GENETIC TRENDS FOR SOME PRODUCTIVE TRAITS OF LOHI SHEEP IN PAKISTAN

K. Javed, A. Iram, M. Abdullah, M. A. Sattar[*] and M. Akhtar[**]

Department of Livestock Production, University of Veterinary and Animal Sciences, Lahore, Pakistan
[*]Department of Theriogenology, University of Veterinary and Animal Sciences, Lahore, Pakistan
[**] Buffalo Research Institute Pattoki, Kasur. Pakistan
Corresponding Author Email: khalidjaved@uvas.edu.pk

ABSTRACT: Data on performance records on birth weight, weaning weight and yearling weight of Lohi sheep maintained at Livestock Production Research Institute (LPRI), Bahadurnagar, Okara during a period 1990-2008 were used in the present study. Birth, weaning and yearling weight (kg) averaged as 2.79±0.05, 18.44±0.31 and 36.70± 0.33, respectively. The effect of year and season of birth, sex, type of birth and age of dam was studied by least square analysis of variance using Harvey's Mixed Model Least Square and Maximum Likelihood (LSMLMW) Computer Program. Birth weight varied significantly for all factors while significant effect of year of birth and season of birth was found on weaning weight. However, the differences due to sex, type of birth and age of the dam were non significant. Effects of year of birth, season of birth and age of dam on yearling weight were found significant. Heritability was estimated using Restricted Maximum Likelihood (REML) procedure under animal model. Low estimates of heritability (0.11± 0.03, 0.08±0.03, 0.10±0.05) for birth, weaning and yearling weights, respectively were observed. Estimated breeding values (EBVs) for birth weight, weaning weight and yearling weight for the males ranged from 0.26 to 0.33, -1.12 to 1.30 and -1.55 to 1.51 and for females -0.25 to 0.27, -0.99 to 1.05 and -1.26 to 1.46 respectively. However, overall EBVs ranged between -0.25 to 0.33, -0.99 to 1.30 and -1.26 to 1.51, respectively. The results showed the decreasing genetic and static phenotypic trends for birth weight where as, the genetic and phenotypic trend for weaning weight showed increasing trend. No specific genetic and phenotypic trend was observed for yearling weight.

Key words: Lohi sheep, heritability, genetic trend, phenotypic trend, Estimated breeding value (EBV)

INTRODUCTION

Statistical techniques presently utilized for the estimation of breeding values in selection program rely on estimates of genetic variation between and within traits of economic importance. The overall impact of any selection program depends on the direct and correlated responses that result from selection. Knowledge of genetic parameters is required for prediction of estimated breeding values. However, various environmental factor may influence the performance of any individual or flock. In Pakistan, Lohi sheep is mainly kept for meat production. Thus traits affecting economic viability include those associated with growth, body weight and rate of gain are among the most economically important and easily measured traits of meat animals. Although weight is an important objective in selection, knowledge of the particular phase of the animal's growth is of utmost importantance. So, the purpose of the present study was to estimate the genetic and phenotypic parameters of growth traits in a flock of Lohi sheep at various stages of growth from birth to yearling

MATERIALS AND METHODS

The pedigree and performance records of Lohi breed of sheep maintained at Livestock Production Research Institute (LPRI), Bahadurnagar, Okara during a period 1990-2008 were utilized for the present study. The ewes were categorized into three age groups; young < 3 years, mature 3-5 years and old >5 years. Recorded information pertaining to identity of individuals, dams and sires, date of birth, birth type, sex, birth weight, weaning weight and yearling weight were used to estimate genetic and phenotypic parameters of various performance traits. The performance traits examined in the present study were included birth weight, weaning weight and yearling weight. Data these traits were statistically analyzed to estimate magnitude of various genetic and non-genetic sources of variation in these traits. Prior to data analysis several edits were preformed to remove the outliers. Such as the lambs having birth weight less than 1kg and more than 5.5kg were not included for the study. Similarly, the animal having weaning weight less 10 kg and more than 35 kg were excluded from the data. The edit criteria for weaning age was also used and animal of weaning age less than 75 and more than 150 days were excluded. The ranges selected here were similar to those for other local breeds viz. Lohi

(Babar, 1994) and Hissardale (Akhtar, 1996) and were close to the population mean ± 3 S.D. Data with any recorded abnormality were also excluded from the analysis.

A). Evaluation of environmental effects: Effect of the environmental factors viz. year and season of birth, type of birth, sex of lamb, weaning age etc on birth weight, weaning weight and yearling weight as appropriate, were evaluated. Sheep is usually considered as seasonal breeder. Lohi sheep mostly exhibits estrous during two seasons, autumn and spring. Due to managemental convenience they are bred during autumn season to have lamb crop during spring when the ambient temperature is mild and plenty of green fodder is available. However, some proportion of population also exhibit estrous round the year and lambs are born throughout the year. Keeping in view the breeding plan the year was divided into four seasons. The spring (Feb-March) and autumn (Sep-Oct) as a regular breeding season while summer (April-August) and winter (Nov-Jan) as off breeding season. For these analyses, Harvey's Least Squares Maximum Likelihood Mixed Model (LSMLMW) computer software was used (Harvey, 1990). The mathematical model assumed was:

$Y_{ij} = \mu + F_i + e_{ij}$ **(Model 1)**

Where Y_{ij} is the measurement of particular trait , μ is the population mean, F_i is the effect of all fixed effects with the restriction that $\sum Fi = 0$ and e_{ij} is the random error associated with each observation.

B) Estimation of heritability: The heritability was estimated by using Restricted Maximum Likelihood procedure outlined by Patterson and Thompson (1971) fitting an Individual Animal Model. All of the available pedigree information was included in the analysis in an attempt to minimize the bias due to selection and non-random mating. The convergence criterions (variance of function values -2 log likelihood) for various genetic parameters were 1×10^{-8}.

A univariate analysis was performed to estimate heritability of various performance traits. Fixed effects found significant during initial analysis (Model 1) were fitted in the model for estimation of genetic parameters. For heritability estimation the mathematical model assumed was as follows:

$Y_{ijk} = \mu + F_i + A_j + e_{ijk}$ (**Model 2**)

Where Y_{ij} is the measurement of particular trait , μ is the population mean, F_i fixed effects observed to be significant from the initial analyses (Model 1), A_j is the random additive genetic effect of j^{th} animal with mean zero and variance $\sigma^2 A$, e_{ijk} is the random error with mean zero and variance $\sigma^2 e$

C). Estimation of Breeding Values and Genetic Trends: Breeding values of animals for various performance traits were estimated by best linear unbiased predication (BLUP) procedure as outlined by Henderson (1973). The DFREML set of computer programmes used above also generates Estimated Breeding Values (EBVs) as a by-product. Breeding values thus estimated were fitted in a fixed effect model having year of birth as the only fixed effect. The least squares solutions of breeding values were drawn against year of birth to depict the genetic trend. Phenotypic values of different performance traits were plotted against the year of birth to determine phenotypic trends.

RESULTS AND DISCUSSION

Data on 5526 lambing and performance records of Lohi sheep from 1990 through 2008 were used in the present study. The percentage of single, twin and triplets lamb born were found 69, 30.80 and 0.3 percent, respectively. The sex ratio was almost 49: 51 for males and females. The mean values for the birth, weaning and yearling weight from 5526, 2901, 2669 records were obtained as 2.79 ±0.05, 18.44±0.31 and 36.70± 0.33 kg, respectively. The percentage of co-efficient of variation was 17.04, 16.02 and 8.34 for the performance traits. The influence of various environmental factors viz; year and season of birth, sex and type of birth, interaction of sex and type of birth, and age of dam on different performance traits viz; birth, weaning and yearling weights was studied. Year and season of birth significantly influenced weight at birth and weaning and yearling whereas sex of lamb, type of birth and age of dam influences birth weight only. These results are almost consistent with the earlier reports on different local breeds of Pakistan (Thalli breed,Hussain *et al.*, 2013;Buchi, Akhtar *et al.*, 2012; Mengali. Tariq *et al.*, 2013).

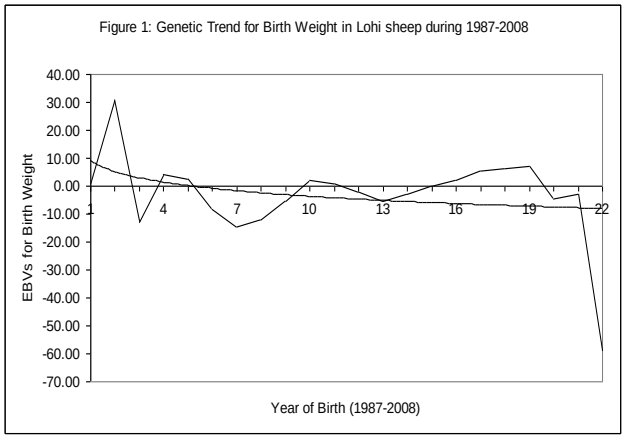
Heritability for Birth weight: The genetic composition of a population can be studied by considering the relative importance of heredity and environmental factors affecting the performance of individuals in that population. The estimate of heritability for birth weight in the present study was 0.11± 0.03. This estimate was based on birth records of 5366 lambs produced by 1730 ewes sired by 133 rams through univariate analysis using DFREML computer soft ware (Meyer, 2000). The estimate was low and it was in agreement with many workers (Behzadi *et al.*, 2007; Akhtar *et al.*, 2008). Behzadi *et al.* (2007) reported the heritability estimates of Kermani lambs as 0.10±0.06 which was very close to the present study. Ozcan *et al.* (2005) analyzed performance data on Turkish Merino sheep and reported the heritability estimate for birth weight at birth as 0.08 which was quite low than the present study. In another study, Akhtar *et al.* (2008) analyzed performance data on Hissardale sheep and reported the heritability estimate for body weight at birth as 0.08±0.02 which was quite low

than the present study. However, Ashtiani *et al.,* (2007) reported heritability of birth weight as 0.33 ± 0.05 in Sangsari sheep. Vatankhah and Talebi (2008) estimated heritabilities and correlations between lamb body weight at different ages and reproductive traits in the Lori-Bakhtiari sheep breed and reported direct heritability for lamb body weight at birth as 0.31 ± 0.02 and an estimate of maternal heritability was 0.22 ± 0.02. However, Akhtar *et al.* (2014) reported a higher heritability estimate for weight at birth (0.194 ± 0.023) in Buchi sheep of Pakistan. The differences in different reports may be due to differences in genotype, size of data set, and method of extimation or edit criteria

Heritability for Weaning weight: The heritability estimate for weaning weight in the present study was 0.08±0.03. The estimation was based on 4956 weaning records of lambs produced by 1471 ewes sired by 128 rams and it was in agreement with findings of other workers (Ozcan *et al.* 2005; Akhtar *et al.,* 2008). Ozcan *et al.* (2005) reported the heritability estimate for weaning weight as 0.08 in Turkish Merino sheep. Akhtar *et al.* (2008) reported heritability estimate for weaning weight 0.10±0.03 in Hissardale sheep and is closely agreement with the present study. Many other workers reported much higher estimates of heritability for weaning weight in different breeds of sheep in different countries and locations (Behzadi *et al.,* 2007 and Ashtiani *et al.,* 2007; Vatankhah and Talebi 2008). Vatankhah and Talebi (2008) estimated heritability as 0.10 ± 0.02 at weaning and estimates of maternal heritability was 0.22 ± 0.02. Ceyhan *et al.* (2009) reported heritability estimate for weaning weight as 0.174 in Sakız sheep. Higher maternal heritability estimate (0.153 ± 0.03) was reported for weight adjusted to 120 days in Buchi sheep of Pakistan (Akhtar *et al.,* 2014).

Heritability for Yearling weight: The estimate of heritability of yearling weight was 0.10±0.05. This was based on 2823 records of animals with progeny records of 1177 dams sired by 120 rams. The estimate was in agreement with many workers. Mokhtari *et al.* (2008) estimated genetic parameters of Kermani sheep maintained in Iran and reported heritability estimate for yearling weight 0.10±0.05. Behzadi *et al.* (2007) also reported somewhat very close estimate of heritability (0.14 ± 0.08) for the trait in Kermani lambs maintained at Shahrbabak Sheep Breeding Research Station in Iran during the period 1993-1998. Akhtar *et al.* (2008) also reported slightly higher estimate of heritability for yearling weight (0.15 ± 0.04) in Hissardale sheep. Some workers reported higher heritability estimates for yearling weight. (Ozcan *et al.* 2005; Behzadi *et al.,* 2007; Akhtar, *et al.,* 2008). Ozcan *et al.* (2005) analyzed performance data on Turkish Merino sheep and reported the heritability estimate for yearling weight as 0.25. The differences between the heritability estimates as obtained in the present investigation and reported in literature may be due to differences in breeds, locations, time periods, size of data set or method of estimation along with other managemental practices.

Estimation Of Breeding Values And Genetic Trends: Estimated breeding values (EBVs) for birth weight, weaning weight and yearling weight obtained from the present study for the males ranged from 0.26 to 0.33, -1.12 to 1.30 and -1.55 to 1.51, respectively. The corresponding values for females for the same traits were -0.25 to 0.27, -0.99 to 1.05 and -1.26 to 1.46. However, the overall range of the estimated breeding values (EBVs) for birth weight, weaning weight and yearling weight obtained from the present study were -0.25 to 0.33, -0.99 to 1.30 and -1.26 to 1.51, respectively. The genetic trend for birth weight figures 1. The genetic trends for birth weight in Lohi sheep showed decreasing trend and phenotypic trend was static, whereas, the genetic and phenotypic trend for weaning weight showed increasing trend. No specific genetic and phenotypic trend was observed for yearling weight. The overall trend was static and this was similar with the results presented by Hussain (2006) who reported that breeding value for rams ranged from -0.447 to 0.216 for birth weight; -1.512 to 2.859 for weaning weight, -1.686 to 2.089 for yearling weight. The overall genetic trend was static. There were wide fluctuations among the least square means for estimated breeding values.



Conclusion: The genetic trend for all performance traits indicated that the breeding programme in the present flock during the period under study has not proved to be efficient. It also indicated that the selection of animals could not be practiced in the proper direction and some sort of random mating has been practiced. Attention to breed type becomes harmful when it is focused without fixing standard of production. In this way, animals above the average in real usefulness were discarded because they did not confirm to breed type in matters which were of little or no economic importance (Javed *et al.* 2002). The genetic difference among the individuals is another

factor which determines the rate of genetic improvement that can be accomplished through selection. With low estimate of heritability, the anticipated improvement in the traits mentioned in the present study is much less through selection as compared to what could be attained by other environmental changes this low estimate of genetic differences among the individuals was considered as an important factor that rendered selection ineffective (Javed, 1999). The culling in the flock under investigation was not according to the recommended level and mostly those animals which were unfit for breeding, repeaters or sick were disposed off. The culling on the basis of low live weight was rarely practiced. It could be inferred from the present study that in the presence of these factors, the selection remained ineffective to bring about the desired changes over the last 18 years period.

REFERENCES

Akhtar, M. K. Javed and M. Abdullah. Single trait analysis for preweaning growth traits of Buchi sheep in Pakistan. The J. Anim. & Plant Sci., 24 (2): (accepted) (2014).

Akhtar, M., K. Javed, M. Abdullah, N. Ahmad and M. A. Elzo. Environmental factors affecting preweaning growth traits of Buchi sheep in Pakistan**.** The J. Anim. & Plant Sci., 22 (3): 529-536 (2012).

Akhtar, P. Genetic and phenotypic parameters of some performance characteristics of Hissardale sheep. PhD Thesis. Univ. of Agric. Faisalabad Pakistan. (1996)

Akhtar, P., S. Ali, A. Hussain, M. A. Mirza, M. I. Mustafa and J. I. Sultan. Heritability estimates of post weaning performance traits in Hissardale sheep in Pakistan. Turk. J. Vet. Anim. Sci. 34 (4):275-279 (2008).

Ashtiani S. R, S. R. Seyedalian and M. M. Shahrbabak. Variance components and heritabilities for body weight traits in Sangsari sheep, using univariate and multivariate animal models. Small Ruminant Research 73 (1-3): 109-114 (2007).

Babar. M. E. Genetic and phenotypic parameters of some performance characteristics of Lohi sheep. PhD Thesis Univ. of Agric. Faisalabad Pakistan (1994).

Behzadi, M. R, F. E. Shahroudi, L. D. Van Vleck. Estimates of genetic parameters for growth traits in Kermani sheep. Anim. Breed. and Gene. 124 (5): 296–301(2007).

Ceyhan A., T. Sezenler, and I. Erdogan (2009). The estimation of variance components for prolificacy and growth traits of Sakız sheep. Livestock Science. 122:68–72.

Harvey, W. R. User's Guide for LSMLMW (PC version) Mixed Model Least Square and Maximum Likelihood Computer Program, Ohio State University, Ohio USA (2000)..

Henderson, C. R. Sire evaluation and genetic trends. In Anim. Breed. Genetics. Am. Soc. Anim. Sci., / Am. Soc. Anim. Sci., / Am. Dairy Sci., Assoc., Champaign, Illinois (1973).

Hussain, A., P. Akhtar., S. Ali, M. Younas, M. Yaqoob, M. E. Babar, K. Javed and A. Shakoor. Factors influencing body weights at different ages in Thalli sheep. The J. Anim. & Plant Sci., 23 (1): 1-6 (2013).

Hussain, A., Genetic Evaluation of Thalli Sheep. PhD Thesis Univ. of Agric. Faisalabad Pakistan (2006).

Javed, K. Genetic and phenotypic aspects of some performance traits in a pure bred herd of Sahiwal cattle in Pakistan. Ph.D Thesis Univ. of Agric. Pakistan(1999).

Javed, K., M. Abdullah and M. A. Khan. Estimation of breeding value and genetic trends in Sahiwal cattle in Pakistan. The J. Anim. Plant Sci. 12 (1): 1-6 (2002).

Meyer, K. User's notes of DFREML Set of Computer Programmes Version 3.0.00α (1997).

Mokhtari. M.S., A. Rashidi and Y. Mohammadi. Estimation of genetic parameters for post-weaning traits of kermani sheep. small ruminant Research. 80(1-3):22-27 (2008).

Ozcan, M., B. Ekiz, A. Yilmaz and A. Ceyhan. Genetic parameter estimates for lamb growth traits and greasy fleece weight at first shearing in Turkish Merino sheep. Small Rumin.Res. 56 (1-3):215-222 (2005).

Patterson, H. D. and R. Thompson. Recovery of inter block information when block sizes are unequal. Biometrika. 58:545-554 (1971).

Tariq, M. M., M. A. Bajwa, K. Javed, A. Waheed, M. A. Awan, M. Rafeeq, N. Rashid and M. Shafee. Identification of environmental factors affecting pre weaning performance of Mengali sheep of Balochistan. The J. Anim. & Plant Sci., 23 (2): 340-344 (2013).

Vatankhah, M. and M. A. Talebi. Heritability estimates and correlations between production and reproductive traits in Lori-Bakhtiari sheep in Iran. South African J. anim. Sci. 38 (2): 110-118 (2008).