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

Hemlata Chouhan, Gyanchand Gahlot, Vijay Kumar Agrawal and Sunita Meena

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; Deshnok, Udairmars, Kalyansar, Nokha, Raiser, Diya and Moondsar 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:

\[ Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 \]

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.

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

The different regression equations for prediction of body weight on the basis of 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 1: Body weight and body measurements at different age group in Marwari goat (Mean ± S.E)

<table>
<thead>
<tr>
<th>Age group/parameters</th>
<th>At birth (919)</th>
<th>3 month (1392)</th>
<th>6 month (2229)</th>
<th>9 month (3648)</th>
<th>12 month (7589)</th>
<th>18 month (7616)</th>
<th>24 month (2086)</th>
<th>Adult (3747)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (kg)</td>
<td>2.97±0.14</td>
<td>6.32±0.32</td>
<td>13.60±0.26</td>
<td>20.24±0.09</td>
<td>24.28±0.07</td>
<td>29.38±0.06</td>
<td>31.53±0.06</td>
<td>33.9±0.07</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>35.3±0.32</td>
<td>43.3±0.26</td>
<td>49.63±0.26</td>
<td>55.81±0.17</td>
<td>59.92±0.13</td>
<td>61.58±0.13</td>
<td>64.36±0.13</td>
<td>65.5±0.17</td>
</tr>
<tr>
<td>Length (cm)</td>
<td>30.6±0.28</td>
<td>42.5±0.23</td>
<td>44.70±0.18</td>
<td>49.87±0.18</td>
<td>53.26±0.11</td>
<td>54.69±0.12</td>
<td>58.05±0.12</td>
<td>59.7±0.15</td>
</tr>
<tr>
<td>Heart girth (cm)</td>
<td>35.9±0.36</td>
<td>43.5±0.30</td>
<td>51.19±0.24</td>
<td>59.44±0.21</td>
<td>64.91±0.15</td>
<td>67.79±0.15</td>
<td>72.50±0.25</td>
<td>73.3±0.19</td>
</tr>
</tbody>
</table>

**Note:**
- H = height, L= body length, HG=heart girth
- Values in parentheses indicate numbers of animals in each age group.

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 developed 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 2: Correlation between different body measurements

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Weight</th>
<th>Heart girth</th>
<th>Height</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>1</td>
<td>0.590*</td>
<td>0.545**</td>
<td>0.564*</td>
</tr>
<tr>
<td>Heart G</td>
<td>1</td>
<td>0.843**</td>
<td>0.743**</td>
<td>0.795**</td>
</tr>
<tr>
<td>Height</td>
<td>1</td>
<td>0.795**</td>
<td>0.795**</td>
<td>0.795**</td>
</tr>
<tr>
<td>Length</td>
<td>1</td>
<td>0.795**</td>
<td>0.795**</td>
<td>0.795**</td>
</tr>
</tbody>
</table>

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

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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References