GENETIC PARAMETERS FOR INDIGENOUS SHEEP IN THE UNITED ARAB EMIRATES

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SUMMARY
Genetic parameters of sheep that are indigenous to the United Arab Emirates were investigated in this study. Early growth traits were analyzed for genetic parameters estimation by REML procedures. The traits analyzed were birth weight, weight at 30 days, weaning weight, average daily gain from 1 to 30 days and average daily gain from 30 to 90 days. Four different animal models were fitted for each trait, all including direct additive genetic variance and various combinations of additive and environmental maternal effects. The most appropriate model was chosen based on Loglikelihood ratio tests. Estimates of direct heritability from the most appropriate models were 0.40 for birth weight, 0.25 for weight at 30 days, 0.11 for weaning weight, 0.43 for average daily gain from 1 to 30 days and 0.10 for average daily gain from 30 to 90 days. From these results it can be concluded that genetic improvement can be achieved for preweaning growth of Local lambs.

Keywords: Genetic parameters, growth

INTRODUCTION
Sheep are important meat producing animals in the United Arab Emirates (UAE) as well as many parts of the world. In UAE, indigenous sheep constitutes about 30-35% of the total number of sheep population. Local Sheep, the most common indigenous sheep breed in the UAE, are relatively small to medium in size with a thin tail with slightly thick base and the color is predominantly black (Alhadrmi et al. 1997; Al-Shorepy 2002). The breed is well adapted to a wide range of farming environments.

Accurate estimates of genetic parameters are essential for development selection schemes. Animal models are most commonly used to analyze growth traits of sheep and other livestock species, and typically include direct, additive maternal, and permanent environmental maternal effects (e.g., Hagger, 1998; Notter, 1998; Okut et al., 1999). Studies of various sheep breeds have shown that both direct and maternal genetic influences are important for lamb growth (Burfening and Kress, 1993; Yazdi et al., 1997; El Fadili, et al., 2000; Al-Shorepy 2002). The objectives of this study was therefore to estimate the genetic parameters for lamb weight and daily gain from birth until weaning in UAE indigenous lambs, by fitting four animal models, attempting to separate direct genetic, maternal genetic and maternal permanent environmental effects.

MATERIALS AND METHODS
Data. Data in this study were the accumulated records over the year 1990 to 2002, obtained from the College of Food Systems Experimental Station located in Al Ain area. Management of the flock has been described by Al-Shorepy (2002). The flock included about 80 ewes with 4 local purebreed rams, which produced approximately 120 lambs yearly.
Statistical methods. General Linear Model procedures of Statistical Analysis Systems (SAS 1994) were used to test the significance of the environmental fixed effects. The analytical model included effects of season of birth (summer, winter), sex of the lamb (male, female) and ewe age at lambing with three age classes (<1.5, 1-5, >3 years) for all traits analyzed. Effects of type of birth (single, twin) for BWT, and type of rearing for WT30, ADG1, WWT and ADG2 with three classes (single birth and rearing, twin birth and single rearing, twin birth and rearing) were also included in the model. The models used to estimate genetic parameters included only significant (P<0.05) random and fixed effects.

Variance components and genetic parameters were estimated using DFREML (Meyer 1998). Four different animal models were fitted. Model 1 considered the animal as the only random effects. Models 2 and 3 included in addition to the additive direct effects both the additive maternal and the permanent environmental effects. Model 4 fitted both the additive maternal and permanent environmental effects. The most suitable model amongst all four models was determined based on likelihood ratio tests for each trait (Meyer 1992). To test the significance of random effects and to identify the most appropriate model, likelihood ratio tests were used after deleting each random effect (excluding residual) from the model. The general representation of the full general model (model 4) used is as follows:

\[ y = Xb + Za + Zm + Zc + e, \]

where

- \( y \) is a \( n \times 1 \) vector of records,
- \( b \) denotes the fixed effects in the model with association matrix \( X \),
- \( a \) is the vector of direct genetic effects with association matrix \( Za \),
- \( m \) is the vector of maternal genetic effects with association matrix \( Zm \),
- \( c \) is the vector of permanent maternal environmental effects with association matrix \( Zc \), and
- \( e \) denotes the vector of residual (temporary environmental) effects.

For all models: \( E(y) = Xb \)

RESULTS AND DISCUSSION

Genetic effects. Estimates of genetic parameters of BWT, WT30, WWT, ADG1, and ADG2 for the most appropriate models are presented in Table 1. Estimates of direct (\( h^2 \)) and maternal (\( m^2 \)) heritabilities for BWT were 0.40 and 0.22, respectively. The direct heritability estimates for WT30, ADG1 and ADG2 were 0.22, 0.27 and 0.10, respectively. Estimates of direct (\( h^2 \)) and permanent environmental effect (\( pe^2 \)) effects for WWT were 0.11 and 0.10, respectively.

Fitting similar models on a subset of the data (1994 to 1999) used in this study (year 1994 to 1999), Al-Shorepy (2002) obtained BWT estimates of 0.32 and 0.17 for \( h^2 \) and \( m^2 \). Yazdi et al. (1997) estimated BWT values of 0.20 and 0.07 for \( h^2 \) and \( m^2 \), in Baluchi sheep. Estimates of direct heritability for WT30 and WWT are within the range of reported estimates (Al-Shorepy and Notter 1996; Notter 1998; Saatci et al. 1999). Permanent environmental effects seem to have more important influence on WWT than BWT. However, interpretation of genetic parameter estimates for maternally-influenced traits requires a large number of observation with repeated records on individual ewes and the presence of related ewes in the data, as discussed by Notter and Hough (1997). Direct heritability estimates for average daily gains were similar to those observed by
Mavrogenis et al. (1980) in Chios lambs. The estimates of maternal heritability for average daily gains were low in the current study and comparable to those reported by Marai et al. (1993). However, Näsholm and Danell (1996), using similar models reported higher maternal effects in Swedish Finewool lambs.

### Table 1. Genetic parameter estimates for preweaning growth from the most appropriate model

<table>
<thead>
<tr>
<th>Trait</th>
<th>No. of Records</th>
<th>Model</th>
<th>$\sigma^2_p$</th>
<th>$h^2 \pm$ s.e.</th>
<th>$m^2 \pm$ s.e.</th>
<th>$pe^2 \pm$ s.e.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BWT</td>
<td>610</td>
<td>2</td>
<td>0.48</td>
<td>0.40 ± 0.10</td>
<td>0.22 ± 0.07</td>
<td>0.22 ± 0.07</td>
</tr>
<tr>
<td>WT30</td>
<td>520</td>
<td>1</td>
<td>3.67</td>
<td>0.23 ± 0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WWT</td>
<td>511</td>
<td>3</td>
<td>10.30</td>
<td>0.11 ± 0.05</td>
<td>0.10 ± 0.06</td>
<td>0.10 ± 0.06</td>
</tr>
<tr>
<td>ADG1</td>
<td>517</td>
<td>1</td>
<td>2664.72</td>
<td>0.27 ± 0.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADG2</td>
<td>475</td>
<td>1</td>
<td>1777.52</td>
<td>0.10 ± 0.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$\sigma^2_p$, phenotypic variance, $h^2$, heritability, $m^2$, maternal heritability, $pe^2$, ratio of the permanent environmental variance to $\sigma^2_p$.

**CONCLUSIONS**

This study confirms the importance of implementing an appropriate model to estimate genetic parameters for growth traits. The results illustrated that genetic improvement can be obtained by selection using both direct and maternal breeding values. Since lambs of Local breed attain slaughter weight at about 5 months of age, the results of the present study indicated that weaning weight is probably the best criterion for selection. This criterion should be superior to birth weight or preweaning growth rate since this trait is much less influenced by maternal effects that mask the genetic potential of the lamb for the fast growth.

Although the data set were limited, they still provide important information on variance components in the UAE indigenous breed of sheep. However, further analyses are required to define appropriate models for other possible selection criteria and for the genetic correlation between these traits and other traits in order to improve slaughter weight of the lambs.

**REFERENCES**


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