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TESTICULAR BIOMETRY AND ITS RELATIONSHIP WITH BODY WEIGHT OF INDIGENOUS GOATS IN A SEMI ARID REGION OF NIGERIA

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ABSTRACT

Records of body weight and testicular measurements (scrotal circumference, scrotal length and average testes weight) were obtained from 296 (197 Red Sokoto and 99 Borno White) indigenous goats of various ages (between one and three years of age) in Nigeria.

Red sokoto goats had significantly ($P<0.05$) higher body weight than the Borno White. The Borno white had significantly ($P<0.05$) longer scrotal length (15.12cm) than the Red Sokoto goats (12.91cm) while scrotal circumference and testes weight were significantly ($P<0.05$) higher in the Red Sokoto. Within breeds, there was a linear relationship between age, body weight and the entire testicular dimension. As age increased, body weight and testicular dimensions increased. Scrotal length had the highest correlation coefficient (0.74 and 0.82) with body weight which was significant ($P<0.01$) in both Red Sokoto and Borno White goats, respectively. Consequently, scrotal length in both breeds of goats was the best single predictor of body weight ($R^2 = 0.602$ and 0.794) for Red Sokoto and Borno White goats, respectively.

Keywords: goats, body weight, testicular measurements, red sokoto, borno white.

INTRODUCTION

Goats occupy a strategic position in the socio economic life of the people of the semi arid region of Nigeria. They are kept primarily for meat and contribute substantially to household income and food security in most households in the rural areas. Body weight is often the most common and informative measure of animal performance [2]. It has been found very effective in assessing the reproductive efficiency and performance in goats. [6] and provide readily obtainable and informative measure for selection, feeding and health care. [18]. This author however reported that this fundamental knowledge is often unavailable to those working with goats due to unavailability of weighing scales; hence decision making and husbandry are based on questionable and subjective estimates of body weight.

[3] reported that the best method of weighing animals without scales is to regress body weight on certain body characteristics which can be readily measured. Numerous studies have been carried out on the linear measurements of Nigerian breeds of goats and their possible use for estimating the animals' live weight [17, 11, 16, 15, and 2] but very few have explored the use of testicular measurements for the same purpose.

[12] and [10] have shown testicular growth and development to be closely related to body size. [6] reported that males with higher values of testicular parameters had higher body weight. This study was made to determine the relationship between body weight and testicular measurements of indigenous goats. In addition the best regression model for prediction of live weight of goats under field conditions will be determined.

MATERIALS AND METHODS

Records of body weight and testicular measurements (scrotal circumference, scrotal length and average testes weight) were obtained from 296 (197 Red Sokoto and 99 Borno White) indigenous goats of various ages (between one and three years of age) in different local government areas of Borno and Yobe states of Nigeria. Both states are in the Semi Arid region of Nigeria. The age of the animals was determined by dentition as described by [14] by counting the number of permanent incisors that have erupted on the lower jaw of the mouth. They were divided into three age groups of less than or equal to one year (≤ 1), greater than one but less than three years (>1 and <3) and greater than or equal to three years (≥ 3). Body weight was measured in kilograms (kg), using a hanging spring balance and sack. Scrotal circumference (SC) was obtained with a cloth tape. It was measured in centimeters (cm) as the largest diameter of the testes and scrotum after pushing the testes firmly into the scrotum. Scrotal length was measured with a vernier caliper as the distance between the tip of the scrotal sack and its neck. Average testicular weight expressed in grams (g) was measured with a sensitive weighing balance calibrated in grams. The right and left testes weight were obtained separately and the average used as the testes weight. Data were subjected to analysis of variance using the General Linear Model of SPSS (2001) with breed and age within breed as fixed factors. Significant means were separated by Duncan's multiple range tests. Correlations between the different testicular parameters with body weight and between the parameters were analyzed. Separate prediction models (linear and multiple regression equations) were developed for the different breeds. The regression model adopted is as follows: $Y= a + b_1X_1 + b_2X_2 + b_3X_3$

Where, Y= body weight, X_1 to X_3 = testicular measurements, a = intercept, b (1-3) = regression coefficients of Y on X (i=1,2,3).

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RESULTS AND DISCUSSIONS

The body weight and testicular biometry of indigenous goat breeds at various ages are presented in Table-1. Within each breed, body weight was significantly ($P<0.05$) higher in bucks aged >3years than those between 1 and 3 years and <1 year. A similar trend was observed for the testicular measurements in all the breeds. This is expected as there is a linear relationship between body weight, testicular measurements and age [12]. Thus, as body weight and age increased, SC, SL and TWT also increased. [4] reported similar relationships in Malabari and Beetal goats and asserted that such relationship may have a predictive value. [5] also reported that testicular measurements increased with age and body weight in Saneen and Jumnapari goats in Malaysia. [1] reported SC and SL of 22.6cm and 13.6cm, respectively at 2 years of age and body weight of 26kg for Red Sokoto bucks. These values are similar to those of Red Sokoto bucks of 23.17cm, 13.26cm and 25.53kg for SC, SL and body weight, respectively at approximately 2 years of age reported in this study.

The correlation coefficient indicating the relationship between the live weight and testicular measurements are shown in Table-2. With body weight, SL had the highest correlation coefficient (0.74 and 0.82), respectively for both red Sokoto and Borno white goats, which were highly significant ($P<0.01$). The other traits SC and TWT had high and significant ($P<0.05$) correlation coefficients indicating a good association with body weight in both breeds of goats. [1] reported correlation coefficients of 0.70 between SC and body weight in red Sokoto goats which is close to that reported in this study. They were however lower than coefficient of 0.94 reported by [5] for Saneen and Jamnapuri crosses. This difference could be due to the effect of genotype or breed. Similar reports of SC being correlated with body weight were observed in bulls [9], rams [7] and Buffalo [6].

The correlation coefficient between testicular measurements were high, positive and highly significant ($P<0.05$) with Sc and SL having the highest value of 0.94 and 0.98 respectively in red Sokoto and Borno white goats. [1] reported similar results in red Sokoto goats. The high, positive and significant correlation between body weight and these testicular measurements suggest that either of these variables or their combinations could provide a good estimate for predicting live weight of these goats.

Table-3 shows the regression output and coefficient of determination for the two goat breeds. The coefficient of determination R^2 indicated that both SL and SC succeeded in describing more variation in body weight than TWT in both Red Sokoto and Borno White goats. SL and SC accounts for 74% and 67% respectively of variation in body weight in red sokoto. While in Borno white, they account for 82% and 81 % respectively. As a single measurement, SL was more reliable in predicting body weight (R^2 = 0.794) in Borno white goats while TWT was the least predictor (R^2 =0.414). However, the highest variation of body weight was accounted for by the combination of SL, SC and TWT than when used individually in both breeds of goat. In red sokoto, a higher R^2 (0.625) was observed when the all dimensions were used in a multiple regression equation. The same was true for Borno white (0.795). Since in both breeds, the highest R^2 was obtained when all the testicular measurements were included in the regression equations, this suggest that weight could be estimated more accurately by combination of two or more measurements. [15,18] made similar observations in their study.

Table-1. Mean and SE of the effect of age within breed on body weight and testicular measurements of indigenous goats.

Breed	N	Age	Body weight	SL	SC	TWT
Red Sokoto	197	Overall	25.99 ± 0.34	12.91 ± 0.12	23.99 ± 0.17	98.43 ± 1.36
	42	1	22.46 ± 0.68^c	10.06± 0.28^c	19.37 ± 0.36^c	55.00 ± 2.87^c
	90	2	25.53 ± 0.50^b	13.26± 0.17^b	23.71 ± 0.24^b	77.28 ± 1.88^b
	65	3	29.98 ± 0.60^a	15.41± 0.21^a	28.89 ± 0.28^a	103.01± 2.23^a
Borno White	99	Overall	23.71± 0.35	15.12± 0.17	20.75 ± 0.25	92.16 ±1.88
	23	1	18.57 ± 0.7^c	9.94 ± 0.36^c	15.31 ± 0.51^c	50.06 ± 2.28^c
	47	2	23.69 ±0.52^b	14.56 ± 0.24^b	21.40 ± 0.34^b	69.89 ± 2.69^b
	29	3	28.86 ± 0.61^a	20.86 ± 0.30^a	25.54 ± 0.42^a	100.5 ± 3.02^a

a,b,c values within columns with different superscript a,b,c are significantly($P<0.05$) different from each other.
SL – Scrotal length SC – Scrotal circumference TWT - Testicular weight

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Table-2. Correlation coefficients between body weight and testicular measurements for indigenous goat breeds.

Breed	Body weight	SL	SC	TWT
Body weight	1.00	0.74**	0.67**	0.60**
SL	0.82**	1.00	0.94**	0.79**
SC	0.81**	0.98**	1.00	0.79**
TWT	0.78**	0.94**	0.96**	1.00

** P<0.01
Values above the diagonal are for red Sokoto while those below are for Borno white goats.
SL – Scrotal length SC – Scrotal circumference TWT - Testicular weight

Table-3. The regression equations and coefficient of determination (R^2) for the testicular measurements of the two indigenous goat breeds.

Breeds		Regression equations	R^2	Significance
Red Sokoto	SL	Y = 1.344+0.634SL	0.602	**
	SC	Y = 4.206+0.563SC	0.517	**
	TWT	Y = 16.664+0.462TWT	0.414	**
	SL,SC,TWT	Y = 0.747+0.490SL+0.091SC+0.010TWT	0.625	**
Borno White	SL	Y = 10.150+0.771SL	0.794	**
	SC	Y = 4.699+0.711SC	0.705	**
	TWT	Y = 14.544+0.676TWT	0.657	**
	SL,SC,TWT	Y = 9.151+0.689SL+0.091SC+0.	0.795	**

** P<0.01
SL – Scrotal length SC – Scrotal circumference TWT - Testicular weight

CONCLUSIONS

SL and SC described more variation in body weight and with their ease of measurement provide a simple tool for rural farmers under field conditions to estimate body weight, when used in a simple or multiple regression equation. Since testicular measurements have high correlation with body weight, they may also be used as selection criteria.

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