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Biochemical and Mineral Profile of South Eastern Algerian Desert Goats (*Capra hircus*)

Research Article

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ABSTRACT

An experiment was conducted in Algerian desert goats to study the effect of age and season on blood biochemical and mineral profile during different physiological stages of the goats. Serum Ca, Mg and Na levels were significantly high at birth and decreases as the age advanced. The season had a significant effect on the decreased levels of Ca, Mg and K and inversely on the increased levels of Na during dry season. The Ca (80.02±4.84 mg/L), Mg (22.14±1.61 mg/L), Na (142±1.73 mEq/L) and K (6.43±0.40 mEq/L) in pregnant goats were significantly higher than in non-pregnant and lactating goats.

KEY WORDS cholesterol, desert, goat, mineral metabolite, triglycerides.

INTRODUCTION

After the second phase of agrarian revolution (1972), the national goat population has progressively increased to reach more than 3.3 million heads. More than 80% of this population is raised in the arid areas, reared in extensive mixed farming systems, together with sheep, in small herds (Moustari, 2008). Goat production is recognized as an important source of the rural economy in Algeria, mainly for the meat and milk production.

The livestock is mostly represented by local breed (Arab or Arbia breed). It is long haired (12-15 cm) and the prevailing color is black or brown, it is small-sized, and both sexes are without horned (Fantazi, 2004).

As this local breed showed a high morphological variability and productive, according to the location area (mountain, stepp or oasis), with the ability to adapt to particular environmental conditions unfavorable natural, our objective was to explore the physiological and health statue, which are poorly studied in Algeria, by the determination of some biochemical metabolite influenced by season, age and reproductive stage in the south eastern Algerian goats as example of the indigenous goats in Algeria.

MATERIALS AND METHODS

Experimental design

This study was conducted in the experimental station of the national institute of agronomical research Sidi-Mehdi-Touggourt, in the south eastern Algerian desert. There are generally two seasons, dry season (from may to October, an average T^{o}_{Max}=35.98 ˚C) and humid season (from November to April, an average T^{o}_{Max}=21.48 ˚C) (Fantazi, 2004). The study period was one year, encompassed the late humid season and late dry season.

Fifty healthy goats were used in this study and were selected by age (young, adult and old) and reproductive status of females (pregnant, non-pregnant and lactating). The animals were grazed on natural pastures. The berseem,

hay, sorghum and concentrate of barley were also given to these goats. The quantity of the fodder and concentrate were changed according to the animal stage and the water was provided twice a day.

The blood samples were collected from jugular vein of fasting animals (24 hours), during the two seasons. The serum was separated by centrifugation at 3000 rpm for 10 min and it was stored at +4 ˚C until usage. All the samples were analysed in the central laboratory in Constantine, Algeria.

Determination of biochemical parameters

Cholesterol and triglycerides levels were determined by enzymatic colorimetric test (CHOD-PAD and GPO-POD, respectively) (Meziane, 2001) using commercially available diagnostic kits. Sodium (Na) and potassium (K) were determined by flame photometry (Daramola *et al.* 2005) using a Jen way PFP 7 from England.

Magnesium (Mg), calcium (Ca) and phosphorus (P) were determined by the colorimetric method, without deproteinization, using calmagite, arsenazo and vanadate molybdate reagents, respectively (Djaalab, 2011).

Statistical analysis

All data were expressed by means ± SE and analysed were carried by using Student's t-test (STATITCF software) for differences between means.

RESULTS AND DISCUSSION

Energy metabolism

Cholesterol

The values of cholesterol (Table 1) concentration reported by Zubcic (2001) and Mollereau *et al.* (1995) were 0.46-0.90 g/L and 0.53-2.11 g/L respectively.

Table 1 The cholesterol variation according to the age group, reproductive status and the seasons

Cholesterol (g/L)	Humid season X ± SE	Dry season X ± SE
Age		
Young	0.59±0.15	0.51±0.10 [b*]
Adult	0.58±0.04	0.56±0.16
Old	0.56±0.10	0.62±0.09
Reproductive status		
Non-pregnant	0.50±0.06	0.58±0.11
Pregnant	0.58±0.06	0.65±0.19
Lactating	0.52±0.09	0.60±0.05

[*] (P<0.05).
[b] Young *vs* old.

Cholesterol concentration, during dry season, was lower in young animals compared with old ones (0.51±0.10 vs. 0.62±0.09). This decrease may be due to high environmental temperature which inturn reduced the feed consumption by 40-60%. Non significant increase in the substance, during both seasons, was observed in the pregnant goats in comparison with the non-pregnant and lactating goats. This result was similar to those obtained by Sandabe *et al.* (2004) and Waziri *et al.* (2010) in Sahel goats and in Merinolandschaf ewes (Antunovic *et al.* 2004). Antunovic *et al.* (2002) reported that cholesterol level in ewe was not be affected by season.

Triglycerides

The values of triglycerides (Table 2) were approximately equal to those (0.14-0.44 g/L and 0.14-1.40 g/L) reported by Mollereau *et al.* (1995) and Daramola *et al.* (2005), respectively. Taking into account the season, no changes were observed in the levels of triglycerides. A similar observation was presented by Krokavec *et al.* (1992). In contrast to our findings, Nazifi *et al.* (2002) reported a remarkable effect of age in triglycerides levels on Iranian goats.

Table 2 The triglycerides variation as affected by the age group, reproductive status and the seasons

Triglycerides (g/L)	Humid season X ± SE	Dry season X ± SE
Age		
Young	0.33±0.18	0.28±0.12
Adult	0.17±0.03	0.20±0.13
Old	0.18±0.06	0.23±0.08
Reproductive status		
Non-pregnant	0.14±0.04	0.18±0.04
Pregnant	0.16±0.02	0.25±0.07
Lactating	0.19±0.05	0.29±0.15

Mineral metabolism

The means ± SE of the mineral concentration are presented in Tables 3 and 4.

Calcium (Ca)

The range of Ca reported by Daramola *et al.* (2005) was 46-96 mg/L, but the value was lower than those (88-120 and 98.4±4 mg/L) determined by Mollereau *et al.* (1995) and Nazifi *et al.* 1999), respectively. This difference might be due to the disorder of the protein metabolism (Mbuh and Mbwaye, 2005) or to the water deprivation (Bengoumi and Faye, 2002).

However, the increase of Ca levels, during the dry season because of the solar-rays specifically (UV) ones which stimulates the synthesis of vit D_3 in the skin .

The increased levels of Ca in the young animals, during the humid season, can be explained by the increased requirements to the skeletal mineralization during the growth period. Old animals showed decreased Ca levels as demonstrated by Ahmed *et al.* (2000) which might be explained by the decrease or the loss of Ca intestinal

Table 3 The mineral concentrations in different age groups and reproductive status during the humid season

Minerals	Humid season (X±SE)				
	Ca (mg/L)	P (mg/L)	Mg (mg/L	Na (mEq/L)	K (mEq/L)
Age					
Young	86.55±2.44	60.13±09.15	23.36±2.14	141.16±4.07	5.16±0.90
Adult	85.12±2.33*	60.26±06.04	20.00±1.86*	137.00±3.00*	5.98±0.26**
Old	80.31±4.52^{b***}	61.76±12.78	21.33±1.88***	140.50±5.15	5.88±0.64***
Reproductive status					
Non-pregnant	83.26±4.10	65.11±17.79	20.65±1.32***	136.00±5.59*	5.50±0.57**
Pregnant	80.02±4.84**	58.18±07.73	22.14±1.61	142.00±1.73*	6.43±0.40^{f*}
Lactating	77.67±3.20^{e*}	60.41±14.62	20.44±1.66	139.14±3.53	5.65±0.57

* (P<0.05); ** (P<0.01) and *** (P<0.001).
^{a} Young *vs* adult; ^{b} Young *vs* old; ^{c} Adult *vs* old; ^{d} Non-pregnant *vs* pregnant; ^{e} Non-pregnant *vs* lactating and ^{f} Pregnant *vs* lactating.

Table 4 The mineral concentrations in different age groups and reproductive status during the dry season

Minerals	Dry season (X±SE)				
	Ca (mg/L)	P (mg/L)	Mg (mg/L)	Na (mEq/L)	K (mEq/L)
Age					
Young	81.39±6.80^{a*}	62.46±7.38	23.19±1.2^{a*}	145.60±4.66	5.20±0.29
Adult	89.07±3.42^{c**}	64.23±4.41	25.24±1.67	140.00±5.51	4.83±0.60
Old	82.46±4.27	62.42±8.14	24.21±1.93	143.00±4.87	4.73±0.72
Reproductive status					
Non-pregnant	82.45±4.51	61.19±8.14	24.60±1.63	144.46±4.05^{d***}	4.43±0.54^{f*}
Pregnant	90.71±2.72	56.50±3.13	26.01±2.59	137.50±0.70	5.55±1.06
Lactating	83.64±1.64^{e*}	62.34±1.08	23.92±3.58	140.66±6.50	5.00±0.87

* (P<0.05); ** (P<0.01) and *** (P<0.001).
^{a} Young *vs* adult; ^{b} Young *vs* old; ^{c} Adult *vs* old; ^{d} Non-pregnant *vs* pregnant; ^{e} Non-pregnant *vs* lactating and ^{f} Pregnant *vs* lactating.

absorption and / or bone resorption (Gueguen and Pointillart, 2000).The presence of hypocalcaemia in the lactating goats during the humid seasons can be explained by the notable drain of Ca for milk production (Tschuor *et al.* 2008; Khan *et al.* 2009; Samardzija *et al.* 2011) which has a significant effect on maternal mineral and skeletal homeostasis during lactation (Liesegang *et al.* 2007). The increase of Ca values in the pregnant goats was as similar to the reports of (Antunovic *et al.* 2002; Tanritanir *et al.* 2009).

Phosphorus (P)

The earlier report of P carried out by Mollereau *et al.* (1995) was 46.5-139.5 mg/L.

The effect of season showed the similar results as registered by Gromadzka Ostrowska *et al.* (1986). The slight increase in P during the dry season could be due to the direct solar radiation. Also, the P-values were increased with age according to Ahmed *et al.* (2000).

Magnesium (Mg)

The values of Mg were in agreement with those (17-38.88 mg/L and 17.01-38.88 mg/L) reported by Castro *et al.* (1977) and Mollereau *et al.* (1995), respectively.

The effect of season on the Mg levels was remarkable, specifically in the dry season (P<0.05 and P<0.001) (Tables 3 and 4). The decrease during the humid season can be explained by the consumption of the green grass (Odette, 2005). A significant decrease of Mg levels in the young animals compared to the adult during the dry season (P<0.05) may be due to the thermal stress, specifically throughout nights. The slight decrease in the old animals can be explained by the decrease of intestinal absorption of Mg with the age, specifically after the age of five years (Marx, 2002) or to the decrease of bone stores. Non significant difference was observed in all reproductive stages of goats.

Sodium (Na)

The range of Na reported by Castro *et al.* (1977) and Mollereau *et al.* (1995) was 147 ± 0.6 mg/L and 141-157 mg/L, respectively. In this study, means analysis showed a significant difference (P<0.05) of Na values affected by season. The significant elevation of Na levels during the dry season according to Khan *et al.* (2009) was due to the consumption of nutrient or water rich in Na (Fantazi, 2004). The water in this area contains salts which compounded by the high evapotranspiration rates in the desert climate and dry season has led to increasing salinity of drainage water and soils. Na levels had seen a slight decrease in olds, as reported Opara *et al.* (2010), specifically in the dry season. It was due to the progressive reduction of Na extracellular concentration with ageing. The water in this area contains salts which compounded by the high evapotranspiration rates in the desert climate and dry season has led to increasing salinity of drainage water and soils.

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A significant difference (P<0.001) between the non-pregnant and pregnant goats was explained by higher requirements of electrolyte by the foetus. Also, this increase could be related to the changes in renal regulation of water and electrolytes during pregnancy (Elnageeb and Abdelatif, 2010).

Potassium (K*)*

The value of K reported by Daramola *et al.* (2005) was 3-6 mg/L. A significant decrease was observed in K levels in dry season (P<0.01 and P<0.001). This decrease was also explained by Meziane (2001). It can be due to the dehydratation.

A significant variation (P<0.05) between pregnant and lactating goats was observed. The increase of K levels with pregnancy in Baladi goats was explained by the anti-mineral corticoids activity of progesterone during the pregnancy (Azabe and Abedl Maksoud, 1999), where the quantities of excreted K are reduced, which it is usually convertible to the increase of this electrolyte in blood. Concerning the age, no change had occurred. Similar findings were observed by Das *et al.* (2010).

CONCLUSION

It can be concluded that the existence of some significant variations in biochemical indicators are related to reproductive status and age of goats. Season had a significant impact on these biological indicators. The concentration of Na was higher in high temperature conditions. Moreover, it was reported that cholesterol level rises in the humid season and declines in dry season. The findings of this study may serve as reference in which alteration due to nutrition deficiency or metabolic disorder could be found in goats.

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