REGRESSION MODELS FOR LIVE WEIGHT PREDICTION FROM BODY DIMENSIONS IN CROSSBRED SHEEP

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Abstract

A total of 795 measurements on each of body weight (BW) and body dimensions (chest girth, rump height, height at withers and body length) were taken in a population of crossbred sheep maintained at the small ruminant research unit of University of Agriculture Makurdi. The coefficients of correlation between body weight and body dimensions were positive, high and significant. Regression equations show that chest girth is the most reliable predictor of BW in the flock of crossbred sheep. The use of chest girth is therefore recommended for adoption by rural farmers in prediction of BW where they are challenged with the non-availability of conventional weigh instruments.

Keywords:

Introduction

In Nigeria, the small ruminant industry represents a very important national resource (Ojedepo, *et al* 2007). Sheep contributes substantially to the natural meat supply and income of many people. Rams form about 80% of the total number of animals slaughtered during religious festivals in Nigeria. About 85% of the total numbers of sheep in Nigeria are under the traditional management system where the flocks are left on free range. This is possible due to the expansive uncultivated land mass in the country. Thus, pockets of herds are found dispersed throughout the agro ecological zones of Nigeria. Under this system of management, assessment of an animal’s growth rate and nutrient requirements, weight gain, feed utilization and carcass characteristics and market value are often subjective and inaccurate. This trend has remained with the small holder farmers in Nigeria over the years because the use of live weight criteria in feeding, marketing and drug administration requires sophisticated facilities which are expensive and hardly affordable by many small holder farmers.

However, over the years, emphasis has shifted from subjective methods of appraisal to more objective methods like the measurements of body dimensions (Essien and Adesope, 2003). Body dimensions can be used to predict live weight at relatively lower costs with a high relative accuracy and consistency. Body dimensions describe an animal more completely than conventional methods of weighing and grading. The importance of conformation as an indicator of commercial value is based on the assumption that carcasses with better conformation have advantages in terms of lean meat content, proportion of higher priced cuts and possibly greater muscles size (Kempster *et al*; 1982; Khogali, 1999).

Determination of live weight is necessary to calculate feed requirements, animal growth, marketing weight and estimation of animal’s cash value as well as conducting breeding studies, field experiments and estimation of dressed carcass weight (Payne, 1990). Thus, body conformations could be important criteria for selection of meat animals. In addition, body conformations could be used to predict live weight fairly well in situations where weigh balances are not available (Payne, 1990; Berge, 1977; Buvanendran, *et al*., 1980; Goonerwardene, and Sahaayuruban, 1983). Body conformations have been used to predict live weights in poultry (Okon, *et al* 1997; Gueye, *et al* 1988); goats (Hassan and Chiroma, 1990); sheep (Kanbasamy, and Gupta, 1983; Ladan *et al* 2009); cattle (Buvanendran,*et al*., 1980; Orheruata and Olutogun, 1994); pigs (Machebe and Ezekwe, 2008) and rabbits (Abdullah *et al*., 2003).

This study therefore investigates the relationship between measurements of some selected body dimensions and body weight in the crossbred sheep with the aim of using the conformation measurements as possible predictors of live weight in the crossbred sheep in the guinea savanna region of Nigeria.

Materials and Methods

Fifty three (53) crossbred (Balami x West African Dwarf) sheep comprising 16 males and 37 females aged between 24 and 36 months maintained at University of Agriculture Makurdi small ruminant unit were used in this investigation. Makurdi is located within the guinea savanna region of the country. Thus it experiences both the wet and dry
seasons with an annual rainfall that ranges from 800 to 1,500mm, an annual temperature range of 21°C to 33°C and an annual humidity range of 45 to 68 percent (Dzungwe, 1991). The experimental animals were identified by ear tagging and managed semi intensively. They were released to freely roam and graze natural pasture around the farm location between the hours of 10.00 - 14.00 hours GMT. They had free access to good drinking water and salt lick. Feeding on natural pasture was regularly supplemented with cereal offals. Routine vaccination against common endemic small ruminant diseases was carried out with periodic dipping and deworming to check buildup of ecto and endo parasites respectively. The body dimensions measured were chest girth (CG), rump height (RH), height at withers (HW) and body length (BL). Body weight (BW) was measured in kilogram while the body dimensions were measured in centimeters. Analysis of variance was carried out to investigate the effect of sex on the body dimensions. Data from both sexes for body weight and body dimensions were pooled and the Pearson’s moment correlation procedure (Steel and Torrie, 1980) was applied to establish the coefficients between BW and each of body dimensions. The best prediction equations for BW from body dimensions were determined. Regression of BW on body dimensions were performed using the general linear model (Harvey, 1987). Consideration was given to the linear, quadratic and cubit effects of the independent variables. The model used was $Y=a+b_1X_1+b_2X_2+b_3X_3+b_4X_4+e$ Where: 

$Y$ = body weight, 

$a$ = the intercept 

$b_1, b_2, b_3, b_4 =$ regression coefficient of the independent variables $1, 2, 3,$ and $4$ 

$X_1, X_2, X_3, X_4 =$ independent variables $1, 2, 3$ and $4$ 

e = random error. 

Results and Discussion

Table 1 shows the variation in body weight and body dimensions of the crossbreed sheep. Live weight had a linear relationship with all the body dimensions measured. Generally, the correlation coefficients presented in Table 2 were positive, high and significant. The correlation coefficient between BW and CG was highest ($r = 0.90$) and very significant ($P<0.01$) followed by that of RH (0.86) then BL ($r =0.85$) and finally HW ($r = 0.81$). The positive relationship between live weight and body dimensions indicates that an increase in live weight of the animals will be accompanied by a corresponding increase in body dimensions and vice versa. The regression equations for predicting live weight of the crossbred sheep based on the measurement of body dimensions were:

$$BW = -21.44+0.71CG, R^2 = 0.81$$

$$BW = -28.85+0.93RH, R^2 = 0.74$$

$$BW = -24.77+0.89BL, R^2 = 0.69$$

$$BW = -31.47+1.06HW, R^2= 0.66$$

The coefficients of determination were 0.81, 0.74, 0.69 and 0.66 for CG, RH, BL and HW respectively. Thus, any of the body dimensions measured may be used to predict body weight using body weight as the dependent variable in a linear equation. However, in using a single index predictor rather than multiple regressions, CG is a more reliable index in estimating body weight. This is suggestive that tissue measurements are better predictors of body weight than skeletal measurements. A similar relationship was documented for Yankassa ewes under traditional management in North Central Nigeria (Ladanet al, 2009). This procedure is therefore recommended under field conditions where weighing balances are not available or affordable.

Table 1: Body weight and body dimensions of the crossbred sheep

<table>
<thead>
<tr>
<th>Measurement</th>
<th>No.</th>
<th>Mean</th>
<th>SD</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live weight (kg)</td>
<td>53</td>
<td>24.82</td>
<td>18.49</td>
<td>0.74</td>
</tr>
<tr>
<td>CG (cm)</td>
<td>53</td>
<td>62.70</td>
<td>2.59</td>
<td>0.02</td>
</tr>
<tr>
<td>RH (cm)</td>
<td>53</td>
<td>55.74</td>
<td>9.07</td>
<td>0.16</td>
</tr>
<tr>
<td>BW (cm)</td>
<td>53</td>
<td>57.14</td>
<td>8.09</td>
<td>0.14</td>
</tr>
<tr>
<td>HW (cm)</td>
<td>53</td>
<td>51.40</td>
<td>7.49</td>
<td>0.50</td>
</tr>
</tbody>
</table>
Table 2: Pearson’s correlation coefficient of body weight and body dimensions in the crossbred sheep

<table>
<thead>
<tr>
<th>Variable</th>
<th>BW (kg)</th>
<th>CG (cm)</th>
<th>RH (cm)</th>
<th>BL (cm)</th>
<th>HW (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW (kg)</td>
<td>-</td>
<td>0.90**</td>
<td>0.86**</td>
<td>0.83**</td>
<td>0.81**</td>
</tr>
<tr>
<td>CG (cm)</td>
<td></td>
<td>-</td>
<td>0.88**</td>
<td>0.56*</td>
<td>0.85**</td>
</tr>
<tr>
<td>RH (cm)</td>
<td></td>
<td></td>
<td>-</td>
<td>0.49*</td>
<td>0.87**</td>
</tr>
<tr>
<td>BL (cm)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>0.49*</td>
</tr>
<tr>
<td>HW (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

** Significant (P<0.01), * Significant (P<0.05) BW = Body weight, CG = Chest girth, RH = Rump height, BL = Body length, HW = Height at withers.

References


Agricultural Organization of the United Nations), Rome, Italy.


