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Short Communication

Phenotypic Relationship between Body Weight, Body Condition Score and Testicular Measurement Traits in Dorper Rams Raised in Syferkuil Farm, Limpopo Province, South Africa

Thobela Louis Tyasi*, Innocent Mokhwee Mohlabeng and Lebelo Joyceline Selala

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

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Correlation, Testicular diameter, Testicular length, Scrotum circumference, Body weight

ABSTRACT

Testicular measurements are good indicators for identification of those animals with suitable sperm production for breeding. The objective of the study was to examine the relationship between body condition score (BCS), body weight (BW) and testicular measurements viz testicular length (TL), testicular diameter (TD) and scrotum circumference (SC). A total of 40 Dorper rams aged between 1 to 5 years were used for data collection. Pearson's correlation was used to determine the relationship between BW, TL, TD and SC, and Spearman' rho correlation was used to determine the relationship between BCS, BW, TL, TD and SC. Pearson's correlation results indicated that BW had a positively high statistical significant correlation with TL (r = 0.64), TD (r = 0.64) and SC (r = 0.64). Spearman's rho correlation results indicated that BCS had a high positively statistical significant correlation with BW (r = 0.84), TL (r = 0.61), TD (r = 0.57) and SC (r = 0.57). TL had a positively statistical significant correlation with TD (r = 0.74) and SC (r = 0.74). Correlation findings suggest that improving TL, TD and SC might improve the BW while BCS might be improved by improving BW. Therefore, the findings of this study might be useful in the selection of rams for breeding purposes.

Dorper is a superior meat type sheep breed in South Africa developed through the long-time effort of crossbreeding of the black headed Persian and the Dorset Horn in 1930 (Ayichew, 2019; Tyasi *et al*., 2020). Body condition score is an important measure of the fitness of an animal for assessing the body reserves of an animal (Faith *et al*., 2016). Condition score uses manual palpation of tissues cover over the backbone and the short ribs immediately behind the last long ribs. Body condition score is not exercised on the farms, and its relationship with body weight and testicular traits is not known (Faith *et al*., 2016). Faith *et al*. (2019) indicated that in livestock production, ram fertility influences flock performance and reproductive efficiency compared to the fertility of individual ewe. However, less studies have been conducted on Dorper sheep breed in determining the relationship between body weight, body condition score and testicular measurement traits. Hence, the objectives of the study were: to determine the relationship 1) between body weight and testicular measurement traits and 2) between body weight, body condition score and testicular measurement traits of Dorper rams. The study will help communal farmers in the management and selection of rams for breeding purposes.

Materials and methods

The current study was conducted at the University of Limpopo Experimental farm. Limpopo province, South Africa. The farm is situated 10 km west of the university. The temperature in winter ranges between 5°C and 28°C and in summer temperature ranges from 10°C to 36 °C and the mean annual rainfall is less than 400mm (Kutu and Asiwe, 2010). Dorper rams of 1 to 5 years of age were used as experimental animals of the study. Dorper rams at the University Experimental Farm were reared under extensive farming system. The rams were subjected to the traditional grazing system which allows them to graze in the morning and return late noon. Feed and clean water were provided *ad libitum*.

Cross-sectional design was used as experimental design where all the 40 rams in the experimental farm were used for midday data collection. Body weight (BW)

* Corresponding author: louis.tyasi@ul.ac.za
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of each ram was taken by placing the rams individually on a weighing scale and recorded as described by Faith *et al*. (2016). Testicular length (TL) was measured with flexible tape in centimetres (cm) as the distance along the caudal surface of the scrotum, from its point of attachment to the tip of the scrotum as described by Akpa *et al*. (2012). Scrotal circumference (SC) was measured with a flexible tape in centimetres (cm) at the maximum point of dimension around the pendulous scrotum after pushing the testes firmly into the scrotal sac Akpa *et al*. (2012). Testicular diameter (TD) was measured in centimetres (cm) with a tailors' flexible tape from the widest anterior-posterior distance of the scrotum Faith *et al*. (2016). Body condition scoring (BCS) was taken on the rams based on the procedure for body condition scoring recommended by Russel (1984) which states that a range of 0-5 scores as follows: Score 0 (BCS0): Extremely emaciated and on the point of death. It is not possible to detect any muscular between the skin and the bone. Score 1 (BCS1): The spinous processes are felt to be prominent and sharp and the eye muscle areas are shallow with no fat cover. Score 2 (BCS2): The spinous processes still feel prominent, but smooth and individual processes can be felt only as fine corrugations, and the eye muscle areas are of moderate depth but have a little fat cover. Score 3 (BCS3): The spinous processes are detected only as small elevations, and are smooth and rounded with individual bones that can be felt only with pressure. The eye muscle areas are full and have a moderate degree of fat cover. Score 4 (BCS4): The spinous processes can just be detected with pressure as a hard line between the fat covered muscle areas. The eye muscle areas are full and have a thick covering of fat. Score 5 (BCS5): The spinous processes cannot be detected even with firm pressure and the eye muscle areas are very full of very thick fat cover. All measurements for BW, testicular measurement traits and body condition scores were taken by one person to avoid individual variation. The data was collected in the midday for testicular measurement traits.

Statistical Package for Social Sciences version. 26.0 (IBM SPSS, 2019) was used for data analysis. Descriptive statistics (average mean, standard deviation, standard error, and coefficient of variance) were calculated. Pearson's correlation was used to estimate the phenotypic relationship between body condition score and body weight, testicular length, testicular diameter and scrotal circumference. Multiple regression was used to estimate body condition score from body weight, testicular length, testicular diameter and scrotal circumference.

The following model will be used:

$BCS = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4$

Where BCS is dependent variable (Body condition score), a is regression intercept, $b_1 - b_4$ is coefficients of regression, and $X_1 - X_4$ is independent variables (BW, TL, TD and SC).

Results

Table I shows the summary of BCS, BW and testicular measurement traits. Table II shows phenotypic correlation between BW and testicular measurements of Dorper rams. The results showed that BW had a positively high significant correlation ($p < 0.01$) with TL, TD and SC. The findings also indicated that TL had a positively high association ($p < 0.01$) with TD and SC, while TD had a positively high significant association ($p < 0.01$) with SC.

Table I. Summary of measured traits.

Traits	Mean±SE	Standard deviation	CV %
BCS	3.53±0.14	0.91	25.69
BW (kg)	36.80±1.86	11.74	31.91
TL (cm)	12.45±0.32	2.01	16.16
TD (cm)	7.56±0.20	1.23	16.30
SC (cm)	23.75±0.61	3.87	16.29

BCS, Body Condition Score; BW, Body Weight; TL, Testicular Length; TD, Testicular Diameter; SC, Scrotal Circumference; CV, Coefficient of Variability (Variation); SE, Standard Error.

The spearman's rho results of BCS, BW, TL, TD and SC are presented in Table III. The results indicated that BCS had a high positively statistical significant correlation ($p < 0.01$) with BW, TL, TD and SC. The results also showed that BW had a high positively statistical significant correlation ($p < 0.01$) with TL, TD and SC. TL had a positively statistical significant correlation ($p < 0.01$) with TD and SC, lastly the TD had a high positively statistical significant correlation ($p < 0.01$) with SC.

Table II. Phenotypic correlation between body weight and testicular measurements of Dorper Rams.

Traits	BW	TL	TD	SC
BW	-			
TL	0.64**	-		
TD	0.64**	0.74**	-	
SC	0.64**	0.74**	1.00**	-

**, Significant at $P < 0.01$; BW, Body weight (kg); *, Significant at $P < 0.05$; TL, Testicular Length (cm); TD, Testicular Diameter; SC, Scrotal Circumference.

Discussion

Sheep are commonly reared for wool, meat and milk productions, and play noteworthy socio-economic roles in the lives of communal farmers (Yakubu and Ibrahim,

2011). The current study was firstly conducted to examine the relationship between BW and testicular measurement traits using Pearson's correlation. Our results showed a highly remarkable relationship between BW and all the testicular measurement traits. A similar report has been reported by Faith *et al*. (2018) in African Dwarf rams. Faith *et al*. (2016) indicated that BW had a statistical significant correlation with the TD and SC but not significant with TL in Yankasa rams. The variations might be due to breed, age and management differences. According to Akpa *et al*. (1998), rams with larger testicular measurement traits might have larger BW. BW and testicular measurement traits indicate spermatozoa production (Agga *et al*., 2011) while Emsen (2005) suggests that testicular measurement traits are statistically significant with reproductive activities. Our findings suggest that BW might be improved by improving TL, TD and SC of Dorper rams. We also examined the relationship between BCS, BW and testicular measurement traits of Dorper rams using Spearman's rho correlation. The results recognised that BCS had a high positively statistical significant correlation with BW, TL, TD and SC. Faith *et al*. (2016) reported that BCS had a highly statistical significant with BW but not significant with TL, TD and SC in Yankasa rams. Tariq *et al*. (2012) reported that BCS had a remarkable correlation with BW of indigenous Mengali sheep of Pakistan. Our findings suggest that BW, TL, TD and SC might be used to improve BCS of Dorper rams. Phenotypic variations in traits of animals are due to genetic and environmental effects, and joints effects of genetic and environment (Rajuana *et al*., 2008).

Table III. Spearman's rho between body condition and body weight and testicular measurements of Dorper Rams.

Traits	BSC	BW	TL	TD	SC
BSC	-				
BW	0.84**	-			
TL	0.61**	0.64**	-		
TD	0.57**	0.64**	0.74**	-	
SC	0.57**	0.64**	0.74**	1.00**	-

**, Significant at P < 0.01; BSC, Body Condition Score; BW, Body Weight; TL, Testicular Length; TD, Testicular Diameter; SC, Scrotum Circumference.

Conclussion

Pearson's correlation results suggest that body weight had a positively high statistical significant correlation with testicular length, testicular diameter and scrotum circumference. While Spearman's rho correlation findings suggest that body condition score had a highly positive statistical significant correlation with body weight, testicular length, testicular diameter and scrotum circumference. Our correlation findings suggest that improving testicular length, testicular diameter and scrotum circumference might improve the body weight while body condition score might be improved by improving body weight. Therefore, the findings of this study might be useful in the selection of rams for breeding purpose.

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Statement of conflict of interest

The authors have declared no conflict of interest.

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