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Review Paper

Association of Linear body Measurements with growth traits in Harnali Sheep

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Abstract

Crossbreeding of native sheep with exotic breeds has been in practice since long to bring about improvement in both wool and mutton production. Harnali is a new synthetic strain of sheep developed for superior carpet wool and better growth. The present investigation was undertaken to study association of linear body measurements with growth in Harnali sheep. Data on 349 Harnali animals pertaining to nine linear body measurements and four growth traits were analysed using mixed linear model with sex, period of birth and dam's age at lambing as fixed effects and sire as random effect. The period of birth had significant effect on all traits except HG, PG, TL, EL and EW. The effect of sex was found significant on all linear body measurements and growth traits except EL and EW. Dam's age at lambing was found non-significant on all traits under study. However, dam's weight at lambing significantly influenced all traits. Heritability estimates for various body measurements and growth traits were moderate to high ranging from 0.30±0.13 to 0.76±18 indicating the scope of improvement in body dimensions and growth performance of Harnali sheep. The phenotypic correlations among body measurements and growth traits were quite varying ranging from 0.01±0.01 to 0.40±0.05. Moderate and positive phenotypic correlations ranging between 0.22±0.05 and 0.31±0.06 were found between BL, BH, HG, PG, HC and FL with six month and yearly body weight of Harnali sheep. Moderate to high genetic correlations (0.16±0.19 to 0.42±0.16) were observed between BL, HG and HC with six month and yearly body weight. It was concluded that positive genetic correlations of some linear body measurements with body weight of Harnali animals indicate the scope of improvement in growth performance through selection based on body dimensions of Harnali sheep.

Keywords: Harnali sheep, Linear body measurements, Genetic correlations, Growth traits.

Introduction

India is home of 42 descript breeds of sheep which are distributed in various agro-climatic zones of the country[1]. Majority of these breeds have been defined in terms of phenotypic characteristics which distinguish them from other populations. Crossbreeding in sheep has been in practice since long to bring about improvement in both wool and mutton production.

The aim of sheep breeders is to bring out genetic changes in animals, with a view of increase in profitability, sustainability and ease of management at production level. Harnali sheep is a new synthetic strain evolved by cross breeding for superior carpet wool, better growth and adaptability.

The crossbreds having 62.5 per cent exotic inheritance from Russian Merino and Corriedale and 37.5 per cent from local Nali breed were mated inter-se for several generations for stable performance. Harnali population has now become stable[2] and stability is one of the most desirable properties of a genotype to be released as a breed for wider utilization.

Body measurements, an indicator of breed standards[3], provide great convenience for the prediction of body weight without weighbridges[4-5]. Knowledge of genetic parameters for various traits and also the genetic relationships between the traits in different breeds of sheep is needed to determine optimal breeding strategies to increase the efficiency of sheep production[6-7].

Body measurements also help in judging the quantitative characteristics of meat and also helpful in developing suitable selection criteria[8]. Close relationship between an animal's chest girth and its body weight has been found[9].

Growth is an important parameter of economic value in sheep production. Research studies are required to find association of body measurements with growth traits to monitor the growth of the sheep. Genetic components for the growth parameters must also be estimated for evolving better selection strategies in sheep production. The present study was conducted to study association of linear body measurements with growth traits in newly evolved Harnali strain of sheep.

Methodology

The data for the present investigation were collected on 349 animals of Harnali sheep extended over a period of 18 years, from 1998 to 2015. The information were recorded on nine morphological characters viz; Body length (BL), Body height (BH), Heart girth (HG), Paunch girth (PG), Tail length (TL), Head circumference (HC), Ear length (EL), Ear width (EW) and Face length (FL) along with four growth traits namely Birth weight (BW), Weaning weight (WW), Six month body weight (SMW) and One year body weight (YBW).

In order to overcome non-orthogonality of the data due to unequal subclass frequencies, least-squares and maximum likelihood computer programme[11] using mixed linear model with dam's weight at lambing as covariate for estimation of various tangible factors on various traits was used. The following mathematical model was used: $Y_{ijklm} = \mu + S_i + P_j + B_k + A_l + b\,(X_D-\overline{X}) + e_{ijklm}$, Where Y_{ijklm} is the 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 is the overall mean; S_i is the random effect of i^{th} sire; P_j is the fixed effect of j^{th} period (j = 1,2,3,….6); B_k is the fixed effect of k^{th} sex (k = 1, 2); A_l is the fixed effect of l^{th} age group of dam (l = 1,2,….7); b is the linear regression coefficient of trait on dam's weight at lambing; X_D is the dam's weight at lambing; $\overline{X}$ is the mean dam's weight at lambing and e_{ijklm} is the random error component.

Heritability estimates for different traits were obtained from sire component of variances using paternal half-sib correlation method and the standard errors of heritability estimates were obtained using the formula[11]. Genetic correlations among different traits were calculated from sire components of variances and co-variances and the standard errors of genetic correlations were estimated using the formula[12].

Phenotypic correlations among various traits were calculated from total variances and covariances and the standard error of phenotypic correlation was computed using the formula[13].

Results and Discussion

Non-genetic factors: The effect of non-genetic factors on body measurements and growth traits was studied to know the accurate estimates of genetic parameters. The period of birth had significant (P<0.01) effect on all traits except HG, PG, TL, EL and EW. The significant effect of period of birth on body measurements and growth traits was also reported in Madras Red sheep[14], in Merinolandschaf sheep[15] and in Makuie sheep[16].

Variation in climatic and managemental conditions were the important causes of the variation in body weight of lambs born during different periods. The effect of sex was found significant on all linear body measurements and growth traits except EL and EW. Simliar findings were also reported in Madras Red sheep[14], in Merinolandschaf sheep[15], in Makuie sheep[16].

This difference of birth weights between the two sexes might be due to hormonal influences. Dam's age at lambing was found non-significant on all traits under study. Similar findings were also reported in Bharat Merino sheep[17], in Makuie sheep[18] and in Malya sheep[19]. Dam's weight at lambing significantly (P<0.01) influenced all traits under study. Similar findings were also reported in different breeds of sheep[16,17,20]. From the results, it was inferred that the data must be corrected for these significant effects before estimating the genetic parameters.

Inheritance of linear body measurements and growth traits: The estimates of heritability for various traits under study are presented in Table-1. Heritability estimates for various body measurement traits were high. The 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 and 0.51±0.17, 0.63±0.18 and 0.66±0.15, respectively while moderate estimate was obtained for PG as 0.30±0.13. High heritability estimates of BH, HG, HC, EL, EW and TL as 0.8±0.02, 0.8±0.01, 0.8±0.02, 0.7±0.03, 0.9±0.01 and 0.8±0.01, respectively were also reported in Beetal goats[21].

Heritability estimates for BL and HG as 0.67 and 0.71 were also reported in the West African sheep[22]. Higher estimates of heritability in present study pointed towards the presence of genetic variability in these traits which might be due to the reason that linear type traits were not included in the selection criterion of Harnali sheep so far. High genetic variability clearly indicates the scope of improvement in these body dimensions.

Table-1
Estimates of heritability along with standard error of body measurements and growth traits in Harnali sheep

Body Measurements Traits	h^2± SE	Growth traits	h^2± SE
Body length	0.62±0.18	Birth weight	0.68±0.19
Body height	0.63±0.15	Weaning weight	0.49±0.17
Heart girth	0.61±0.16	Six month weight	0.65±0.15
Posterior girth	0.30±0.13	One year body weight	0.44±0.17
Tail length	0.76±0.18		
Head circumference	0.63±0.18		
Ear length	0.51±0.17		
Ear width	0.63±0.18		
Face length	0.66±0.15		

Table 2
Phenotypic (r_p) and genetic (r_g) correlations along with standard error of various body measurements with growth traits in Harnali sheep

Traits	BW		WW		SMW		YBW	
	r_p	r_g	r_p	r_g	r_p	r_g	r_p	r_g
L	0.10*±0.02	-0.02±0.14	0.03±0.01	-0.14±0.15	0.22**±0.0.6	0.20±0.16	0.24**±0.05	0.11±0.15
H	0.06±0.01	0.08±0.16	0.09±0.02	0.07±0.17	0.19**±0.04	0.34±0.18	0.18**±0.04	0.06±0.18
HG	0.40**±0.05	-0.26±0.16	0.19**±0.03	-0.09±0.18	0.27**±0.06	0.16±0.19	0.31**±0.06	0.42±0.16
PG	0.07±0.01	-0.06±0.21	0.13*±0.02	0.09±0.22	0.21**±0.04	-0.08±0.25	0.26**±0.04	0.26±0.14
TL	0.01±0.01	0.04±0.13	-0.13*±0.01	-0.08±0.14	0.06±0.03	0.02±0.16	-0.04±0.02	-0.10±0.15
HC	-0.03±0.01	0.02±0.09	0.09±0.03	0.05±0.15	0.20**±0.05	0.19±0.16	0.26**±0.03	0.35±0.14
EL	0.09±0.02	0.02±0.15	-0.13*±0.04	-0.19±0.16	-0.04±0.02	-0.21±0.17	-0.05±0.02	-0.33±0.15
EW	0.09±0.04	0.03±0.14	-0.08±0.03	-0.17±0.15	0.03±0.01	-0.12±0.16	0.03±0.04	-0.15±0.15
FL	0.01±0.01	-0.12±0.16	0.09±0.02	0.02±0.17	0.23**±0.06	0.15±0.19	0.17**±0.05	0.23±0.17

** Significant at P<0.01, * Significant at P<0.05

Heritability estimates for BW, WW, SMW and YBW were obtained as 0.68±0.19, 0.49±0.17, 0.65±0.15 and 0.44±0.17 respectively (Table-1). The heritability estimates of BW reported in the literature ranged from 0.02±0.01 in Iran Black sheep[23] to 0.33±0.05 in Sangsari sheep[24].

The estimates of heritability in the present study for WW, SMW and YBW were somewhat higher than those reported in literature. However, higher estimates of heritability for WW and YBW as 0.508±0.1602 and 0.651±0.190 respectively were also reported in Madras Red sheep[25]. Higher estimates of heritability for growth traits in present study pointed towards the availability of genetic variability which can be exploited for further improvement in the growth performance of Harnali sheep.

Association of linear body measurements with growth traits: The phenotypic and genetic correlations of linear body measurements with growth traits in Harnali sheep are presented in Table-2. The phenotypic correlations of linear body measurements with growth traits were quite varying in magnitude ranging from 0.01± 0.01 to 0.40±0.05. The phenotypic correlations of BL, BH, HG, PG, HC, and FL with SMW and YBW were positive and significant with moderate in magnitude ranging from 0.17±0.05 to 0.31±0.06. The phenotypic correlations of linear body measurements with earlier growth traits were found low to moderate in magnitude.

The genetic correlations of body measurements with growth traits were low to high ranging from 0.02± 0.09 to 0.42±0.16. The genetic correlations of body measurements traits with body weights at early ages (BW, WW) were low to moderate in magnitude. The genetic correlations of HG, PG, HC and FL with YBW were 0.42±0.16, 0.26±0.14, 0.35±0.14 and 0.23±0.17, respectively. Medium to high correlations among various body measurements and growth traits were also reported both at genetic and phenotypic level[15,16,26,27]. The moderate to medium genetic associations of some linear body measurements with growth traits indicate the scope of inclusion of the body dimensions in selection programmes for improving the growth performance of the sheep.

Conclusion

High estimates of heritability for body measurements and growth traits pointed towards the presence of genetic variability which clearly indicates the scope of improvement in body dimensions and growth performance of Harnali sheep. Moderate to high genetic correlations of some linear body measurements with body weight indicated that these traits can serve as selection tool, for improving of growth performance as well as they can be used as indicators to predict body weight under field conditions in the absence of weighing scales.

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References

1. National Bureau of Animal Genetic Resources (2015). Animal Genetic Resources. NBAGR, Karnal, Haryana.
2. Sehrawat V. (2005). Studies on genetic architecture of the synthetic sheep population. M.V.Sc. Thesis, College of Animal Sciences, CCS Haryana Agricultural University, Hisar , Haryana, India.
3. Pesmen G. and Yardimci M. (2008). Estimating the live weight using somebody measurements in Saanen goats. *Achiva Zootech*., 11, 30-40.
4. Afolayan R.A., Adeyinka I.A. and Lakpini C.A.M. (2006). The estimation of live weight from body measurements in Yankasa sheep. *Czech J. of Anim. Sci.*, 51, 343-348.
5. Yakubu A. (2009). Fixing collinearity instability in the estimation of body weight from morpho-biometrical traits of West African Dwarf goats. *Trak. J. of Sci*., 7, 61-66.
6. Komlosi I. (2008). Genetic Parameters for growth traits of the Hungarian merino and meat sheep breeds in Hungary. *Applied Ecology and Environmental Research.,* 6, 77-84.
7. Gamasaee V.A., Hafezian S.H., Ahamdi A., Baneh H., Farhadi A. and Mohamadi A. (2010). Estimation of genetic parameters for body weight at different ages in Mehraban sheep. *African Journal of Biotechnology.,* 9, 5218-5223.
8. Islam M.R., Saadullah A.R., Howlider and Huq M.A. (1991). Estimation of live weight and dressed carcass weight from different body measurements in goats. *J. Anim. Sci.,* 61, 460-461.
9. Otoikhian C.S.O., Otoikhian A.M., Akporhuarho O.P. and Isidahoman C. (2008). Correlation of body weight and somebody measurement parameters in Quda sheep under extensive management system. *Afr. J. Gen. Agric.,* 4, 129-133.
10. Harvey W.R. (1990). Mixed model least squares and maximum likehood computer program. Versao PC-1.
11. Swiger L.A., Harvey W.R., Everson D.O. and Gregory K.E. (1964). The variance of interclass correlation involving groups with one observation. *Biometrics*., 20, 818-826.
12. Robertson A. (1959). The sampling variation of genetic correlation coefficient. *Biometrics.,* 15, 469-485.
13. Snedecor G.W. and Cocharan W.G. (1968). Statistical methods. Oxford & IBH Publ. Co. New Delhi, India.
14. Balasubramanyam D., Raja T.V., Kumarasamy P. and Sivaselvam S.N. (2012). Estimation of genetic parameter and trends for body weight traits in Madras Red sheep. *The Indian Journal of Small Ruminants.,* 18,173-179.
15. Petrovic M.P., Petrovic V.C., Muslic R.D., Ilić Z., Spasić Z., Stojković J. and Makshimovic N. (2012). Genetic and phenotypic of the body measured traits in Merinolandschaf breed of sheep. *Biotechnology in Animal Husbandry.,* 28, 733-741.
16. Jafari S. and Hashemi A. (2014). Estimation of genetic parameters for body measurements and their association with yearling liveweight in the Makuie sheep breed. *S. Afr. J. Anim. Sci.,* 44, 141-147.
17. Chopra A., Prince L.L.L., Gowane G.R. and Arora A.L. (2010). Influence of genetic and non-genetic factors on growth profile of Bharat Merino sheep in semi-arid region of Rajasthan. *Indian Journal of Animal Sciences*., 80(4), 376-378.
18. Abbasi M.A. and Ghafouri-Kesbi F. (2011). Genetic co (variance) components for body weight and body measurements in Makooei sheep. *Asian–Aust. J. Anim. Sci*., 24, 739-743.
19. Çilek S. and Gotoh T. (2014). Effects of Dam Age Lamb Gender, and Singleton or Twin Status on Body Size of Malya Lambs in Middle Anatolia, Turkey. *J. Fac. Agr., Kyushu Univ.,* 59(2), 313-320.
20. Singh H., Pannu U., Narula H.K., Chopra A. and Murdia C.K. (2013). Influence of genetic and non-genetic factors on pre-weaning growth in Marwari sheep. *The Indian Journal of Small Ruminants.,* 19(2), 142-145.
21. Waheed A., Khan M.S., Ali S. and Sarwar M. (2011). Estimation of growth curve parameters in Beetal goats. *Arch. Tierzucht*., 54, 287-296.
22. Fadare A.O., Peters S.O., Adedeji T. A. and Ozoje M.O. (2014). Genetic and phenotypic parameter estimates of body morphometric traits of West African dwarf lambs in a humid tropical environment. *Tropical Agriculture*., 91(3), 165.
23. Rashidi A. (2013). Genetic parameter estimates of body weight traits in Iran-Black sheep. *Journal of Livestock Science and Technologies.,* 1(1), 50-56.
24. Miraei-Ashtiani S.R., Seyedalian A.R. and Moradi - shahrbabak M. (2007). Variance components and heritabilities for body weight traits in Sangsari sheep, using univariate and multivariate animal models. *Small Rumin. Res*., 73, 109-114.
25. Ganeshan R., Dhanavanthan P., Balasubramanyam D., Kumarasamy P. and Kiruthika. (2013). Estimation of genetic parameters of growth traits in Madras Red sheep. *Journal of Agriculture and Veterinary Science*., 3, 69-73.
26. Cam M.A., Olfaz M. and Soydan E. (2010). Body measurements reflect body weights and carcass yields in Karayaka sheep. *Asian Journal Animal and Veterinary Advances.,* 5, 120-127.
27. Iyiola-Tunji A.O., Olugbemi T.S., Ali A.O. and Ojo O.A. (2011). Inter-relationship between body measurements and price of sheep in an open market in Kano State. *Animal Production.,* 13(1), 64-68.