RESTRICTED SELECTION INDICES FOR MILK YIELD AND GROWTH OF KID GOATS IN IRAQ

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INTRODUCTION

Genetic improvement of local goats for milk and meat in Iraq is required to cope with the growing demands of the human population. Restricted selection index (RSI), which maximizes genetic gain in chosen traits while keeping others at zero level, is presented in Lin (1985). Also, it is known that the rate of improvement is directly related to the accuracy with which the goats are ranked, the intensity of selection, the amount of genetic variation available in the trait, and the generation interval. The objective of this study was : 1) to estimate VCV of the studied traits ; 2) to compute genetic gain when selection was on total milk yield (TMY) alone ; 3) to apply RSI for TMY in association with the kid goat weight at 6 months (WT6M), and 4) to construct RSI for increasing WT6M and kid goat weight at 12 months (WT12M) with restriction on kid goat weight at 18 month (WT18M).

MATERIAL AND METHODS

A total of 451 TMY records of 307 does from the four genetic groups (L, D, DL and SL) bred at Agargouf Goat Breeding Station, Baghdad, Iraq, for four milking seasons (1995, 1997, 1998 and 2000) were used in this study. Also, body weights of 998 kids (WT6M, WT12M and WT18M) born at the station during 1994 - 2000 for different genetic groups (L, D, F1 and F2 of DL and SL crosses, Backcross of these crosses with Local (DL × L and SL × L), Damascus (D × DL and D × SL) or Saanen (S × SL and S × DL) and the crosses (SL × DL and DL × SL) were utilized. Genetic and phenotypic variance-covariance (VCV) matrices were estimated by restricted maximum likelihood (REML) method (Patterson and Thompson, 1971) with accounts or the fixed effects. The VCV matrices for TMY with WT6M, and for WT6M and WT12M with WT18M were tested for positive and the non-positive matrices were 'bent" or modified to be positive (Hays and Hill, 1981). Genetic gain was computed when selection was on TMY alone, and also the correlated response for WT6M was calculated (Falconer, 1989). RSIs for increasing TMY with restriction on WT6M, and for increasing WT6M and WT12M with restriction on WT18M were constructed (Lin, 1985).

RESULTS AND DISCUSSION

The modified genetic (GM) and phenotypic (PM) VCV for constructing selection indices were :

$$GM = \begin{array}{c} \\ \text{TMY} \\ \text{WT6M} \end{array} \begin{array}{c} \begin{array}{cc} \text{TMY} & \text{WT6M} \end{array} \\ \begin{pmatrix} 151.76 & -0.431 \\ -0.431 & 0.8941 \end{pmatrix} \end{array} \qquad PM = \begin{array}{c} \begin{array}{cc} \text{TMY} & \text{WT6M} \end{array} \\ \begin{pmatrix} 2100.45 & -83.241 \\ -83.241 & 9.7695 \end{pmatrix} \end{array}$$

The genetic gain due to selection based on TMY only was :

$$RTMY = i\, h_{TMY}\, \sigma_{ATMY} = (1)\,(0.27)\,(12.319) = 3.326 \text{ kg}$$

and the correlated response for WT6M was :

$$CRWT6M = i\, h_{WT6M}\, h_{TMY}\, r_A\, \sigma_{PWT6M} = (1)(0.30)(0.27)(-0.037)(3.126) = -0.0094 \text{ kg}$$

Although, the result was low and negative, RSI to increase TMY of the doe and restriction on WT6M of their kids is important to avoid the weight decreases at such an age. Economical weights (a) depending on the importance of each trait included in the selection will be :

$$a' = [\text{TMY} \quad \text{WT6M}\,] = [\,2 \quad 1]$$

The selection index for unrestricted (bo) and restricted (b*) trait was :

$$bo = Po\text{-}1\ Go\ ao = (2100.45)\text{-}1\ (151.76)(2) = 0.144502$$

$$b^* = P^*\text{-}1\ G^*\ a^* = (9.7695)\text{-}1\ (0.8941)(1) = 0.091520$$

Therefore, the restricted selection index (b) is :

$$b = G^{-1} \begin{pmatrix} Go & 0 \\ 0 & G^* \end{pmatrix} \begin{pmatrix} bo \\ b^* \end{pmatrix} = \begin{pmatrix} 0.144960 \\ 0.161398 \end{pmatrix}$$

which gives the RSI as b= 0.144960 TMY + 0.161398 WT6M.

The correlation between the genetic merit (A) and the index (I) can be computed :

$$r_{IA} = \sigma_I / \sigma_A = 6.364 / 24.621 = 0.26\ **\ \ (P < 0.01)$$

In order to have kids with higher body weights for sale, or to advance their puberty which consequently reduces their generation interval, and to decrease feeding cost for maintenance, another RSI was constructed for increasing the WT6M and WT12M with restriction on WT18M. The modified genetic (GM) and phenotypic (PM) VCV matrices used in the selection index were :

$$GW = \begin{array}{c} \\ \text{WT6M} \\ \text{WT12M} \\ \text{WT18M} \end{array} \begin{array}{c} \begin{array}{ccc} \text{WT6M} & \text{WT12M} & \text{WT18M} \end{array} \\ \begin{pmatrix} 2.0388 & 0.5844 & 0.7968 \\ 0.5844 & 3.4568 & 1.3832 \\ 0.7968 & 1.3832 & 5.4044 \end{pmatrix} \end{array} \qquad PW = \begin{array}{c} \begin{array}{ccc} \text{WT6M} & \text{WT12M} & \text{WT18M} \end{array} \\ \begin{pmatrix} 11.9927 & 9.4153 & 9.0798 \\ 9.4153 & 15.7125 & 11.5903 \\ 9.0798 & 11.5903 & 21.6173 \end{pmatrix} \end{array}$$

In this case, economical weights (a) of each trait can be in the vector a' :

$$a' = [\ \text{WT6M} \quad \text{WT12M} \quad \text{WT18M}\ ] = [\ 3 \quad 2 \quad 1\ ]$$

The selection index for unrestricted (bo) trait is :

$$bo = P^{o-1}\, G^o a^o = \begin{pmatrix} 11.9927 & 9.4153 \\ 9.4153 & 15.7125 \end{pmatrix}^{-1} \begin{pmatrix} 2.0388 & 0.5844 \\ 0.5844 & 3.4568 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 0.329382 \\ 0.354213 \end{pmatrix}$$

whereas the selection index for restricted (b*) trait is :

$$b^* = P^*\text{-}1\ G^*\ a^* = (21.6173)\text{-}1\ (5.4044)(1) = 0.250003$$

Therefore, the restricted selection index (b) can be :

$$b = G - 1 \begin{pmatrix} Go & 0 \\ 0 & G* \end{pmatrix} \begin{pmatrix} bo \\ b* \end{pmatrix}$$

$$b = \begin{pmatrix} 2.0388 & 0.5844 & 0.7968 \\ 0.5844 & 3.4568 & 1.3832 \\ 0.7968 & 1.3832 & 5.4044 \end{pmatrix}^{-1} \begin{pmatrix} 2.0388 & 0.5844 & 0 \\ 0.5844 & 3.4568 & 0 \\ 0 & 0 & 5.4044 \end{pmatrix} \begin{pmatrix} 0.329382 \\ 0.354213 \\ 0.250003 \end{pmatrix} = \begin{pmatrix} 0.292318 \\ 0.309371 \\ 0.127725 \end{pmatrix}$$

So, RSI is : b = 0.292318 WT6M + 0.309371 WT12M + 0.127725 WT18M
The correlation computed between the genetic merit (A) and the index (I) was :

$r_{IA} = \sigma_I / \sigma_A = 2.4856 / 7.4099 = 0.34$ ** ($P < 0.01$)

Aziz (1988) showed that using restricted selection index for increasing 50-day and 100-day body weights with restriction on birth weight of Suffolk and Dorset lambs would reduce lamb losses at birth.

CONCLUSION

Based on the data we analyzed, we conclude that : 1) there was a negative genetic and phenotypic variation between TMY and WT6M, so RSI to increase TMY of the doe without any effect on WT6M of their kids should be made ; and 2) RSI to increase WT6M and WT12M with restriction on WT18M should be used to have kids with higher WT6M for sale, or to be mature earlier to reduce generation interval, with restricted body weight at later ages to decrease feeding cost for maintenance.

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