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EFFECTS OF BREED, AGE, SEASON AND WEEK ON MILK SECRETION RATE AND EIGHT HOUR MILK YIELD OF WEST AFRICAN DWARF AND RED SOKOTO GOATS

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ABSTRACT

A comparative study on milk secretion rate and 8 h milk yield of West African Dwarf (WAD) and Red Sokoto (RS) goats was carried out at Abeokuta, Nigeria. The milk secretion rate and 8 h milk yield obtained for WAD and RS were 6.57±0.34 ml/h, 52.57 ± 2.74 ml and 7.32±0.35 ml/h, 58.55 ± 2.83 ml respectively. Does aged 1.5-3 years had higher secretion rate and part milk yield 7.42±0.36 ml/h and 59.37± 2.86 ml than older does 6.47±0.34 ml/h and 51.75±2.72 ml. The milk secretion rate and 8 hr milk yield were higher in the wet season 7.51±0.35 ml/h and 60.11±2.81ml than in the dry season 6.38±0.35 ml/h and 51.00±2.76 ml. They were also higher in the early weeks of lactation and declined towards the end of lactation.

INTRODUCTION

Lactogenesis is defined as the initiation of lactation. This process is a cellular change whereby mammary epithelia cells are converted from a non-secretory state to a secretory state. Milk synthesis which naturally commences following parturition takes place in the gland epithelium. The alveolar cells merge to form fine vesicles (alveoli) which are encompassed on the outside by myoepithelial cells (composite cells) especially muscle tissue (Schams *et al*., 1984). According to Linzell (1996), milk yield in cows rises to a maximum at 5-6 weeks after calving or parturition and declines exponentially until dry. The udder of cows and goats are capable of secreting colostrum some weeks before parturition. In pigs, sheep and horses no milk can be obtained until some few hours before parturition, while milk secretion is delayed in man until some few hours before parturition. Whereas, Zygoyiannis (1994) observed that the yield increased to a maximum in 4 -5 weeks and, thereafter declined until weaning at 12 weeks. Synthesis of goat milk largely depends on nutritional factors (Morand – Fehr *et al*., 1982). Purfusion of goat and sheep mammary glands has been associated with reduced rate of milk secretion (Linzell, 1996). Secretion rate of milk falls promptly and precisely to half as soon as perfusion begins, but continues at this rate for about 12 h. However, glands transplanted or joined unto other goats (even a male) secreted more milk and for longer period.

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Milk yield is dependent on the amount of secretory tissues and the rate of milk secretion (per unit of time). Secretion rate is affected by the accumulation of milk in the alveolar lumen. Accumulation of milk in the lumen increases the intra-mammary pressure. Once the intra-mammary pressure reaches a certain level, secretion rate declines; and if the pressure continues to rise secretion rate may stop and milk starts to be reabsorbed. The inhibition of milk secretion that accompanies increasing intra-mammary pressure is probably caused by a chemical inhibitor rather than the increased pressure of the fluid itself. According to Linzell (1996), a negative feedback substance on milk influences the rate of milk secretion in goats. He also observed that a local factor that is widely held to influence the rate of milk secretion is pressure, which is suppose to cause involution when milk removal is stopped and is responsible for the composition of colostrum.

Some recent works have focused on different parameters for milk yield improvement in indigenous goats. Akpan and Duru (1999) reported on milk yield and efficiency of estimation of total milk yield using average records in non-suckling Red Sokoto goats. James and Osinowo (2002) examined the relationship between udder dimensions and milk yield in West African Dwarf goats, Red Sokoto and Sahel goats. Most recent is the work of Bemji (2003) who reported on the relationship between 3x8 h and 24 h milk yield estimates. From all these works, no attention has been given to milk secretion rate. It is therefore necessary to investigate the influence of some factors such as breed, age, season and week on milk secretion rate and which could be incorporated to improve milk production in indigenous goats.

MATERIALS AND METHODS

Experimental animals and their management

Sixteen West African Dwarf (WAD) and Red Sokoto (RS) does were used for this experiment. The animals were managed under an intensive system with zero grazing. They were fed mainly on chopped (*Panicum maximum*, *Pennisetum purpureum* and *Stylosanthes hamata forages*) and supplemented with 0.3 – 0.5 kg/head/day of a concentrate compounded from wheat offal (40 %), dry brewers grains (36 %), maize (5 %), bone meal (0.5 %), palm kernel cake (18 %) and common salt (0.5 %). given *ad libitum.* Bucks were introduced to does for heat detection and natural mating. The animals were subdivided into two groups with regard to their age and season of kidding. These include 1.5-3 years, 3.5-5 years, and wet and dry seasons. Their ages were determined by dentition formula according to Saini *et al.* (1992).

Milking of goats

Milking of goats that kidded in the wet season commenced from the month of May, 2002 while those that kidded during the dry season were milked from the month of October, 2002, each for 12 weeks. On each milking day, the kids were separated from the dams at 8.00 am and the does were milked dry. The isolated does were milked dry 8h later that is at 1600 hr to obtain the milk yield, after which the kids were returned to their dams. Milk secretion rate was obtained on hourly basis by dividing the 8-h milk yield by 8. Milk samples were obtained weekly for 12 consecutive

weeks from each doe after kidding except for the first three days postpartum when samples of colostrum were collected.

Statistical analysis

The data generated from this study were subjected to least squares analysis of variance (Systat, 1993). The model used for the analysis was

$$Y_{ijkl} = \mu + B_i + A_j + S_k + W_l + E_{ijkl}$$

Where:

Y_{ijkl} = The value of the milk component of interest

μ = The overall mean of the milk component of interest

B_i =The fixed effect of the i^{th} breed (I = 1, 2)

A_j= The fixed effect of the j^{th} age group (j = 1.5-3, 3.5-5)

S_k = The fixed effect of the k^{th} season of birth (k = 1,2)

W_l = The fixed effect of the l^{th} week of lactation (l = 1,2, ….. 12)

E_{ijkl} = random error term associated with each record.

RESULTS

Effects of age, season and week were significant on 8-h yield and milk secretion rate ($P<0.05$, 0.05 and 0.001 respectively). Does aged within the first three years of life produced more milk and had higher milk secretion rate than those that have exceeded three years. The values for 8-h yield and secretion rate were higher in wet season 60.11±2.81 ml and 7.51±0.35 ml/h than in dry season 51.00±2.76 ml and 6.38±0.35 ml/h. The 8-h milk yield and secretion rate were higher in the first week of lactation with a mean value estimated at 95.56± 6.61 ml and 11.95±0.83 ml/h. It declined gradually to the sixth week, and increased by the 7^{th} week before it gradually declined to the twelfth week with a mean value estimated at 38.35±7.64 ml and 4.79±0.95 ml/h. The breed effect was not significant ($P>0.05$).

DISCUSSION

The result of the present study clearly showed that the 8-h milk yield of the does increased in the 1^{st} week of lactation, reached its highest in the 5^{th} week and afterwards declined till the 12^{th} week. This result corroborates the findings of Akinsoyinu et al. (1977) who reported peak milk yield on the 5^{th} week of lactation in the two breeds.

Similarly, secretion rate of milk was higher in the first week of lactation and gradually declined to the fifth week when it was static for two weeks and declined towards the end of twelfth week.

The average 8-h milk yield of 157.70ml/day (161.90 g/day) and 175.66ml/day (179.86g/day) for WAD and RS goats were lower than the milk yield of 300 g/day, 468.06 g/ day and 545.0 g/day reported by Akinsoyinu et al. (1977); Akinsoyinu *et al*. (1982) and Ehoche and Buvanendran (1983) for WAD and RS goats respectively. The differences observed in the milk yield of does in this study and that reported by other authors could be due to management system adopted, different ages and liveweight of does. It might also be due to the differences in milk extraction methods during the experimental period while some authors used oxytoxin injections prior to milking, others estimated milk yield using kid weight differences before and after suckling. They are however higher than the values obtained by James and Osinowo (2002) who reported 118.7ml/ day

(122.9g / day) and 142.5 ml / day (148.2 g) for WAD and RS respectively.

Red Sokoto goat produced higher milk yield and milk secretion rate than WAD goat and this result agrees with the findings of Akinsoyinu et al. (1982); Ehoche and Buvanendran (1983) in the same breed. However, James (2000) confirmed further in his study that with regards to average partial daily milk per kg liveweight, WAD goats significantly ($P<0.001$) produced the highest average PDM of 8.4 ml /day while RS does produced 8.2 ml /day.

The 8-h milk yield and milk secretion rate obtained in this study was higher in the wet season than dry season and higher for does aged between 1.5-3 years. Yakin and Eker (1961) reported that milk production were at maximum at the fourth year after which it fell rapidly. In addition, this result is in agreement with the report of Fisher (1979) who recorded higher milk yield for does kidding in the rainy season and Gelais (1999) who reported higher milk yield for does kidding in winter. This is accompanied by the availability of adequate fresh forage during wet season.

CONCLUSION

Milk secretion rate was higher in Red Sokoto than West African Dwarf goats, the animals aged 1.5-3yrs than those aged 3.5-5 yrs and wet season than dry season. It was also higher in the early stage of lactation and decline towards the end of lactation.

Table 1. Effects of breed, age, season and week on milk secretion rate of WAD and RS goats

Variables	Subclass	No of samples	MSR (ml/h) (LSM+ SEM)	8 HR MY (ml) (LSM+ SEM) 52.57
Breed	WAD	96	6.57+0.34	+ 2.74
	RS	96	7.32+0.35	58.55 + 2.83
Age	1.5-3	96	$7.42+0.36^{a}$	$59.37 + 2.86^{a}$
	3.5-5	96	$6.47+0.34^{b}$	$51.75 + 2.72^{b}$
Season	Dry	96	$6.38+0.35^{b}$	$51.00 + 2.76^{b}$
	Wet	96	$7.51+0.35^{a}$	$60.11 + 2.81^{a}$
Week	1	16	$11.95+0.83^{a}$	$95.56 + 6.61^{a}$
	2	16	$8.36+0.83^{ab}$	$66.88 + 6.61^{ab}$
	3	16	$8.50+0.83^{ab}$	$68.00 + 6.61^{ab}$
	4	16	$6.76+0.83^{b}$	$54.06 + 6.61^{b}$
	5	16	$7.51+0.83^{ab}$	$60.06 + 6.61^{ab}$
	6	16	$5.94+0.86^{b}$	$47.48 + 6.91^{b}$
	7	16	$6.52+0.83^{b}$	$52.13 + 6.61^{b}$
	8	16	$6.56+0.86^{b}$	$52.51 + 6.91^{b}$
	9	16	$5.19+0.86^{b}$	$41.50 + 6.91^{b}$
	10	16	$5.56+0.86^{b}$	$44.44 + 6.91^{b}$
	11	16	$5.72+0.86^{b}$	$45.76 + 6.91^{b}$
	12	16	$4.79+0.95^{b}$	$38.35 + 7.64^{b}$

[a-b]Means in the same subclass having different superscripts differ significantly ($P<0.05$), LSM-least squares means
MSR- milk secretion rate
8 HR MY- 8 hour milk yield
SEM- standard error mean

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