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RELATIONSHIP OF PARITY AND SOME BREEDING CHARACTERISTICS IN RED SOKOTO GOATS

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ABSTRACT
Data on some breeding characteristics; litter size (LS) kidding interval (KI), dam mating weight (Mwt), Kidding weight(Kwt) and 60 day post kidding weight(60dPKwt) as well as body size characteristics(HW,BL and HG) collected from 1000 Red Sokoto does of small holder farmers in Kano State, Nigeria, were analysed to estimate the relationships amongst these characteristics themselves and between them with parity of dam. The mean LS, KI, Mwt, Kwt and 60dPKwt were 1.45, 6.90 months 20.4kg, 24.7kg, and 23.0kg, respectively. The mean height-at-withers (HW), body length (BL) and chest girth (CG) were 54.4cm, 59.0 and 65.8cm, respectively. The correlations amongst all the measured characteristics were positive and significant (P<0.01 – 0.05; r = 0. 32- 0.93). The correlation between Mwt and Kwt was the strongest (r = 0.93). The relationships between parity and all the characteristics measured was positive and highly significant (P<0.01; r = 0.49-0.87) The correlation of parity with mating weight (Mwt) was the strongest (r = 0.87). The prediction equations of body weight at different stages of growth using combinations of linear body measurements were significant (P<0.01) However, the prediction equation of 60 day post- kidding weight using the combination of the linear body measurements (HW, BL, CG) was the best (R2 = 72.0%) followed by kidding weight (R2 = 55.4%) and mating weight (R2 = 54.76%), respectively. Therefore, the equation for the prediction of 60 day post kidding weight (60d PKwt) using the combination of linear body measurements (HW, BL, CG) adequately explained about 72% of the variation in the 60d PKwt of the does. This implies that combination of linear body measurements can be used with high degree of reliability to estimate body weight in Red Sokoto goats.

KEYWORDS: Kidding interval, kidding weight, litter size, mating weight, body size characteristics

INTRODUCTION
Small ruminant production systems in Nigeria have endured in relation to the overall pattern of crop production and farming systems. Goats are important for a larger part of the Nigeria rural population. Goats are kept as an important component of farming activities, particularly by smallholders. Nearly ninety nine percent of small ruminants in Nigeria are found in the hands of smallholders. This fact indicates an important role for smallholders. Goats play a complex function in Nigeria's farming systems. Their biological and economic functions have long been recognized. Besides producing animal products, they also provide manure to maintain soil fertility (Suradisastra,1993). The contribution of goats within the total farming income for small goat keepers is substantial. In Nigeria goats are kept primarily for meat production, thus, production traits of interest are litter size or the number of young weaned per breeding female per year and their growth rate (Bradford, 1993). Therefore, the evaluation of breeding performance of smallholder goats can provide important information to understand its productive potential using local resources. This study therefore, determined the relationship of parity with some breeding characteristics of Red Sokoto goats.

MATERIALS AND METHODS
Study location
The study was conducted in the year 1998, under the smallholder production system at Saunawa and Amarzakawa villages in Kano State, Nigeria. These villages are located in the Sudan savannah zone of Nigeria on Latitude 11^o 59' and Longitude 8^o 34', and altitude 486.5m above sea level. The mean annual rainfall is 1293mm with minimum temperature (14^{o}C) in December and January, and maximum (41^{o}C) in April. (IAR,2005)

Animals and Management

A total of 1000 Red Sokoto does were involved in this study, which lasted for 3 years (2005- 2008). The animals in each of the locations were identified using necklace tags. They were managed under the small holder rural system. They were housed at night and released the next morning for grazing. The goat's houses were made using corn stalk for fencing and thatched roof for protection against heat and rainfall. The houses were open sided for adequate ventilation. There was no organized health care provision in terms of vaccination and deworming. However, veterinary officers were called to treat the animals when cases of ill-health occur. Supplementary feeding of the animals was done in the morning before turning them out for grazing and in the evening before they were kraaled. They were supplemented with groundnut hulms, beans pods, maize/ millets or sorghum offals. Minerals blocks and water were also provided. The breeding animals were group in ratio of 1male to 10 females, and the males were permanently paired with the females. The kids were allowed to run with their dams throughout the study period, and weaning was by natural means

Data Collection

Data on litter size (LS) kidding interval (KI), dam mating weight (Mwt), Kidding weight(Kwt) and 60 day post kidding weight(60dPKwt) as well as linear body measurements [Body length(BL): measured as length of the whole dorsum from the first thoracic vertebra to the tuber sacrale; Chest girth(CG): the circumference of the heart; Height-at-withers (HW): measured from the highest point on the dorsum to the ground surface at the level of the front legs]. The measurements were taken in the morning before turning the animal out for grazing. The weight of each animal was taken in (in kg) using movable scale by carrying it individually and standing on the scale, the difference between this weight and the individuals' weight was taken as the weight of the animal. Linear body measurements were taken (in cm) using flexible tape and measuring stick

Data Analysis

The data collected were subjected to standard statistical analysis. The means and standard error were determined for each trait. The coefficient of variation (CV) was calculated as the standard deviation divided by the mean multiply by 100. The relationships amongst the measured characteristics were determined using correlation and linear regression analysis procedure of SAS (SAS, 1999).

RESULTS AND DISCUSSION

The summary statistics of the measured characteristics is presented in Table 1. Litter size computed by dividing the total number of kids born by the total number of does kidded, in this study ranged from 1 to 3 this agreed with the litter size of 1- 3 reported by Amoah, and Gelaye,(1990) but lower than 1 to 4 earlier reported by Amoah *et al* (1996). The mean litter size in this study (1.45) was similar to the 1.45 earlier reported by Nuru (1985) and was within the range value of 1.12 – 1.45 obtained by Osinowo and Abubakar (1989) in the same breed (Red Sokoto goats). However, the value obtained in this study was lower than the 1.7 and 1.8 reported by Otchere *et al* (1993) and Akpa *et al* (2004), respectively. The mean kidding interval in this study 6.9 month (207 days) was close to the 204 days reported by Sodiq (2004) in Kecang goats of Indonesia and 215 days reported by Awemu, *et al* (1999) in Red Sokoto goats raised under traditional system of management. The value obtained is however lower than 336 days reported by Mtenga *et al* (1994) in small east African goats and 240 days reported by Adu *et al* (1979) in Red Sokoto goats under intensive system of management. The variation in the values of the kidding intervals is probably due to differences in management systems. Usually there is a controlled breeding policy under intensive system of management to achieved the best breeding season, in contrast to the extensive or traditional system of management in which there is no control breeding, animals of all ages and sexes are allowed to run together day and night (Mtenga *et al*.,1994), hence the shorter kidding intervals. Short kidding intervals can improve the rate of turnover of generations of animals and so speed up genetic progress. This is a sound strategy and one that occurs as a natural consequence of a village management system where male goats are continually present and fertility control is not practiced. The mean values for the linear body measurements (HW, BL and CG) in this study were within the range reported by Hassan and Ciroma (1992) and Akpa *et al*,(1998) in the same breed. The linear body measurements were less variable (CV= 7.7 -8.7%) than the other characteristics measured (CV= 14.2 – 34.6%) however, the most variable trait was litter size (34.2%). The high coefficient of variation (CV) is an indication that there was a high variation in these characteristics within the animals population used and is reflected in the measurements. Similarly, the high variation in the litter size coupled with its strong positive relationship with the body size characteristics ($r = 0.32 – 0.48$) indicates the possibility of improving this trait alongside the body size characteristics through indirect selection.

Table 1: Summary statistics of measured characteristics in Red Sokoto goats

Characteristics	N	Mean(+SE)	CV	Min	Max
Litter size (LS)	127	1.45± 0.04	34.6	1.0	3.0
Kidding interval(KI) (months)	127	6.9 ± 0.70	14.2	6.0	9.0
Mating weight (Mwt) (kg)	127	20.4 ± 0.43	22.7	12.5	31.0
Kidding weight (Kwt)(kg)	127	24.7 ± 0.39	17.4	15.5	33.6
60days post kidding weight(60PKwt)(kg)	127	23.0 ± 0.42	20.2	14.0	35.0
Height –at-withers (HW)(cm)	127	55.4 ± 0.40	7.7	40.0	67.0
Body length(BL) (cm)	127	59.0 ± 0.43	8.3	46.5	73.0
Chest girth(CG) (cm)	127	64.8 ± 0.52	8.7	53.0	79.0

SE: standard error

The correlations of the measured characteristics (Table 2) were positive and significant (P<0.01 – 0.05; r = 0. 32- 0.93). This indicates that selection for any of these traits will result in a correlated response in the others. (Thiruvankadan, 2005; Hamalayun *et al.,* 2006), hence it may not be necessary to include all these traits in a selection index aim at improving them, especially traits like litter size whose heritability is very low can be improved through indirect selection. However the values of the correlation coefficients varied with different measurements indicating a variation in the strength of the relationships amongst the various traits measured. The correlations amongst the body size characteristics (HW, BL, CG) was positive and highly significant (P<0.01; r = 0.66 – 0.80).This is in agreement with the reports of Hassan and Ciroma, (1992) in Red Sokoto goats, Akpa *et al*, (2006) in Yankasa rams, and Oseni and Ajayi (2008) in West African dwarf (WAD) goats.

The strong relationship (r =0.61) observed between litter size and mating weight implies that increase in mating weight would significantly improved the litter size of does. Sachdeva *et al.* (1973) in their study, concluded that a high energy diet seems to be associated with a greater proportion of multiple births, but they provided no information on doe mating weight, a factor that this study found to have direct significant influence on litter size. It seems that the ability to improve the condition or live weight of the

Doe at mating could improve ovulation rate and thereby increase litter size of goats, a situation that makes “flushing” a realistic part of proper management practice.

The usual weight changes in the doe during pregnancy are often assumed to be indicative of prenatal development of the fetus. Significant correlations have been established between the birth weight of the offspring and the body weight of the dam in goats (Epstein and Hertz, 1964). In this study Mating weight and kidding weight were highly correlated(r = 0.93); implying that does with high body weight at mating might maintain a high kidding weight. This agreed with the report of Rafiq (1995) that optimum live weights are required for desirable conception rates and birth weight of lambs and kids. This observation underscored the important of imposing flushing treatment before the starts of breeding season of the does.

Table 2: Phenotypic correlations amongst the measured characteristics

Traits	KI	Mwt	Kwt	60dPK wt	HW	BL	CG
Litter size(LS)	0.47**	0.61**	0.54**	0.50**	0.32*	0.42**	0.48**
Kidding interval (KI)		0.57**	0.58**	0.52**	0.26*	0.42**	0.44**
Mating weight (Mwt)			0.93**	0.81**	0.49**	0.65**	0.73**
Kidding weight (Kwt)				0.84**	0.53**	0.69**	0.72**
60 days post kidding weight (60dPKwt)					0.64**	0.74**	0.84**
Height –at-withers (HW)						0.70**	0.66**
Body length (BL)							0.80**

** P<0.01; * P<0.05

The relationships between parity and all the measured characteristics as presented in Table 3 were positive and highly significant (P<0.01; r = 0.49-0.87). The correlations of parity with mating weight (Mwt) was the strongest (r = 0.87). The increase in Mwt of does with parity implies that advanced parity does may give birth to relatively heavier kids than those of the early parity does. This is probably due to the development of the physiological processes with increase in parity of the doe.

The strong positive correlation(r = 0.61) between litter size (LS) and parity indicates that increase in parity of the doe may increase LS. This may be associated with the physiological maturity of the doe. Amoah *et al* (1996) reported that lower prolificacy of primiporous does may be associated with an underdeveloped state of the reproductive features required for successive litter bearing compared with those of multiparous does that have reached physiological maturity. The favourable relationship between LS and parity is in agreement with the reports of Amoah and Gelaye (1990) but contrary to the report of Zahraddeen *et al*,(2008) and Akpa *et al* (2008) that LS hardly correlated with parity in local goats and negatively correlated in rabbits, respectively. Kidding interval was also positively correlated with parity, in line with the report of Akhmad *et al*,(2003).

Table 3: Correlated relationship of parity of does with the measured characteristics

Traits	N	Parity
Litter size	127	0.61**
Kidding interval (months)	127	0.63**
Mating weight (kg)	127	0.87**
Kidding weight (kg)	127	0.79**
60 days post kidding weight (kg)	127	0.77**
Height –at-withers (cm)	127	0.49**
Body length (cm)	127	0.64**
Chest girth (cm)	127	0.70**

** P<0.01

Table 4 shows the prediction equations of body weight at different stages of growth using combinations of linear body measurements. All the prediction equations were significant (P<0.01) .However, the prediction equation of 60 day post- kidding weight using the combination of the linear body measurements (HW, BL, CG) was the best (R2 = 72.0%) followed by kidding weight (R2 = 55.4%) and mating weight (R2 = 54.76%), respectively. The prediction of live weight using linear body measurements has been reported in goats (Hassan and Ciroma, 1992; Noran *et al*., 1997; Akpa *et al.*,1998), Sheep (Osinowo *et al.*, 1992; Gizaw 1995: Akpa *et al*.,2006), Cows (Heinrich *et al.*,2007) and Gilt (Machebe and Ezekwe, 2008). In this study the equation for the prediction of 60 day post kidding weight(60d PKwt) using the combination of linear body measurements (HW, BL, CG) was much better, explaining about 72% of the variation in the 60d PKwt of the does.

CONCLUSSION

The favourable relationship of parity with litter size, dam mating weight, kidding weight and linear body measurements observed in this study is an indication that dam parity is an important factor in any breeding programme aim at improving the performance of the goats. Also the strong positive correlation between the dam mating weight with kidding weight and litter size implies that optimum mating weight is required for desirable conception rates, kidding weight and increase in litter size. This observation underscored the important of adopting flushing treatment of does before the starts of breeding season, as a realistic part of proper management practice in goat husbandry.

Table 4: Prediction of mating weight, kidding weight and 60 day post kidding weight using combinations of linear body measurements

Traits	Prediction equations	LOS	R^2(%)
Mating weight (Y1)	Y1= - 20.639-0.047X1+0.190X2 + 0.0494X3	**	54.7
Kidding weight (Y2)	Y2= 15.070 +0003X1 + 0.277X2 + 0.355X3	**	55.4
60 days post kidding weight (Y3)	Y3= 26.741 + 0.118X1 +0.143X2 + 0.529X3	**	72.0

X1=height-at-withers, X2=body length, X3= chest girt; ** P<0.01; LOS: level of significant

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