Project Title: Quantitative Evaluation of the Antimicrobial Food Safety Risks Associated with the use of Tylosin for Reduction of Liver Abscesses in Fed Cattle

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Background

In-feed and in-water use of medically important antimicrobials for the control and prevention of diseases have become controversial since it is argued that this exposes healthy animals to medically important antimicrobials possibly increasing the spread of antimicrobial resistance (AMR). Restricting use of medically important antimicrobials in food- animal production has been suggested as a means to reduce AMR. Conversely, studies have reported only small quantitative risks of human-bacterial pathogens acquiring AMR due to the use of antimicrobials in food-animal production. Tylosin phosphate (trade name Tylan), a macrolide class antimicrobial, is included in the feed of most feedlot cattle to prevent or reduce occurrence of liver abscesses. Concerns have been raised that use of tylosin in cattle feed may increase the occurrence of antimicrobial-resistant human infections.

The objective of this study was to collect data regarding the occurrence of antimicrobial-resistant (AMR) enterococci in cattle feces and on cattle pen surfaces as part of a risk assessment to determine if AMR enterococci populations were significantly altered by in-feed use of tylosin.

Methodology

Sixteen 6-hd feedlot pens were utilized over the course of the experiment (Figure 1). All pens except two were populated with 6-hd of cattle. Seven pens received the normal feed ration, which included tylosin. Another seven pens received the normal feed ration without tylosin. Fecal swabs and pen surface material were collected on five occasions: at feedlot arrival ("Arrival", 9 November 2015), in January (29 January 2016), April (25 April 2016), and June (20 June 2016). All samples were cultured for detection and enumeration of erythromycin-resistant (ERYr) enterococci.

Findings

ERYr enterococci was detected in all fecal swab samples prior to initiation of the study. By the final sampling in June, the percent of fecal samples with high concentrations of ERYr enterococci in the treated group had increased to 82.9%, resulting in an average fecal concentration of ERYr enterococci of 2.99 log CFU/ swab for the treated group.

From arrival to the June sampling period, the increase in the percentage of enumerable samples and the average fecal concentration of ERYr enterococci at the June sampling were not as large for the control group as they were for the treated group. ERYr enterococci were ubiquitous in almost all of the pens on each sampling period, including the pens that did not contain animals.

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The concentration of ERYr enterococci in the pen surface samples were similar for treated and control pens for all sampling periods, but the average concentration of ERYr enterococci for the treated pens was higher than that of the control pens. Interestingly, the increase in the ERYr enterococci concentration in pen surface material due to tylosin in the feed was smaller than the increase in ERYr caused by animal manure being deposited in the pen (Table 1).

Implications

This study supports the conclusion of previous work by this lab and other researchers that determined that enrichment of resident soil bacteria by the addition of nutrients (manure) appears to have a more significant impact on the AMR bacterial populations than selective pressure by antimicrobial use in livestock production. This information will have a significant impact on the interpretation of AMR data and its ramifications for the livestock production industry.

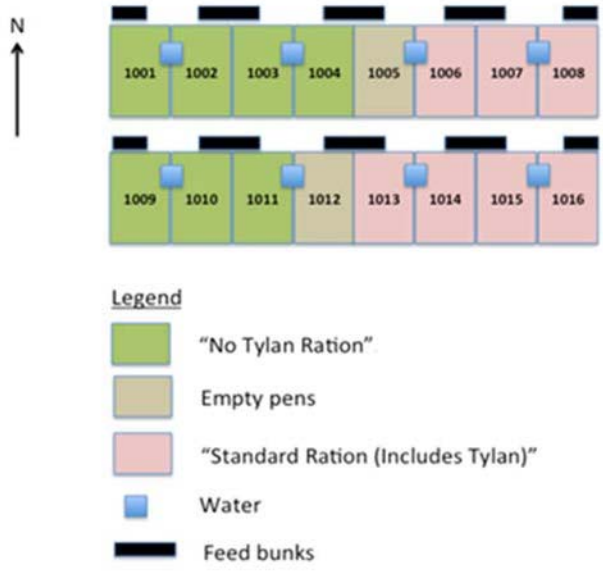

Figure 1. Sixteen 6-hd feedlot pens were utilized over the course of the experiment.

Table 1. Pen surface *Enterococcus* mean log CFU/swab concentrations ± SD

		ERY^r *Enterococcus*		
Sample occasion	Sample date	+ Tylosin	– Tylosin	Empty
Arrival	11/9/15	0.65 ± 0.00	0.71 ± 0.31	0.65 ± 0.00
Jan	1/29/16	4.29 ± 0.62	3.84 ± 0.74	0.32 ± 0.94
April	4/25/16	4.55 ± 0.59	4.52 ± 0.66	1.62 ± 1.06
June	6/20/16	4.53 ± 0.55	3.12 ± 0.96	0.65 ± 0.00

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