

Impact of Lactation Stage on the Body Condition and Milk Quality of Black Goat

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Abstract

A total of nineteen black does were used in this study to investigate the impact of lactation stage on body condition, blood metabolism and milk composition. Body condition was assessed together with blood and milk samples, which were collected at week 6 (early), 14 (mid) and 22 (late) of lactation. Body condition score of each doe was also assessed. The overall mean of body condition score was 2.35 ± 0.08 and serum total protein, glucose, triglyceride averaged, respectively 5.80 ± 0.10 g/dl, 120.87 ± 5.34 mg/dl, 51.04 ± 5.38 mg/dl, and milk fat, protein, lactose, solid non fat and total solid percentages averaged 3.24 ± 0.15 , 4.49 ± 0.10 , 4.44 ± 0.01 , 9.71 ± 0.11 , and 12.95 ± 0.20 , respectively. Body condition at kidding decreased significantly at week 4 and then increased significantly ($p < 0.05$) during mid and late part of lactation. Lactation stage also significantly affected ($p < 0.05$) all milk constituents, and glucose.

Keywords: *Lactation stage, BCS, blood metabolism, milk composition, goat*

1. Introduction

Goat extensive system has an important social and economic role in emphasizing marginal areas due to goat's particular ability for browsing poor pastures in dry environments giving high biological value products (Decandia *et al.*, 2005). Blood biochemical attributes are important indicators of the metabolic activity in lactating animals (karapehlivan *et al.*, 2007). During lactation, secretory cells of mammary gland utilize 80% of the blood circulating metabolites for milk synthesis, depending on the speed of infiltration of precursors of milk compounds (*i.e.* free amino acids, glucose and fatty acids). The strong reduction in lipogenesis and the increased fatty acid release, supported by norepinephrine and epinephrine stimulation, induce an increase in lipase activity of mammary gland, to provide the substrates for milk fat synthesis (Nazifi *et al.* 2002). Also, in lactating goats an increase in total

protein level of serum was observed with the progress of lactation due to the catabolism of protein for milk synthesis (Krajnicakova *et al.* 2003).

The present investigation was planned to study the influence of lactation stage on BCS, blood metabolism and milk composition.

2. Materials and Methods

This experiment was conducted at livestock project of Animal Production Department, Faculty of Agriculture and Forestry, University of Duhok. Nineteen black goats aged 3-6 years, with a mean body weight of 43.34 ± 1.24 kg, were used. The does were allowed to graze in natural pasture from morning till mid-day and encaged during after-

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noon. In addition, a concentrate was given at the rate of 0.5 kg/head/day.

Samples of blood and milk were collected at weeks 6 (early), 14 (mid) and 22 (late) of lactation. Each doe was also scored for their body condition, according to Santucci and Maestrini (1985).

Blood samples, (10 ml), were withdrawn from jugular vein of each doe and stored in vacuum glass tubes containing no anticoagulant. After standing at room temperature for 20 min, the tubes were centrifuged at 3,000 rpm for 10 minutes; the serum samples were then stored at -25°C until analyzed. Serum total protein, Glucose and triglycerides contents were determined with the use of commercial kits (BIOLAPO SA, France) and finally measured using the UV Spectrophotometer.

Milk samples, (50 ml) were immediately analyzed by EKO MILK TOTAL (Eon Trading LLC, U.S.A.) to determine the chemical composition of milk (fat, protein, lactose, solid non fat, and total solid).

General Linear Model was used to estimate Best Linear Unbiased Estimates effects (SAS, 2002) to study the effect of lactation stage on studied traits. Alongside, Duncan multiple test Duncan, (1955) within SAS, (2002) was used to detect differences among least square means. Correlation Coefficients between milk components and blood biochemical were calculated.

3. Results and Discussion

The overall mean and standard error of body condition score was 2.35 ± 0.08 and serum total

protein, glucose, and triglyceride averaged, respectively 5.80 ± 0.10 g/dl, 120.87 ± 5.34 mg/dl, and 51.04 ± 5.38 mg/dl. Milk fat, protein, lactose, solid non fat and total solids percentages averaged 3.24 ± 0.15 , 4.49 ± 0.10 , 4.44 ± 0.01 , 9.71 ± 0.11 , and 12.95 ± 0.20 , respectively (Tables 1 and 2).

The initial score of body condition at kidding was (2.44) which significantly decreased to (1.97) at early lactation (Figure 1). This reduction could be attributed to the negative energy balance during this period (De Vries and Veerkamp, 2000) and then BCS increased significantly ($p < 0.05$) to (2.25 and 2.73) at mid and late stages of lactation, respectively. However, this improvement in BCS could be due to the availability of nutrients in the natural pasture during spring in addition to feeding concentrate. Similarly, Branca and Casu (1989); Atti *et al.* (1995) in sheep, and Cabiddu *et al.* (1999); Casamassima *et al.* (2007) in goat, found that BCS increased significantly as lactation progressed.

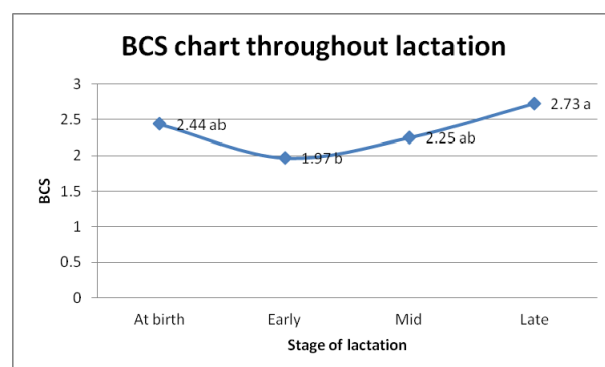


Figure 1: Body condition score of does throughout lactation.

Table 1

Least-square means $\pm$ standard errors of blood biochemical during lactation.

Studied trait	Overall mean	Lactation stage		
		Early	Mid	Late
No. of obs.	56	19	19	18
Protein g/dl	5.80 ± 0.10	5.63 ± 0.17^a	6.10 ± 0.17^a	5.67 ± 0.18^a
Glucose mg/dl	120.87 ± 5.34	163.36 ± 6.85^a	101.94 ± 4.57^b	96.01 ± 6.42^b
Triglyceride mg/dl	51.04 ± 5.38	62.42 ± 5.91^a	36.18 ± 2.11^a	55.34 ± 14.80^a

Means with different letters within each row differ significantly ($p < 0.05$) according to Duncan test.

Table 2Least-square means $\pm$ standard errors of milk composition (%) during lactation.

Studied trait	Overall mean	Lactation stage		
		Early	Mid	Late
No. of obs.	57	19	19	19
Fat	3.24 $\pm$ 0.15	3.93 $\pm$ 0.23 ^a	2.32 $\pm$ 0.17 ^b	3.47 $\pm$ 0.23 ^a
Protein	4.49 $\pm$ 0.10	4.14 $\pm$ 0.11 ^b	4.23 $\pm$ 0.08 ^b	5.11 $\pm$ 0.20 ^a
Lactose	4.44 $\pm$ 0.01	4.38 $\pm$ 0.01 ^c	4.43 $\pm$ 0.009 ^b	4.52 $\pm$ 0.02 ^a
SNF	9.71 $\pm$ 0.11	9.24 $\pm$ 0.13 ^b	9.44 $\pm$ 0.07 ^b	10.44 $\pm$ 0.24 ^a
Total solid	12.95 $\pm$ 0.20	13.18 $\pm$ 0.27 ^a	11.77 $\pm$ 0.21 ^b	13.92 $\pm$ 0.35 ^a

Means with different litters within each row differ significantly ($p < 0.05$) according to Duncan test.

Lactation stage significantly ($p < 0.05$) affect serum glucose but not serum total protein and triglyceride. The highest level of glucose (163.36 $\pm$ 6.85 mg/dl) was observed at early stage of lactation which then declined to 101.94 $\pm$ 4.57 and 96.01 $\pm$ 6.42 mg/dl at mid and late stages of lactation, respectively (Table 1). This result may be attributed to the negative correlation between serum glucose and milk lactose ($r = -0.34$). Similarly, Casamassima *et al.* (2007) recorded that Lactation stage significantly affect serum glucose but not total protein and triglyceride in Montefalcone and Valfortorina goats. A negative and non significant correlation between serum triglyceride and milk fat ($r = -0.01$), and serum protein and milk protein $r = -0.07$ was observed in the current work. These values may be due to the limited number of observation involved in this study. Similarly, a negative relationship between serum glucose and milk lactose and between serum total protein and milk protein was reported earlier by Amer *et al.* (1999) in Saudi Ardy goats.

Lactation stage significantly affected ($p < 0.05$) all milk components. It appears from Table (2) that fat and total solid percentage was at its highest ($p < 0.05$) at the late stage of lactation (3.47 and 13.92 %, respectively) followed by early stage (3.93 and 13.18 %, respectively) and mid stage (2.32 and 11.77 %, respectively) of lactation. This variation could be explained by the negative correlation between milk yield with fat and total solid content (Merkhan, 2011). A similar trend was found earlier by Baker, (2007), Agnihotri and

Rajkumar, (2007), Mohammed *et al.* (2007), Guler *et al.* (2007), and Hassan *et al.* (2010).

Each component, protein, lactose and solid non fat showed the lowest values (4.14, 4.38, and 9.24 %, respectively) during early lactation, and then significantly ($p < 0.05$) increased towards the end of lactation (5.11, 4.52, and 10.44 %, respectively). Similarly, other investigators indicated that protein percentage was highest ($p < 0.05$) in late lactation (Peris *et al.*, 1997; Soryal and El Shaer, 2006; Mohammed *et al.*, 2007; Norris *et al.*, 2011). However, Soryeal and El Shaer (2006) and Hassan *et al.* (2010) noticed that lactose content showed the lowest value during early lactation and then significantly increased to attain the maximum value during mid and late lactation.

4. Conclusion

It can be concluded that Lactation stage influences BCS, serum glucose and milk constituents. However, raising goats on a pasture rich in nutrients and feeding concentrate improve BCS, during mid and late parts of lactation.

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