

UDDER SIZE AND MILK PRODUCTION POTENTIALS OF GOATS AND SHEEP IN THE SOUTH WEST OF NIGERIA

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ABSTRACT

Twelve adult lactating goats and sheep (2 to 2 1/2 years old) comprising three groups of four each of West African Dwarf (WAD) goats and sheep and Yankasa ewes were used for a nine week trial. The animals kidded and lambed between January and March. During these periods, the udder sizes of the dams were measured weekly before hand milking thrice a week to determine the milk yield. Samples of the milk were analysed for their composition. The results showed that the udder size increased with increasing milk yield (112 - 248ml) up to the peak of lactation which was between weeks 3 and 4 after parturition. Thereafter it decreased in size till the end of the experiment. The coefficient of variation (CV) of the udder size was influenced by breed. Udder size was positively correlated with milk yield. Milk yields were generally low or and ranged between 39 and 70ml and this was dependent on the behaviour of the lactation curve. The milk protein and ash contents for the three breeds were comparable to those of the temperate breeds. Though Yankasa sheep exhibited the highest milk production potential, yet the peculiar characteristics of goat milk cannot be overlooked.

Key Words: Udder size, milk yield and composition, West African Dwarf, (WAD) Yankasa, WAD goat, sheep.

INTRODUCTION

Milk is the most complete source of nutrients for children (Pastor *et al*, 1993) and it is adjudged the best possible food and drink for a baby. In Nigeria, the milk consumption far out weighs its production (FAO, 1987). This may be attributed to the over dependence on cow's milk which, at present, is grossly

inadequate. Literature on udder size, milk yield and composition in Nigeria deals largely with cattle (Adeneye *et al*, 1970; Adeneye 1989) and to a limited extent, goats (Akinsoyinu *et al*, 1977; Akinsoyinu, 1981) and sheep (Adu *et al*, 1974; Alokun, 1989). In developed countries, recent work had been reported on udder size, milk yield and composition of goats (Wang, 1989; Montaldo and Martinez-Lazano, 1993). With the current adverse effects of food crisis in Nigeria, it has now become necessary to look for possible ways of getting more nutritive feeding items notably milk, to alleviate these effects. This could possibly be achieved by using our local breeds of goats and sheep whose potentials have long been neglected as sources of dairy and dairy products.

It was on this note that the present work was designed to provide more information on udder size, milk yield and composition of WAD goats and sheep as well as Yankasa sheep as influenced by breeds and stage of lactation.

MATERIALS AND METHODS

Animals and their Management

Twelve (12) lactating small ruminant dams (2 to 2 1/2 years of age) and of unknown parity comprising three groups of four each of WAD does and ewes, and four Yankasa ewes were used for the trial. The WAD does and ewes kidded and lambed respectively between January and February, 1994 while the Yankasa ewes lambed between February and March of same year. All the animals were fitted into the experiment at three weeks after parturition in a Completely Randomized Block design experimental arrangement. They were raised on a semi-intensive system of management and were always allowed to graze Giant Star grass (*Cynodon nlemfuensis*). Salt licks and clean

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water were provided for the animals throughout the experiment. Veterinary care was available when required.

Measurement of udder size

Udder circumference was measured weekly throughout the experimental period that lasted 9 weeks using a one-metre length metric tape.

Collection of Milk

Hand milking was done thrice a week for all the experimental animals by 6.00am on the designated milking days. Prior to the day of milking, the offsprings were always separated overnight from their dams from 6.00pm to 6.00am. Milk collection was done for nine weeks. Milk yields were measured using a measuring cylinder of 100cm³ capacity immediately after collection. Portions of the total milk collected from each dam per day were stored in a deep-freeze cabinet at -5°C till required for analysis. Before analysis, each sample was warmed to 40°C to melt the fat and then cooled to 20°C. The desired triplicate quantities necessary for analysis were taken for each well-mixed sample. No preservatives were added.

Analytical Procedure

Milk samples were analysed for total solids, fat, crude protein (N x 6.38), lactose, and total ash. Solid-not-fat (SNF) content of the milk samples were calculated as the difference between the total solids and fat composition of the milk.

The total solids were determined by drying weighed amount of samples (approximately 10ml) to constant weight at 105°C for 24 hours. Fat was estimated by the Gerber's method as described by Davis (1959). Protein (N x 6.38) was also determined (A.O.A.C., 1990). Lactose was assessed by the method of Barnett and Tawab (1957), the total ash was determined when a known weight of sample (approximately 5ml) was evaporated to dryness and ashed in a muffle furnace at 500 - 550°C for 2 hours. In addition, the protein-fat (P/F) ratio (Gupta and Rao, 1972) and fat/SNF ratio were calculated. Statistical evaluation was by Analysis of variance and treatment means compared by Duncan's

multiple Range Test (Steel and Torrie, 1980).

RESULTS

Table 1 shows the udder size variation and milk yield as influenced by stage of lactation. Both the udder size and milk yield were shown to increase till the second week of the experiment which was the fifth week *post partum*. The coefficients of variation for udder size were highest in WAD sheep (24.66) and least in WAD goat (18.50). The milk yield was significantly ($P < 0.05$) influenced by stage of lactation and breeds.

Table 2 reveals the correlation coefficients (r) values and regression equations of udder size and milk yield. It showed that udder size and milk yield as traits can be selected together for milk production in the three breeds examined but the degree of selection will be more favoured in WAD and Yamkasa sheep breeds. Figure 1 shows the lactation curves for the three breeds examined. It indicated that though milk yield curves were highest at week 4 of the experiment, the curves varied with different breeds. Table 3 shows the mean milk composition and their interrelationships. It showed that all the compositions and the interrelationships calculated were not significantly ($P > 0.05$) influenced by the breed effects expect for ash contents.

DISCUSSION

The udder sizes of the three breeds used in this study increased with increasing milk yield up to the peak of lactation which was between 3 and 4 weeks after parturition before it decreased in size till the end of the experiment. This agreed with other reports (Rugina *et al*, 1982; Perez *et al*, 1983). The CV was highest in WAD sheep followed by Yankasa sheep and WAD goat. This suggests that udder size may be influenced by breed and that breeds could respond positively to selection in udder size in that order. The significant correlations between udder size and milk yield observed here corroborate the report of Perez *et al*, (1983) and Odabasioglu, (1985). This may be due to the fact that

TABLE 1: UDDER SIZE AND MILK YIELD OF GOATS AND SHEEP AS INFLUENCED BY STAGE OF LACTATION

Week of Sampling	WAD goat		WAD sheep		Yankasa Sheep	
	Udder size cm	Milk yield ml	Udder size cm	Milk yield ml	Udder size cm	Milk Yield ml
3	17.0	112	26.2	143	27.1	127
4	22.3	143	29.1	198	30.9	248
5	21.9	123	24.9	175	28.1	188
6	21.2	97	24.1	133	27.5	163
7	21.2	80	23.0	148	26.9	163
8	20.0	80	22.0	114	25.3	118
9	17.7	60	18.5	88	19.0	98
10	15.5	78	15.3	53	18.7	85
11	12.0	65	12.5	39	15.3	70
Mean	18.76	93.11 ^b	21.74	121.22 ^a	24.31	140 ^a
S.Dev.	3.47	27.87	5.36	53.25	5.29	56.31
C.V.	18.50		24.66		21.76	

WAD = West African Dwarf

CV = Coefficient of Variation

a,b, - means along the same row with any unidentical superscripts differ significantly (P < 0.05)

TABLE 2: CORRELATION COEFFICIENTS (R) AND REGRESSION EQUATIONS OF UDDER SIZE AND MILK YIELD OF GOATS AND SHEEP

Milk yield versus udder size	r values	Regression Equations
WAD goat	0.60	Y = 11.71 + 0.08X
WAD sheep	0.98	Y = 9.99 + 0.10X
WAD Yankasa	0.89	Y = 12.55 + 0.89X

Y = Udder size variation; X = Milk yield

TABLE 3: VARIATION IN MILK COMPOSITION AND INTERRELATIONSHIP BETWEEN MILK CONSTITUENTS OF GOATS AND SHEEP.

Parameters	WAD goat	WAD Sheep	Yankasa
Total Solid (%)	15.54 ± 2.05	14.86 ± 1.48	15.69 ± 1.00
Solid Not Fat (SNF) %	11.32 ± 2.16	11.28 ± 1.81	11.66 ± 1.47
Protein %	4.89 ± 1.03	4.90 ± 0.68	5.06 ± 0.38
Fat %	4.22 ± 1.07	3.58 ± 1.38	4.03 ± 1.02
Lactose %	5.66 ± 1.36	5.57 ± 1.68	5.74 ± 1.27
Ash %	0.78 ^b ± 1.07	0.81 ^{ab} ± 0.04	0.84 ^a ± 0.05
Fat/SNF ratio	0.39 ± 0.15	0.34 ± 0.18	0.36 ± 0.12
Protein/Fat ratio	1.23 ± 0.39	1.59 ± 0.71	1.36 ± 0.51

WAD = West African Dwarf

a,b = means along the same row with unidentical superscripts differ significantly (P < 0.05).

parturition necessitates the needs to feed the new born. Thus, there is increased blood flow with nutrients to the udder; and this may lead to increase in udder size and milk synthesis and production. By implication it may be possible to predict milk yield from the measurement of udder size using regression equations.

The milk yields of the breeds examined were low when compared with the temperate breeds (Wallace, 1948; Thomson and Thomsom, 1953; Badamana, 1990). This could be due to the fact that these animals are of small body size especially the WAD goats and the animals have not been selected for milk production. The mean milk yields which were influenced ($P < 0.05$) by stage of lactation and breed agree with the reports of Akinsoyinu *et al* (1977) and Pastor *et al* (1993). The lactation curve is similar to the one reported (Ologun and Oshodi, 1994) for Yankasa sheep. Yankasa sheep with the mean milk yield of 140ml, though very low, appeared to show the greatest milk yeild. With the mean yield, coupled with the bigger body size, these animals might be genetically superior to WAD goat and sheep. Further comparative studies of the milk yield among these animals using larger numbers are suggested.

The average percent total solid, SNF observed in this study were lower than those reported (Akinsoyinu *et al*, 1977; Alok, 1989) for goats and sheep respectively, but higher than those reported elsewhere (Devendra, 1980; Koushik and Gupta, 1989 and Nyakalo *et al*, 1990). While the average percentage crude protein content for the three breeds were comparable to those reported (Nyakalo *et al*, 1990), fat and lactose contents of the milk were lower than those reported elsewhere (Akinsoyinu *et al*, 1977; Devendra, 1980) and also higher than reported by Koushik and Gupta (1989).

The percentage ash contents for the three breeds examined were significantly ($P < 0.05$) influenced by breeds. This corroborated the report by Jenness (1986). The observed ash contents were comparable to those of Akinsoyinu *et al*, (1977); Devendra, (1980);

Koushik and Gupta, (1989) and Nyakalo *et al*, (1990) but lower than those reported (Alok, 1989). The Fat/SNF ratios obtained were lower than the 0.54 reported by Koushik and Gupta (1989). This thus indicates that these three breeds have little quantity of fat in their milk. Conversely, the protein/fat ratios were all higher than the values reported (Koushik and Gupta, 1989). Their milk protein contents were therefore high with attendant lower fat content. The indication of this is that more protein will be consumed per unit volume than fat in their milk.

Generally, all the compositions measured were not significantly influenced ($P < 0.05$) by breed except the ash content. From this study, it appears that Yankasa sheep may have some genetic superiority which favour milk production better than in the remaining two other breeds, yet goat milk has its own peculiar qualities that are nutritionally and medically superior to sheep or cow's milk (Egwu *et al*, 1995). Therefore, improvement can still be achieved in the milk yields and composition of the three breeds with the introduction of good management practices such as selection and cross breeding, provision of good nutrition, to mention but a few.

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