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Accuracy of Body Weight Prediction in Nigerian Red Sokoto Goats Raised in North Eastern Nigeria Using Linear Body Measurement

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Abstract: The relationship between live body weight and linear body measurements of 163 complete sets of records were analysed using linear and multiple regression. The regression equations obtained were improved by stepwise approach of analysis. The accuracy of the relationship was found to depend upon sex and time measurement were taken within the year. The best prediction equation was obtained for female. The best equation was obtained in the period of February to April. In the males the best predictive variables were chest girth, height at withers and body length while for females only chest girth and body length is enough to predict live body weight even more accurately. Because of variation in the accuracy of prediction from one period to another within a year, the use of linear body measurement may not be considered as precise predictors of body weights in this group of goat.

Key words: Goats, body measurement, body weight, prediction, regression

INTRODUCTION

The assessment of body weight is one of the most important single trait in the assessment of goat production (Hassan and Ciroma, 1992). It is used in monitoring the growth pattern of most domestic livestock. A good estimate of body weight is of great importance for the study of growth pattern and management of goats both on station and on farm. Under rural conditions, lack of cheap portable weighing scale and skilled technician has made it very difficult to assess liveweight objectively and accurately. This is especially very true among the peasant farmers found in very remote villages all over Nigeria.

In Nigeria, goats are the most numerous of all types of livestock. FAO (1991) put the estimate of goats in Nigeria at 22 million. However a recent livestock revised the population of goats to 34.5 million (RIM, 1991). The animals are primarily kept for meat which is a relished delicacy in Nigeria. The Federal Ministry of Agriculture (FMA, 1981) estimated that goats contributed about 17% of the total meat supply in Nigeria. In order to increase the meat yield from goat, there is the need for genetic improvement of its liveweight. Due to lack of weighing scale in the remote rural area of Nigeria, it is almost impossible to obtain any accurate measurement of this very important trait. It is therefore desirable to estimate liveweight from other simple traits such as linear measurement using easily obtainable and cheaply available metric tape rule.

Ngere *et al.* (1979), Moruppa and Ngere (1986), Ibiwoye and Oyatogun (1987) and Osinowo *et al.* (1989) have all reported on earlier works done the use of linear body measurement to predict live weights of goats in Nigeria. Other authors such Bassano *et al.* (2001) reported works that have been done on the use of linear body measurements to estimate body weight of Alpine Ibex. In their own recent work, Bassano *et al.* (2001) used the linear body measurement to construct regression equations which could be used to predict the live body weight of Capra Ibex.

Osinowo *et al.* (1989) developed regression equations that could be used to predict body weight from some of the linear measurements. Most of the earlier studies has shown that chest girth is a good estimator of body weight (Guèye *et al*., 1998; Thiruvenkadan, 2005).

The aim of this study was to test the accuracy and precision of regression equations to estimate body weight in 2 common breeds of goat in the north western part of Nigeria.

MATERIALS AND METHODS

One hundred and sixty three set of data were collected on Red Sokoto and White Borno goats kept at the University of Maiduguri Teaching and Research Farm.

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The following data were recorded

- Body weight-recorded to the nearest 0.5 kg using a Salter Spring balance.
- Chest girth-a circumferential measure taken to the nearest 0.5 cm around the chest at the level of the third to fourth cervical vertebrae.
- Withers Height-was measured as the distance from the surface of a platform to the withers.
- Body length-measured as the distance from the external occipital protuberance to the base of the tail

The vdata was analysed using SAS software (SAS, 1995). The regression equations for predicting body weights of goats in this study were improved by means of stepwise multiple regression analysis (Snedecor and Cochran, 1989). In addition to the above four variables we replaced chest girth by squared value of chest girth in multiple regression as used for other domestic herbivores.

To indicate the accuracy of linear measurement of the predictive equation, we used the coefficient of determination. We analysed the linear relationship between weight and the three body measurements using Pearson correlation coefficients (r_p). Two tailed probability values were reported with $\alpha = 0.05$.

RESULTS AND DISCUSSION

Table 1 showed the Pearson correlation coefficient of body weight and the other three linear measurements. The correlation analysis was separated for the two sexes. The chest girth showed the highest correlation for both sexes. The coefficient of determination (R^2) for chest girth shown in Table 1 is an indication that the chest girth succeed in estimating body weight more than any of the other linear body measurement. Fact that the R^2 values of chest girth were 0.73 and 0.99 for male and female goats, respectively combined with the ease of measurement justifies the use of chest girth as a foremost weight predictor. Thiruvenkadan (2005) suggested that the higher association of body weight with chest girth was possibly due to relatively larger contribution in body weight by chest girth (consisting of bones, muscles and viscera). This is in agreement with the findings of Nesamvuni *et al.* (2000), Slippers *et al.* (2000), Topal *et al.* (2003) and Topal and Macit (2004).

Table 2 showed the multiple regression equations obtained using multiple regression analysis (stepwise method) between the body weight and linear body measurement for different periods of the year. The best prediction equation was obtained for data taken from February to April, the coefficient of determination being 0.97. This is followed by the period of August to October the coefficient of determination value being 0.88.

Multiple regression analysis was also performed on body measurement based on sex. This prediction equation was more accurate for females than males, the R^2 values being 0.92 and 0.56, respectively (Table 3).

The relationships between body measurement and body weight may appear to differ significantly between the 2 sexes of goat. Similar situation was observed in Kanni Adu goats of India by Thiruvenkadan (2005). This may be explained by the likely difference in fat deposition in the two sexes as suggested by Bassano *et al.* (2001) for Alpine Ibex. In the female, body length carried more weight more weight in predicting body weight than any of the other body measurements. In fact, only chest girth combined with body length is enough to estimate body weight accurately ($R^2 = 0.92$). In the male, even when all the 3 variables of chest girth, Height at withers and body length were included in the prediction equation. The level of accuracy is still far less than the prediction equation for the female.

Seasonal variation in the relationship between body weight and body measurement was observed in this flock of goat. This is in agreement with Bassano *et al.* (2001) who observed similar pattern in captured wild goat Alpine Ibex. The seasonal variation observed in the present study could be due to seasonal variation in body condition caused by seasonal availability of feed and water in northern part of Nigeria where this study was carried out.

Table 1: Relationship between weight and body measurements in goats

	Sex	
Traits	Males (n = 131)	Females (n = 32)
Chest girth	0.73***	0.99***
Height at withers	0.71***	0.85***
Body length	0.72***	0.95***

***p = 0.0001

Table 2: Body weight estimation in Nigerian red sokoto goat by months of measurement

Period	Equation	n	R^2	p-value
Overall	y = 1.24+0.19a-0.73b+0.73c	163	0.61	0.0001
Feb-April	y = 0.56b+0.72c-17.04	28	0.97	0.0001
May-July	y = 1.64-0.72b-0.88c	52	0.47	0.0001
Aug-Oct	y = 0.43a+0.16c-20.23	83	0.88	0.0001

Table 3: Body weight estimation in Nigerian goats by sex

	Sex	
Traits	Males (n = 131)	Females (n = 32)
Equation	y = 2.16+0.23a-0.41b+0.36c	y = 0.40a+0.60c-12.13
N	131	32
R^2	0.56	0.92
P	0.001	0.001

The prediction equation obtained on breed basis suggest that one single equation cannot predict accurately the body weight of goat. In order to obtain an accurate prediction equation, multiple regression analysis must be carried out separately for each sex, rather than one single analysis combining data for both sexes.

In conclusion, although chest girth is the most highly correlated trait to body weight in this study, combining it with other linear body measurement (height at withers and body length is a stepwise multiple regression will produce the best prediction equation for body weight. Linear measurements will be a simple indirect estimation for females than male in the group of goats under study.

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