

## 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  $-0.864 \pm 0.35$ ,  $-0.005 \pm 0.001$  and  $-0.545 \pm 0.30$  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, respectively (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  $-1.461 \pm 0.96$ ,  $-0.003 \pm 0.005$  and  $0.333 \pm 1.02$ , 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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