Estimates of heritability for growth and wool traits in Marwari sheep at arid region of Rajasthan

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ABSTRACT

Data on 4201 records of Marwari sheep maintained at Arid Region Campus of Central Sheep and Wool Research Institute, Bikaner (Rajasthan) distributed over a period of 15 years (1996-2010) were analyzed for estimation of heritability of growth and wool traits. Traits studied were body weights from birth to yearling, average daily gains between adjacent stages of growth and greasy fleece yield of first and second clip. Heritability estimates from paternal half sib method were 0.23 ± 0.040, 0.65 ± 0.073, 0.83 ± 0.085, 0.72 ± 0.083 and 0.67 ± 0.085 for body weight at birth, 3, 6, 9 and 12 months of ages, respectively, 0.72 ± 0.074, 0.41 ± 0.056 and 0.88 ± 0.093 for average daily gains during 0-3, 3-6 and 6-12 months of ages, respectively and 0.98 ± 0.090 and 0.37 ± 0.065 for greasy fleece yield of first and second clip, respectively. Moderate to high heritability estimates indicated the presence of high genetic variance and low environmental variance. Hence, individual selection may be done effectively for improvement in these traits.

Key words: Average daily gain (ADG), Body weights, Greasy fleece yield (GFY), Heritability estimates, Marwari sheep.

Marwari is one of the renowned sheep breed of arid region of Rajasthan reared for its medium and coarse quality carpet wool and mutton. The breed is well known for its high disease resistance, draught tolerance, capacity to travel longer distances in search of forage and is the lifeline of the communities who rear it (Yadav et al., 2009). The prime basis of any breed improvement programme is effective utilization of genetic variations among the animals. So, estimation of heritability is necessary for predicting response to selection.

Hence, present study was undertaken to evaluate performance and to estimate the heritability of various growth and wool traits in Marwari sheep, so as to generate information that will be helpful in developing future breeding plans for conservation and genetic improvement of the breed.

Pedigree and performance data on 4201 animals used in the present study (2013) was collected from the database of Marwari sheep, maintained at Arid Region Campus (ARC) of Central Sheep and Wool Research Institute (CSWRI), District Bikaner, Rajasthan, over a period of 15 years (1996-2010). The data were divided into five periods viz., P1 (1996-1998), P2 (1999-2001), P3 (2002-2004), P4 (2005-2007) and P5 (2008-2010). Performance traits included in the study were body weight at birth (BWT), three (3WT), six (6WT), nine (9WT) and twelve (12WT) months of age, average daily gain from birth to three (ADG1), three to six (ADG2) and six to twelve (ADG3) months of ages and greasy fleece yield of first (GFY1) and second (GFY2) clip.

Data with any recorded abnormalities and the outliers were removed prior to data analysis. Data were analyzed by least square analysis of variance (LSMLMW; Harvey, 1990) for estimation of heritability. The model included the random effect of sire; fixed effects of period of birth (5 levels), sex of lamb (2 levels) and parity of ewe (5 levels); and ewe weight at lambing was fitted as a covariate.

Heritability estimates for birth weight (BWT) was 0.23 ± 0.040 (n 4201). Lower estimates were reported

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by Nehra and Singh (2006) in Marwari sheep (0.12) and Akhtar et al. (2007) in Hissardale sheep (0.08). Higher estimates were given by Swain et al. (2004) in Bharat Merino sheep (0.25), Mishra et al. (2009) in Malpura sheep (0.29) and Gohil (2010) and Singh (2012) as 0.33 and 0.27 in Marwari sheep, respectively. The moderate heritability estimate suggests that birth weight of Marwari sheep can be improved through selection.

Heritability of weaning weight (WWT) was estimated to be 0.65 ± 0.073 (n 4012). Lower estimates were reported by Nehra and Singh (2006) and Singh (2012) as 0.40 and 0.17 in Marwari sheep, respectively, and Mishra et al. (2009) in Malpura sheep (0.18). Contrast to the above findings, higher estimate was given by Gohil (2010) in Marwari sheep (0.74). It indicates that the selection of the sires and dams on the basis of their own body weights at three months of age might prove quite effective for bringing about genetic improvement. However, the estimate may be inflated upwards as maternal effect is more pronounced up to weaning and thus, this mayn’t be the true additive value and may be containing a proportion of additive maternal effect in it. Heritability for weaning weight was more than birth weight indicating that population was exhibiting more genetic variability than birth weight. Variation in the mother’s milk yield and differences in feeding regime might have caused lower pre-weaning heritability estimates.

The heritability estimates for post-weaning body weights were 0.83± 0.085 (n 3519) at six months (6WT), 0.72±0.083 (n 2893) at nine months (9WT) and 0.67±0.085 (n 2315) at twelve months (12WT) of ages. Higher estimates than the present study was observed by Sharma et al. (2003) in Marwari and Nali sheep (0.84) and Gohil (2010) in Marwari sheep (0.86) at 6WT. At six months, maternal effects are reduced considerably and there is also similar plane of nutrition for all the individuals in the flock. This might have helped to reduce the environmental variability resulting in higher heritability values. Therefore, weight at six months can be considered a good criterion for selecting animals. The estimated h² values at 9WT and 12WT were lower than those estimated by Gohil (2010) in Marwari sheep (0.82 and 0.79, respectively).

Heritability estimates for average daily gain from birth to weaning (ADG1), weaning to six months (ADG2) and six to twelve months (ADG3) of age were reported as 0.72±0.074 (n 4012), 0.41±0.056 (n 3519), and 0.88±0.093 (n 2315), respectively. Singh (2012) reported lower heritability estimates of all these traits as 0.39 ± 0.060, 0.23 ± 0.055 and 0.51 ± 0.074, respectively, in Marwari sheep.

Heritability estimates for greasy fleece yield of first and second clip were reported as 0.98±0.090 (n 3519) and 0.37±0.065 (n 2315), respectively. Parihar (2012) reported lower heritability estimates for both clips as 0.39 ± 0.093 and 0.26 ± 0.079 in Magra sheep, respectively. Joshi (2001) reported lower estimate for first clip and higher for second clip as 0.701 ± 0.151 and 0.956 ± 0.173 in Marwari sheep, respectively.

The moderate to high heritability estimates for all growth and wool traits is indicative of the presence of large amount of variability in the flock that can be exploited through selection for further genetic improvement in the flock. For body weight traits high heritability estimate was obtained at six months of age, which indicated that the present practice of selecting animal at six months of age should be continued in future, as at this stage maternal effects are very less pronounced and also the effect of generation interval can be managed efficiently.

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REFERENCES


