

Development of a health index using an automated, chute-side blood leukocyte differential to guide antibiotic treatment at processing

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Introduction

Antibiotics play an important role in the health and welfare of livestock, but their use is under intense scrutiny. A recent feedlot trial examined the use of a chute-side, automated blood leukocyte differential (QScout BLD) to guide selective antibiotic treatment at processing. One objective was to develop an index that is predictive of performance (average daily gain and morbidity). The second objective was to determine the impact of selective treatment vs metaphylaxis at processing.

Materials and Methods

Sample collections for this trial were conducted under supervision of a licensed veterinary research consulting group. Moderate-risk, stockyard-sourced cattle (n=1,554; 57.7% heifers, 42.3% steers) weighing 650 (\pm 300) lb (295 \pm 136 kg) were enrolled in the trial from September to October 2015 in Nebraska. At processing, calves within each pen were randomly assigned to receive treatment (TRT group, n=777) with gamithromycin (Zactran) or no treatment (NOTRT group, n=777). During processing, body weight and rectal body temperature were recorded and 2 blood samples were collected, 1 for BLD testing and the other to store for future analysis. The TRT and NOTRT groups were comingled within a pen. Mortality and morbidity events were recorded by a single individual throughout the study. Around 40 days (43 \pm 11) after processing, calves were weighed. Hot carcass weight and carcass data were collected at slaughter. Carcass value was calculated by a national beef marketing group using grid pricing average for the previous 12 months.

High and low thresholds were determined for neutrophils and lymphocytes that were predictive of ADG and morbidity. These cutoffs were used to retrospectively assign calves to a "normal" (NRM) or "abnormal" (ABNRM) status based on QScout BLD test results. Combining this assignment with randomized treatment yielded a 2 by 2 factorial that included NRM TRT, ABNRM TRT, NRM NOTRT, ABNRM NOTRT. These groups were used to determine the impact of treatment of cattle diagnosed as "NRM" or "ABNRM". Statistical analysis was conducted by an independent statistician.

A mixed model (SAS, VERSION) was used to test effects of treatment, diagnosis, treatment x diagnosis on morbidity rates, ADG, and carcass data. Entry weight, sex, and pregnancy status were included as covariates.

Results

Using the thresholds that were developed, 86.8% of the calves had NRM statuses and 13.2% had ABNRM statuses. The NRM TRT, NRM NOTRT, and ABNRM TRT groups had no statistical difference in ADG through 40 days. The ABNRM NOTRT group had 0.35 lb (0.16 kg)/head/day less gain than the ABNRM TRT group. Hot carcass weight was confounded by pregnancy status. For steers, the NRM TRT, NRM NOTRT, and ABNRM TRT groups had no statistical difference in hot carcass weight. Steers in the ABNRM TRT group averaged 24 more pounds (10.9 kg) per head than steers in the ABNRM NOTRT group. The NRM TRT and NRM NOTRT groups had morbidity rates of 23.64% and 32.49%, respectively. The ABNRM TRT and ABNRM NOTRT groups had morbidity rates of 19.28% and 43.10%, respectively. There was no statistical difference in morbidity rates of the NRM TRT and ABNRM TRT groups. Mortality rate averaged 1.0% and did not differ across groups.

Significance

This study demonstrated that applying the determined thresholds to QScout BLD results identified a group of calves that benefited from treatment by reduced morbidity and increased weight gain to harvest. Untreated cattle with normal BLDs had similar ADG and hot carcass weight but higher morbidity compared to treated counterparts. QScout BLD shows promise as a tool to provide objective data to guide treatment of cattle at processing to reduce use of antibiotics. Restricting arrival treatment to calves with BLD results outside the normal range would have resulted in 86.8% reduction in antibiotic use compared to metaphylaxis in this study. Additional trials should be conducted to test selective treatment vs metaphylaxis of high-risk cattle upon arrival and to determine the efficacy of selective treatment.