OPEN ACCESS
Advances in Animal and Veterinary Sciences

Short Communication

Phenotypic Correlation Between Body Weight and Testicular Measurement Traits of Savanna Breeding Bucks

Katleho Lephuting, Lebelo Joyceline Selala, Kwena Mokoena, Thobela Louis Tyasi*

Department of Agricultural Economics and Animal Production, University of Limpopo, Private Bag X1106, Sovenga 0727, Limpopo, South Africa.

Abstract | The current study was conducted to assess the associations among body weight and testicular measurement traits of Savanna breeding bucks. The study follows the descriptive research method. A total of 19 Savanna goat bucks between the ages of 2 and 3 years old were used as experimental animals. Three testicular measurement traits namely testicular length (TL), testicular diameter (TD), and scrotal circumference (SC) were collected using a measuring tape. Body weight (BW) was collected using the electronic weighing scale. Data was analysed using Pearson's correlation and simple linear regression. Phenotypic correlation results indicated that SC (r = 0.90) and TL (r = 0.86) had a highly positive statistically significant correlation with BW ($p < 0.01$). Testicular measurement traits are positively correlated with each other ($p < 0.05$). These findings suggest that when the measured testicular measurement traits increase the BW of the Savanna breeding bucks also improves. Regression analysis findings revealed the highest coefficient of determination ($R^2 = 0.81$) was recorded on SC as compared with other testicular measurement traits. Regression results suggest that scrotal circumference is a reliable indicator of body weight in Savanna breeding bucks. The results of the study might be useful to Savanna goat farmers during breeding selection for the improvement of live body weight.

Keywords | Correlation, Testicular diameter, Testicular length, Scrotal circumference, Regression

Received | February 03, 2023; **Accepted** | April 12, 2024; **Published** | May 18, 2024
***Correspondence** | Thobela Louis Tyasi, Department of Agricultural Economics and Animal Production, University of Limpopo, Private Bag X1106, Sovenga 0727, Limpopo, South Africa; **Email:** louis.tyasi@ul.ac.za
Citation | Lephuting K, Selala LJ, Mokoena K, Tyasi TL (2024). Phenotypic correlation between body weight and testicular measurement traits of savanna breeding bucks. Adv. Anim. Vet. Sci., 12(7):1286-1289.
DOI | https://dx.doi.org/10.17582/journal.aavs/2024/12.7.1286.1289
ISSN (Online) | 2307-8316

INTRODUCTION

The Savanna goats is an indigenous breed of South Africa and was developed in 1955 with a group of indigenous does and a large white buck on Cilliers and Sons ranch (Maynard, 2015). They breed all year round, mature early, and have long productive lives (Mazhangara *et al*., 2019). Savanna goats are primarily meat goats; they produce delicious, mild-tasting chevon. Chevon is a good source of dietary protein that has lower saturated fatty acid, total fat, and cholesterol content which makes it a healthier product (Mazhangara *et al*., 2019). According to Tyasi *et al*. (2022), there is a positively strong correlation between body weight and testicular diameter, testicular length, and scrotal circumference. Testicular characteristics and body weight were identified as important indicators of animal breeding capacity (Kerketta *et al*., 2015). As such, the selection of highly fertile bucks is of paramount importance in goat production. Nonetheless, communal farmers find it challenging to select their bucks due to a lack of information about fertility tests and the high associated costs of getting such data from each buck in a herd (Waheed *et al*., 2011). According to Faith *et al*. (2016) buck fertility has a greater impact on herd growth and reproductive efficiency than individual doe fertility. However, fewer studies have been conducted on Savanna goats to determine the association

between body weight and testicular measurement traits. Hence, the objectives of the study were to: (1) determine the relationship between testicular traits and body weight of Savanna goat bucks and (2) estimate body weight using testicular measurement traits in Savanna goat bucks. This information will help farmers to improve body weight by selecting testicular traits.

MATERIALS AND METHODS

Study area

The Bosveld Game Breeders (BGB) in Bylsteel, Limpopo, South Africa was used as a study area. The farm was situated in the Capricorn District Municipality. Winter temperatures range between 18˚C to 32˚C and summer temperatures range between 30˚C to 32˚C. The mean annual rainfall was approximately 478 mm (IDP, 2013). Longitude coordinates are 29˚30'59"E and latitude coordinates are 23˚32'17"S.

Experiment with animals and management

Descriptive research was conducted on a total of 19 Savanna bucks between the ages of 2 to 3 years old were used. The bucks were reared under the extensive system. They followed the traditional system of grazing which means that they were allowed to graze outside their camps in the early morning and then return in the afternoon. Licks, supplements, clean water, and feed were always availed to the bucks for usage when required.

Data collection

Body weight and testicular traits (testicular length, scrotal circumference, and testicular diameter) were observed parameters in this study. Buck's body weight (BW) was determined by placing each buck on a weighing scale as outlined by Mathapo and Tyasi (2022). The buck's body weight was recorded. Testicular length (TL) is defined as the distance along the caudal surface of the scrotum. It was measured from its place of attachment to the tip of the scrotum with extensible tape in centimeters (cm) as stated by Akpa *et al.* (2012).

After the testes were pressed firmly into the scrotal sac, the scrotal circumference (SC) was measured with the usage of a tape measure calibrated in centimeters (cm) at the maximum point of dimension around the distended scrotum (Akpa *et al.*, 2012). The testicular diameter (TD) was measured in centimeters (cm) from the widest anterior-posterior length of the scrotum using a tailor's flexible tape (Faith *et al.*, 2016).

Statistical analysis

The statistical package for social sciences (IBM SPSS, 2020) version 27.0 software was utilized to analyze the data. Descriptive statistics were utilized for the summarization of measured traits. The relationship between testicular measurement traits and body weight was evaluated using Pearson's correlation. Simple linear regression was used to estimate body weight using testicular measurement traits. The model below was used:

$$y = a + bx$$

Where; Y= dependent variable (BW), a= intercept, b= regression coefficient, x= independent variables (Testicular measurement traits).

RESULTS AND DISCUSSION

Goats are not only recognized for their quality meat but they are also appreciated as a source of liquid currency in the event of a financial emergency and for their leather (Patni *et al.*, 2015). This study first focused on establishing the association between live body weight and testicular measurement traits of Savanna goat bucks using Pearson's correlation. Table 1 illustrates a phenotypic correlation between BW and the testicular measurement traits of Savanna goat bucks. SC indicated a highly statistically significant correlation with BW. TL was highly statistically correlated with BW and SC. The outcome showed that live body weight had a positive relationship with the testicular diameter and a positively high significant relationship with scrotal circumference and testicular length. The current study is in harmony with the study of which concluded that the scrotal circumference accounted for variation in body weight in Nigerian Sokoto goats. The study reported by Mathapo and Tyasi (2022) partially agrees with the current study that there was a significant relationship between body weight and scrotal circumference, however, disagrees with the study that there was no correlation between body weight and testicular length. The variations may be attributable to differences in goat breeds. The current results are similar to the results of Varghese *et al.* (2019) which found a strong relationship between body weight with scrotal circumference and testicular length in Deoni bulls.

Table 1: Phenotypic correlation between body weight and testicular measurement traits

Trait	BW	SC	TL	TD
Body weight (BW)	1.00			
Scrotal circumference (SC)	0.90**	1.00		
Testicular length (TL)	0.86**	0.85**	1.00	
Testicular diameter (TD)	0.42*	0.58**	0.42*	1.00

BW= body weight, SC= scrotal circumference, TD= testicular diameter, TL= testicular length, **= significant at $p < 0.01$, *= significant at $p < 0.05$.

Table 2: Prediction of body weight from testicular measurement traits.

Traits	Model	R^2	RMSE
Scrotal circumference (SC)	Body weight = -90.20 + 5.83 SC	0.81	108.80
Testicular length (TL)	Body weight = -75.62 + 8.91TL	0.73	155.09
Testicular diameter (TD)	Body weight = -1.417 + 3.56TD	0.18	474.41

TD= testicular diameter, TL= testicular length, SC= scrotal circumference, R^2= Coefficient of determination, RMSE= Root mean square error.

The coefficient of correlation merely shows the relationship between traits without finding the effect of each testicular measurement trait to live body weight (Mathapo and Tyasi, 2022). Hence, simple linear regression was utilized to predict the effect of testicular measurement traits on the live body weight of Savanna breeding bucks. Simple linear regression results for the prediction of live BW from testicular measurement traits are depicted in Table 2. The results indicate that the model with the SC can be used to predict BW of the Savanna breeding bucks due to the highest coefficient of determination (R^2= 0.81) and low mean square error (RMSE= 108.80). The findings revealed a high coefficient of determination in scrotal circumference than testicular length. Scrotal circumference was reported to be the recommended predictor of body weight in Yankas rams (Mabu *et al*., 2020). According to Ezihe *et al*. (2017), African Dwarf bucks with larger testicular measurement traits might have larger live body weight. This study suggests that scrotal circumference may be used as a selection basis for breeding bucks.

CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicated a relationship between testicular measurement traits and body weight in Savanna goat bucks. Therefore, the improvement of the measured testicular measurement traits might result in the improvement of body weight. The results of simple linear regression point to a positive statistically significant effect of scrotal circumference on the live body weight of Savanna goat bucks. This implies that scrotal circumference might be used to improve the live body weight of the Savanna breeding bucks.

ACKNOWLEDGMENT

The authors would like to extend their warm regards to the Strydom Family of Game breeders for allowing them to use their animals during the conduction of the research.

NOVELTY STATEMENT

This is the first report on the relationship between body weight and testicular measurement traits of Savanna goat bucks.

AUTHOR'S CONTRIBUTION

KL and TLT designed the experiment. KL, LJS and KM collected the data. KL, TLT and KM analysed the data. KL, LJS and KM wrote the manuscript. TLT revised and edit the manuscript. All authors reviewed the final draft of the manuscript.

Ethical approval

The study was conducted following the rules and regulations of the University of Limpopo Animal Research Ethics Committee with the approval of AREC/17/2023:UG.

Conflict of interest

The authors have declared no conflict of interest.

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