



The influence of trace minerals source on copper, manganese, and zinc binding strength to rumen digesta in cattle fed a corn silage-based diet.

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ABSTRACT

Twelve crossbred steers fitted with rumen *cannulae* were used to determine the influence of trace mineral (TM) source on relative binding strength of minerals in the ruminal insoluble digesta fraction (IDF). Steers (n = 4/treatment) were fed a corn silage-based diet containing no supplemental Cu, Mn, and Zn for 7d. On d 8, steers received a bolus dose (2 x NRC requirement) of the respective TM from sulfate (STM), organic (ORG; provided as Zn methionine, Mn methionine, and Cu lysine), or hydroxy TM (HTM; Micronutrients USA LLC) sources. Ruminal samples were obtained at 2 h intervals starting at -4 and ending at 24 h post dosing. Ruminal samples were centrifuged and supernatant and the IDF were collected and frozen separately. Binding strength of Cu, Mn, and Zn to the IDF was estimated at 0, 12, and 24 h using dialysis against 0.05 M Tris-EDTA. At 0 h pre-dosing, IDF concentrations of Cu, Mn, and Zn were similar across treatments. At 12 h post dosing Cu and Zn IDF concentrations were greater ($P < 0.05$) in HTM vs STM and ORG supplemented steers, and Mn concentrations were greater ($P < 0.05$) in HTM and ORG vs STM supplemented steers. At 24 h post dosing, IDF Zn concentrations were greater ($P < 0.05$) in HTM vs STM and ORG supplemented steers and Cu and Mn concentrations were similar across treatments. At 12 and 24 h post dosing the percent Cu and Zn released following dialysis was greater ($P < 0.05$) in HTM vs STM and ORG supplemented steers. The percent released of Cu, Mn, and Zn at 0 h, and Mn at 12 and 24 h were similar across treatments. Data indicate that a greater concentration of Cu and Zn from HTM is loosely bound to the ruminal IDF.

MATERIALS AND METHODS

- 12 Crossbred Angus steers (BW 452.8 ± 21.8kg)
- Steers were fed the diet without supplement for 7 days → received treatment on day 8
- Treatments:
 - Experiment 1: 20 mg Cu/kg DM, 40 mg Mn/kg DM, and 60 mg Zn/kg DM, from either sulfate (SO₄), hydroxy (IntelliBond), or organic sources.
- Ruminal samples were obtained at 2h intervals until 24h post-dosing for soluble (fraction obtained after centrifugation)
- The solid digesta (at 0,12, and 24h) were dialysis against 0.05M Tris-EDTA.

RESULTS

Influence of dialysis on Copper, Manganese, and Zinc release from rumen solid digesta 0, 12, and 24 hours after receiving a pulse dose of 20 mg copper, 40 mg manganese, and 60 mg zinc/kg DM from either hydroxy, sulfate or organic TM sources.

Item	Treatment				CONTRAST		
	Initial mineral concentration of digesta, mg/kg DM	HTM	STM	ORG	SEM	HTM vs STM	STM vs ORG
0 hour							
Copper		0.97	0.98	0.94	0.22	0.99	0.95
Manganese		8.7	8.8	8.8	1.21	0.91	0.96
Zinc		13.3	12.2	11.0	1.14	0.41	0.36
12 hours							
Copper		31.0	5.5	7.9	3.40	0.01	0.01
Manganese		34.7	29.5	34.7	3.87	0.01	0.01
Zinc		128.1	33.6	35.0	8.24	0.01	0.33
24 hours							
Copper		0.77	1.3	1.7	1.98	0.38	0.40
Manganese		8.6	8.5	8.4	2.87	0.87	0.99
Zinc		21.3	11.0	11.2	12.44	0.01	0.91
Tris-EDTA, (0.01M ethylenediaminetetraacetate in 0.05M tris-hydroxymethyl-aminomethane)							
% Released							
0 hour							
Copper		39.6	42.1	44.0	2.06	0.56	0.66
Manganese		42.8	54.1	49.2	3.03	0.08	0.41
Zinc		55.3	51.1	57.9	3.07	0.30	0.11
12 hours							
Copper		69.5	24.9	31.8	4.00	0.01	0.14
Manganese		77.9	70.6	82.6	24.31	0.23	0.06
Zinc		87.9	32.2	36.7	11.32	0.01	0.27
24 hours							
Copper		82.9	33.0	32.7	14.26	0.01	0.95
Manganese		72.1	76.6	69.9	9.37	0.45	0.27
Zinc		90.4	41.0	36.3	15.36	0.01	0.25

DISCUSSION

- ❖ Zn and Cu concentrations in ruminal solid digesta were greater in steers receiving HTM compared with STM. That suggests that STM may have higher rumen bypass.

CONCLUSION

- ❖ The results of this experiment suggests that a greater concentration of Cu and Zn from HTM is loosely bound to the ruminal insoluble digesta fraction.