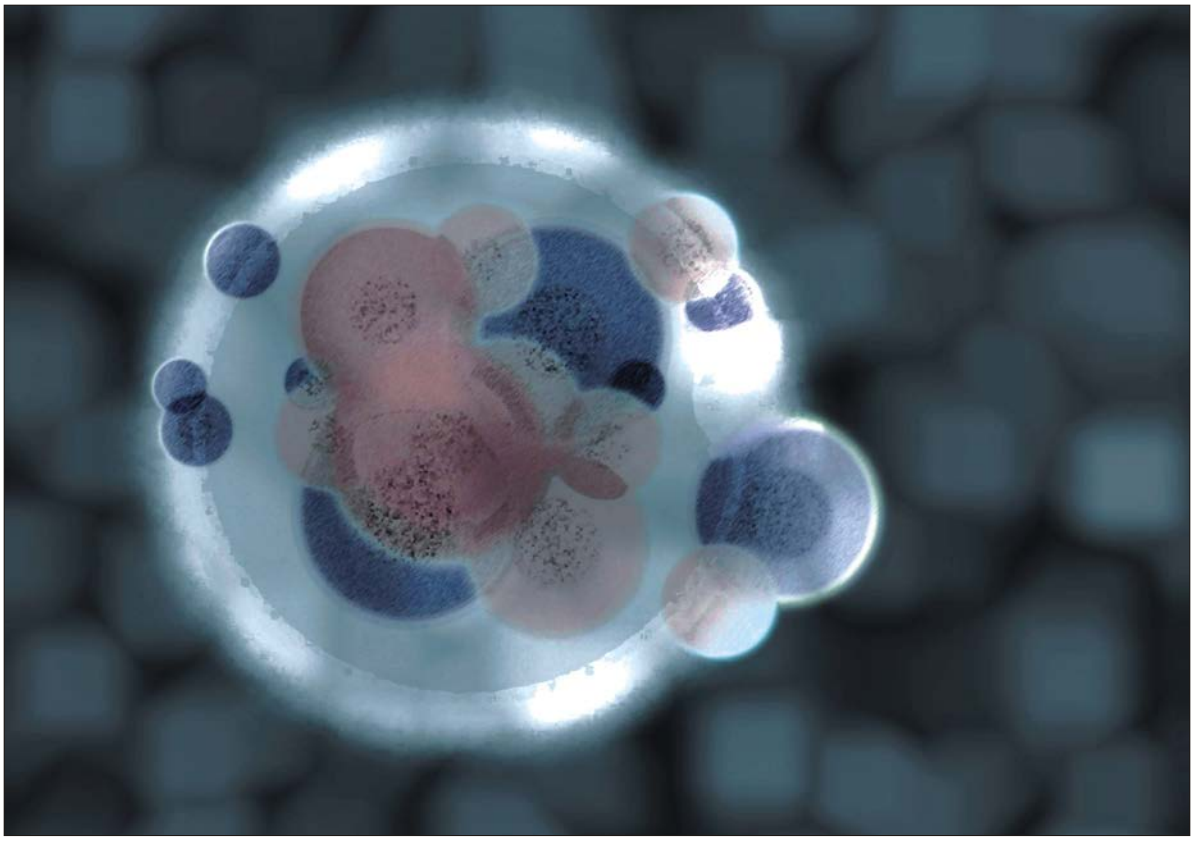

Journal of Biological Sciences

ISSN 1727-3048

science alert

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Journal of Biological Sciences 5 (5): 654-656, 2005
ISSN 1727-3048

Response of Tswana Goats to Mineral Supplementation under Intensive Management

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Abstract: This study was conducted at the Botswana College of agriculture Content Farm in Gaborone for a period of 90 days. Three groups of 18 Tswana bucks in a group of six each, designated A, B, C of almost the same age and weight were used. Group A bucks were fed Dolichos lablab (as a supplement) and Veldt grass (as basal diet) at a ratio 60:40 and water at *adlibitum*. Group B were fed as Group A with an addition of common salt (Sodium Chloride- NaCl) and Group C were also fed as Group A with an addition of a mixture of Dicalcium phosphate and common salt at a ratio of 1:1. The water, veldt grass and dolichos lablab leftovers were weighed daily and the mineral supplements weighed every two days, then all the consumed ration was calculated. The bucks were weighed fortnightly. The results showed that mineral supplementation had influenced the production of Tswana bucks as there was an improved weight gains on goats fed mineral supplements.

Key words : Tswana goats, mineral supplements, veldt grass, lablab

INTRODUCTION

Adequate mineral concentration and imbalance in animals are important as excessive amounts of one mineral may interfere with utilization of one or more other elements.

Sodium Chloride (NaCl) is common salt that serves as a source of mineral elements Sodium (Na) and Chlorine (Cl). It is the most common mineral supplement added to any livestock ration. It is a condiment, which stimulates the secretion of saliva and makes feed more palatable[1]. It occurs largely in the fluids and soft tissues of animal body [2]. Salt is used as a natural carrier for trace minerals or other material such as medicines or antibloating drugs since all animals have a natural appetite for it. It is also required for good animal production particularly for lactating animals and those species, which sweat profusely, as it maintains osmotic pressure in the extracellular and intracellular fluids and also maintains acid-base balance. It can be fed in loose form or as compressed blocks. Where soils are quite saline, it may not be necessary to feed salt nor will the consumption be very high if it is available. If mixed in feed, it should be fairly fine in texture, non-caking and free flowing. If Potassium Iodide (KI) is used, a stabilizer is usually added to preserve the Iodine content. Sodium is required for preservation of normal muscle cell irritability and permeability. Sodium makes up 93% of the basis of blood serum and thus it is the predominant basic element concerned with neutrality regulation. It is required in transmission of nerve impulses, active transport of nutrients and for muscle contraction and water balance[3]. Chlorine is found in large concentrations inside and outside the cells of body tissues. It regulates extracellular osmotic pressure[4]. It regulates acid-base balance, controls water balance, and also the formation of hydrochloric acid in the gastric juice. It is the chief anion of gastric juice where it unites with hydrogen ions to form hydrochloric acid[4].

Dicalcium Phosphate is one of the more common mineral supplements for both Calcium (Ca) and Phosphorus (P). Supplementary Ca and P are generally needed in many animal diets since the demands are higher than most minerals. They are used for skeletal growth, lactation, and egg production because many feedstuffs are borderline to deficient in these minerals. In herbivorous animals, phosphorus is usually more apt to deficient since more forage is relatively lower in P than in Ca. Most sources of Ca are well utilized by different animal species even though net digestion may be low particularly in older animals.

Calcium is the structural component of the skeletal transport by blood from the gastro internal tract to other tissues for utilization. It is required for normal blood coagulation and controls the excitability of nerve and body fluids. Calcium functions in bone mineralisation and metabolic regulation (cell signaling) and muscle contraction. Calcium is essential for skeletal formation, normal blood clotting, rhythmic heart action, neuromuscular excitability, enzymes activation and permeability of membranes[1]. Calcium is more abundant mineral in the body, needed for bone formation,

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development of teeth, production of milk, transmission of nerve impulses, maintenance of normal muscle excitability (along with Sodium and Potassium), regulation of heart beat, movements of muscles, blood clotting (conversion of prothrombin to thrombin) and activation and stabilization of enzymes (i.e. pancreatic amylase).

Phosphorus is a component of the skeleton, which provides structural support for the body. It is a component of phospholipids, which are important in lipid transport and metabolism and cell membrane structure. It is a component of high-energy phosphate bonds as a phosphate of RNA and DNA, the vital cellular constituent required for protein synthesis. It is a constituent of several enzymes such as cocarboxylase, flavoproteins, NAD. Ca and P are generally needed in many diets because they are required for skeletal growth or lactation and many feedstuffs are deficient in these minerals[3]. She also stated that, NaCl occurs largely in the fluids and soft tissues of animal body as they maintain osmotic pressure in the extra cellular and intracellular fluids and also in maintaining acid-base balance. Salt is also used as a carrier of valuable minerals and other materials because of its palatability to animals. She continued that, salt is included at 0.25-0.5% of total ration and most of the time it may be provided free choice.

Goat rearing is one of the important economic and social activities from which food, non-food commodities and income are derived in the villages especially by women. Traditional livestock farmers in Botswana do not supplement grazing ruminants with mineral except for salt. Consequently, grazing livestock must depend largely upon forage to supply their mineral requirements. The objectives of this study were to determine daily intake of Tswana goats fed Dolichos Lablab (*Lablab purpureus*) and veldt grass as basal diet. Also to determine growth rate of Tswana goats fed different mineral supplements.

MATERIALS AND METHODS

The study was conducted at the Botswana College of Agriculture's farm for a period of 90 days. Eighteen yearling male goats (bucks) were housed in individual pens measuring 1x1.5 m with concrete floor under a common roof using completely randomized design. All bucks were fed 40% veldt grass and 60% Dolichos lablab (*Lablab purpureus*) and each goat fed according to 4% of its body mass. Water was given at *ad libitum*. Six goats were fed only veldt grass and lablab which serve as control Group (A) while the other 12 were fed the basal diet and mineral supplementation. Six goats were offered Sodium Chloride (Common salt) *ad libitum* as the first mineral supplement treatment (B), while the other six were fed a 1:1 ratio mixture of Sodium chloride and Dicalcium phosphate as the second mineral supplement treatment (C). For this 1:1 ratio mixture, 50 kg of each mineral salt was used. Goats were fed these mineral supplements at *ad libitum*. The pens were cleaned daily before feeding again, and the lablab and grass leftovers were removed everyday. These leftovers were weighed with a platform electronic scale before being removed. Water which was also given at *ad libitum*, but measured before being offered to each buck, was also changed everyday with the leftovers measured with a measuring cylinder. The mineral supplement leftovers were weighed after every 2 days using a platform electronic scale. Goats were weighed fortnightly before the morning feeding. The experiment was set up in a completely randomized design and the data analysed by analysis of variance (ANOVA) at $p>0.05$ using computer Statistical Analysis System (SAS)[5]. Feed provided for the goats were analysed for mineral contents using procedure of AOAC[6].

Dolichos lablab and veldt grass, were collected in the sampling bags, weighed and then oven dried for 24 h at 105°C to determine dry matter.

RESULTS

The dry matter content was high in Dolichos lablab (88.70%), which was given as a forage supplement than in veldt grass (88.67%), which was fed as a basal feed (Table 1). Crude protein was high in Dolichos lablab (16.4%) compared to (9.31%) of veldt grass. Both veldt grass and Dolichos lablab are good sources of total minerals (ash) with the range of 10.83-10.87%, respectively. Major minerals Ca, P, N, K, Na and Mg varied for these two forages. Dolichos lablab had high quantities of P, N, Ca and K with Na being high in veldt grass. Minor minerals were also shown in Table 1 and they were Cu, Fe, Mn and Zn. Dolichos lablab had high contents of Cu as 3.55 ppm compared to 2.05 ppm of veldt grass. Veldt grass had high contents of other micro minerals compared to Dolichos lablab and they were 63.42 ppm compared to 15.04 ppm Zn, 873.68 ppm compared to 625 ppm Fe and 138.70 ppm compared to

Table 1: Composition of feed offered to the experimental goats

Mineral elements	Dolichos lablab	Veldt grass
Dry matter (%)	88.70	88.67
Ash (%)	10.87	10.83
ADF (%)	31.35	25.27
NDF (%)	48.22	35.27
ADL (%)	4.74	3.30
Crude protein (%)	16.4	9.31
Zinc (ppm)	15.04	63.42
Iron (ppm)	625.98	873.68
Phosphoms (%)	0.71	0.42
Calcium (%)	0.33	0.16
Magnesium (%)	0.50	0.43
Sodium (%)	0.001	0.09
Potassium (%)	2.69	0.45
Copper (ppm)	3.55	2.05
Manganese (ppm)	36.48	138.70

Table 2: Response of Tswana goats to mineral supplementation on body weight, feed and water intake

Parameters	Group (A)	Group (B)	Group ©	Significance
Initial body weight (kg)	23.980±0.870	24.083±0.811	24.170±1.0852	NS
Final body weight (kg)	30.170±0.496	31.23.±0.513	31.930±0.729	NS
Average body weight (kg)	24.850±0.372	25.490±0.913	27.330±0.606	NS
Body weight change (kg)	6.200±1.159	7.200±1.526	7.800±1.336	NS
Average daily gain (kg)	0.069±0.013	0.079±0.017	0.086±0.015	NS
Daily water intake	1021.640±4.591	1297.870±2.509	1484.680±2.537	*
Daily Veldt grass intake (g)	291.510±1.979	296.920±2.409	307.230±2.962	*
Daily Dolichos lablab intake (g)	494.330±1.672	512.240±11.643	514.050±2.015	*
Daily mineral supplement feed intake (g)	------	13.220±0.415	25.040±0.541	*

NS- Non-significant ($p>0.05$); *- Significantly difference ($p<0.05$)

36.48 ppm Mn, respectively. Table 1 showed ADF, NDF and ADL values for the two forage feeds. These were high in Dolichos lablab compared to veldt grass.

The goats supplemented on the ratio 1:1 mixture of dicalcium phosphate and common salt had slightly higher average daily gain with 0.086 and 0.079 kg/day compared to 0.069 kg/day for those goats in the control Group. The treatments effects on daily veldt grass intake, daily Dolichos lablab intake and daily water intake were significantly different ($p<0.05$) with the highest from those goats fed on the mixture of ratio 1:1 dicalcium phosphate and common salt. There was also significant difference ($p<0.05$) on daily mineral supplement feed intake with a high intake in those goats fed on a mixture of 1:1 ratio dicalcium phosphate and common salt as 25.04±0.514 g compared to 13.22±0.415 g of those fed on common salt only (Table 2).

DISCUSSION

Ruminants that depend primarily on forage to satisfy mineral requirements have suffered deficiencies in one or more minerals because concentration of mineral elements in forage depends upon interactions of factors such as soil, plant species, stage of maturity, yield, pasture management and climate[7]. Both macro and micro mineral serve different functions in the body of the animal. It is therefore important to know the mineral composition of particular feed given to the animal. Mineral deficiencies and toxicities do occur in animals due to imbalances of minerals in the body. Calcium and phosphorus are both important for the development and maintenance of the animal body. A deficiency of either or both in growing animals leads to poorly developed bones. Phosphorus is also important in maintaining adequate feed intake.

The daily veldt grass intake, Dolichos lablab intake and water intake were significantly different ($p<0.05$) in all the groups with those in Group C having the highest intake and those in Group A the least, (Table 2). Daily mineral supplement intake feed was also significant ($p<0.05$) with goats in Group C having the highest intake than those in Group B. Feed intake is affected by the chemical composition of the feed together with other factors such as physiological stage of the animal and type of feed. The average daily weight gain was slightly higher in Group C and least in Group A (Table 2). Dolichos lablab contained a high NDF, ADF and ADL values as indicated in Table 1. Mineral supplementation influence the body weight gains of Tswana goats therefore increased production. Tswana goats can be raised in dry lot on veldt grass and Dolichos lablab with mineral supplementation of Dicalcium phosphate and common salt in the ratio 1:1. Farmers should be encouraged to supplement their goats with at least affordable 1:1 ratio of Dicalcium phosphate and common salt in order to improve goat production.

REFERENCES

1. McDowell, L.R. and L. Russel, 1985. Animal Feeding and Nutrition. In: Nutrition of Grazing Ruminants in Warm Climates. Academic Press Inc. Harcourt Brace Jovanovich Publishers, San Doego, New York .
2. Aganga, A.A. and M. Nsinamwa, 1997. Ruminants Feeds and Feeding in Botswana, Government Printers. Gaborone, Botswana.
3. Aganga, A.A., 2000. Optimal Feeding of Grazing animals in Botswana. Proceeding of Livestock Feeding Systems Workshop Held at the Centre of In-service and Continuing Education, Botswana College of Agriculture, Gaborone, Botswana.
4. Church, D.C. and Pond, 1978. Basic Animal Nutrition and Feeding. O and B Books, USA.
5. SAS, 1995. User's Guide: Statistical Analysis System Procedures. SAS Institute, Inc., Cary, NC.
6. AOAC., 1995. Association of Official Analytical Chemists. Official Methods of Analysis. 16th Edn., Arlington, Virginia, USA.
7. Ramirez, R.G., T.A. Haelein and J. Reyna, 1996. Nutrient and mineral profile in white tailed deer (*Odocoileus virginianus*, texanus) diets in Northeastern Mexino. Small Ruminant Res., 23: 7-16.