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Determine of Feed Potassium and Calcium by Goats Grazing at Natural Range, West Kordofan, Sudan

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ABSTRACT

This study was conducted at El-khuwei locality, west Kordofan, Sudan, during the flowering and seed setting stages on the natural range land in year 2011. The main objective of this study was to determine the macro minerals in the feed potassium K and calcium Ca at the flowering and seed setting stages on the natural range land. Sampling was done by locating 2 km 2 each stage at the plants maturity (flowering and seed setting stages). A completely randomized design (CRD) was used to selected samples of feed. The results indicated that stages effect on feed macro minerals concentration were significantly ($P<0.001$) higher potassium K (0.22 ppm) concentration at the flowering stage and lower potassium K (0.07 ppm) concentration at the seed setting stage. There was increased calcium Ca (8.02 ppm) concentration at the flowering stage and decreased Ca (6.76 ppm) concentration during the seed setting stage.
Keywords: Stages, feed, potassium, calcium, goat.

INTRODUCTION

Ruminants grazing forages in severely mineral-deficient areas may be more limited by this condition than by lack of energy or protein (McDowell and Conrad, 1977). McDowell *et al.* (1983) stated deficiencies or imbalances of trace elements in soils and forages are responsible for low production and reproduction among grazing livestock. Miles and McDowell (1983) reported that pastures in Ethiopia are deficient in Calcium (Ca), Phosphorus (P), Sodium (Na) , Zinc (Zn) , Copper (Cu), Cobalt (Co), Sulfur (S) and Selenium (Se), but their Iron (Fe) and Magnesium (Mn) levels are too high. The potassium (K) content of plants is high compared with the potassium requirements of sheep and goat. Sadaqat *et al.* (1996) observed low levels of potassium 0.48-1.72 % in forages in Pakistan. On the other hand K concentrations in Kenyan forages were quite high (Abate, 1985). Masters and Feels (1990) reported that during autumn and summer, pasture contained adequate potassium 6-22 g per kg for sheep, the

highest concentrations being recorded in summer. Oil seed meals and green growing forages are excellent sources of K (Rick, 2007). Potassium deficiency for ruminants results in nonspecific symptoms such as slow growth, reduced feed and water intake, lowered feed efficiency, muscular weakness, nervous disorders and degeneration of vital organs (McDowell, 1992). Calcium is the most abundant mineral in the body, 90% of Ca is found in the bones and teeth (Rick, 2007). Calcium is normally one of the primary limiting factors in the diets of sheep and goat and hence need to be provided as supplement (Rick, 2007). Some of the important functions of Ca are blood clotting, membrane permeability, muscle contraction, nerve functions, and cardiac regulation and enzyme activations (Rick, 2007). Moreover, excess of macro elements, such as Ca can reduce clotting ability of blood and cause hemorrhagic conditions (Hall *et al.*, 1991). As dietary Ca intake increases, its absorption is reduced (Rick, 2007). There is evidence that deficiencies of elements such as Ca occur under farming conditions. Nutritional calcium deficiency is associated with weakness, poor animal performance that has swollen joints, lameness, weak bones, and a propensity for broken bones (Puls, 1994). Vitamin D is required for active absorption of calcium. The objective of this study was to determine feed K and Ca concentrations at the natural rangeland, west Kordofan, Sudan.

MATERIALS AND METHODS

Study Area

This study was conducted at El-khuwei locality (Longitudes 28˚:33' to 28˚:30'N and latitudes 12˚:14' to 14˚:12' E). The long term average annual rainfall is about 300-mm, consisting of storms of short duration between July and September with the highest rainfall generally occurring in August. The soil of the site lies within the sand dune area locally known as "Goz" soil. During the rainy season, forage biomass is suitable to provide sufficient feed for animals, but during the dry season forage is scarce and small quantities of grain are also fed to animals. The site is naturally dominated by grasses namely Huskneet (*Cenchrus biflorus),* Shilini (*Zornia glochidiata*), Bigail (*Blepharis linarifolia*) and Aborakhus (*Andropogon gayanus*). The trees included Humied (*Sclerocarya birrea*), Higlig (*Balanites aegyptiaca*) and Sider (*Zizuphus spina- Christi).* The Shrubs include Kursan (*Boscia senegalensis*), Usher (*Calotropis*), Mereikh (*Leptadenia pyrotechnica*) and Arad (*Leptadenia pyrotechnica)* according to MARF (2009).

Sampling and Experimental Study

Sampling was done on two stages of plant maturity at flowering and seed setting in selected locations (2 km^2 each), within each season randomly selected and collected thirty samples of feed.

Samples and Preparation of Macro Potassium and calcium

Feed sampling

Samples of feed were collected from those species that were most frequently grazed by goats at this range. The parameters measured diet botanical composition was estimated using the bite-count techniques, (Fadlalla and Cook, 1985). Within each season 60 goats was kept for this study. The first goat was followed for five times, and then the second one followed for another five minutes and so on for all goats. The procedure was repeated tine times, thus each goats followed for one hour in the first day, was also followed by observer for three days and 600 bites, and species of plant ingested and bite were recorded

Feed preparation

One gram of the dried forage sample was taken in a 50 ml conical flask, and kept overnight after adding 5 ml concentrated HNO_3 and 5 ml perchloric acid ($HClO_4$). Next day, again 5 ml

HNO_3 was added to each sample. All the samples were digested on hot plate at 250° C in fuming hood till the material was clear. After digestion the material was cooled down and the volume was made up to 50 ml with double distilled water and stored in clean airtight bottles for analysis of metal ions (Anon, 1990).

Laboratory analysis

Macro elements in the feed Calcium (Ca) were analyzed using atomic absorption spectrophotometer (Singh *et al*., 2005). Potassium (K) concentration was analyzed using flame photometer (AOAC, 1990).

Statistical Analysis

The data were analyzed using a completely randomized design (CRD) with the effect of stages as the whole plots and effects of sampling as the sub-plots (Steel and Torrie, 1980). SPSS version 10 (Statistical Package for Social Sciences, 1996) was used for the statistical analysis.

RESULTS

Feed Potassium and Calcium

Table 1 shown macro elements in feed during the flowering and seed setting stages at El-khuwei locality, west Kordofan State, Sudan. Stages effect were significantly difference (P<0.001) higher potassium K (0.22-0.07ppm) at flowering stage than that at seed setting stage respectively. Statistically there was no significant difference (P< 0.05) between calcium during flowering and seed setting, even thought there was increased calcium Ca (8.02-6.76ppm) at the flowering stage compared to seed setting stage respectively**.**

Table 1. Feed potassium and calcium during the flowering and seed setting stages at El-khuwei locality

Minerals	Stages		Mean	SE±	significant
	Flowering	Seed setting			
Potassium K (ppm)	0.22[a]	0.07[b]	0.15	0.02	**
Calcium Ca (ppm)	8.02	6.76	7.39	0.53	NS

[a,b] Values with the same raw bearing different superscript vary significantly at P <0.05 or P<0.001,
** = high significant (P < 0.001), ns= not significant

DISCUSSION

Feed potassium

Feed potassium showed significant effect of stages, higher K (0.22ppm) concentration were observed at flowering stage and less K (0.07ppm) concentration are found at the seed setting stage. Green growing forages are excellent sources of K (Rick, 2007). Higher forage K+ 2.11% concentrations were observed at rainy period and lower 1.60% values are found at the dry period, however, all mean feed concentrations were higher than the optimal values 0.60 % as suggested by Khan *et al.* (2009), this result is agreement and similar with study. The findings on plant K with a range of (1.58 - 37.1 g/kg) are similar to those recorded by Ramirez *et al*. (2001) who found higher K concentration in shrubs grazed by goats during summer than in other seasons; increased K 1.96 g/kg level during the cold wet season and decreased K 0.52g/kg during the hot dry season. During the hot dry season all the plants had adequate levels of K to meet adult goat requirements. With the exception of Azadirachta indicate (1.75 g/kg), all the plants collected had adequate levels of K in the cold dry season. Variation of K in plants within different seasons may partially be attributed to different stages of plant maturity at the time of sampling. Khan *et al.* (2009) reported variation of K in plants within different seasons may partially be attributed to different stages of plant maturity at the time of sampling and the translocation of minerals to the root system. Plant species such as

Balanites aegyptiaca (37.1 g/kg in the hot dry season) and Amaranth us spinosum (15.9 g/kg) had K concentrations as much as 10 times the required levels, high K concentrations first result in an Mg deficiency; when K is in greater imbalance, they will cause a Ca deficiency.

Feed calcium

Feed calcium was higher (8.02 ppm) concentrations at flowering stage and least (6.76 ppm) during the seed setting stage. Khan *et al.* (2009) reported mineral Ca concentrations and soluble carbohydrates may respectively increase and decrease dietary Mg requirements of livestock, whereas raised dietary P levels appears to lower the requirements for both Ca and Mg. Effect of seasonal differences was increased Ca 19.8 g/kg concentrations at cold season and decreased 8.05 g/kg at hot dry season, all browse plants had adequate levels of Ca (range 0.02 to 58.4 g/kg) to meet adult goat requirements of 1.3 to 3.3 g /kg in the diet (NRC, 2007) except Eleusine coracana which had Ca concentration below the required minimum during the hot dry season (0.02 g/kg) and in the wet season (0.36 g/kg). In another study Ca is not usually deficient, for optimal livestock performance, in foliage from browse plants that grow in tropical regions (Ramirez *et al*, 2001). Ca and P are both important in the development and maintenance of the animal's body; the recommended calcium to phosphorus ratio in the diet is a minimum of 2:1 and a deficiency of either or both in growing animals leads to poorly developed bones. However, in the present, this ratio was not achieved in any of the plants; goats are known to be tolerant to high Ca: P ratios. Forage Ca concentrations observed in our present reported were mostly similar to those study.

CONCLUSIONS

It can be concluded that at the flowering stage higher potassium concentration and least during the seed setting stage, however increased calcium at the flowering stage and decreased during the seed setting stage.

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