

Investigation of Blood Calcium, Phosphorous and Magnesium Status of Grazing Sheep During Dry and Wet Seasons, Al Jabal Al Akhdar, Libya

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Abstract— The study aimed to determine the levels of calcium (Ca), phosphorus (P), and magnesium (Mg) in the blood of grazing sheep in dry and wet seasons. Blood samples were collected from a total of 69 animals of both sexes, in October and March, and analyzed for Ca, P and Mg. The levels of Ca, P, and Mg were 8.84 ± 1.28 , 6.97 ± 2.15 , 2.7 ± 0.5 and 11.46 ± 1.9 , 8.03 ± 1.5 , 2.76 ± 0.5 for dry and wet seasons respectively. Seasons of sampling significantly influenced ($p < 0.05$) Ca and P of sheep serum while Mg was not significantly influenced. The mean blood values of Ca and P were higher in wet season than dry season. The results also showed that sex had no a significant effect ($p > 0.05$) on blood serum mineral concentrations of sheep, while the age influenced these minerals in sheep blood.

Keywords— age, grazing sheep, macro-minerals, season, sex.

1 INTRODUCTION

All the organisms in animal kingdom need mineral elements for normal life sustaining processes. Calcium (Ca), Phosphorus (P), and Magnesium (Mg) are among of the macrominerals needed by an animal. These minerals exist in the cells and tissues of the animal and in feedstuffs in specific concentrations

[1]. Minerals cannot be synthesized by living organisms and must be obtained in optimum amounts from the environment if survival and production goals are to be maintained [2].

Mineral requirements of the small ruminants depend on age, sex, kind and level of production, and animal adaptation to the area [3], [4]. Other factors that produce variations in mineral concentrations in healthy small ruminants, include chemical form of minerals and their interrelationships with other nutrients in the diet, forage species, and season [5], [6]. Seasonal variability can markedly affect the minerals content of the small ruminant diet as a result of changes in composition and stage of growth and availability of pasture to the animal [7], [8].

Nutritional disorders due to deficiency, excess or imbalance of mineral elements can impair normal body functions of the animal and have more significant consequences than infectious diseases [9].

Blood is the most important biosubstrate for the estimation of mineral status of an animal [5], [10]. The purpose of this study was to determine the levels of the macrominerals Calcium, Phosphorus and Magnesium in blood of grazing sheep, as indicators of their status in the semi-arid areas of Libya, and to evaluate the effect of season, age and sex on the levels of these minerals in sheep blood.

2 MATERIALS AND METHODS

2.1 Study area

The study was conducted at Omar Al mukhtar village, south of Al Bayda, Al Jabal Al Akhdar district, Libya. Blood samples

were collected from animals, in March during the wet season, and in October during the dry season. Animals were randomly selected and grouped according to sex and age as less and greater than 2 years. The number of animals used were consisting of thirty six in the dry season (20 females [10 < 2; 10 > 2], 16 males [10 < 2, 6 > 2]) and thirty three in the wet season (20 females [10 < 2; 10 > 2], 13 males [9 < 2; 4 > 2]). The animals were allowed to graze the pasture during the day, whereas they were sheltered in a barn at the night and supplemented with small quantities of concentrates in form of barley grain.

2.2 Blood samples collection and preparation

Blood samples were collected by jugular vein puncture into tubes without anticoagulant. After clotting, the blood samples were centrifuged at 3000 rpm for 10 minutes to separate the sera, which were stored at -20°C for further analysis.

2.3 Laboratory analysis

Determination of serum calcium, phosphorus, and magnesium was done using a semi-automatic analyzer, (Biosystems, BTS-350, Spain) by the standard methods of absorptive spectrophotometry. Using known standards from Archem, Germany.

2.4 Statistical analysis

The effect of age, sex and season on the blood mineral content was computed using t-test format (SPSS version 16). Statistical significance levels were ($P < 0.05$).

3 RESULTS AND DISCUSSION

The effects of animal age and sex on the mean concentrations of Ca, P and Mg in blood of sheep are shown in Table 1]. Serum calcium concentrations were significantly ($p < 0.05$) higher in young animals in both age groups. Similar observation was reported by Sowande et al. [11] and attributed this to Ca requirements of the young animals. Ricks [12] stated that young animals absorb minerals such as Ca more efficiently than older animals. Ibrahim [13] and Samdija et al. [14] also reported higher macrominerals values in young animals than

the old ones, whereas Ishag et al. [15] reported higher Ca and P levels in older sheep.

Phosphorus level was significantly ($p < 0.05$) higher in young females compared to values obtained for older ones, while it was higher in older males but not statistically different from the level in young males ($p > 0.05$). Magnesium concentrations in older females compared well with values obtained for young females ($p > 0.05$), while it was significantly ($p < 0.05$) higher in older males than that in younger ones.

Serum calcium, phosphorus, and magnesium levels were not significantly influenced by sex in both sex groups. This result is in agreement with Sowande et al. [11] but in contrast with the finding of Ishag et al. [15] Calcium concentrations were slightly higher in male animals compared to females in both sex groups ($p > 0.05$). Phosphorus level was higher in young males than that of young females and in older males but the differences were not statistically significant ($p > 0.05$). Magnesium values were comparable in male and female sheep in both sex groups ($p > 0.05$).

TABLE 1: effect of age and sex on blood minerals of sheep

Minerals (mg/dl)	Females (Mean±SD)		Males (Mean±SD)	
	more than 2 (N= 20)	less than 2 (N= 19)	more than 2 (N= 20)	less than 2 (N= 20)
Calcium	8.61±1.7 ^b	10.1±1.5 ^a	9.07±0.9 ^b	11.03±2.1 ^a
Phosphorus	6.38±2.1 ^{ab}	7.4±1.01 ^a	8.1±1.3 ^a	8.2±1.3 ^a
Magnesium	2.86±0.5 ^a	2.57±0.4 ^a	3.18±0.5 ^a	2.55±0.6 ^{ab}

^{ab}means along the same row having different superscripts are significant ($p < 0.05$), N= number of animals

Effect of season on blood minerals concentration of grazing sheep is presented in Table [2].

Season had a significant effect on serum Ca and P levels which were significantly ($p < 0.05$) higher in sheep blood during the wet season. Magnesium concentration was comparable in sheep blood during both seasons. Sowande et al. [11] reported higher Ca level during the wet season and higher P concentration during the dry season. Dar et al. [16] found only seasonal influence on Ca levels in sheep blood, while P and Mg levels were not affected by seasonal variation.

TABLE 2: effect of season on blood minerals in sheep

Minerals (mg/dl)	Wet (N=33) Mean ±SD	Dry (N=36) Mean ±SD
Calcium	11.46±1.9 ^a	8.84±1.28 ^b
Phosphorus	8.03±1.5 ^a	6.97±2.15 ^b

Magnesium	2.76±0.5	2.70±0.5
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Mean mineral concentrations in the blood of the animals in the present study are within the physiological levels stated by Meyer and Harvey [17] during both seasons except for Ca during the dry season. The ratio of Ca to P in animals in both seasons fall within the normal range at Ca: P ratio.

The mean levels of serum calcium in the present study were comparable to those mentioned by Ranjith and pandey [1] while were higher than that reported by Sudhan et al. [18]) and Samanta [19] in sheep. The mean values of serum phosphorus and magnesium were higher than those reported by Tajane et al. [20] and Sharma [21], respectively.

The little increase in Mg concentration in sheep blood during the wet season may be related to the dietary high potassium concentration. It has been well established that the high potassium level in growing lush grass interfere with magnesium absorption in ruminant animals [5]. Moreover, native pasture forages have during the early spring lower levels of magnesium because of the soil cool and wet conditions prevent plants from Mg absorption [22]. Magnesium should be supplemented to ruminants as the metabolism of this mineral from the blood is not very efficient in these species [2].

Sheep are economically important livestock to the common people in Libya. The animals scattered around in arid and semi-arid conditions. Grazing animals subsist mainly on feedstuffs in the form of pasture and hay and/or crop residues. Mineral supplements to ruminants are not a common practice in the country, the main supplements are protein and energy in the form of agro-industrial by-products such as cereal brans [23]. In the absence of mineral supplements, forages should contain sufficient mineral elements to cover all requirements of animals [2]. Mostly the pasture are considered to be adequate in nutritive value to sustain animals. However, optimal performance is only possible if there is an adequate supply of minerals [8]. Weak growth and reproductive problems are common in some years in Libya. It has been recommended that soil, forages and other feedstuffs grazed by animals in areas rearing ruminants to be routinely tested for minerals to estimate the needs of grazing animals as well as the season of the year when they are most required [2], [9].

4. CONCLUSION

Season variation affected calcium and phosphorus levels in blood serum of sheep. In the present study, levels of blood minerals tested in sheep grazing the natural pasture were within the critical levels except for Ca during the dry season, which was lower. Similar study should be conducted to ascertain the macro- and micro-mineral concentrations in the blood of sheep in Libya, as this study is subjected to some limitations

being not all minerals could be estimated and this due to financial constraint and animals resources encountered during the course of this work.

5. REFERENCES

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