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Comparative Study of Udder Traits and Milk Composition in Small Ruminant

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Target Audience: Ruminant Nutritionist, farmers, researcher, scientist

Abstract

*The comparative study of udder traits and milk composition of small ruminant were assessed. A total of 320 small ruminants were used for the study. Comprising of 80 from each breeds of sheep and goats (80 Sahellian ,80 Red Sokoto goats and 80 Uda and 80 Yankasa sheep). Matured ewes and does were used for the study, age range between 2-4 years of age and with average body weight of 20-35kg.The udder and teat characteristics were measured (UW, TW, UL, UV, TL, TW and TFD) using flexible tape and venire caliper while the body weight was done using weighing balance. Milk quality were analyzed for protein%, fat%, lactose%, ash%, casein% and total solid %. The milk composition of small ruminant investigated that there was no statistical significance variation in the values of milk composition of small ruminant, although the protein % of sheep was slightly higher than goat. Sheep and goat may have the potential of moderate to high milk production under good management and improve feeding. Highest mean value of body weight was obtained in sheep as compared with goats. The descriptive statistics of udder and teat measurement indicated highest mean value of teat to floor distance of sheep. Lowest mean value was obtained in the value of udder volume of sheep. The Pearson correlation of udder and teat measurements of small ruminant investigated that there exists strong significant correlation between body weight and TFD (r = 0.73**) which indicate that increase in body weight may lead to increase in teat to floor distance. Moderate strong and significant correlation was observed between UW and UC with the value of r = 0.49**. These imply that increase in one parameter may lead to increase in other parameter at an average rate. Low significant correlation was observed in the following parameters BW and UL (r = 0.33*), UW and BW (r = 0.23 **), UL and UW (r = 0.37*), UW and TFD (0.33**), UW and TL (r = 0.167*), UC and TW (r = 0.147*), TL and TFD (r= 0.127*) and TW and TFD (0.227**) respectively. The variation of udder and teat measurements of small ruminant observed significant variation in the body weight of pregnant ewe and doe as compared to lactating once. Based on the study there was no statistical significant variation in the values of milk composition of small ruminant. The variation of udder and teat measurements of small ruminant observed significant variation in the body weight of pregnant ewe and doe as compared to lactating once.*

Key words: Milk composition, Udder measurement, Breed and Small ruminant

Description of Problem

In Nigeria the large ruminant particularly the cattle have been the major sources of domestic meat and milk supply. Milk supply from other animals such as sheep, goats and camels is negligible. Sheep and goat possess a great adaptability to various harsh environmental condition, short gestation period, small size and can be feed to different diets as compare to cattle. They are very important animals for their good productivity, they produced meat, milk and skin (1). Small ruminants thrive well in areas where other activities are not possible and provide a cushioning effect in the period of drought. Sometimes it is called liquid assets because it can be converted into cash for urgent family needs (2). The udder is very important gland in reproductive animals for milk production. Several studies have confirmed that udder and teats characteristics are important determinants of milk yield and milking ability in dairy animals (3). Better knowledge of morphological udder trait variability allowed the identification of mammary trait most suitable for incorporation into selection programs for dairy sheep breeds (4). Phenotypic characteristics are important for breed identification and for variation of morphological traits in farm animals (5). Interrelationship among udder measurements and milk yield within sheep and goats have been demonstrated yet not fully investigated. In dairy sheep, the most important functional traits are those related to udder morphology. Evaluating of udder morphology can be performed by direct measurement of the udder (6). Sheep milk has been used by man since the beginning of sheep domestication, and its heath potential has been investigated. In South America, sheep milk products are traditionally made by hand, using raw milk without the addition of dairy cultures, this differentiates the products by their typical flavors and aromas. The main goal of dairy production is to improve traits related to milk production. It is possible to apply stronger selection in sheep and goat than in dairy cows, due to higher fertility and shorter generation interval (7). There are wide variations in milk constituents within and between species which depend on many factors. Some of these factors are genetics, type of diet, udder health and season. Distinct climatic conditions and lactation periods are also known to have pronounced influence on the milk composition and yield (8). The objectives of the study were to compare the udder measurements and milk composition of sheep and goats. The objectives of the study were to compare the udder and teat measurements and milk composition of sheep and goats.

Materials and Methods

Study Area

The research was conducted in Maiduguri, Borno state. Maiduguri is situated on latitude 10° 11° N and longitude 12° and 13° E and at an altitude of 354m above sea level. The area falls within the Sahelian (semi-arid) region of West Africa which is noted for its great climatic and seasonal variation. It has very short period of rainfall about 3 – 4 months given 645.9 mm of precipitation per annum with a long dry season of about 8-9 months. The temperature could be as low as 26.77°C during the dry cold season (October-January) and as high as 40.12°C during the dry hot (February and May). Relative humidity is about 5% in April and up to 60% in August while day length varies from 11-12 hours (9).

Experimental Animals.

A total of 320 small ruminants were used for the study. Comprising of 80 from each breeds

of sheep and goats (80 Sahellian ,80 Red Sokoto goats and 80 Uda and 80 Yankasa sheep). Matured ewes and does were used for the study age range between 2-4 years of age and with average body weight of 20-35kg.The animals were obtained from Kasuwan Shanu Maiduguri cattle market.

Data collection

Udder measurements

The animals were restrained in standing position or recumbent positions before the parameter were measured. The breed of each animal was determined and the measurement were measured using flexible tape and meter rule as described by (10).

Eight (8) udder and teat measurement were measured. The following parameters were measured as follows.

i. Udder length (UL)-this was measured as the distance between the base of udder attachment to the abdominal region and the point of teat protrusion from the udder.

ii. Udder width (UW)-this was measured as the distance between the widest points of the udder.

iii. Udder circumference (UC)-this was measured as the distance (perimeter) round the widest point of the udder.

iv. Teat height to ground (THG)-this was measured as the distance between teat tips to the ground.

v. Teat length (TL)-this was measured as the distance between teat tip and base of attachment to the teat. vi. Teat width (TW)-this was measured as the distance between the widest points of the teats.

vii. Distance between the teats (DBT)-this was measured as the distance between the front and hind teat .

viii. Udder volume was obtained using the formula.

$V=(4/3)$

r^3

Where $r = (UL+UW)/4$

According to (9) .

Milk sample collection

Milk Samples

Before the milk collection hands were sanitized and gloves was used during collection this is done in other to avoid contamination of the samples. Milk samples (100ml) was collected in sterile tubes directly from the udder. Milk sample was collected from 10 ewes and 10 does per breed postpartum by hand milking procedure to determine the milk composition of the two breeds of sheep and goat. The milk sample was collected in a sterile plastic flask and immediately transferred in to an ice box before taken for milk quality analysis in Adamawa State University Mubi Laboratory. Milk quality was analyses for fat%, protein%, lactose%, solids non solid fat% and vitamins %.

Procedure for milk composition procedures

Milk samples was analyzed for total solids (TS), crude protein (CP), butterfat, solids-non-fat (SNF), ash and lactose. Total solid (TS) was obtained by drying about 5.0g milk sample to a constant weight at 105°C for 24 hours. Butterfat was estimated by the Rose Gottlieb method as described by the procedure. Milk protein (N x 6.38) was determined using the semi-micro distillation method using Kjeldahl and Markham's apparatus. Ash content was obtained by drying and ashing a weighed milk sample (10 ml) to a constant weight at 550°C for 48 hours. Lactose content was determined from fresh samples using standard procedure (11).

Statistical analysis

All data generated were subjected to descriptive statistics, analysis of variance using ANOVA SPSS Version 20 and Pearson correlation was used to determine the relationship between the udder characteristics and teat measurements. Mean were separated using Duncan's multiple range.

Results and Discussions

Composition of milk variation in small ruminant

Table 1. Present the milk composition of small ruminants in the study area. From the study, it was observed that, there were no statistical variation in the values of milk composition of small ruminant. The protein % of sheep was higher than goat with the values of 3.92+-0.24 %, though it is lower than the findings of 12 who observed the values of 5.52,5.33% in the study for West African Dwarf (WAD) and Yankasa breed of sheep respectively. These may be due to genetic variation, management or environment. The result obtained for milk protein percent were within the range as observed by 13 who obtained the value of 3.84+-0.03% in the study. The present result was not in agreement with the findings of 14 who obtained higher values of protein 4.89+-0.10%. From the study it was observed that goat have higher fat% than sheep though it was not significant. The value of 3.42 % for sheep and 3.33 for goat obtained in the present study was within the range as investigated by (13). Nevertheless, sheep and goats reared on semi-arid rangeland of the Northeast of Nigeria have the potential for moderate milk production under good management and nutrition. Therefore, nutritional supplements are required to increase milk production and quality for optimal growth of kid and milk supply.

Table 1: Composition of Milk Variation in Small Ruminant.

Species	Protein%	Fat%	Lactose%	Ash%	Casein%	Total solid%
Goat	3.283±0.26	3.42±0.41	3.72±0.54	0.39±0.28	2.47±0.33	7.15±0.53
Sheep	3.92±0.24	3.33±0.36	3.76±0.59	0.38±0.38	2.71±0.52	7.48±0.63

Descriptive statistic of udder measurement of small ruminant

Table 2 present the descriptive statistics of udder and teat measurements of small ruminant. The higher mean value of body weight (BW) was obtained in sheep species with the value of 38.37kg, and also teat to floor distance (TFD) of 40.81cm for sheep respectively. The results of present findings similar with 15 who observed variation in breed of goats studied. Lowest mean value was obtained in udder volume of sheep with the value of 1. 09m^3.

Pearson correlation of udder and teat measure of small ruminant.

The combined Pearson correlation of udder and teat measurement of small ruminant were presented in Table 3. There observed a strong significant correlation between BW and TFD with the value of (r=0.731**) this indicate that increase in body weight may lead to increase in teat to floor distance TFD, this finding is in lined with the study of 15 who observed the values of (r=0.62) in the study. Moderate strong and significant correlation was observed between udder width (UW)

Table 2: Descriptive Statistic of Udder Measurement of Small Ruminant

PARAMETER	MEANS	SE	MAXIMUM CV RANGE	MINIMUM CV RANGE
SHEEP				
BW (kg)	38.37	1.13	36.15	40.60
UL(cm)	12.88	0.36	12.17	13.39
UW(cm)	12.27	0.28	11.72	12.82
UC(cm)	3.85	0.16	3.53	4.18
UV(m^3)	1.09	0.72	0.032	2.51
TL(cm)	2.58	0.11	2.36	2.81
TW(cm)	1.53	0.53	1.31	1.76
TFD(cm)	40.81	0.04	39.65	41.98
GOAT				
BW(kg)	24.25	0.44	23.37	25.13
UL(cm)	11.25	0.14	10.98	11.53
UW(cm)	11.16	0.11	10.95	11.38
UC(cm)	3.78	0.06	3.66	3.91
UV(m^3)	1.27	0.28	0.71	1.83
TL(cm)	3.00	0.47	2.91	3.09
TW(cm)	1.99	0.04	1.90	2.08
TFD(cm)	30.81	0.23	30.35	31.27

BW: boby weight, UL: udder length, UW: udder width, UC: udder circumference, UV: udder volume, TL: teat length, Whereas TW: teat width, TFD: teat to floor distance.

and udder circumference (UC) with the values of (r=0.493**) while low significant relationship were obtained between body weight (BW) and udder length (UL) with the values of (r=0.327**), between udder length (UL) and udder width (UW) with the of values of (r=0.327**), between udder length(UL) and udder width (UW) with the values of (r=0.370**), between udder width (UW) and teat to floor distance (TFD) with the values of (r=0.330**) respectively. This present finding Agreed with the findings of (16). Other relationships observed were either low, significant or low relationship but not significant. This indicated that increase of one trait may not necessarily lead to increase in the other trait respectively.

Variation of udder and teat measurement in small ruminant

The variation of udder and teat measurement of small ruminant were presented in Table 4. There observed significant variation in the body weight of pregnant ewe as compared with lactating ewes with the values of 41.18±0.99kg and 35.55±2.03kg respectively. Similar trend was observed with goat species with the value of 24.94±0.60kg and 23.55±0.66kg although not significant variation observed. This present study Agreed with the findings of (17) who observed higher udder measurements and body weight in pregnant ewes as compared to the lactating ewes. This may be also due to influence of hormones during pregnancy (18). Although, there exist variation in the values of other parameters during pregnancy and lactating but there was

Table 3: Pearson correlation of udder and teat measure of small ruminant

	BW	UL	UW	UC	UV	TL	TW	TFD
BW(kg)	1							
UL(cm)	0.327**	1						
UW(cm)	0.238**	0.370**	1					
UC(cm)	0.106*	0.087	0.493**	1				
UV(m^3)	0.028	0.084	0.12	0.099	1			
TL(cm)	0.029	0.188*	0.167*	0.114	0.088	1		
TW(cm)	0.151*	0.178*	0.110*	0.147*	0.096	0.652	1	
TFD(cm)	0.731**	0.301**	0.330**	0.181*	0.032	0.127*	0.227**	1

BW: boby weight, UL: udder length, UW: udder width, UC: udder circumference, UV: udder volume, TL: teat length, Whereas TW: teat width, TFD: teat to floor distance *P < 0.05: **P < 0.01

Table 4: Variation of udder and teat measurement in small ruminant

PARAMETER	SHEEP P	SHEEP L	GOAT P	GOAT L
BW (kg)	41.18±0.99	35.55±2.03	24.94±0.60	23.55±0.66
UL (cm)	13.37±0.31	12.39±0.64	11.19±0.19	11.32±0.21
UW (cm)	12.50±0.24	12.04±0.50	11.23±0.15	11.09±0.16
UC (cm)	3.89±0.14	3.82±0.30	3.76±0.09	3.81±0.09
UV (cm)	1.16±0.63	1.02±1.29	1.65±0.38	0.88±0.42
TL (cm)	2.68±0.10	2.49±0.21	3.03±0.63	2.96±0.06
TW (cm)	1.56±0.10	1.50±0.20	1.97±0.06	2.01±0.06
TFD (cm)	41.45±.52	40.18±1.06	30.54±0.31	31.08±0.34

BW: body weight, UL: udder length, UW: udder width, UC: udder circumference, UV: udder volume, TL: teat length, Whereas TW: teat width, TFD: teat to floor distance, sheep P: sheep pregnant, sheep L: sheep lactating, goat P: goat pregnant, goat L: goat lactating

no much significant variation that exist between, UL, UW, UC, UV, TL, TW and TFD in the study.

Conclusions

The composition of milk variation of small ruminant investigated that there was no statistical significant variation in the values of milk composition of small ruminant. Sheep and goat has the potential of moderate milk production in the study area under improve management and good nutrition. The descriptive statistics of udder and teat measurement indicated that highest mean value of body weight was obtained in sheep species as compared with goats and also teat to floor distance of sheep. The correlation observed in the study were either significantly strong, moderate, other either low, significant or low relationship but not significant. This indicated that increase of one trait may not necessarily lead to increase in the other trait respectively.

Recommendations

It is expected that selection for body weight in small ruminant will lead to increase in some udder measurements that positively correlated.

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