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# The Relationship Between Body Weight and Testicular Measurements in Kabbashi Eco-Type Desert Rams

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**Abstract:** Ten Kabbashi rams were used to investigate the relationship between their body weights and testicular measurements. The rams were purchased at 7 months of age and maintained under uniform condition of feeding and management. Body weights and testicular measurements were taken once every month. The testicular measurements (cm) and body weights (kg) were subjected to linear {Y = a+bX} and logarithmic {$Y = b_0+b_1 \ln(X)$} regressions where, Y is the testicular measurement and X is the body weight, a and b are constants denoting the intercept and the regression coefficient, respectively. There was a strong and positive correlation between testicular measurements and body weight in Kabbashi rams. The average live body weights increased from 22.95 kg at 7 months of age to reach 64.31 kg by 28 months. The average testicular circumference increased from 20 cm at 7 months to 34.5 cm at 20 months of age. Corresponding changes in the testicular length were found to be 12.70 and 20.81 cm at 7 and 20 months of age, respectively. The linear regression coefficient for the testicular length and testicular circumference on body weight were 0.214 and 0.287 and the coefficients of determination ($R^2$) were 0.822 and 0.782. Due to the strong correlation between body weight and testicular measurements, body measurements can be used to select Kabbashi rams for breeding programs. However, further studies are needed to determine the relationship between these subjective morphological criteria and the actual fertility and semen quality in Kabbashi rams.

**Key words:** Body weight, testicular measurement, rams, fertility, feeding

## INTRODUCTION

Body weight is often the most common and informative measure of animal performance. It has been found very effective in assessing the reproductive efficiency and performance in farm animals (Bongso *et al*., 1984) and provide readily obtainable and informative measures for selection, feeding and health care (Thiruvenkanden, 2005). Testis size is important because of its high correlation with sperm production potential and it is a highly heritable trait that could easily be improved by selection (Hafez *et al*., 1955). Larger testis size in beef bulls have been reported to be correlated with increased sperm output (Coulter and Foote, 1979; Blockey, 1980), decreased age at puberty, increased mature testicular size (Coulter and Foote, 1979; Coultler and Keller, 1982) and increased pregnancy rate (Blockey, 1980; Lunstra and Coutler, 1993). Testicular development in young rams was found more closely associated with body weight than with its age (Matos *et al*., 1992). However, Venter *et al*. (1984) proposed that minimum scrotal circumference standards at a certain age should be established for individual breeds.

The aim of this study is to determine the relationship between body weight and testicular measurements in Kabbashi eco-types of the Sudan Desert ram and to estimate the correlations among measures of body weight and age to scrotal measurements. In addition, the best regression model for prediction of testicular measurements from their live weight under field conditions will be determined. The ultimate expected outcome is to obtain a practical and informative means for prediction of ram's fertility from body and testicular measurements.

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## MATERIALS AND METHODS

**Site of study:** This experiment was conducted from September 2009 to June 2011 at the Animal Production Research Center (APRC), Department of Small Ruminant Research (Kuku, Khartoum North, Sudan).

**Experimental animals:** Ten selected Kabashi eco-type desert rams were used in this study. The rams were purchased at the age of 7 months and with an average body weight of 22.95±2.23 kg. Dentition Method was used to determine the age of the rams by counting the number of permanent incisors that have erupted on the lower jaw of the mouth. They were maintained under uniform condition of feeding and management. The rams were housed in 10 separated pens (2×1.5 m).

**Feeding:** The experimental animals were kept under zero-grazing system where forages were cut and carried to the pens. The forages comprised of Alfa alfa (*Medicago sativa*) and Abu 70 (*Sorghum bicolor)*. Abu 70 was offered daily while Alfa alfa was offered once weekly. Moreover, a concentrate diet (10.9 MJ, ME/kg and 19.2% CP) was offered at a rate of 1 kg/animal/day. Blocks of salt lick and drinking water were available continuously.

**Body weight and testicular measurements:** The rams were weighed once every month using an animal balance and the body weight was recorded in kilograms. The Scrotal Circumference (SC) was measured monthly by grasping the neck of the scrotum with the hand using the fingers to push the testicles ventrally to eliminate any wrinkles. The measuring tape was passed around the scrotum and tightened at the greatest width of the two testicles. Scrotal Length (SL) was taken as the distance between the tip of the scrotal sack and its neck. The scrotal measurements were recorded in centimeters.

**Statistical analysis:** The monthly testicular measurement (cm) and body weight (kg) were subjected to linear and logarithmic regressions:

$$Y = a+bX$$

$$Y = b_0 + b_1 \ln(X)$$

Where:

Y = Testicular measurement
X = Body weight
a and b = Constants denoting the intercept and the regression coefficient, respectively

Data analysis was performed using StatView Software (Abacus Concepts Inc., Berkeley, CA, USA).

## RESULTS AND DISCUSSION

The relationship between body weight and testicular measurement in Kabbashi rams was investigated in this study. As shown in Table 1, the rams were still growing and their average live body weights increased from 22.95±2.23 kg at 7 months of age to reach 64.31±10.72 kg by 28 months of age. It has been suggested that young ram to be used for breeding should have scrotal circumference >30 cm (Master, 1988). In the present study, the average testicular circumference in Kabbashi rams increased from 20.00±2.36 cm at 7 months to reach 34.50±3.43 cm at 20 months of age. Corresponding changes in the average testicular length were found to be 12.70±1.34 and 20.81±1.85 cm at 7 and 20 months of age, respectively. Testicular development in young rams was found more closely associated with body weight than with its age (Matos *et al*., 1992). Testicular measurements and the changes that occur during growth of the testis from birth to sexual maturity have been well documented for rams (Dyce *et al*., 2002). In many studies, testicular measurements have been evaluated and related to some seminal parameters usually sperm concentration and sperm motility. Hafez *et al*. (1955) reported that testis size is important because of its high correlation with sperm production potential and it is a highly heritable trait that could easily be improved by selection.

There was a strong and positive correlation between testicular measurements and body weight in Kabbashi rams. In the present study linear regression coefficient for the testicular length and testicular circumference on body weights were 0.214 and 0.287 (Table 2 and Fig. 1). This means that for each unit increase in body weight there was a 0.214 unit increase in the testicular length and at the same time there was 0.287 unit increase in testicular circumference. The relationship between the body weight and testicular measurements was further emphasized by the positive and significant correlation coefficients

Table 1: Body weights and testicular measurements in Kabbashi eco-type desert rams

| Age (months) | No. of rams | Body weight (kg) | Testicular circumference (cm) | Testicular length (cm) |
|---|---|---|---|---|
| 7 | 10 | 22.95±02.23$^a$ | 20.00±2.36$^a$ | 12.70±1.34$^a$ |
| 15 | 10 | 36.10±06.47$^b$ | 28.10±2.77$^b$ | 15.90±1.61$^b$ |
| 28 | 8 | 64.31±10.72$^c$ | 34.50±3.43$^c$ | 20.81±1.85$^c$ |

Values (means±SD) in the same column with different superscripts differ significantly at $p<0.05$

Table 2: Simple regression equation and coefficient of determination ($R^2$) of testicular measurements on body weight in Kabbashi eco-type desert rams

| Testicular measurement | Regression equation (Y = a+bx) | $R^2$ | p-values |
|---|---|---|---|
| TL | TL = 7.938+0.214 B.W. | 0.822 | <0.0001 |
| TC | TC = 16.26+0.286 B.W. | 0.782 | <0.0001 |

BW = Body Weight, TL = Testicular Length, TC = Testicular Circumference

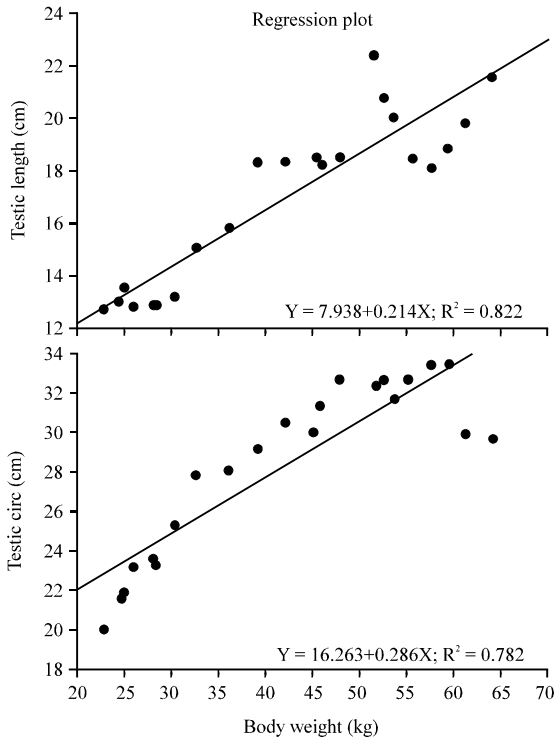


Fig. 1: Simple regression equation of testicular measurements on body weight in Kabbashi rams

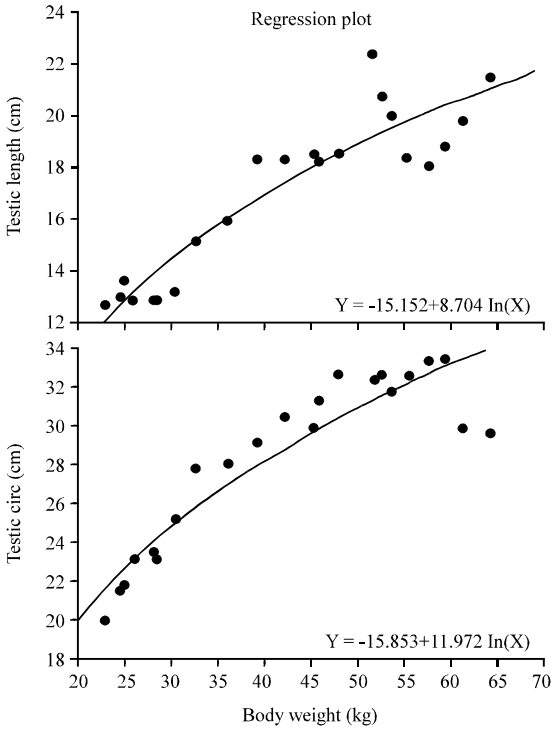


Fig. 2: Logarithmic regression equation of testicular measurements on body weight in Kabbashi rams

Table 3: Matrix of correlations coefficient between body weights and testicular measurements in Kabbashi eco-type desert rams

| Coefficient | Body weight (kg) | Testicular length (cm) | Testicular circumference(cm) |
|---|---|---|---|
| Body weight (kg) | 1.000 | - | - |
| Testicular length (cm) | 0.884** | 1.000 | - |
| Testicular circumference (cm) | 0.907** | 0.876** | 1.00 |

**p<0.0001, N = 22 observations

Table 4: Logarithmic regression equation and coefficient of determination ($R^2$) of testicular measurements on body weight in Kabbashi eco-type desert rams

| Testicular measurement | Regression equation {$Y = b_0+b_1$ ln(X)} | $R^2$ | p-values |
|---|---|---|---|
| TL | TL = -15.152+8.704 In (B.W.) | 0.855 | <0.0001 |
| TC | TC = -15.853+11.972 In (B.W.) | 0.861 | <0.0001 |

BW = Body Weight, TL = Testicular Length, TC = Testicular Circumference

(r = 0.884 and 0.907) as shown in Table 3. The variations in the testicular measurements due to variation in the body weight were very high as indicated by the coefficient of determination ($R^2$) (0.822 and 0.782 for testicular length and circumference, respectively).

The logarithmic regression coefficient is the percentage increase of the dependent variable at each 1% increase of the independent variable. Gaili and Nour (1980) used this regression coefficient (b) to relate the growth of each whole sale cut to whole carcass growth. They stated that when the value of b is <1, the organ or tissue grows at a lower rate than the whole body weight does but when the value of b is >1 then the organ or tissue grows at a higher rate than the whole body weight does. They also mentioned that the difference in growth is significant if the error of b is less than the difference between b and 1. On the light of the earlier explanation, the testicular measurement in Kabbashi rams grow at a higher rate than the body weight does since the logarithmic regression coefficient (b) for the testicular length and testicular circumference on Kabbashi body weight were 7.938 and 11.972 (Table 4 and Fig. 2).

Because of lack in measurable traits related to sire fertility, effective means for selecting males with superior fertility is limited (Lunstra and Coutler, 1993). Livestock farmers place more weight on morphological traits as selection criteria (subjective selection) rather than production selection criteria (objective selection). This procedure was implemented in the sheep industry where farmers were performing subjective selection of ewes and rams for improving wool and lambing performance (Gavigan and Parker, 1997). Therefore, due to the unavailability of objective measurable traits for selecting males with superior fertility, body measurements can be used for selection of Kabbashi rams. However, further

studies are needed to determine the relationship between these morphological criteria and the actual fertility and semen quality in Kabbashi rams.

## CONCLUSION

There was a strong and positive correlation between testicular measurements and body weight in Kabbashi rams. Due to unavailability of direct measurable traits for selecting males with superior fertility, body measurements can be used for selection of sire rams. However, further studies are needed to determine the relationship between these morphological criteria and the actual fertility and semen quality in Kabbashi rams. The ultimate aim would be to find objective selection criteria for ram fertility.

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