Haryana Vet. (December, 2016) **55 (2)**, 198-201 **Research Article**

ASSOCIATION OF LINEAR BODY MEASUREMENTS WITH GREASY FLEECE WEIGHT IN SHEEP

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ABSTRACT

The data for nine linear body measurements and greasy fleece weight (GFW) on 349 Harnali sheep (a new synthetic strain) were analysed to study the association of body measurements with greasy fleece weight. The mixed linear model methodology with dam's weight at lambing as covariate was used to study the effect of non-genetic factors on body measurements and greasy fleece weight. Genetic parameters were estimated by paternal half sib correlation method using sire components of variance and covariance and backward stepwise regression procedure was utilized to develop prediction equations**.** Information were recorded on body length (BL), body height (BH), heart girth (HG), paunch girth (PG), tail length (TL), head circumference (HC), ear length (EL), ear width (EW), face length (FL) and GFW. High heritability estimates were obtained for BL, BH, HG, TL, HC, EL, EW, FL and GFW while moderate estimate was obtained for PG. The phenotypic correlations of various linear body measurements with GFW were quite varying in magnitude ranging from -0.01±0.01 to 0.58±0.05. FL was found to have high phenotypic correlation with GFW (0.58±0.05). The genetic correlations of PG, HC, EL and FL with GFW were estimated as -0.32±0.22, 0.21±0.14, -0.32±0.15 and 0.11±0.17, respectively. The various combinations of linear type traits to predict GFW were found to have coefficient of determination as high as 0.22. The phenotypic and genetic correlations of GFW with body measurements indicated that greasy fleece weight of animal is directly related to its face length and head circumference which can be used as a tool for selection of animals for higher grease fleece weight.

Key words: Greasy fleece weight, genetic parameters Harnali sheep, linear body measurements

India is a rich repository of sheep genetic resources having 42 descript breeds of sheep which are distributed in various agro-climatic zones of the country (NBAGR, 2015). Majority of these breeds have been defined in terms of phenotypic characteristics which distinguish them from other populations. Crossbreeding of native sheep with exotic breeds has been in practice since long to bring about improvement in both wool and mutton production. Harnali sheep is a new synthetic dual purpose strain evolved for superior carpet wool and better growth. The crossbreds having 62.5%exotic inheritance from Russian Merino and Corriedale and 37.5% from local Nali breed were mated inter-se for several generations for stable performance. Harnali population has now become stable (Sehrawat, 2005) and stability is one of the most desirable properties of a genotype to be released as a breed for wider utilization.

Greasy fleece weight (GFW) and growth rate are the important economic traits in sheep. Generally, wool traits are highly heritable and easy to measure. In recent years, there have been a great number of studies on the association of body weight with various body measurements taken at different growth periods of sheep (Afolayan *et al*., 2006; Kunene *et al*., 2009; Cam *et al*., 2010). But little is known about the association of GFW and linear body measurements. The value of sheep depends mainly on body weight and GFW. Body measurements, an indicator of breed standards, provide great convenience for prediction of body weight without weighbridges (Khan *et al.,* 2006; Yakubu, 2010; Cam *et al.,* 2010). However, wool quantity is also an important economic trait in fine wool breeds. Studies on association between linear body measurements and GFW will be helpful in planning breeding strategies for improvement in growth and wool quantity. Hence, the present investigation was undertaken to study the association of linear body measurements with GFW in Harnali sheep.

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MATERIALS AND METHODS

The data for the present study were recorded on 349 Harnali sheep maintained in the Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar over a period of 18 years from 1998 to 2015. The adult animals above 2 years of age were recorded for nine linear body measurements and annual GFW. Information were recorded on body length (BL), body height (BH), heart girth (HG), paunch girth (PG), tail length (TL), head circumference (HC), ear length (EL), ear width (EW), face length (FL) and GFW. Least-squares and maximum likelihood computer programme of Harvey (1990) using mixed linear model with dam's weight at lambing as covariate for estimation of various tangible factors on body measurements and adult body weight was used. The following mathematical model was used:

$$Y_{ijklm} = \mu + S_i + P_j + B_k + A_l + b\,(X_D-\bar{X}) + e_{ijklm}$$

Where, Y_{ijklm}=observation on m^{th} animal belonging to l^{th} age group of dam, of k^{th} sex born in j^{th} period of birth, of i^{th} sire; μ=overall mean; S_i=random effect of i^{th} sire; P_j=fixed effect of j^{th} period of birth (j = 1,2,3,….6); B_k=fixed effect of k^{th} sex (k = 1, 2); A_l=fixed effect of l^{th} age group of dam (l = 1,2,….7); b=linear regression coefficient of trait on dam's weight at lambing; X_D=dam's weight at lambing; $\bar{X}$=mean dam's weight at lambing; e_{ijklm}=random error component.

Genetic and phenotypic correlations and heritability were estimated by paternal half sib correlations method using sire component of variance and covariance. Backward stepwise regression procedure of Draper and Smith (1998) was utilized to predict GFW from linear body measurements.

RESULTS AND DISCUSSION

Effect of Non-genetic Factors: The effect of non-genetic factors on linear body measurements and GFW was studied to standardize the data for estimation of genetic parameters. The period of birth had significant (P<0.01) effect on BL, BH, HC, FL but had non-significant on other body measurements. The period effect on length, height and circumference of the animals might be due to variation in availability of feed and fodder in different periods. The period of birth had non-significant effect on GFW. However, significant period effect on GFW was reported by Kumar *et al.* (2006) in Avikalin sheep and Dixit *et al.* (2009) in Bharat Merino sheep. The significant effect of period of birth on body measurements was also reported by Otoikhian *et al.* (2008) in Ouda sheep, Petrovic *et al.* (2012) in Merinolandschaf sheep and Jafari and Hashemi (2014) in Makuie sheep The effect of sex was found significant (P<0.01) on all the body measurement traits and GFW except EL and EW. The males were having higher estimates for all body measurements than females. This variation might be due to hormonal influences and higher birth weight in males. Males produced more annual grease fleece (1792.84±52.47 gm) than the females (1532.47±38.89 gm). This difference might be due to the differences in the body sizes of the two sexes. Similar findings were also reported by Jafari and Hashemi (2014) in Makuie sheep, Otoikhian *et al*. (2008) in Ouda sheep and Petrovic *et al.* (2012) in Merinolandschaf sheep. The effect of dam's age at lambing was non-significant on all the body measurements and greasy fleece weight. This might be due to the reason that weight of dam at lambing was taken as covariate in the model and weight of dam generally corresponds to the age. Similar findings were also reported by Abbasi *et al.* (2011) in Makuie sheep and Cilek and Gotoh (2014) in Malya sheep. However, significant effect of dam's age at lambing on body measurements was reported by Jafari and Hashemi (2014) in Makuie sheep. Dam's weight at lambing significantly (P<0.05) influenced all body measurements and grease fleece weight indicating that body condition score of dam at the time of lambing is an important factor for body conformation of lambs in the adult age. Higher body condition score of dams at lambing reflect better nourishment of the lambs before and after birth. Similar findings were also reported by Jafari and Hashemi (2014) in Makuie sheep and Petrovic *et al.* (2012) in Merinolandschaf sheep.

Genetic Parameters: The heritability estimates for BL, BH, HG, TL, HC, EL, EW and FL were obtained as 0.62±0.18, 0.63±0.15, 0.61±0.16, 0.76±0.18, 0.63±0.18, 0.51±0.17, 0.63±0.18 and 0.66±0.15, respectively (Table 1) while moderate estimate was obtained for PG (0.30±0.13). High heritability estimates of BH, HG, HC, EL, EW and TL were also reported by Waheed *et al.* (2011) in Beetal goats. Fadare *et al.* (2014) reported estimates of heritability for BL and HG as 0.67 and 0.71 in the West African sheep. The heritability estimates of BL, BH, HG and PG lower than those found in present study were reported by Mandal *et al.* (2010), Panda *et al.* (2014) and Bakhshalizadeh *et al.* (2016) in Muzaffarnagri, Ekda and Moghani sheep, respectively. Higher estimates of heritability for body measurement traits in present study pointed towards the presence of genetic variability in these traits which indicates the

Table 1
Heritability, genetic (r_g) and phenotypic (r_p) correlations along with standard error among linear body measurements and greasy fleece weight

BL	0.62±0.18	0.06±0.02	0.02±0.15
BH	0.63±0.15	0.05±0.02	0.08±0.01
HG	0.61±0.16	0.12*±0.03	0.09±0.17
PG	0.30±0.13	0.04±0.02	-0.31±0.22
TL	0.76±0.18	-0.02±0.01	-0.05±0.14
HC	0.63±0.18	-0.01±0.01	0.21±0.14
EL	0.51±0.17	-0.05±0.02	-0.32±0.15
EW	0.63±0.18	0.02±0.01	-0.08±0.15
FL	0.66±0.15	0.58**±0.05	0.11±0.17
GFW	0.54±0.17	_	_

BL=Body length, BH=Body height, HG=Heart girth, PG=Paunch girth, TL=Tail length, HC=Head circumference, EL=Ear length, EW= Ear width, FL=Face length, GFW=Greasy fleece weight. *=significant correlation; **=Highly significant correlation

Table 2
Prediction of GFW from different linear body measurements in Harnali sheep

Eq. No.	Prediction equations	R2
1	Y = 167.39 + 17.22L – 14.47H + 28.62 HG – 2.53PG + 5.14TL – 31.41HC – 18.39EL + 60.32EW + 10.79FL	0.22
2	Y = 180.96 + 17.16L – 14.11H + 26.16HG +4.65TL – 32.66HC – 17.98EL + 59.94EW + 11.87FL	0.22
3	Y = 142.82 + 19.72L – 12.40H + 26.23 HG – 32.40HC – 15.94EL + 62.95EW	0.22
4	Y = 143.48 + 19.38L – 12.38H + 25.59HG + 2.99TL – 30.82HC	0.22
5	Y = 138.09 + 18.00L – 13.96H + 26.52HG – 27.99HC + 39.27EW	0.21
6	Y = -117.71 + 10.11L = 26.22HG + 40.67EW – 30.67HC	0.20
7	Y = - 57.43 + 28.79HG + 47.87 EW – 22.67HC	0.19
8	Y = - 90.01 + 16.71 HG + 46.36EW	0.16

scope of improvement in body dimensions of Harnali sheep. The estimate of heritability for GFW in present study (0.54±0.17) was higher than 0.49±0.08 as estimated by Khan *et al.* (2015) in Rambouillet crossbred. Lower estimates of heritability for GFW than that found in the present study were also reported by Dey and Bappaditya (2004), Kumar *et.al.* (2005) and Jafari and Hashemi (2014) in different breeds of sheep.

The phenotypic and genetic correlations of linear body measurements with GFW are presented in Table 1. FL had the highest phenotypic correlation (0.58±0.05) with GFW following by HG (0.12±0.03). The significant and positive phenotypic correlations of FL and HG with GFW indicate positive association between wool yield and face length and heart girth of the animal. A moderate and positive genetic correlation of GFW was estimated with HC and FL. However, moderate and negative genetic correlations of GFW was found with PG and EL. Medium to high correlations among various body measurements and performance traits were also reported both at genetic and phenotypic level by Cam *et al.* (2010), Iyiola-Tunji *et al.* (2011), Petrovic *et al.* (2012) and Jafari and Hashemi (2014). The phenotypic and genetic correlations of GFW with body measurements indicated that grease fleece weight of animal is directly related to its face length and head circumference which can be used as a tool for selection of animals for higher grease fleece yield.

Prediction of GFW from Different Linear Body Measurements: Efforts were made to develop equations for prediction of GFW from body measurements of the animal and the results are presented in Table 2. When all the body measurements were included the prediction equation was Y = 167.39 + 17.22BL – 14.47BH + 28.62HG – 2.53PG + 5.14TL – 31.41HC – 18.39 EL+ 60.32 EW +10.79 FL (R^2=0.22). The GFW can be predicted with R^2=0.20 with four traits viz; body length, heart girth, ear width and head circumference and the equation was Y=-117.71 + 10.11BL - 26.22HG + 40.67EW – 30.67HC (Eq. 6). The regression equation with two traits was established as Y = -90.01 + 16.71HG +46.3EW (R^2=0.16) when heart girth and ear width were considered. The result showed that coefficient of determination (R^2) was low with various combinations of the linear body measurements to predict GFW. Hence it is not practically feasible to predict GFW on the basis of the linear body measurements in Harnali sheep, however, some idea can be obtained about GFW of the animal from linear body measurements.

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