GENETIC, PHENOTYPIC AND RESIDUAL CORRELATIONS AMONG VARIOUS PERFORMANCE TRAITS IN TEDDY GOATS

Asad Ullah Hyder, Muhammad Sajjad Khan, Pervez Akhtar and Khalid Zafar Gondal[1]
Department of Animal Breeding and Genetics, [1]Department of Livestock Management, University of Agriculture, Faisalabad, Pakistan

ABSTRACT

The data on pedigree and performance records of 1666 Teddy goats maintained at the Livestock Production Research Institute, Bahadurnagar (Okara), Pakistan were analyzed in the present study. Birth weight, weaning weight, yearling weight, pre-weaning growth, age at first kidding and number of kids weaned were the traits analyzed. The bivariate model of derivative-free restricted maximum likelihood (DFREML) computer programme was used to estimate the correlations. Significant genetic correlations were found between birth weight and weaning weight (0.69) and weaning weight and yearling weight (0.61) while phenotypic correlations between birth weight and weaning weight (0.65), birth weight and age at first kidding (-0.61) and weaning weight and yearling weight (0.52) were found significant. The residual correlation indicated a strong negative correlation between birth weight and pre-weaning daily gain and birth weight and age at first kidding.

Key words: Phenotypic and genetic correlations, Performance traits, Teddy goats

INTRODUCTION

The goat is one of the smallest domesticated ruminants which has served mankind earlier and longer than cattle and sheep. It is managed for the production of milk, meat and hair/mohair, particularly in arid, semitropical, tropical or mountainous areas. In temperate zones, goats are kept often rather as supplementary animals by small holders, while commercially cows or buffaloes are kept for milk, cheese and meat, and sheep for wool and meat production. Nevertheless, there are more than 0.6 billion goats world wide presently producing more than 1.9 million tons of meat besides mohair, cashmere, leather and dung; and a large number of people consume meat, milk and milk products from goats world wide. Goat herds, on the other hand low producing though, are an expression of capital assets and wealth in Africa and Asia where they are found in large numbers (Haenlein, 1999). In Pakistan, there are about 48.5 million heads (FAO, 1999). Goats can survive on bushes, trees, desert scrub and aromatic herbs when sheep and cattle would starve to death. Goat herders often have neglected a rational numerical balance between goat numbers and sparse vegetation. Due to these specifications, goats are valued by cattle and sheepmen in the fight against brush encroachment on millions of acres of open range land. The ultimate goal of genetic selection requires exploration of traits of economic interest. The environmental influences, the genotype effects and the bias in these estimates reflects accuracy of selection decisions.

Pedigree and performance records of Teddy goats during 1975-2000 were utilized for the present study collected from the Livestock Production Research Institute (LPRI), Bahadurnagar (Okara) Pakistan. The Institute has its key role in livestock development activities and the herds and flocks at this institute are thought to be serving as gene pool. Though the Teddy goat flocks are present at the public and private farms but no scientific records are maintained regularly. Inclusion of records from other stations would have lead to greater errors resulting in the form of unauthenticated results. Moreover the data available at LPRI, Bahadurnagar was sufficient to draw inferences for further studies. The present study was planned to investigate the genotypic, phenotypic and environmental correlations among various traits of economic importance for Teddy goat breed of Pakistan.

MATERIALS AND METHODS

The data on 1666 Teddy goats kept during 1975-2000 at the Livestock Production Research Institute, Bahadurnagar (Okara) were utilized in the present study. The pedigree and performance records were analyzed statistically for the estimation of genetic, phenotypic and residual/environmental correlations between various performance traits. Bivariate analysis under restricted maximum likelihood was carried out using DFREML (Meyer, 1997).

The various parameters estimated from the bivariate analysis were as follows:

Phenotypic correlation (r_P) = $Cov_{P_i, P_j} / \sigma_{P_i} \sigma_{P_j}$
Genetic correlation (r_G) = $Cov_{A_i, A_j} / \sigma_{A_i} \sigma_{A_j}$
Residual correlation (r_E) = $Cov_{E_i, E_j} / \sigma_{E_i} \sigma_{E_j}$

where,

σ^2_{Ai} = additive genetic variance for the i^{th} trait
σ^2_{Pi} = phenotypic variance for i^{th} trait
σ^2_{Ei} = residual variance for the i^{th} trait
Cov_{Pij} = phenotypic covariance for the traits i and j
Cov_{Aij} = additive genetic covariance for the traits i and j
Cov_{Eij} = residual covariance for the traits i & j

RESULTS AND DISCUSSION

Bivariate derivative-free restricted maximum likelihood analysis was carried out for the estimation of genetic, phenotypic and residual variance and covariance components of the traits recorded.

Birth weight and weaning weight

The estimates of genetic, phenotypic and environmental correlations between birth weight and weaning weight were 0.69, 0.65, and 0.49, respectively (Table 1). It may be concluded from the high estimate of genetic correlation that same genes tend to influence the two traits and that selection for one will improve the other as a correlated response i.e. higher birth weight of kids will generally be associated with higher weaning weight by them later in life. Velez-Naver *et al.* (1977), while analyzing data on Anglo-Nubian kids, reported a significant correlation estimate of 0.35 between birth weight and weaning weight. Siddiqui *et al.* (1981) also reported a high and significant phenotypic correlation among these traits. A high and significant genetic and phenotypic correlation between these two traits (0.40, 0.42) was also reported by Endang (1988), while Ayode and Butterworth (1982) have reported high phenotypic correlation estimate of 0.47. Garcia-Betancourt (1982) reported low phenotypic correlation estimate of 0.28 which was significant while Oka *et al.* (1994) reported a low estimate of genetic correlation viz. 0.14.

Birth weight and pre-weaning average daily gain

The estimates of genetic, phenotypic and environmental correlations between birth weight and pre-weaning average daily gain were 0.07, 0.47, and -0.67, respectively (Table 1). It may be concluded from the low and non significant estimate of genetic correlation that same genes do not influence the two traits and that selection for one will not improve the other as a correlated response. Hermez *et al.* (1997) reported that genetic correlation between birth weight and pre-weaning average daily gains was low which is similar to the findings of the present study. Schoeman *et al.* (1997) also reported the same non significant genetic correlation (0). Mourad and Anous (1998) reported genetic correlation between birth weight and pre-weaning average daily gain to be high ($P<0.05$) while phenotypic correlation was also high ($P<0.01$) and positive.

Birth weight and age at first kidding

The genetic, phenotypic and environmental correlations between birth weight and age at first kidding were -0.09, -0.61, and -0.66, respectively (Table 1). It may be concluded from the low estimate of genetic correlation that same genes do not tend to influence the two traits and that selection for one will not improve the other as a correlated response i.e. higher birth weight of female kids will not generally be associated with age at kidding kidding. No information about this correlation was available in literature reviewed.

Birth weight and number of kids weaned

The genetic, phenotypic and environmental correlations between birth weight and number of kids weaned were 0.08, 0.09 and -0.03, respectively (Table 1). It suggested that birth weight of female kids and number of kids weaned by her are two independent traits, not influenced by each other. Available literature was lying barren in this respect, to give information about this correlation.

Weaning weight and yearling weight

The estimates of genetic, phenotypic and environmental correlation between weaning weight and yearling weight were 0.31, 0.52 and 0.12, respectively (Table 1). It may be concluded from the moderate but significant estimate of genetic correlation that same genes tend to influence the two traits and that selection for one will improve the other as a correlated response i.e. higher weaning weight of kids will generally be associated with higher yearling weight by them later in life. Madell and Patro (1984) also reported high genetic correlation (0.60±0.29) between weaning weight and yearling weight which is similar to the findings of the present study while Darokhan and Tomar (1983) had reported contradictory results i.e. zero genetic correlation. Phenotypic correlation estimate of high value (0.54) was reported by Velez-Naver *et al.* (1977) in Anglo-Nubian goats. Siddiqui *et al.* (1981) had also reported high and significant phenotypic correlation between weaning and yearling weight of Osmanabadi goats.

Yearling weight and number of kids weaned

The genetic, phenotypic and environmental correlation estimates between yearling weight and number of kids weaned were -0.06, 0.08 and 0.02, respectively

(Table 1). It suggests that yearling weight of female kids and number of kids weaned by her are two independent traits, not influenced by each other.

Table 1. Phenotypic, genetic and environmental/ residual correlations among various performance traits of Teddy goats

Description	Estimates
Genetic correlations	
Birth weight and weaning weight	0.69*
Birth weight and pre-weaning ADG	0.07
Birth weight and age at first kidding	-0.09
Birth weight and number of kids weaned	0.08
Weaning weight and yearling weight	0.31*
Yearling weight and No. of kids weaned	-0.06
Phenotypic correlations	
Birth weight and weaning weight	0.65*
Birth weight and pre-weaning ADG	0.47
Birth weight and age at first kidding	-0.61*
Birth weight and number of kids weaned	0.09
Weaning weight and yearling weight	0.52*
Yearling weight and No. of kids weaned	0.08
Residual / environmental correlations	
Birth weight and weaning weight	0.49
Birth weight and pre-weaning ADG	-0.67
Birth weight and age at first kidding	-0.66
Birth weight and number of kids weaned	-0.03
Weaning weight and yearling weight	0.12
Yearling weight and No. of kids weaned	0.02

*Significant at P<0.05
ADG = average daily gain

Based on the findings of this study it can be concluded that incorporation of genetically highly correlated traits in single selection program for rapid genetic improvement of Teddy goats could be better breeding strategy.

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