Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 647

1994

Effects of supplemental trace minerals and prevaccination on stressed calves

S.A. Lindell

Robert T. Brandt Jr.

Gerald L. Stokka

See next page for additional authors

Recommended Citation

Lindell, S.A.; Brandt, Robert T. Jr.; Stokka, Gerald L.; Gramlich, S.M.; and Milton, C.T. (1994) "Effects of supplemental trace minerals and prevaccination on stressed calves," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 1. https://doi.org/10.4148/2378-5977.2050

Effects of supplemental trace minerals and prevaccination on stressed calves

Authors

S.A. Lindell, Robert T. Brandt Jr., Gerald L. Stokka, S.M. Gramlich, and C.T. Milton

EFFECTS OF SUPPLEMENTAL TRACE MINERALS AND PREVACCINATION ON STRESSED CALVES

S. A. Lindell, R. T. Brandt, Jr., G. L. Stokka [1], S. M. Gramlich, and C. T. Milton

Summary

Two trials were conducted to evaluate the effect of high dietary levels of trace minerals on performance and health of stressed calves. In trial 1, 221 Brahman crossbred steers (674 lb, 1/8 to 1/4 Brahman) were used to evaluate the effect of copper (Cu) and zinc (Zn) supplementation on performance and immune response. The steers were shipped from northern Texas to the KSU Beef Research Unit with an 18-hour transit time. Receiving diets were formulated to contain 1) NRC-recommended levels of Cu and Zn or 2) 4 times recommended levels. In trial 2, 112 Angus cross steers (518 lb) were used to evaluate effects of the same trace mineral supplementation and preweaning vaccination on performance and immune response. Half of the steers were vaccinated (modified live IBR, BVD, PI_3, BRSV) 14 days prior to weaning, and all were vaccinated at weaning (day 0). No differences occurred in dry matter intake, daily gain, serum Zn and Cu, or IBR antibody titer as a result of trace mineral level in either study. Prevaccination had no effect on performance or health of weaned calves. However, IBR antibody titers at weaning (day 0) were higher ($P<.001$) for prevaccinated vs non-prevaccinated calves. We concluded that either the level of stress imposed in the two trials was not great enough to cause acute trace mineral deficiencies, or that NRC-recommended levels are adequate for stressed as well as non-stressed animals. Prevaccination with a modified live vaccine resulted in an elevated antibody titer response but no improvement in health of newly weaned calves.

(Key Words: Bovine Respiratory Disease, IBR, Zinc, Copper, Morbidity.)

Introduction

Approximately 80% of all deaths of newly received calves in commercial feedlots is due to bovine respiratory disease (BRD). Stress and infection generally result in lower feed intake and increased mineral excretion, thus depleting mineral reserves that are essential to the immune system. Other research has shown that elevating levels of some nutrients (e.g., Zn and Cu) in feeds may increase performance and reduce morbidity. A functional immune system is critical before stressors are incurred. One strategy to enhance immune response is to vaccinate against pathogens involved in BRD before weaning, followed by a booster at weaning. These studies were initiated to determine if feeding high levels of Zn and Cu, as well as vaccinating against respiratory disease before weaning, would enhance performance and health of stressed calves.

Experimental Procedures

In trial 1, 221 head of Brahman cross steers (674 lb) were used to evaluate the effects of high levels of trace mineral supplementation on performance and health in a 30-day study. The steers were shipped from northern Texas with an 18 hour transit time and were randomly allotted to four pens

[1]College of Veterinary Medicine.

(two pens/treatment). The control (1X) diet was formulated to meet NRC-suggested levels for Cu (10 ppm) and Zn (40 ppm). The treatment diet (4X) was formulated with four times those amounts. Diets consisted of corn, silage, molasses, and alfalfa hay (Table 1). Blood samples were taken upon arrival from Texas and upon completion of the trial and were analyzed for Zn and Cu.

In trial 2, 116 Angus crossbred steers (518 lb) from the KSU Cow-Calf Unit were used to evaluate the effects of high-level trace mineral supplementation and preweaning vaccination in a 35-day receiving study. Half of the steers were given Bovishield-4® 14 days prior to weaning. On October 1, 1992, steers were weaned (day 0) and shipped to the KSU Beef Research Unit. Upon arrival, steers were held on concrete without access to feed and water for 24 hours to induce further stress. The following day, steers were weighed, eartagged, treated for parasites (Ivomec®), vaccinated (Bovishield-4®, Ultrabac-7®), and assigned to one of 16 pens in a 2 × 2 factorially arranged, completely randomized design (four pens per treatment). Diets were the same as for trial 1. Blood samples were obtained on days 0 and 35 and were analyzed for Zn and Cu and IBR antibody titer.

Results and Discussion

In trial 1, steers consuming 4X diets were similar to those consuming the 1X in daily gain, feed efficiency, serum Cu and Zn, and morbidity (Table 2). Similar results were obtained in trial 2 (Table 3). In addition, in trial 2, IBR titers were similar between trace mineral levels. No differences were observed for steers that were vaccinated preweaning vs controls in dry matter intake, daily gains, feed efficiency, or serum Zn and Cu. IBR antibody titer was significantly elevated at day 0 ($P<.001$) in prevaccinated calves. However, no differences occurred in IBR antibody titers at day 35.

Feeding high levels of Zn and Cu did not increase serum levels, most likely because of homeostatic mechanisms of the body. Serum Zn and Cu levels at day 0 indicated that calves were not deficient (>1 ppm), so a response to supplementation would not be expected. Unfortunately, it is difficult to predict whether stressed feeder cattle are deficient in important trace nutrients on arrival. Therefore, fortifying receiving diets with trace nutrients (not necessarily at 4X the requirements) seems feasible as a precautionary measure. In trial 1, morbidity rate from BRD was very low at 3.2% (7 head). The response to treatment was very good with few repulls. We recorded no mortality and a 100% first-time response to treatment. In trial 2, the highest morbidity occurred during weeks 3 and 4, with the majority occurring during days 22 through 28. The overall morbidity rate from BRD was 29% (34 head), which is typical of that expected in newly weaned calves. Response to treatment was also very good, with no mortality and a 90% first-time response to treatment. Both trials indicated that the viral pathogens IBR, BVD, PI3, and BRSV were not primary factors in BRD and that bacterial agents were likely the primary pathogens.

Table 1. Composition of Total Mixed Rations [a] for Trials 1 and 2

Ingredient	As Fed Basis %	Dry Matter %
Corn	43.9	47.77
Silage	11.6	4.79
Supplement	7.0	7.75
Molasses	4.0	3.76
Alfalfa hay	33.5	35.93
Total	100	100

[a]Rations contained 12.7% crude protein, .55 % Ca, .3% P; 1X and 4X diets contained 13.7 and 54.65 ppm Cu and 47.01 and 194.45 ppm Zn, respectively. Supplemental Cu and Zn were supplied as copper sulfate and zinc oxide, respectively.

Table 2. Effects of Trace Mineral Supplementation on Performance, Health and Blood Constituents of Newly Received Calves in Trial 1

Item	Treatment [a] 1X	4X	SEM
Pen/trt.	2	2	
Head/trt.	110	111	
In wt.	669	679	10.33
End wt.	772	772	8.32
Daily gain, lb	3.34	3.00	.187
Daily feed, lb dry matter	22.15	21.48	.222
Gain/Feed	.151	.139	.0077
Day 0			
Serum Zn, ppm	1.12	1.05	.063
Serum Cu, ppm	1.26	1.28	.042
Day 30			
Serum Zn, ppm	.996	1.11	.048
Serum Cu, ppm	1.84	1.86	.080
Morbidity, head	5	2	

[a]1X = formulated using NRC recommendations for Cu and Zn. 4X = formulated with four times the 1X level.

Table 3. Effect of Trace Mineral Supplementation and Prevaccination (PV) on Performance, Blood Constituents and Health in Trial 2

Item	Treatment [a] 1X	4X	PV(-)	PV(+)	SE M
No. pens	8	8	8	8	
Head/trt.	58	54	58	54	
In wt.	519	516	515	519	4.7
End wt.	584	582	581	585	5.6
Daily gain, lb	1.88	1.89	1.89	1.87	.080
Daily feed, lb dry matter	11.6	11.6	11.6	11.8	.28
Gain/feed .161	.161	.163	.160	.0046	
Day 0					
Serum Zn ppm	1.40	1.36	1.36	1.39	.0428
Serum Cu, ppm	1.58	1.63	1.57	1.64	.0526
IBR titer[b]	1:1	1:1	1:1	1:2	.576
Day 35					
Serum Zn, ppm	1.40	1.39	1.48	1.33	.0445
Serum Cu, ppm	1.54	1.55	1.53	1.56	.0335
IBR titer	1:4	1:4	1:4	1:4	.984
Morbidity	17	17	18	16	

[a]1X = formulated using NRC recommendations for Cu and Zn. 4X = formulated with four times the 1X level. PV = preweaning vaccination with Bovishield - 4®.
[b]Prevaccination vs non-prevaccination (P<.001)