IMPACT OF FEEDING STAGE, CATTLE SOURCE, AND SEASON ON *SALMONELLA* PREVALENCE IN BOVINE LYMPH NODES

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I. INTRODUCTION

Peripheral lymph nodes (LNs) are known to be widely distributed throughout the fatty tissues of beef carcasses and have the ability to harbor *Salmonella*, creating concern for potential ground beef contamination. Previous research has demonstrated that *Salmonella* prevalence rates in bovine LNs can differ among feeding operations [1]. To investigate possible factors influencing these differences, we designed two experiments. The primary objective of experiment 1 was to determine if differences in prevalence rates between feeding operations were due to cattle source or due to factors associated with different stages of feeding. The second experiment was designed to address cattle source and seasonality by determining if *Salmonella* prevalence differed (1) between cattle of Mexican and U.S. origins when exposed to the same feedlot environment and (2) between warm and cool seasons. Data from these experiments add to the current body of knowledge and help to narrow the scope of future pre-harvest research opportunities.

II. MATERIALS AND METHODS

Experiment 1. Weanling steers (n = 80) of common and known origin were selected for this study. For the purposes of this study, feeding stages were defined as: (1) post-weaning, (2) stocker, (3) 60 d on feed, and (4) 120 d on feed. Twenty steers were harvested post-weaning (stage 1) and the remaining 60 were divided equally between two feeding locations (identified as either location A or B) with previously determined levels (one “high” and one “low”) of *Salmonella* prevalence in LNs. Ten steers were harvested from each feeding location after each remaining feeding stage at a commercial abattoir. Due to illness, 4 steers did not complete the study. Left and right subiliac and superficial cervical lymph nodes were collected from each carcass (n = 304 total lymph nodes) and matching node types were pooled by animal (n = 152 total samples). *Salmonella*, if present, was isolated from the lymph nodes following the USDA-FSIS Microbiological Laboratory Guidebook 4.08 method. Presumptive positive samples were confirmed using PCR, and isolates from confirmed positive samples were serotyped.

Experiment 2. A commercial feedlot in South Texas was chosen based on its routine management of nearly equal numbers of cattle originating from the U.S. and Mexico, and historical likelihood of producing cattle with *Salmonella*-positive LNs. Paired subiliac LNs (n = 800 LNs) were collected from 100 carcasses per origin (Mexico and U.S.), per season (warm and cool). Within each animal, left and right LNs were pooled yielding n = 400 total LN samples. LNs were processed and analyzed as previously described.

Statistical analyses. For both experiments, data were analyzed using JMP Pro software (SAS Institute, Inc., Cary, NC). Contingency tables were produced for main effects (feeding stage, origin, or season), and within table differences were determined using Fisher’s exact test and an $\alpha = 0.05$. To determine differences across feeding stages within a given location, Fisher’s exact test was performed for all pairwise comparisons, and the Bonferroni correction for multiple comparisons was applied using $\alpha = 0.0017$.

III. RESULTS AND DISCUSSION

Experiment 1. As presented in Table 1, *Salmonella* in bovine LNs differed ($P < 0.05$) between location A and location B and among feeding stages in location B. *Salmonella*-positive LNs were not recovered from either

feeding stage 1 (post-weaning) or location A. Within location B, there was an increase in *Salmonella* prevalence as cattle progressed into later stages of feeding: at 22.2% (4/18), 77.8% (14/18), and 94.4% (17/18) for feeding stages 2, 3, and 4, respectively. PCR-confirmed positive samples submitted for serotyping often contained multiple indistinguishable serovars (40.0%); however, Montevideo (20.0%), Mbandaka (17.14%), and Anatum (11.43%) were the most commonly identified individual serovars.

TABLE 1. Prevalence of *Salmonella*-positive peripheral lymph node (LNs) samples[a] by location for each feeding stage[b]

Feeding location	Stage 1	Stage 2	Stage 3	Stage 4
Farm	00.0 (0/40) (n = 20 steers)	--	--	--
Location A	--	00.0 (0/20) a, x (n = 10 steers)	00.0 (0/18) a, x (n = 9 steers)	00.0 (0/20) a, x (n = 10 steers)
Location B	--	22.2 (4/18) b, x (n = 9 steers)	77.8 (14/18) b, y (n = 9 steers)	94.4 (17/18) b, y (n = 9 steers)

a,b: Values within a column lacking a common letter differ ($P < 0.05$).
x,y: Values within a row lacking a common letter differ ($P < 0.017$).
[a] At the conclusion of each feeding stage, steers from each location were harvested and left and right superficial cervical and subiliac LNs (n = 304 LNs) were removed. Within animal, left and right LNs of each type were pooled (n = 152 total samples).
[b] Feeding stages were identified as (1) weaning, (2) background/stocker, (3) 60 d on feed, (4) 120 d on feed.

Experiment 2. *Salmonella*-prevalence rates from cattle of Mexican and U.S. origin were similar ($P = 0.4836$), at 54.0% (108/200) and 50.0% (100/200), respectively. *Salmonella* prevalence differed ($P = 0.0354$) between seasons, with 46.5% (93/200) and 57.5% (115/200) *Salmonella*-positive samples from cool and warm seasons, respectively. Seasonal findings from the current study are in agreement with previous research [2]. Serotyping resulted in fourteen different serovars with Cerro (21.6%), Anatum (19.7%), Muenchen (17.8%), Montevideo (14.4%), and Kentucky (12.0%) comprising the majority.

IV. CONCLUSION

While the reasons for the differences seen between feeding operations, and increased *Salmonella* prevalence in LNs at later feeding stages remain unexplained, results from experiment 1 indicate that factors other than cattle source were likely influencing *Salmonella* prevalence in LNs. Findings from experiment 2, where similar prevalence rates were seen between cattle that originated from two different countries but were managed in the same feeding location, further suggest that factors other than cattle source are contributing to *Salmonella* prevalence in bovine LNs. Overall, results from these experiments strongly encourage further investigation into the role of feedyard environment and management practices. To maintain progression in this sector of pre-harvest research, establishing methods to evaluate the role of environmental, management-related, or other factors yet to be identified, is imperative. Outcomes of such efforts could result in practical pre-harvest approaches to reducing *Salmonella* prevalence rates in bovine LNs, and subsequently, ground beef products.

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