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Production Performance of Crossbred (Saanen and Nubian) Goats in the Second Kidding under Sudan Conditions

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Abstract: The present study was conducted to determine birth weight, body weight, milk yield, milk composition, freezing point and acidity at second kidding of 8 crossbred goats. The does (average body weight was 33.5 kg) were milked once daily and weighed every ten days. The average birth weight of kids was 3.56 kg. Average milk yield was 1.237 L and the peak daily milk yield of 1.359 L was reached during 40-50 days of lactation. The averages milk constituents were 4.173±1.399% fat, 3.66±0.835% protein, 4.914±0.66% lactose, 0.733±0.245% ash and 13.48±1.727% total solids. The average freezing point was -0.561±0.0365°C and acidity was 0.203±0.035%. Milk constituents were plotted during the study. The correlation between body weight and milk yield, body weight and fat, while milk yield and total solids, freezing point and total solids and lactose content and freezing point revealed a negative value.

Key words: Milk yield, milk composition, second kidding, crossbred (Saanen× Nubian) goats, Sudan

INTRODUCTION

Interest in the value of goats as domestic livestock is presently widespread. Moreover, it has been stimulated by a wide recognition of their role in food production, their economic importance in the tropics and subtropics where they are concentrated and the fact that they constitute an important component of traditional farming systems^[1]. Goats are found in all types of environments from arid to humid zones and they do very well in the drier tropics. This is because of their ability to withstand dehydration and their browsing habit which enable them to survive, where cattle and sheep cannot^[2]. Similarly goat's possess physiological-anatomical attributes, which enable them to adapt better than other domestic animals to extreme local conditions^[3]. Hence, goats are kept to provide human nutrition as well as possibilities of earnings, especially in times of economic crisis^[4]. Moreover goats produce a relatively higher milk yield per unit of live weight compared to cows and buffaloes^[5]. In temperate countries, where, goats are used primarily or exclusively for milk production, claims have been made that goat milk has important advantages over cow milk for human nutrition^[6]. With respect to goat's milk, it was claimed that the goat's milk used with advantage to replace cow's milk in the diet of those suffering from allergy to cow's milk and other staple foods^[2,6].

The indigenous goats in the tropics are well known for their tolerance of the environment and they generally exhibit low productive and reproductive performance. However in many developing countries goat's milk can be produced more efficiently using limited resources^[7].

The importation of exotic dairy goat breeds from temperate regions in an effort to meet the need for fresh milk production failed, because of inability of these breeds to tolerate the local environment, management and endemic diseases^[8]. Therefore, crossbreeding is recommended and this is not only due to the fact that cross breeding have the advantage of being the quickest breeding method for improving genetic potentials for production, but it exploit the non additive gene action^[9]. Eventually, in the tropics goats are rarely kept just for milk but goat's meat and goat's milk products are of great importance in subsistence agriculture^[2,6].

Four local breed types of goats are known in Sudan: Nubian (the only specialized dairy goat), Desert, Nilotic dwarf and Tegri^[10].

The Saanen goat is the best known representative of dairy goat breeds^[3]. Saanen goats have been used with success to increase milk yields of the indigenous tropical breeds of goats where adequate year-round feeding is assured^[11]. They were introduced to Sudan since 1993 in order to upgrade the local breeds.

Hence, the objective of this study was to estimate the production performance (birth weight, body weight, milk

yield and milk composition) of crossbred between Saanen and Nubian (50%) in the second kidding under Sudan condition.

MATERIALS AND METHODS

Study area: The experiment was conducted from the period of June to November 2002 at Improved Goats Production Project Farm at Helat Kuku in North-eastern region of Khartoum State. The farm was belonging to the Ministry of Agriculture and Animal Resources of Khartoum State. The herd was established as a model of dairy goat management for provision of improved cross does and bucks to areas of Khartoum State.

Housing: Selected animals were kept in a pen, as one group, throughout the experiment. The pen measures 14.5×5.25×1.16 m. The roof was 2.85 m in height and was constructed with corrugated and galvanized zinc sheets. The floor was concrete. The pen contains a secured metal bucket for water and other for feed.

Experimental animals: A total of eight females (30-36 months old) at their second kidding were selected for the present study. The goats are crossbred (50%) between female Sudanese Nubian goat and male Switzerland Saanen goat.

Feed intakes: Six hundred grams of concentrate diet was offered daily per animal at 9 am Green Bersem (Alfalfa) was offered at a rate of 400 g per animal after consuming the concentrate, collectively for the entire group. Water was supplied *at libitum*. Ingredients and composition of concentrate diet were: Sorghum grains (40%), Wheat bran (40%), Groundnut cake (19%) and salt (1%).

Data collection

Weighing: Live weight (kg) was taken immediately after parturition for females and their kids and then every ten days, for does, throughout the experimental period. The weighing was conducted before feeding.

Meteorological data: The temperature and the relative humidity during the experimental period were obtained from Shambat Agro. Meteorological Observatory. The maximum, minimum and mean levels were 36.3 and 69.0; 26.0 and 18.0; 31.66 and 41.06, respectively.

Feed analysis: The samples of concentrate feed were analyzed by chemical analysis^[12].

Milk yield: A total of 120 daily milk yields from the eight does were obtained throughout the first 17 weeks (early lactation stage) of the second lactation during June to November 2002. The does were milked once daily by hands at 8:30 am before feeding. The milk yield were recorded in Liters.

Milk collection: A total of 93 milk samples were analysed during early stage of lactation started five days from kidding to exclude colostrum. The collection of milk samples was carried out once every ten days until the end of experimental period. Milk samples were collected from does before the milking of the does. The samples were collected after washing the udder in clean bottles, with tight covers to prevent leakage and milk spoilage. The samples were transported in an ice container to maintain the samples at 0-4°C. The samples were brought to the Department of Dairy Production, Faculty of Animal Production, University of Khartoum Laboratory, where analysis of all samples were conducted on the same day.

Chemical analysis: The fat content was determined by Gerber method^[13]. The total nitrogen was determined using Kjeldahl method^[14]. The total solids of milk were determined by the modified method of AOAC^[15]. The acidity of milk was determined using titration method^[13]. The freezing point was measured by means of a thermistor Cryoscope, FISKE, USA^[15].

Statistical analysis: Mean, standard deviation, maximum and minimum values were estimated by using Excel 2000. Correlations between some measurements were also estimated. The same program was used for the graphical representations of data.

RESULTS

Birth weight: The average birth weight of the kids during the present study was found to be 3.56±1.0283 kg (Table 1). The same table also showed that the maximum weight was 4.8 kg and the minimum weight was 2.0 kg.

Body weight: The average weight of does (Table 1) was 33.506±5.533 kg, the maximum weight was 37.975 kg, which was reported during the first 10 days following kidding, while, the minimum weight (28.633 kg) was found between 110-120 days. The average weight curve in this study (Fig. 1) shows that the weight declined gradually after kidding at 35 days, then it showed more or less similar values until 80 days. However, the average weight showed sharp decrease from the end of 105 days and continued to the end of the experimental period.

Table 1: Production potential of crossbred (Nubian× Saanen) goat in Sudan

Item	Maximum	Minimum	Mean	SD
Birth weight (kg)	4.800	2.000	3.560	1.0283
Body weight (kg)	37.975	28.633	33.506	5.533
Milk yield (L)	1.359	0.968	1.237	0.339
Fat (%)	4.943	3.200	4.173	1.399
Protein (%)	5.618	3.126	3.660	0.835
Lactose (%)	5.567	4.560	4.914	0.660
Ash (%)	0.965	0.578	0.733	0.245
Total solids (%)	16.310	12.323	13.481	1.727
Freezing point (°C)	-0.519	-0.608	-0.561	0.036
Acidity	0.256	0.182	0.203	0.035

Milk yield and persistency of lactation: The present study comprised lactation records of eight does for 120 days. The average daily milk yield was 1.237 ± 0.339 L (Table 1). The maximum milk yield recorded was 1.359 L, which was obtained during 40-50 days following kidding. The minimum milk yield (0.968 L) was reported during the first 10 days. The average persistency of lactation curve obtained in this study (Fig. 1) shows that milk production started at level of 0.968 L during the first 10 days and it raises to the maximum level (1.359 L) in 45 days. Then it showed a slight gradual decline from 50 days and continues to be below from 75 days till 120 days. The correlation between body weight and milk yield revealed a positive value (+0.4175).

Milk composition

Fat content: The average fat content was $4.173 \pm 1.399\%$, the maximum fat content recorded 4.943%, which was obtained during the first 10 days and the minimum was 3.2%, which was found during 100-110 days (Table 1). The average fat (Fig. 2) showed irregular pattern, where the curve begins at higher level and then gradually decreased in 35 days. It was again increased after 35 days and decreased gradually until 105 days. Moreover, the correlation between body weight and fat % revealed a positive value (+0.1333), while the correlation between milk yield and fat % revealed a negative value (-0.0692).

Protein content: The average, maximum and minimum content were 3.66 ± 0.835 , 5.618 and 3.126%, respectively (Table 1). Moreover, the average protein contents (Fig. 2) show higher level during the first 20 days. Then it approximately continued in a constant level till 75 days and increased slightly until 85 days.

Lactose content: The average, maximum and the minimum was lactose content was 4.914 ± 0.66 , 5.567 and 4.56%, respectively (Table 1). The average, lactose (Fig. 2) shows slight regular increase level until 25 days. Then it about continued in a constant level till 120 days.

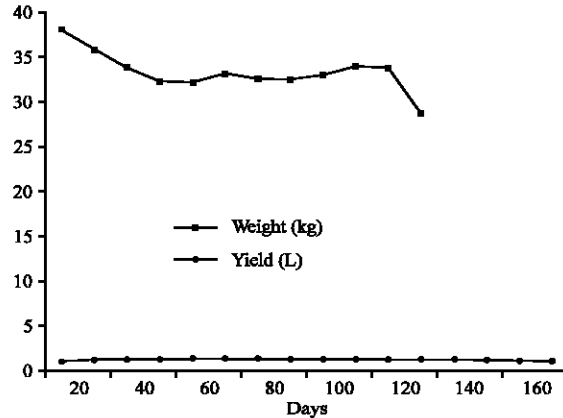


Fig. 1: Body weight (kg) and milk yield (L) of Saanen × Nubian goat's

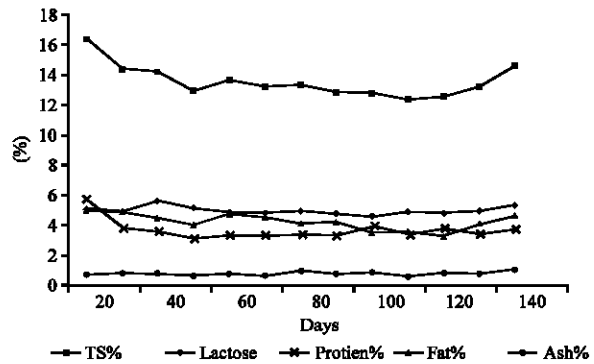


Fig. 2: Chemical composition of Saanen × Nubian goat's milk

Ash content: The average ash content was 0.733 ± 0.245 , the maximum content was 0.965% and the minimum content was 0.578% (Table 1). The average ash contents (Fig. 2) show decreasing rate in 35 days then the ash increased in fluctuation way until 120 days. In general, the ash contents showed an irregular pattern throughout the study period.

Total solid contents: The average total solids content was $13.481 \pm 1.727\%$ (Table 1). The maximum content was 16.31% and the minimum content was 12.323%. The average total solids contents (Fig. 2) show gradual decrease in the total solids content until 35 days. Then approximately continued at constant level until 110 days, before slight increase in 115 days. The correlation between milk yield and total solids % was negative.

Freezing point: The average of freezing point was $-0.561 \pm 0.036^\circ\text{C}$, the maximum freezing point was -0.519°C

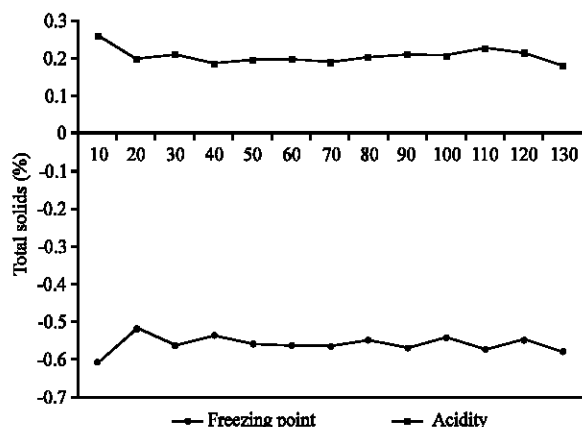


Fig. 3: Freezing point and lactic acid % of Sannen x Nubian goat's milk

and the minimum freezing point was -0.608°C (Table 1). The average freezing point (Fig. 3) shows an irregular pattern through out the study period. The correlation between the freezing point and the total solids % was -0.3086 and between lactose and freezing point was -0.2197 .

Acidity: The average acidity (lactic acid %) was $0.203 \pm 0.035\%$, the maximum was 0.256% and the minimum was 0.182% (Table 1). Moreover, the acidity (Fig. 3) shows a decreasing value during the first 15 days then followed by an irregular pattern. The increase being more pronounced at the end of the study period (105 days), then it decreases during 110-120 days.

DISCUSSION

The average birth weight of crossbred in the present study (3.56 kg) might be attributed to the genetic factors^[6]. Moreover, it was higher than that reported previously for Nubian goat and for crossbred (Nubian x Anglo-Nubian and Toggenburg)^[16]. This was also higher than that reported for crossbred 50% Nubian x 50% Saanen ($2.1\text{-}2.9\text{ kg}$)^[7]. This might be attributed to low feed intake and /or due to differences in the dams weights between this and previous study, whereas the dam's weights in the present study were higher (33.5 kg) than those of the previous study since the does weight averaged 20.8 kg ^[7]. Moreover, the differences in parity could be another reason^[17]. Also the parity of does in the present study was the second and those of the previous were in their first parity. Birth weight is strongly correlated with growth rate and adult size and also with kid viability, therefore it is an important factor affecting productivity^[6].

The persistency of lactation curve (Fig. 1) for the crossbred goat (Nubian x Saanen); in which the peak milk

yield was reached in the second month (5th-7th week) was in line with the previous findings^[10,11,18]. The lactation curve for milk produced by goats is relatively flat; moreover it peaked at 8-10 weeks from kidding^[2]. However those reports found persistency to occur three weeks later than the present study.

The decline in the mean daily milk yield after the peak was due to advancement of lactation^[5]. The average daily milk yield of crossbred goat (Nubian x Saanen) found in the present study (1.237 L) was lower and this might be due to low feed intake level in the present study compared to other study. Also it could be due to the milking practices, since the does milked once a day in the present study, while the does were milked twice daily in the other study which claimed that the crossbred (Saanen x Nubian) had 2.55 kg as mean daily milk yield in second lactation^[11]. Also milking twice a day yields 40% more milk than once a day; milking three times a day yields 5-20% over twice a day milking and milking four times a day may yield an additional 5-10%^[15].

The average daily milk yield of crossbred goat was lower than those reported for Anglo-Nubian and (Alpine x Saanen) goat^[19]. This might be due to the differences in genetic and environmental factors^[2,6]. However the average daily milk yield of crossbred goat (1.237 L) was more or less similar to 0.95 kg for pure Saanen goats, studied previously^[18], although, the crossbred goats in the present study, were fed less than the pure Saanen of the previous study^[18]. Similarly, the average daily milk yield was higher than the average daily milk yield reported for crossbred Nubian 50% x Saanen 50% (0.51 L)^[7]. This might be due to the differences in parities, since the does in previous experiment^[7] were at their first kidding and have low body weight. While, the does in the present study were in the second kidding and have high body weight which supported the previous studies^[6,20].

The fat % (4.173%) was higher than those reported for crossbred (Alpine x Saanen)^[21], pure Saanen under Sudan condition^[18] and cross Saanen goats in Brazil^[22]. This might be due to the genetic differences, where the tropics breeds give higher fat % than temperate breed^[6]. Moreover, the average fat % of the crossbred in the present study was more or less similar to the finding for Nubian goat, although the fat % in the present study was higher than those for crossbred (Nubian 50% x Saanen 50%) reported previously^[7]. This might be due to the low quality of roughages, which was used in that experiment (Sun dried chopped Abu 70). The quality of roughages affect the level of acetate production to maintain milk fat content as explained previously^[15].

The average protein (3.66%) was more or less similar to the protein (3.7%), which reported for crossbred

(Nubian×Saanen)^[7]. However, the average protein in this study was higher than for pure Saanen (3.43%)^[18], while the average protein in the present study was lower than those for pure Nubian goats (3.46%)^[16]. This might be due to genetic factor where the heritabilities of protein are 0.50^[15]. Also, the tendency for milk of tropical breeds appears to be higher in total solids, mainly due to higher fat and protein contents^[6].

The average lactose content in the present study (4.914%) was higher than that reported for Nubian goat (4.31%)^[16], pure Saanen (4.41%)^[18] and for Alpine, Nubian× Saanen and Toggenburg (4.37, 4.16, 4.56 and 4.16%, respectively)^[23].

The average ash content (0.733%) was lower than those reported for Sudanese Nubian goat (0.84%)^[16], while, it was higher than that reported for Saanen breeds (0.65%)^[18]. These differences might be due to differences between breeds^[11]. The average ash content in this study was more or less similar to those reported for Saanen goat (0.74%)^[24].

The average total solids content reported in this study (13.48%) was similar to those reported for Nubian goat in Tiawan (13.56%)^[23]. The average total solid was higher than the average total solids content for crossbred (Saanen×Nubian)^[7]. This might be due to the highly correlation of the total solids yield with milk yield, where the milk yield of the does in the present study was higher than that mentioned before^[7]. This supported the report, which stated that the genetic correlation between total solid yield and milk yield revealed +0.9^[15].

The freezing point in the present study (-0.561 °C) was more or less similar to the previous reports^[24,25]. The acidity (Lactic acid %) in the present study (0.203%) was more or less similar to those reported for goat's milk^[24] and for cross Saanen goat^[22].

The present study concluded that Saanen crossbred goat have a good capability for adapting themselves to Sudan local environmental conditions. However, some conditions must be taken into consideration, in particular the feed intake and energy concentration of the diet. Selection within Nubian breed must go in line for improving the Nubian goat and consequently a crossing process can be used with Saanen goat even to bring out a good crossbred. Moreover, an extra effort is needed to determine the most efficient percentage of crossbred between Nubian and Saanen goat.

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