

Evaluation of Response and Safety to Parenteral Trace Mineral Supplementation in Idaho Neonatal Dairy Hutch Calves

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Introduction

Areas of the Northwest United States are trace mineral deficient, necessitating oral and/or parenteral supplementation in livestock. Selenium has been shown to be an important component of the antioxidant system of mammalian cells, and deficiency is known to be associated with white muscle disease and ill thrift in young calves. Recommended serum selenium levels for adult cattle are 0.08-0.30 µg/mL, and cattle are considered marginally deficient in selenium when serum levels are 0.03-0.07 µg/mL. There is scant evidence in the scientific literature comparing different commercially available parenteral supplements in dairy calves. This trial evaluated serum trace mineral levels, injection site and clinical aptitude scores (ISS/CAS) of neonatal dairy calves supplemented with two common parenteral trace mineral products.

Materials and Methods

Sixty bull calves purchased from six dairies and brought to the calf ranch were selected for the study. Upon arrival, calves were weighed, had a complete physical examination, and were randomly assigned to one of three treatment groups: Treatment A (Tx A) - BO-SE (Intervet/Schering Plough) 5.0 mL (5.0 mg sodium selenite and 250 mg vitamin E); Treatment B (Tx B) - Multimin[®] 90 (Multimin USA, Inc.) 1 mL (5.0 mg sodium selenite, 60 mg zinc oxide, 10 mg manganese carbonate, and 15 mg cupric carbonate); or Treatment C (Tx C) - Control 3 mL isotonic sterile saline. Serum was collected at 0, 5, 24, and 168 hours (hrs) for trace mineral analysis. Calf serum total protein levels were determined at 0 hours to assess passive transfer. Calves were evaluated and given a CAS at 0, 5, 24, and 168 hours. Injection site locations were recorded at 0 hours and an ISS was given at 5, 24, and 168 hours. Two calves died before 168 hours and were excluded from the study.

Results

Serum samples were analyzed using an Agilent 7500ce inductively coupled plasma - mass spectrometer

for selenium (Se), copper (Cu), manganese (Mn), and zinc (Zn). The Wilcoxon test was used to compare trace mineral levels of each group at each collection. Mean serum Se levels and standard deviations for Tx A, Tx B, and Tx C, respectively, were as follows: 0 hr - 0.06 +/- 0.01 µg/mL, 0.07 +/- 0.02 µg/mL, 0.06 +/- 0.02 µg/mL; 5 hr - 0.19 +/- 0.04 µg/mL, 0.19 +/- 0.06 µg/mL, 0.06 +/- 0.01 µg/mL; 24 hr - 0.14 +/- 0.03 µg/mL, 0.13 +/- 0.02 µg/mL, 0.07 +/- 0.02 µg/mL; and 168 hr - 0.08 +/- 0.01 µg/mL, 0.09 +/- 0.02 µg/mL, 0.07 +/- 0.02 µg/mL. Serum Se levels were not different between Tx A and B ($P > 0.05$) at any collection time. However, both treatments were elevated compared to controls (Txs A and C at 5 and 24 hr; Txs B and C at 5, 24, and 168 hrs; $P < 0.05$). Statistically significant differences were detected between treatments with respect to other trace minerals ($P < 0.05$): Mn (Tx A and B, A and C, and B and C at 5 hrs, Tx A and B and B and C at 24 hrs, and Tx A and B at 168 hrs); Zn (Tx A and B and B and C at 5 hrs); Cu (Tx A and B and B and C at 5 hrs). ISS, CAS, and total protein levels between groups were all analyzed with ANOVA. Calves in Tx A had significantly higher ISS compared to Tx B and C ($P < 0.05$). There were no statistically significant differences in the CAS between treatments ($P = 0.24$) or in total protein levels ($P = 0.24$).

Significance

We conclude that supplemented calves have equivalent acute elevations in serum trace mineral levels, and these elevations are consistent with the trace mineral content of the product. Calves receiving parenteral supplementation had adequate serum selenium levels within 24 hours of treatment, but were at low normal by 168 hours. The products used in this study elicited different tissue reactions (ISS); however, the clinical significance of this observation is unknown. Veterinarians and producers will find value in this direct comparison between these products.