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Phenotype based selection of milking Marwari goat under field conditions in Rajasthan

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Abstract

Marwari goat is well define goat breed of Rajasthan which is highly adaptable, faster growing, good meat and milk producing goat in the arid and semi-arid region of state. The phenotypic database of milking Marwari doe (n=29226) regarding body weight and body measurements at birth, 3, 6, 9, 12, 18 months and adult age over a period from year 1990 to 2015, was collected from the ICAR sponsored all India coordinated research project on Marwari goat improvement, Bikaner, Rajasthan. Least square analysis using general linear model was carried out to estimate the mean value of different traits under field conditions with due consideration for the effect of season, year and cluster. Body weights of milking doe were predicted through regression equations by linear regression method with body weight as dependent variable and different body measurements as independent variables. Highest coefficient of determination was observed at 9 month age. The study concluded that heart girth and body length could be effectively utilized to predict the body weight of Marwari goat under field conditions and thus more economical benefits could be delivered to farmers through selection of good milking doe at an early stage.

Keywords: Marwari goat, body weight, body measurements

Introduction

An increase in 0.76% of goat population in Rajasthan despite a downward trend (3.82 %) in national goat population^[1] indicates the substantial role of goat farming in the rural economy of the state. The second most populous goat breed of India, Marwari goat, constitutes about 5.31% (7.18 million) of the national goat population with pure bred animals of about 5.34 million^[1] and forms a major chunk. The Marwari goat of Rajasthan is considered as a dual purpose animal which is known for its faster growth, efficient breeding, high salt tolerance and requires less water than any other species of the region^[2, 3].

Growth traits form an important basis of selection of good quality milking animals apart from reproductive characteristics and also important indicators of adaptability of the species in relation to its environmental conditions. Estimation of live weight using body measurements is a practical, faster, easier and economical method especially in rural condition where insufficient resources place constraints in the identification of superior animals in terms of body weight^[4]. Different studies have reflected the importance of morphometric analysis of growth traits with single or multiple measurements as an effective and reliable indicator of body weight prediction in goat^[5, 6, 7, 8]. Thus the present study was carried out in milking Marwari goats with an objective to select good milking animals through prediction of live body weight on the basis of multiple linear regression equation under field conditions.

Material and Methods

The data for the present investigation was collected from flock's of Marwari goat maintained under ICAR sponsored "All India Co-ordinated Research Project (AICRP) on Marwari Goat Improvement," Bikaner, Rajasthan. The information on different morphological measurements of Marwari goat were collected for the period from 1990 to 2015 from the different cluster villages; Deshnoke, Udairamsar, Kalyansar, Nokha, Raiser, Diaya and Moonsar of Bikaner district (n=29226).

Coefficient of determination (R^2) and prediction equations were evolved through multiple regression analysis method of SPSS software. The coefficient of determinant (R^2) was calculated for the purpose of constructing best prediction equation by using the standard analysis of variance procedure for multiple regressions where R^2 is the fraction of sum of

squares of the deviations of Y estimate from its mean that is attributable to regression. Separate prediction equations were developed for different age group of female animals for different measures. Linear regression model was arrived, to develop prediction equation for body weight. Multiple regression analysis was carried out to develop prediction equation for body weights on the basis of body measurements. The following mathematical model was used for developing the prediction equation:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3$$

Where,

Y = dependant variable (body weight)

a = intercept / constant

b_1 , b_2 and b_3 are the partial regression coefficients

x_1 , x_2 and x_3 are the height, heart girth and body length respectively.

Result and Discussion

Body weight and body measurements of Marwari goat

The age wise body weight and phenotypic measurements are represented in the form of means and standard error classified in Table 1. The sharp increase in body weight from three months to twelve months indicates the growth potential of Marwari goat. The present study is in agreement with similar observation in Surti goat at birth^[9], Berari goats at birth and 3 month of age^[10], Konkan Kanyal goat at 12 month of age^[11] whereas as^[9] reported higher value of heart girth than height at 12 month of age.

Table 1: Body weight and body measurements at different age group in Marwari goat (Mean \pm S.E)

Age group/ parameters	At birth (919)	3 month (1392)	6 month (2229)	9 month (3648)	12 month (7589)	18 month (7616)	24 month (2086)	Adult (3747)
Body weight (kg)	2.97 \pm 0.14	8.62 \pm 0.11	13.60 \pm 0.09	20.24 \pm 0.07	24.28 \pm 0.06	29.38 \pm 0.06	31.53 \pm 0.09	33.9 \pm 0.07
Height (cm)	35.3 \pm 0.32	43.3 \pm 0.26	49.63 \pm 0.26	55.81 \pm 0.17	59.92 \pm 0.13	61.58 \pm 0.13	64.36 \pm 0.22	65.5 \pm 0.17
Length (cm)	30.8 \pm 0.28	42.5 \pm 0.23	44.70 \pm 0.18	49.87 \pm 0.15	53.26 \pm 0.11	54.69 \pm 0.12	58.05 \pm 0.19	59.7 \pm 0.15
Heart girth (cm)	35.9 \pm 0.36	43.5 \pm 0.30	51.19 \pm 0.24	59.44 \pm 0.21	64.91 \pm 0.15	67.79 \pm 0.15	72.50 \pm 0.25	73.3 \pm 0.19

Note: H = height, L = body length, HG = heart girth

Values in parentheses indicate numbers of animals in each age group.

Prediction equations of body weight and coefficient of determination (R^2)

The correlation coefficient between different morphometric traits are represented in Table 2. The correlation coefficients

between body weights and body measurements at different ages were positive and strongly correlated ($P \leq 0.01$) ranging from 0.545 to 0.795.

Table 2: Correlation between different body measurements

Parameters	Weight	Heart girth	Height	Length
Weight	1	0.590**	0.545**	0.564**
Heart G		1	0.843**	0.743**
Height			1	0.795**
Length				1

** Correlation is significant at the 0.01 level (2-tailed).

The different regression equations for prediction of body weight on the basis of different body parameters (height, body length and heart girth) and coefficient of determination are presented in Table 3. Among the different prediction equation

develop for body measurements, the prediction equation for heart girth was observed to be most fit followed by length on the basis of R^2 values.

Table 3: Best fitted regression equation and coefficient of determination (adjusted R^2) at different age groups in Marwari milking goat

Age group	Equations	R	R^2	F
Birth (919)	$Y = 3.788 + (-0.012) \cdot BH + (-0.031) \cdot BHG$	0.051	0.226	24.398
3m (1392)	$Y = 8.829 + 0.045 \cdot BHG + (-0.028) \cdot BL$	0.082	0.286	111.391
6m (2229)	$Y = 12.621 + 0.015 \cdot BHG$	0.060	0.246	526.262
9m (3648)	$Y = 3.803 + 0.157 \cdot BHG + 0.088 \cdot BL$	0.257	0.507	155.880
12m (7589)	$Y = 6.340 + 0.168 \cdot BL + 0.132 \cdot BHG$	0.140	0.374	341.418
18m (7616)	$Y = 21.310 + 0.096 \cdot BHG$	0.020	0.141	52.916
24m (2086)	$Y = 10.669 + 0.279 \cdot BHG$	0.102	0.319	313.879
Adult (3747)	$Y = 3.974 + 0.226 \cdot BHG + 0.171 \cdot BL$	0.135	0.368	204.865

Values in parentheses indicate numbers of animals in each age group.

where Y = body weight (kg), BH = body height (cm), BL = body length (cm) and BG = body girth (cm)

The coefficient of determination in different equations indicates that heart girth succeed in estimating body weight more than any other linear measurement and forms an integral component of all the prediction equations with better results obtained in combination with two or more body measurement

including heart girth. The partial regression graph clearly indicates a strong relationship between body weight and heart girth (Fig. 1)

The present study is in close similarity with findings of^[12] which also reported combination of all parameters was most

suitable for prediction of body weight at 3 month of age in Kanni Adu goat. Likewise [5, 6] also reported heart girth or its combination with other body measurement as most suitable for prediction of body weight in Malabari goat at birth. In

corroboration, combination of height, heart girth and length were found more suitable for prediction of body weight in Surti goat at 6 month [13] as reported in the present study for nine months of age for Marwari goat.

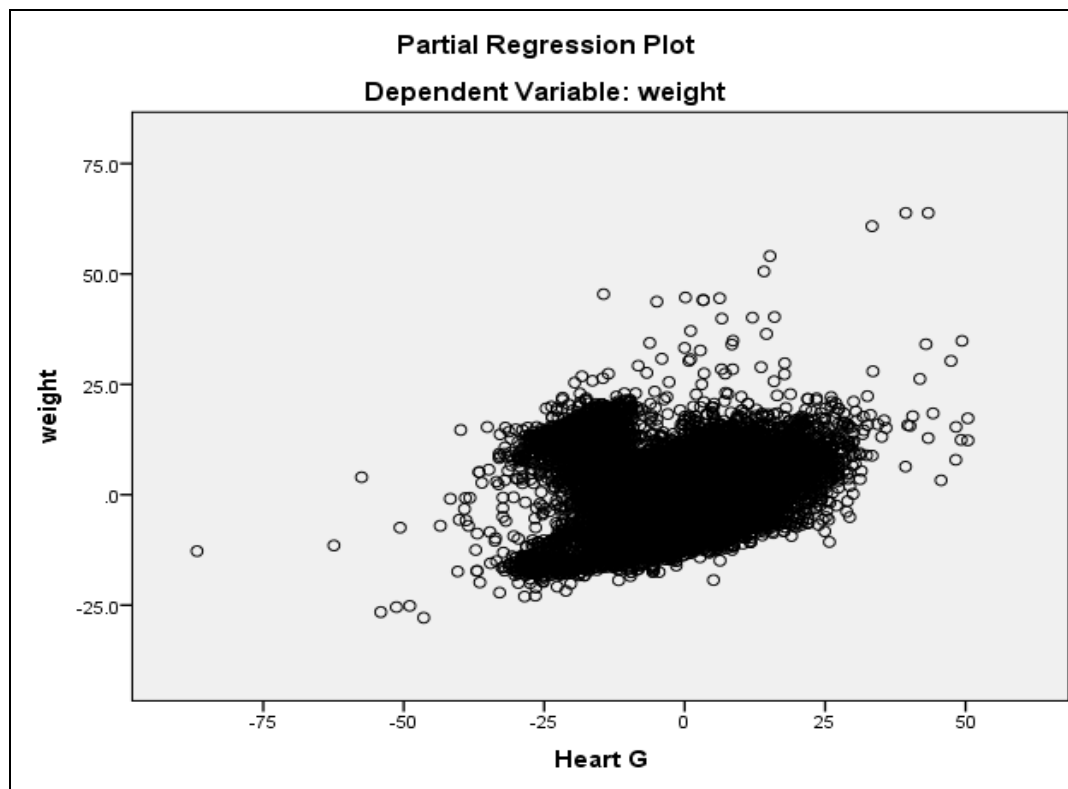


Fig 1: Partial regression plot of body weight and heart girth

Conclusion

The present study concluded that the selection of good quality milking goat for breed improvement programmes could be possible on the basis of phenotypic measurements in Marwari goats under field conditions.

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