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Udder and linear body measurement in ewes and does in relation to performance of their offspring under the traditional system of management

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Abstract

Forty-eight lactating does and ewes were used to study partial milk yield, udder dimensions, linear body measurement in ewes, does and performance of their offspring under the traditional system of management. Milk yield, udder dimensions, linear body measurements of dam and offspring were significantly superior in sheep. Average partial milk yield was 53.86 and 78.56 ml per week for goat and sheep respectively. There was no significant effect of parity on all variables measured. Udder circumference was the most related trait to partial milk yield (r=0.57) in goat. The highest correlation was observed between partial milk yield and teat length (r=0.39) in sheep. Partial milk yield was significantly correlated with weight (r=0.33) in kids. Milk yield was significantly correlated with lamb's heart girth (r=0.49) followed by foreleg length (r=039) in lambs. Based on the results of the present study, it could be recommended that partial milk yield could possibly be determined based on udder size and teat length in extensively managed does and ewes respectively. Kid's heart girth could be a good indicator of doe's milk production.

Keywords: Udder, linear body measurement, ewes, does, performance, offspring and traditional system.

Introduction

Goat and sheep play important roles in the welfare of small arable farmers in Nigeria through the income generated when sold. There is global concern about alleviating poverty and improving the welfare of the rural populace. About 85% of the small holder farms in Nigerian sub-humid zone keep West African Dwarf goat (WAD) (Bayer, 1986). Local sheep and goat breeds in Nigeria have the potential to supply a significant portion of milk deficit in the country because sheep number far exceed cattle number in both rural and urban communities (RIM, 1992, Adewumi, 2005). They are also more affordable to resource poor families and produce more milk in relation to body size than cattle (Nuru, 1985). In spite of this potential, sheep and goats have largely been neglected by researchers in respect of increased milk production.

Parity also referred to as lactation number or age at parturition has been reported in ewes that were intensively managed. Conflicting reports on the effect of parity on milk yield abound in literature. James and Osinowo (2004) reported that milk yield in lactating does increased with increased number of parities while Tancina *et al.* (2011) demonstrated decrease in milk flow rate in 2nd and 3rd parity and attributed it to decreasing intra-mammary (cisternal) pressure due to reduced milk production. Mavrogenis and Papachristoforou, (2000) reported a significant parity effect on sheep and goat and obtained highest milk yields from third parity ewes and does. On the other hand, El-Abid *et al.* 2010 obtained no significant effect of parity on milk yield of Sudanese Nubian goats. There is therefore the need to determine the effect of parity on performance of tropical sheep and goat in extensively managed system.

The udder morphology criteria and its health status are important factors influencing milk production of ewes and does. Therefore, selection with a good heritability is a good index for increasing milk yield (Thompson and Thompson, 1987). The use of udder phenotypic variation has provided a basis for initial screening in doubling the average milk production in sheep (Reynolds and Brown, 1991). Selections of dairy animals are made either on actual yield test or on some physical characteristics which are considered to be indicative of yield ability. The udder is a modified skin gland where milk biosynthesis takes place, therefore its importance and shape should be considered for studying. Milk yield which is the quantity of milk produced from the mammary gland of lactating dams has a lot of nutritional benefit to the offspring. Growth of lambs depends essentially on the milk production of the dam. It is therefore essential to estimate the quantity of milk furnished by the dam in relation to performance and linear body measurements of their offspring

Linear body measurement and live weight in ewes have been used extensively for a variety of reasons both in experimental work and in selection practices (Cam *et al.*, 2002, Adewumi, 2006 and 2011). In production system, knowing an animal live weight is important in the market and a breeding programme. Animals have a balance relationship between body weight and body measurements. From this stand point, liveweight is determined to the nearest kilogram (kg), and thereafter it could be evaluated using body measurement which can be adopted when selling animals. Economic studies have shown that dairy production in sheep and goat production is more profitable than meat or wool production from small ruminant. While body measurements have proved to be good predictors of body weight but this was not the case with milk yield (Adewumi *et al.*, 2003; Atta and El khidir, 2004, Afolayan *et al.*, 2006). There is dearth of information on this topic in extensively managed sheep and goat. Therefore, the aim of this research was to investigate udder dimensions, linear body measurements, and partial milk yield in does, ewes and their offspring as affected by parity and species under the extensive system of management.

Materials and Method

The Experiment was conducted with 26 ewe with their lambs and 22 lactating does with their kids in Ogun state in the South-Western part of Nigeria. The age and weight of the dams were 2-4years and 19 and 23kg respectively. The animals were managed extensively without provision for shelter. Data collection was done once in a week for twelve weeks. The traditional hand milking method was used to collect the milk from both sheep and goat. A dry cleaned bowl was used to collect milk, after the udder had been washed well and dried with a towel. The milk collected in the dry cleaned bowl was measured with the aid of a table weighting scale and measuring cylinder to measure the amount of milk collected from each of the sheep and goat. Milk collection started from the second week of lactation. The lambs and kids were separated from their dams overnight. This was done to prevent suckling and facilitate partial milking the following morning with the lambs and kid at foot for stimulation of milk let down. Milk collected was measured in volume using a 250ml graduated cylinder to determine the yield. Udder dimension such as Udder circumference, Udder width, Distance between teats, Teat length, Teat circumference

Udder dimensions

Udder circumference: taken as distance round the mid udder region

Udder width: taken as horizontal distance

from one end of the udder to the other
Distance between teats: estimated by measuring the distance between the right and left teat; from the middle point of the teat.
Teat length: distance between the tips of the teat to the base of the teat
Teat circumference: distance round the mid teat region.

Linear body measurement

Linear body measurements were taking with the aids of measuring tape and these include:
Heart girth: the body circumference immediately posterior to the front leg (cm)
Rump height: the vertical distance from the top of the pelvic girdle to the ground (cm)
Wither height: the vertical distance from the top of the scapular to the ground (cm)
Body length: the distance between the point of the shoulder corresponding to the outer and central tuberosity of the left humerus to the left tuber ischii
Fore leg length: the vertical distance from the chest region to the ground.
Hind leg length: the vertical distance from the side of the pelvic girdle to the ground.
Tail length: this is the measurement from the tip end of the tail to the top of the vent region.

Statistical analysis

The data collected were subjected to Two-Way Analysis of Variance (ANOVA) without interaction using Statistical Package for Social Sciences (SPSS) (Field, 2000) and significant means were separated using Duncan's multiple range test of the statistical package. The relationships among parameters were estimated using Pearson's correlation and regression analysis.

The statistical models used were:

$Y_{ikl} = \mu + T_j + S_k + \square_{ikl}$ Model 1

Where μ = Population mean
T_j = Fixed effect of species (1, 2)
S_k = **Fixed** effect of parity (1, 2, 3)
$\square_{ij}$ = Random residual error associated with each record

$Y = a + bx$.................... (linear) Model 2

$Y = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n$ (Multiple linear) Model 3

Where Y= milk yield (dependent variable), x= body weight of dam, linear measurement of does, ewes, lambs and kids (independent variable), b = regression coefficient of Y on X

Results and Discussion

Effect of species on milk yield, udder traits and linear body measurements

The mean ± standard error, ANOVA, correlation and regression analysis of milk yield, udder traits and linear body measurement for goat and sheep are represented in Table 1-6. The overall mean ± standard error of milk yield, weight of dam, height at withers, body length, heart girth, fore leg length, hind leg length, tail length, and rump height for goat were 53.86ml, 19.26cm, 47.22cm, 54.57cm, 64±1.05cm, 29.96cm, 34.48cm, 16.82cm, 50.61cm, and for sheep: 78.55ml, 23.08cm, 61.58cm, 59.58cm, 73.36cm, 39.31cm, 43.18cm, 21.40cm, 64.81cm. Milk yield, weight of dam and linear body measurement were significantly different between species (Table 1). Average milk production was 53.86 and 78.56 ml week^{-1} while mean body weight was 19.20 and 23.09 kg for goat and sheep respectively. On body weight basis, milk yield was 2.81 and 3.4 ml kg^{-1}BW day^{-1} body weight for goat and sheep respectively. These values were lower than the ones obtained by Adewumi and Olorunisomo, 2009. Sheep was significantly superior in milk yield, weight, udder dimensions and linear body measurement which was consistent with the findings of Adewumi, et *al* (2003), James and Osinowo, (2004). These authors associated larger udder dimension with higher milk yield. Equivalent mature body weights were higher in sheep (19.20kg for goat and 23.09 for sheep). On the contrary, Mavrogenis and Papavasiliou, 2009 reported a higher weight value for goat as compared to sheep. Generally, the temperate breeds of goats are heavier than the ones in this study. The height at withers, body length and heart girth values were higher than those reported by Adewumi *et al.* (2011) while the hind leg, tail length and rump height were shorter than the ones recorded by Adewumi *et al.* (2011). This implies that sheep raised under the extensive system tend to be slopy downwards towards the back than sheep raised under the semi-intensive system.

Effect of parity on all variables measured were not significant ($P<0.05$) for sheep, goat and their offspring. This is in line with the findings of El-Abed *et al.* (2010) but contrary to the findings of James and Osinowo, (2004), Zahraddeen *et al.* (2009). These authors reported that milk yield in lactating does increased with increased number of parities. This could probably be due to the differences in the management system. Trend in parity for all measured parameters was consistent except for udder circumference and udder width which decreased with increased number of parities in goat (Table 2). There was an increase in distance between teats from 7.60 to 9.60 cm in goat which contradicts the reports of Amao *et al.* (2003). Nevertheless, goats in parity 2 had the least milk production (50.58mls) while parity 3 exhibited the highest milk production (59.60mls). However, there was a slight increase in udder measurements in parity 2. This observation contradicts the findings of Knight and Wilde (1993) who reported an increase in population of milk secreting cells in the mammary gland with increased parity which led to general increase in the udder size, arising from increase in the udder dimensions. The increase which is for lactopoiesis definitely leads to increase in udder dimensions. However, Tancina, *et al.* (2011) demonstrated decrease in milk flow rate in 2nd and 3rd parities and attributed it to decreasing intra-mammary (cisternal) pressure due to reduced milk production. Linear body measurements, except height at withers, increased with increase in parity in goats. Conversely, these parameters decreased with increase in parity in sheep.

No significant difference between kids and lambs was observed for heart girth, hind leg length, foreleg length, and tail length only (Table 1). The overall mean values for weight, height at withers, body length, heart girth, hind leg length, fore leg length, tail length and rump height for kids were 3.38kg, 28.96cm,, 31.55cm, 36.41cm, 21.60cm, 24.65cm, 8.83cm and 32.48cm while for lambs, they were 5.30kg, 40.21cm, 36.49cm, 39.01cm, 21.81cm, 26.16cm, 10.25cm and 34.44cm. The observed values for weight and height at withers were similar with the report of Adewumi *et al.* (2009), while the other body dimensions were . Lambs were also seen to be heavier in weight and other body measurements than kids.

There was a significant effect of parity on the weight and tail length in lambs but the parity had no effect on weight and other body measurements of kids (Table 2). This means that as parity increases, body weight

Table 1. Means (± se) of milk yield, udder dimension and linear body measurements in sheep and goat

Traits	Doe (22)	Ewe (26)
Weight (kg)	19.20 ± 0.76^{b}	23.09 ± 0.78^{a}
Milk yield (cm)	53.86 ± 7.19^{b}	78.56 ± 7.49^{a}
Udder circumference (cm)	28.44 ± 1.23^{b}	31.61 ± 1.28^{a}
Udder width (cm)	14.26 ± 0.60^{b}	16.85 ± 0.63^{a}
Distance between teats (cm)	8.35 ± 0.40^{b}	9.59 ± 0.42^{a}
Teat length (cm)	2.26 ± 0.09^{a}	1.61 ± 0.10^{b}
Teat circumference (cm)	3.56 ± 0.15	3.11 ± 0.16
Height at wither (cm)	47.22 ± 1.15^{b}	61.58 ± 1.20^{a}
Body length (cm)	54.57±1.24^{b}	59.85±1.29^{a}
Heart girth (cm)	64.00±1.05^{b}	73.36±1.10^{a}
Foreleg length (cm)	29.96±0.87^{b}	39.31±0.91^{a}
Hind leg length (cm)	34.48±1.28^{b}	43.18±1.34^{a}
Tail length (cm)	16.82±0.76^{b}	21.40±0.79^{a}
Rump height (cm)	50.61±1.00^{b}	64.81±1.04^{a}
	Kid	Lamb
Weight (kg)	3.38 ± 0.16^{b}	5.30 ± 0.16^{a}
Height at wither (cm)	28.96 ± 1.34^{b}	40.21±1.40^{a}
Body length (cm)	31.547 ± 1.47^{b}	36.49±1.53^{a}
Heart girth (cm)	36.41 ± 1.38	39.01±1.43
Hind leg length (cm)	24.65 ± 1.07	26.16±1.11
Fore leg length (cm)	21.60 ± 0.78	21.81 ± 0.81
Tail length (cm)	8.83 ± 0.56	10.25±0.58
Rump height (cm)	32.48 ± 1.26^{b}	34.44±1.31^{a}

^{a,b} Means with a different superscript in a different column are significantly different (P<0.05)

and tail length of lambs also increase significantly. The increase in body weight of kids and lambs with increased parity is consistent with trend reported by Osinowo *et al.* (1993) and Wilson (1986). Height at withers, hind leg and foreleg decreased with parity but the decrease was not significant. Height at withers increased as parity increased in lambs. Trend in parity did not show a definite pattern for other body measurements in kids and lambs.

Tables 3 and 4 showed the results of correlation coefficient between milk yield and udder measurements of goats and sheep. With Pearson's correlation modules, milk yield was positively and moderately correlated with udder circumference traits. Of the udder dimensional traits, udder circumference was the most related trait to milk yield and the correlation between these two traits was (r=0.57, P<0.05) in goat. Previous studies on the relationships between udder dimensions revealed that there was positive association among those traits in goats. This confirms to the report of Saiyed and Patel (1989) and Labed'Ko (1989) who recorded significant correlation between milk yield and udder circumference. Similarly, a significant correlation was obtained between milk yield and weight of dam (r=0.50, P<0.05). This is in line with the report of Bemji *et al.* (2006). Udder circumference was positively correlated (r=0.86, P<0.01) with udder width in goats. James *et al.* (2008) concluded that udder circumference and udder width were the best descriptors of the pattern of udder growth during pregnancy and lactation. There was no significant correlation between milk yield and distance between teats in goat. There was

Table 2. Effect of parity on milk yield, udder dimensions and linear body measurement in sheep and goat

Doe				Ewe		
	Parity			Parity		
Trait	1	2	3	1	2	3
Weight (kg)	51.40	50.58	59.60	75.66	80.00	80.00
Milk yield (cm)	18.80	18.58	20.40	23.46	23.12	22.66
Udder circumference (cm)	30.60	27.92	26.80	30.80	34.38	29.67
Udder width (cm)	16.10	14.17	12.50	16.53	18.19	15.83
Distance between teat	7.60	8.04	9.40	8.90	10.23	9.67
Teat length (cm)	2.04	2.63	2.10	1.60	1.68	1.57
Teat circumference (cm)	3.60	3.63	3.44	2.89	3.54	2.90
Height at wither (cm)	45.00	46.66	50.00	62.33	62.75	59.67
Body length (cm)	52.40	54.91	56.40	60.73	60.50	58.33
Heart girth (cm)	65.00	61.00	66.05	73.66	73.75	72.66
Foreleg length (cm)	28.40	29.08	32.40	39.67	39.63	38.67
Hind leg length (cm)	31.40	34.67	37.40	43.80	43.75	42.00
Tail length (cm)	15.20	16.67	18.60	21.80	21.75	20.67
Rump height (cm)	49.80	50.25	51.80	65.67	66.13	62.66
	Kids			Lambs		
Weight (kg)	3.20	3.23	3.70	4.76[b]	5.10[b]	6.03[a]
Height at wither (cm)	38.20	39.75	42.67	38.20	39.75	42.67
Body length (cm)	36.83	34.63	38.00	36.83	34.62	38.00
Heart girth (cm)	39.57	37.13	40.33	39.57	37.12	40.33
Hind leg length (cm)	21.43	23.00	21.00	21.43	23.00	21.00
Fore leg length (cm)	27.07	27.75	23.25	27.07	27.75	23.67
Tail length (cm)	1.20	8.45	1.03	12.00[a]	8.45[b]	10.33[ab]
Rump height (cm)	36.27	37.38	32.67	36.27	37.38	32.67

[a, b] Means with a different superscript in a different column are significantly different (P<0.05).

also a high and significant correlation between distance between teats and teat circumference (r=0.61, P<0.01) in goat. However, the measure of milk yield was negatively correlated with teat length (r=-0.32) and teat circumference (r=0.06).

The correlation between milk yield and weight was not significant (r= 0.23; P>0.05) in sheep. This strongly suggests that body size is not a determinant of the volume of milk production in extensively managed ewe. This is in line with the report of Mavrogenis and Papachristoforou, (2000) who suggested that milk yield is independent of body size and concluded that body size when expressed is probably the consequence of better feeding and improved management practices during periods of stress. There was no significant correlation between milk yield and udder circumference (r= 0.29; P>0.05). This implies that as udder circumference increases, udder width also increases significantly. In contrast, a significant correlation (r= 0.58; P>0.05) between milk yield and udder circumference was demonstrated by Adewumi *et al.* (2003). High correlation was observed between udder circumference and udder width (r=0.92, P<0.01). A similar finding was obtained by Kominaks *et al.* (2009). There was a negative correlation between milk yield and distance between teats in sheep which is contrary to the report of James,

Table 3. Correlation matrix between milk yield, udder dimension and linear body measurements in goat

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MK	1.00													
WT	0.50*	1.00												
UC	0.57**	0.03	1.00											
UW	0.41	-0.19	0.86**	1.00										
DT	0.17	0.46*	0.03	-0.20	1.00									
TT	-0.32	-0.16	-0.09	-0.06	-0.24	1.00								
TC	-0.06	0.38	-0.04	-0.04	0.61**	-0.01	1.00							
HT	0.19	0.48*	0.34	-0.42	0.64**	-0.39	0.28	1.00						
BL	0.36	0.36	-0.09	-0.25	0.36	-0.14	-0.10	0.67*	1.00					
HG	0.06	0.39	-0.00	-0.14	0.48*	-0.09	0.11	0.41	0.52*	1.00				
FL	0.06	0.43*	0.17	-0.41	0.78***	-0.41	0.36	0.71**	0.38	0.28	1.00			
HL	0.25	0.52*	-0.20	-0.48**	0.61**	-0.42	0.26	0.74**	0.57**	0.22	0.72**	1.00		
TL	-0.06	0.21	-0.20	-0.40	0.60**	-0.23	0.02	0.60**	0.29	0.25	0.80**	0.54*	1.00	
RH	-0.06	0.49*	-0.49*	-0.57**	0.61**	-0.25	0.29	0.77***	0.31	0.41	0.76**	0.61**	0.75**	1.00

*Significant (P <0.05), **Significant (P<0.01), ***Significant (P< 0.001).

MK= milk yield, WT = Weight of dam, UC = Udder circumference, UW = Udder width, DT = Distance between teat, TL = Teat length, TC = Teat circumference, HW=Height at withers, BL=Body length, HG=Heart girth, FLL=Fore leg length, HLL=Hind leg length, RH=Rump height

(2002) and could be due to the fact that the milk yield by other authors were collected every 12hours and 24hours interval while in this study, milk yield was collected on weekly basis. Udder circumference was high and significantly correlated (r= 0.65; P<0.01) with teat circumference and udder width which is consistent with the findings of Amao, (1999). By implication, it shows that the larger the udder circumference, the larger the teat circumference. Udder circumference has a negative correlation (r= -0.22; P>0.05) with teat length. The highest correlation though low was observed between milk yield and teat length (r=0.39; P>0.05). This is consistent with the

Table 4. Pearson correlation matrix between milk yield, udder dimension and linear body measurements in sheep

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MK	1.00													
WT	0.23	1.00												
UC	0.29	0.34	1.00											
UW	0.20	0.43*	0.92**	1.00										
DT	-0.14	0.27	0.52**	0.53**	1.00									
TT	0.39	-0.16	-0.22	-0.28	-0.27	1.00								
TC	0.13	0.07	0.65**	0.62**	0.36	0.12	1.00							
HT	-0.03	0.29	0.48*	0.37	0.14	-0.26	0.45*	1.00						
BL	-0.19	0.08	0.10	0.02	0.05	0.19	0.25	0.65***	1.00					
HG	-0.19	0.33	0.41	0.29	0.21	-0.35	0.27	0.73**	0.52**	1.00				
FL	0.16	0.17	0.32	0.14	0.16	.06	-0.03	0.19	0.06	0.43*	1.00			
HL	0.24	0.31	0.39	0.27	0.16	0.09	-0.03	0.28	0.11	0.38	0.92**	1.00		
TL	-0.11	0.10	0.32	0.33	0.04	-0.23	0.08	0.24	-0.05	0.39*	0.50**	0.61**	1.00	
RH	0.02	0.11	0.52**	0.38	-0.37	-0.11	0.41*	0.65**	0.40*	0.48*	-0.20	0.21	0.33	1.00

: (P <0.05), **Significant (P<0.01), ***Significant (P< 0.001).

MK= milk yield, WT = Weight of dam, UC = Udder circumference, UW = Udder width, DT = Distance between teat, TL = Teat length, TC = Teat circumference, HW=Height at withers, BL=Body length, HG=Heart girth, FLL=Fore leg length, HLL=Hind leg length, RH=Rump height

Table 5 Pearson correlation matrix between milk yield in does, ewes and linear body measurements in kids and lambs

	1	2	3	4	5	6	7	8	9	10
Kids										
MY	1									
WT	0.33	1								
HW	0.19	0.44*	1							
BL	0.01	0.36	0.34	1						
HG	-0.16	-0.05	0.49*	0.08	1					
FLL	0.20	0.39	0.73**	0.47*	0.55**	1				
HLL	0.22	0.36	0.59**	0.64**	0.49*	0.93**	1			
TL	0.02	0.43*	0.43*	0.84**	0.14	0.55**	0.69**	0.67**	1	
RH	-0.04	0.38	0.75**	0.75**	0.42*	0.66**	0.67**	0.64**	0.78**	1
Lambs										
MY	1									
WT	0.01	1								
HW	0.36	0.57**	1							
BL	0.11	0.26	0.52**	1						
HG	0.49**	0.36	0.79***	0.60**	1					
FLL	0.39*	-0.04	0.09	0.05	0.17	1				
HLL	0.12	-0.15	0.15	-0.08	0.31	0.66**	1			
TL	-0.03	-0.46*	-0.39*	-0.31	-0.17	0.00	0.03	-0.16	1	
RH	0.25	-0.04	0.24	-0.15	0.36	0.55**	0.90***	0.25	0.11	1

MK= milk yield, WT = Weight of dam, UC = Udder circumference, UW = Udder width, DT = Distance between teat, TL = Teat length, TC = Teat circumference, HW=Height at withers, BL=Body length, HG=Heart girth, FLL=Fore leg length, HLL=Hind leg length, RH=Rump height

report of Adewumi *et al.* (2003). The authors demonstrated a moderate correlation between milk yield and teat length.

Table 5 shows the Pearson's correlation matrix between milk yield of does and body measurements of kids and between milk yield of ewes and body measurements of lambs. The correlation between milk yield in does and body weight of kids (r=0.33) and the correlation between milk yield in ewes and body measurements of lambs (r=0.13) were low, positive but not significant (P<0.05) (P>0.05. By implication, growth rate of kids and lambs may not be a good indicator of milk yield in does and ewes as evident in this study. The low and non significant correlation of partial milk yield with weight does not reveal their consistent contribution to the

Table 6. Linear regression equation between milk yield, udder dimensions and linear body measurements of does, ewes, kids and lambs

Species	Equations	r	r^2
Goat	MK = -39.16 + 3.25UC	0.57	0.32
	MK = -119.16 + 3.18UC + 4.30WT	0.75	0.56
Sheep	MK = 13.88 + 39.29TL	0.39	0.15
	MK = 69.10 + 48.01TL + 2.19UC	0.55	0.30
Kids	No variable was qualified to enter the equation	-	-
Lambs	MK = - 9.10 + 2.23HG	0.49	0.24

MK= milk yield, WT = Weight of dam, UC = Udder circumference, TL = Teat length, HG=Heart girth

milk yield. This is consistent with the work carried out by Kremer et *al.* (1995) and Adewumi *et al.* (2011). Milk yield was significantly correlated with lamb's heart girth (r=0.49; P<0.01) followed by foreleg length (r=039; P<0.05). Heart girth has been reported to be significantly associated with live weight by Afolayan *et al.* (2006) in adult sheep. Therefore, its relationship with milk yield of dam may be of economic importance. The lowest correlation was obtained between milk yield and tail length (r=0.03; P>0.05).

A stepwise multiple regression analysis was carried out when weight and other body measurements were added one at a time. The essence was to determine how other body measurements would influence the precision of milk yield predictions. It was observed that weight appeared to be an important additional variable to udder circumference to obtain up to 56% predictor of milk yield in does while udder circumference was an important additional variable to teat length to obtain up to 30% in ewes. No variable was qualified to enter the equation for milk yield and linear body measurements in kids but only heart girth was the only determinant of milk yield in lambs. A moderate association between the udder circumference and milk production could be established in the present study as reflected by the fact that udder circumference explain 32% of the variation of milk yield in goat. However, a low association between teat length and milk production of 15% was obtained in sheep. Komanilov *et al.* (2009) reported 45% of the variation in udder circumference and milk yield.

Conclusion

Sheep produced more milk than goat, as observed from this study. Milk yield was not affected by number of parity. Third parity produced more milk than first and second parities for goat, while first parity produced more milk than second and third parities for sheep. A moderate association between udder measurements and milk production in goats could be established in this study. Growth rate of kids and lambs is not a good indicator of milk yield in does and ewes but heart girth in lambs seems to be a good indicator of milk yield. With regard to importance of the individual traits, the present study showed that the combination of udder circumference with weight is a significant predictor of milk production in goat and to a little extent in sheep under the extensive management system.

Recommendation

Based on the results of the present study, it could be recommended that milk yield could possibly be determined based on udder sizes of does and ewes. . In addition, improvement can still be achieved in the milk yield of goats and sheep with the introduction of good management practices and provision of good nutrition.

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