

Project Title:	Validation of Environmental Predictors of <i>Salmonella</i> Contamination in Feedlot Environments
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Background

The foodborne pathogen *Salmonella* has been detected in peripheral lymph nodes (PLNs) of cattle at harvest (Arthur et al., 2008; Gragg et al., 2013a; Haneklaus et al., 2012). Fat trim containing lymph nodes may be a component of ground beef and has been identified as a potential source of *Salmonella* in this commodity. The mechanism of entry of *Salmonella* into bovine PLNs has yet to be determined, but it has been suggested that *Salmonella* present on cattle hides may be introduced through bites or wounds. Thus, identifying effective tools for assessing *Salmonella* levels in pre-harvest environments is likely a key component to preventing infection of bovine tissues with this pathogen. Previous studies identified feedlot pen tank water and pen floor surface material as reliable sample types for the examination of *Salmonella* prevalence and levels in a given feedlot. Further, it was observed that aberrantly high levels of *Salmonella* contamination on cattle hides (defined as hides contaminated at $\geq 10^3$ CFU/100cm²) was related to peripheral lymph node contamination with *Salmonella*. The research reported here aimed to further examine the utility of these environmental samples for characterizing *Salmonella* levels on farm and for predicting the likelihood of downstream lymph node contamination.

The objective of the study was to validate the efficacy of environmental predictors for estimating levels of *Salmonella* contamination in feedlot environments and subsequent lymph node contamination.

Methodology

Six pens of cattle (average of 125 head/pen) on a commercial feedlot were sampled for this study. Hide swabs, fecal swabs, pen floor surface material, and tank water were collected from 30 head per pen and were analyzed for *Salmonella* prevalence and levels. Cattle were sampled on entry to the yard, at implant and at harvest, where either one subiliac lymph node (n=156 carcasses) or six nodes per carcass (n=24 carcasses; Figure 1) were collected. All samples were tested for *Salmonella* prevalence and levels.

Findings

These data confirm that feedlot pen tank water and surface material are convenient sample types that readily provide a good estimate of overall *Salmonella* hide contamination of cattle housed in a given feedlot.

Data examining *Salmonella* prevalence in PLN using one or more lymph nodes per carcass, demonstrate the increased accuracy of sampling multiple nodes per carcass for identifying those with one or more contaminated PLN. Accordingly, future studies aimed at assessing



the effect of a given pre-harvest intervention, need to do so by measuring *Salmonella* prevalence and level in at least two of the same PLN (i.e., both subiliac), but preferably the six PLN described here.

As the end of this study coincided with the U.S. Government shutdown in 2013, it was necessary to freeze the final samples prior to processing. Noteworthy was the observation that while lymph node *Salmonella* prevalence was consistent with samples collected from cattle from this yard at similar times of the year, levels were found to be on average two logs lower than expected (Table 1). These data suggest that freezing lymph node containing fat trim prior to further fabrication may significantly damage the *Salmonella* present, to the extent that further processing steps render them non-viable. Further testing is needed to determine if freezing of fat trim is a useful intervention for decreasing viable *Salmonella* in this potential point source for ground beef.

Implications

Data presented here provide information on the utility of the tools described for determining the prevalence and levels of *Salmonella* in feedlot environments and confirm their predictive ability for indicating *Salmonella* contamination in PLN of cattle at harvest.

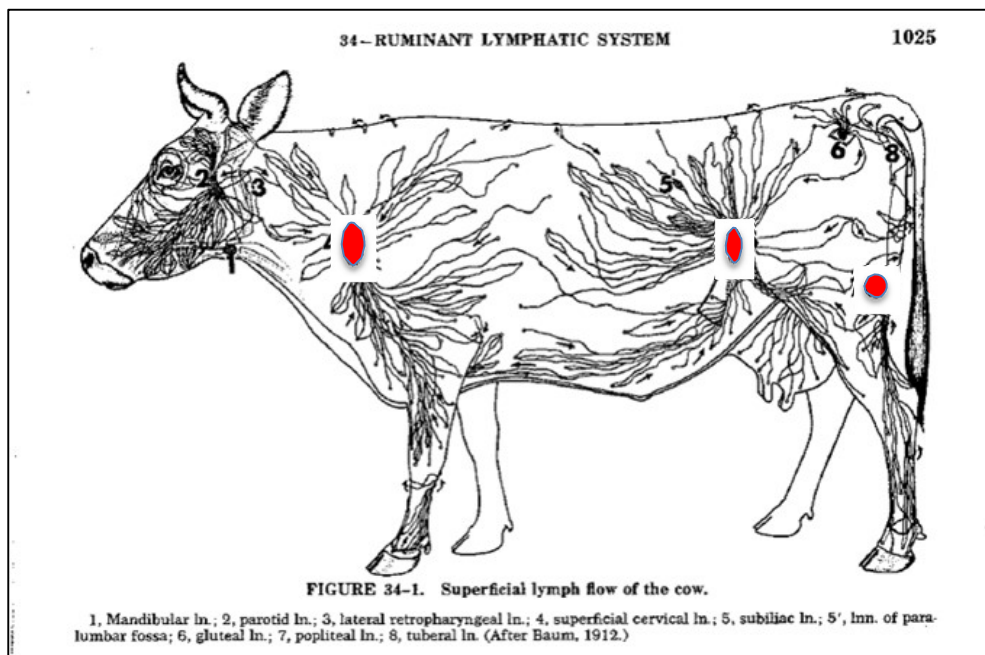


Figure1. Map of the bovine peripheral lymph node (PLN) system. Nodes collected in this study indicated in red. Source: Ruminant Lymphatic System (Saar and Getty) In Anatomy of the Domestic Animals. Eds Sisson and Grossman.



Figure 2. Pen surface material and tank water samples are useful predictors of *Salmonella* hide contamination for a given cohort of cattle, and as well as downstream lymph node contamination.

Table 1. *Salmonella* prevalence and levels in peripheral lymph nodes* (from n=30 carcasses/pen). A single subiliac lymph node was collected from 156 carcasses and 6 lymph nodes per carcass were collected from 24 carcasses.

Pen	1 LN/carcass tested (n=26/pen)			6 LN/carcass tested (n=4/pen)		
	% of carcasses with one LN positive	Enumerable (%)	Level (CFU/g)	% of carcasses with at least one LN positive	Enumerable (%)	Level (CFU/g)
1	50	15.4	4.1	100	30.4	44.6
2	50	11.5	1.2	100	12.5	1.71
3	57.7	15.4	1.1	100	20.8	14.5
4	34.6	7.7	0.4	100	4.35	0.77
5	50	15.4	2	100	16.7	32.8
6	53.8	7.7	0.7	75	0	1.24
Average	49.4	12.2	1.58	95.8	14.1	15.94

*Indicates that samples were frozen prior to analysis and consequently represent underestimated values due to loss of *Salmonella* viability.