Associations of serum biomarkers of stress and inflammation measured at arrival with bovine respiratory disease incidence, mortality, and growth of calves transported within the first 4 days of life

M.L.K. Celestino, DVM ; **P.R. Menta**, DVM ; **L. Fernandes**, DVM ; **D. Poit**, DVM ; **R.C. Neves**, DVM, PhD ; **L.S. Caixeta**, DVM, PhD ; **V.S. Machado**, DVM, PhD
[1]Department of Veterinary Sciences, Texas Tech University, Lubbock, TX 79415
[2]Department of Veterinary Population Medicine, University of Minnesota, St. Paul, MN 55108

Introduction

Bovine respiratory disease (BRD) is 1 of the major causes of mortality and growth delay in pre-weaned calves. Stressful events, such as commingling and transportation, are predisposing factors to BRD. Elevation in circulating concentrations of the inflammatory biomarker haptoglobin (Hp), and stress biomarkers cortisol and l-lactate, have been observed in calves after long-distance transportation. Therefore, the objective of this study is to investigate the association between circulating levels of Hp, cortisol, and lactate at day of arrival and BRD incidence, mortality, and growth of calves transported within the first 4 days of life. We hypothesized that higher levels of Hp, cortisol, and lactate are associated with higher BRD incidence and mortality, and with delayed growth during the pre-weaning period.

Materials and Methods

A cohort of 168 jersey and jersey-cross calves from 8 different sources located in MN were enrolled after they were transported to a heifer raising facility located in NM. At day of arrival, blood samples were collected for the measurement of serum biomarkers of stress and inflammation. The diagnosis and treatment of BRD was performed by trained employees. Calves were health scored using the University of Wisconsin calf health chart at 7, 14, and 21 days after arrival, and weighed at 60 days of age. Data on incidence of BRD, birth weight, breed, source, parity of dam, and dystocia were extracted using the heifer raising facility's DairyComp 305 database. Hp was measured using colorimetric assay via quantification of the haptoglobin/hemoglobin complex. Commercial kits were used for the measurement of cortisol (Arbor Assays) and l-lactate (ScienCell). After initial analysis, the biomarkers data was dichotomized based on medians as low Hp (L-Hp) or high (H-Hp), low cortisol (L-Cor) or high cortisol (H-Cor), and low l-lactate (L-Lac) or high l-lactate (H-Lac). The data was analyzed using multivariate logistic regression, Cox Proportional Hazards models, repeated measures ANOVA, and multivariate linear regression models. The variables dam parity, birth weight, breed and dystocia were offered to all models, and source was included as a random effect. All statistical analyses were undertaken in SAS 9.4.

Results

The medians for serum concentrations of Hp, cortisol, and l-lactate were 67.9 μg/mL, 17.36 ng/ml, and 6.5 mM, respectively. No correlation was found between the biomarkers. The BRD incidences for L-Hp and H-Hp calves were 10.9% and 3.4%, respectively (P = 0.07). Calves in L-Hp groups were 3.15 times more likely to be diagnosed and treated for BRD than calves in H-Hp group (HR = 3.15, P = 0.06). The incidence of BRD was 8.8% and 4.2% for L-Cor and H-Cor calves, respectively (P = 0.22), and 5.5% and 6.8% for L-Lac and H-Lac calves, respectively (P = 0.74). Health scores decreased by week of life (P = 0.01) but were not affected by biomarkers concentration. The overall mortality was 3.6% (L-Hp = 3.5% vs H-Hp = 1.9%, P = 0.53; L-Cor = 3.7% vs H-Cor = 1.8%, P = 0.42; L-Lac = 6.6% vs H-Lac = 1.0%, P = 0.10). Additionally, calves in H-Hp had a higher average daily gain compared to L-Hp calves (1.10 lb [0.498 kg]/d vs 0.99 lb [0.450 kg]/d, P < 0.01). Average daily gain was not affected by cortisol or l-lactate grouping (P = 0.15 and P = 0.18, respectively).

Significance

In conclusion, calves with serum Hp greater than 67.9 μg/mL at day of arrival tended to be less likely to have BRD, and had a higher average daily gain compared to calves in the L-Hp group. High levels of Hp have been generally associated with increased risk for disease and impaired performance. In general, the Hp concentrations of our study animals were below the Hp concentrations associated with pathological processes. Therefore, we speculate that high Hp in our study was indicative of an activated and robust immune system rather than indicating a pathological process. However, further research is needed to test this hypothesis.