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Correlation Between Udder Traits With Breed, Live Weight, Age and Parity in Respect to Milk Production of Indigenous Goats in Adamawa State, North-eastern Nigeria

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ABSTRACT

The objective of the study is to correlate between udder traits with breed, live weight, age and parity in respect to milk production of indigenous goats in Adamawa State, North-Eastern Nigeria. Thirteen households were randomly selected for the study from which 55 semi-intensively managed indigenous goats comprising of 13 Sahel, 20 Sokoto Red and 22 Non-descript Does within the age limits of 1, 2, 3 and 4 years and parities of 1, 2, and 3 respectively. Age, parity, live weight (Lwt) and udder parameters, like: teat floor (TF), teat angle (TA), udder length (UL), udder volume (UV) and teat length (TL) were measured. The Sahel does have higher values of Lwt, TF, TA, UL, UV, and TL respectively. The three breeds did not differ significantly in TA. The difference between Sokoto Red and Non-descriptive goat was only in TF distances. Sokoto Red goats had significantly higher ($P < 0.05$) value of TF than Non-descript goats. All other udder traits increased numerically with advance in age except for TA. There was a significant ($P < 0.05$) effect of parity on Lwt, TF, and UV. The values of all the parameters measured increased with increase in parity, except TA that was highest in does in their first parity. There was significant ($P < 0.01$) age x breed interaction effect on all parameters investigated except TA. The Sahel does exhibited higher superiority in all the parameters measured over other breeds at various ages except in does aged ≥ 4 years. The Sahel does across all age groups compared with the other two breeds have the highest values of TF, TL UL and UV. The results of breed x age and breed x parity interactions showed significant effect only in TF distances which

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is an indication of growth in relation to skeletal development among all the breeds and in some age and parity groups. Lwt has high relationship with TF, TL, UV, age and parity. Similarly, parity had high relationship with all the parameters except for breed and UL. The values of udder traits of Sahel goats were higher ($P < 0.05$) than other breeds which may be due to superiority of the Sahel goats for milk production. Hence, it could be concluded that Sahel goat could have better milk production potentials than Red Sokoto and Non-descriptive goats in in this north-eastern Nigeria. This could form a basis for selection and breeding decision for milk production.

Keywords: Relationship, Udder Traits, Breed, Age, Parity, Milk Yield, Goats, Nigeria

INTRODUCTION

More than 57% of the goats' world population (316 Million) are found in the tropics (Yadav, 2010) but milk produced from goats is too low and seldom used for economic dairying. The poor milk production of these indigenous goats have been attributed to poor genetic potentials, unplanned breeding, inadequate feeding, harsh environmental condition, poor management and disease constraints. In Nigeria, there are three common breeds of goats namely: West African Dwarf, Sahel and Sokoto Red or Maradi (Oni, 2002). A substantial number of non-descript types are also found (Hagan, *et al.,* 2012). The Sokoto Red is the most wide-spread, most important and well known goat breed in Nigeria, accounting for about 70% of the estimated 53.8 million goats in country (FAOSTAT, 2008). This formed a higher proportion of goats found in the villages in the northern two third of the country (Blench, 1999).

The importance of goat as a provider of essential food in terms of meat and dairy products (protein) has been discussed and documented in many studies (Boyazoglu and Morand-Fer; Haelein, 2004). This importance is also reflected by goats' largest increase in population during the last 20 years (FAO, 2001) and the largest untapped increase in milk production compared to other ruminant farm animals (Midau, *et al*., 2010).

One of the most important traits of dairy goat is the ability to produce large quantity of milk. Milk yield of 7kg per week is higher than 1.6kg per week recorded by Sankey (1991), for Sokoto Red goat. Milk production of goats is likely to be greater than in the official statistics, because of the large unreported volume (Midau, *et al*., 2010). This is not surprising because, the use of goat milk at the rural household levels is not popular and unrecorded. While at the national level more goat milk flow through the informal selling points than the formal markets (Aina, 2012).

It is therefore, important to evaluate the main traits that are related to milk production such as udder, teat and body weight and their relationship with milk yield and residual milk after milking (Peris, *et al*., 1999). Shape and size of the udder and teat have been shown to relate well with milk yield and milk flow rate (Marnet, *et al*., 1999; Marie-Etancelein, *et al*., 2002). The objective of the study is to correlate between udder traits with breed, live weight, age and parity in respect to milk production of indigenous goats in Adamawa State, North-Eastern Nigeria.

MATERIALS AND METHODS

The Study Area

Adamawa State is located at the area where the River Benue enters Nigeria from Cameroon Republic and is one of the six states in the North-East geopolitical zone of Nigeria. It lays between latitudes 7^0 and 11^0 North of the

Equator and between longitudes 11^0 and 14^0 East of the Greenwich Meridian (Mohammed, 1999). It shares an international boundary with the Republic of Cameroon to the East and interstate boundaries with Borno to the North, Gombe to the North-West and Taraba to the South-West (Adebayo, 1999; ASMLS, 2010a), as shown in Figure Ia.

Figure Ia: Map of Nigeria Showing Adamawa State

According to Adebayo and Tukur (1997), Adamawa State covers an area of land mass of about 38,741km². The state is divided into three Senatorial Zones (Northern, Central and Southern) which translates to three agricultural zones as defined by INEC (1996), which are further divided into 21 Local Government Areas (LGAs) for administrative convenience.

The State has a population of 2,102,053 persons (NPC, 1990). The main ethnic groups in the state are the Kilba, Higgi, Quadoquado, Lala, Yungur, Bwatiye, Chamba, Mbula, Margi, Ga'anda, Longuda, Kanakuru, Bille, Bura, Yandang, Fali, Gude, Verre, Fulani and Libo (Adebayo & Tukur, 1997; Adebayo, 1999; ASMLS, 2010b). The dominant religions are Christianity and Islam, although some of its inhabitants still practice African traditional religions. The major occupation of Adamawa people is farming. The soil type is ferruginous tropical soils of Nigeria based on genetic classification of soils by the Food and Agricultural Organization of the United Nations (FAO, 1996).

The soils are a function of the underlying rocks, the seasonality of rainfall and the nature of the wood-land vegetation of the zone. The soils are derived from the basement complex, granite and gnesis that form the ranges of mountains. The mineral resources found in the state include iron, lead, zinc and limestone (Adebayo & Tukur, 1997).

The common relief features in the state are the Rivers Benue, Gongola, Yadzaram and Kiri Dam, Adamawa and Mandara mountains and Koma hills. The state has minimum and maximum rainfall of 750 and 1050 mm per annum and an average minimum and maximum temperature of 15^0C and 32^0C, respectively. The relative humidity ranges between 20 and 30% with four distinct seasons that include early dry season (EDS, October – December); late dry season (LDS, January – March); early rainy season, (ERS, April – June) and late rainy season (LRS, July – September), according to Adebayo (1999). The vegetation type is best referred to as guinea savannah (Areola, 1983; Adebayo & Tukur, 1997). The vegetation is

made up of mainly grasses, aquatic weeds along river valleys and dry land weeds inter-spersed with shrubs and woody plants. Plant heights ranges from few centimeters (Short grasses) to about one meter tall (tall grasses), which form the bulk of animal feeds.

Cash crops grown in the state include cotton and groundnuts, sugarcane, cowpea, benniseed, bambara nuts and tiger nuts, while food crops include maize, yam, cassava, sweet potatoes, guinea corn, millet and rice. The communities living on the banks of rivers engage in fishing, while the Fulani and other tribes who are not resident close to rivers are pastoralists who rear livestock such as cattle, sheep, goats, donkeys, few camels, horses and poultry for subsistence (Adebayo & Tukur, 1997; Adebayo, 1999).

The Study Site

Mubi-North LGA is located at the northern part of old Sardauna Province, which now forms Adamawa North Senatorial District as defined by INEC (1996). The region lies between latitude 9^0 30´´ and 11^0 North of the equator and longitude 13^0 and 13^0 45´´ East of Greenwitch Meridian. It has an altitude of 696 meters above sea level with an annual mean rainfall of 1,220mm and a mean temperature of 15.2^0C during hamattan periods from November to February and 39.7^0C in April (ADADP, 1986). The LGA has essentially a mountainous landscape tranversed by river Yedzaram and many tributaries, Mandara and Adamawa mountains form part of this undulating landscape (Mansir, 2006). The Gude, Fali, Fulani and other tribes dominate the area which has a lot of pasture land. Mubi region is bordered in the North by Michika LGA, in the West by Hong LGA and in the South by Mubi South LGA, Maiha LGA in the South-East and the Republic of Cameroon in the East as seen in Figure IIb. It has a land area of about 4,728.77 km² and human population of about 759,045 going by NPC, (1991) census projected figures (Adebayo & Tukur, 1991). It has an international cattle market linking neighboring countries such as Cameroon, Chad, Central Africa, Niger, Mali and Senegal to Southern Nigeria where cattle are consumed as shown in Figure Ib.

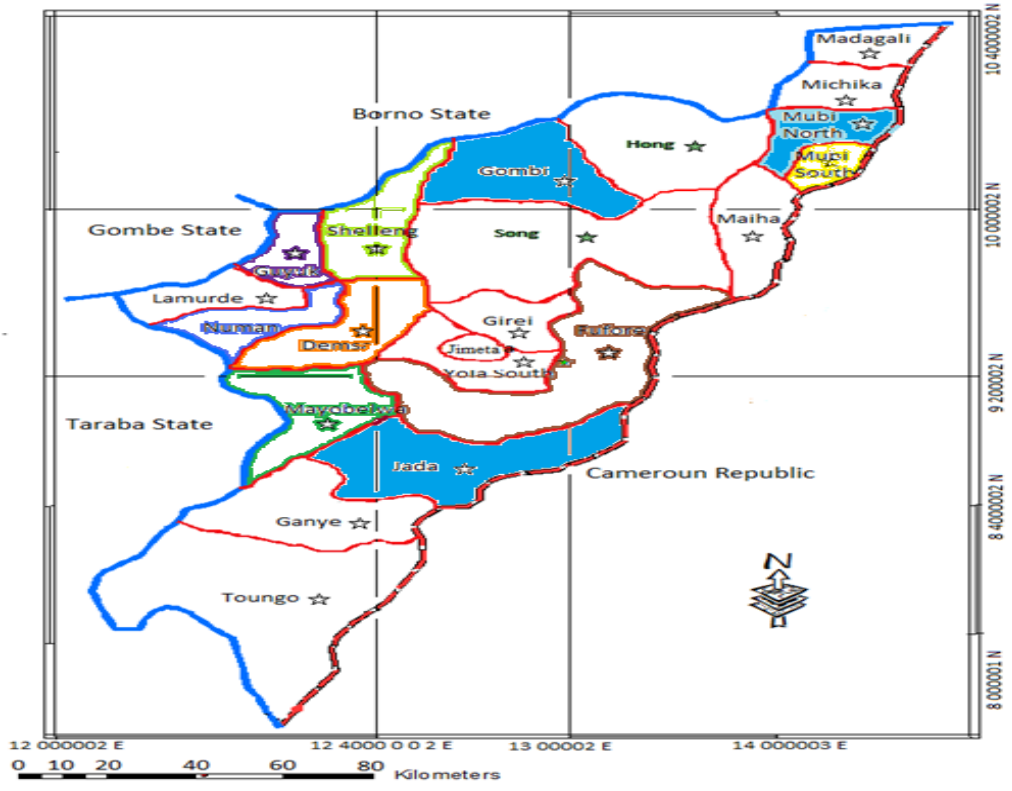

Figure Ib: Map of Adamawa State Showing the Study Area in Blue Colour

Selection of Goat Farmers

The study covered a period of 8 months (January to September, 2017), during which visits were paid to Mubi town and its environs where goat farmers were identified. The objective of the study was explained to them and their permission obtained to participate in the study. Actual participation in the study was based on the willingness of farmers.

Data Collection

The study was conducted on 13 households in Mubi metropolis where data were obtained on age, parity, body weight and udder measurements of three goat breeds using questionnaires and personal interviews. The age of the animals was determined using the dentition method described by Abegaz and Awgichew (2009). Live Weight (Lwt) was measured using weighing scale while information on parity was obtained from the farmers' memory. Udder traits like Teat Angle (TA) which is the teat inclination was measured with the aid of divider and protractor. Teat Floor (TF) is the minimum distance between teat end and ground, Udder Length (UL) is the distance from the perianal insertion to the bottom of udder cistern and Teat Length (TL), the distance between teat tip and base of attachment to the udder (that is distance from the gland insertion to the tip) were measured using flexible metric tape as described by Rovai, *et al.*, (2004). Udder Volume (UV) which is the index of mammary function was measured using water displacement method (Blatchford*, et al.,* 1983).

Data Analysis

The data generated were analysed using General Linear Model (GLM) as contained in SPSE (2012) Statistix 9.1, fitting the following model: $Y_{ijkl} = \mu + B_j + A_j + P_k + e_{ijkl}$. Where: Y_{ijkl} = the i^{th} observation on the i^{th} breed, B_j = is the effect of j^{th} breed (1, 2, 3); j^{th} age and k^{th} parity; μ = is the overall mean; A_i = is the effect of i^{th} age (1, 2, 3, 4,); P_k = is the effect of k^{th} parity (1, 2, 3,); eijkl = is the residual (error). The comparison of means was done using LSD

RESULTS AND DISCUSSION

The results of the live weights and udder traits of the three breeds of goats are presented in Table 1. The findings show that, there were significant ($P < 0.05$) variations in live weight (Lwt) and udder parameters amongst the breeds. The Sahel goats had significantly ($P < 0.05$) higher Lwt, TF, TL, UL and UV than the Sokoto Red and Non-descript goats as shown in table 1. The breed variations, and superiority of Sahel goats in values of udder traits over the other breeds may be associated with their higher Lwt compared to Sokoto Red or Non-descript goats. The similarities seen in the values of Lwt and all udder traits with exception of TF recorded in Sokoto Red and Non-descript goats may be due to indiscriminate breeding between the Sokoto Red and West African Dwarf (WAD) goats. Back crossing of the first filial generation (F_1) with either Sokoto Red or WAD goats may have resulted to the Non-descript goats. Since the West African Dwarf goats are genetically achondroplastic in nature. This is probably inherited by the Non-descript goats, thus, making them shorter and bulkier than Sokoto Red goats. The genetic and environmental factors such as nutrition might have partly contributed to the differences in terms of TF between Sokoto Red and Non-descript goats. These results are in agreement with the findings of Hagan *et al*. (2012) who reported a significant location effects with regard to body length and height at withers in indigenous goats of coastal savannah and semi deciduous zones of Ghana. They also reported that, goats of coastal savannah zone have higher TF values than those of forest zone. Since the WAD goats are stereotypically said to be native to forest belts (Blench, 1999) where the ambient temperature is low compared to the Northern belts where the ambient temperature is high. This makes WAD in the North taller

than those found in the south and this phenotypically affected the Non-descript goats causing them to be taller than WAD. The WAD is also shorter than the Sokoto Red goats hence shorter in TF distances. The three breeds did not differ significantly ($P > 0.05$) in TA. The results show that, there were significant variations ($P < 0.05$) in UV where the Sahel goats had higher value than the two other breeds. Similarly, it was observed that Sahel goats had comparatively higher UL than the two breeds. The differences between the Sokoto Red and Non-descript goats were not significant ($P > 0.05$). Age had no significant ($P > 0.05$) effect on most of the traits measured except in TF as shown in (Table 1) where it was higher in does within the age range of ≤ 1 year. All udder traits increased with advancement in age. Similarly, Lwt, TF, and UV varied significantly ($P<0.05$) with parity. It is evidence that, all udder traits increase numerically with parity. TA, TL and UV showed no significant ($P > 0.05$) differences with parity. The increase in Lwt, TF and other udder traits with parity could be associated with growth in body tissues and skeletal development. The increase in UV and UL in all breeds as they advance in age and parity is due to activity of prolactin and udder tissue elasticity. Studies have shown that, in older goats, a proportion of mammary alveoli that develop in previous lactations do not normally regress completely, but add to those which develop in subsequent lactations thus, increasing the volume of the udder particularly the secretory parenchyma (Knight and Peaker, 1982). The increase in TL may be as a result of growth processes and suction performed by the kids which is reflected by decrease in TF in the older does. Similar observations were made and reported by Peris *et al.* (1999), that as the teat got longer, it gets narrowed. There was significant ($P < 0.01$) age x breed interaction effect on almost all the parameters measured except TA as shown in Table 2. The Sahel breeds either at 1, 2, or 3 years and above had the highest values all through. The effects of breed x parity interactions followed a similar trend as in age (Table 3). The results show that, there was high relationship between Lwt and most of the udder traits as shown in Table 4. It is also evidence that, as the animals advance in age and parity, the heavier they become and this follows linearly with other body parts or structures. This proved that, growth in relation to skeletal development is evident among all the breeds and in some age and parity groups. This is consistent with the report of Hagan, *et al*., (2012) who reported that, there was continuous increase in body length and height at withers with increasing age in indigenous goats of the Coastal Savanah and Forest Eco-zones of Ghana.

CONCLUSION AND RECOMMENDATIONS

The findings show that, the values of udder traits of Sahel goats were comparatively higher ($P < 0.05$) than other breeds which may be due to superiority of the Sahel goats for milk production. Hence, it could be concluded that, Sahel goats could comparatively have better milk production potentials than Red Sokoto and Non-descriptive goats in that order in this north-eastern region of Nigeria. This could also be an important basis for selection and breeding decision for milk production in northern Nigeria. One of the major negative setbacks of the study is the poor management practices observed among smallholder goat farmers. The higher performances of Sahel goats indicate that, the breed is better adapted to the northern region of Nigeria. With proper management practice and good nutrition, the animals may display their optimum genetic potentials and enabling accurate evaluation of the traits by farmers and researchers. That could form a reliable data base for future meaningful selection and breeding in small ruminant industry in Nigeria. The animals studied were Sahel, Sokoto Red and Non-descript goats. It is recommended that further investigation under improved management be carried out elsewhere.

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Table 1: Means ± SE by Breed, Age, and parity on Live weight and Udder Traits of Does

Variables	Lwt	TA^0	TF	TL	UL	UV
Breed	*	NS	**	**	**	***
Sokoto Red	28.85 ± 1.03^{b}	55.08 ± 4.74^{a}	25.51 ± 0.85^{ab}	3.15 ± 0.12^{ab}	10.94 ± 0.36^{b}	0.33 ± 0.02^{b}
Sahel	32.42 ± 1.08^{a}	52.90 ± 4.94^{a}	27.27 ± 0.89^{a}	3.45 ± 0.12^{a}	12.24 ± 0.38^{a}	0.44 ± 0.12^{a}
Non-descript	27.40 ± 1.11^{b}	55.57 ± 5.08^{a}	23.08 ± 0.91^{b}	2.99 ± 0.12^{b}	10.72 ± 0.39^{b}	0.32 ± 0.02^{b}
Age	NS	NS	**	NS	NS	NS
1year	30.62 ± 2.43^{a}	46.30 ± 11.18^{a}	29.52 ± 2.00^{a}	3.33 ± 6.27^{a}	10.94 ± 0.85^{a}	0.37 ± 0.04^{a}
2years	27.19 ± 1.74^{a}	54.85 ± 7.97^{a}	25.38 ± 1.43^{b}	3.05 ± 0.19^{a}	10.85 ± 0.61^{a}	0.35 ± 0.03^{a}
3years	26.40 ± 1.77^{a}	58.52 ± 8.10^{a}	23.25 ± 1.45^{c}	3.38 ± 0.20^{a}	12.12 ± 0.62^{a}	0.35 ± 0.03^{a}
4years	34.03 ± 3.03^{a}	58.41 ± 13.91^{a}	22.98 ± 2.49^{c}	3.03 ± 0.34^{a}	12.15 ± 1.06^{a}	0.39 ± 0.06^{a}
Parity	*	NS	**	NS	NS	**
1	23.89 ± 2.11^{b}	63.17 ± 9.68^{a}	20.42 ± 1.74^{c}	2.76 ± 0.23^{a}	10.04 ± 0.74^{a}	0.33 ± 0.04^{c}
2	33.42 ± 1.53^{a}	55.95 ± 7.03^{a}	25.62 ± 1.26^{b}	3.17 ± 0.17^{a}	11.31 ± 0.53^{a}	0.37 ± 0.03^{b}
3	31.36 ± 3.03^{ab}	44.44 ± 13.91^{a}	29.81 ± 2.50^{a}	3.67 ± 0.34^{a}	12.54 ± 1.06^{a}	0.40 ± 0.04a

NS = Non significant *** = P < 0.001, ** = P < 0.01, * = P < 0.05: Lwt = live weight, TA^0 = Teat angle, TF = Teat Floor, TL = Teat length, UL = Udder length, UV = Udder volume, 1, 2, 3 = number of parities.

Table 2: Means ±SE by Age x Breed Effects on Live weight and Udder Traits of Does

Variables	Lwt	TA^0	TF	TL	UL	UV
Age x Breed	**	NS	*	**	***	***
≤ 1 year x Sokoto Red	25.00 ± 2.10^{ef}	65.00 ± 9.97^{a}	23.67 ± 1.78^{c}	3.00 ± 0.21^{bc}	11.67 ± 0.72^{abc}	0.29 ± 0.04^{d}
≤ 1 years x Sahel	31.00 ± 2.10^{bcde}	48.17 ± 9.97^{a}	28.67 ± 1.78^{a}	3.37 ± 0.21^{ab}	11.67 ± 0.72^{abc}	6.43 ± 0.04^{abc}
≤ 1 years x N-descript	18.83 ± 2.10^{g}	51.67 ± 9.97^{a}	21.67 ± 1.78^{d}	2.32 ± 0.21^{d}	9.13 ± 0.72^{d}	0.26 ± 0.04^{d}
≤ 2 years x Sokoto Red	24.50 ± 1.82^{fg}	59.50 ± 8.64^{a}	23.75 ± 1.54^{c}	2.50 ± 0.18^{cd}	10.25 ± 0.62^{cd}	0.31 ± 0.04^{d}
≤ 2 years x Sahel	32.00 ± 1.82^{abcd}	56.88 ± 8.64^{a}	25.35 ± 1.54^{b}	3.25 ± 0.18^{ab}	12.25 ± 0.62^{ab}	0.42 ± 0.04^{abc}
≤ 2 years x N-descript	29.50 ± 1.82^{cdef}	57.88 ± 0.64^{a}	24.13 ± 1.54^{bc}	3.00 ± 0.18^{bc}	10.63 ± 0.62^{bcd}	0.32 ± 0.04^{cd}
≥ 3 years x Sokoto Red	37.50 ± 2.10^{a}	49.33 ± 9.97^{a}	26.17 ± 1.78^{b}	3.43 ± 0.21^{ab}	11.00 ± 0.72^{abcd}	0.42 ± 0.04^{abc}
≥ 3 years x Sahel	34.33 ± 2.10^{abc}	48.67 ± 9.97^{a}	29.33 ± 1.78^{a}	3.70 ± 0.21^{a}	12.17 ± 0.72^{abc}	0.47 ± 0.04^{a}
≥ 3 years x N-descript	35.67 ± 2.10^{ab}	47.00 ± 9.97^{a}	27.00 ± 1.87^{ab}	3.37 ± 0.21^{ab}	11.00 ± 0.72^{abcd}	0.37 ± 0.04^{abcd}

NS = Non significant *** = P < 0.001, ** = P < 0.01, * = P < 0.05: Lwt = live weight, TA^0 = Teat angle, TF = Teat Floor, TL = Teat length, UL = Udder length, UV = Udder volume.

Table 3: Means ± SE by Breed x Parity effects on Live weight and Udder Traits of Does

Variables	Lwt	TA^0	TF	TL	UL	UV
Breed x Parity	**	NS	**	***	**	***
Sokoto Red x 1	24.00 ± 1.51^{c}	60.00 ± 7.66^{a}	23.50 ± 1.47^{cd}	2.70 ± 0.18^{cd}	11.10 ± 0.58^{a}	0.30 ± 0.03^{cd}
Sokoto Red x 2	26.75 ± 1.69^{bc}	57.00 ± 8.56^{a}	25.73 ± 1.65^{c}	3.20 ± 0.20^{abc}	10.75 ± 0.65^{ab}	0.30 ± 0.03^{cd}
Sokoto Red x 3	35.00 ± 1.69^{a}	49.25 ± 8.56^{a}	26.63 ± 1.65^{bc}	3.53 ± 0.20^{ab}	11.00 ± 0.65^{ab}	0.40 v 0.03^{ab}
Sahel x 1	28.50 ± 1.69^{bc}	57.38 ± 8.56^{a}	25.88 ± 1.65^{c}	3.40 ± 0.20^{ab}	12.38 ± 0.65^{ab}	0.40 ± 0.03^{ab}
Sahel x 2	34.67 ± 1.38^{a}	54.25 ± 6.99^{a}	25.50 ± 1.34^{bc}	3.25 ± 0.17^{ab}	12.23 ± 0.53^{a}	0.44 ± 0.03^{a}
Sahel x 3	34.33 ± 1.95^{a}	48.67 ± 9.88^{a}	29.33 ± 1.90^{a}	3.70 ± 0.23^{a}	12.17 ± 0.75^{a}	0.47 ± 0.04^{a}
N-descript x 1	18.83 ± 1.95^{d}	51.67 ± 9.88^{a}	21.67 ± 1.90^{e}	2.32 ± 0.23^{d}	9.13 ± 0.75^{b}	0.26 ± 0.04^{d}
N-descript x 2	29.40 ± 1.28^{b}	61.79 ± 6.47^{a}	22.21 ± 1.24^{d}	3.07 ± 0.15^{bc}	11.21 ± 0.49^{a}	0.33 ± 0.02^{bcd}
N-descript x 3	35.67 ± 0.95^{a}	47.00 ± 9.88^{a}	27.00 ± 1.90^{b}	3.37 ± 0.23^{ab}	11.00 v 0.75^{a}	0.37 ± 0.04^{abc}

NS = Non significant *** = P < 0.001, ** = P < 0.01, * = P < 0.05: Lwt = live weight, TA^0 = Teat angle, TF = Teat Floor, TL = Teat length, UL = Udder length, UV = Udder volume, 1, 2, 3 = number of parities.

Table 4: Relationships Between Live weight and Udder Traits

	Live weight	TA^0	TF	TL	UL	UV	Age	Breed
TA^0	-0.2306^{NS}	-	-	-	-	-	-	-
TF	0.5295^{***}	-0.6372^{***}	-	-	-	-	-	-
TL	0.4996^{***}	-0.0961^{NS}	0.4241^{**}	-	-	-	-	-
UL	0.2609^{NS}	0.5516^{***}	-0.1969^{NS}	0.3772^{*}	-	-	-	-
UV	0.7163^{***}	0.0646^{NS}	0.3496^{*}	0.3652^{*}	0.5459^{**}	-	-	-
Age	0.6274^{***}	-0.1362^{NS}	0.2438^{NS}	0.5010^{**}	0.2088^{NS}	0.3815^{*}	-	-
Breed	0.0124^{NS}	0.0070^{NS}	-0.2183^{NS}	-0.1147^{NS}	-0.0794^{NS}	-0.0188^{NS}	0.0000^{NS}	-
Parity	0.6970^{***}	-0.1948^{NS}	0.3718^{*}	0.5112^{***}	0.0890^{NS}	0.3989^{**}	0.9144^{***}	0.0419^{NS}

NS = Non significant *** = P < 0.001, ** = P < 0.01, * = P < 0.05: Lwt = live weight, TA^0 = Teat angle, TF = Teat Floor, TL = Teat length, UL = Udder length, UV = Udder volum