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REGRESSION ANALYSIS OF LINEAR BODY MEASUREMENTS ON LIVE WEIGHT IN SUDANESE SHUGOR SHEEP

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ABSTRACT: *In this research, linear regression models were improved for estimation of body weight using various linear body measurements from Sudanese Shugor sheep. Simple regression models were formed when Body weight (Bwt) was dependent variable and heart girth (HG), height at withers (HTW) and height at hip (HTH) as independent variables. The best derived regression prediction equation for estimation of body weight determinated by using beta (β) as the constant based on number of variables used for the equation, mean square error (MSE) and Coefficient of determination (R^2). The model including the most appropriate measurements such as heart girth, height at wither and height at hip were the best fitted model (β = -47.54, MSE = 9.39 and R^2=0.61) for estimation of body weight in Sudanese Shugor sheep in this study.*

Key words: *Linear body measurements, Body weight, regression analysis, Shugor sheep, Sudan*

ORIGINAL ARTICLE

INTRODUCTION

Sudanese Shugor is moderately large sheep ranging in colour from light to dark brown. They have occasional patches of wool under the hair sulieman et al, (1990). They are found mainly along and to the west of the White Nile, and are the most common in the western part of Gezira, where they graze cotton residues and other agricultural byproducts.

Body weight is an important economic trait in the selection of animals. The main purposes of animal breeding practices are to improve traits of economics values (Mendes et al., 2005).

An accurate method for estimation body weight of livestock is a very important aspect of livestock breeding and production. Knowledge of Animal's live weight is of important for determining its food requirements for growth, maintenance and production, and the correct dosages in drug administration. Direct determination of live weight involves the use of weighing scales. Proper and accurate estimation of body weight is difficult under field condition production systems due to lack of weighing scales. The need to estimate live weight of animals especially sheep from simple and easily measurable morphological variables such as linear body measurements of different parts of the body become evident. Measurements of various body conformations are of value in judging quantitative characteristics of meat and are also helpful in developing suitable selection criteria. Moreover, because of the relative ease in measuring linear dimensions they can be used as an indirect way to estimate live weight (Getachew, 2008).

Apart from the conventional use of scale in determining the weight of sheep, weight determination by estimating some linear parameters could be employed (Winrock International, 1992).

This study was carried out to establish the relationship between live weight and some linear body measurements in Sudanese Shugor sheep as step towards using predictive models to estimate live weight of sheep.

MATERIALS AND METHODS

Source of data

The data used for this study were collected on a random sample of 81 male (8 months of age) shugor sheep kept at Extension and Rural Development Center, Faculty of Animal Production, University of Gezira, Sudan. The animals were managed under semi-intensive system. The flock was offered feed comprising groundnut cake, wheat bran, Dura, salt, oyster shell and green fodders. The sheep were watered regularly. Live weight was determined by small ruminants weighing scale. After determining the live weight, each animal was placed on all four legs on an even surface, and the following linear body measurements were taken with the measuring tape.

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Heart Girth (HG): Heart girth is a circumferential taken around the chest just behind the front legs and withers. The measurement should be taken to the nearest 0.5 cm.

Height at withers (HTW): This measure the distance from the surface of platform on which the animal stands to the withers. The measurement is best made by using a special measuring stick made with two arms one which held vertical and the other at right angles it sliding firmly up and down to record height.

Height at Hip (HTH): Height at hip is the distance from the surface of a platform to the hip using a measuring stick as described for height at withers.

Body length (BL): Body length refers to the distance from the base of tail to the base of neck.

All measurements were taken in the morning before the animals were fed. Each linear body measurement was recorded in centimeters and each live weight in kilograms.

Statistical Analysis

A simple regression analysis was carried out to describe the relationship between the independent variables consisting of asset of linear body measurements of Shugor sheep on the one hand, and the live weight as the dependent variable on the other hand. In selecting the appropriate variables for the predictive equation, the all possible selection procedure was adopted. This involved computing all possible and the best subset regression equation. Each equation was ten assessed by its coefficient of determination (R^2) and the constant based on the number of variable that used for the prediction.

Statistical Packages for Social Sciences (SPSS) release 15.0 (2006) was used as a tool for fitting the Prediction equation.

RESULTS AND DISCUSSION

Knowing the live weight of sheep is very useful to make appropriate management decisions. However, because of lack of accurate scales in most farms, linear body measurements of animals can be used to estimate live weight Equations correlating live weight and linear body measurements have been developed for some breeds (Gizaw, 1995).

It is important to know the different parts of the sheep body to understand the different linear measurements described in this present study. Table 1 presents the studied linear body measurements of Sudanese Shugor sheep, least-squares mean were mentioned.

Table 1 - Least square (means ± SE) of physical linear trait in Sudanese male Shugor sheep at eight months of age

Physical traits	N	Means ± SE
Body weight(kg)	81	29.60 ± 0.54
Body length(cm)	81	60.06 ± 0.55
Heart girth(cm)	81	73.23 ± 0.44
Height at withers(cm)	81	69.46 ± 0.52
Height at hip(cm)	81	72.98 ± 0.47

Determination of the accurate degree of correlation between live weight and linear body measurements in sheep may help to obtained methods for estimation of traits they are not easily measured under field condition. In present study, estimations were made by regressing the live weight on measurements of heart girth, Height at withers and height at hip of the animals. The regression coefficients of live weight on those linear measurements are shown in Table 2. There were relatively high level of significant ($P<0.05$) regression coefficients between live weight and linear body measurements. The finding of this study were consistent with those reported by Heinrichs et al.(1992), Adeyinka and Mohammed (2006b), Ojedapo et al. (2007), Samuel anf Salako (2008), and Sownade and Sobola (2008), that live body was highly correlated with linear body measurements.

Table 2 - Coefficients associated with regression of live weight(kg) on linear body measurements(cm) of Sudanese Shugor sheep breed

Model	Beta	SE	t value	sig.
1 (constant)	-47.54	7.00	-6.79	0.000
Heart girth (cm)	0.42	0.09	4.67	0.000
Height at withers (cm)	0.30	0.09	3.34	0.001
Height at hip (cm)	0.35	0.10	3.46	0,001
Derived Equation: Y = -47.54 +0.42(HG) + 0.30(HTW) + 0.35(HTH)				

These relationships were further classified by using the significance of the regression coefficients, as illustrated by t values (Table 2). Heart girth showed the best relationship at this age followed by height at hip and height at withers. Heart girth is the most variable live body measurement since it reflects condition in the animal, the results in the present study is similar to that reported for the same breed by sulieman et al. (1990).

Increasing the genetic potential for meat production of a sheep breed requires selection for increased size and live weight. Proper size and weight measurement are often difficult in field due to lack of weighing scales.

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Linear measures like heart girth are useful under these situations (Gizaw, 1995). The relatively high accuracy and significance of predictors of the prediction equation developed for this sheep breed at certain age (eight months) in the present study proposed that simple linear regression equation was sufficient to be used in the estimation of live weight from linear body measurements in sheep breeds. However, more investigation is needed in this field of research so as to confirm this statement. This is advantages for those concerns with sheep breeding and production especially in Sudan.

CONCLUSION

The strong relationship and very highly significant P values of regression between live body weight and linear body measurements of Sudanese Shugor sheep indicated that the independent variables or their combination could be used to estimate live body weight of those sheep. Heart girth had the highest correlation to live body weight according to t value. A simple regression model using linear body measurements that had relatively high coefficient of determination ($R^2 = 0.61$) could be utilized.

Finding of present study suggested that the derived equation could be used to estimate live body weight of Sudanese Shugor sheep breed.

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