RESEARCH ARTICLE Bhartiya Krishi Anusandhan Patrika, Volume 37 Issue 3: 281-284 (September 2022)

Prediction of Body Weight from Linear Body Measurements in Kashmiri (*Kashir*) Goat

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10.18805/BKAP490

ABSTRACT

Background: Kashmiri (*Kashir*) goat is nondescript and highly variable, medium sized, goat genetic resource of Kashmir. The goat possessing excellent survivability and is distributed in Kashmir valley. In Jammu and Kashmir, Gujjars and Bakerwals have adopted the sheep and goat rearing as their primary occupation. Body weights at different ages of life cycle of animals are important traits owing to their direct relation with farmers income.

Methods: Data on body weight and body measurements *viz* ear length (EL), body length (BL), body height at wither (BH), chest girth (CG) and tail length (TL) of 162 adult Kasmiri (*Kashir*) nondescript goats, irrespective of gender, were collected from Febuary 2019 to January 2020 to estimate the body weight from body measurements. The data were subjected to standard statistical analysis using SPSS software. Descriptive statistics and Pearson correlation was worked out to observe association among traits under study. The linear regression was utilized to predict body weight from linear body measurements.

Result: The average body weight (BW), ear length (EL), body length (BL), body height at wither (BH), chest girth (CG) and tail length (TL) of 36.94±0.99 kg, 13.13±0.36 cm, 55.48±0.43 cm, 65.93±0.62 cm, 69.61±0.73 cm and 12.94±0.15 cm, respectively were observed for Kashmiri goat in the present study. The body weight was having positive and significant correlations with BL, HW, CG and TL. The correlation of body weight with EL and TL was low. Similarly the correlation of body weight with HW was moderate whereas with BL and CG was significantly high indicating these two traits can define body weight of animal more accurately. Based on R^2 (coefficient of determination) criteria, the best regression model for predicting body weight of Kashmiri goat was obtained by using combination of BL (body length) and CG (chest girth) with R^2 (coefficient of determination) of 0.795. Prediction equation with R^2 value of 0.806 was obtained when all traits were included in regression model where as prediction equation with R^2 value of 0.589 was obtained when only chest girth was used as independent variable.

Key words: Body length, Body measurement, Body weight, Chest girth, Kashmiri (*Kashir*) goat.

INTRODUCTION

In Jammu and Kashmir sheep and goat rearing is the core activity of rural population bringing socio-economic upliftment of weaker sections of the society *viz*; Gujjars, Bakerwals, Chopans, Gaddies and Changpas. Gujjars and Bakerwals have adopted the sheep and goat rearing as their primary occupation (Anonymous, 2004). Edivence like recovery of tool made from bones of domestic sheep and goat during excavation at Gufkral, Pulwama located 41 km from Srinagar (Anonymous, 1984) and as reported by Lawrence, 1895 in his book (The Valley of Kashmir) that goat skin fetched one rupee in the mountains and tax on goats for the summer grazing in Kashmir was only Rs 5 per hundred goats. All this suggest sheep and goat rearing was in practice in this region since time immemorial. Body weights at different ages of life cycle of animals are important traits owing to their direct relation with farmers income (Cam *et al*., 2010). However, the framers are unaware of the fact and do not record body weight of animals due to different reason. The most important reason among for not recording body weight being unavailability of weighing scales. Further, body weights are supplemented with linear body measurements which describe an animal or breed completely than the conventional methods of weighing or grading (Abbas *et al*., 2021). The linear body measurements of the animals are necessary for establishing breed standards, in judging the quantitative characteristics of meat and helpful in developing suitable selection criteria

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How to cite this article: Rather, M.A., Bashir, I., Shanaz, S., Alam, S., Shah, R., Hamdani, A., Ahanger, S. and Mir, S.A. (2022). Prediction of Body Weight from Linear Body Measurements in Kashmiri (*Kashir*) Goat. Bhartiya Krishi Anusandhan Patrika. 37(3): 281-284. DOI: 10.18805/BKAP490.

Submitted: 14-03-2022 **Accepted:** 06-07-2022 **Online:** 20-09-2022

(Sharaby and Suleiman, 1987; Islam *et al*., 1991). Body measurements of animal also provide great convenience for the predicting of body weight without weighbridges (Afolayan *et al*., 2006; Adeyinka and Mohammed, 2006; Yakubu, 2009). Kashmiri goat is nondescript and highly variable, medium sized, goat genetic resource of Kashmir. The goat possessing excellent survivability and is distributed in Kashmir valley. Many studies have been under undertaken by different workers recently to study the animal genetic resources of Jammu and Kashmir in recent years (Rather *et al.*, 2020; Rather *et al.,* 2021; Alam *et al.*, 2021).

Aim

To establish breed standards for linear body measurements in judging the quantitative characteristics of weight and helpful in developing suitable selection criteria. To predict body weight of Kashmiri goat under field conditions in absence of weighing balance.

MATERIALS AND METHODS

Information/data on body weight and different body biometric parameters *viz*. body length (from point of shoulder to pin bone), chest girth (the circumferential measure taken around the chest just behind the front legs and withers), height at weathers (the distance from the ground to the withers), ear length and tail length were recorded on 162 Kashmiri (*Kashir*) goats (Table 1). The study was undertaken over the period of one year from Febuary 2019 to January 2020. Measuring tape and spring balance was used to measure biometric traits *via*: Ear length, body length, height at weathers, chest girth and tail length and body weight, respectively. Animals above one year of age were considered for study. The Data was normalized before analysis. Outliers were removed. The descriptive statistical analysis was done using IBM SPSS 20 (Snedecor and Cochran, 1989). Simple linear regression was used to predict body weights from biometric traits separately with body weight as dependent variable and backward stepwise regression procedure of Draper and Smith (1998) was utilized to predict ABW from linear body measurements. The model initially used in backward stepwide was x1+x2+x3...+xn = y where xn= Linear body measurements and y= Weight. The combinations of traits were used for traits with correlation coefficients >0.25.

RESULTS AND DISCUSSION

The average body weight (BW), ear length (EL), body length (BL), body height at weathers (BH), chest girth (CG) and tail length (TL) of 36.94±0.99 kg, 13.13±0.36 cm, 55.48±0.43, 65.93±0.62 cm, 69.61±0.73 cm and 12.94±0.15, respectively were observed for Kashmiri goat in the present study. The overall estimates for different biometric traits and body weight fall within the range reported in different goat breeds by different workers in Beetal goats. Iqbal *et al*., 2013 reported overall means±S.E. for body weight (kg), body length (inch), height at withers, heart girth of 27.16±3.94 (kg), 27.00±1.35 inch, 28.34±1.32 inch and 27.00±1.41 inch, respectively. (Moaeen-ud-Din *et al*., 2006) reported 64.97 cm body length, 70.23 cm height at withers and 61.29 cm hearth girth, in Crossbred (BeetalxTeddi) goats. Hamayun *et al*. (2006) reported body length of 60.14 cm; withers height 63.14 cm and heart girth 61.29 cm in Beetal goats. Shettar and Rudresh (2003) reported mean body weight of 31.33±0.20 kg in Bidri goats which is lower than that of present study.

Correlation coefficients between live weight and other body measurements

The phenotypic correlations among different traits along with their significance are presented in Table 2. The body weight was having positive and significant correlations with BL, HW, CG and TL. However, the correlation between BW and ear length was non-significant. The correlation of BW with EL and TL was low. Similarly the correlation of BW with HW was moderate whereas with BL and CG was significantly high indicating these two taints can define body weight of animal more accurately. The results of present study are in agreement with those of (Fasae *et al.,* 2005) and (Afolayan *et al.,* 2006) in Yankasa sheep. Positive correlations of body weight with different biometric traits were also observed by (Bassano *et al.,* 2003) Alpine Ibexand Sowande and Sobola (2007) in West African dwarf sheep. (Iqbal *et al.,* 2013) in Beetal goats and (Younas *et al.,* 2013) in Hissaldale sheep also reported positive correlation between different biometric traits and (Rather *et al*., 2021) in Kashmir Merino sheep reported positive and significant phenotypic correlations between different biometric traits. (Salako, 2006) reported positive and significant correlation among body dimensions in Uda Sheep. Dakhlan *et al*. (2021) in Saburai Goat also reported positive phenotypic association among body weight and different biometric traits at different ages. The positive and favorable phenotypic relationship of body weight with

Table 1: Descriptive statistics of biometric traits of Kashmiri (*Kashir*) goat.

Trait	N	Mean±SE (cm)	Std. deviation	CV %
BW		36.94±0.99	12.56	34.00
EL	162	13.13±0.36	4.63	35.26
BL	162	55.48±0.43	5.49	9.90
HW	162	65.93±0.62	7.86	11.92
CG	162	69.61±0.73	9.34	13.42
TL	162	12.94±0.15	1.94	14.99

Table 2: Phenotypic correlation among biometric traits.

Trait	EL	BL	HW	CG	TL
BW	0.14	0.63**	0.40**	0.77**	0.19*
EL		0.11	0.08	0.1800*	0.11
BL			0.38**	0.61**	0.10
HW				0.54**	-0.11
CG					0.06

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

*. Correlation is significant at the 0.05 level (2-tailed).

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

Equation	R	R square	Adjusted R square	P. value
BW= 31.82+0.390 EL	0.144	0.021	0.015	0.068
BW= 20.63+1.260 TL	0.194	0.038	0.032	0.013
BW= -5.26+0.640 WH	0.160	0.031	0.012	0.001
BW= -43.32+1.447 BL	0.399	0.16	0.141	0.001
BW= -34.90+1.0320 CG	0.589	0.35	0.331	0.001
BW= -53.229+0.599 BL+0.818 CG	0.795	0.632	0.627	0.001
BW= -62.53-0.018 HW-0.021 EL+0.569 BL+0.828 CG+0.847 TL	0.806	0.649	0.638	0.001
BW= -62.53+0.567 BL+0.8185 CG+0.852 TL	0.806	0.649	0.638	0.001
BW= -61.839-0.018+0.570 BL+0.826 CG+0.847 TL	0.806	0.649	0.638	0.001

BL and PG suggested that these two traits separately or in combination with each other can define and predict body weight in nondescript goats of Kashmir. Hence, these two traits can be used to develop a regression equation to estimate body weight of this goat when weighing scales may not be available.

Regression models (Equations 1-9) between body weight and body measurements of Kashmiri nondescript goats are presented in Table 3. Based on R^2 (coefficient of determination) criteria, the best regression model for predicting body weight of Kashmiri goat was obtained by using combination of BL (body length) and CG (chest girth with R^2 (coefficient of determination) of 0.795. However, for height coefficient of determination of 0.806 was obtained when BL, CG and TL were considered with backward stepwise regression procedure. EL and WH got eliminated with backward stepwise regression procedure. The coefficient of determination R^2 indicated BL, CG and TL successful to describe more variation in adult live weight of this goat. When traits were considered separately for linear regression highest and least R^2 was obtained for chest girth and ear length, respectively (Table 3). Even though all biometric traits included in the present study may give together a better prediction of body weight in Kashmiri goat owing to R^2 value of 0.806. However, single body measurement (CG) can be the best predictor of BW in this goat. Adeyinka and Mohammed (2006) in Nigerian red sokoto goats, Tadesse and Gebremariam (2010) in Highland, (Musa *et al*., 2012) in Sudanese Shogur, by (Chitra *et al*., 2012) in Malabari goat, (Raja *et al*., 2013) in Attappady black goats, (Ravimurugan *et al*., 2013) in Kilakarsal sheep, (Berhe, 2017) in Maefur goat, (Kumar *et al*., 2018) in Harnali sheep, (Habib *et al*., 2019) in black bengal goat and also reported heart girth as indicator in live weight estimation and (Dakhlan *et al*., 2020, 2021) also reported that CG was the best predictor to BW in small ruminants. However, (Rather *et al*., 2021) observed that height at withers was the most important and reliable indicator in body weight estimation for Kashmir Merino sheep.

CONCLUSION

The phenotypic correlations of body weight with different biometric traits considered in current study indicated that these traits can be used to predict body weight in nondescript Kashmiri (*Kashir*) goat when weighing scales may not be available under field conditions. Correlation of body weight with BL and CG was significantly high indicating these two traits can define body weight of animal with 79.5% accuracy. Further, chest girth alone or combinations other biometric traits can be used with 59% to 81% accuracy for predicting the body weight in nondescript Kashmiri (*Kashir*) goat.

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