

Breed Differences in Body Weight, Body and Testicular Measurements and Their Relationship in Red Sokoto and Sahel Goats at Weaning

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ABSTRACT

One hundred and seven (107) individual records of Red Sokoto (RS) and Sahel (S) kids at weaning were used to compare body weight (BWT), body measurements (BM) and testicular measurementsTM of the two breeds. Efforts were also made to relate BWT with BM and TM in order to identify those that best predict BWT. The BM considered were body length (BLT), heart girth (HGT) and height at withers (HWT). The TM were testicular length (TL), testicular width (TW) and scrotal circumference (SC). Breed differences for BWT and BM were not significant ($p > 0.05$). Phenotypic correlations between BWT and BM/TM were significantly ($p < 0.001$) high and positive. Among the TM, SC and TW had the highest correlations with BWT in S (69.80%) and RS (74.40%), respectively. However, among the BM, HGT had the highest correlation in both breeds (S, 96.50%; RS, 76.40%). The measurements (TM/BM) with the highest correlations also had the highest coefficients of determinations in both breeds. This study established the similarity in BM and TM of S and RS breeds of goat at weaning. At weaning age, while SC best predicts BWT in S, TW best predicts BWT in RS. However, HGT gave the best prediction of BWT in both breeds.

Key words: Body weight, measurements, testicular, breed, goats

INTRODUCTION

Weaning is the act of separating young animals from their mothers. Age at weaning in goats is a compromise between kid growth and allowing the nanny to recover for the next pregnancy (Steel, 1996). The performance of a kid at weaning is of significance because it provides an intrinsic measure of the potential of maternal environment on one hand and the growth potential of the animal on the other hand (Anna and Oje, 1996). Performance at weaning is also an indirect measure of postweaning performance because both are positively correlated (Lasley, 1978).

Apart from body weight, other traits that can be used to evaluate performance of kid at weaning are body conformation and testicular characteristics. Body conformations are of value in judging quantitative characteristics of meat, and also helpful in developing selection criteria (Sarma *et al.*, 1984). Information on testicular characteristics is useful in determining the breeding potential of animals. Semen production is related to testicular development as shown by a positive correlation between testicular weight and extragonadal sperm production (Amann, 1970). However, since testicular weight cannot be measured in live animals, scrotal circumference provides reliable information on testicular weight because of its significant correlation with testicular weight (Palasz *et al.*, 1994). Correlations of testicular measurements with body weight are also useful in buffaloes, rams and goats (Bongso *et al.*, 1984; 1982). However, none is available on Sahel and Red Sokoto breeds of goat especially at weaning. This paper highlights the body and testicular measurements and their relationship in Red Sokoto and Sahel goats at weaning.

MATERIALS AND METHODS

One hundred and seven (107) individual records of Sahel and Red Sokoto breeds of goat collected over a period of 3½ years from October, 1999 to April, 2003 at the University of Maiduguri Teaching and Research Farm were used for the study. Maiduguri is located within the Sahelian (Semi arid) region of West Africa on latitude 11.38° North and longitude 32.17° East of the equator at an altitude of 354m above sea level. Temperature range of the

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region is between 23°C – 40°C. The minimum recorded in the harmattan while the maximum recorded in the dry hot season.

The parents of the animals used for the study were on semi intensive system of management. They were grazed on a mixture of grasses (*Boerharia diffusa*) and browse plants (*Balnite egyptica* and *Zizipus maronana*) twice (morning and evening) a day. In between the grazing periods they were offered supplements of mixture of cowpea husk and wheat offals (10.1). To ensure good health, animals were routinely treated against endoparasites and ectoparasites using ivomec. They were equally (periodically) injected with broad-spectrum antibiotics (Oxytetracycline L.A). Anytime stress was suspected, the animals were offered multivitamins (injectable).

At weaning (3 months), body weights were taken with a hanging balance. The following measurements were also taken.

Body measurements

Body length (BLT) from head to the tail drop. Measured with measuring tape Heart girth (HGT) circumference round the chest, just behind the shoulder.

Measured with measuring tape, Height at withers (HWT): from the withers to the floor surface. Measured with graduated wooden rule.

Testicular measurements

Scrotal circumference (SC): the circumference round the testis midway along the length. Measured with the aid of measuring tape. Testicular width (TW), Testicular height (TH) and Testicular length (TL); these were measured with the aid of a vernier caliper.

Testicular volume (TV): determined using the following expression:

$$TV = \frac{3}{4} \times TL/2 \times TW/2 \times TH/2 \times 3.142 \text{ (Bilaspuri and Singh, 1993).}$$

The body and testicular parameters of the two breeds were compared using Student's *t*-test (Snedecor and Cochran, 1989). Relationship of body measurements and testicular measurements with body weights were determined by correlation and regression analyses using linear model:

$$Y = a + bx$$

where,

Y = Body weight

X = Body/testicular measurement

a = a constant

b = regression coefficient

a and b were determined according to the procedure of Steel and Torrie (1980).

RESULTS AND DISCUSSION

Body weight, body measurements and testicular measurements

The results of analysis of body weight and body measurements in Table 1 indicate that the two breeds [Sahel (S) and Red Sokoto (RS)] had similar body weights ($p > 0.05$), body length, heart girth and height at withers.

Average weaning weight observed in this study is lower than values in literature. Mavrogenis *et al.* (1984) reported 17.69 kg for Damascus goats while 13.20 and 12.7 kg were reported by Sebhatul *et al.* (1994) for Alpine and Nubian goats respectively. However, 8.10 kg (Red Sokoto) and 8.80 kg (Sahel) reported by Zakara (1985) are comparable to values recorded in this study. Average BLT, HGT and HWT reported are higher than values (BLT, 47.40 cm; HGT, 36.30 cm; HWT, 38.10 cm) reported by Muhammed and Amin (1996) in S while higher values (BLT, 58.60 cm; HGT, 51.10 cm; HWT, 51.80 cm) were reported by Akpa (2000) for Red Sokoto goats at weaning. This may be due to differences in environment (Ozoje and Herbert, 1997) and the age at weaning. Non-significant breed differences observed in this study, which may be attributed to similar body weights (Weiner and Hayter, 1974), contradict significant breed differences reported by Bilaspuri and Singh (1993) in Malabari and Beetal goats.

As shown in Table 2 non significant breed differences ($p > 0.05$) were recorded for all the testicular measurements. This implies that Red Sokoto and Sahel goats had similar testicular measurements at weaning. Testicular length and TW values observed are similar to those (TL, 3.4 cm, TW, 3.1 cm) of Sirohi breed of goats reported by Misra *et al.* (1984). However, non-significant differences among the testicular measurements contradict reports of Bilaspuri and Singh (1993) and Nwakalor and Orji (1983) in goats and cattle, respectively. This may be due to differences in the age of animals in different experiments. Breed differences in testicular measurements depend on age (Toele and Robinson, 1985; Das and Sakar, 2004).

Phenotypic relationship between body weight and body measurement

Correlation coefficients between body weight and body measurements (Table 2 and 3) in the two breeds are significantly ($p < 0.001$) high and positive. They are similar to values reported by Muhammed and Amin (1996) in

Sahel goats and Thiruvenkadam (2005) in Kanni Adu kids. These values suggest that any of the body measurements can serve as a good indicator of body weight of goats at weaning. However, in the two breeds, HGT had the highest correlation, hence it can be regarded as the best indicator of body weight. Similar observations were made by Osinowo *et al.* (1992) in Yankassa sheep and Red Sokoto goats, Muhammed and Amin (1996) in Sahel goats and Thiruvenkadam (2005) in Kanni Adu goats. The least indicator of body weight in Red Sokoto and Sahel are HWT and BLT respectively. Similar findings on HWT had also been reported in goats by Muhammed and Amin (1996), and sheep (Kalra *et al.*, 1996). Generally, high positive correlation between BM and BWT is an indication that BM and BWT may be under the influence of same genes. Selection for body size could therefore play a significant role in increasing live body weight. The values of the coefficient of determination (R^2) for regression equations of the two breeds showed that HGT had the highest R^2 (S, 83.60%; RS, 76.49%) among all the body measurements. This affirms HGT as the best body measurement that can be used in predicting body weight of goats at weaning.

Table 1. Body weight (kg±SE), Body measurements and testicular measurements in two Nigerian breeds of goat

Parameter	Breed		Calculated t-value
	Red Sokoto	Sahel	
Body weight	7.70 ± 0.28	7.75 ± 0.37	0.08
Body measurements (cm)			
BLT	58.93 ± 0.88	59.12 ± 0.91	0.15
HGT	42.12 ± 0.59	41.86 ± 0.73	0.38
HWT	43.20 ± 0.65	42.46 ± 0.69	0.77
Testicular measurement			
TL (cm)	4.32 ± 0.14	4.43 ± 0.23	0.48
TW (cm)	1.87 ± 0.07	2.21 ± 0.13	0.94
TV (cm)	4.20 ± 0.45	5.09 ± 0.96	0.84
SC (cm)	9.87 ± 0.34	9.60 ± 0.34	0.33

BLT-Body length, HGT-hearth girth, HWT-Height at withers, TL-Testicular length, TW-Testicular width, TV-Testicular volume, SC-Scrotal circumference

Table 2. Correlation and regression equations of body and testicular measurements with body weight in Red Sokoto goats

Parameter	Regression equation	r	R^2
Body measurement			
BLT	BWT = -3.74+0.19BLT	0.63	39.90
HGT	BWT = -9.12+0.40HGT	0.87	76.40
HWT	BWT = -5.79+0.31HWT	0.76	57.30
Testicular measurement			
TL	BWT = 1.52+1.53TL	0.59	34.40
TW	BWT = 1.02+3.65TW	0.74	55.40
TV	BWT = 5.68+0.58TV	0.72	51.70
SC	BWT = 1.14+0.73SC	0.69	47.20

BLT – Body length, HGT – heart girth, HWT – Height at withers, TL – Testicular length, TW – Testicular width, TV – Testicular volume, SC – Scrotal circumference, BWT – Body weight

Phenoypic relationship between body weight and testicular measurements

Very high, positive and significant ($p < 0.001$) correlations (Tables 2 and 3) recorded between body weight and testicular measurements correspond with observations of Ilaspuri and Singh (1993) in goats and Notter *et al.*, (1981) in rams. Courrot (1962) stated that gonadal development in young male is closely related to live weight, while Coulter and Foote (1977) are of the view that this association makes males with larger testes to possess larger body because of the anabolic effect of androgen. In RS, testicular width had the highest correlation with body weight. This is closely followed by TV; SC and TL in that order. This trend agrees with the reports of Bilaspuri and Singh (1993) on left testis of Malabari goats but contradicts observation of Misra *et al.*, (1984) in Sirohi goats. In Sahel goats, on the other hand, SC had the highest correlation with body weight while TL had the least. Bongso *et al.*, (1982), Bratte *et al.*, (1999) and Das and Sakar (2004) reported similar findings in goats, rams and bulls, respectively.

Table 3. Correlation and regression equations of body and testicular measurements with body weight in Sahel goats

Parameter	Regression equation	r	R ²
Body measurement			
BLT	BWT = -13.40 + 0.19BLT	0.88	78.90
HGT	BWT = -8.93 + 0.40HGT	0.97	83.60
HWT	BWT = -6.82 + 0.34HWT	0.69	42.10
Testicular measurement			
TL	BWT = 2.18 + 1.53TL	0.68	45.60
TW	BWT = 6.79 + 0.35TW	0.68	46.40
TV	BWT = 3.26 + 2.62TV	0.69	48.00
SC	BWT = 3.92 + 0.47SC	0.70	48.70

BLT – Body length, HGT – heart girth, HWT – Height at withers, TL – Testicular length, TW – Testicular width, TV – Testicular volume, SC – Scrotal circumference, BWT – Body weight

From the values of correlations, it could be concluded that TW and SC may be regarded as the best indicator of body weight in RS and S goats respectively. The values of the coefficient of determination (R²) of the regression equations between body weight and testicular measurements also attest to the predictive values of these measurements. While testicular width had the highest R² (55.40%) in Red Sokoto, scrotal circumference had the highest R² (48.70%) in Sahel goats.

CONCLUSION

The result of this study showed that, at weaning, Sahel (S) and Red Sokoto (RS) goats had similar body weight, body measurements and testicular measurements. Values of correlation and regression coefficients of body weight and body measurements showed that heart girth is the best indicator and predictor of body weight in the two breeds (RS and S). Based on the coefficient of determination of regression between body weight and testicular measurements, testicular width and scrotal circumference gave the best prediction of body weight in RS and S goats respectively.

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