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Calcium, Phosphorus, Sodium and Potassium Concentrations in Blood Serum of Yearling Goats Raised Semi-Intensively in Minna, North Central, Nigeria.

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ABSTRACT

The aim of this study is to evaluate the serum concentration levels of calcium, phosphorus, sodium and potassium in yearling goats raised semi-intensively. 5ml blood sample were obtained bi- weekly from the jugular vein of the yearling goats and poured into test tubes not containing anti-coagulants from which serum was obtained for electrolyte assay. The weight of the animals were also determined bi-weekly. The mean calcium, phosphorus, sodium and potassium levels obtained during the study ranges between 1.66±0.06 - 2.59±0.08; 12.71±0.57-140.29±2.57 and 3.33±0.06-4.79±0.26 mmol/L respectively. The result revealed that the levels of sodium and potassium obtained from the experimental goats were within the normal level required for the young growing goats. However, the levels of calcium and phosphorus fall below required levels. There was a progressive increase in the weight of the animals from week 2 to week 4; however, decrease in weight gain was evidenced from week 6 to week 8. It is recommended that supplementation of calcium and phosphorus minerals in form of free choice mineral supplement which are generally considered for livestock that do not have access to concentrates would seem most important for optimum productivity of grazing goats in the study area.

1. Introduction

According to Balicka-Raimisz (1999), goat is the most resourceful and efficient ruminant all over the world. Easy handling, adaptability to living free, modest feeding requirements and effective conversion of limited feed resources are desired factors favouring the goat as a stock animal for small scale farmers. Kidwell (2000) notes that goats make a valuable contribution to maintain the productivity of the pasture as they graze and so they fit in well with other enterprises, particularly cattle operations.

Meschy (2002) observed livestock to obtaining most of their minerals from the feeds and forages that they consume, and that their mineral intakes are influenced by the factors that determine mineral content of plants and their seeds. The concentration of all minerals in plants depends largely on; plant genotype, soil environment, climate and stage of maturity.

Macro-mineral (calcium, phosphorus, sodium and potassium) are required in larger quantities. Nutrient requirements of specific mineral elements vary depending on animal age, weight, stage of production, lactation status, breed, stress and bioavailability (Mc Dowell, 1997). Mineral element are dietary essentials for all animals and influence the efficiency of livestock production. Mc Dowell (1997) reported that approximately 5% of the body of an animal consists of minerals which are required for vital cellular processes in the body.

According to Agarwal *et al*. (2006), blood is a specialized body fluid that performs several vital functions hence, it has been frequently referred to as the seat of the soul. As such blood could be used in assessing the nutritional status of a particular animal. It has also been reported that animal tissue or fluid mineral concentrations reflect better availability of mineral than the forage mineral. Furthermore, blood is the most important bio-substrate

for the estimation of mineral status of animal (Khan *et al*., 2006). Therefore, this current study seeks to assess the levels of calcium, phosphorus, sodium and potassium in the blood serum of yearling goats within the study area.

2. Material and methods

2.1 Experimental Animal and Management

A ten (10) weeks experiment was conducted on 7 yearling goats (9-12months old) on grazing areas of Gidan Kwano campus of the Federal University of Technology, Minna North Central, Nigeria. The animals were allowed to acclimatize for a period of one week, during this period, they were dewormed using albendazole at the dosage rate of 5ml/10kg body weight. They were also treated against possible blood parasites using Terramycin long acting at the dose rate of 1ml/10kg body weight. Each animal was properly tagged for easy identification and were kept in the experiment pen being managed under semi-intensive system. They were tethered and each pole in the grazing area was numbered and the poles were tied with their tag numbers corresponding with each pole. Water and feed was giving to them *ad libitum*.

The animals were taken to the grassing area everyday as early as 8:00am in the morning and taken back to their pen by 6:00pm in the evening. They were weighed bi-weekly using a bathroom scale throughout the experimental period.

2.2 Blood Collection and Electrolyte Assay.

Blood samples were collected bi-weekly in the morning hours before the animals were taken out for grazing. 5ml blood sample from individual animal were drawn through the jugular vein (Frandson, 1986) using a 5ml syringe and poured into a test tubes not containing anti-coagulants. The sample bottles were immediately transferred to Bosso Veterinary centre where plasma was separated by centrifugation at 3000rmp for 20-30minutes, then placed in bottles and stored until analysis. Thereafter, the serum electrolyte; calcium, phosphorus, sodium, and potassium were determined spectrophotometically using (Bayer Express Plus Clinical Chemistry Analyser).

2.3 Statistical Analysis

The data obtained from the study was analysed using one way ANOVA for differences among mean mineral levels of the studied goats. The significant difference between means were tasted using Duncan's multiple range test. Data were represented by mean ± standard error (S.E). Means were considered significantly different when ($P<0.05$).

3. Results

Table 1 shows the mean serum calcium, phosphorus, sodium and potassium levels respectively. The mean calcium levels obtained in the study ranges between 1.66 ± 0.06 to 2.59 ± 0.08 mmol/L obtained in week 2, 1 and 4 respectively. The mean serum calcium level in week 2 (1.66 ± 06) differs significantly ($P<0.5$) from each other and within weeks. The mean sodium levels obtained ranges between $127.71\pm 0.57$to 140.29 ± 2.57 mmol/L obtained in week 2 and 10 respectively. However, week 2 and 6 differs significantly ($P<0.05$) from the values obtained in other weeks. The mean level obtain in week 2 differs significantly from the preceeding weeks.

The mean potassium levels obtained ranges between 3.33 ± 0.06 to4.79 ± 0.26mmol/L obtained in week 2 and 4 respectively. The mean potassium level in week 2 differs significantly ($P<0.05$) from the rest preceeding weeks having a much lower level of 3.33 ± 0.66 mmol/L as compared to $4.79\pm 0.26, 4.09 \pm 0.15$, 4.39 ± 0.31 and 4.41 ± 0.26 mmol/L obtained in weeks 4, 6, 8, and 10 respectively.

Figure 1 show the weight changes obtained throughout the study period. There was a progressive increase in weight from week 2 to week 4. However, there was a gradual decrease in weight from week 6 to 8 which gradually picked up again at week 10 of the experiment.

4. Discussion

In the present study, the mean serum calcium and sodium levels obtained was consistent with the value obtained in previous studies (Ikhimioya and Imansuen, 2007) where Dwarf goats fed *Panicum maximum* supplement with *Afzelia africana* and *New bouldia leavis* were 2.31 ± 0.08mol/L and 138.05 ± 2.55mmol/L. However, serum phosphorus and potassium level obtained were higher than what was obtained in the present study. Geographical factors and animal management practice might be responsible for the variations in the values obtained.

The mean serum calcium and potassium levels obtained also agrees with the finding of Sarmardzija *et al*. (2011), who studied the comparison of blood serum macro minerals concentration in meat and dairy goats in Zagreb,

Europe in which the serum calcium and potassium levels obtained in their study were 2.39± 0.02mmol and 4.88±0.08mmol/L respectively.

Daramola *et al*. (2003) in their findings on the determination of the haematological and biochemical parameters of West African Dwarf goats conducted in Ilorin, Nigeria, 2.7±1.4mmol 138.1 ±1.0mmol and 5.2 ±0.1mmol/L were obtained which were higher than those obtained in the present study. However, lower serum calcium level of 1.5±0.4±mmol/L was obtained from their result. Breed differences and different management practices might have been responsible for the variations noticed. Similarly, Sowande *et al*. (2008) in their study on the serum mineral in West African Dwarf goats grazing natural pasture during wet and dry seasons, in Ogun state, Nigeria, obtained serum calcium, phosphorus and potassium levels of 5.01-5.94 –mmol/L, 3.41-3.71mmol/L, and 5.07-5.97mmol/L which are higher than those obtained in the present study. However, a lower serum sodium level of 102.69 - 102.69mmol/L was obtained. Breed, management practices and geographical factors could be attributable to this differences observed.

The current study revealed that the levels of serum sodium and potassium obtained from the experimental goats is within the normal levels required in the body of growing goats. However, serum, calcium and phosphorus levels obtained falls below the levels required in the body of growing goats. The low serum calcium levels obtained in this study has implications on the findings of Meschy (2002), who reported that inadequate intake of calcium may result to slow growth rate in yearling goats. Similarly, low levels of serum phosphorus has implications based on earlier report (Minson, 1990) in which phosphorus deficiencies were attributed to be more prevalent in tropical grazing regions and that this has tremendous implications on goat performance.

In this current study, the decrease in body weight from week 6 to 8 was as a result of worm infection, which was noticed through progressive diarrhoea for about one week. The faecal samples analysed showed evidence of strongle eggs. Consequently, the animals were treated using Albendazole, which results in a subsequent weight increase in the 10^{th} week. This outcome confirms previous report (Adama *et al*. (2009) in which several gastrointestinal helminthes were found in the faecal samples of cattle of all ages kept under semi-intensive system in the same farm the current research is been conducted. Parasitic infections and possible low levels of calcium and phosphorus obtained from surrounding forages might be responsible for the low level of the serum values of the minerals obtained in this study. Since it has been established that parasites absorb the mineral content of animals through blood sucking, most especially in haemochosis infection (Urquhart *et al*. 1996).

5. Conclusion

The current study reveals that the levels of sodium and potassium obtained from experimental goats were within the normal levels required in the body of goats for proper growth and development. However, serum calcium and phosphorus levels obtained fall below the normal body requirements of yearling goats. This portends a great danger to the productive efficiency of goats within the study area. Therefore, it is recommended that supplementation of calcium and phosphorus minerals in form of free-choice mineral supplement which are generally considered for livestock that do not have access to concentrates would seem the most important for productivity of grazing goats in the study area.

Table 1. The mean Serum levels of Calcium, Phosphorus, Sodium and Potassium (mmol/L) obtained in the blood of studied goats.

Mineral (mmol/L)	Week 2	Week 4	Week 6	Week 8	Week 10
Calcium	1.66^{c}±0.06	2.59^{a} ± 0.08	2.44^{ab} ± 0.06	2.29^{b}± 0.07	2.40^{ab}± 0.06
Phosphorus	1.19^{a}±0.07	1.41^{a}±0.09	1.23^{a}±0.18	1.23^{a}±0.18	1.27^{a}±0.04
Sodium	127.71^{b}±0.57	138.71^{a}±2.83	135.00^{ab}±3.51	140.00^{a}±2.90	140.29^{a}±2.57
Potassium	3.33^{b}±0.06	4.79^{a}±0.26	4.09^{a}±0.15	4.39^{a}±0.31	4.41^{a}±0.26

Mean ± = Standard Error of Mean. Values with different letters as subscript were significantly different from each other ($P<0.05$)

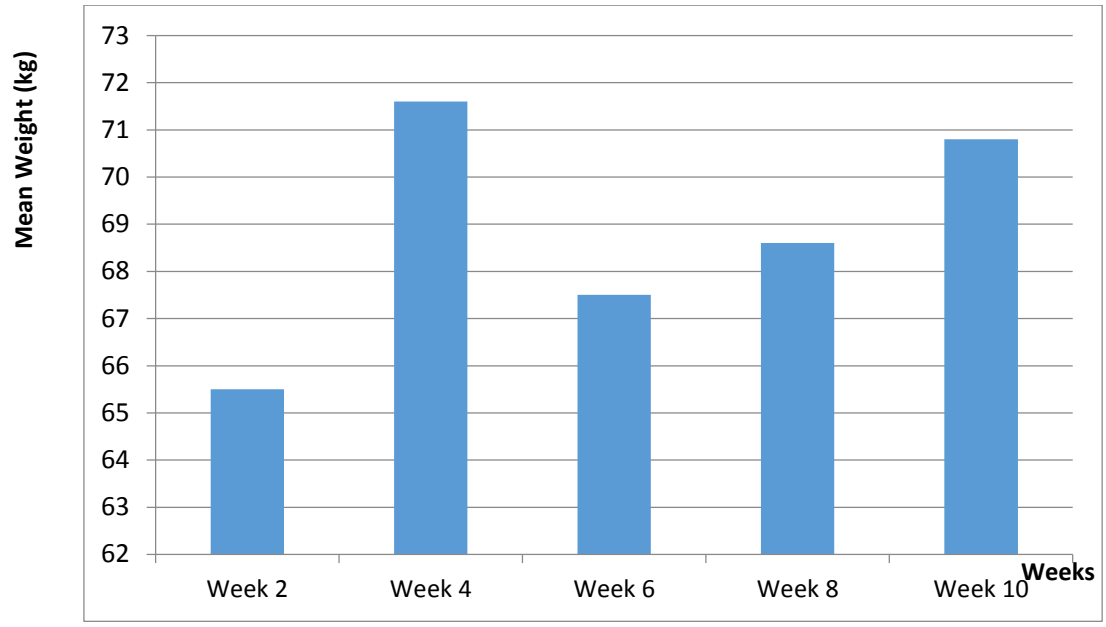

Fig. 1. Mean Weight changes (kg) obtained in the studied goats during the study period.

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