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Milk Flow Rate and Milking Frequency in Red Sokoto Goats

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Abstract: Twenty-four Red Sokoto goats were hand milked for 120 days to determine milk flow rate. The does were grouped into three for once, twice and thrice a day milking to determine the effect of milking frequency on milk flow rate. The average daily milk yield and milk flow rate was 466.9g and 3.5g/sec, respectively. Milking frequency significantly ($P<0.01$) influenced milk yield and milk flow rate. The higher the milking frequency, the higher the milk yield, but with a decreasing flow rate. Milk yield and milk flow rate were significantly ($P<0.01$) and positively correlated ($r = 0.88$). Both milk yield and flow rate reached their peak at the 4th week of production. The optimum milking frequency for Red Sokoto goat in this study was the twice daily milking, since there was 52.7% increase in milk yield from once a day, with a marginal 7.9% reduction in milk flow rate.

Key words: Milk yield, flow rate, milking frequency, goats, red sokoto

Introduction

Goats contribute about 10144 x 10^3 metric tonnes to the world milk production (FAO, 1996). Although in the tropics, milk is secondary to meat production, it is extremely important in the nutritional well-being, especially of the rural community where many who cannot afford to buy milk products, or alternatively are unable to get them by rearing cattle or buffalo can easily get milk by rearing goats.

The Red Sokoto, is the most important goat breed in Nigeria, accounting for about 70% of the estimated 34.5 million goats in Nigeria (Osuhor *et al.,* 1998). A knowledge therefore, of its milk flow rate (economy of milking) would be useful in achieving good management and selection programme to improve its milk production.

Milk flow rate in goats is highly heritable (Ricordeau *et al.*, 1989). Selection for this trait has been suggested as a means of reducing the needs for milking labour since labour for milk harvest may account for as much as 80% of annual milking cost (Blake and McDaniel, 1978) and over 50% of routine operational requirement of dairy farm (Al-Bright, 1964).

For the dairy farmer, decision as to milking frequency can have large economic effects since increased milking frequency results in higher variable costs, such as feeds, labour and utilities, among others. This study was therefore, aimed at estimating the responses of milk yield and milk flow rate to milking frequencies.

Materials and Methods

The study was conducted at the National Animal Production Research Institute (NAPRI), Shika-Zaria. Shika is located between latitude 11 °N and longitude 12 °E at attitude of 640m above sea level. The mean annual rainfall is 1100mm and the temperature ranges between 21 to 36 °C.

The study used 24 Red Sokoto goats which were grazed twice daily from 8.00 am to 12 noon and from 2.00 p.m. to 6.00 p.m. A concentrate mixture of 30% maize, 35% of wheat offal and 35% cotton seed cake was fed at the rate of 300g/head/day. Water and mineral salt licks were provided free choice. Animals were routinely dewormed and sprayed against ectoparasites. The 24 lactating does were grouped into 3 of 8 animals each, corresponding to once, twice and thrice a day milking respectively. The does were milked for 120 days (17 weeks) using hand milking. Once a day milking was done in the mornings; twice a day in the mornings and evenings; thrice a day in the mornings, afternoon and evenings. Measurements were made of milk yield and milking time per doe per milking period. Milk flow rate was defined and estimated as milk yield (MY) per milking time (MT). Milking time was measured from the moment the milker placed his hands on the udder to begin milking to the moment the last drop of milk was released from the udder, using a watch clock. The effect of milking frequency on average daily milk yield and milk flow rate was done using analysis of variance (SAS, 1998) and significant means were separate using the Duncan's New Multiple Range Test. The correlated relationship between milk yield and flow rate by milking frequency was also determined; and the trend over time plotted using a graph.

Results

The average daily milk yield and flow rate was 466.9g and 3.5g/s, respectively for Red Sokoto goats in this study (Table 1). However, the milk yield and flow rate was highly variable, 23.61 and 22.90%, respectively. Milking frequency significantly ($P<0.01$) influenced milk yield and flow rate; with increasing frequency leading to

Table 1: Least squares means for average daily milk yield and milk flow rate over 120 days lactation period

Frequency	N	Milk yield (g)	Flow rate (g/s)
Once a day	8	331.8 ± 19.56[c]	3.9 ± 0.19[a]
Twice a day	8	506.5 ± 31.63[b]	3.6 ± 0.23[b]
Thrice a day	8	562.4 ± 28.33[a]	2.9 ± 0.16[c]
Overall	24	466.9 ± 26.51 (23.61)	3.5 ± 0.19 (22.90)

[a, b, c]means under the same column with different superscripts are significantly different, (P< 1.01). Figures in parenthesis are coefficient of variabilities (%).

Source of Fig. 1: The mean daily milk yield and flow rate during the 17 week (120 day) Lactation period of Red Sokoto does or the 3 milking frequency (i.e. OAD + TAD + THAD/3)

WEEKS	MILK YIELD (g)	FLOW RATE (g/s)
1	510.00	4.19
2	533.33	4.27
3	596.67	4.18
4	690.00	4.92
5	610.00	4.17
6	526.67	4.02
7	493.33	3.87
8	493.33	3.34
9	470.00	2.87
10	453.33	3.20
11	426.67	3.30
12	406.67	3.30
13	383.33	2.71
14	366.67	2.77
15	340.00	2.58
16	320.00	2.79
17	316.67	2.47

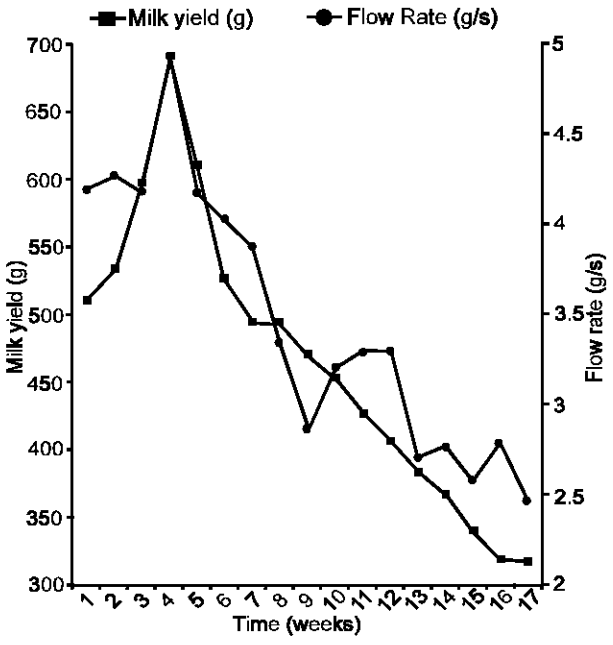

Fig. 1: The relationship of milk flow rate and milk yield with time

a corresponding increase in milk yield but at a decreasing flow rate. Milk yield increased from once to twice, once to thrice, and twice to thrice a day milking by 175.0, 230.6 and 56.0g respectively. Conversely, milk flow rate decreased from once to twice, once to thrice and twice to thrice a day milking by 0.31g, 1.05 and 0.74g/s respectively.

The peak milk production in Red Sokoto goats was at the 4th week of lactation (Fig. 1).

This is the week at which milk yield and flow rate were at their highest. Before the 4th week of lactation, milk yield and flow rate steadily increased but less rapidly for flow rate than for milk yield. Between the 4th and 7th week of lactation, there was a sharp drop in milk yield. A similar trend was observed for milk flow rate between the 4th and 5th week. However, after the 7th and 5th week, milk yield and flow rate respectively, showed a fairly constant and gradual drop over time. All the same, the correlations of milk yield with flow rate for once, twice and thrice a day milking were highly significant and positive (P<0.01; r = 0.79, 0.95 and 0.92, respectively).

Discussion

The average daily milk yield of 466.9g while agreeing with the range of 450-550g reported by Nuru (1985) and the report of Akinsoyinu *et al.* (1982) of 3.28kg/week, equivalent to 468.6g daily, disagreed with 664g reported by Akpa (1999) for Red Sokoto goats. The differences could be due to differences in management of the goats. Akpa (1999) report was based on the performance of Red Sokoto goats under the agro pastoral system of management which involves herding of the animals on daily basis and supplementing with agricultural waste and by-products. The current study was carried out under the institutional management which is basically semi-intensive in nature.

The 3.5g/sec., milk flow rate for Red Sokoto goats was lower than 12.0 to 16.1g/s reported for cross breds of some Latin American goats that were hand milked (Lu *et al.*, 1991; Montaldo and Martinez-Lozano, 1993). It was also lower than 494mc/min equivalent to 8.23g/s machine milked Morciano-Granadian dairy goats in Barcelona (Peris *et al.*, 1996). Although the present study recorded a lower flow rate in comparison to existing reports on goats, the high coefficient of variation obtained indicates the possibility of improvement through selection and better management.

The observed increase in milk yield and flow rate resulting from increasing milking frequency conforms with the reports of other workers that milk yield increases with milking frequency (Knight *et al.*, 1994). Caruthers and Copeman (1990) reported that cow's milked once a day, produced 10-23% less milk and milk solids than those milked twice a day. Also, losses of up to 35 and 50% for milking once a day have been reported by Holmes *et al.* (1992); Cleanson *et al.* (1959), respectively. Wild and Knight (1990) observed a 26% reduction in milk yield during a 2 weeks of once a day milking. In Red Sokoto goats, Fajeminsin (1991) reported 522 and 728g of milk yield for once a day and twice a day milking, respectively. These values represent a loss of 28.3% in milk yield if the goats were milked once rather than twice a day. In this study there was 34.5 and 41% loss for once rather than twice and thrice a day milking, respectively; and 10% loss for twice and rather than thrice a day milking. In other words, milking Red Sokoto goats twice and thrice instead of once a day increased milk yield by 34.5 and 41% respectively. Also, milk yield increased by 10% when the goats were milked thrice instead of twice a day. The greatest losses on once a day milking could be associated with levels of residual milk in the udder, although the relationship may not be strong (Caruthers and Copeman, 1993).

However, milk flow rate was retarded by 8.6 and 36.7% when milking of Red Sokoto goats, increased from once to twice and thrice, respectively; and by 25.9% from twice to thrice. The reduction in milk flow rate with increasing milking frequency, even though milk yield increased, suggest that milking took a longer time relative to the amount of milk added. Thus, milk yield increased in a decreasing manner in opposition to time which increased in an increasing manner. Therefore, looking at flow rate as a yardstick for measuring economics of milk production, once a day milking tended to be favoured. But its milk yield was lower than that of twice and thrice a day milking, respectively. Consequently, its financial returns would be expected to decrease (Knight and Dewhort, 1994).

From the results of this study, twice a day milking appears to provide the optimum milking frequency in Red Sokoto goats. This is because of the 52.7% increase in milk yield with a marginal reduction in flow rate of 7.9% in comparison to once a day milking. On the other hand, although thrice a day milking had 69.5% increase in milk yield, there was a wide reduction in the flow rate of 26.9% from once a day milking. Similarly, thrice a day milking provided only an 11% increase in milk yield over twice a day milking while having a wide reduction in milk flows rate of 20.6%. This further suggest a better profit and economic margin for twice a day since milking speed determines the dairy labour profit (Dodd and Foot, 1953). It was reported that labour for milk harvest accounts for as much as 80% of annual milking cost (Blake and McDaniel, 1978) and over 50% of routine operational requirements of dairy farms (Albright, 1964). Labour for milk harvest may be reduced by adopting a system of milking that allows high milk yield at fast rate of flow.

The correlation coefficients between milk yield and flow rate observed for the milking frequencies were higher than that reported by Montaldo and Martinez-Lozano (1993) for hand milking crossbred goats. However, the strong positive correlation between milk yield and flow rate at a constant milking frequency conforms with the findings of Peris *et al.* (1996) who reported a significant positive correlation between milk yield and flow rate in sheep. When consideration was given to varying milking frequency, increase in milking frequency resulted in increased milk yield but at retarded flow rate. This may suggest a fixed milk flow rate in goats which may be breed specific; and may not be reasonably modified positively by varying milking frequency. In Saanen goats, milk yield increased proportionately with flow rate up to a limit which was determine by the sphincter teat diameter (Bovillion and Ricodeau, 1970).

The trend of milk yield and flow rate in the Red Sokoto goats was similar; with the peak occurring at the 4th week of lactation. This observation agrees with the findings of Akpa (1999) who reported that peak milk yield in agropastoral Red Sokoto goats occurred at the 4th week of lactation. Also, it is consistent with reported peak periods for milk yield in tropical goats (Devendra, 1980; Osinowo and Abubakar, 1989; Ruvuna *et al.*, 1995).

The similarity in the pattern of milk yield and flow rate further affirms the high correlations between them. Although milk yield and flow rate reached their peak at the 4th week of lactation, a significant drop in flow rate occurred at 5th week while that for milk yield was at the 7th week of lactation; which there after for both maintained a gradual decline over time. This suggests a relatively high persistency in both yield and flow rate. Schmiudt and Vleck (1974) reported high milk yield due to correspondly high persistency and peak milk production. Similarly, there must be high milk flow rate, persistency and peak milk yield in order to get a high profit margin in a dairy industry.

Conclusion: The wide variation in milk yield and flow rate in Red Sokoto goats were indications that their dairy potentials are largely unimproved, which could be done through selection and better management practices. Twice daily milking appears to be an optimum milking frequency for goats.

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