Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

JEZS

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(5): 360-363

Received: 28-07-2019
Accepted: 30-08-2019

Ruhi Meena
Department of Animal Genetics and Breeding College of Veterinary and Animal Science, Navania, Udaipur, Rajasthan, India

Correspondence
Ruhi Meena
Department of Animal Genetics and Breeding College of Veterinary and Animal Science, Navania, Udaipur, Rajasthan, India

Genetic and phenotypic parameters estimates for daily gain traits of Sonadi sheep

Ruhi Meena

Abstract
The aim of present study was to estimate the genetic and phenotypic parameters for average daily gain traits of Sonadi sheep. Records of lambs were collected over a period of four years from Sonadi unit maintained at CVAS Navania (Rajasthan) under Mega Sheep Seed Project. Traits included for the study were ADG-1 from birth to weaning, ADG-2 from weaning to 6 month of age and ADG-3 from 6month to 12 month of age. Low estimates of heritability were observed for all average Daily Gain traits. However, estimates of genetic parameter with high sampling error do not agree with empirical results. The direct maternal genetic correlation (r_{am}) was negative for all average daily gain traits. A negative estimate of σ_{am} resulted in increase in direct and maternal heritability pointing towards cross substitution effect in the partitioning of total variation. The estimates of Phenotypic correlation was observed as 0.13 ± 0.09, 0.13 ± 0.09 and -0.16 ± 0.08 between ADG1-ADG2, ADG1-ADG3 and ADG2-ADG3, respectively. All genetic and phenotypic correlation between daily gain traits showed weak association-ship.

Keywords: Sonadi sheep, heritability, genetic and phenotypic correlation

Introduction
Rajasthan with 9.08 Million of sheep population (Livestock census, 2012) is the 3rd largest sheep rearing state (13.95% of total sheep of India) of the country. However, the inter census period (2007-12) showed 18.86 percent decline in sheep population of Rajasthan. The southern and eastern districts of Rajasthan are home tract of Malpura and Sonadi breeds known for triple purpose *i.e.* milk, meat and wool production. Small and marginal farmers belong to pastoralist community rear the Sonadi Sheep for their livelihood in the region. According to breed survey 2013, the total population of Sonadi was estimated as 0.15 million including 14237 breed able ram (Singh and Sharma, 2017) [1]. Sonadi rams are not available in optimum number in the breeding tract due to cross breeding with Marwari sheep. Sonadi sheep has the unique characteristic of golden fibre and survival on scarce fodder condition during drought. The fleece of Sonadi sheep is extremely coarse and hairy. Belly and legs are devoid of wool. Very little attention has been paid on the overall improvement of Sonadi sheep which has good potential for meat (13.72 kg at slaughter) production, milk (1-1.5 kg/day) and wool (0.5-1.2 kg/annum). On the other hand, Profitabity is important component to make small ruminant production system economically viable. Profitability of flock is influenced by growth and reproduction performance traits. Growth performance is an important indicator for profitability as fast growth rate entails reaching market weight early, which brings a quicker income to the farmer. It also has implication in the reproductive efficiency of individual. Fast growth performance allows individual to breed early and contribute more progeny in its lifetime (Momoh *et al.* 2013) [2]. Lambs weighed more and grew faster than kids, irrespective of the stage of growth. Keeping in view of the above economic consequences of Sonadi sheep, the present investigation was planned to estimates the genetic and phenotypic parameters for growth traits of Sonadi sheep.

Material and Methods
The Data on Growth production records on Sonadi sheep maintained at Mega Sheep Seed Project coordinating Sonadi sheep unit, CVAS Navania, pertaining to period 2014-2017, were utilized for this study. A total record of 519 animals belongs to 258 females and 261 males spread over a period of 4 years from 2014 to 2017 comprised the material for this study. The lambing pattern revealed that the lambing occurred throughout the year. However most of the lambing was observed between September and February months with maximum in the

month of December. On the basis of prevailing lambing pattern, lambing seasons was categorized into two seasons as Major (November to Feb.) and Minor (July to October) lambing season. Data was categorized into four categories for years. The data related to gender of lamb was classified according to male and female. The influence of various non-genetic factors *i.e*. period, sex and season of lambing on average daily gain traits and to overcome the problem of non-orthogonality of effects due to unequal and disproportionate sub-class frequencies least square technique (SPSS 14.0) was employed. Variance and (co)variance components for additive direct and maternal direct effect were estimated by restricted maximum likelihood procedures (REML) using derivative free algorithm fitting an animal model for growth traits. The analysis was worked out by the WOMBAT approach (Meyer 2007) [3]. Univariate animal models were fitted to estimate (co)variance components for all the traits. The direct maternal correlation (r_{am}) was computed as the ratio of the estimates of direct maternal covariance (σ_{am}) to the product of the square roots of estimates of σ^2_a and σ^2_m. The total heritability (h^2_t), was also be calculated for all traits (Willham, 1972) [4].

Results and Discussions

Environmental effects

The least-square means along with standard errors and effects of non-genetic factors on body weight of Sonadi sheep are presented in Table 1. Subjecting the data to least squares ANOVA, Season of lambing showed non-significant effect on pre-weaning and post weaning daily gain traits. Generally, lamb born during the minor lambing season (July-October) showed higher estimates compared to lamb born in major season (November- February). Period of lambing showed a significant effect on all average daily gain traits of Sonadi sheep born in various period. The sex of lamb had highly significant (P<0.001) effect on all average daily gain traits. Male lambs were heavier than female at all development stages. It was observed that difference between weight of male and female lambs was increased as increase in age.

The estimates of various growth traits in accordance with the findings of others (Gowane, 2015) [5]. The findings of present study of effect of non-genetic factors of body weight were in partial or full agreement with the findings of many other workers. Most of the environment factors had significant effect on all average daily gain traits in the present study. Pre-weaning and post weaning daily gain traits among lambs born in different periods and seasons suggest that growth of lambs may be attributed to differences in environmental conditions such as availability of grazing and feeding stuffs in different years and seasons. Lambs born in minor season (July to Oct.) were heavier than those born in major season (Nov. to Feb.) due to the availability of favorable environment to the developing fetus when good quality grasses are available during July to October months. The difference in body weight between male and female with the advancement of age might be due to the increasing difference in endocrine system.

Table 1: Season, period and sex wise Least squares means and standard errors of growth traits of Sonadi sheep

Effect	ADG1 (0-3 months)	ADG2 (3-6 months)	ADG3 (6-12 months)
N	373	249	136
μ	91.31± 0.25	66.07± 2.45	55.35±
Season	NS	NS	NS
Season I	91.31±3.19	48.09±3.38	55.35±2.45
Season II	92.05±3.62	49.93±3.77	56.12±2.81
Period	***	***	***
I	41.61±2.70	65.96±2.98	55.73±2.13
II	102.30±2.41	49.01±2.99	27.55±2.30
III	95.45±2.52	55.15±3.62	48.58±10.29
IV	127.36±11.4		
Sex	***	***	***
I	95.70±3.3	54.43±3.48	65.19±2.84
II	87.66±3.43	43.59±3.48	46.27±2.42

* P<0.05; ** P< 0.01*** P<0.001

Genetic Effect

Estimates of variance components and genetic parameter of average daily gain traits for appropriate animal models for Sonadi sheep are presented in Table 2, 3 and 4. On the basis of log L values, maternal genetic and permanent effect model with correlated direct and maternal genetic ($\sigma_{am}\neq0$) component can be considered as the best fit model for explained the variance and covariance components of all traits. The direct heritability was recorded as low estimate for all average daily gain traits.

High sampling error of variance and covariance component was observed for all traits. It may be due to small number of animals and low number of progeny per family. Average number of progeny per dam was very low. Similar to the present findings, (Meyer, 1992) [6] observed that sampling error of variance components was influenced by number of families, number of dam per sire and number of progeny per dam.

Average Daily Gain during pre-weaning period (ADG-1)

Direct heritability was estimated as 0.04 by fitting the simple additive (Model I) and uncorrelated covariance between direct and maternal genetic (model II, IV and V) with same log L value (-1365.98). Fitting non-zero correlated covariance between direct and maternal effect in addition to maternal genetic and permanent effect increased the value of log L (-1365.81). On the basis of Log L value model VI can be considered as best fitted model for average daily gain (ADG1) but high negative estimates (-1.00 ± NE) was observed for genetic correlation between direct and maternal effect.

The estimated direct heritability for ADG1 from the model VI in Sonadi sheep was 0.10±0.14. The maternal heritability (m^2) was estimated as 0.03 ± 0.48. Higher negative estimates (-1.00 ±NE) was observed for genetic correlation between direct and maternal heritability. Dass and Acharya, (1970) [7] observed the heritability for ADG1 as 0.12±0.20.

Table 2: Estimates of Variance components and heritability (h^2±SE) for average daily gain (0-3m) traits-

Items	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
σ^2_a	21.788	22.201	55.609	22.153	22.21	57.76
σ^2_m		0.001	20.341		0.003	20.315
σ_{am}			-33.623			-34.253
σ^2_c				0.003	0.001	0.001
σ^2_e	536.48	536.10	517.916	536.141	536.09	515.95
σ^2_p	558.27	558.30	560.24	558.30	558.302	559.77
h^2	0.04±0.11	0.04±0.12	0.10±0.14	0.04±0.12	0.04±0.12	0.10±0.14
m^2		0.00±0.08	0.04±0.27		0.00±0.35	0.04±0.48
r_{am}			-1.00±NE			-1.00±NE
c^2				0.00±0.085	0.00±0.36	0.00±0.36
h^2_T	0.03	0.04	0.03	0.04	0.04	0.03
t_m		0.01	0.00	0.01	0.00	-0.43
Log L	-1365.98	-1365.98	-1365.81	-1365.98	-1365.98	-1365.81

Average daily gain (ADG-2)

The inclusion of maternal effect into simple univariate model did not improve the log L value in Model I, II IV and V. Genetic parameter were estimated as 0.16 for direct heritability. However, addition of non-zero correlation ($r_{am} \neq 0$) between direct and maternal effect showed higher Log L value than other models. Model III and VI showed high negative estimates of r_{am} value (-1.00±NE). High negative estimates of between additive and maternal genetic covariance increased the additive genetic variance component resulting higher estimates of direct heritability (0.50±0.29) and maternal heritability (0.22±0.36). The negative correlation between direct and maternal genetic effects may be explained as the negative influence of dams on the maternal ability of their female offspring through overfeeding Koch, (1972) [8]. Estimate of direct heritability was in agreement with the Prince (2010) [9] in Avikalin Sheep and Gowane *et al.* (2011) [10] in Garole cross Malpura sheep.

Table 3: Estimates of Variance components and heritability (h^2±SE) for average daily gain (3-6) traits

Items	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
σ^2_a	122.731	122.639	388.017	122.586	122.659	387.960
σ^2_m		0.003	172.071		0.003	172.469
σ_{am}			-258.389			-258.669
σ^2_c				0.003	0.004	0.002
σ^2_e	640.853	640.932	478.37	640.99	640.91	478.649
σ^2_p	763.58	763.575	780.07	763.57	763.58	780.412
h^2	0.16± 0.15	0.16± 0.17	0.50± 0.29	0.16±0.17	0.16±0.17	0.50 ± 0.29
m^2		0.00± 0.13	0.22± 0.36		0.00± 0.73	0.22 ± NE
r_{am}			-1.00±0.38			-1.00 ± NE
c^2				0.00±0.13	0.00± 0.73	0.00± 0.80
h^2_T	0.16	0.16	0.09	0.16	0.16	0.11
t_m		0.04	0.02	0.04	0.04	-0.84
Log L	-946.44	-946.44	-944.11	-946.45	-946.45	-944.11

Average daily gain (ADG-3)

Variance components and genetic parameters for average daily gain (ADG-3) are presented in Table 4. Total phenotypic variance (σ^2_p = 318.33) was partitioned into additive, maternal permanent and residual effect. Similar log L values were obtained in all models. Genetic parameters were found to be non-estimable. It may be due to small size of data. Prince (2010) [9] reported the low heritability estimates (0.03) in Avikalin sheep.

Table 4: Estimates of Variance components and heritability (h^2±SE) for average daily gain (6-12) traits

Items	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6
σ^2_a	0.002	0.364	0.039	0.002	0.003	0.091
σ^2_m		0.005	0.15		NE	0.217
σ_{am}			-0.073			-0.140
σ^2_c				0.008	0.008	0.001
σ^2_e	318.32	318.32	318.23	318.32	318.32	318.28
σ^2_p	318.33	318.33	318.35	318.33	318.33	318.45
h^2	0.00 ±0.29	0.00±0.30	0.00±0.30	0.00±0.30	0.00±0.30	0.00±0.30
m^2		0.00±0.17	0.00±0.41		0.00±0.00	0.001±0.00
r_{am}			-0.95±NE			-0.99±NE
c^2				0.00±0.17	0.00±0.17	0.001±0.00
h^2_T	0.00	0.00	0.00	0.00	0.00	-0.00
t_m		0.00	0.00	0.00	0.00	0.00
Log L	-454.41	-454.41	-454.41	-454.41	-454.41	-454.41

Correlations estimates

The genetic and phenotypic correlations among average daily gain at different ages are presented in Table5. Genetic correlation among daily gain traits were presented above the diagonal and phenotypic correlations below the diagonal in the table.

The estimates of genetic correlation were observed as 0.94 ±NE, -0.94 ±NE and -1.00 ± NE for ADG1-ADG2, ADG1-ADG3 and ADG2-ADG3, respectively. Phenotypic correlations was estimated as 0.13 ± 0.09, 0.13 ± 0.09 and -0.16 ± 0.08 between ADG1-ADG2, ADG1-ADG3 and ADG2-ADG3, respectively. All genetic and phenotypic correlation between daily gain traits showed weak association-ship.

Table 5: Genetic (above Diagonal) and Phenotypic (below diagonal) correlation among Daily Gain Traits

Parameters	ADG1	ADG2	ADG3
ADG1	-	-0.94±NE	-0.94±NE
ADG2	0.13±0.09	-	-1.00±NE
ADG3	0.13±0.09	-0.16±0.07*	-

*$P<0.05$ ** $P<0.01$ ***$P<0.001$

Conclusion

The results obtained in this study have demonstrated the importance of non-genetic factors as source of variation in average daily gain traits. Most of the non-genetic factors influenced the body weight of sheep therefore measures to be taken for standardizing the management of flock for sustainable growth. However, estimates of genetic parameter with high sampling error do not agree with empirical results. During genetic evaluation, family size and number of progeny should be considered for low sampling error in dataset. All genetic and phenotypic correlation between daily gain traits showed weak association-ship.

References

1. Singh PK, Sharma A. Assessment of Degree of Endangerment of Livestock Breed in India. Indian Journal of Animal Science. 2017; 87(3): 316-323.
2. Momoh OM, Rotimi EA, Dim NI. Breed effect and non-genetic factors affecting growth performance of sheep in semi-arid region of Nigeria. Journal of Applied Biosciences. 2013; 67:5302-5307.
3. Meyer K. WOMBAT-A tool for mixed model analyses in quantitative genetics by restricted maximum likelihood (REML). Journal of Zhejiang University Science B. 2007; 8:815-821.
4. Willham RL. The role of maternal effects in animal breeding: III. Biometrical aspects of maternal effects in animals. Journal of Animal Science. 1972; 35:1288.
5. Gowane GR, Prince LLL, Lopes FBC, Sharma RC. Genetic and phenotypic parameter estimates of live weight and daily gain traits in Malpura sheep using Bayesian approach. Small Ruminant Research. 2015; 128:10-18.
6. Meyer K. Variance components due to direct and maternal effects for growth traits of Australian beef cattle. Livestock Production Science. 1992; 31:179-204.
7. Dass GS, Acharya RM. Growth of Bikaneri sheep. Journal of Animal Science. 1970; 31:1-4.
8. Koch RM. The role of maternal effects in animal breeding. VI. Maternal effects in beef cattle. Journal of Animal Science. 1972; 35:1316-1323.
9. Prince LLL, Chopra Ashish, Gowane GR, Arora AL. Factors affecting growth in Avikalvin sheep. Indian journal of animal science. 2010; 87:1104-1108.
10. Gowane GR, Chopra A, Prince LLL, Paswan C, Arora A L. Genetic analysis for growth traits of prolific Garole x Malpura (GM) sheep. Tropical Animal Health and Production. 2011; 43:299-303.