

Effect of cobalt supplementation on humoral immune response in weaned beef calves

R.B. Sager, DVM, MS, DABVP (Beef Cattle)

Montana State University, Animal and Range Sciences, Bozeman, MT 59717

Introduction

The National Research Council (NRC) requirements for cobalt (Co) (0.1 mg/kg or 0.1 ppm; DM intake) were first published in the 1950s when production expectations for beef cattle production were two-thirds as great as present-day production expectations. Recommended NRC Co requirements were derived during the 1950s from experiments with cattle that were genetically different, fed different rations, and raised with different production and economic expectations compared with cattle today. Compared with their 1950s counterparts, today's beef cattle are 35 to 40% larger anatomically, grow at increased rates, and were genetically selected for maximum muscle growth. Rumen microbial organisms use Co for the synthesis of vitamin B₁₂, which is a necessary cofactor for vital metabolic pathways in lipid and carbohydrate energy metabolism. In the past, studies have focused on the effect of Co supplementation on performance and growth. The objective of this study was to evaluate supplementation of weaned beef calves with 3 levels of Co on humoral immune response to *Brucella abortus* vaccination.

Materials and Methods

Twenty-seven crossbred (Angus x Lowline) steer calves with a mean body weight of 450 ± 50 lb (204.5 ± 22.7 kg) were randomly selected from a group of 85 steers from a ranch in southwestern Montana. On October 20, 2010, calves were vaccinated with a combination 7-way clostridial bacterin-toxoid/*Histophilus somni* bacterin and a MLV combination BHV-1, BVDV, PI₃, BRSV/*Pasteurella multocida*-*Mannheimia haemolytica* bacterin and treated for parasites topically with doramectrin. The calves were weaned 20 days later and moved to group pens (9 calves per pen), where they were acclimated for another 20 days. On day 1 of the trial, each calf was individually weighed and processed, which included the application of an electronic individual identification ear tag and collection of a blood sample via coccygeal venipuncture and a percutaneous liver biopsy specimen

by use of the Shackelford Courtney liver biopsy instrument (0.2 cm diameter x 25 mm in length), before being randomly assigned to 1 of 3 Co treatments (Co proteinate at 0.139 ppm, 0.489 ppm, or 0.898 ppm). The Co mineral was fed *ad libitum* for the duration of the trial (90 days), and was routinely monitored for consumption and wastage. Mixed grass-alfalfa hay was fed *ad libitum* to meet a growth requirement of approximately 1.25 to 2.0 lb (0.57 to 0.9 kg) per day. The hay was fed once daily and refusals were recorded every 14 days. On day 60, steers were weighed and administered *Brucella abortus* RB51 vaccine. Another liver biopsy specimen was obtained on day 90 for Co analysis. Liver biopsy samples were rinsed with 0.10M physiological buffered saline solution (pH, 7.4), placed in aluminum foil, folded, and frozen in liquid nitrogen until Co analysis was performed.

The grass-alfalfa hay was analyzed by Midwest Laboratory, and water was analyzed by the Montana Diagnostic Laboratory. Cobalt proteinate analysis was conducted by Balchem Corporation. Serum antibody titers against RB51 *B. abortus* were determined by an ELISA conducted by the Department of Immunology and Infectious Diseases. Hepatic Co mineral concentration was determined by use of inductively coupled plasma mass spectroscopy performed by the US Fish Technology Center.

Results

Weaned beef calves fed Co proteinate at 4 times the NRC recommended amount had significantly ($P < 0.004$) higher antibody titers against *B. abortus* than did calves fed Co proteinate in accordance with NRC recommendations.

Significance

Results suggested that weaned beef calves supplemented with Co proteinate at 4 times the amount recommended by the NRC had increased humoral immunity, which could aid in reducing calf morbidity and improve profitability.