

# Prediction of age from both measurements and body weights in Khillar cattle

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## ABSTRACT

The data on body measurement traits of 71 male and 83 female Khillar calves from birth to 30 months of age were recorded to study breed characteristics. The data were classified according to the age of animals in five age groups, viz. M1 (0-3), M2 (3-6), M3 (6-12), M4 (12-18) and M5 (18-30 months of age). The reliability of predictions of age from body measurements traits and body weight was high (>90 per cent) in male and female Khillar calves. The best-fit prediction equations were obtained at 18-30 months of age in male and female Khillar calves. The age of the calves could be satisfactorily predicted from body weight at 18-30 months of age in male and females.

## INTRODUCTION

India is home tract of over 30 breeds of humped cattle. Some well defined milch breeds are Sahiwal, Red Sindhi and Gir. Dual-purpose breeds are Hariana, Ongole, Deoni, Tharparkar and Kankrej. Draught breeds are Amritmahal, Kangayam. Malvi, Siri, Hallikar and Khillar (Banerjee, 1996).

The Khillar breed of cattle is predominantly suited to roadwork. Strength and pace of this breed are the chief requisites. The animals are put to various agricultural operations. These animals have comparatively long body with massive head resembling Mysore type cattle and are able to endure scarcity of fodder (Mahanta, 1961). Cows are poor milk yielder and mostly used for nursing their calves. Well-fed animals attain maturity early and calve for the first time at as early as 30 months of age and subsequently every 14 to 15 months.

The body measurements play important role in judging the animal. Body measurements as per the age of animals are true indicators of the growth and health status of animals. These traits have important bearing on the sexual maturity and draught ability of the animal. The qualitative traits viz., colour of coat, skin, muzzle, horns, hooves, switch of tail and orientation of horns and ears are important for defining a particular breed.

## MATERIAL AND METHODS

The data pertaining to body measurement traits and body weights of 154 Khillar calves at different stages of their age were collected from Khillar Cattle Breeding Farm, Junoni, Dist. Solapur (Maharashtra).

### Body Measurement traits:

1. Height at wither (HAW): Vertical distance from ground to the highest point of withers.
2. Heart girth (HG): Circumference of chest just behind the point of elbow.
3. Body length (BL): Oblique distance from point of

shoulder to pin bone.

4. Head length (HL): Distance from tip of nostrils to the pole.
5. Ear length (EL): Distance from base of ear to tip of the ear at the lower surface.
6. Estimated body weight: Body weight as estimated by Johnson's (1940) formula. The records for body measurement traits were considered up to 30 months of age. The data were further classified according to age in months as follows:

Sr. No.	Age (months)	Code
1.	0-3	M1
2.	3-6	M2
3.	6-12	M3
4.	12-18	M4
5.	18-30	M5

Estimation of body weight: Body weight (BW) was estimated by Johnson's formula (1940)

$$BW = \frac{L \times G^2}{300}, \text{ Where,}$$

L = Body length (inch)

G = Heart girth

BW = Body weight (pounds)

The data were subjected to least squares procedure to count for non-orthogonality of the data (Harvey 1991).

### Biometrical model

$$Y_{ij} = \mu + A_i + e_{ij} \quad ; \text{ Where,}$$

$Y_{ij}$  = Individual observation of body measurement traits under ith age group.

$\mu$  = Overall mean

$A_i$  = fixed effect of ith age group

$e_{ij}$  = The random error NID with mean and variance  $(0, \sigma^2)$ , respectively

The standard error of  $\mu$  was worked out from inverse matrix (Snedecor and Cochran, 1968) as  $S.E. (\mu) = \sqrt{C_{11}}\sigma^2e$ , Where

$\mu$  = Overall mean

$C_{11}$  = Corresponding diagonal element for the constant

$\sigma^2e$  = Error mean square;  $(\sigma^2e = \sum \sum_{ij} - R(\mu, A_i))$

**Correlation coefficient**

The correlation coefficients among various traits were calculated by using following formula:

$$\frac{\sum X_i Y_i - (\sum X_i \sum Y_i) / N}{\sqrt{(\sum X_i^2 - \sum X_i^2 / N)(\sum Y_i^2 - \sum Y_i^2 / N)}}$$

$r =$  ..... where

$$\sqrt{(\sum X_i^2 - \sum X_i^2 / N)(\sum Y_i^2 - \sum Y_i^2 / N)}$$

$X_i$  and  $Y_i$  are two variables

$N$  = Total number of observations

$r$  = Correlation coefficient

The significance of correlation was tested by correlation table (Snedecor and Cochran, 1968)

**Regression**

For prediction of age

$$Y = a \pm bX \quad \text{Where,}$$

$Y$  = Estimation of cumulative age in months (M1 - M5) and body measurements (Cm)

$a$  = Pure constant intercept

$b$  = Regression coefficient of body measurement traits and age

$X$  = Body measurement traits (cm) and age (months)

**RESULTS AND DISCUSSION**

*Prediction of age, and body length:* The regression coefficient of age on BL at 0-3, 3-6, 6-12, 12-18 and 18-30 months of age in male and female calves were 0.14, 0.22, 0.34, 0.45, 0.59; and 0.19, 0.31, 0.37, 0.46, 0.75, respectively (Table 1). Whereas, the regression coefficients of BL on above said ages were 5.77, 3.41, 2.78, 2.02, 1.58 in male and 4.6, 2.5, 2.54, 2.08, 1.30 (Table 2) in female Khillar calves which were found to be significant ( $P < 0.01$ ).

Table 1. Prediction of age from body measurement traits (BL, HG, HAW, BW) in Khillar

Independent traits	Age group	Male			Female		
		a	bi	R2%	a	bi	R2%
BL	M1	-8.6406	0.14 **	86	-10.7936	0.19**	89
	M2	-13.30	0.22**	76	-18.4375	0.31**	78
	M3	-23.5402	0.34**	95	-22.5355T	0.37**	94
	M4	-35.0758	0.45**	92	-30.2979	0.46**	95
	M5	-51.4305	0.59**	94	-60.8983	0.75**	98
HG	M1	-7.8297	0.12**	86	-9.5928	0.15**	90
	M2	-10.7421	0.16**	71	-12.3264	0.19**	76
	M3	-19.4965	0.25**	96	-21.4854	0.30**	95
	M4	-32.7620	0.36**	92	-26.8745	0.33**	96
	M5	-34.3258	0.38**	97	-36.1287	0.41**	97
HAW	M1	-9.0294	0.14**	87	-9.3594	0.15**	91
	M2	-13.3732	0.20**	75	-12.5939	0.20**	79
	M3	-24.8095	0.33**	76	-30.3966	0.40**	93
	M4	-30.5847	0.38**	91	-44.2378	0.53**	92
	M5	-72.3444	0.71**	90	-104.8659	1.05**	96
BW	M1	-1.9086	0.10**	88	-2.1133	0.11*	91
	M2	-0.7736	0.09**	79	-1.3678	0.10*	63
	M3	1.89	0.08**	97	1.73 13	0.10*	98

\*\* P < 0.01; \* P < 0.05; a = Pure constant intercept; bi = Regression coefficient; R2 = Coefficient of determination

The coefficient of determination ( $R^2$ ) for prediction of age on the basis of body length at above mentioned age groups in male and female Khillar calves were 86, 76, 95, 92, 94 per cent and 89, 78, 94, 95 and 98 percent, respectively. The best-fit prediction equations were obtained at 6-12 and 18-30 months of age in male and female Khillar calves, respectively. These results indicated that the age of Khillar calves could be predicted on the basis of BL at 6 to 12 months in male and 18 to 30 months in female Khillar calves. These results were in consonance with those reported by Rathi and Balaine (1982) in Brown Swiss x Hariana calves.

*Prediction of age and heart girth:* The regression coefficients of age on BL at 0-3, 3-6, 6-12, 12-18 and 18-30 months of age in male and female calves were 0.12, 0.16, 0.25, 0.36, 0.38; and 0.15, 0.19, 0.30, 0.33, 0.41, respectively (Table 1). The regression coefficient of HG on age in male and female Khillar calves at aforesaid age groups were 6.85, 4.25, 3.72, 2.50, 2.53; and 5.80, 3.87, 3.13, 2.19, 2.32, respectively (Table 2). The regression coefficients were significant ( $P < 0.01$ ) in both sexes.

Table 2. Prediction of body weight and body measurements from age and vice - versa in Khillar calves

Independent traits	Age group	Male			Female		
		a	bi	R2%	a	bi	R2%
BL	M <sub>1</sub>	-8.6406	0.14 **	86	-10.7936	0.19**	89
	M <sub>2</sub>	-13.30	0.22**	76	-18.4375	0.31**	78
	M <sub>3</sub>	-23.5402	0.34**	95	-22.5355	0.37**	94
	M <sub>4</sub>	-35.0758	0.45**	92	-30.2979	0.46**	95
	M <sub>5</sub>	-51.4305	0.59**	94	-60.8983	0.75**	98
HG	M <sub>1</sub>	-7.8297	0.12**	86	-9.5928	0.15**	90
	M <sub>2</sub>	-10.7421	0.16**	71	-12.3264	0.19**	76
	M <sub>3</sub>	-19.4965	0.25**	96	-21.4854	0.30**	95
	M <sub>4</sub>	-32.7620	0.36**	92	-26.8745	0.33**	96
	M <sub>5</sub>	-34.3258	0.38**	97	-36.1287	0.41**	97
HAW	M <sub>1</sub>	-9.0294	0.14**	87	-9.3594	0.15**	91
	M <sub>2</sub>	-13.3732	0.20**	75	-12.5939	0.20**	79
	M <sub>3</sub>	-24.8095	0.33**	76	-30.3966	0.40**	93
	M <sub>4</sub>	-30.5847	0.38**	91	-44.2378	0.53**	92
	M <sub>5</sub>	-72.3444	0.71**	90	-104.8659	1.05**	96
BW	M <sub>1</sub>	-1.9086	0.10**	88	-2.1133	0.11*	91
	M <sub>2</sub>	-0.7736	0.09**	79	-1.3678	0.10*	63
	M <sub>3</sub>	1.89	0.08**	97	1.73 13	0.10*	98

\*\*  $P < 0.01$  \*  $P < 0.05$ ; a = Pure constant intercept ; bi = Regression coefficient ; R2 = Coefficient of determination

The coefficient of determination ( $R^2$ ) for prediction of age on the basis of heart girth at above mentioned age groups in male and female Khillar calves were 86, 71, 96, 92, 97 per cent, and 90, 76, 95, 96, 97 percent, respectively. The best-fit prediction equation was obtained at 18-30 months of age in male and female Khillar calves. The results revealed that the age of male and female Khillar calves can be predicted on the basis of HG at 18 to 30 months.

*Prediction of age and height at wither (HAW):* Simple regression coefficients of age on HAW at 0-3, 3-6, 6-12, 12-18 and 18-30 months of age in male and female

Khillar calves were highly significant ( $P < 0.01$ ) and the estimates were 0.14, 0.20, 0.33, 0.38, 0.71; and 0.15, 0.20, 0.40, 0.53, 1.05, respectively (Table 1). The significant ( $P < 0.01$ ) regression coefficients of HAW on age in male and female Khillar calves at above said age groups were 6.02, 3.66, 2.27, 2.36, 1.25; and 5.85, 3.87, 2.31, 1.73, 0.91, respectively (Table 2).

The coefficient of determination ( $R^2$ ) of the prediction of age on the basis of height at withers at above mentioned age groups were 87, 75, 76, 91, 90 per cent in male and 91, 79, 93, 92, 96 percent in female calves. The best-fit prediction equations were obtained at 12-18 and

18-30 months of age in male and female Khillar calves, respectively. These results showed that the age could be predicted from HAW at 12 to 18 months of age in male and at 18 to 30 months of age in female Khillar calves.

*Prediction of age and body weight:* The regression coefficients of age on body weight at 0-3, 3-6 and 18-30 months of age in male and female Khillar calves were 0.10, 0.09, 0.08; and 0.11, 0.10, 0.10, respectively (Table 1). The regression coefficients of body weight on age in male and female Khillar calves were 8.50, 8.50, 12.01; and 7.73, 5.75, 9.63, respectively (Table 2) and were highly significant ( $P < 0.01$ ). The regression coefficient of age on body weight was observed to be significant ( $P < 0.01$ ) at 3-6 months of age. Whereas all the remaining regression coefficients of age as well as body measurements in different age groups were statistically highly significant.

The coefficient of determination ( $R^2$ ) of prediction of age on the basis of body weight at above mentioned age groups were 88, 79 and 97 per cent in male; and 91, 63 and 98 per cent in female calves. The best-fit prediction equations were obtained at 18-30 months of age in male and female Khillar calves. These results showed that the age could be satisfactorily predicted from body weight of the animals in the age group of 18 to 30 months in male and female Khillar calves. These results were in consonance with those reported by Rathi and Balaine (1982) in BS x Haryana calves.

## CONCLUSION

The reliability of prediction of age from body measurement traits and body weight was high (>90 percent) in male and female Khillar calves. The body measurement traits have close association with the advancement in age in Khillar calves.

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