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Mineral requirements for growth of Moxotó goats grazing in the semi-arid region of Brazil

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ABSTRACT

Indigenous goats play an important role in the semi-arid region of Northeastern Brazil as a biological resource with great genetic variability and historical value. In addition, they are a source of animal protein of high biological value, available to people of low income. However, there is a lack of information about these animals, mainly regarding their nutritional requirements. Therefore, the objective of this study was to determine net requirements of Ca, P, Mg, Na and K for growth of 36 male Moxotó goat kids (15.69 ± 0.78 kg initial BW), grazing in the semi-arid region of Brazil. Four kids were slaughtered at the beginning of the experiment (baseline group, 15.37 ± 0.30 kg BW) and the remainder (n = 32) were allocated randomly to one of the four levels of concentrate supplementation (treatments groups: 0, 0.5, 1.0 and 1.5% BW), with eight kids per group. When the animals in the 1.5% BW treatment group reached 25 kg BW, the animals in the other treatment groups were also slaughtered. The individual whole empty body was weighed, ground, mixed and sampled for chemical analyses. The body composition (g/kg empty body weight; EBW) ranged from 10.80 to 11.50 g Ca; 7.86 to 8.74 g P; 0.37 to 0.42 g Mg; 1.57 to 1.61 g Na and 1.58 to 1.74 g K, for Moxotó kids at 15 and 25 kg BW. The net mineral requirements (g/kg empty weight gain; EWG) were determined by comparative slaughter technique which ranged from 9.53 to 10.65 g Ca; 7.41 to 8.65 g P; 0.36 to 0.43 g Mg; 1.31 to 1.41 g Na and 1.47 to 1.70 g K for animals with BW ranging from 15 to 25 kg. In conclusion, our study indicated that indigenous goats grazing in the semi-arid region of Brazil have different mineral requirements from those values recommended by international committees for dairy and meat goats.

1. Introduction

Minerals are essential to the animals, participating as structural components of tissues, and acting in body fluids as electrolytes to maintain the acid–base balance, the osmotic pressure and permeability of cell membranes (Underwood and Suttle, 1999). Mineral deficiency has been reported in literature as responsible for low production, and reproductive disorders have been widely observed among ruminants.

It is noteworthy that not enough importance has been given to mineral nutrition of animals, especially goats. This statement is justified by the scarcity of information on this subject. The requirements in minerals for goats worldwide have been empirically estimated by the extrapolation of the requirements for cattle and sheep (ARC, 1980; NRC, 1981; AFRC, 1998). Despite similarities between cat-

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Table 1
Chemical composition of the experimental concentrate and extrusa (% of dry matter).

Item	g/kg DM						
	Corn[a] meal	Soybean meal	Wheat meal	Cotton meal	Extrusa[b]	Limestone	Mineral supplement
Dry matter	870.6	863.4	888.8	866.8	231.0	–	–
Crude protein	939.0	458.3	150.8	336.0	118.7	–	–
Calcium	0.22	2.24	1.07	1.18	23.45	234.85	123.74
Phosphorus	7.81	3.84	5.54	2.89	7.42	0.74	62.55
Magnesium	3.31	3.02	4.26	3.71	4.58	1.64	4.63
Sodium	0.49	0.54	0.48	0.42	15.27	0.40	64.39
Potassium	0.21	0.43	0.25	0.24	11.30	0.08	0.15

[a] By-product from corn flakes manufacture.
[b] The collection, sampling and analyses of DM and CP were done according Gonzaga (2007).

tle and sheep, goats show differences in the grazing habits, physical activities, water consumption, food selection, milk composition, carcass composition, metabolic disorders and parasites (NRC, 1981).

The information on macromineral requirements reported in the NRC (2007) for goats were from a review conducted by Mesch (2000). This author presented a review on the assessment of mineral requirements for goats, with the intention of proposing more appropriate recommendations for this species. However, the recommendations presented by the author are based on feeding tests developed over the course of several years.

Studies on nutritional requirements in Brazil have been conducted in feedlot regimen. However, it would be desirable to estimate these requirements in conditions identical to those in which the animal is traditionally raised in its region of origin. In addition, it is necessary to study the native or naturalized animals, which are characterized as rustic animals adapted to the origin conditions due to the natural selection process that were submitted over the years and are currently considered as valuable genetic material (Rocha et al., 2007).

In literature, there is wide variation in the body composition values, and therefore in the mineral requirements for goats due to differences between production systems, breeds, diets, weather, in addition to different methodologies used in determining these parameters. Goats have a greater bone:meat ratio in the body (AFRC, 1998) and increase in body calcium is slower than in sheep (Pfeffer and Keunecke, 1986; Pfeffer, 1989; Kessler, 1991; Pfeffer et al., 1995). When compared to sheep and cattle, goats have better phosphorus recycling through saliva, hence, greater concentration of this mineral in saliva (Kessler, 1991) and absorb more phosphorus from the diet (70–75%; Mesch, 2000). The present study was carried out to estimate the net requirements of Ca, P, Mg, Na and K for growth of Moxotó goat kids grazing in the semi-arid region of Brazil.

2. Material and methods

The experiment was conducted at the Experimental Station at the Federal University of Paraiba - UFPB, located at the municipality of São João do Cariri (Paraiba, Brazil), between coordinates 7°29′34″ S and 36°41′53″ W. The climate is Bsh type – hot semi-arid, according to the Koopen classification, and vegetation is typical of *Caatinga*. The average maximum temperature during the experimental period was 31.45 °C, and the average minimum was 20.11 °C, relative humidity was 61.2% and there was 44.26 mm of rainfall. Humane animal care and handling procedures were followed according to the university's animal care committee.

Thirty-six Moxotó castrated kids with average initial body weight (BW) of 15.69 ± 0.78 kg at about 4 months old were used. Four animals were slaughtered at the beginning of the experiment, with 15.37 ± 0.30 kg of BW, representing the initial body composition (baseline group; BL). The remaining kids ($n = 32$) were allocated randomly to four treatments that consisted of four concentrate supplementation levels (treatment groups: 0, 0.5, 1.0 and 1.5% BW). These kids were pair-fed in eight slaughter groups. A slaughter group consisted of one kid from each treatment, and they were slaughtered when the animals from group 1.5% BW reached 25 kg BW.

The animals had access to native pasture from 7 a.m. to 4 p.m., when they were collected in a pen equipped with individual stalls of 2.0 m × 1.0 m, without coverage, with ground floor, to receive the supplementation. The animals had free access to drinking water, and the collective fountains were located at the management center and the experimental concentrate was the same for all treatments, varying only the amount offered to the animals once a day (4 p.m.). The refused feed was weighed, recorded and sampled in the morning of the next day.

The chemical composition of the experimental concentrate ingredients is presented in Table 1. This was calculated according to NRC (1981) to allow a growth rate of 150 g/day for the animals with 1.5% BW supplementation level. The amounts of ingredients and nutrients of the experimental concentrate are presented in Table 2. To control the growth and adjust the concentrate supply, the animals were weighed weekly, before feeding, with a scale with precision of 0.1 kg.

The experimental area was composed of two paddocks of approximately 8 ha each. The occurrence percentage and the availability of botanical components analyzed in the experimental area during the

Table 2
Ingredient and chemical composition of the experimental concentrate (g/kg DM).

	g/kg DM
Ingredient	
Corn meal[a]	580
Soybean meal	270
Wheat meal	50
Cotton meal	50
Limestone	10
Mineral supplement	40
Composition	
Dry matter	875.85
Crude protein	202.55
Gross energy (Mcal/kg DM)	4.30
Digestible energy (Mcal/kg DM)[b]	3.83
Metabolizable energy (Mcal/kg DM)[c]	3.14
Calcium	8.14
Phosphorus	8.50
Magnesium	3.34
Potassium	0.27
Sodium	3.05

[a] By-product from corn flakes manufacture.
[b] Computed from digestibility coefficient of the gross energy.
[c] Estimated considering 82% of digestible energy (NRC, 1989).