

The Estimation of Body Weight from Body Measurements in Kilakarsal Sheep of Tamil Nadu, India

Research Article

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ABSTRACT

Data on body weight and body measurements (body length, height at withers, chest girth and paunch girth) of adult Kilakarsal sheep have been collected from 124 adult animals managed at the farmers filed in Tirunelveli districts of Tamil Nadu, India to estimate the body weight from body measurements. The data were subjected to standard statistical analysis using SPSS software and linear regression analysis was applied by keeping the body weight as the dependant variables and different body measurements as independent variables. The overall means (\pm SE) for body weight, body length and height at withers, chest girth and paunch girth of Kilakarsal sheep pooled over sexes were 23.39 ± 0.33 kg, 56.92 ± 0.31 cm, 69.74 ± 0.33 cm, 71.92 ± 0.44 cm and 69.44 ± 0.49 cm, respectively. The Pearson correlation coefficient between body weight with body length, height at withers, chest girth and paunch girth were 0.525, 0.531, 0.831 and 0.761, respectively. The R^2 values for the regression equation, considering individual independent variables *viz.* body length, height at withers, chest girth and paunch girth were 0.276, 0.282, 0.691 and 0.579, respectively. The highest R^2 value was obtained from chest girth variable followed by paunch girth. The R^2 values increased with the addition of independent variables in the equation and the maximum R^2 value was obtained as 0.783 from all the variables. The study revealed that the chest girth is the best predictor for the estimation of body weight and this alone contributed 69.1 per cent variation in the body weight of adult Kilakarsal sheep.

KEY WORDS body weight, correlation, Kilakarsal sheep, prediction, regression.

INTRODUCTION

Various body measurements are of value in judging the quantity characteristics of meat and also are helpful in developing of suitable selection criteria (Islam *et al.* 1991). Body measurements supplemented to body weight describes more completely an individual or population than do the conventional methods of weighing and grading. These body measurements have been used at various times for the estimation of weights when live weights are measured alongside these parameters (Salako and Ngere, 2002).

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

Alternative body measurements and indices estimated from various combinations of conventional and non conventional body parameters not only provide superior guide to weights but are also used as indicators of type and function in livestock (Manson, 1996). FAO have used height at withers as a prime indicator (Wilson, 1995). It is documented that there is a close relationship between the dis-

tance around an animal's chest girth and its body weight (Otoikhian *et al.* 2008). Enevoldson and Kristensen (1997) reported that different models might be needed to predict body weight in different environmental conditions and breeds. Body measurements have been used to predict body weight by several authors in many breeds of sheep (Prasad *et al.* 1990; Nayak *et al.* 2008).

Such procedures are almost nonexistent for southern breeds of Tamil Nadu sheep. Kilakarsal sheep which is also known as Karuvi and Adikaraisal are one of the descriptive sheep breed of Tamil Nadu, India. They are medium in size with compact body conformation. They have dark tan coat dorsally with black colouration in the ventral region especially in the under belly and inner side of legs. A black colour is also noticed above the eyelids on either side and along the lower jaw.

Rams have well developed twisted horns and the ewes were polled. These sheep are found in the areas of Manur and Palayamkottai blocks of Tirunelveli and Ottapidaram block in Thoothukudi district (Ravimurugan *et al.* 2010). The present study was undertaken to determine the relationship between body weights and linear measurements and to determine the best fitted regression model for prediction of live weight of Kilakarsal sheep under field conditions.

MATERIALS AND METHODS

The data used in the study includes biometric traits observed on 124 adult Kilakarsal sheep. A flexible tape rule was used to measure the parameters *viz.* Body length (BL) distance from point of shoulder to the point of tuber ischii; height at withers (HAW) distance from the base of hoof to the highest point of withers; chest girth (CG) body circumference around the chest just behind the elbow joint and paunch girth (PG) body circumference around the paunch as described (Ravimurugan *et al.* (2007).

The data were subjected to standard statistical analysis using SPSS software (Snedecor and Cochran (1989) and linear regression analysis was made by keeping the body weight as the dependent variable and different body measurements as independent variables.

Step wise linear regression analysis has been made to identify the best predictor variable for estimating the body weight. Regression analysis has been carried out by including different body measurement variables individually and collectively.

The comparison amongst actual body weight and predicted body weight was made by paired t-test (Slippers *et al.* 2000). To determine the best fitted regression equation the criterion *viz.*, estimated by coefficient multiple determination (R^2), residual mean squares (MSE) were used as described by (Snedecor and Cochran (1989). Error standard

deviation (SDC) and range observed in predicted weight were also calculated for evaluating and comparing different regressions models.

RESULTS AND DISCUSSION

Results of the descriptive analysis are presented in Table 1.

Table 1 Pooled over mean, standard deviation (SD) and standard error (SE) of body measurements of Kilakarsal sheep (n=124)

Body measurements	Mean	SD	SE
Body weight (BW)	23.39	3.65	0.33
Body length (BL)	56.92	3.42	0.31
Height at withers (HAW)	69.74	3.72	0.33
Chest girth (CG)	71.92	4.95	0.44
Paunch girth (PG)	69.44	5.48	0.49

It was observed that the Kilakarsal sheeps were 69.74 ± 0.33 cm tall from the ground. This is an indicator of the size of the animal at mature age. The Kilakarsal sheep is a smaller than Vembur or Ramnad White sheep, these are the two sheep breeds most important belonging to southern Tamil Nadu as reported by Ganesakale and Rathnasabapathy (1973).

Among the body measurements, chest girth (71.92 ± 0.44 cm) was the highest value and it was followed by height at withers (69.74 ± 0.33 cm) and paunch girth (69.44 ± 0.49 cm). Similar observations of chest girth was noticed by Karunanithi *et al.* (2005) in Mecheri sheep (73.8 ± 0.40), Chandran *et al.* (2009) in Vembur sheep (78.7 ± 0.20) and Ravimurugan and Devendran (2009) in Ramnad White (77.54 ± 0.45).

The correlation coefficients of body measurements in Kilakarsal sheeps were shown in Table 2.

Table 2 Pearson correlations among the body measurements of Kilakarsal sheep

Body weight (BW)	1.00	-	-	-	-
Body length (BL)	0.52*	1.00	-	-	-
Height at withers (HAW)	0.53*	0.39*	1.00	-	-
Chest girth (CG)	0.83**	0.46*	0.55*	1.00	-
Paunch girth (PG)	0.76**	0.32*	0.41*	0.69*	1.00
	BW	BL	HAW	CG	PG

BW: body weight; BL: body length; HAW: height at withers; CG: chest girth and PG: paunch girth.

* Significant ($P < 0.05$) and ** Significant ($P < 0.01$).

Positive correlation was found between parameters measured and body weight i.e. as the body measurements increased while body weight also increased. Among these three measurements, chest girth had the highest correlation coefficient.

The high correlation coefficients between body weight and body measurements suggest that either of these variables or their combination could provide a good estimate for predicting live weight of Kilakarsal sheeps.

The step wise regression equations generated from the step wise regression analysis of values of the various pa-

rameters as they associate with one another considering body weight of the sheep as a dependent variable from the equations is shown in table 3.

Table 3 Prediction equations and coefficient of determination (R^2) in different body measurements

Parameters	Prediction equation	R^2
Body weight (BW)	$Y = -8.556 + 0.561 X_1$	0.27
Body length (BL)	$Y = -12.979 + 0.521 X_2$	0.28
Height at withers (HAW)	$Y = -20.670 + 0.613 X_3$	0.69
Chest girth (CG)	$Y = -11.781 + 0.506 X_4$	0.57
Paunch girth (PG)	$Y = 32.213 + 0.182 X_1 + 0.052 X_2 + 0.353 X_3 + 0.234 X_4$	0.78

Y: estimated body weight (kg); X_1 : body length (cm); X_2 : height at withers (cm); X_3 : chest girth (cm) and X_4 : paunch girth (cm).

The coefficient of determination (R^2) indicated that the body measurements were successful to describe more variation in live weight.

The highest R^2 value was obtained from chest girth variable and this was followed by paunch girth. Whereas the body length and height at withers yielded poor R^2 values were found and this indicated that the body weight is the less dependent variable in the equation and the maximum R^2 value of 0.783 was obtained when all the variables were included.

Based on the colinearity diagnostic, the best prediction equation for predicting the body weight from body measurements is by including the chest girth variable alone and the equation is $Y = -20.670 + 0.613 X_3$. Body length of sheep gave a 27.6 per cent estimation of body weight, 28.2 per cent body estimation as from height at withers, 69.1 per cent estimation of body weight depends on the chest girth, paunch girth contribute 57.9 per cent of body weight estimation while a huger percentage 78.3 per cent of body weight can be assessed from a combination of all parameters using equation $Y = 32.213 + 0.182 X_1 + 0.052 X_2 + 0.353 X_3 + 0.234 X_4$.

Thus, chest girth is the best predictor for the estimation of body weight and this alone contributed 69.1 per cent variation in the body weight of adult Kilakarsal sheep. Similar findings were reported by Afolayan *et al.* (2006) in Yankasa Sheep. Contrary to the present observation made by Baffour-Awuah *et al.* (2000) in Ghana Cross bred Sheep.

CONCLUSION

Taking into account the following results obtained from the present study: 1) body weight and the three body measurements were significantly correlated with each other and 2) body weight had higher association with chest girth than body length or height. We conclude that the chest girth alone or combinations of three measurements may be used for predicting the body weight in Kilakarsal sheep.

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