

Genetic parameters of body weights and prediction of mature body weight in Murrah buffaloes

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ABSTRACT

Data on body weights of 725 Murrah buffaloes from birth to 30 months of age at six monthly intervals were recorded. Heritability of body weights at birth, 12 months and 30 months of age were moderate to high and significant. There were high and significant ($P < 0.01$) correlations between body weight at 6 months, 12 months, 18 months, and 24 months with other body weights respectively. The phenotypic correlations between body weights at successive ages were found to be positive and highly significant. Prediction equation based on 6-month body weight was chosen as the most appropriate with an accuracy of 46.90%.

Keywords: buffaloes, body weights, genetic parameters, prediction, heritability

INTRODUCTION

The birth weight and weight at subsequent ages of an animal are important parameters of its life. Each of these characteristics is an expression of its genotype and serves as a reliable aid to selection for efficient performance of livestock. For any successful livestock genetic improvement programme, genetic parameters of economic traits are of prime importance. Accuracy of breeding programme and future strategy greatly depends on the heritability and correlation estimates of different traits of interest. Heritability and correlation estimates further provide idea regarding the scope of selection criteria. Body weight at maturity is an important criterion that affects the future production potential of the animal. Assessment of adult body weight of an animal from early body weights will prove to be an important tool for selection of the best animal.

The present study was undertaken to explore the possibilities of improvement in Murrah buffaloes with particular reference to their growth traits. The objective of the study undertaken was to estimate the genetic parameters of growth traits and also to predict the body weight at 30 months of age based on weights at early ages

MATERIAL AND METHODS

The data used in the present study were collected from weight registers of Murrah buffalo herd maintained at the livestock farm of National Dairy Research Institute, Karnal. Data on body weights of 725 Murrah animals maintained at NDRI, Karnal over a period of 15 years (1993-2007) were used for the present study.

The heritability estimates were obtained by paternal half sib correlation method (Becker, 1986) from the variance component. Only those sire which had records on at least three or more daughters were considered for analysis. The following model was used:

$$Y_{ij} = \mu + S_i + e_{ij}$$

Where, Y_{ij} - record of the j^{th} progeny of i^{th} sire,

μ - Overall mean,

S_i - Effect of i^{th} sire, and

e_{ij} - Random error associated with record of j^{th} progeny of i^{th} sire assumed to be NID ($0, \sigma_e^2$).

The genetic and phenotypic correlations among different traits were estimated from the analysis of variance and co-variance using half-sib data as suggested by Becker (1986). The genetic correlations were calculated from the sire component of variance and co-variance.

Body weight at 30 months of age was predicted using body weights at different early ages by using the formula of Multiple Linear Regression (MLR) Model as given below:

$$\hat{Y} = a + b_1 X_1 + b_2 X_2 + \dots + b_n X_n$$

Where, \hat{Y} = is expected body weight at 30 months of age,

a is the intercept,

b_1, b_2, \dots, b_n are the partial regression coefficients and

X_1, X_2, \dots, X_n are various body weight traits at different ages.

RESULTS AND DISCUSSION

Genetic parameters: Estimates of genetic and phenotypic parameters of body weights at different ages in Murrah buffaloes are presented in Table 1. Body weights at birth, 12 months and 30 months of age were moderate to high and significantly heritable. Similar estimates of heritability were reported by Yadav *et al.*, (2001) and Cassiano *et al.*, (2003) in Murrah buffaloes. Heritability estimates of body weights at 6, 18 and 24 months of age were low to moderate but not significantly different from zero. The estimate was in agreement with Vij *et al.*, (1993). Above estimates of heritability of different body weight traits, particularly weight at birth, 12 and 30 month of age clearly indicate that these traits can be used as selection criteria.

Phenotypic correlations of birth weight with other body weight traits were low to moderate and significant ($P < 0.05$). There were high and significant ($P < 0.01$) correlations between body weight at 6 months, 12 months, 18 months and 24 months with other body weights respectively. The results indicate that the phenotypic correlations between body weights at successive ages were found to be positive and highly significant. This was in agreement with Gurang and Johar (1984) and Dahama and Malik (1988). High and significant correlations among different body weight traits indicate that earlier body weights can be used for prediction of body weight at later ages.

Prediction of body weight: Table 2 shows the values of coefficients of determination (R^2), regression coefficients, intercepts etc. of different prediction equations. Highest R^2 value (53.62%) was obtained for prediction, which uses data on birth weight, 6 months and 12 months body weights. From practical point of view, it is suggested to have as fewer number of predictor variables (independent variables) as possible. It may also be advantageous if these traits could be expressed at early age of an animal. This would help in early selection of animals without much investment

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to keep them for a long period in the herd. Thus, one has to make a genuine judgment in using the prediction equations. Considering the above mentioned principle, prediction equation which uses the data on 6 months body weight for prediction of 30 months body

weight was chosen as most appropriate having accuracy of 46.90%. The present findings are in agreement with those obtained by Yadava (2009) in Sahiwal cattle.

Table 1 Estimates of genetic and phenotypic parameters of different body weights (months) at different ages in Murrah buffaloes

Traits	Body weights at					
	Birth	6M	12M	18M	24M	30M
Birth	0.349± 0.160	-0.338 ± 0.65	-0.388 ± 0.690	-0.678 ± 0.316	-0.645± 0.352	-0.809 ± 0.183
6M	0.143 ± 0.072*	0.129± 0.129	-0.347 ± 0.480	-0.639 ± 0.479	0.670 ± 0.459	0.429 ± 0.603
12M	0.159 ± 0.074*	0.596 ± 0.060**	0.271± 0.130	0.968 ± 0.057	-0.041 ± 0.931	-0.180 ± 0.799
18M	0.178 ± 0.074*	0.507 ± 0.065**	0.755 ± 0.049**	0.252± 0.247	0.721 ± 0.322*	0.656 ± 0.337
24M	0.246 ± 0.073*	0.548 ± 0.063**	0.676 ± 0.055**	0.779 ± 0.047**	0.357 ± 0.262	0.835 ± 0.182**
30M	0.172 ± 0.074*	0.577 ± 0.061**	0.695 ± 0.054**	0.764 ± 0.049**	0.891 ± 0.034**	0.587 ± 0.289

Diagonal values = Heritability; * Indicates significant at (P < 0.05); **Indicates significant at (P < 0.01); values below diagonal = Phenotypic correlation; Values above diagonal = Genetic correlation.

Table 2. Coefficient of determinations shown in different combination of variables:

XX	X	Y	A	b ₁	b ₂	b ₃	R ²
1,2,3	4	212.041 ± 25.080	0.252037 ± 0.551037	0.915508 ± 0.204486	0.595116 ± 0.123025	0.5362	
1,2	4	248.2596 ± 24.97762	0.342369 ± 0.574676	1.470597 ± 0.176616	--	0.4702	
1,3	4	252.5764 ± 24.25655	0.422081 ± 0.570121	--	0.904205 ± 0.105606	0.4802	
2,3	4	219.1172 ± 19.70853	--	0.921955 ± 0.20368	0.597023 ± 0.122762	0.5356	
2	4	258.0411 ± 18.79917	--	1.481784 ± 0.175391	--	0.4690	
3	4	264.964 ± 17.54587	--	--	0.911076 ± 0.105104	0.4785	

X = Independent variables; 3 = Body weight at 12 months of age; a = Intercept
Y = Dependent variable; 4 = Body weight at 30 month of age; 1= birth weight;
2 = Body weight at 6 month of age; b₁, b₂-Regression coefficient; R² = Coefficient of determination.

Body weight around maturity is having greater impact on the performance of animals as it has negative correlation with the age at first calving. The results of the present study showed that, although the accuracy of prediction of body weight at 30 months of age with early body weights is in general low but it can be utilized as indicative for better dairy farming. The low accuracy of prediction equations indicates that model developed did not cover most of the variability in the response variables.

CONCLUSION

Low to moderate estimate of heritability of different growth traits indicated the scope of further improvement in these traits through selection. The accuracy of prediction of body weight at 30 month of age from body weight at 6 month was low to moderate (45%-55%).

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