

Efecto de la suplementación parenteral con Cu, Zn y Se en terneros al pie de la madre

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Los sistemas pastoriles extensivos de producción bovina se ven afectados por carencias de microminerales que pueden afectar el crecimiento de los terneros antes del destete. El objetivo del estudio fue evaluar en terneros al pie de la madre, entre los tres meses y el destete (7 meses) el efecto de la suplementación parenteral con cobre (Cu), zinc (Zn) y selenio (Se) sobre las ganancias de peso y las concentraciones plasmáticas de Cu, Zn y la actividad glutatión peroxidasa (GPX) en sangre entera, como indicativa del estatus de Se en los animales.

El estudio se realizó en un establecimiento dedicado a la cría bovina ubicado en el departamento de Graneros, provincia de Tucumán, Argentina. Se utilizaron 42 terneros al pie de la madre, con un peso promedio de $97,4 \pm 15,9$ kg, los cuales fueron divididos en dos grupos. El grupo Tratado (GT; n=33), recibió por vía subcutánea el día del inicio del estudio (Día 0) una dosis de una solución con Cu (15 mg/mL), Zn (50 mg/mL) y Se (10 mg/mL), a razón de 1 mL/50 Kg de peso vivo (SUPLENUT® Se, Biogénesis Bagó, Argentina). El grupo Control (GC; n=9) fue inyectado con 1 mL/50 kg de solución fisiológica.

Los animales fueron pesados en cuatro ocasiones (Días 0, 40, 68 y 112). En esos días, también se tomaron muestras de sangre de los 9 animales del GC y de 15 animales del GT, siempre utilizando los mismos animales para todos los muestreos. Las muestras de sangre se tomaron en tubos con heparina sódica y se emplearon para evaluar las concentraciones de Cu y Zn en plasma y la actividad GPx en sangre entera.

Los datos se analizaron mediante un modelo mixto con medidas repetidas en el tiempo con el Procedimiento MIXED del programa estadístico SAS (9.4). Las variables fijas fueron el Tratamiento (grupo), el Tiempo (día) y la interacción entre ambos. La variable aleatoria fue el animal. En caso de existir interacción entre Tratamiento y Tiempo se utilizó SLICE statement para determinar en qué momento del tiempo hubo diferencias entre los grupos. Los valores de probabilidad que se consideraron como significativos fueron $p < 0,05$.

En cuanto al peso se observó un efecto significativo del Tratamiento ($p=0,02$), del Tiempo ($p < 0,01$) y de la interacción entre ambos ($p < 0,01$). La interacción se produjo porque si bien no hubo diferencias entre GT y GC al día 0 ($98,5 \pm 3,4$ vs $93,1 \pm 6,6$ kg) ni al día 40 ($127,4 \pm 3,4$ vs $116 \pm 6,6$ kg), el GT presentó mayor peso al día 68 ($150,9 \pm 3,4$ vs $129,2 \pm 6,6$ kg; $p < 0,01$) y al día 112 ($152,2 \pm 3,4$ vs $126,4 \pm 6,6$ kg; $p < 0,01$). En cuanto a la ganancia diaria de peso (GDP) se observó un efecto del Tratamiento ($p < 0,01$) y del Tiempo ($p < 0,01$), no así de la interacción ($p=0,18$). El GT tuvo una mayor GDP que el GC entre los días 0 a 40 (721 ± 27 vs 572 ± 53 g/día), entre los días 0 a 68 (773 ± 28 vs 531 ± 53 g/día) y entre los días 0 y 112 (479 ± 27 vs 286 ± 54 g/día). Los niveles de Cu en plasma fueron afectados por el Tratamiento ($p=0,04$), el Tiempo ($p < 0,01$) y la interacción entre ambos ($p < 0,01$). El GT tuvo cupremias menores al GC al Día 0 ($42,7 \pm 3,6$ vs $57,6 \pm 4,7$ $\mu\text{g/dL}$, $p=0,02$), mientras que fueron superiores en el GT al día 40 ($49,4 \pm 3,6$ vs $24,1 \pm 4,7$ $\mu\text{g/dL}$; $p < 0,01$) y al día 68 ($33,3 \pm 3,7$ vs $17,1 \pm 4,7$ $\mu\text{g/dL}$; $p < 0,01$), sin diferenciarse al día 112 ($23,3 \pm 4,2$ vs $10,6 \pm 6,5$ $\mu\text{g/dL}$, GT vs GC, respectivamente; $p=0,11$). El Zn plasmático solo se vio afectado por el Tiempo ($p < 0,01$) sin efecto del Tratamiento ni de la interacción Tiempo x Tratamiento. La actividad de GPx estuvo afectada por el Tratamiento ($p < 0,01$), el Tiempo ($p < 0,01$) y la interacción entre ambos ($p < 0,01$). La interacción se produjo porque si bien al Día 0 no hubo diferencias entre GT y GC ($16,1 \pm 3,5$ vs $15 \pm 4,5$ U/mL de hematocrito, respectivamente; $p=0,84$), el GT fue mayor al GC al día 40 ($75,2 \pm 3,5$ vs $18,3 \pm 4,5$

U/mL de hematocrito; $p < 0.01$), al día 68 ($95,9 \pm 3,5$ vs $20,6$ U/mL de hematocrito; $p < 0.01$) y al día 112 ($44,1 \pm 3,7$ vs $20,4 \pm 4,5$ U/mL de hematocrito; $p < 0.01$).

Se concluye que, bajo las condiciones del presente estudio, la suplementación subcutánea con Cu (0,3 mg/kg), Zn (1 mg/kg) y Se (0,2 mg/kg) en terneros al pie de la madre aumentó el peso de los animales y mejoró el estatus de Cu y de Se.



The majority of farmers did not measure colostrum quality (7). Colostrum was most commonly stored in a freezer (9) or at ambient (6). Most farmers did not feed pooled colostrum (6). The majority of farmers fed three or more litres of colostrum at first feed (10). Colostrum was most commonly fed from a teat-ed-bucket (10) or oesophageal feeder (6) and most commonly within two hours of birth (7). While the majority of farmers vaccinated calves against blackleg (*Clostridium chauveoi*) (11), a minority vaccinated cows (5). The most common housing system was group housing (13), on straw bedding (13) with one water point/pen (9) (most commonly more than 10 calves/water point, 8) and twenty or less calves/pen (9). When problems occurred, the most common liquid feeding systems were mob feeders (7), automatic feeders (AF) (6) and open buckets (4) and combinations of these. Teats were replaced either at the start of the season (5) or when damaged (5). Automatic feeders were most commonly calibrated at the start of the season (5). All farmers fed milk replacer (MR); at least eight products were used. The mix rate most commonly used was 12.5% (7), varying up to 15% (3). Maximum feeding rate/feed and / day was 3 (2) and 6L (13), respectively, fed most commonly at 38°C or less (7). Starter ration (12 different products, predominantly coarse, 8) was introduced most commonly at 7 or less days of age (11). Calves had ad lib access to straw (13) and hay (2). Weaning criteria most commonly used were weight/size (12), age (7) and meal consumption (6), most commonly over more than a week step down (7).

Conclusions: From this audit of farms affected by calf abomasal disorders it can be concluded that the calf management on these farms was, in general, (accepting small sample size), representative of Irish dairy farms and, of recommended practice. Management aspects that might be altered include requesting necropsy and laboratory investigations to improve case definitions, reducing the pen-stocking rate, increasing the number of water points/calf, replacing teats more often, calibrating the AF more often and using a lower MR mix rate when problems occur. This study suggests that some farmers perceive that abomasal disorders have become a greater problem in recent years on Irish dairy farms; the concurrent and ongoing expansion of the national dairy herd may be a latent contributing factor. On some farms abomasal disorders can cause relatively high morbidity and mortality – there is a need to characterise the risk factors, case definitions and trouble-shooting protocols for this problem to assist farmers, their veterinarians and nutritional advisors with outbreaks. It is recognised that holistic investigation of abomasal disorders involves, in addition to a questionnaire audit, a farm visit.

Keywords: Dairy calf, abomasal bloat, survey.

AH-P38

Effect of parenteral copper, zinc, and selenium supplementation on beef calves

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Objectives: Micromineral deficiencies can reduce growth rate in calves in grazing cow-calf system. The aim of this study was to evaluate the effect of parenteral copper (Cu), zinc (Zn) and selenium (Se) supplementation of pre-weaning calves on weight gain, plasma Cu and Zn concentrations, and glutathione peroxidase (GPx) activity in whole blood, as indicative of Se status.

Materials and methods: The trial was carried out on a farm located in Graneros, Tucumán, Argentine. Forty-two Angus-crossbreed calves (20 females and 22 males; 97.4 ± 15.9 kg and 3 months of age) were used. They were kept as cow-calf pairs since day 0 of the trial until weaning (day 112). Calves were assigned into two groups. Treated group (TG; n=33, 16 females and 17 males) was injected subcutaneously with a solution of Cu (15 mg/mL), Zn (50 mg/mL) and Se (10 mg/mL; SUPLENUT® Se, Biogénesis Bagó, Argentine), at a dose of 1 mL/50 kg of body weight (BW) on day 0 of the trial. The Control group (CG; n=9, 4 females and 5 males) was injected with 1 mL/50 kg of saline sterile solution. Body Weight and blood samples (TG: 15; CG: 9) was taken on days 0, 40, 68 and 112. Blood samples were collected in sodium heparin tubes to assess plasma Cu and Zn concentrations by atomic absorption spectrophotometer and GPx activity in whole blood by Ransel spectrophotometric kit (Randox Lab., UK). Data were analyzed with a mixed model for repeated measures over time using the MIXED Procedure of the SAS 9.4 (SAS Inst. Inc.). The model included the fixed effect of Treatment (Group), Time (day) and their interaction, and the random effect of calf. Slice statement was used for detecting differences within each interaction. Probability values <0.05 were considered significant.

Results: There were a Treatment (p=0.02), Time (p<0.01), and Time x Treatment interaction (p<0.01) effects on BW. There were no differences between TG and CG on day 0 (98.5 ± 3.4 vs 93.1 ± 6.6 kg) and on day 40 (127.4 ± 3.4 vs 116 ± 6.6 kg), but the TG had higher BW on day 68 (150.9 ± 3.4 vs 129.2 ± 6.6 kg; p<0.01) and on day 112 (152.2 ± 3.4 vs 126.4 ± 6.6 kg; p<0.01) than the CG. Regarding average daily gain (ADG), there were a Treatment (p<0.01) and Time (p<0.01) effects, but there was no effect of their interaction (p=0.18). Treatment group had higher ADG than CG from days 0 to 40 (721 ± 27 vs 572 ± 53 g/day; p=0.01), days 0 to 68 (773 ± 28 vs 531 ± 53 g/day; p<0.01) and days 0 to 112 (479 ± 27 vs 286 ± 54 g/day; p<0.01). There were a Treatment (p=0.04), Time (p<0.01), and Time x Treatment interaction (p<0.01) effects on plasma Cu concentration. Treatment group had lower plasma Cu concentration than CG on day 0 (42.7 ± 3.6 vs 57.6 ± 4.7 µg/dL, p=0.02), but TG had higher plasma Cu concentration than CG on day 40 (49.4 ± 3.6 vs 24.1 ± 4.7 µg/dL; p<0.01) and on day 68 (33.3 ± 3.7 vs 17.1 ± 4.7 µg/dL; p<0.01). There was no difference between groups at day 112 (23.3 ± 4.2 vs 10.6 ± 6.5 µg/dL, TG vs CG, respectively; p=0.11). Plasma Zn concentration was affected by Time (p<0.01), without effect of Treatment or Time x Treatment interaction (p=0.39). There were a Treatment (p<0.01), Time (p<0.01), and Time x Treatment interaction (p<0.01) effects on GPx activity. There was no difference between TG and CG (16.1 ± 3.5 vs 15 ± 4.5 U/mL hematocrit, respectively; p=0.84), TG had higher GPx activity than CG on day 40 (75.2 ± 3.5 vs 18.3 ± 4.5 U/mL hematocrit; p<0.01), on day 68 (95.9 ± 3.5 vs 20.6 U/mL hematocrit; p<0.01) and on day 112 (44.1 ± 3.7 vs 20.4 ± 4.5 U/



mL hematocrit; $p < 0.01$).

Conclusions: The results indicate that parenteral Cu (0.3 mg/kg), Zn (1 mg/kg) and Se (0.2 mg/kg) supplementation on pre-weaning beef calves increase BW and improve Cu and Se status.

Keywords: calves, copper, zinc, selenium, supplementation.

AH-P39

Performance and carcass attributes of feedlot steers supplemented with parenteral trace minerals and vitamins

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Objectives: Beef cattle fattening system, especially during receiving period, generates strong oxidative stress, affecting weight gain and carcass attributes. The objective of this study was to evaluate the effect of parenteral supplementation with minerals and vitamins that intervene in antioxidant defense during admission to a feedlot system on these parameters.

Materials and methods: The study was carried out in a commercial feedlot (CONECAR, Ganadera Santa Fé SA) located in Carcarañá, Santa Fé province, Argentina. Fifty-six Aberdeen Angus steers were used, with an average body weight (BW) of 321.1 ± 12.9 kg, which arrived at feedlot after a 750 km trip. At arrival (Day 0) the animals were randomly divided into two groups. The treated group (TG, $n=27$) received on Day 0 a subcutaneous injection with trace minerals (copper 40 mg, zinc 160 mg, manganese 40 mg and selenium 20 mg; ADAPTADOR MIN, Biogenesis Bagó, Argentina) and another with vitamins (vitamin A palmitate 238,000 IU and vitamin E acetate 200 IU; ADAPTADOR VIT, Biogenesis Bagó, Argentina), while the control group (CG, $n=29$) did not receive any treatment. The animals were weighed on Days 0, 17, 43, 55, 113 and 192 (the last weighing was done 3 days prior to slaughter). On Days 55 and 113, ultrasound scans of the carcass were performed to assess the ribeye area, backfat thickness, and percentage of intramuscular fat, while retail cut, yield grade, and marbling score were also assessed on day 113. On the day of slaughter, the carcass evaluation was carried out in the slaughterhouse to determine Yield and weight of the carcass. To evaluate BW, average daily gain (ADG), ribeye area, backfat thickness, and percentage of intramuscular fat, mixed linear regression models with repeated measures over time were used (PROC MIXED of SAS 9.4; SAS Institute Inc). Time (Days), Treatment (TG and CG) and their interaction were used as fixed effects, and the animal as random effect. Slice statement was used for detecting differences within each interaction. The retail cut, yield grade, marbling score, yield and carcass weight were analyzed with linear regression models with PROC MIXED, using Treatment as the only fixed effect. Data are presented

as least squares means \pm standard error of the mean. Values of $p \leq 0.05$ are considered significant and $p < 0.1$ and > 0.05 are considered tendencies.

Results: With regard BW, there were a Time effect ($p < 0.01$) and a Time \times Treatment interaction tendency ($p = 0.07$), because on Day 192 the TG had greater BW than the CG (570.8 ± 4.7 vs 557.7 ± 4.5 kg, respectively; $p = 0.04$). There were no differences for BW between the groups on the rest of the Days ($p > 0.05$). Regarding ADG, only a Time effect was observed ($p < 0.01$), although in the period between Days 43 and 55 the TG tended to gain more weight than the CG ($1,589$ vs $1,302$ kg/day, respectively; $p = 0.09$). Regarding the ribeye area, backfat thickness and percentage of intramuscular fat, only an Time effect ($p < 0.01$) was observed. There was no Treatment effect ($p > 0.1$) on Retail Cut (64.7 ± 0.2 vs $64.8 \pm 0.2\%$), Yield Grade (2.54 ± 0.04 vs 2.56 ± 0.04), Marbling score (4.34 ± 0.03 vs 4.32 ± 0.03) Yield (59.9 ± 0.3 vs $60.2 \pm 0.3\%$) and carcass weight (342 ± 3.5 vs 335.7 ± 3.4 kg; TG and CG, respectively).

Conclusions: It is concluded that under the conditions of this study, parenteral supplementation with minerals and vitamins that intervene in the antioxidant defense at the entrance of a fattening pen increased the weight of the animals at the end of the cycle, without modifying the carcass.

Keywords: Feedlot, body weight, carcass attributes, trace minerals, vitamins.

AH-P40

A longitudinal study of bovine trichomonosis incidence in Spanish beef mountain herds with different infection status

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Objectives: Bovine trichomonosis (BT) is a sexually transmitted disease considered a major cause of early reproductive failure in natural extensive breeding cattle. In the absence of effective vaccines and drugs, BT is controlled by diagnostic testing and culling of infected bulls. In Spain, BT is substantially spread among beef cattle herds and its control is voluntary¹. We observed that herds from mountain management systems are at greater risk for the introduction of the infection, which could be attributed to the relatively high local prevalence and specific management practices, such as the use of communal grazing lands^{1,2,3}. In the present study, a longitudinal study was carried out to compare infection incidence in three epidemiological scenarios: *i*) herds with BT-negative status (BT-negative herds); *ii*) herds with BT-positive status where infected bulls were eliminated to interrupt the transmission cycle (BT-cleared herds); and *iii*) BT-positive herds where positive bulls were maintained in the herd (BT-positive herds).

Effect of parenteral copper, zinc, and selenium supplementation on beef calves

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Objective

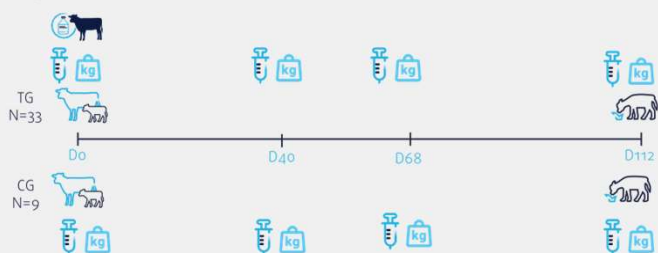
Micromineral deficiencies can reduce growth rate in calves in grazing cow-calf systems.

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Materials y Methods

The trial was carried out on a farm located in Graneros, Tucumán, Argentina. Forty-two Angus-crossbreed calves (20 females and 22 males; 97.4 ± 15.9 kg and 3 months of age) were used. They were kept as cow-calf pairs since day 0 of the trial until weaning (day 112). Calves were assigned into two groups. Treated group (TG; $n=33$, 16 females and 17 males) was injected subcutaneously with a solution of Cu (15 mg/mL), Zn (50 mg/mL) and Se (10 mg/mL; SUPLENUT® Se, Biogénesis Bagó, Argentina), at a dose of 1 mL/50 kg of body weight (BW) on day 0 of the trial. The Control group (CG; $n=9$, 4 females and 5 males) was injected with 1 mL/50 kg of saline sterile solution. Body Weight and blood samples (TG: 15; CG: 9) were taken on days 0, 40, 68 and 112. (Figure 1). Blood samples were collected in sodium heparin tubes to assess plasma Cu and Zn concentrations by atomic absorption spectrophotometer and GPx activity in whole blood by Ransel spectrophotometric kit (Randox Lab., UK). Data was analyzed with a mixed model for repeated measures over time using the MIXED Procedure of the SAS 9.4 (SAS Inst. Inc.). The model included the fixed effect of Treatment (Group), Time (day) and their interaction, and the random effect of calf. Slice statement was used for detecting differences within each interaction. Probability values <0.05 were considered significant.

Figure 1: Trial Activities

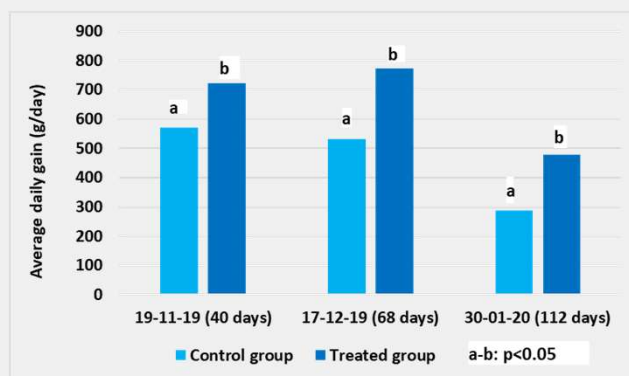


Results

There were a Treatment ($p=0.02$), Time ($p<0.01$), and Time x Treatment interaction ($p<0.01$) effects on BW. There were no differences between TG and CG on day 0 (98.5 ± 3.4 vs 93.1 ± 6.6 kg) and on day 40 (127.4 ± 3.4 vs 116 ± 6.6 kg), but the TG had higher BW on day 68 (150.9 ± 3.4 vs 129.2 ± 6.6 kg; $p<0.01$) and on day 112 (152.2 ± 3.4 vs 126.4 ± 6.6 kg; $p<0.01$) than the CG.

Regarding average daily gain (ADG), there were a Treatment ($p<0.01$) and Time ($p<0.01$) effects, but there was no effect of their interaction ($p=0.18$). Treatment group had higher ADG than CG from days 0 to 40 (721 ± 27 vs 572 ± 53 g/day; $p=0.01$), days 0 to 68 (773 ± 28 vs 531 ± 53 g/day; $p<0.01$) and days 0 to 112 (479 ± 27 vs 286 ± 54 g/day; $p<0.01$). (Figure 2)

Figure 2. Effects of copper, zinc and selenium supplementation in beef calves on average daily gain.



There were a Treatment ($p=0.04$), Time ($p<0.01$), and Time x Treatment interaction ($p<0.01$) effects on plasma Cu concentration. Treatment group had lower plasma Cu concentration than CG on day 0 (42.7 ± 3.6 vs 57.6 ± 4.7 $\mu\text{g/dL}$; $p=0.02$), but TG had higher plasma Cu concentration than CG on day 40 (49.4 ± 3.6 vs 24.1 ± 4.7 $\mu\text{g/dL}$; $p<0.01$) and on day 68 (33.3 ± 3.7 vs 17.1 ± 4.7 $\mu\text{g/dL}$; $p<0.01$). There was no difference between groups at day 112 (23.3 ± 4.2 vs 10.6 ± 6.5 $\mu\text{g/dL}$, TG vs CG, respectively; $p=0.11$). Plasma Zn concentration was affected by Time ($p<0.01$), without effect of Treatment or Time x Treatment interaction ($p=0.39$). There were a Treatment ($p<0.01$), Time ($p<0.01$), and Time x Treatment interaction ($p<0.01$) effects on GPx activity. There was no difference between TG and CG on day 0 (16.1 ± 3.5 vs 15 ± 4.5 U/mL hematocrit; respectively; $p=0.84$), TG had higher GPx activity than CG on day 40 (75.2 ± 3.5 vs 18.3 ± 4.5 U/mL hematocrit; $p<0.01$), on day 68 (95.9 ± 3.5 vs 20.6 U/mL hematocrit; $p<0.01$) and on day 112 (44.1 ± 3.7 vs 20.4 ± 4.5 U/mL hematocrit; $p<0.01$).

Conclusions

The results indicate that parenteral Cu (0.3 mg/kg), Zn (1 mg/kg) and Se (0.2 mg/kg) supplementation on pre-weaning beef calves increase BW and improve Cu and Se status.