Effect of a Trace Mineral Injection on Growth Performance of Natural Beef Feedlot Steers

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Summary and Implications

Overall, it was observed that there were no effects of the trace mineral (TM) injection on Natural beef steer growth performance, regardless of the timing of an injectable TM product in the natural program (start of growing phase, start of finishing phase, or start of growing and finishing phases). While TM injection did further increase liver Cu, Zn, Mn, and Se concentrations, limited influence on performance was noted, likely due to the steers having excellent TM status at the beginning of the experimental period. Further research needs to be done utilizing steers with varying TM status to evaluate effects on growth and carcass traits in response to a rapid improvement in TM status.

Introduction

Natural beef production has become a popular niche market for producers to sell a value added product to consumers. USDA programs create guidelines for producers so their cattle can qualify as natural. One of those programs is "Never Ever 3", which requires that animals have never been given antibiotics, animal products, or hormones. Because natural cattle cannot receive these growth promoting products utilizing TM may help growth processes and health. Utilizing an injectable trace mineral source is an advantageous way to quickly increase TM status of cattle. The objective of this study was to determine the effects of an injectable TM product on the growth performance and TM status of Certified Angus Beef Natural feedlot steers.

Materials and Methods

Growing Phase. This study was conducted at the Iowa State University Beef Nutrition Farm in Ames, IA. One hundred and sixty-eight certified natural, black hided, high percentage Angus beef steers (790 ± 80.6 lbs), blocked by initial body weight (BW), were assigned to receive an injection of either sterilized physiological saline (SAL, n = 84 steers) or Multimin90 (MM, n = 84 steers) at a dosage rate of 1mL per 150 lbs of BW on d 0. Steers were placed on a corn-silage-based diet total mixed ration for 56 days on an ad libitum basis for the growing phase. Steers were weighed on d -1, 0, 28 and 56 of the growing phase. Steers were transitioned to a finishing diet for 4 weeks, from days 57 through 83, before beginning the final finishing diet on d 84.

Finishing Phase. On d 84, half of the steers within treatments were randomly assigned to receive a second injection of SAL or MM, while half received the opposite injection of that administered in the growing phase. This resulted in 4 total treatments 1) d 0 saline, d 84 saline (SAL/SAL, n = 42 steers); 2) d 0 saline, d 84 Multimin90 (SAL/MM, n = 40 steers); 3) d 0 Multimin90, d 84 saline (MM/ SAL, n = 40); and 4) d 0 Multimin90, d 84 Multimin90 (MM/MM, n = 42). Steer interim BW were taken every 28 days throughout the remainder of the trial and double weights were taken on d 161 and 162 just prior to harvest. A 4% pencil shrink was applied to all live BW measures as well as in the calculation of ADG and F:G. Average daily gain was calculated for each individual steer, with DMI and F:G calculated on a pen basis.

Sample Collection. Feed samples of the total mixed ration and ingredients were taken weekly to determine dry matter content. With these measurements DMI and feed conversion were calculated. Liver biopsies were conducted on days -5, 14, 79, and 98 for mineral analysis.

Statistical Analysis. Live animal performance, and liver TM concentrations were analyzed using the MIXED procedure of SAS with fixed effect of treatment. Steer weight and ADG were calculated on an individual steer basis, making steer the experimental unit. Because steers were pen fed, DMI and F:G was calculated on a pen basis, making pen the experimental unit. Liver mineral data were analyzed as repeated measures with day of sampling as the repeated effect and d -5 values were used as covariates in analysis.

Results

Intake and Growth Performance. During the growing phase (Table 1), there were no treatment effects on BW, ADG, DMI or F:G ($P \geq 0.17$). There were also no treatment effects during the finishing period (Table 2; d 84 to 161) on initial and final BW, ADG, DMI, or F:G ($P \geq 0.16$).

Liver Mineral Concentrations. Liver mineral concentrations are illustrated in Figure 1. There tended to be a treatment × day interaction ($P = 0.08$) for liver Cu. This interaction is driven by differences between MM/MM and SAL/SAL steers, where MM/MM steers have greater liver Cu than SAL/SAL steers on d 14 ($P = 0.04$) and 98 (P =0.01) but only tended to be greater on d 79 ($P = 0.08$). Liver Cu concentrations also were greater in MM/MM steers than in MM/SAL steers on d 98 ($P = 0.03$). There were no treatment × day interactions for liver Zn and Mn concentrations ($P \geq 0.34$). Treatment tended to affect liver Zn (P = 0.08) as concentrations in the liver tended to be greater in steers receiving MM at the beginning of the growing phase (MM/SAL, MM/MM) compared to steers that received saline for the entire trial (SAL/SAL), while SAL/MM steer liver zinc concentrations were intermediate. Treatment tended to effect liver Mn concentrations (P = 0.08), which was driven by the MM/MM steers having greater liver Mn than SAL/SAL steers on d 14 (P = 0.01). On d 79, MM/MM steers tended to have greater liver Mn concentrations than MM/SAL (P = 0.09) and SAL/SAL (P = 0.07) steers. There was an interesting treatment × day interaction for liver Se concentrations (P < 0.001), where concentrations increased on d 14 in cattle receiving MM compared to SAL, no differences were observed on d 79, but there was a substantial increase on d 98, within cattle that received MM as the second injection (SAL/MM, MM/MM) compared to steers receiving saline.

Multimin90 injection did not affect performance of steers in a natural program during the growing or finishing phases compared to saline injections; however, MM did increase liver Cu, Zn, Mn, and Se concentrations above controls which already had excellent status.

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Table 1. Effects of saline or trace mineral injection on growing performance of natural feedlot steers.

	SAL	MM	SEM	*P*-value
Initial BW, lb[1], d 0	790	789	2.5	0.96
Final BW, lb[1], d 56	955	956	4.1	0.76
ADG, lb/d[2]	2.94	2.98	0.05	0.65
DMI, lb/d[3]	19.65	18.96	0.34	0.17
F:G[3]	7.68	7.81	0.143	0.52

[1] A 4% pencil shrink was applied to all live BW measures as well as in the calculation of ADG and F:G.
[2] Steer was experimental unit n = 83 per treatment.
[3] Pen was experimental unit n = 7 per treatment.

Table 2. Effects of saline or trace mineral injection on finishing period performance of natural feedlot steers.

						P-value		
	SAL/SAL	SAL/MM	MM/SAL	MM/MM	SEM	Trt 1	Trt 2	Trt 1 × Trt 2
Initial BW, d 84[1]	1065	1063	1054	1056	13.7	0.52	0.97	0.89
Final BW, d 161[1]	1322	1315	1306	1310	15.6	0.47	0.94	0.70
ADG, lb/d[2]	3.24	3.21	3.17	3.22	0.07	0.63	0.84	0.59
DMI, lb /d[3]	24.52	24.40	23.93	23.90	0.37	0.16	0.83	0.91
F:G[3]	7.49	7.69	7.68	7.26	0.225	0.60	0.64	0.18

[1] A 4% pencil shrink was applied to all live BW measures was well as in the calculation of ADG and F:G.
[2] Steer was experimental unit n = 40 per treatment (SAL/MM and MM/SAL) and n = 42 per treatment (SAL/SAL and MM/MM).
[3] Pen was experimental unit n = 7 per treatment.

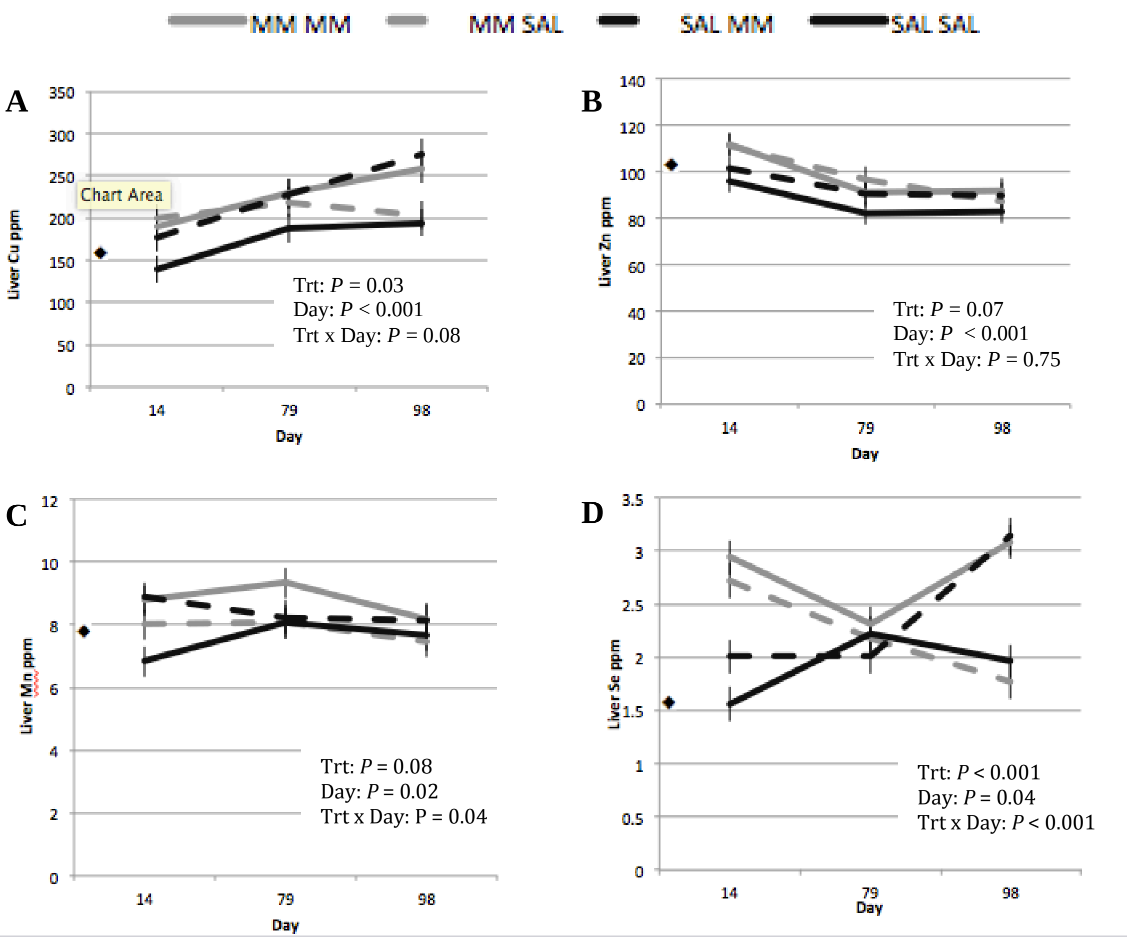

Figure 1. Effect of a trace mineral injection (MM) or saline injection on liver Cu concentrations (A), liver Zn concentrations (B), liver Mn concentrations (C), and liver Se concentrations (D). Values are means ± SEM; *n* = 7 per injection group combination. The MM injection (Multimin90) provided 15 mg Cu/mL (as copper disodium EDTA), 10 mg Mn/mL (as manganese disodium EDTA), 5 mg Se/mL (as sodium selenite), and 60 mg Zn/mL (as zinc sodium EDTA). Day -5 overall average for all treatment means are indicated by ◆ and d -5 values for each steer were used as a covariate for analysis.