns that received subtherapeutic chlortetracycline had an increased overall proportion of positive fecal samples (p=0.006), and an increased odds of a pen to be positive (OR 6.45, 95% CI 2.49-16.99) as compared to those samples from pigs not receiving antimicrobials in the diet. Analyses based on individual sample status are pending.

**Discussion** These preliminary results suggest that at least in the early finisher phase, there is no impact of the group sizes/stocking densities evaluated in this trial and *Salmonella* shedding. It is uncertain if the trial had continued until marketing whether this trend would have been maintained, as the pigs would have grown sufficiently to far surpass recommended space allowance guidelines. Further analyses of the data are pending.

The increased *Salmonella* shedding in pigs that received sub-therapeutic chlortetracycline is in disagreement with previous clinical trials from our laboratory that suggest no difference (Funk et al, unpublished data) or decreased prevalence (Mack and Funk, SafePork 2005). The discordant results from clinical trials conducted on different farms may suggest that the effect of subtherapeutic chlortetracycline on *Salmonella* shedding may be farm specific, and potentially dependent upon the resident *Salmonella* strain. Serotyping and antimicrobial resistance data from this work is pending, and may shed light on the associated increase in *Salmonella* prevalence. This lack of concordance in the data may also suggest that the “true” effect is null, which warrants larger scale, multi-farm assessments of the association between inclusion of subtherapeutic chlortetracycline in swine diets and *Salmonella* shedding in swine.

**Conclusions** Preliminary data suggest that there is no association between the group sizes/stocking densities evaluated in this study and *Salmonella* shedding. There was an increased risk of *Salmonella* shedding in pigs that received subtherapeutic chlortetracycline in the diet, which is in disagreement with previous results from our lab and therefore warrants cautious interpretation when considering the risk of subtherapeutic antimicrobials for *Salmonella* shedding in market swine.

**References**


