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Estimation of Genetic Trend for Body Weights at Post-Weaning in Zandi Sheep

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Abstract: Data from body weights at post-weaning were used to genetic trend for Zandi sheep reared in Khojir breeding station of Tehran-Iran over a 16 years period (1993-2008) using animal model for lambs, rams and ewes. Genetic trends were estimated for 6 Months Weight (6MW), 9 Months Weight (9MW) and Yearling Weight (YW) traits. For investigation of each trait appropriate models using 3-trait analysis were applied. Breeding values of animals were predicted by Best Linear Unbiased Prediction (BLUP) methodology under three-trait animal models. Genetic trends of studied traits were estimated by regressing mean of breeding values on birth year. The genetic trends were positive and significant for 6MW, 9MW and YW and were 21, 72 and 65 g year^{-1}, respectively.

Key words: Animal model, body weight, genetic trend, post weaning, Zandi sheep, Iran

INTRODUCTION

Accurate prediction of breeding value of animals is one of the best tools available to maximize response to selection programme. Success of a breeding programme can be assessed by actual change in breeding value expressed as a proportion of expected theoretical change of the breeding value mean for the trait under selection (Jurado *et al*., 1994). Estimation of genetic trend is important to test the efficiency of applied breeding schemes and to provide breeders with information to develop more efficient selection programmes in the future. Genetic trend estimates for body weights of Zandi sheep is unavailable. Hence, the aim of the research was to estimate genetic trends for body weights of Zandi sheep at post-weaning.

MATERIALS AND METHODS

In order to study the genetic trend of body weight traits at post-weaning in Zandi sheep applied information that was collected during 1993-2008 in Animal Breeding Center (Tehran, Iran). The under studied traits were 6 Months Weight (6MW), 9 Months Weight (9MW), Yearling Weight (YW). Description of data structure of the traits studied is shown in Table 1.

During the breeding season (commenced in August) extended ewes that were detected in estrus using teaser rams were mated to fertile rams at the rate of 20-25 ewes per ram. Ewes were kept in the flock for 8 lambing years of age. The rams were used for 3 or 4 breeding years. In order to avoid inbreeding, rams were allocated rotationally to each group of ewes. The details about characteristics and management of Zandi sheep in Khojir breeding station have been described in the previous study (Mohammadi *et al*., 2010).

Table 1: Description of data set with some pedigree informations about for lamb weight at post-weaning in Zandi sheep

	Traits*		
Items	6MW (kg)	9MW (kg)	YW (kg)
Number of records	2634.00	1893.00	1115.00
Number of sire	202.00	188.00	156.00
Number of dam	1045.00	761.00	448.00
Mean	27.55	33.80	36.13
S.D	4.76	5.02	5.86
C.V (%)	17.37	14.56	16.21

6MW: 6 Months Weight, 9MW: 9 Months Weight, YW: 12 months weight, SD: Standard Deviation and CV: Coefficient of Variation

For estimation of variance components simplex procedure was applied also DFREML 3.1 (Meyer, 2000) to fit 3-trait animal models for the studied traits. Genetic analysis of mentioned traits illustrated the importance of maternal permanent environmental effects for 6MWT and only direct genetic effects on 9MWT and YWT. Thus, the most appropriate models obtained were used in the current 3-trait analysis. The most appropriate models for these traits were as follows:

Model I:

$$Y = Xb+Z_1a+e$$

Model II:

$$Y = Xb+Z_1a+Z_2c+e$$

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Where:

y = A vector of records on the different traits

b, a, c and e = Vectors of fixed effects, direct additive genetic effects, maternal permanent environmental effects and the residual effects, respectively

X, Z_1 and Z_2 = Corresponding design matrices associating the fixed effects, direct additive genetic effects and maternal permanent environmental effects to vector of y

The most appropriate model for 6MWT included direct additive genetic effects as well as maternal permanent environment effects (model 2) but the best model for 9MWT and YWT had only the direct additive genetic effects (model 1) in this study.

The model accounting for fixed effects included type of birth (single and twin) only on 6MW, age of dam at lambing (2-8 years old for 6MW, 2-7 for 9MW and 2-6 for YW), sex of lamb (male and female), year of birth (1993-2008) and age of lamb at 6, 9 and 12 months of age (in days) as a covariate for 6MW, 9MW and YW, respectively.

Breeding values of individual animals were predicted with Best Linear Unbiased Prediction (BLUP) methodology. In order to estimate the genetic trends, means of predicted breeding values for lambs in year of birth were calculated. Genetic trends were obtained by regression means of predicted breeding values on year of birth for each trait. Genetic trends analyses were performed with the REG procedure of the SAS 9.1 software package (SAS, 2003).

RESULTS AND DISCUSSION

The estimates of genetic trend (g per year) for mentioned traits are shown in Table 2. In each 3-traits, irregular fluctuations were perceived in yearly mean predicted breeding values and the low and fix predicted breeding values mean from 1993-1995 was apparently due to selection of sires with low breeding value. The genetic trend values estimated illustrate that there has been a significant and positive genetic improvement in studied traits and reveals that selection could be relatively effective.

6-months weight: Means of predicted breeding values of 6MW in each year of birth calculated from the 3-trait analysis are shown in (Fig. 1). Generally, the mean predicted breeding values reflect a rather increase and irregular over time for this trait between 1994 and 2008. Estimate of genetic trend for 6MW in the study was 21 g year^{-1}. Shaat *et al.* (2004) worked on Ossimi sheep in Egypt and reported that genetic trend during 1970-1999 was 21 g year^{-1} for 6MW which the finding of these researchers is exactly in agreement with estimate obtained in the study. Higher estimates were observed by Klerk and Heydenrych (1990) in South African for Dohne Merino sheep (59 g year^{-1}) by Shaat *et al.* (2004) in Egypt for Rahmani sheep (135 g year^{-1}) and by Rashidi and Akhshi (2007) in Iranon Kurdi sheep (129 g year^{-1}).

Table 2: Estimates of genetic trends (g year^{-1}) of body weight at post-weaning

Weight at	GT±SE	R^2 (%)
6 months	21±1.44**	0.94
9 months	72±6.09**	0.91
Yearling	65±5.06**	0.92

GT: Genetic Trend, R^2: Regression fit for genetic trend. **: p<0.01

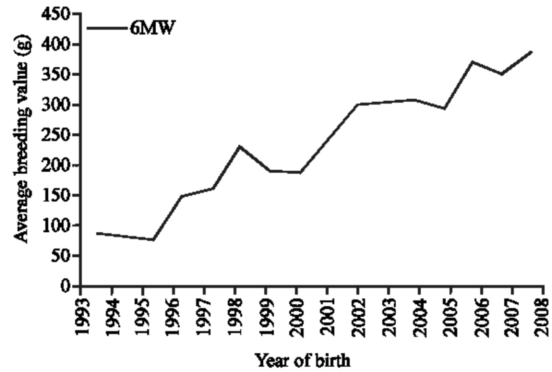

Fig. 1: Means of predicted breedding value of 6MW in each year of birth

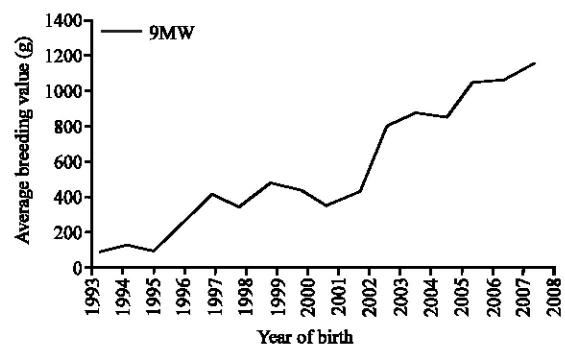

Fig. 2: Means of predicted breedding value of 9MW in each year of birth

9-month weight: In Fig. 2 means of predicted breeding values of 9MW in each year of birth calculated from the 3-trait analysis are depicted.

The genetic trend value estimated for this trait (72 g year^{-1}) was rather low. Estimate of genetic trend for 9MW obtained by Mokhtari and Rashidi (2010) on Kermani sheep was 81 g year^{-1} which it was higher than of the finding in current study.

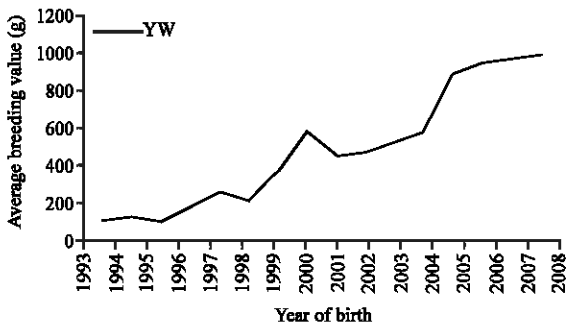

Fig. 3: Means of predicted breeding value of YW in each year of birth

The main reason for insignificant genetic trend for 9MW was presumably due to poor quality and quantity of pasture and low temperature in December (synchronous with the 9 months stage of growth) also, the ground is mostly covered with snow.

Yearling weight: Means of predicted breeding values of YW in each year of birth calculated from the 3-trait analysis are shown in (Fig. 3). Estimate of genetic trend for YW obtained in the present research (65 g $year^{-1}$) was higher than those of 59 g $year^{-1}$ was reported in Dohne Merino sheep by Klerk and Heydenrych (1990). Values of genetic trend estimates reported by Bosso *et al*. (2007) in Djallonke sheep (90 g $year^{-1}$) and by Mokhtari and Rashidi (2010) on Kermani sheep (156 g $year^{-1}$) were higher than of the result.

CONCLUSION

The relatively low genetic progress estimated from this research reflects the actual lack of consistent directional selection for clear selection goals. On the other words, the main reason for get results from studied traits in present study could be the absence of clear and focused selection criteria during 1993-2008.

Also, this study indicates that an effective breeding programme could be resulted more progress in genetic gains of body weight traits at post-weaning in this breed.

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