GENETIC EVALUATION OF IRAQI LOCAL GOATS AND THEIR CROSSES USING MILK TRAITS

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INTRODUCTION

In Iraq, improvement of local goat for milk through selection and/or crossbreeding has been initiated in 1993. Estimation of heritability and repeatability after adjusting records of milk traits for the fixed effects and using relationship matrix is necessary in order to measure gain due to selection and to maximize accuracy of predicted breeding values (Freeman, 1998 ; Sakul *et al*., 1999). Moreover, if the genetic potential of the flock is to be improved, both males and females should be selected (Verma and Chawla, 1988). Animal model (AM) procedure allow simultaneous evaluation of all animals (including those without records) for direct additive genetic merit, not only on the basis of their own records but also through the inclusion of the inverse of the relationship matrix on the performance of all relatives (Sakul *et al.*, 1999). Quaas (1988) and Westell *et al*. (1988) showed how genetic groups could be included in individual animal models to take into account the differences in the average genetic merit of animals imported into a population. This study aimed to evaluate the animals genetically on milk traits by predicting their breeding values individually using the animal model Program.

MATERIALS AND METHODS

This study utilized 451 records of total milk yield (TMY) and test day milk yield (TDM), and 345 records of post weaning milk yield (PWM) from 307 does belonging to four genetic groups (L, D, D×L and S×L) bred at Agargouf Goat Breeding Station during four milking seasons (1995, 1997, 1998 and 2000). Parameters, h^2 and r, were estimated by Restricted Maximum Likelihood (REML) method (Patterson and Thompson, 1971) after adjusting the records for fixed effects (genetic group, age, year and season of kidding, sex of kid and type of birth, and regression on weight). The Animal Model Program (Meyer, 1991) was used to predict breeding values (PBV) for does with records and their parents, and real producing ability (RPA) for does only. Unknown parents were assigned to group effect based on their date of birth (Quaas, 1988; Westell et al., 1988). The model for analysis was :

$$Y= Xb + Za + Wp+ e$$

where Y, b, a, p and e are vectors of observation for each trait, fixed effects, random additive genetic effects, random permanent environmental effects, and residual effects respectively. X, Z and W are the incidence matrices associated with above vectors respectively. Also, it was assumed that a, p and e are normally distributed with zero mean and not correlated.
The mixed model equation for the above model can be written as :

$$\begin{pmatrix} X'X & X'Z & X'W \\ Z'X & Z'Z + tA^{-1} & Z'W \\ W'X & W'Z & W'W + Ik \end{pmatrix} \begin{pmatrix} b \\ a \\ p \end{pmatrix} = \begin{pmatrix} X'Y \\ Z'Y \\ W'Y \end{pmatrix}$$

where $t = (1-r) / h^2$, $k = (1-r) / (r-h^2)$ and A^{-1}= the inverse of the numerator relationship matrix which was set up following rules given by Quaas (1976).
RPA was computed as sum of PBV and permanent environmental effects for each doe. This value can be used to rank does and expected yield in next lactation. The values of PBV and RPA for TMY were ranked in descending order for each sex for selection. Spearman's rank correlation coefficients between the breeding values of studied traits were obtained.

RESULTS AND DISCUSSION
The values of k and t used in AM for each trait were calculated from h^2 and r (Table 1).

Table 1. Values of heritability, repeatability, parameters k and t for the studied traits

Traits	Heritability	Repeatability	Parameter (k)	Parameter (t)
Total milk yield	0.46	0.56	4.4	0.96
Total day milk yield	0.83	0.88	2.4	0.15
Post weaning milk yield	0.53	0.70	1.76	0.57

The overall mean PBVs for TMY, TDM and PWM were -0.864±0.35, -0.005±0.001 and -0.545±0.30 kg respectively (Table 2). The PBVs for TMY, TDM and PWM ranged between –7.97 to 18.17, -0.054 to 0.027 and –6.741 to 5.801 kg in bucks, and ranged between –30.23 to 40.87, -0.104 to 0.257 and –17.24 to 42.39 kg in does, espectively (Table 2).

Table 2. Predicted breeding values (kg) for milk traits

	Total milk yield			Total day milk yield			Post weaning milk yield		
	Bucks	Does	Total	Bucks	Does	Total	Bucks	Does	Total
Animals, no.	31	611	642	31	611	642	31	611	642
Mean	3.589	-1.09	-0.864	-0.024	-0.004	-0.005	-3.719	-0.384	-0.545
S.E.	1.40	0.38	0.35	0.006	0.001	0.001	0.57	0.32	0.30
Minimum	-7.97	-30.23	-30.23	-0.054	-0.104	-0.104	-6.741	-17.24	-17.24
Maximum	18.17	40.87	40.87	0.027	0.257	0.257	5.801	42.39	42.39

According to the recommendation of Kinghorn (1997) and Banks *et al*. (1998) in order to reduce the generation interval and age structure of the flock, all bucks and does were ranked in descending order depending on their PBVs of TMY. Therefore, the expected genetic gain for their offspring will be 14.80 kg (Table 3).

Table 3. Expected genetic gain (kg) of offspring

	Male		Female	
	Bucks	Male kids	Does	Female kids
Selection %	25	75	76	24
Animals selected, no.	8	24	305	95
Average breeding value	13.4	24.8	5.6	14.5
Average breeding value for parents	21.99		7.61	
Expected genetic gain for progeny	14.80 kg			

Spearman's rank correlation coefficients between the PBVs of TMY with each of TDM and PWM were 0.21 and 0.58 ($P<0.01$) respectively, and 0.25 between TDM and PWM ($P<0.01$). Average RPA values of the 307 milking does for TMY, TDM and PWM were –1.461±0.96, -0.003±0.005 and 0.333±1.02, and ranged between –42.22 to 59.32, -0.216 to 0.469 and –35.84 to 91.56 kg respectively. When milking does ranked in descending order according to their RPAs of TMY to choose the best individuals for selection, it was found that their rank is totally the same as PBVs. Thus the same does were selected and their average RPA was –1.201 kg.

CONCLUSION

We conclude that it is feasible to use the animal model for evaluating dairy goats and obtaining averages for predicted breeding values and real productive ability values, which are helpful in ranking and comparing animals.

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