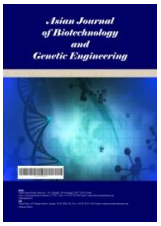

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Relationship of Testicular Biometrics with Body Weight in Rams: A Slaughter House Study in Yobe State, Africa

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Authors' contributions

This work was carried out in collaboration among all authors. Author MIM design the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors JMM and BAA manage the analysis of the study. Author YS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The research was a slaughter house survey of a testicular biometrics in relation to body weight in Ram. A total of 100 samples (Testes) were collected from rams of age ranges of 1 – 3 years. The data collected on each animal include; breed, color, sex, age, scrotal circumference, scrotal length, testes weight and body weight. The study was aimed to determine the relationship between testicular weight and body weight in sheep, and to predict the body weight in sheep from these testicular measurements. The data were subjected to the analysis of variance (ANOVA) using a general linear model SPSS (2001), significant means were separated using a Duncan multiple range test, a regression model was used to predict the body weight of rams with these testicular measurements as the independent variables. Descriptive method was used for the interpretation of the result. The relationship between body weight and testicular measurements were highly positive and significant at (P<0.01) except the relationship between body weight and testicular weights in

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Balami was significant at (P<0.05) level while the relationship between body weight and scrotal length was not significant. From the result of the study obtained farmers especially in Nigeria and other developing countries of the world can select superior breeds of rams in the field and predict the probable weights using testicular measurements especially; scrotal length scrotal circumference and testicular weight in Balami and Yankasa in the absence of weighing scale, and at the end to proffer suggestion for selection based on the testicular size as an indirect criterion for selection for genetic improvement.

Keywords: Testicular; biometrics; scrotal length; sheep; Balami; Uda and Yankasa.

1. INTRODUCTION

Linear body measurement have been used in animals to estimate body weight and price of sheep in open market [1,2,3,4,5,6]. Some authors [7,8,9,10] had used linear body measurement to examine relationship among economic characteristics, reproductive performance and to study the interactions between heredity and the environment in several animals. This method of evaluating livestock is especially important in rural communities where weighing scale may not be available [11, 12].

Sheep were among the first domestic animals and their role was critical for advancement of human civilization. As ruminants they have several functions ranging from food to fertilizer that are essential to human life in both developed and developing countries of the world [13]. It was established; Nigeria had about 33 million Sheep from the country's ruminant livestock population [13]. Sheep are reared primarily for meat and they play significant socio-economic role in the lives of rural dwellers [14]. They thrive in a wide variety of environment in the tropics and sub-tropic [15]. The study and management of animal populations requires information about the factors affecting population dynamics [16].

Information on body size and testicular traits of various breeds at constant age is of great importance in the selection of genetically superior animal for production and reproduction purposes [17]. Reproductive parameters determine several aspects of sheep production including genetic improvement so adequate data on reproduction is very essential for reproductive management and to set up feasible breeding schedule [18]. In livestock production, ram fertility influences flock performance and reproductive efficiency compared to the fertility of individual ewe; thus selection of highly fertile male is of paramount importance for improvement in reproduction [19]. A large body size is an indicator of good growth rate, an important trait when marketing sheep within different communities [19]. In the absence of live weight data, breed and visual assessment of size are the most important factors in determining the price for live animal [19]. It is important for farmers to know what the market prefer in order to align their breeding strategy with the market demands [19]. Information on reproductive organs characteristics values is necessary in breeding soundness evaluation to determine fertility efficiency of breeding males, In domestic sheep, males with large testes increase their share of paternities when receptive females are in abundance [20]. Information includes scrotal circumference measurements, an integral part of animals with a pendulous scrotum particularly in bulls due to their high correlation with testicular size and sperm production capacity [21]. These information includes scrotal circumference measurements, an integral part of animals with a pendulous scrotum particularly in bulls due to their high correlation with testicular size and sperm production capacity [22]. Parameters such as body size and testicular measurements are also commonly employed in breeding soundness evaluations, among the selection criteria, testicular size is the most suitable to indirectly improve the reproductive performance of female and a reliably parameter of the status of the reproductive growth, spermatogenesis and seminal characteristics [23].

This study was undertaken to determine the relationship between testicular measurements and body weight in rams. Predict body weight of rams from these testicular measurements also to proffer recommendations on selection based on testicular size as an indirect criterion for selection, for genetic improvement, reproduction, growth, and for the production of meat.

2. MATERIALS AND METHODS

2.1 Location and Climate of the Study Area

Data were collected on two different breeds of sheep, from various towns of Yobe State. These include Gashua metropolis and Garin Alkali. The

study lasted three (3) months (June – September, 2009). Yobe state is located within the Sahelian (semi-arid) region of Africa on latitude 10^0.05N-13^0.45N and 10^0.05N - 13^0.40N while the longitude are 11^0.30E – $14^0$20E and 9^0.20E - 12^0.04E respectively North East Arid Zone Development Program [24].

Yobe is characterized by long dry seasons punctuated by cold and dusty wind. Principally there are two seasons in this area, the wet and dry season. The wet season is the shortest and usually lasts for 3 – 4 months (June – September). The dry season begins from October – May. The annual rainfall in this area ranges between 500 and 650mm/a [24]. The relative humidity may reach up to 45% during wet season and drops to 5 – 10% in the drier season. The dry hot season has a temperature range of 39.8 – 40.7^{0C}, while during the wet season, the temperature can fall to as low as 31.0^0C [24].

2.2 Vegetation of the Study

The typical Sahel savannah vegetation predominates in this area. The plants found have so much adopted themselves to the short rainy season accompanied by a long dry season. The most dominant plants are the thorny bushes and shrubs. The few scattered trees found in this area of settlement are mostly the Gum Arabic *Acacia Senegalensis*, Boabab *Adansonia digitata*, Tamarind tree *Tamarindus indica*, Soap berry tree *Balanite egyptica*, Neem tree *Azadirachta indica*, Sand Paper tree *Ximenia Africana*, are found in settlement area. Grasses are the very short varieties that complete their life cycle within the three (3) month off rainfall. In the most cases grasses are not seen growing all over the place, but are discontinuous in nature and highly related to rainfall reliability and general condition of area. These grasses are used for building material and as well as provide fodder for livestock in the area [24].

2.3 Data Collection

Data were collected on two different breeds of rams (Balami and Yankasa) in which 100 records were taken. Data collected on each animal including breed, color, sex, age (number of permanent incisor), scrotal circumference, testes weight, body weight and scrotal length. Breed, sex and colour were determined by visual appraisal when sheep were standing in a linage, age of the animals were determined by dentition. The animals were first restrained, the mouth forced to open and number of incisors examined to determine the age [12].

The probable age of sheep with a given number of incisors is given below,

Permanent incisors	Age of sheep
None	less than 1 year 3 months
1 pair	1 year 3 months – 1 year 10 months
2 pair	1 year 10 months – 2 years 4 months
3 pairs	2 years 4 months – 3 years
4 pairs	More than 3 years.

Testicular measurements were obtained by using a cloth tape, these were described below according to [25].

Scrotal circumference, is measure as the greatest diameter of the testes, scrotal length, is taken as length of the scrotum from the neck of scrotum to its top or tip. Body weight of the sheep is taken by using a weighing balance. Testes weight is obtained after incision with a sharp knife and removing the epididymis and the testes weighed on a scale which is graduated in grams (spring beam balance).

2.4 Statistical Analysis

The data obtained were subjected to analysis of variance (Anova) using a general linear model of SPSS (2001) to evaluate breeds and age, effect on body weight and testicular measurements. Significant means were separated using the Duncan's multiple range test [26]. A regression model was also used to predict the body weight of rams with scrotal length, scrotal circumference and testicular weight as independent variables.

3. RESULTS AND DISCUSSION

Least square means ±SE of the effect of breed on body weight and testicular measurements of rams are presented in Table 1. The body weight of Balami and Yankasa rams were 33.6kg and 30.672kg respectively indicating that Balami rams were heavier than Yankasa rams. [27]; reported mean weights of 65kg and 55kg for Balami and Yankasa respectively. The body weights obtained in this study were lower than those previously reported for Nigerian breeds of sheep [27]. This could be due to the fact that most of the animals in their research were kept under intensive management, which is in contrast to the animals used in this study that

were extensively managed. However, [28], reported values of 29.86 and 25.84kg for Balami and Yankasa sheep which are close to those obtained in this study.

Scrotal length (16.339 and 14.755cm) for Balami and Yankasa sheep is highly significantly (P<0.01) different from each other. Similarly, [29] reported a significant (P<0.05) effect of breed on scrotal length of goats. The larger scrotal length of Balami rams compared to Yankasa could be an adaptive feature of Balami breed which is mainly found in the sahel savanna region. It enables the Balami to reduce the effect of high temperature on the testis.

Scrotal circumference of Balami and Yankasa were 25.369 cm and 25.068cm respectively. They were not significantly (P>0.05) different from each other. [30]. in his study on scrotal circumference of Suffolk and Finn breeds of rams, reported the significant effect of breed on their testicular measurements.

Testicular weight (111.741g and 124.20g) for Balami and Yankasa respectively were significantly different from each other. This agrees with the report of [30] who reported significant effect of breed on the testicular weight of Suffolk and Finn rams.

Least mean ± SE of the effect of age on body weight and testicular measurement in rams is shown in Table 2. Body weight of Balami rams increased significantly (P<0.05) from 25.02, to 41.996 kg and Yankasa from 26.637 t0 34.199kg with animals aged one year having the least body weight and those aged three (3) years having the highest. Thus, body weight increased with age. This finding agrees with those of [31] and [32], who observed that body weight increased with age in Sannem kids at 1st, 4th, 6th and 8 month as 3.29, 5.62, 11.20, and 13.64 kg respectively.

Similarly, testicular measurements of Balami and Yankasa rams were significantly (P<0.05) affected by age and increased with age. Scrotal lengths and scrotal circumference respectively for Balami were 14.34cm and 19.84cm for rams aged one year, 18.95cm and 26.56cm for two years old and 21.71 and 29.70 cm for rams aged three years. The same trend was observed for Yankasa in all the testicular measurements. These findings agree with those of [33], who reported that scrotal lengths increased with age of ram lamb at different ages 6, 12, 24, 36, 48, 60 and 72 weeks corresponding to 4.40, 6.79, 10.96, 13.46, 15.92, 17.17 and 18.67cm respectively. [34], also reported that scrotal length increased with age in goat. [33], also reported that; scrotal circumference increased with age of rams. They reported scrotal circumference at 6, 12, 24, 36, 48, 60 and 72 weeks as 6.03, 8.91, 16.37, 20.50, 22.56, 23.44 and 23.44 respectively. [35] Reported the scrotal circumferences of 29, 30, 31, 32, 33 and 34 cm corresponding to 5 – 6, 6 – 8, 8 – 10, 10 – 12, 12 – 18 and 18 months of age respectively in Corriedale rams. The significant effect of age on testicular weight was reported by [34,36] who reported higher weight in bulls 6 – 7 years of age compared to those of 3 – 4 years old.

Table 1. Least square mean ±SE of the effect of breed on body weight and testicular measurements in rams

BREED	BW	SL	TWt	SC
Balami	33.652± 0.71 [a]	33.652±0.71 [a]	111.741±0.88 [b]	25.369±10.52 [a]
Yankasa	30.672±0.49 [b]	14.755±0.23 [b]	124.201±2.51 [a]	25.068±0.29 [a]

ab, - means within column with different superscripts are highly significant (P< 0.01) different from each other. Keys; BW; Body weight, SL, scrotal length, SC, scrotal circumference, TW, Testicular weight

Table 2. Least squares means ±SE of the age effect on body weight and testicular measurements in rams

Breed	Age	B.W	SL	SC	TWt
Balami	1	25.021±1.78 [c]	14.340±1.10 [c]	19.840±1.34 [c]	83.33±13.6 [c]
	2	33.938±0.76 [b]	18.958±0.41 [b]	29.561±0.57 [b]	106.462±4.1 [b]
	3	41.996±0.91 [a]	21.719±0.44 [a]	29.707±0.57 [a]	145.429±5.0 [a]
Yankasa	1	26.637±1.01 [c]	18.208±0.50b	20.375±0.61 [c]	91.842±5.4 [c]
	2	31.182±0.73 [b]	15.512±0.34 [a]	24.546±0.44 [b]	127.429±3.7 [b]
	3	34.199±0.80 [a]	15.544±0.37 [a]	30.284±0.45 [a]	153.90±5.0 [a]

a,b,c – means within column with different superscripts are highly significant (P< 0.01) different from each other Keys; BW – Body weight, SL- Scrotal length, SC Scrotal circumference, TWt – Testicular weight

Simple Pearson correlation coefficient between body weight and testicular measurements is shown in Table 3. The relationship between body weight were high positive and highly significant (P<0.01), except the relationship between body weight and testicular weight of Balami is significant (P<0.05), while the relationship between body weight and scrotal length was insignificant (p>0.05). This finding agrees with those of [37] in Barbari and Beetal goats at 3 – 4 years of age. Body weight of Balami was significantly in correlation with testes weight (0.359), scrotal length (0.562) and scrotal circumference (0.381), while in Yankasa testes weight (0.271), scrotal circumference (0.444) and not significantly correlated with scrotal length (0.098). This finding agrees with that of [38], on crossbreed Rams.

Scrotal length was significantly in correlation with testicular weight (0.670) and scrotal circumference (0.759) in Balami breed while Yankasa breeds scrotal length significantly correlated with testicular weight (0.577) and scrotal circumference (0.518). This findings disagrees with that of [32], on relationship of scrotal length with other parameter in ram lamb due to difference in age. Testicular weight was significantly correlated with scrotal circumference (0.639) in Balami breed, (0.736) in Yankasa. This finding agrees with the report of [35], on relationship of scrotal length with other parameters in ram lamb due to differences in age. Testicular weight was significantly in correlation with scrotal circumference (0.639) in Balami breed, (0.736) in Yankasa. This also agrees with the report of [35].

Prediction equation and coefficient of determination (R^2) for testicular measurements of Balami and Yankasa breed of sheep are shown in Table 4. The best predictor of body weight was scrotal length which had the highest (R^2) value of 0.316, followed by scrotal circumference with 0.145 and testicular weight 0.129. All the testicular measurements are included in the above equation, the accuracy in a multiple regression prediction did not improve as

Table 3. Simple correlation co-efficient of body weight and testicular measurement in rams

Bw	SL	TWt	Sc
Bw	0.562**	0.359*	0.381**
Balami	0.566**	0.271**	0.471**
Yankasa	0.098^{NS}	0.208*	0.444**
SL	1	0.670**	0.759**
Balami	1	0.577**	0.518**
Yankasa	1	0.343**	0.569**
TWt		1	0.639**
Balami		1	0.736**
Yankasa		1	0.678**
Sc			1
Balami			1
Yankasa			1

*Keys; BW, Body weight, * Significant, SL, Scrotal length, * * Highly Significant, SC – Scrotal circumferenceNS – non significant, TWt, Testicular weight*

Table 4. Prediction equation and coefficient of breeds (R^2 0.316)

Breed	Testicular measurement	Equation	R^2
Balami	SL	Y = 8.719 + 0.562SL	0.316
	SC	Y = 17.134 + 0.381SC	0.145
	TWt	Y = 27.354 + 0.359	0.129
	SL,SC,TWt,	Y = 18.618 + 0.09SL + 0.221SC + 0.155TWt	0.175
Yankasa	SL	Y = 28.614 + 0.098SL	0.01
	SC	Y = 17.870 + 0.271SC	0.222
	TWt	Y = 26.630 + 271TWt	0.074
	SL,SC,TWt	Y = 20.927 + (-0.117)SL + (-0.128)SX + (0.641)TWt	0.259

Keys; SL: Scrotal length, SC: Scrotal circumference, TWt: Testicular weight

Indicated by the (R^2) value. This implies that scrotal length is the best predictor of body weight in Balami rams. This finding agrees with those of [39] in swamp buffalo. In Yankasa breed, scrotal circumference had the highest (R^2) value of (0.222) followed by scrotal length (0.01) and testicular weight (0.074) respectively. When all the testicular measurements are included in a multiple regression equation, it resulted in a 3% increase in accuracy prediction which was not significant at (P>0.03), thus the best single prediction in body weight in Yankasa ram is scrotal circumference. This finding agrees with that of [34] in Malabari goat who reported scrotal circumference is the best predictor of the body weight in Yankasa rams.

4. CONCLUSION AND RECOMMENDATION

This study attempted to establish a relationship between body weight and testicular measurements of Balami and Yankasa rams of different ages. Those testicular measurements that had positive and significant relationship with body weight were used in regression equation to predict the body weight. In this study, body weight was positively and significantly correlated with testicular measurements. For the Balami rams, the correlation value between scrotal circumference and body weight was 0.381, body weight and testicular weight was .359 and body weight with scrotal length was 0.562. In Yankasa rams, the correlation value between body weight and scrotal circumference was 0.471 and body weight with testicular weight was 0.271 in this order. The (R^2) value in Balami ranges from 0.129 to 0.316 and that of Yankasa range from 0.074 to 0.01 respectively.

From the result of this study, it is recommended that farmers can select superior breeds of rams in the field and predict the probable age and weights using testicular measurements especially; scrotal length scrotal circumference and testicular weight in Balami and Yanksa, in the absence of weighing scale. Animals should be properly restrained in taking measurements to reduce field errors. It is important to ensure accuracy of the calibration of flexible tapes used for taking measurements. It is also recommended that animals for such studies be kept under intensive management system for accurate measurements and avoid problems with butchers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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