Environmental and Genetic Effects on Early Growth Traits in Moghani Sheep Breeds

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Abstract: The effects of environmental factors on early growth traits (birth weight, weaning weight, body weight at 6 months of age and daily gain from birth to weaning and weaning to 6 months of age) using 10432 records in Moghani sheep breed were studied and Genetic and Environmental variance component were estimated using 8468 records of Jafariabad Animal Breeding Station from 1999 to 2004. Birth year on all traits and dam age had significant effect only for birth and weaning weight. Sex of lambs and birth type had no significant effect only daily gain from weaning to 6 months of age. Additive genetic direct variance, maternal environmental variance and heritability were estimated by REML fitting two different Animal models. The estimate of maternal environment variance was higher than additive genetic direct variance in some traits. Estimates of direct heritability for all traits were low.

Key words: Environmental and genetic factor, growth traits, Moghani sheep

INTRODUCTION

Moghani is an Iranian fat-tailed sheep and its main breeding center is Moghan plain on the North East of Azarbayjan and West of Caspian sea and categorized in meat-wool type breed (Saadat Nori and Siah Mansour, 1989; Tavakkolian, 2000). The early growth traits (Birth Weight (BW), Weaning Weight (WW), Body Weight at 6 months of age (BW6)) is an important role in productivity and is one of the major selection traits in this breed.

These traits are known to be influenced by direct and maternal genetic effects as well as by environmental effects. A number of reports indicate considerable maternal effects for these traits in sheep (Hassen et al., 2003; Nasholm, 2004; Van Vleck et al., 2003). From the mother's perspective, maternal effects on progeny performance result from maternal traits controlled by her genotype and associated environmental factors. Therefore, these effects are divided into genetic and environmental components. However, from the side of the offspring, maternal effects are reflected as environmental (Szwaczowski et al., 2006). Therefore, it is essential for genetic assay, selection programs, animal breeding strategy, breeding value estimation and mating strategy that estimates these components and correcting data for this effects.

There are many reports for genetic parameters in other breed sheep, but in Moghani sheep there is a

few report and nor in order to multiple traits analysis (Cloete et al., 2002; Saadat Nori and Siah Mansour, 1989).

The objective of this research was to estimate direct additive genetic variance as well as non-genetic effects on early growth traits. Maternal environmental variance was also estimated.

MATERIALS AND METHODS

The effects of environmental factors on BW, WW, BW6, Daily Gain from Birth to Weaning (DGB-W) and Daily Gain from Weaning to 6 months of age (DGW-6) using 10432 records of Moghani breed in Jafariabad Sheep Breeding and Genetics Station in East Azarbayjan in related of Jahad Organization were studied from 1999 to 2004. The effects of genetic factors on these traits were estimated using 8468 records with DFREML and Animal model method due to improper saving information and unknown pedigree in some data. Statistical analysis of data for the understudied traits was done using SPSS software and the following model.

\[ Y_{ij} = \mu + YS_i + S_j + B_k + A_l + e_{ij} \]

Where:

- \( Y_{ij} \) = Observation of each trait
- \( \mu \) = Mean of trait
- \( YS_i \) = ith year-season of fixed effect (included 12 classes)
The significant effect of environmental factors can be influenced phenotypic data for growth traits and therefore, it is necessary that these effects in genetic assay models in this breed.

The breeding of Moghan sheep is very depending on pasture condition and considerate to unstable environmental such as difference in raining, humidity and temperature in different years which effect the quality and quantity of pastures and situation of ewes' breeding and her milk production will cause to significant effect of year on all traits. This trends were mentioned in many of breeds such as Baluchi (Yazdi et al., 1998) and Afirno (Snyman et al., 1995) and Horro and Menz sheep (Tibbo, 2006).

According to many of study, birth weight increased significantly from the first to third parity, was higher for lambs born as singles than multiples and for male than female lambs (Tibbo, 2006; Mavrogenis, 1996; Yazdi et al., 1998) that correspond to results of this study can be caused by higher body condition in older ewes, sexual male hormones in ram lambs and higher competition in multiples.

The significant effect of dam age on early growth traits have been published with many scientists such as Olthoff and Boylan (1991), Snyman et al. (1995), Yazdi et al. (1998) and Esmaeili Zade et al. (2002) and shown that this effect in different of ages is a curve status and between 4 to 6 years of age is a optimal condition.

The effects sex and birth type for DGW-6 in this study are opposite to few study (Snyman et al., 1995; Yazdi et al., 1998) because inaccuracy in weighting the lambs. Moreover BW6 and DGW-6 in lambs from ewes with 3 to 6 years old were higher than other ages in some study (Yazdi et al., 1998; Bathaie, 1994) and its opposite

### RESULTS AND DISCUSSION

**The effects of environmental factors:** The effect of birth year was significant on all traits. The lamb sex and birth type don’t significant only for DGW-6 and dam age was significant only for BW and WW (Table 1).

### Table 1: Least square means and standard errors for early growth traits

<table>
<thead>
<tr>
<th>Sources</th>
<th>BW (kg)</th>
<th>WW (kg)</th>
<th>BW6 (kg)</th>
<th>DG6-B (kg)</th>
<th>DG6-W (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.51±0.01</td>
<td>20.73±0.10</td>
<td>34.33±0.15</td>
<td>0.180±0.002</td>
<td>0.151±0.001</td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>4.62±0.03</td>
<td>-</td>
<td>-</td>
<td>37.38±0.33</td>
<td>0.186±0.002</td>
</tr>
<tr>
<td>2000</td>
<td>4.73±0.14</td>
<td>21.83±0.21</td>
<td>36.82±0.37</td>
<td>0.169±0.002</td>
<td>0.180±0.002</td>
</tr>
<tr>
<td>2001</td>
<td>4.53±0.04</td>
<td>19.78±0.20</td>
<td>36.73±0.22</td>
<td>0.189±0.002</td>
<td>0.167±0.001</td>
</tr>
<tr>
<td>2002</td>
<td>4.74±0.03</td>
<td>19.21±0.21</td>
<td>31.62±0.29</td>
<td>0.160±0.002</td>
<td>0.138±0.001</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>-</td>
<td>22.03±0.21</td>
<td>31.83±0.25</td>
<td>0.169±0.001</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.32±0.02</td>
<td>19.64±0.13</td>
<td>31.70±0.17</td>
<td>0.170±0.001</td>
<td>0.134±0.001</td>
</tr>
<tr>
<td>Male</td>
<td>4.69±0.02</td>
<td>21.74±0.14</td>
<td>36.73±0.22</td>
<td>0.189±0.002</td>
<td>0.167±0.001</td>
</tr>
<tr>
<td>Birth type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>4.59±0.02</td>
<td>22.16±0.11</td>
<td>35.44±0.19</td>
<td>0.193±0.001</td>
<td>0.147±0.001</td>
</tr>
<tr>
<td>Twin</td>
<td>4.09±0.02</td>
<td>18.35±0.15</td>
<td>32.36±0.25</td>
<td>0.158±0.002</td>
<td>0.156±0.001</td>
</tr>
<tr>
<td>Dam age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 years</td>
<td>4.27±0.05</td>
<td>20.07±0.29</td>
<td>32.29±0.44</td>
<td>0.175±0.003</td>
<td>0.147±0.002</td>
</tr>
<tr>
<td>3 years</td>
<td>4.59±0.04</td>
<td>21.14±0.26</td>
<td>34.60±0.44</td>
<td>0.184±0.002</td>
<td>0.149±0.002</td>
</tr>
<tr>
<td>5 years</td>
<td>4.64±0.05</td>
<td>20.60±0.32</td>
<td>34.36±0.48</td>
<td>0.177±0.003</td>
<td>0.152±0.002</td>
</tr>
<tr>
<td>7 years</td>
<td>4.44±0.07</td>
<td>21.36±0.39</td>
<td>35.51±0.59</td>
<td>0.188±0.003</td>
<td>0.157±0.002</td>
</tr>
<tr>
<td>9 years</td>
<td>4.62±0.08</td>
<td>20.97±0.51</td>
<td>33.87±0.71</td>
<td>0.182±0.005</td>
<td>0.148±0.002</td>
</tr>
<tr>
<td>11 years</td>
<td>4.22±0.17</td>
<td>19.33±0.72</td>
<td>33.28±0.91</td>
<td>0.168±0.006</td>
<td>0.155±0.002</td>
</tr>
<tr>
<td>13 years</td>
<td>5.55±0.50</td>
<td>22.00±0.98</td>
<td>34.50±0.66</td>
<td>0.183±0.005</td>
<td>0.139±0.003</td>
</tr>
</tbody>
</table>

*ns = non significant; *p<0.05; **p<0.01; ***p<0.001; ****p<0.0001
with current study that’s could be the consequence of 
inaccuracy in lamb weight and birth date of lamb data files.

Genetic and phenotype parameters: Estimation of 
variance components and genetic and phenotype 
parameters for two animal models and base on single trait 
analysis are shown in Table 2.

Evaluation of growth traits depends on heritability 
variation arising from additive genetic and maternal 
effects (Wilson and Reale, 2006). It is well known that 
estimates of genetic parameters vary widely across 
authors, year, methods and genetic groups for the same 
traits (Szwaczkowski et al., 2006).

In this study the ewe’s records were not available and 
the number of lambs per ewes was low and therefore it’s 
not possible that estimate maternal genetic effect and 
maternal environment effect accurately.

The results show direct heritability is nearly low for 
al traits because of high environmental variance as the 
result of unfavorable and variable conditions of breeding 
and inaccuracy in pedigree information.

Direct heritability estimates obtained in the present 
study are in agreement with reported for various 
populations by a number of authors. For instant in study 
of Van Vleck et al. (2003) and Hassen et al. (2003) direct 
heritability for birth weight were estimated about 0.27 and 
0.17, respectively. Similar results were also reported by 
Fossecco and Notter (1995) for crossbred sheep and 
indicate the impact of size and structure of data on 
estimates of the parameters.

The estimate of heritability for early growth trait of 
Iranian native sheep was done in many study and direct 
heritability were estimate between 0.06 to 0.45 for BW, 
0.12 to 0.52 for WW, 0.14 to 0.43 for BW, 0.11 to 0.44 for 
DOB-W and 0.15 to 0.34 for DGW-6 (Mavrogenis, 1996; 
Snyman et al., 1995; Esmaeili Zade, 2002) and estimate of 
heritability in this study for early growth traits were in the 
range of other scientist.

The likelihood ratio test based on the two models 
likelihood logarithm shows don’t significant difference 
between two models for all traits and therefore the first 
model is suggested for all traits analysis. The maternal 
environment effect in Moghani breed growth traits is 
don’t significant in this study and corresponding with 
other study that reported the importance of direct genetic 
or maternal environment effects or at least one of these 
and difference between them can be because of don’t 
sufficient records, large number of ewes without records 
and low number of progeny per ewes. However many of 
study such as Vaez Torshizi et al. (1996) on Australian 
Merino and Yazdi et al. (1998) on two herd of Baluchi 
breed have reported significant maternal effects specially 
maternal additive genetic effect on early growth traits.

One of the most popular criteria of goodness of 
model fit is residual variance estimates. These error 
variance estimates for the traits studied are listed in 
Table 2. In the most case, the smallest ones were obtained 
for a model with direct genetic and maternal environmental 
effect. So, the likelihood ratio test indicates that maternal 
environmental effect, should not be include into the linear 
model for genetic evaluation of studied traits in this breed. 
In this study, comparison between residual variance in 
model 2 relative with model 1 show that for WW the 
reduction in variance is maximum and show that for this 
trait the effect of maternal environmental variance is great 
relatively.

Ignoring these effects in the model will cause bias 
and up estimate direct heritability. Also studies show that 
due to difference ewe’s milk production, the effect of 
maternal environment in weaning weight and daily gain 
up to weaning is more than birth weight which is in
accordance with results of this study. However improper information and records could result in up explainable estimation. It is suggested that in understudy herds correct pedigree registration and accurate information collection is necessary for analysis of traits.

CONCLUSIONS

Birth weight is an important economic traits that have an effect on many traits related with it in sheep follow the results of many study and in order to the significant effects of birth year, lamb sex, birth type and dam age, this effects must be mentioned in study of this trait. The Meyer one Animal model is proper to total traits analysis and show that maternal environmental effect fraction (in pregnant or lactation period) is less important than direct genetic effect especially for after weaning age traits. However ignoring this effects cause biases in results.

REFERENCES


