

*Original Research***Genetic, Phenotypic and Environmental Trends for Production and Reproduction Traits in Kashmir Merino Sheep****Mubashir Ali Rather*, S. Shanaz, N. A. Ganai, Mohammad Ashraf Baba¹, Ambreen Hamadani, Mir Shabir Ahmad and Tavsief Ahmad**

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Abstract

Kashmir Merino is a major synthetic breed of sheep developed in the state of Jammu and Kashmir through crossing cross breeding between 1942-1964 for apparel wool, better growth and adaptability. The aim of the present study was to estimate genetic, phenotypic and environmental trends for the Kashmir Merino sheep for nine performance traits viz: birth weight (BWT), 6 months body weight (6-MWT), yearling body weight (12-MWT), greasy fleece yield of first clip (GFY-1), greasy fleece yield of second clip (GFY-2), fiber diameter (FD), staple length (SL), age at first lambing (AFL) and Inter-lambing period (ILP) so as have an insight into performance of the breed over years. The data on 6300 birth records spread over twenty-one years of Kashmir Merino sheep maintained at Government Sheep Breeding Farm Kralapathri and Government Sheep Breeding Farm Goabal Kashmir was considered for the present study. The BLUP values for BWT, 6-MWT, 12-MWT, GFY-1, GFY-2, FD, SL, AFL and ILP were 3.33 ± 0.07 kg, 18.82 ± 0.18 kg, 21.20 ± 0.27 kg, 0.75 ± 0.01 kg, 0.85 ± 0.02 kg, $21.20 \pm 0.21 \mu$, 4.40 ± 0.05 cms, 1098.68 ± 6.28 days and 395.46 ± 7.71 respectively. The genetic trends for BWT, 6-MWT, 12-MWT, GFY-1, GFY-2, FD, SL, AFL and ILP were -0.012 kg/period, -0.024 kg/period, 0.190 kg/period, 0.001 kg/period, -0.003 kg/period, 0.024μ /period, -0.045 cms/period, -12.411 days/period and 2.383 days/period respectively. The phenotypic trends were negative for BWT, GFY-2, FD, SL and AFL and 6-MWT, 12MWT, GFY-1 and ILP.

Key words: BLUP Values and Phenotypic Trends, Genetic Trends, Kashmir Merino**How to cite:** Rather, M., Shanaz, S., Ganai, N., Baba, M., Hamadani, A., Ahmad, M., & Ahmad, T. (2019). Genetic, Phenotypic and Environmental Trends for Production and Reproduction Traits in Kashmir Merino Sheep. International Journal of Livestock Research, 9(12), 73-78. doi: 10.5455/ijlr.20190510100655**Introduction**

Kashmir Merino is a crossbred strain developed by crossing Gaddi, Bhakarwal and Poonchi with 50 to 75% exotic inheritance of Rambouillet and Merino sheep (Tomar, 2004). The breed was developed through cross breeding to improve the genetic potential of native breeds for wool traits to meet the rising demand for good

quality apparel wool. The breed is being maintained at Government Sheep Breeding Farms in the State. Since this breed is an important genetic resource for the state of J&K, understanding the changes in its production potential over the years is important. This may essentially be done by generation and interpretation of genetic, phenotypic and environmental trends for various production and reproduction traits. Estimated breeding values (EBV) reflect the true genetic potential or genetic transmitting ability of animals. The accuracy of selection depends on the variability of breeding values (Kinghorn, 1997). Genetic trend estimation describes the change in production per unit of time due to change in mean breeding value (Harville and Hendeason, 1966). The estimation of environmental and phenotypic trends is also crucial as they help in understanding whether the changes in production are of genetic origin or environmental origin or observed at phenotypic scale (Nirban, 2013). Earlier studies on genetic trend were based on the method described by Smith *et al.* (1962). In recent times, genetic trend is depicted as the average breeding value over years/ periods. The present study was therefore under taken to study Kashmir Merino sheep with respect to some important performance traits.

Materials and Methods

The performance data spread over twenty-one years (1997-2017) maintained at sheep Breeding Farm Kralapathri, Sheep Breeding Farm Goabal and Fleece Testing Laboratory were used for present study. All records were available in the form of paper records which were first digitized in excel spread sheets for data analysis. Flock books, body weight and wool record registers were used for data collection which were maintained at two sheep breeding farms. Data classification was done into seven periods, each period consisting of three years. The analysis was carried out by mixed model least-squares maximum likelihood (LSMLMW) computer (PC-2) programme designed by Harvey (1990). Breeding values of sires were estimated by Best Linear Unbiased Prediction (BLUP) procedure described by Henderson (1973) using the following mixed model.

$$Y = Xb + Zu + e$$

Linear Model for the estimation:

$$\text{Phenotypic Value} = \text{Mean} + \text{Sire} + \text{Year} + \text{Sex} + \text{Error}$$

The genetic trends were calculated by regression of average predicted breeding values versus the animal's birth period (Smith, 1962). The phenotypic trends of the traits were estimated by regressing phenotypic values of the trait on period of the birth of the animals, respectively (Malik *et al.*, 2018). The subtraction of sire's breeding value means was computed from phenotypic values, and the regression of obtained values on period of birth was considered as environmental trend (Roshanfekar *et al.*, 2015) using Minitab Statistical Software.

Results and Discussion

The phenotypic values for BWT, 6-MWT, 12-MWT, GFY-1, GFY-2, FD, SL, AFL and ILP were 3.34 ± 0.05 kg, 19.33 ± 0.45 kg, 22.44 ± 0.46 kg, 0.82 ± 0.03 kg, 0.80 ± 0.02 kg, 20.33 ± 0.05 μ , 3.86 ± 0.14 cms, 1090.22 \pm 19.45 days and 401.45 \pm 22.29 respectively Table 1.

Table 1: Phenotypic and breeding values of sires

Performance trait	Phenotypic values	Average	EBV Minimum	EBV Maximum
BWT	3.34 ± 0.05 kg	3.33 ± 0.07 kg	-0.43 ± 0.11	0.25 ± 0.09
6-MWT	19.33 ± 0.45 kg	18.82 ± 0.18 Kg	-5.91 ± 1.02	3.58 ± 0.72
12-MWT	22.44 ± 0.46 kg	21.20 ± 0.27 kg	-2.95 ± 0.63	3.17 ± 0.90
GFY-1	0.82 ± 0.03 kg	0.75 ± 0.01 kg	-0.21 ± 0.05	0.47 ± 0.04
GFY-2	0.80 ± 0.02 kg	0.85 ± 0.02 kg	-0.44 ± 0.05	0.35 ± 0.05
FD	20.33 ± 0.05 μ	21.20 ± 0.21 μ	-0.99 ± 0.31	0.39 ± 0.12
SL	3.86 ± 0.14 cms	$4.040.05 \pm$ cms	-0.27 ± 0.69	0.39 ± 0.12
AFL	1090.22 \pm 19.45 days	1098.68 \pm 6.28 days	-33.20 \pm 23.88	29.65 \pm 21.70
ILP	401.45 \pm 22.29 days	395.46 \pm 7.71 days	-11.20 \pm 14.04	23.19 \pm 14.69

The breeding values obtained were Best Linear Unbiased Prediction (BLUP) estimates. The estimated breeding values ranged from -0.43 ± 0.11 kg to 0.25 ± 0.09 kg for birth weight, -5.91 ± 1.02 kg to 3.58 ± 0.72 kg for six months body weight and -2.95 ± 0.63 kg to 3.17 ± 0.90 kg for yearling body weight in Kashmir Merino sheep. The estimated breeding values for greasy fleece yield of first clip and greasy fleece yield of second clip ranged from -0.21 ± 0.05 kg to 0.47 ± 0.04 kg and -0.44 ± 0.05 kg to 0.35 ± 0.05 kg respectively. The estimated breeding values for FD and SL were -0.99 ± 0.31 kg to 0.39 ± 0.12 kg and -0.27 ± 0.69 kg to 29.65 ± 21.70 kg respectively. The same parameter for reproduction traits was observed between -33.20 ± 23.88 days to 29.65 ± 21.70 days for AFL and -11.20 ± 14.04 days to 23.19 ± 14.69 days for ILP. The result of the present study was in line with findings of the Hussain (2006) who reported breeding value of sires ranged between -0.447 to 0.216 for birth weight, -1.357 to 2.440 for six months body weight and -1.686 - 2.089 for yearling body weight in Thalli sheep. The genetic phenotypic and environmental trends are presented in Table 2.

A negative genetic trend was observed for BWT, 6-MWT, GFY-2, SL & AFL whereas positive genetic trends were observed for 12-MMW, GFY-1, FD and ILP in the present study. All genetic trends obtained were non-significant except for fiber diameter and staple length. Declining genetic trends may mainly be attributed to due to increased inbreeding coefficient and loss of heterosis on the farms. Non-significant trends indicate that effective selection may not have taken place for the said breed over the years. Gopal *et al.* (2000) while studying Marwari sheep in also reported negative genetic trend for birth weight. Singh and Dhillon (1991) also reported negative genetic response (-0.136 kg) for birth weight in Avivastra sheep. Parihar (2013) in Magra also found negative genetic trend for six months body weight.

Table 2: Genetic, phenotypic and environmental trends

Trait	Trend	Trend/ period	F value	P value	R ²
BWT	Phenotypic trend	- 0.045 (kg)	4.73	0.082	0.0486
	Genetic trend	-0.012 (kg)	0.89	0.398	0.182
	Environmental trend	- 0.052 (kg)	52.96	0.001	0.914
6-MWT	Phenotypic trend	0.186 (kg)	5.69	0.063	0.532
	Genetic trend	-0.024 (kg)	0.03	0.866	0.008
	Environmental trend	0.152 (kg)	16.36	0.01	0.766
12-MWT	Phenotypic trend	0.102 (kg)	0.56	0.486	0.0101
	Genetic trend	0.190 (kg)	1.85	0.245	0.316
	Environmental trend	0.049 (kg)	0.15	0.711	0.03
GFY-1	Phenotypic trend	0.015 (kg)	8.73	0.032	0.0633
	Genetic trend	0.001 (kg)	0.01	0.936	0.0002
	Environmental trend	0.017 (kg)	50.05	0.001	0.909
GFY-2	Phenotypic trend	- 0.007 (kg)	0.25	0.64	0.047
	Genetic trend	-0.003 (kg)	0.02	0.894	0.005
	Environmental trend	- 0.008 (kg)	2.63	0.166	0.344
FD	Phenotypic trend	- 0.005 (μ)	0.29	0.611	0.056
	Genetic trend	0.024 (μ)	9.16	0.039	0.696
	Environmental trend	- 0.032 (μ)	14.09	0.013	0.686
SL	Phenotypic trend	- 0.006 (cms)	0.15	0.713	0.03
	Genetic trend	- 0.045 (cms)	9.05	0.04	0.694
	Environmental trend	0.011 (cms)	0.54	0.495	0.098
AFL	Phenotypic trend	- 3.071 (days)	0.25	0.637	0.48
	Genetic trend	-12.411 (days)	2.01	0.216	0.287
	Environmental trend	9.343 (days)	5.37	0.068	0.518
ILP	Phenotypic trend	2.850 (days)	10.65	0.031	0.727
	Genetic trend	2.383 (days)	5.63	0.077	0.585
	Environmental trend	0.467 (days)	0.78	0.426	0.164

Arora *et al.* (2010) in Malpura sheep, Mokhtari *et al.* (2010) in Kermani sheep, Balasubramanyam *et al.* (2012) in Madras red, Mohammadi and Rostam (2015) in Zandi sheep and Mallick *et al.* (2016) in Bharat Merino sheep also reported the positive genetic trend for 12-MMW. Balasubramanyam *et al.* (2012) and Venkataramanan (2013) also reported positive genetic trends for yearling body weight. Malik *et al.* (2018 b) also found negative genetic trends for birth weight, six months body weight, and yearling body weight and greasy fleece weight. Positive genetic trend for ILP was also found by Malik *et al.* (2018). The trend estimates for birth weight were not significant. Non-significant genetic trends for production and reproduction traits indicate that proper selection for improvement was not applied during past. Arora *et al.* (2010) estimated non-significant genetic trend birth. Di *et al.* (2014) also reported non-significant genetic

changes for BWT and 12-MMW Chinese superfine Merino sheep. The phenotypic trends (Table 2) for 6-MWT, 12-MMW, GFY-1 and ILP were positive whereas negative for BWT, GFY-2, FD, SL and AFL in Kashmir Merino sheep. All phenotypic trends were non-significant except for GFY-1 and ILP. The positive genetic trends can be attributed to high environmental effects. Bappaditya and Poonia (2006) reported that phenotypic trends of birth weight, six-month weight, and fiber diameter were non-significantly in Nali flock of sheep. Negative phenotypic trend was also estimated by Malik *et al.* (2018 b) for BWT. Venkataramanan (2013) also reported negative phenotypic trends for birth weight in Sandyno sheep and positive phenotypic trends for 6-MWT and 12-MMW in Sandyno and Nilagiri sheep. El-Wakel and Elsayed. (2013) also reported negative phenotypic trends for birth weight. Malik *et al.* (2018) also reported positive phenotypic trend for ILP. The environmental trends were positive for 6-MWT, 12-MMW, GFY-1, SL, AFL and ILP and negative for BWT, GFY-2, FD and FD were. The environmental trends were significant for BWT, 6-MWT, GFY-1 and fiber diameter. Malik *et al.* (2018) also reported positive environmental trends for AFL and ILP.

Conclusion

Declining genetic trends for many traits is a matter of concern for breeders and may mainly be attributed to due to increased inbreeding coefficient and loss of heterosis on the farms and non-significant trends indicate that effective selection may not have taken place for the said breed over the years. Therefore, further studies for the estimation of inbreeding across farms as well as the use of advanced biometrical techniques for scientific selection is recommended.

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