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EVIDENCE OF LOW SODIUM STATUS IN BEEF CATTLE GRAZING COLONIAO GUINEA GRASS PASTURE

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Summary

Steers and cows with calves a foot grazed (Panicum maximum cv. Coloniao) pasture for 72 d. The adult cattle showed significant lowering in salivary sodium (Na) concentration with concommitant increases in potassium (K) concentration compared with cattle grazing mixed grass swards. These changes were indicative of a low Na status, Milk concentration of Na and K were not affected.

The Coloniao guinea grass contained a mean level of 0.018% Na whereas other grasses growing under the same soil conditions varied in Na content from 0.115 to 0.700%.

I. INTRODUCTION

Playne (1970) suggested that the levels of sodium (Na) in some tropical grasses are below those considered sufficient for the requirements of lactating cows. We examined the concentration of Na in guinea grass from a number of areas in Queensland. Levels in creeping guinea (P. maximum Q 8132), P. maximum cv. Coloniao, P. maximum cv. Hamil and P. maximum (C.P.I. 37910, Makeuni) ranged from 0.007 to 0.014, 0,011 to 0.025 and 0.007 to 0.027% from granite, mixed alluvial and basalt soils respectively, In view of these low levels, we examined some physiological parameters in beef cattle grazing predominantly Coloniao guinea grass.

II. MATERIALS AND METHODS

(a) Pastures

Two 1.5 ha paddocks at the Animal Husbandry Research Farm, Rocklea were sown with Coloniao guinea in October, 1970. These were heavily grazed in the summer of 1971 to prevent other grasses present from seeding and by 1972 a relatively pure stand of Coloniao guinea was available. Other paddocks used in the experiment contained predominantly Cynodon dactylon and Paspalum dilatatum pastures.

(b) Animals and Management

Six Hereford cows and six Shorthorn steers grazed the Coloniao guinea pasture (Group I) and were rotated between paddocks at weekly intervals. The cows calved in the paddocks from 6 to 24 d after the commencement of the experiment. For comparison, measurements were made on a group of four Hereford cows and four Shorthorn steers grazing Cynodon dactylon and Paspalum dilatatum pastures (Group II). At the commencement three of these cows had calves ranging in age from 2 to 21 d and the fourth cow calved 11 d later.

Animals were removed from their paddocks only for weighing and sampling, care being taken to ensure that Group I did not graze outside their paddocks on these occasions, All cattle received Brisbane city water containing about 50 p.p.m. Na.

(c) Sampling

The experimental period commenced in late February 1972 and concluded 72 d later. On d 0, 16, 28, 44, 56 and 72 saliva samples were taken from the cows and steers. The calves were sampled on d 44, 56 and 72 only. Two samples of mixed saliva were collected on each occasion from the adult cattle and one from the calves by the method described by Murphy and Connell(1970).

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Samples of milk were obtained on d 16, 28, 44,56 and 72, Total milk production was estimated for each cow 42 d after calving by removing the calf for 24 h then machine milking immediately following an intravenous injection of 10 I.U. oxytocin.

At each sampling period the cattle were weighed and pasture samples were taken for Na and K analysis, Coloniao guinea was cut about 10 cm above ground level and analysed either as whole plant or top, middle and bottom third of the plant,

Soil samples were taken from one of the Coloniao guinea paddocks using a routine auger technique.

(d) Chemical Methods

Na and K concentrations in saliva and milk were estimated with an Instrumentation Laboratories Model 143 flame photometer, For pasture samples, an EEL flame photometer was used and allowances were made for interferences of calcium and phosphorus; Method A of Loveday, Beatty and Norris (1972) was used for soil analyses.

III. RESULTS

The mean ionic concentrations of the saliva are shown in Table 1. The Group I cows showed a significant reduction in Na and concommitant elevation of K concentrations from d 16 onwards, Group I steers had significantly lower salivary Na concentrations than Group II steers on d 28 and 44. Group I calves had lower Na levels than Group II calves, but this was significant only at 56 d.

Following the 72 d sampling, Group I cows and calves grazed pastures similar to those of Group II animals. Thirteen days later the mean saliva Na and K levels (m-equiv./1) of Group I cows were 146.6 ± SD 8.0 and 7.3 ± 4.2 respectively and of the calves, 149.6 ± 6.2 and 5.5 ± 1.0 respectively.

There were no differences in the Na level in milk at each of the five sampling times and mean values ranged from 15.4 to 24.5 m-equiv./1. The K level in milk was significantly different between treatments only on d 44(46.6 Group I v.43.5 Group II; $P < 0.05$) and mean values ranged from 41.7 to 46.0 m-equiv./1. The-overall mean 24 h milk yield was 2.8 ± SD 1.04 1 containing 25.7 - 5.2 m-equiv./1 Na giving a mean daily excretion at 6 weeks lactation of 1.63 - 0.63 g Na.

No problems were associated with calving and all cattle appeared in good health throughout the experiment, There was no difference in live weight change, calf growth rate or milk yield between cattle of Groups I and II. The initial live weights (kg) of all cows and steers were 411.1 ± SD 31.6 and 267.4 ± 45.0 respectively and 72 d live weights were 357.5 ± 24.0 and 253.6 ± 38.8.' The calves weighed 45.0 ±13.1 at 28 d and 67.9 ± 14.6 at 72 d.

The mean Na level in the Coloniao guinea grass was 0.018% (DM) ranging from 0.008 to 0.024%. There were no marked differences in the Na levels present at different plant heights. Group II grazed grasses varying in Na content from 0.115 to 0.700%. The Coloniao guinea paddocks contained a small amount of other grasses which ranged in Na content between 0.023 and 0.613%.

The total cation exchange capacity of the soil from the Coloniao guinea paddock and the exchangeable K and Na (m-equiv./100 g) were 29, 0.55, 0.32; 30, 0.30, 0.36; 31, 0.20, 0.90; 27, 0.18, 2.00 at depths of 040, 10-20, 20-40, and 40-60 cm respectively.

IV. DISCUSSION

The depressed concentration of Na and the concommitant increase in K in the saliva of cows grazing Coloniao grass was of the order originally reported by Bott et al. (1964) in Na deficient cattle and similar in magnitude to levels found in intensively fed cattle exhibiting Na deficiency (Murphy, Morris and Gartner 1970 ; Morris and Gartner 1971; Morris and Murphy 1972) and more recently in Na deficient cows grazing native pasture (Murphy and Plasto 1973). Although our cows exhibited

TABLE 1

Mean Concentration of Na and K (m-equiv./l in saliva from cows, steers and calves grazing either *Coloniao guinea* (Group I) or *Cynodon dactylon* and *Paspalum dilatatum* (Group II) pastures

Day	Ion	I		II		Average	I	II	Average
		Cows	Steers	Cows	Steers	SE	Calves*	Calves*	SE
0	Na	143.3	152.1	146.0	147.3	4.0			
	K	12.3	5.9	6.2	8.2	2.9			
16	Na	81.9c,d,e	124.0c	137.2d	137.3e	6.9			
	K	64.8c,d,e	29.2c	13.7d	11.6e	7.2			
28	Na	74.5c,d,e	114.6a,b,c	154.4a,d	151.8b,e	9.5			
	K	77.4c,d,e	35.4a,b,c	5.6a,d	7.1b,e	9.0			
44	Na	55.0c,d,e	128.4a,c	140.9d	146.4a,e	5.9	118.0	131.7	4.2
	K	96.1c,d,e	14.9c	9.3d	6.2e	6.9	11.1	8.3	1.3
56	Na	70.7c,d,e	135.9c	152.7d	154.5e	7.3	101.8a	142.9a	9.5
	K	79.4c,d,e	15.9c	5.4d	6.0e	7.7	25.1	5.8	7.0
72	Na	93.6c,d,e	132.4c	152.7d	151.9e	6.9	117.8	141.3	7.5
	K	56.3c,d,e	18.9c	5.2d	5.1e	7.5	15.4	10.1	4.5

* Calves compared separately to cows and steers

Means in the same row with the same notation are significantly different; a,b denote $P < 0.05$; c,d,e denote $P < 0.01$

this low Na status, productive differences were not demonstrated. This could be attributed to the declining plane of nutrition as shown by the weight loss of the steers and to the relatively short period on test. By comparison our steers were not as deplated, as judged by salivary levels, as the cows which had to meet the lactational loss of Na.

Van Leeuwen (1970) estimated that pastures containing 0.07% Na are suboptimum in Na for lactating dairy cows and that the requirement is about 0.15%. The level of 0.018% in the Coloniao guinea pasture was well below these estimates. A liberal assumption of 10 kg DM intake of this pasture would provide 1.8 g Na daily, total intake being about 3.0 g after allowing for the Na provided by the drinking water. The Agricultural Research Council (1965) gives the Na requirement as 11.7 g for 5 kg milk yield. Thus the Na requirement of our cows producing only 2.8 kg milk would be less than 11.7 g but greater than 3.0 g to maintain normal Na homeostasis.

The concentrations of Na and K in milk were not significantly different between treatments and were similar to those reported by Murphy and Plasto (1973).

Pasture species present with the Coloniao guinea had up to thirty times greater levels of Na. Although Na was relatively low in the surface soil, levels in the sub-soil were moderately high and the analyses did not indicate a nutrient deficiency. Thus we conclude that Coloniao guinea and other varieties of guinea grass may have a poor capacity for Na uptake and when cattle, particularly lactating cattle, graze these pastures exclusively a deficiency of Na could result.' As requirements of Na are a function of milk yield (Agricultural Research Council 1965), the effect in lactating dairy cows could be quite marked compared with the relatively low milk producing beef breeds.

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