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ORIGINAL RESEARCH PAPER

MILK PRODUCTION AND COMPOSITIONS IN FEMALE MOUNTAIN AND CROSSBRED GOATS

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This study was carried out on female goats (Syrian Mountain: Jabali and crossbred: Damascus x Syrian Mountain) to determine daily milk production (morning, evening and total) and milk compositions (protein, fat, lactose and total solids). Thirty female goats from each breed, aged about two years were used in their first lactation season for a period of 165 days, starting 60 days after kidding. There were huge variations among individuals within the same breed in terms of milk production. Average daily milk production/doe was 929 and 958 g for Syrian Mountain and crossbred does, respectively, with no significant ($P>0.05$) differences between them. The highest daily milk production /doe was 1555 and 1800 g, and the lowest production was 280 and 240 g for Syrian Mountain and crossbred does, respectively. Results also indicated that there were no significant ($P>0.05$) differences in milk compositions between the two breeds, with overall averages (%) for protein content 3.42, and 3.42, fat 4.64 and 4.74, lactose 4.23 and 4.21, and total solids 13.00 and 13.04 for Syrian Mountain and crossbred does, respectively. However, significant ($P<0.05$) increases in the percentage of fat and total solids were recorded in the morning milking in the does of the two breeds. In crossbred does, lactose content was significantly higher ($P<0.05$) in the evening milking than the morning one, whereas, in Syrian Mountain does, protein content was significantly higher ($P<0.05$) in the morning milking as compared to the evening one. Comparing the milk production and composition obtained in the present study with those reported from other goat breeds, it could be noticed that the tested components were within the normal values with no difference between the two studied breeds.

Keywords: Syrian Mountain (Jabali) goats, crossbred goats, milk production, milk composition

Introduction

Goats are important small ruminants in many parts of the world and the major livestock of many countries such as India, Pakistan and Bangladesh (Khanum et al., 2000) due to the characteristics they possess in terms of withstanding harsh conditions and the low cost of maintenance (Zarkawi et al., 1999). They are important components of livestock industry and play a vital role in the socio-economic structure of rural poor (Pal et al., 2011). In west Asia including Syria, goats are raised in dry regions with prolonged drought, extreme climate fluctuation and water scarcity and are usually kept in mixed flocks with sheep (Iñiguez, 2004). The number of goat population in Syria was estimated to be around 1.5 million, in which about 95% of them are Syrian Mountain and the remainings are Damascus goats (AASA, 2010). The Damascus goat is seasonal and is native to Syria where certain reproductive parameters in Damascus does have been studied (Zarkawi, 2007; Al-Ani et al., 2009; Zarkawi and Soukouti, 2010). Moreover, the Damascus goat was introduced into some countries to improve the performance of the local breeds (Khalil et al., 2010).

The Syrian Mountain goats inhibit the extremely unfriendly and harsh environment. They are black goats, with dropping ears and a curved head; both sexes have horns (Wurzinger et al., 2008).
The characteristics of the crossbred goats (Damascus x Syrian Mountain) were described by Bakri (2010) as follows: the colour usually black, wide ears, long neck with few individuals having tassels, slight convex profile, some animals have small horns while others are hornless.

Goat milk and its products have a three-fold significance in human nutrition including feeding more starving and malnourished people and treating people affected with cow milk allergies and gastro-intestinal disorder, due to the unique physiological and biochemical quality characteristics of the goat milk (Haenlein, 2004). Goat milk has been used as a good alternative to human and bovine milk in various clinical conditions such as allergy, atopy and inflammatory diseases, and it posses immunomodulating capacities and releases nitric oxide, a potent vasodilator endowed with anti-atherogenic properties (Jirillo et al., 2010). A number of researchers studied production (Mioč et al., 2008), composition (Strzalkowska et al., 2009) and somatic cell counts (Simismyeh and Kaskous, 2010) in goats' milk; and factors affecting milk production (Flores et al., 2011), hair colour variation (Olfaz et al., 2011), quality (Garcia-Hernandez et al., 2007) and the management practices (Dhuppe et al., 2009).

In Syria, as mentioned above, several studied were carried out on Damascus does only, with no work being done on Syrian Mountain or crossbred does. Therefore, the main objective of the present study was determination of milk production and milk compositions (protein, fat, lactose and total solids) in both breeds during the first lactation season.

Materials and Methods

Study site and experimental animals

This study was performed in Ura Station for Improving the Mountain Goats, the Scientific Agricultural Research Centre in Sweida, General Commission for Scientific Agricultural Research. This station is located about 15 km south of Sweida city (115 km south of Damascus), 985 m above sea level, with an average annual rainfall of approximately 300 mm.

Sixty female goats (30 Syrian Mountain and 30 Syrian Mountain x Damascus crossbred), aged about two years were used in their first lactation period. Does were previously treated for oestrus synchronisation with intravaginal sponges containing 40 mg of flugestone acetate (FGA, Chronogest®, Intervet International B.V., The Netherlands) for 18 days, and were naturally mated.

Animal housing, feeding and hygiene

Animals were kept indoors at night and outside for most of the day. Indoors, they were offered diets based on barley and wheat straw supplemented by vitamins. Water and mineral licks were available *ad libitum*. Outdoors, they had free access to natural grazing. In addition, all animals received preventive vaccines according to the programme adopted in the station.

Sampling and analysis of milk

Does in both breeds were manually and completely milked twice daily (morning: 06:00h and evening: 18:00h) once/fortnight/doe for a period of 165 days, starting 60 days after kidding. Morning and evening milking samples were collected and weighed individually, and daily milk yield: g/doe (morning, evening and total) was calculated. In addition, milk compositions (protein, fat, lactose and total solids) for each doe were also determined using Lacto Scope (Delta Instrument, The Netherlands) milk analyser.

Statistical analysis

Data were statistically analysed by means of the General Linear Mixed Model procedure of SAS (SAS, 2002) using the following equation:

$$X_{iljn} = \mu + ID_n + \alpha_i + (\alpha\delta)_{il} + (\alpha\delta\rho)_{ilj} + \varepsilon_{iljn}$$

where:

X_{ijn}: percentage of fat, protein, lactose and total solids;
μ: overall mean;
ID_n: random effect of animal;
α_i: the effect of breed (Syrian Mountain and crossbred);
$(\alpha\delta)_{il}$: the effect of the interaction between the breed and lactation;
$(\alpha\delta\rho)_{ilj}$: the effect of the interaction between the breed and lactation and the measuring day;
ε_{ijn}: random (residual) effect.

Results and Discussion

Huge individual variations in daily milk production were observed among the experimental animals in the two groups. Average daily milk production /doe was

929 ± 30 and 958 ± 40 g for Syrian Mountain and crossbred goats, respectively, with no significant (P>0.05) difference between them. Consequently, no improvement in daily milk production in the crossbred goats occurred as a result of the crossbreeding. Maximum and minimum daily milk production was 1555 and 280, 1800 and 240 g for Syrian Mountain and crossbred goats, respectively. Similar individual variations in daily milk production were reported in Damascus goats in Oman (200-1300 g) (El Hag et al., 1995) and in Polish White Improved goats in Poland (800-5000 g) (Olechnowicz and Sobek, 2008).

Despite the fact that the Syrian Mountain goat is not a dairy breed, the average daily milk production recorded in the present study could be considered satisfactory. In Turkey for example, Toplu and Altinel (2008) reported an average daily milk production in Hair goats of 435 g, 507 g in Sokoto breed in Nigeria (Akpa et al., 2003) and 1090 g in southern Khorasan crossbred goats in Iran (Modarresi et al., 2011), whereas, the average reached 2700 g in Polish Color Improved goats in Poland (Bernacka, 2006). In Ethiopia, Mestawet et al. (2012) compared the daily milk production of 4 goat breeds (pure and crossbred). They reported differences in milk production among them being 1410, 1130, 930 and 850g for Boer, Arsi-Bale, Toggenburg-Arsi-Bale cross and Somali goats, respectively.

As for milk compositions (protein, fat, lactose and total solids) and the effect of milking time (morning or evening) on the above compositions, Table 1 shows no significant (P>0.05) difference between the two breeds concerning the above parameters.

Table 1. Average (± SE) percentage of milk compositions (protein, fat, lactose and total solids) of Syrian Mountain and crossbred does, and the effect of the time of milking (morning or evening) on the compositions

Factors	Milk Compositions (%)			
	Protein	Fat	Lactose	Total Solids
Overall Average	3.42 ± 0.02	4.69 ± 0.07	4.22 ± 0.03	13.02 ± 0.10
Breed				
Syrian Mountain	3.42 ± 0.03	4.64 ± 0.11	4.23 ± 0.04	13.00 ± 0.15
Crossbred	3.42 ± 0.03	4.74 ± 0.09	4.21 ± 0.04	13.04 ± 0.12
Breed x Milking Time				
Syrian Mountain, morning milking	3.44 ± 0.03^{b}	4.39 ± 0.10^{a}	4.23 ± 0.04^{ab}	12.76 ± 0.12^{a}
Syrian Mountain, evening milking	3.39 ± 0.03^{a}	5.22 ± 0.10^{b}	4.19 ± 0.04^{ab}	13.42 ± 0.12^{b}
Crossbred, morning milking	3.45 ± 0.03^{ab}	4.09 ± 0.11^{a}	4.20 ± 0.04^{a}	12.52 ± 0.14^{a}
Crossbred, evening milking	3.40 ± 0.04^{ab}	5.28 ± 0.14^{b}	4.27 ± 0.05^{b}	13.54 ± 0.17^{b}

^{abc} Means within a column followed by different letters are significantly different (P<0.05)

Overall averages of milk composition contents (%) were: protein 3.42 and 3.42 , fat 4.64 and 4.74, lactose 4.23 and 4.21, and total solids 13.0 and 13.04 for Syrian Mountain and crossbred goats, respectively. Concerning the milking time, a significant ($P<0.05$) difference in fat content in both breeds was recorded, which was higher in the evening milking than the morning one. Similar results were reported by Högberg (2011) in Swedish Landrace goats in Sweden. In addition, a significant ($P<0.05$) difference in total solids content was recorded, which was higher in the evening milking than the morning one in both breeds. In crossbred does, lactose content was significantly higher ($P<0.05$) in the evening milking than the morning one, whereas, in Syrian Mountain does, protein content was significantly higher ($P<0.05$) in the morning milking as compared to the evening one. In Saanen and Alpine goats kept in Slovenia, Kastelic and Kompan (2006) reported no difference in fat content between morning and evening milking, but larger percentage of protein and lactose was reported in morning than in evening milk.

Comparing the results of milk compositions obtained in the present study with those of other goat breeds, it could be seen that the values of milk compositions were within the normal values reported in other breeds. Average protein content (%) in the milk of both breeds was 3.42 which is close to 3.48% reported in Granadina goats in Spain (Ceballos et al., 2009), higher than 2.81% reported in White Shorthaired goats in Czech (Dračková et al., 2008), 2.85% in Barkey goats in Egypt (Salem et al., 2004), 2.89% in Alpine goats in the USA (Fekadu et al., 2005), 3.01% in Polish White Improved goats in Poland (Olechnowicz and Sobek, 2008), 3.15% in Swedish Landrace goats in Sweden (Högberg, 2011), but lower than 3.87% reported in Alpine goats in the USA (Soryal et al., 2005).
In the present study, the fat content averaged 4.64 and 4.74% for Syrian Mountain and crossbred goats, respectively, which was higher than 3.13% reported in White Shorthaired goats in Czech (Dračková et al., 2008), 3.5% in Damascus goats in Oman (El Hag et al., 1995), 3.62-3.86% in Turkish Saanen (Konyali et al., 2010), 3.04% in Polish White Improved goats in Poland (Olechnowicz and Sobek, 2008), 2.76 and 4.38% in Alpine and Nubian goats, respectively in the USA (Soryal et al., 2005), but lower than 5.23% reported in Granadina goats in Spain (Ceballos et al., 2009).

As for lactose content, it was 4.23 and 4.21% for Syrian Mountain and crossbred goats, respectively, which was close to 4.25% in Polish White Improved goats in Poland (Olechnowicz and Sobek, 2008), and slightly higher than 4.11% reported in Granadina goats in Spain (Ceballos et al., 2009), but lower than 4.59% in White Shorthaired goats in Czech (Dračková et al., 2008), 4.63% in Bianca Monticellana goats in Italy (Palocci and Tripaldi, 2011), 4.75% in Swedish Landrace in Sweden (Högberg, 2011) and 4.9% in Boer, Arsi-Bale, Toggenburg-Arsi-Bale cross and Somali goats in Ethiopia (Mestawet et al., 2012).

Concerning the last studied component (total solids), average values were 13.0 and 13.04% for Syrian Mountain and crossbred goats, respectively, which were higher than 9.53% in Turkish Saanen goats (Koyuncu and Pala, 2008), 10.01% in Alpine

goats in the USA (Soryal et al., 2005), 11.14% in White Shorthaired goats in Czech (Dračková et al., 2008), but lower than 13.45, 13.54% and 13.57% reported in Nubian goats in the USA (Soryal et al., 2005), in Polish Color Improved goats in Poland (Bernacka, 2006) and in Granadina goats in Spain (Ceballos et al., 2009), respectively.

Conclusions

This is the first documented report in Syria concerning the studied parameters. Under the study conditions, results could indicate the good performance of the two breeds as compared to other goat breeds in terms of milk production and milk compositions, with no difference between the two breeds.

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