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On-Farm Prediction of Testicular Characteristics in Bucks at Specific Ages

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ABSTRACT [ENGLISH/ANGLAIS]

A total of one hundred Savannah brown bucks aged between six and eighteen months, raised under the extensive system of management were used for this study. Parameters considered were scrotal circumference, testicular weight, and actual testicular weight, weight of tunica albuginea, testicular circumference, and testicular volume prior to and after slaughter and body weight before and after slaughter. All the parameters considered had a high coefficient of determination (0.72-0.81), except testicular volume and the weight of tunica albuginea which had of 0.40 and 0.36 respectively. The correlation among the parameters considered had values ranging from 0.266 – 0.922. The scrotal circumference, testicular weight, body weight changes and actual testicular weight can easily be estimated at any specific age under field conditions when using a simple regression equation. The strong positive correlation could also be utilized as a tool in selecting bucks for reproductive purposes and reduce wastage of resources by farmers.

Keywords: Selection, correlation, prediction, testicular characteristics

RÉSUMÉ [FRANÇAIS/FRENCH]

Un total de cent dollars brunes Savannah âgés entre six et dix-huit mois, soulevées dans le cadre du vaste système de gestion ont été utilisées pour cette étude. Paramètres pris en compte étaient la circonférence du scrotum, poids des testicules, et le poids exact detesticules, le poids de la tunique albuginée, la circonférence du testicule, et le volumetesticulaire avant et après l'abattage et le poids du corps avant et après l'abattage. Tousles paramètres considérés ont un coefficient élevé de détermination (de 0,72 à 0,81), à l'exception du volume des testicules et du poids de albuginée qui a de 0,40 et 0,36respectivement. La corrélation entre les paramètres considérés ont des valeurs allant de 0,266 - 0,922. La circonférence du scrotum, poids des testicules, des changements de poids corporel et le poids exact de testicules peuvent facilement être estimée à n'importe quel âge spécifique dans des conditions de terrain lors de l'utilisation d'une équation de régression simple. La forte corrélation positive pourrait également être utilisé comme un outil dans le choix des mâles à des fins de reproduction et de réduire le gaspillage des ressources par les agriculteurs.

Mots-clés: Sélection, la corrélation, la prévision, les caractéristiques des testicules

INTRODUCTION

Goats are kept primarily for meat and contribute substantially to household income and food security in most households in the rural areas [1]. Although goats are known to breed all year round, their fertility characteristics have not been fully documented to facilitate effective genetic improvement by selection and crossbreeding at all levels of production ([2]). In the male for instance, there is the need to establish measurable criteria for judging breeding soundness and guiding selection of males for breeding. These criteria include scrotal measurements, libido and semen quality tests[3, 4, and 5]and the relationship between them. Since farmers may not be in a position to test ejaculate qualities of males before using them for breeding, a procedure that would

utilize external testicular measurements may provide a good guide to breeding soundness especially where bucks are reputed to have exceptionally high libido [2]. Studies associating testicular measurements obtained during the different phases of growth are scarce. In this respect, it is not only necessary to determine how these traits respond to selection at different ages, but also the magnitude of correlation between these traits [6]. The aim of the present study is to establish prediction equations for external testicular characteristics at specific ages in Savannah brown goats in the Guinean savannah of Nigeria.

MATERIALS AND METHODS

The study was carried out in Minna, the Niger state capital located between latitudes 8°20'N and 11°30'N and

longitude 3°30'E and 7°20'E [7]. A total of one hundred (100) apparently healthy Savannah Brown bucks were used for this study with ages between 6 to 18 months. They were raised under the extensive system of management at the farms they were obtained. Bucks were weighed before and after slaughter by the use of an Avery weighing scale. Parameters considered include the scrotal circumference, testicular weight, and actual testicular weight, weight of tunica albuginea, testicular circumference and total volume prior to and after slaughter. Scrotal circumference was measured at the widest point of the scrotum using a measuring tape in centimeters. The testicular weight was taken for each testis in grams after slaughter; while the actual testicular weight is the testicular weight after the tunica albuginea had been removed (in grams) by the use of a sensitive weighing balance and the average weight of the two testicles used as the actual testicular weight. The testicular circumference was determined using a cloth tape in centimeters also at the widest point of the testes. The testicular volume was obtained by the water displacement technique.

Data collected were subjected to analysis using the Statistical Analysis Software [8].

RESULTS

Mean changes ± standard errors of parameters considered in this study across specific ages in bucks show that significant (p<0.05) differences exist between the age groups (table 1).

Prediction equations for the testicular characteristics at specific ages from this study are presented in table 2. All the parameters considered had a high coefficient of determination (r=0.72-0.81), while testicular volume and the weight of tunica albuginea had average values of 0.40 and 0.36 respectively.

Table 3 shows the correlation existing among the parameters considered for this study with values ranging from 0.266 – 0.922

DISCUSSION

The mean testicular weight of 64.06±4.76 grams, 51.73±10.90 grams, and 49.48±5.50 grams for bucks at 18 months, 12 months and 6 months of age respectively were obtained from this study which indicates that testicular properties increases in size as the animal advances in age. This agrees with the findings of [9] and [10]. Raji *et al*. [1] reported testicular weights in Red Sokoto bucks of 55.00±2.87 grams (12 months), 77.28±1.88 grams (24

months), and 103.01±2.23 grams (36 months) which is higher than the result from this study. This could be due to breed differences, physical condition of the selected animals, agro-climatic condition, nutritional level, housing and other management practices.

A similar trend was observed for the mean actual testicular weight where animals at 18 months of age were significantly (p<0.05) different from those at 6 and 12 months of age, though the values for the bucks at 12 months were higher than that at 6 months.

The mean scrotal circumference obtained for bucks at 18 months of age from this study were significantly (p<0.05) different from those at 12 and 6 months of age. . Boligon *et al.* [6] and Kabiraj *et al* [11] reported a range of 17.50 – 22.88 from their study for black Bangladesh bucks. The results from this study for bucks at 18 months of age falls within this range, while that at 6 and 12 months were lower. This could be attributed to breed differences, climatic conditions and management practices.

Mean testicular volume of 63.50±5.40mls for bucks at 18 months of age was significantly (p<0.05) higher than 6 and 12 months of age. .Similarly, results obtained for the mean weight of tunica allbuginea from bucks at 18 months of age had significantly (p<0.05) higher values than those at 6 and 12 months of age.

Mean body weight changes of bucks were significantly (p<0.05) different across the ages of 6, 12, and 18 months, which indicates that as the animal advances in age, body size increases concurrently until a particular age [11] when it gradually ceases. A mean body weight of 12.41±1.80 kilograms at 12 months, 17.62±0.22kilograms and 23.95±1.66 kilograms at18 months of age [11, 12, 13] was reported for Bengal black bucks. The result from this study for the mean body weight is lower than that for the Bengal black goats; this could be attributed to breed differences, prevailing climatic conditions and management practices.

The R^2 values obtained from the regression analysis of this study shows that predicting the scrotal circumference at any age of the animal is the most reliable (81%); followed by testicular weight, body weight changes and actual testicular weight. [1] reported R^2 values for scrotal circumference and testicular weight of 51.7% and 41.4% (Red Sokoto goats) and 70.5% and 65.7% (Borno white goats) which are lower than that obtained from this study. These differences could be attributed to the breed, management practices and variation in climatic zones. The parameters that are least reliable to be predicted are

the testicular volume and mean weight of tunica albuginea (40% and 36% respectively).

The correlation between body weight changes and testicular characteristics was moderate and significant (p<0.05) with testicular weight and testicular volume while it was not significantly (p>0.05) correlated other parameters. Testicular weight and testicular volume were high, positive and strongly correlated (r=0.992) followed by actual testicular weight and weight of tunica albuginea. This implies that either of them can both be estimated easily when the value for one is known [1]. Negative correlation was not observed between any of the parameters studied.

Table 1: This table shows mean changes ± standard error in testicular parameters of bucks within different age groups

Age (months)	N	MTWT	MATWT	MSC	MTV	MWTTA	MBWTC
6	39	49.48±5.50[b]	31.54±2.67[b]	16.30±3.27[b]	49.05±5.69[b]	16.48±2.70[b]	7.61±1.16[c]
12	38	51.73±10.90[b]	32.80±8.60[b]	16.85±2.30[b]	50.46±10.91[b]	16.42±3.75[b]	10.38±2.01[b]
18	23	64.06±4.76[a]	43.00±2.58[a]	19.33±0.48[a]	63.50±5.40[a]	19.65±2.80[a]	15.30±1.34[a]

MTWT=mean testicular weight (grams); MATWT=mean actual testicular weight (grams); MSC=mean scrotal circumference (centimeters);
MTV=mean testicular volume (mililiters); MWTTA=mean weight of tunica albuginea (grams); MBWTC=mean body weight changes (Kilograms);
N=number of observations; a,b,c= means with different superscripts differ significantly (p<0.05)

Table 2: This table shows prediction equations of testicular characteristics of bucks at specific ages

Predictor	Prediction equation	R^2 value
Testicular weight (grams)	$Y_1 = 40.45 + 1.22x$	0.79
Actual testicular weight (g)	$Y_2 = 23.32 + 0.96x$	0.72
Scrotal circumference (cm)	$Y_3 = 14.49 + 0.25x$	0.81
Testicular volume (ml)	$Y_4 = 42.94 + 0.95x$	0.40
Weight of tunica albuginea (g)	$Y_5 = 11.51 + 0.82x$	0.36
Body Weight changes (kg)	$Y_6 = 3.41 + 0.64x$	0.73

X=age in years

Table 3: This table shows correlation among testicular parameters

Parameters	TW	ATW	SC	TV	WTTA	BWTC
TW	-					
ATW	0.950*	-				
SC	0.406*	0.372*	-			
TV	0.992*	0.960*	0.392*	-		
WTTA	0.784*	0.797*	0.266	0.912*	-	
BWTC	0.395*	0.320	0.301	0.386*	0.286	-

TW= testicular weight; ATW=actual testicular weight; SC=scrotal circumference; TV=testicular volume; WTTA=weight of tunica albuginea;
*BWTC= body weight change; *= P<0.05 (significant)*

CONCLUSION

It is concluded that the scrotal circumference, testicular weight, body weight changes and actual testicular weight can easily be estimated at any specific age under field conditions when using a simple regression equation. The high, strong and positive correlation could also be utilized as a tool in selecting bucks for reproductive purposes and reduce wastage of resources by farmers.

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CONFLICT OF INTEREST

No conflict of interests was declared by authors

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