SELENIUM SUPPLEMENTATION ENHANCES WEIGHT GAIN IN CATTLE

SUPLEMENTAÇÃO COM SELÊNIO AUMENTA GANHO DE PESO EM BOVINOS

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SUMMARY

To evaluate the effect of selenium on cattle growth in a continuous grazed pasture system. Selenium was added to protein-mineral salt and given to male, around-12-month old, non-castrated Nellore calves. Animals were randomly and equally distributed into 4 groups (15 calves/group) which received supplementation containing 0, 3.6, 5.4 or 6.4 mg selenium/animal/day (groups Gc, G3.6, G5.4 and G6.4, respectively). The animals were weighed on day zero and 120, and the pasture forages were collected at day 0 for chemical analyses. Weight gain was higher in cattle from G5.4 (45.58%) than in the other groups, and higher in G3.6 (24.97%) and G6.4 (22.67%) than in Gc. The supplementation with 5.4 mg selenium/animal/day enhanced weight gain in cattle fed on selenium poor diet (0.04 mg of Se/kg dry matter).

INTRODUCTION

Selenium is an essential element for human beings and other animals. It participates in cell antioxidant processes, constitutes many selenoproteins, like glutathione peroxidases (GSH-Px), which protect tissues against oxidative damage, and thus maintains both cell and tissue integrity (Carvalho et al., 2003).

On the other hand, selenium deficiency in cattle which makes diagnosis difficult and leads to high economic losses (Peixoto et al., 2003), causes white muscle disease or nutritional muscle dystrophy (Carvalho et al., 2003), decrease in growth, carcass yield
and milk production (Peixoto et al., 2003), increase in fertility problems and leads to increased mortality (Ivancic and Weiss, 2001). Selenium is toxic for cattle in overdose quantities, causing blindness, salivation, rough and non-lustrous hair, hoof deformation, claudication, abdominal pain, emaciation, hepatic cirrhosis, cardiac atrophy, lethargy and depression (Carvalho et al., 2003).

The present study investigated the effect of selenium ingestion on cattle growth in a continuously grazed pasture, by adding different amounts of selenium into the protein-mineral salt that was given to cattle.

MATERIAL AND METHODS

Sixty male, non-castrated Nellore calves (Bos indicus) aged about 12-months were studied. These animals were adapted to the climatic conditions of the farm in Lutécia, SP, Brazil, where the experiment was carried out.

The calves were randomly divided into 4 groups (15 individuals each group): Gc, G3.6, G5.4 or G6.4, in which they received 0, 18, 27 or 32 mg selenium/kg protein-mineral salt, respectively, for 150 days. In this period, the salt consumption was estimated at 200 g/animal/day and the animals consumed 0, 3.6, 5.4 or 6.4 mg selenium/animal/day (Gc, G3.6, G5.4 and G6.4, respectively).

The experiment was carried out in 150 days. In the first 30 days, the cattle were allowed to adjust to the protein-mineral salt and pasture and on the 3rd day selenium supplementation started.

Cattle rotated from one paddock to another every 30 days, and thus each group stayed at least once in each paddock. The protein-mineral salt was administered to cattle in a covered, wooden feeder and waterers were placed 50 m from the water.

The cattle were weighed on days 31 and 120 in the morning, without prior feeding restriction and before drinking water.

The protein-mineral salt (Matsuda Top Line Recria®, Matsuda Seeds and Animal Nutrition, Alvares Machado, SP, Brazil) is composed of calcium, phosphorus, magnesium, sodium, cobalt, copper, sulfur, iron, iodine, manganese, zinc, nickel, maximum fluorine: 650 mg; vitamin A, D and E; metabolizable energy, maximum equivalent protein from non-protein nitrogen: 140 mg, buffer and solubility of phosphate in 2% citric acid: 95%.

Pasture forages were Brachiaria decumbens in paddocks I, II and III, and Brachiaria brizantha in paddock IV. On day 0 a sample of these plants was collected at pasture height (20 cm above the soil) from each paddock for further chemical analyses.

Selenium concentration in the leaves of pasture forages was determined by graphite furnace atomic absorption spectrophotometer. Dry matter, crude protein, ether extract, crude fiber concentration and mineral matter from forages were determined as recommended by the Association of Official Analytical Chemists (AOAC, 1990); total digestible nutrients and non-nitrogenous extract was determined as proposed by Neves et al. (2002).

Weight gain among treatments (Gc, G3.6, G5.4 and G6.4) were compared by one-way ANOVA followed by Tukey multiple comparisons test (Zar, 1999).

RESULTS AND DISCUSSION

The paddock rotation allowed animals from all the groups to have similar pasture conditions during the experiment. Forage chemical analyses revealed similarity among pasture quality on day 0 (table I). The mean live weights of cattle from the experimental groups at the beginning (Gc = 182.53±10.30; G3.6 = 180.27±12.61; G5.4 = 174.60±7.88; G6.4 = 183.00±7.86) and at the end of the experiment (Gc = 237.00±17.75; G3.6 = 247.40±21.29; G5.4 = 252.40±17.20; G6.4 = 248.60±14.14). This result reinforces that any weight difference among groups must be derived from the selenium treatments.
According to the National Research Council – NRC (1996), beef cattle need 0.1 mg Se/kg forage. Thus, selenium concentration in the forage plants sampled from all the paddocks (0.04 mg Se/kg forage) evidences that the study area is selenium deficient.

NRC (1996) reports that animals fed on forage containing 0.02-0.05 mg Se/kg may present decrease in weight gain. In fact, such weight loss was detected in cattle from group Gc, which fed on forage plants containing only 0.04 mg de Se/kg and not supplemented with selenium. In this group other symptoms of selenium deficiency, such as white muscle disease or nutritional muscle dystrophy, were not detected. This result is in accordance with Pavlata et al. (2002) who also observed changes in the performance of selenium-deficient calves.

Weight gain in the animals from G5.4, which were supplemented with 5.4 mg selenium/animal/day, increased 45.58% over the control group. This dosage is beneficial for cattle growth and weight gain, and the animal did not present any symptom of intoxication by selenium. These results corroborate those obtained by Witchtel et al. (1994) also found a 15% increase in growth in calves that received intra-ruminal selenium pellet. However, Lawler et al. (2004) reported no effect of both diet concentration and source of Se on performance, traits and carcass quality in heifers.

Weight gain was similar between cattle supplemented with 3.6 and 6.4 mg selenium/animal/day (groups G3.6 and G6.4, respectively), as was similar between these groups and the control group (Gc) (figure 1). Thus, these supplementation levels are undesirable since they do not bring any benefit for weight gain in Nellore calves and still increase mineral supplementation costs.

The animals supplemented with 6.4 mg selenium/animal/day decreased weight gain by 15.68% as compared to group G5.4 (figure 1). This result agrees with Jekins and

Table I. Chemical analyses of the pasture forage Brachiaria decumbens from paddocks I, II and III and B. brizantha from paddock IV.
(Análise química das forragens Brachiaria decumbens dos piquetes I, II e III e B. brizantha do piquete IV).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Paddocks I</th>
<th>Paddocks II</th>
<th>Paddocks III</th>
<th>Paddocks IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDN (%)</td>
<td>62.54</td>
<td>61.54</td>
<td>61.13</td>
<td>62.35</td>
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<tr>
<td>CP (%)</td>
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<td>3.80</td>
<td>4.10</td>
<td>6.40</td>
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<tr>
<td>CF (%)</td>
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<td>26.10</td>
<td>27.00</td>
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<td>2.60</td>
<td>2.40</td>
<td>2.45</td>
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<tr>
<td>NFE (%)</td>
<td>61.40</td>
<td>60.30</td>
<td>59.30</td>
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<tr>
<td>MM (%)</td>
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<tr>
<td>Se (mg/kg)</td>
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<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
</tbody>
</table>

TDN: total digestible nutrients; CP: crude protein; CF: crude fiber; EE: ether extract; NFE: nitrogen free extract; MM: mineral matter.
Hidroglu (1986), who observed decrease in weight gain in calves supplemented with 10 mg Se/kg. This effect was observed in group G6.4, probably because the selenium level used was too high to supplement calves. However, other intoxication symptoms were not observed in calves from group G6.4.

In conclusion, this study recommends a supplementation of 5.4 mg selenium/animal/day to enhance weight gain of animals fed on selenium-poor diets (0.04 mg Se/kg dry matter).

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REFERENCES