

COPPER AND ZINC PARENTERAL SUPPLEMENTATION IN PRE-WEANING CALVES

Guillermo Mattioli², Diana Rosa², *Juan M. Rodriguez Persico¹, Esteban Turic¹, Jesus Pesoa¹, Luis Fazzio²

¹Biogénesis Bagó SA, Argentina. ²Laboratorio de Nutrición Mineral, Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata, 60 y 118, 1900 La Plata, Argentina. E mail: juan.persico@biogenesibago.com

INTRODUCTION

Beef cattle production represents the main economic activity of the Salado River basin (SRB), in Buenos Aires province, Argentina. This area covers 5.5 million hectares and produces two million calves per year. Animals are raised under an extensive system based on naturalized grass as the main source of nutrients. The economic benefit of the region resides on selling calves weaned at 6-7 months of age. Different authors have reported copper (Cu) and zinc (Zn) deficiency in the SRB, together with related effects such as decreased daily weight gain (DWG) and hematological changes. Although the diagnosis of both deficiencies in the herd is based on the assessment of plasma Cu and Zn concentrations, there are discrepancies regarding results interpretation. In this work we discuss whether plasma Cu and Zn concentrations are modified after parenteral Cu, Zn and Cu+Zn supplementation of pre-weaning calves, thereby altering DWG and hematological parameters.

MATERIALS AND METHODS

A total of 40 clinically healthy Aberdeen Angus calves were used. They were kept as cow-calf pairs since 0 day of the trial (three months of age) until weaning (month seven; 120 day of the trial). Calves were assigned to one of four homogeneous groups according to weight, sex and age (n= 20 each group), and treated as follows: Cu group (0.3 mg/kg Cu edetate); Zn group (1 mg/kg Zn edetate); Cu+Zn group (same doses of Cu and Zn edetate - Suplenut®, Biogénesis Bagó - Argentina); and control group (supplemented with saline sterile solution). The animals were subcutaneously injected every 40 days from November 2015 to March 2016 within 0, 40, 80 and 120 days of the trial, when plasma Cu and Zn concentrations, weight and hematological parameters were recorded. A completely randomized 2x2 factorial treatment design was used and data were analyzed with a mixed model for repeated measures over time.

RESULTS

In groups with Cu supplementation (Cu and Cu+Zn groups), plasma Cu concentration increased after the second sampling (Cu x time interaction, $p < 0.01$ - **Table 1**). We also found Cu x Zn interaction ($p = 0.09$), being plasma Cu concentration higher in the Cu+Zn than in the Cu group. In turn, plasma Cu concentration was lower in the Zn than in the control group. In the case of plasma Zn concentration, it increased after Zn supplementation (Zn and Cu+Zn group, **Table 1**). In terms of weight, time differences were observed in the Zn-treated group, finding higher body weight after the second sampling (**Table 1**). Differences in weight gain (Zn x time interaction; $p < 0.01$) were observed in the Zn but not in the Cu group ($p > 0.1$). Regarding hematological parameters (erythrocytes, leukocytes and enzymes), no differences were detected in any of the four study groups.

Table 1. Least squares means for cupraemia, zincemia and live weight in pre-weaning calves supplemented with copper (Cu), zinc (Zn) and copper + zinc (Cu+Zn) and without supplementation (Ctrl) along time (T).

Day of the trial	Groups				P- value ²				
	Ctrl	Cu	Zn	Cu+Zn	Zn	Cu	Zn x Cu	Zn x T	Cu x T
Cupraemia (µg/dL)									
0	46	42	44	45	0.67	<0.01	0.09	0.96	<0.01
40	49	88	45	89					
80	53	87	49	89					
120	55	76	47	81					
Zincemia (µg/dL)									
0	84	80	85	81	0.02	0.12	0.77	0.48	0.98
40	112	101	115	117					
80	108	102	115	109					
120	92	91	109	100					
Weight (Kg)									
0	92	92	93	92	0.02	0.73	0.43	<0.01	0.48
40	124 ^a	124 ^a	127 ^b	126 ^b					
80	145 ^a	146 ^a	148 ^b	149 ^b					
120	172 ^a	173 ^a	181 ^b	177 ^b					

^{a-b} Different letters within rows means $P < 0.05$

CONCLUSIONS

Parenteral Zn supplementation in calves every 40 days improved daily weight gain, which indicates the risk for Zn deficiency in this area. Marginal Cu concentrations observed in this trial did not lead to lower weight gain in calves. Marginal Cu and Zn concentrations did not alter hematological parameters.

Copper and Zinc Parenteral Supplementation in Pre-weaning Calves

Guillermo Mattioli², Diana Rosa², *Juan Rodriguez Persico¹, Esteban Turic¹,
Jesus Pesoa¹, Luis Fazzio²

Beef cattle production represents the main economic activity of the Salado River basin (SRB), in the province of Buenos Aires, Argentina. This area covers 5.5 million hectares and produces two million calves a year. Animals are raised under an extensive system based on naturalized grass as the main source of nutrients. The economic benefit of the region resides on selling calves weaned at 6-7 months of age. Different authors have reported copper (Cu) and zinc (Zn) deficiency in the SRB, together with related effects such as decreased daily weight gain and hematological changes. Although the diagnosis of both deficiencies in the herd is based on the assessment of plasma Cu and Zn concentrations, there are discrepancies regarding data interpretation. Here we discuss whether plasma Cu and Zn concentrations are modified after parenteral Cu, Zn and Cu+Zn supplementation of pre-weaning calves, thereby altering daily weight gain and hematological parameters. A total of 40 clinically healthy Aberdeen Angus calves were used. They were kept as cow-calf pairs since 0 day of the trial (three months of age) until weaning (month seven; 120 day of the trial). Calves were assigned to one of four homogeneous groups according to weight, sex and age (n= 20 each group), and treated as follows: Cu group (0.3 mg/kg Cu edetate); Zn group (1 mg/kg Zn edetate); Cu+Zn group (same doses of Cu and Zn edetate - Suplenut®, Biogénesis Bagó-); and control group (supplemented with saline sterile solution). The animals were subcutaneously injected every 40 days from November 2015 to March 2016 within 0, 40, 80 and 120 days, when plasma Cu and Zn concentrations, weight and hematological parameters were recorded. A completely randomized 2x2 factorial treatment design was used and data were analyzed with a mixed model for repeated measures over time. In groups with Cu supplementation (Cu and Cu+Zn groups), plasma Cu concentration increased after the second sampling (Cu x time interaction, $p < 0.01$). We also found Cu x Zn interaction ($p = 0.09$), being plasma Cu concentration higher in the Cu+Zn than in the Cu group (76.2 vs 73.4 $\mu\text{g/dL}$). In turn, plasma Cu concentration was lower in the Zn than in the control group (46.2 vs 50.7 $\mu\text{g/dL}$). In the case of plasma Zn concentration, it increased after Zn supplementation (Zn and Cu+Zn group, $p = 0.02$). In terms of weight, time differences were observed in the Zn-treated group, finding higher body weight after the second sampling ($p < 0.02$). Differences in weight gain (Zn x time interaction; $p < 0.01$) were observed in the Zn but not in the Cu group ($p > 0.1$). Regarding hematological parameters (erythrocytes,

leukocytes and enzymes), no differences were detected in any of the four study groups. Cu plasma concentration was a good indicator of risk, since it remained into a marginal range (between 20 and 60 $\mu\text{g/dL}$ - in unsupplemented Cu groups), indicative of depletion of the liver copper store, but not lower enough to provoke lower weight gain. Zinc plasma concentration was higher than expected in unsupplemented Zn groups, and with a narrow difference with supplemented groups (96.3 vs 103.9 $\mu\text{g/dL}$). Our results show that Zn supplementation improved body weight in pre-weaning calves raised in the SRB. Further research showing the importance of herd risk diagnosis based on plasma Zn concentration could contribute to preventing a lower body weight at weaning time.