INFLUENCE OF MILKING FREQUENCY ON LACTATION CHARACTERISTICS OF RED SOKOTO GOATS

AKPA, Gerald Nwachi., EDINO, Okpanachi and YASHIM, Suleiman
Animal Science Department, Ahmadu Bello University, Zaria, Nigeria

Corresponding author: AKPA, Gerald Nwachi. Animal Science Department, Ahmadu Bello University, Zaria, Nigeria

ABSTRACT

The study was carried out to determine the consequences of milking frequency on total yield, average-daily yield, peak day, flow rate, dairy merit and persistency in Red Sokoto goats. Thirty lactating does were divided into three categories on milking frequencies, once a day, trice a day and thrice a day milking of 10 animals each. All the does were at their third lactation and were hand milked for a period of 120 days postpartum. Over the 120 days lactation period, total yield, average daily yield, peak yield, peak day, flow rate, dairy merit and persistency were 55.5±2.95 kg, 0.466±0.025 kg, 0.791±0.042 kg, 33.8±4.01 d, 3.7±0.25 g/d, 10.6±0.21 % and 96.1±7.92 %. Milking frequency significantly (P<0.05) influenced total yield, average daily yield, peak yield, and milk flow rate, but not peak day, dairy merit and persistency. Milk yield characteristics increased with milking frequency, but at a decreasing flow rate. In Red Sokoto goats milking frequency affected milk yield characteristics but not dairy merit and persistency. The high lactation persistency of these goats was an indication of their ability to maintain milk production throughout lactation.

Keywords: Milking frequency, Milk yield, Dairy merit, Lactation persistency, Red Sokoto goats

INTRODUCTION

The World Health Organisation (WHO) recommended protein requirement of an adult is 0.5 - 1.0 g per kg body weight per day (65 g per day) and (approximately 20 g) of this should come from animal protein source (Flachowsky, 1999). On the average about 25 g of animal protein is available per person per day and these ranges between 9 g in Africa and 65 g in North America (Flachowsky 1999). Thus indicating that protein of animal origin for Africa is far below the recommended 20 g per capita per day.

Animal milk is one good source that can be used to bridge this gap. Out of 537403 x 10^3 metric tonne of total milk production from popular dairy animals (cow, buffalo, sheep and goats), goats contribute 10144 x 10^3 metric tonne which is about 5% (FAO, 1997). In Africa, goats contribute 2078 x 10^3 metric tonne which is about 9.2% of total milk production (22501 x 10^3 metric tonne) from dairy animals (FAO, 1997). A good dairy goat gives about 3.4 litres of milk daily which is 900 – 1800 kg milk in a 305 day lactation period (Haenlein, 1992). Compared to cows, goats will be nutritionally more economical because of their smaller size, require less food and of a type much cheaper than cows. This implied that the potential production of milk from goats could be further stimulated to increase the overall milk supply from dairy animals. Above all, goat milk fat and protein are readily digested; and the constituent amino acids absorbed more efficiently than those of cows (Jandal, 1996). The mean fat and protein percentages of milk were 4.75 and 3.38% for Red Sokoto; and 6.9 and 3.9% for West African Dwarf goats (Ehoche and Buvanendran, 1983; Akinsoyinu et al., 1977).

Accurate prediction of yield responses to increasing milking frequency is required for sound decisions by dairy producers to optimize economic returns (Erdman and Varner, 1995). Kiel et al. (1997) compared twice and thrice daily milking and found that milk yield was increased by 4.7 % and 7.3 %, respectively. Therefore, more frequent removal of milk enables a longer maximal secretion rate (Barpeled et al., 1995). In Red Sokoto goats, both total milk yield efficiency of milk production were influenced positively by increasing milking frequency (Akpa et al., 2001). The current study was therefore carried out to ascertain the influence of milking frequency on lactation characteristics of Red Sokoto goats.

MATERIALS AND METHODS

Study Area and Animal Management: This study was conducted in Ahmadu Bello University Farm, Zaria, using 30 Red Sokoto goats that were at their third parity. The does were allowed to graze sown pasture of Gamba and Digiteria, together with other animals on the farm. In addition, they received concentrate mixture consisting of whole maize, wheat offal and cotton seed cake in the ratio of 1:1:1. Concentrate mixture was given at 3% body weight. The 30 does were grouped into 3 groups of 10 each: for hand milking once a day (OAD) in the morning, twice a day (TAD) in the morning and evening; and thrice a day (THAD) in the morning, afternoon and evening. Each doe was milked for 120 days.

Data Collection and Estimations: Measurements were made of each doe for body weight taken every 30 days and averaged over the 120 days in kg; milk yield, MY (kg); milking time, MT (seconds); Average daily yield, ADY (kg); Total yield, TY (Kg); peak yield, PY (kg); and peak day, PD (days). Flow rate (FR) was defined as MY/MT. Dairy merit (DM) was calculated using the measures as described by Rao and Nagaceukar (1979) as follows:

*Fat corrected milk (FCM) = [(0.4 x milk yield (kg)] + [(15 x Fat yield (kg)]

*FCM/kg W = $\dfrac{FCM}{W}$ where W = body weight (kg)

*FCM/kg MW = $\dfrac{FCM}{W^{0.75}}$ where MW is the metabolic weight

*FCN/day/kg MW = $\dfrac{FCM/day}{W^{0.75}}$ *Net energy efficiency (NEE)(%) =

$$\dfrac{750 \, X \, FCM/day \, X100}{(750 \, X \, FCM/day)+70W^{0.75}}$$

Where 750 = kilocalories of energy per kg of FCM and 70 = Basal metabolic rate,

*Dairy Merit (DM) (%) =

$$\dfrac{NEE \, X \, FCM/day}{FCM/day+0.173W^{0.75}} \quad (Brody, 1945).$$

The average fat percent in milk obtained for the different animals was used for calculating FCM on the basis of lactation yield in 120 days. Total fat yield was calculated as % Fat x total milk yield.

The lactation persistency for each doe was calculated using the method of ratios (Ludwick and Peterson, 1943). The total lactation period of 120 days was divided into four consecutive periods of 30 days each; and total milk yield in each period for each doe was recorded. The following ratios were obtained:

$$R_1 = \frac{X_2}{X_1} ; R_2 = \frac{X_3}{X_3} ; R_3 = \frac{X_4}{X_3}$$

Where X_1, X_2, X_3 and X_4 refer to the total milk yield in the four consecutive periods. The ratios were added and weighting factors calculated as:

$$W_1 = \frac{R_1}{R_1 + R_2 + R_3} ; W_2 \, \frac{R_2}{R_1 + R_2 + R_2} ;$$

$$W_3 = \frac{R_3}{R_1 + R_2 + R_3}$$

By using W_1, W_2 and W_3, the persistency index (PI) of each doe was calculated as: PI = ($W_1.R_1$ + $W_2.R_2$ + $W_3.R_3$) 100.

Statistical Analysis: Least squares means and standard errors for total yield, average daily yield, peak day, flow rate, dairy merit and persistency were estimated (SAS, 1989). These characteristics were subjected to analysis of variance using the estimated values for each of 10 does in the 3 milking frequency groupings. Significant means were separated using the Duncan's Multiple Range Test. (SAS, 1989).

RESULTS AND DISCUSSION

Table 1 shows the effect of milking frequency on dairy characteristics of these goats. While milking frequency significantly (P < 0.05) influenced total yield, average daily yield, peak yield and milk flow rate, did not affect peak day, dairy merit and persistency of these goats. The milk yield characteristics increased with increase in milking frequency. Conversely, increase in milking frequency decreased milk flow rate.'

The observed corresponding incremental effect of milking frequency on milk yield characteristics have been reported by several other workers (Eradman and Varner, 1995; Barpeled *et al.,* 1995; Klei *et al.,* 1997). As was observed by Barpeled *et al.,* (1995), the main effect of milking frequency on milk yield was directly related to the actual milk removal from the udder, regulated by the presence of protein in the milk that inhibits milk secretion and the feedback inhibitor of lactation (FIL). As milk accumulates in the udder between milking, secretion rate gradually decreases because of the action of FIL.

Table 1: Least squares means of dairy characteristics by milking frequency

Character	N	Once	Twice	Thrice	Overall
Total yield (kg)	10	39.6±3.01[b]	60.1±3.59[a]	66.8±2.58[a]	55.5±2.95
Mean daily yield (kg/d)	10	0.3±0.03[b]	0.5±0.03[a]	0.6±0.02[a]	0.5±0.03
Peak-yield (kg/d)	10	0.6±0.03[b]	0.8±0.05[a]	0.9±0.06[a]	0.8±0.04
Peak day (d)	10	27.5±1.41	29.8±7.68	36.8±6.71	33.8±4.01
Flow rate (g/s)	10	4.4±0.48[a]	3.8±0.45[ab]	2.9±0.21[b]	3.7±0.25
Dairy merit (%)	10	10.3±0.47	10.6±0.28	10.9±0.34	10.6±0.21
Persistency (%)	10	96.6±6.30	92.0±2.25	99.5±15.21	96.1±7.92

a, b means along the same row with different superscript differ significantly (P<0.05)

More frequent removal of milk from the udder enables a longer maximal secretion rate than less frequent one, causing milk accumulate in the udder between milking, leading to gradual decrease in milking secretion rate due to the FIL effect. Therefore, milking frequency is extrinsic in action; thus explaining why it had no influence on peak day, dairy merit and persistency which are intrinsic properties of the does that are less subjected to extrinsic influences.

Since labour for milking harvest accounts for as much as 80% of animal milking cost (Blake and McDaniel, 1978), and over 50% of the routine operational requirement of dairy farms (Albright, 1964), labour for milk harvest may be reduced by adopting a system of milking that allows high milk yield at a faster flow rate. For economics of milk production therefore, twice a day (TAD) milking appears to provide optimum milking frequency for Red Sokoto goats in this study. This is because there was a 40% (200 g) increase in milk yield with a marginal reduction in flow rate of 14% (0.6 g/s) compared to once a day (OAD) milking. Although thrice a day (THAD) milking had a significant increase in milk yield of 50% (300 g), there was a wide reduction in milk flow rate of 52% (1.5g/s) when compared with OAD milking. All the same, THAD milking provided an increase of 10% (56 g) over TAD), but this was not significant (P>0.05) and cannot compensate for the reduction in the milk flow rate of 31% or 0.9 g/s. This suggests a better profit and economic margins for TAD since milking speed determines the dairy labour profit (Dodd and Foot, 1953)

Conclusion: In this study, milking frequency significantly influenced milk yield characteristics but not peak day, dairy merit and persistency in Red Sokoto goats. It appears that twice daily milking of these goats would provide a better profit and economic margin for the farmers.

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