

EFFECT OF INJECTABLE SUPPLEMENTATION WITH COPPER AND ZINC ON WEIGHT, HEMATOLOGICAL PARAMETERS AND IMMUNE RESPONSE IN PRE-WEANING BEEF CALVES

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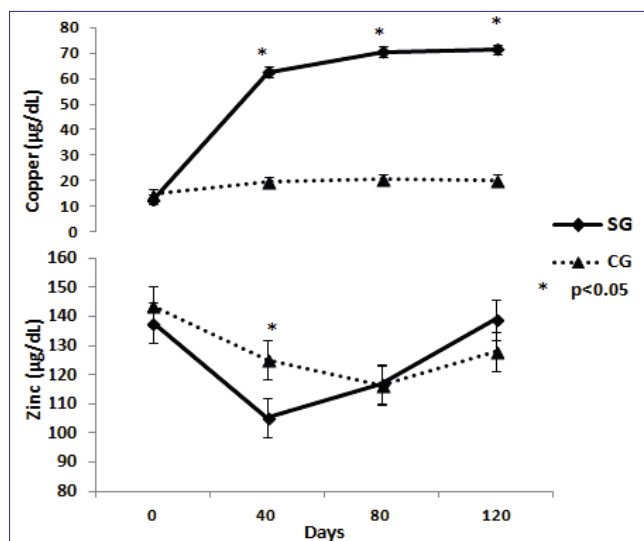
INTRODUCTION

Cow-calf operations may be affected by trace mineral deficiencies, particularly copper (Cu) and zinc (Zn) deficiency. Both are clinically different at an advanced grade of deficiency, but cause similar consequences at the beginning, such as low weight gain, hematological changes and immune failure. 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. In this work, we evaluated the effect of parenteral Cu and Zn supplementation on plasma Cu and Zn concentration, weight gain, hematological parameters and immune response to BoHV-1 in calves.

RESULTS

Treatment increased plasma Cu but not Zn concentration ($p < 0.05$ and > 0.1 , respectively), maintaining the Cu values higher than 60 $\mu\text{g/dL}$ in the SG and lower than 20 $\mu\text{g/dL}$ in the CG (Figure 1). Zn plasma concentration did not show differences between groups and remained higher than 90 $\mu\text{g/dL}$, lower threshold limit value proposed as adequate range for several authors. Similarly, calves in SG had higher packed cell volume, mean corpuscular hemoglobin and mean corpuscular volume ($p < 0.05$), and tended to increased hemoglobin concentration ($p = 0.07$). The BoHV1 titers were significantly higher in the SG on d 80 and d 120 (Figure 2). Body weight, also was different in SG (Table 1).

Figure 1: Plasma Cu and Zn concentrations in pre-weaning calves



MATERIALS AND METHODS

Forty Aberdeen Angus calves, body weight (BW; 99 ± 8 Kg) were selected. They were kept as cow-calf pairs through the trial, started when calves had 3 months of age and finished at weaning time (7 months). The calves were assigned in two groups ($n = 20$), and they were treated with a subcutaneous injection at d 0, d 40, d 80 and d 120 of the trial. At the same days, blood samples were taken and (BW) of the animals was registered. The supplemented group (SG) was treated with copper edetate (0,3 mg/kg) and zinc edetate (1 mg/kg) (Suplenut® Biogénesis Bagó - Argentina), while the control group (CG) received a saline solution. On d 40 and d 80, all calves were vaccinated with inactivated bovine herpesvirus 1 (BoHV1-Bioqueratogen Air®, Biogénesis Bagó - Argentina). Blood samples were used to measure plasma Cu and Zn concentrations and hematological parameters. At d 40, d 80 and d 120 BoHV1 titers were evaluated by serum virus neutralization (SN) assay. Data were analyzed as a complete randomized design with repeated measures using PROC MIXED (SAS 9.1)

Figure 2: Titer responses for inactivated bovine herpes virus 1 (BoHV-1) vaccine in pre-weaning calves

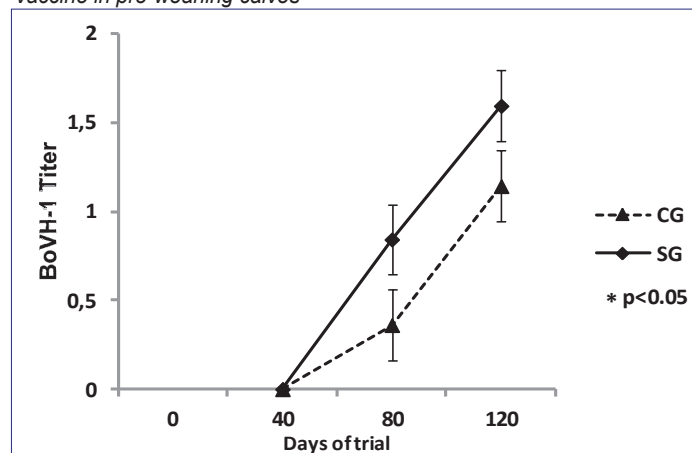


Table 1: Body weight in pre-weaning calves ($n = 20$ in each group)

Body weight (kg)	SG	CG	SEM	p-value
day 0	102.10	100.85		0.7818
day 40	133.20	126.10	3.1843	0.1177
day 80	165.55	155.85		0.0333
day 120	183.90	171.75		0.0080

CONCLUSIONS

Copper deficiency caused less body weight at weaning time and immunological consequences; while Zn deficiency was not present. On the other hand, Cu and Zn plasma concentration were good indicators of risk. Finally, frequent Cu supplementation was necessary to prevent deficiency consequences.

Effect of injectable supplementation with copper and zinc on weight, hematological parameters and immune response in pre-weaning beef calves

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Cow-calf operations may be affected by trace mineral deficiencies, particularly copper (Cu) and zinc (Zn) deficiency, which may decrease the calf daily weight gain and modified hematological and immunological parameters. Salado's river basin is the most important area of Argentina devoted to cow-calves operations, and there are antecedents of Cu and Zn deficiencies. Both are clinically different at an advanced grade of deficiency, but cause similar consequences at the beginning, such as low weight gain, hematological changes and immune failure. 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. To evaluate these possible consequences Aberdeen Angus calves (n=40, average BW 99 ± 8 Kg) clinically healthy were selected. They were kept as cow-calf pairs through the trial, started when calves had 3 months of age and finished at weaning time (7 months of age). The calves were assigned in two groups (n= 20 per group), and they were treated with a subcutaneous injection at d 0, d 40, d 80 and d 120 of the trial. At the same days, blood samples were taken and body weight (BW) of the animals was registered. The supplemented group (SG) was treated with copper edetate (0,3 mg/kg) and zinc edetate (1 mg/kg) (Suplenut® Biogénesis Bagó- Argentina), while the control group (CtlG) received a saline sterile solution. On d 40 and d 80 of the trial, all calves were vaccinated with inactivated bovine herpesvirus 1 (BHV1-Bioqueratogen Air® Biogénesis Bagó- Argentina). The vaccines were subcutaneously administered according to label directions. Blood samples were used to measure plasma Cu and Zn concentrations (n=20 per group) and hematological parameters (n=10 per group). At d 40, d 80 and d 120 BHV1 titers (n=10 per group) were evaluated by serum virus neutralization (SN) assay, and titers were reported as log₁₀ transformation of the reciprocal of the average greatest dilution that observed no cytopathic effect. Data were analyzed as a complete randomized design with repeated measures using PROC MIXED (SAS 9.1). Treatment increased plasma Cu but not Zn concentration (P <0.05 and >0.1, respectively), maintaining the Cu values higher than 60 µg/dL (adequate range) in the SG and lower than 20 µg/dL (severe deficiency range) in the CtlG. Zn plasma concentration did not show differences between groups and remained higher than 90 µg/dL, lower threshold limit value proposed as adequate range for several authors. Similarly, calves in SG had higher packed cell volume, mean corpuscular hemoglobin and mean corpuscular volume (P

<0.05), and tended to increased hemoglobin concentration ($P=0.07$). The BHV1 titers were significantly higher ($P < 0.05$) in the SG on d 80 and d 120. Body weight, also was different in SG (Time by treatment interaction $P < 0.05$) being 184 and 172 (± 3.2) kg for the SG and CtlG respectively on d 120 of the trial. Cu deficiency, under conditions of this trial, caused less body weight at weaning time and immunological consequences, with early hematological changes; while Zn deficiency was not present. On the other hand, Cu and Zn plasma concentration were good indicators of risk. Finally, frequent Cu supplementation was necessary to prevent deficiency consequences in Salado River basin area.