Group Relationship of Salmonella ELISA Antibody Status of Grower-Finisher Hogs to Fecal Shedding Detectable by Culture

Bruce Lawhorn, DVM, MS
Associate Professor/Extension Swine Veterinarian, Rm #2 College Veterinary Medicine/Texas Ag Extension Service
Texas A&M University System, College Station, Texas 77843-2487

In June 1998, the National Pork Producer’s Council funded this study. The objectives are:

1. compare the development of Salmonella ELISA antibody with fecal shedding of Salmonella within each group of hogs,
2. compare the pre-harvest ELISA antibody to Salmonella with post-harvest culture of Salmonella from ileocecal lymph nodes, and
3. compare pre-harvest fecal culture to post-harvest fecal culture of combined cecal/rectal feces.

From July through December 1998, five separate groups of 30 pigs originating from farrow-to-finish farm E were double ear tagged, blood and fecal sampled and transported to grower-finisher facilities at farms “D, R, J, E, and C” (Texas Dept of Criminal Justice swine farms). The average starting weights of pigs were approximately 100 lbs on 4 farms and 55 lbs on farm C; each group of 30 tagged pigs represented a random sampling from a total of 185 pigs. Fecal and blood sampling was continued at approximately monthly intervals with the last sampling within 5 to 14 days of slaughter. Fecal sampling was accomplished after observing each tagged animal defecating when snare restrained and collecting samples with disposable latex gloves, or collecting feces with a fecal loop via rectal insertion. Blood was collected by needle and syringe from the right brachiocephalic vein and then deposited into sterile plastic tubes. Sera was tested for antibody by Salmonella MIX ELISA at NOBL Laboratories, Ames, Iowa and feces by Salmonella enrichment culture at the College of Veterinary Medicine, Texas A&M University Microbiology Laboratory, College Station, Texas. Positive cultures were maintained for serotyping. Samples of ileocecal lymph nodes and combined cecal/rectal feces were collected at slaughter (Texas Dept Criminal Justice swine slaughter plant) and cultured. All serotyping of cultured Salmonella is pending. Results to date represent 1/3 of the work necessary to complete the entire experimental protocol. A unique aspect of this study is the supplemental feeding of cooked food waste for various lengths of time in the finishing period.

Sampling within 14 days of slaughter as used in this study is possibly the technique a veterinarian in the US may use to describe or certify the pre-harvest Salmonella status of a group of finisher hogs immediately prior to slaughter. The slaughter sampling and culture of ileocecal lymph nodes and cecal/rectal combined feces on the same hogs that were blood and fecal sampled within 14 days before slaughter represents an example of an immediate post-harvest Salmonella sample a US veterinarian might collect to describe or certify the Salmonella status of a group of finisher hogs at the packer. No blood samples were taken at slaughter since the last pre-harvest blood sampling for MIX ELISA was within 14 days of slaughter and culture of ileocecal lymph nodes for Salmonella has been positively associated with ELISA results.
### Culture and ELISA Results:

**FARM “D”**

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**Objective 1:** 0 ELISA and culture pos at 1st sampling. 18 ELISA pos (High >50%) and 0 culture pos at 2nd sampling. 0 ELISA and one culture pos (Low 0 to <25%) at 3rd sampling. 17 ELISA pos (High >50%) and 3 culture pos (Low 0 to <25%) at 4th sampling. All 3 culture pos pre-harvest were from different animals. 11 hogs ELISA pos only one time; 16 animals ELISA pos twice; and 23 different hogs ELISA pos once or twice. 3/4 hogs culture pos pre-harvest were ELISA pos twice. 1/4 culture pos hog pre-harvest was ELISA neg at all 3 samplings (one ELISA sampling not done).

**Objective 2:** 17 hogs were ELISA pos at the 4th sampling, prior to slaughter while one hog post-harvest was Salmonella lymph node pos but ELISA neg at all 4 pre-harvest samplings. Therefore, ELISA pos antibody immediately pre-harvest was not individually or group correlated with lymph node culture for Salmonella post-harvest (there was a strong inverse relationship).

**FARM “R”**

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**Objective 1:** 0 ELISA and culture pos at 1st sampling. 11 ELISA pos (Moderate 25 to 50%) and 4 culture pos (Low 0 to <25%) at 2nd sampling. 0 ELISA and 1 culture pos (Low 0 to <25%) at 3rd sampling. 3 ELISA pos (Low) and 0 culture pos at 4th sampling. 5 total pos Salmonella culture pre-harvest; 3 from different hogs and 2 from same hog (4 total hogs culture pos). 12 hogs were ELISA pos once; one hog was ELISA pos twice. 13 total ELISA pos hogs once or twice. 3/4 hogs culture pos pre-harvest were never ELISA pos; 1/4 hogs culture pos twice pre-harvest was ELISA pos once.

**Objective 2:** 3 hogs were ELISA pos at 4th sampling, prior to slaughter while 0 hogs were lymph node pos post-harvest. There was no individual correlation. The low number (0 to <25%) of ELISA pos pre-harvest (3/29) was group correlated with the Low number (0/29) of lymph node pos post-harvest.

**Objective 3:** 0 hogs had pre-harvest pos cultures at 4th sampling and 1 different hog had pos post-harvest cecal/rectal combined fecal culture. Feces culture were the same immediately pre- and post-harvest so there was a group correlation.

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Farm “J”

8-5-98 9-3-98 10-8-98 11-12-98 11-17-98Feces 11-17-98LN

cult = 0% cult = 13% cult = 37% cult = 50% cult = 79% cult = 59%

0/30 4/30 11/30 15/30 23/29 17/29

ELISA = 0% ELISA = 53% ELISA = 27% ELISA = 70%

0/30 16/30 8/30 21/30

Objective 1: 0 ELISA and culture pos at 1st sampling. High (53%) ELISA pos and Low (13%) culture pos at 2nd sampling. Moderate (27%) ELISA pos and Moderate (37%) culture pos at 3rd sampling. High (70%) ELISA pos and Moderate (50%) culture pos at 4th sampling. 15 hogs were culture pos once pre-harvest; 6 hogs were culture pos twice pre-harvest; one hog was culture pos three times pre-harvest; 22 hogs were culture pos one to three times pre-harvest; 12 hogs ELISA pos once; 12 hogs ELISA pos twice; 3 hogs ELISA pos three times; 27 hogs ELISA pos one to three times. 20 hogs culture pos pre-harvest were ELISA pos one to three times. 2 hogs culture pos pre-harvest were ELISA neg at all samplings.

Objective 2: 21 hogs ELISA pos at the 4th sampling prior to slaughter while 13 of these same 21 hogs were lymph node pos post-harvest and 7 of these same 21 were lymph node neg. 9 hogs were ELISA neg at 4th sampling; 4 of these 9 hogs were lymph node pos post-harvest; 5 of these 9 hogs ELISA neg at the 4th sampling were lymph node neg post-harvest. Therefore ELISA pos antibody at 4th sampling pre-harvest was individually and group correlated with pos lymph node culture for Salmonella post-harvest.

Objective 3: 15 hogs had pre-harvest pos cultures at 4th sampling while 14 of these same 15 had post-harvest cecal/rectal combined pos cultures. 15 hogs were culture neg at 4th sampling; 9 of these 15 hogs had post-harvest pos cecal/rectal combined cultures; 6 of these 15 had post-harvest neg cecal/rectal combined cultures. Pre-harvest pos culture at 4th sampling trended to be individually correlated and was group correlated to post-harvest pos cecal/rectal combined cultures.

Farm “E”

8-12-98 9-10-98 10-13-98 11-30-98 12-7-98Feces 12-7-98LN

cult = 0% cult = 0% cult = 7% cult = 7% cult = 7% cult = 21%

0/30 0/29 2/30 2/30 2/29 6/29

ELISA = 13% ELISA = 27% ELISA = 27% ELISA = 37%

4/30 8/30 8/30 11/30

Objective 1: Low (13%) ELISA and 0 culture pos at 1st sampling. Moderate (27%) ELISA and 0 culture pos at 2nd sampling. Moderate (27%) ELISA and Low (7%) culture pos at 3rd Sampling. Moderate (37%) ELISA and Low (7%) culture pos at 4th sampling. 4 total Salmonella cultured pos pre-harvest, all from different hogs (4 total hogs culture pos). 7 hogs were ELISA pos once; 7 hogs were ELISA pos twice; 2 hogs were ELISA pos three times; 1 hog was ELISA pos four times; and 17 total hogs were ELISA pos one to four times.

Objective 2: 11 hogs were ELISA pos at 4th sampling while 1 of these same 11 hogs were lymph node pos post-harvest. 10 of these same 11 hogs were lymph node neg post-harvest. 19 hogs were ELISA neg at 4th sampling while 5 of these 19 were lymph node pos post-harvest. Although there was no individual correlation between 4th sampling ELISA pos pre-harvest and lymph node pos culture post-harvest, 4th sampling ELISA pre-harvest showed 11 pos and post-harvest lymph node culture showed 6 pos (only 1 hog both ELISA/lymph node pos), demonstrating a group correlation.
Objective 3: 2 hogs had pre-harvest pos cultures at 4th sampling while 1 of these same 2 had post-harvest cecal/rectal combined pos culture. 27 hogs were culture neg at 4th sampling pre-harvest; 1 of these 27 hogs had pos post-harvest culture; 26 had post-harvest neg cecal/rectal combined cultures. 1 hog culture pos at 4th sampling- same hog was cecal/rectal culture pos and lymph node pos post-harvest. 1 sample pos pre-harvest and same animal pos (out of 2 total pos) post-harvest indicates an individual correlation. 2 (7%) culture pos at 4th sampling pre-harvest are the same as 2 (7%) pos cecal/rectal cultures post-harvest demonstrating a group correlation.

FARM “C”

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Objective 1: 0 ELISA and culture pos at 1st and 2nd sampling. Low (8%) ELISA pos and Low (3%) culture pos at 3rd sampling. Moderate (31%) ELISA pos and Low (0%) culture pos at 4th sampling. Only one culture pos pre-harvest. 7 hogs ELISA pos once; 2 hogs ELISA pos twice; 9 different hogs ELISA pos once or twice. One culture pos hog never ELISA pos.

Objective 2: 9 hogs were ELISA pos at the 4th sampling prior to slaughter while 6 of these same 9 hogs were lymph node pos post-harvest and 3 of these same 9 were lymph node neg. 20 hogs were ELISA neg at 4th sampling; 6 of these 20 hogs were lymph node pos post-harvest; 14 of these ELISA neg at 4th sampling were lymph node neg post-harvest. Therefore ELISA pos antibody at 4th sampling pre-harvest was individually and group correlated with pos lymph node culture for Salmonella post-harvest.

Objective 3: 0 hogs had pre-harvest pos cultures at 4th sampling and 22 had pos post-harvest cecal/rectal combined fecal cultures. There was no individual or group correlation between pos cultures at 4th sampling pre-harvest and pos post-harvest cultures (there was a strong inverse relationship).

Results Summary

Objective 1: It is obvious that the ELISA and culture results in individual hogs and within the same group of hogs may be similar or vary greatly when sampled monthly during the growerfinisher phase of production. All 5 groups studied to date started out with as “Salmonella clean” pigs (all from farm “E”) and became ELISA and/or culture positive at variable rates or remained relatively “clean” as they grew to market weight.

Objective 2: In “D, R, J, E, C” farm groups there seems to be individual animal correlation between ELISA pos at the 4th sampling and post-harvest lymph node culture in 2/5 (40%) groups and a group correlation between these pre- and post-harvest tests in 4/5 (80%) groups.

Objective 3: In “D, R, J, E, C” farm groups there seems to be individual animal correlation between feces culture pos at the 4th sampling and post-harvest cecal/rectal combined culture pos in 2/5 (40%) groups and a group correlation between these pre- and post-harvest cultures on 4/5 (80%) farms.

It was interesting that there was no individual or group correlation between pre- and post-harvest cultures in farm “C” group (there was a strong inverse relationship). Farm group “C” showed very little evidence of Salmonella infection pre-harvest (only 1 culture positive in 4 samplings [118 cultures] but 31% ELISA pos at 4th sampling) but heavy Salmonella infection at slaughter (79% feces and 43% lymph node positives). Because of a inmate lockdown at farm C, there was a delay in sending this group to slaughter until 17 days after the 4th pre-harvest sampling. There was also a delay of an extra day of lairage at the slaughter facility. Exposure during extended lairage was the most likely source of heavy Salmonella infection. However, exposure during an extended length of time (> 14 days) between 4th sampling and slaughter cannot be ruled out as a contributing cause.

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Conclusions

With the data to date on these 5 groups of hogs, it seems that veterinarians may assess the Salmonella status of a group of finisher hogs by using the pre- or post-slaughter tests in this study. Objective 2 and 3 result summaries suggest that there is a partial individual and strong group correlation between pre- and post-slaughter tests. Note that all hogs tested post-harvest were shipped individually as a farm group and were all kept in a separate pen as a group prior to slaughter. Mixing of groups of hogs on trailers and in holding pens prior to slaughter may not give the same results. Also, Salmonella serotyping results may alter preliminary interpretation of results of this study.

Sampling within 5 to 14 days before slaughter seem to give the most reliable pre-harvest assessment of Salmonella status of a group of finisher hogs compared to other sampling periods. Results on farm group “C” indicate that pre-harvest sampling greater than 14 days before hogs are slaughtered or, more importantly, sampling at slaughter after an extended lairage may completely invalidate any attempts to describe or certify the Salmonella status of a group of slaughter weight hogs.

References


