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Biochemical parameter values for a small ruminants model under the influence of physiological stages in an arid area

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Abstract

In Algeria, goat farming is one of the most important agricultural activities, linked to the breeding of small ruminants, and plays an important role in human nutrition thanks to its meat, hair and milk. Many profitable breeds arrived in Algeria for adaptation and crossbreeding to improve local population, including the Alpine breed. Our aim was to analyze the functioning of the goatherd in the Oases, and we focused on the impact of physiological stage on the biological biomarkers that reflect the adaptability of the Alpine breed. This work was carried out on 46 Alpine goats belonging to a state-owned farm [Technological Institute for the Development of Saharan Agriculture (T.I.D.S.A.)] located in the commune of El-hajeb, wilaya of Biskra, (North-East Algeria). Samples came from clinically healthy goats at different physiological stages (23 pregnant, 23 lactating). Circulating concentrations of TP, ASAT, ALAT, ALP, TC and Glucose were determined .Statistical analysis of the results showed that ALAT levels were significantly lower in lactating than in pregnant goats, while alkaline phosphatase and glycemic levels were significantly higher in lactating than in pregnant goats. As a result, concentrations of total protein, ASTAT and cholesterol did not show significant differences between the two stages of the goats.

Keys words: Dry period, Female goats, Gestation, Lactation, metabolic profile.

Introduction

From the era of nomadic livestock rearing, which for a long time made the most of the region's pastoral resources through its perpetual movements, several factors have contributed to a considerable change in the way people lived in the region [1]. Depending on the status of livestock farming in pastoral society, the repercussions have been most noticeable in terms of herding methods. Abundantly distributed throughout the world, goats are mainly

found in the Earth's particularly aggressive environments. Adaptive traits such as feeding habits, food efficiency and tolerance to pathogens have enabled them to benefit from natural resources generally ignored by other domestic ruminants and to be able to the environment [2]. The goat remains the animal that occupies a predominant place in the diet of communities and the richness of the goat has proved to be of prime importance. The goat is valued for its lean red meat, consumed by dyslipidemia subjects or in prevention of obesity, type 2 diabetes or cardiovascular problems, due to its low fat content and high muscle content [3]. Goat's milk benefits from its high nutritional value and in some regions has become a staple food. [4] Including Kabylia the replacement for women's milk for breastfed babies [5].Numerous goat-breeding improvement programs have been set up, such as the crossbreeding program with improved breeds carried out by breeding institutes and the intensification project in difficult areas [6]. At present, we can observe a range of management methods, from intensive in the oases and irrigated areas, to extensive in the pastoral livestock farming of the Dhahars and El Ouara rangelands. Between these "extreme limits", there are varying degrees of intensification, depending on the resources and natural constraints of each herd [7]. Cattle, sheep and goatherds of indigenous breeds are not very productive, and their performance is unsatisfactory given the investment, maintenance and conservation costs involved in developing the livestock sector. Goat numbers in Algeria are concentrated in difficult, degraded and mountainous regions [8] and have been estimated at over 5 million head , where they represent an important economic activity for the rural community [9] .Algeria's goat heritage is widely varied, represented by the Maghreb breed, the Arbia breed, the Kabyle breed, the Makatia breed and the M'Zabia breed, ...etc. The breeding of these adapted breeds is focused on mixed production (meat and milk) [5]. Many high-performance breeds such as Saanen, Alpine and Maltese characterized by their high milk production have been reintroduced in Algeria for adaptation trials and to improve the zoo technical performance of the local population (milk and meat production) [10]. The aim of this work is to determine the adaptability of the alpine breed of goat population under different environmental conditions to its habitat by assessing the influence of seasons on blood profile as well as some metabolite concentrations.

Material and methods

Study area

The "Ain Ben Naoui" station, known as the Technological Institute for the Development of Saharan Agriculture (T.I.D.S.A.), is located in the commune of El hajeb, west of the capital of the wilaya of Biskra, 7 km from the Biskra-Alger national road. The station is located at an altitude of 87 m above sea level, with a total surface area of 20.5 hectars. The "Ain Ben Naoui" experimental station has taken charge of the following areas:

- Sheep breeding (Ouled Djellal breed), to study their zootechnical performance.
- Goat breeding (Alpine breed), to study their adaptability.
- In addition, a study of the adaptability of some crops introduced into the region to the salty climate and soil. **(ITELV 2000).**

The Biskra region faces a semi-desert climate, with almost no annual precipitation and irregular distribution from one year to the next. Rainfall and temperature record show that the Biskra region belongs to the Saharan bioclimatic zone, with mild winters and hot, dry summers. The region's winds (CH'HILI) are frequent throughout the year, but irregular, often violent and laden with fine particles, and lastly the soils are sandy-loamy in texture, with the presence of gypsum soil formations in the form of crusts. The hydro-morphic sign is marked at depth by the asphyxiation of crop roots in winter. In summer, intense evapotranspiration causes salt to rise to the soil surface, resulting in the appearance of white efflorescence and saline deposits in the gypsum layers of the soil. The animal preservation and utilization committee of the technological Institute for the Development of Saharan Agriculture has validated the herd management protocol.

Animal management

The T.I.D.S.A experimental station is also interested in goat breeding, studying the behavior of the alpine breed in Saharan areas, where the lack of green forage is very marked compared with its native range, where feed is abundant throughout the year, and temperatures are low. The station aims to crossbreed the alpine breed with the local breed to increase the latter's milk production.

Blood sampling

Our study involved 30 goats of the Alpine breed, randomly selected and divided into 02 categories (15 lactating females and 15 pregnant females). Each animal selected underwent blood sampling at the jugular vein [11] at 08:30 am before feeding in EDTA and heparin tubes. Sample tubes included a label and number for each goat, then centrifuged at 4,000 rpm for 15 minutes. Biochemical assays for the following markers carried out in the biochemistry laboratory: Total protein (TP), Aspartate Aminotransferase (ASAT), Alanine Aminotransferase (ALAT), alkaline phosphatase (ALP), Total Cholesterol (TC) and Glucose .

Statistical analysis

Data analyzed by ANOVA and Tukey test using the Minitab statistical program, to test the statistical significance of the differences between the untreated control group and the treated groups. Results at $P \leq 0.05$ considered statistically significant.

Results

Biochemical metabolite results are shown in **Table 1**, where total protein concentration showed no significant difference between pregnant and lactating goats, and the same was true for Aspartate Aminotransferase (ASAT) and cholesterol levels ($p>0.05$).On the other hand, Alanine Aminotransferase (ALAT) levels showed a significant difference ($p<0.01$) between the two physiological stages studied. With regard to alkaline phosphatase and glucose levels, the results showed a highly significant decrease ($p<0.001$) in pregnant goats compared to lactating goats.

Table 1: Evaluation of some biochemical parameters between two physiological stages of goats (pregnant and lactating).

Physiological stage	Biochimichal Parameters	Mean ± SD	Observation
Gestating	Total protein mg/L	61.73±9.60	NS
Lactating		58.90±2.96	
Gestating	ASAT Activity UI/L	63.1±14.40	NS
Lactating		52.89±3.12	
Gestating	ALAT Activity UI/L	15.88±2.92	S*
Lactating		10.67±6.26	
Gestating	Phosphtase Alcalin UI/L	73.2±40.80	HS**
Lactating		109.7±53.40	
Gestating	Cholsterol g/L	0.85±0.127	NS
Lactating		0.95±0.137	
Gestating	Glucose g/L	0.54±0.05	HS**
Lactating		0.65±0.04	

NS .No significant ($p>0.05$); S. significant ($p<0.01$); HS**.Highly significant ($p<0.001$); HS***.Highly significant ($p<0.0001$).

Discussion

The biochemical profile is an indicator of the sanitary quality and condition of the animals [12] .The results of this study show that certain parameters vary widely during the different physiological stages in Alpine goats in an arid environment. In our study, the average total protein values show a non-significant increase in pregnant goats compared to lactating goats. [13] described a significant increase in protein concentrations in pregnant goats, but other studies have shown an increase in protein levels as lactation progresses [14]. According to [15] a decrease in protein levels during the various stages of gestation, which explains why the muscular fetus reaches a high level of growth at the end of gestation, so it synthesizes its proteins from its mother's amino acids.

For Aspartate Aminotransferase (ASAT) levels, our results show a non-significant increase in pregnant goats compared with goats at the start of lactation, which is in line with the work of [16] who reported an increase from the second week of gestation. Other studies have shown that ASAT enzyme activity in goats is higher at the end of gestation compared with other groups and this is due to the greater permeability of hepatocyte cell membranes caused by liver detoxification in pregnant goats [17]. In other studies, an increase in ASAT activity levels observed under the effect of glucocorticoids, which secrete during gestation [18]. [19] suggested that elevated

ASAT activity could correspond to a protein deficit and energy supplementation of the ration in relation to high liver metabolic activity, while [20] reported that ASAT enzymatic activity remained unaffected by physiological stage.

In our study, Alanine Aminotransferase (ALAT) concentrations increased significantly in pregnant goats. [16] obtained the same result, which could be due to intense muscular effort. Increased transaminase activity could indicate an imbalance in certain muscle and liver cells due to the intensification of neoglucogenesis pathways associated with gestation [15] .The enzymatic activities of ALAT and ASAT are good indicators of the mobilization of the body's protein reserves when the animal is in negative energy balance [21].

The comparison between the averages in our study reflects a significant difference in alkaline phosphatase in suckling goats compared with pregnant goats. The same result appears in the work of [15] who described higher values on day 14 post parum compared with day 145 of gestation. This immense activity of alkaline phosphatase during lactation could be due to the increased production of bone isoenzymes. While the results reported by [22] highlight that, the activity of this enzyme was higher at the end of gestation than at the beginning of lactation. In contrast, [23] reported no significant influence of physiological stage on alkaline phosphatase enzyme activity.

In ruminants, serum cholesterol levels depend on a number of factors. For example, the composition of the feed ration, age, sex, breed, season, gestation, lactation and diseases of the liver and bile ducts [19]. The significant drop in total cholesterol at the end of gestation was reported in goats by [24] and in other species such ewes by [18], this is probably linked to the role of this metabolite in ovarian steroid synthesis. Other studies have reported high cholesterol levels at the end of gestation. In the same profile [25] marked an increase in cholesterol levels during gestation compared with the values obtained on the 45th day postpartum, a result which could be explained by the increased absorption of cholesterol by the tissues involved in milk synthesis. In goats, [26] demonstrated a significant decrease in cholesterol levels on days 60, 90 and 120 of lactation and a significant increase on day 150 of the same period, thus showing that lactation has a considerable effect on serum cholesterol levels.

Glucose as an energy source is necessary for production and reproduction [12]. Our results show a significant increase in blood glucose levels in suckling goats compared to pregnant goats. The decrease in blood glucose levels during gestation can be explained by the increased permeability and utilization of maternal glucose by the fetus as well as by the fact that the rapid development of the fetus in the last third of gestation requires greater energy intake, which the mother must satisfy [19] . [27] reported no significant difference in blood glucose levels during gestation or lactation. Other studies, such as [28] observed very high blood glucose levels on the last day of gestation. [25] obtained lower glucose levels on days 100 and 150 of gestation than on day 45 postpartum, given that glucose requirements after parturition exceed those during gestation and for another reason, the increase in milk production implies the mobilization of glucose for the synthesis of milk lactose[29].

Conclusion

The study and analysis of the goat herd in the Oases shows that many breeding procedures have been ignored, despite the results obtained, which reflect the breed's ability to adapt to its new environment, and the herd's prolificacy, which is very encouraging, the adjustment of breeding management remains essential.

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