

Relationship Between Liver Abscess Microbiome of Feedlot Cattle and Soil Organic Matter Microbiome Isolated from Feedlot Pens

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Introduction

Liver abscess (LA) prevalence has increased 15% for beef cattle and 25% for Holstein cattle (National Beef Quality Audit, 1995; McKeith et al., 2012). Due to increasing trends in LA rate, the efficacy of tylosin phosphate has been questioned. *Fusobacterium Necrophorum* has been indicated as a liver abscess causing bacteria from previous research (Nagaraja and Chengappa, 1998). Previous data demonstrates breed and days on feed have the greatest effect on liver abscess incidence (Reinhardt and Hubbert, 2015). Liver abscess incidence are greater from cattle harvest in the central plains compared to desert southwest region (Reinhardt and Hubbert, 2015). Prevalence of liver abscess is greater in Holstein compared to beef-breed counterparts (Reinhardt and Hubbert, 2015).

Objective & Hypothesis

The objective was to evaluate soil organic matter (SOM) microbiome of feedlot pens, associated liver abscess (LA) microbiomes, and the impact of breed, location, and tylosin. We hypothesized microbial load in SOM is a predisposing factor to liver abscesses in cattle.

Materials & Methods

- Liver abscess samples were collected from Tolleson, AZ (SR) and Greeley, CO (CR) processing facilities.
- Using a 15-cm core soil probe, SOM was sampled from each of the four quadrants of corresponding feedlot pens.
- DNA was extracted from samples using the Repeated Bead Beating Plus Column method (Yu and Morrison, 2004).
- Samples were sequenced on an Illumina MiSeq and bacteria were identified using NCBI, GreenGenes, and RDP databases.
- Shannon Wiener Index (SWI) and Richness were calculated.
- Shannon Wiener Index is the number of different genera and their abundance.
- Richness is the number of different genera.
- Reported data is from a subset of five pens.
- Data was analyzed using the Mixed procedure and Pearson's correlation of SAS 9.4.

Results

Figure 1. Regional effect on liver abscess and soil organic matter genera richness.

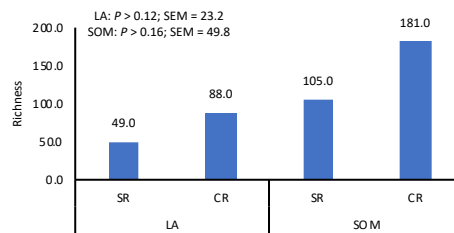


Figure 2. Regional effect on liver abscess and soil organic matter genera Shannon Wiener Index.

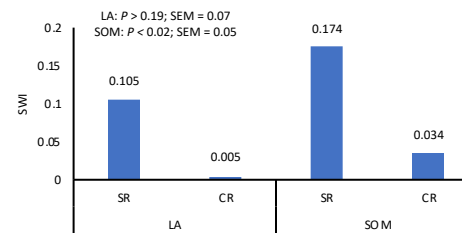


Figure 3. Breed effect on liver abscess and soil organic matter genera richness.

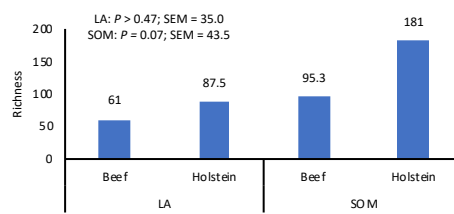


Figure 4. Breed effect on liver abscess and soil organic matter genera Shannon Wiener Index.

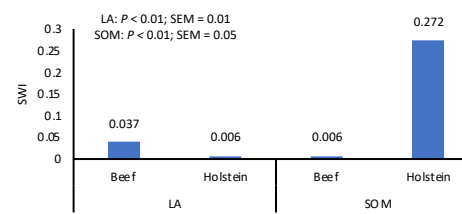


Figure 5. Effect of tylosin usage on liver abscess and soil organic matter genera richness for Holsteins within the Southwest region.

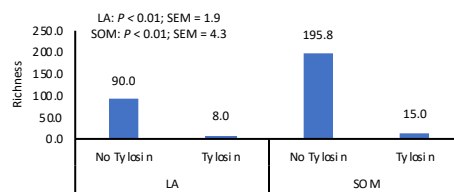


Figure 6. Effect of tylosin usage on liver abscess and soil organic matter genera Shannon Wiener Index for Holsteins within the Southwest region.

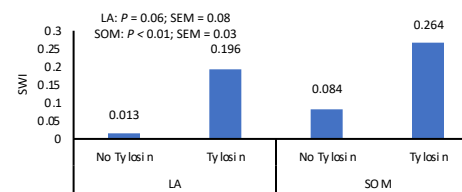


Table 1. Correlation¹ of soil organic matter diversity with liver abscess percentage and liver abscess severity across regions, breed, and tylosin usage.

Genera Diversity Indices	r ²	P-value
LA%		
Richness	0.58	< 0.01
SWI	-0.49	0.03
LA Severity (A+)		
Richness	0.63	< 0.01
SWI	-0.44	0.05

¹ Pearson's correlation coefficients (P < 0.05).

Conclusion & Implications

- The most prevalent genera identified in liver abscesses were *Fusobacterium* (64.2%), *Bacteroides* (18.6%), and *Arthrobacter* (5.6%).
- Predominant SOM genera were *Atopostipes* (13%), *Clostridium* (10%), and *Turibacter* (7%).
- A regional effect (P < 0.02) for SOM SWI was observed in the SR and CR at 0.174 and 0.105, respectively.
- However, a regional effect was not observed for liver abscesses (P > 0.19).
- The SWI of SOM and liver abscesses of Holsteins are lower (P < 0.01) compared to beef counterparts.
- Additionally, *Clostridium*, *Fusobacterium*, and *Atopostipes* populations were greater (P < 0.05) in SOM of Holstein pens than beef pens.
- Genus richness was lower (P < 0.05) for both SOM and liver abscesses from pens of cattle fed tylosin versus no tylosin.
- Cattle fed tylosin resulted in decreased genus richness in both SOM (15) and LA (8) samples.
- There is a negative correlation between SOM SWI and LA% (r² = -0.49; P = 0.03) and LA severity (A+) (r² = -0.44; P = 0.05).
- A negative correlation between SOM SWI and LA% implies feedlot pens with an unbalanced microbial environment is more likely to present cattle with higher levels of liver abscesses and severity (A+).
- Considering the small number of pens evaluated, more research is required before inference can be applied to the industry.
- In conclusion, SOM may serve as an alternative vector for pathogens causing liver abscesses.

Literature Cited

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- Yu, Z. and M. Morrison. 2004. Biotechniques. 36: 808-812.