Selection For Reduce Fat-tailed In Lori-Bakhtiari Sheep

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Introduction

The fat-tail plays an important role in adaptation of sheep raised under the harsh feeding conditions of arid and semi-arid regions, where the availability of foodstuffs, especially good quality roughage, is seasonal (Al Jassim et al. (2002)). The climatic conditions, production systems of nomadic or transhumant pastoralists, poor environmental conditions, economic limitations as well as the requirements of the people forced the sheep producers to select for higher fat-tail weight across generations. Now, in intensive and semi-intensive systems most of the factors contributing of large fat-tail lost their importance and therefore, a decrease in fat-tail size is desirable for producers and consumers. This is mainly because of the possible association between high levels of dietary saturated animal fats and cardiovascular disease (Kempster et al.(1986)). The relative merit of different sheep breeds for meat production is determined by a high proportion of lean and a low proportion of fat and bone in the carcass (Farid. (1991)). Lori-Bakhtiari is a fat-tailed breed of sheep, with a population more than 1.7 million, which is well adapted to hilly and mountain ranges of Bakhtiari region, west of Isfahan stretched out to Southern Zagros Mountain. Relative to other Iranian fat-tailed breeds Lori-Bakhtiari is a large breed, having the largest fat-tail. Fat-tail weight in this breed, is a major component of total body weight and the peresent meat production performance of Lori-Bakhtiari sheep is far for optimal. Success in increase lean tissue formation as well as decreasing fat tail size entails breeding from genotypes that are genetically superior for lean tissue formation and inferior for fat-tail formation. Up now, fat-tail weight trait has not been incorporated into selection objectives for any fat-tail breed of sheep. First, this is because of an absence of reliable estimates of genetic and phenotypic parameters in the relevant breeds, for fat-tail weight and associated traits, which may be used as selection criteria e.g. measurements of fat-tail. Secondly, little is known about the relationship between fat-tail weight and other traits relevant to breeding goals for fat-tail sheep. The aim of the current study was to estimate the genetic trends for fat-tailed weight and body weight of Lori-Bakhtiari sheep.

Material and methods

The selection program was undertaken at breeding station of Lori-Bakhtiari sheep in Chaharmahal and Bakhtiari province, Iran. The data set used in this study was body weight of 4924 lambs at 6 months of age (BW6M), fat-tailed weight (EFTW) and ultrasonic measurement of soft tissue over the 12th rib, 120 mm from the dorsal midline (GR) of 1482 lambs at 6 months of age recorded from a Lori-Bakhtiari research flock in Shahrekord. The

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data for first trait had been collected during eigthteen years, 1990 to 2008, while for other traits had been collected during five years, 2003 to 2008. Flock is managed under semi-migratory or village system. The flock is kept generally from December to May at the station and in this period is fed with alfalfa, barely and wheat stubble indoors. The sheep graze on range and cereal pastures the rest of the year. The breeding period extends from late August to late October (ewes are assigned randomly to the selected rams) and consequently, lambing starts in late January. During pre weaning time, lambs suckle their mothers and from 15 days of age they have access to creep feed *ad-libitum* and they are weaned at an average age of 90 ± 5 days. After weaning male and female lambs are separated. Female lambs are kept on the pasture of cultivated alfalfa, while males are kept indoors and fed using maintenance and growth ration to 6 months of age. Body weight and external fat-tailed dimensions were recorded at 6 month of age. Various external fat-tail dimensions were included: Upper width (UFTW), middle width (MFTW), lower width (LFTW), length (FTL, from the point of attachment to the tip), length of gap (FTGL, from the point which fat-tail split to bilateral lobs to the tip), depth of fat-tail (FTD, from the attachment point of fat-tail to the body to the point of seperating bilateral lobs), upper circumference (UFTC, at the point of attachment of fat-tail to the body) and middle circumference (MFTC, at the point of middle of fat-tail). All fat-tail measurements were done with a measuring tape to the nearest 0.5 cm. All measurements were made while the animal was holden in a standing position. Lambs were slaughtered at 6 months of age in different years. After slaughtering and skinning, all the abdominal and thoracic organs were removed. The fatty tissues surrounding kidney (kidney fat), heart (pericardial fat) and those in the abdominal cavity (omental and mesentery fat) were separated and weighted. The warm carcass was weighed immediately after dressing and removal of offal parts. The carcasses were chilled at 3±2 °C for approximately 18 h, and then cold carcasses were weighed. Then fat-tailed was removed and weighted. Prediction equations were derived for fat-tailed weight by multiple regression analyses performed as follow:

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{e}$$

$$E\,(\mathbf{y}) = \mathbf{X}\boldsymbol{\beta},\ E\,(\mathbf{e}) = 0,\ \mathrm{Var}\,(\mathbf{y}) = \sigma^2_e$$

Where: $\mathbf{y}$, vector of observations for fat-tailed weight; $\boldsymbol{\beta}$, vector of regression coefficients for various external fat-tailed dimensions; $\mathbf{e}$, vector of residual; $\mathbf{X}$, design matrix and σ^2_e, residual variance. For each independent variable multiple regression equations were fitted by using the regression procedure (SAS, 2000). Ultrasonic soft tissue depth measured in live lambs (UGR). All lambs were scanned by the method of Pie Medical Scanner 480 (Pie Medical (1990)). Data were analyzed using multiple traits mixed model procedure. Variance and covariance components were estimated using restricted maximum likelihood (REML) methods (Meyer (2007)). The employed multiple traits animal model was as follows:

$$\mathbf{y_i} = \mathbf{X_i}\,\mathbf{b_i} + \mathbf{Z_i}\mathbf{a_i} + \mathbf{e_i}$$

Where $\mathbf{y_i}$ is a vector of observations for trait i, $\mathbf{b_i}$ is a vector of fixed effects for trait i, $\mathbf{b_1}$, $\mathbf{b_2}$ and $\mathbf{b_3}$ includes year of lambing, age of dam, sex and type of birth of lamb, and age of lamb at evaluation as covariate for body weight at 6 months of age and weight of lambs at

evaluation as covariate for EFTW and UGR at 6 months of age, $\mathbf{a_i}$ is a random vector of direct additive genetic effects of the animals for trait i, $\mathbf{e_i}$ is a vector of random residual effects for trait i, $\mathbf{X_i}$ and $\mathbf{Z_i}$ are known incidence matrices relating the observations to the fixed and random effects in the model. Breeding values of individual animals were predicated with Best Linear Unbiased Predication methodology. Genetic trends were computed by regressing estimated breeding values on year of birth with using the procedure REG of the Statistical Analysis System (SAS (2000)).

Results and discussion

The average, standard deviation, coefficients of variation, estimate of heritability and estimate of genetic trend traits are shown in table 1. Coefficient of variation for EFTW trait was high. Waldron et al (1992) reported that coefficient of variation for fat was 25 percent in the carcass of lambs of Romney and its crosses. It is important to note, that considerable variation exists for growth and especially for fat-tail estimate. Heritability estimates were moderate for BW6M and UGR traits, whereas the estimate of heritability EFTW was relatively high. The estimate of heritability for body weight at 6 months of age was consistent with previous reports (Fogarty (1995); Safari, et al. (2005)). Fogarty (1995) reported heritability estimate range from 0.10 to 0.25 for deep soft tissue on 12th rib. It is important to note, that considerable variation and heritability relatively high exists for fat-tail estimated.

Genetic change was positive for body weight at 6 months of age (155 g/year) that was higher than those of 91 and 135 g/year were reported by Shaat et al. (2004) in Rahmani sheep and Mokhtari and Rashidi (2010) in Kermani sheep, respectively. Genetic trend estimates for EFTW (-40 g/year) and UGR (-0.024 mm/year) were negative. The decreasing genetic trend was low for UGR trait. Therefore, selection would be effective for improvement in carcass composition by decreasing to fat-tailed and subcutaneous fat. Thus, even with positive genetic correlation between body weight and fat-tail it is possible to increase body weight and reduce fat-tail size by multi-trait selection.

Table 1: The average, standard deviation, coefficient of variation, estimate of heritability and of genetic trends traits

Traits	Mean ± SD	CV	h^2	Genetic trend
BW6M	40.11 ± 8.07	13.45	0.26 ± 0.03	155 ± 29(g/year)
EFTW	2.39 ± 1.37	57.49	0.40 ± 0.06	-40 ± 4(g/year)
UGR	8.44 ± 1.90	18.07	0.27 ± 0.06	-0.024 ± 0.008(mm/year)

Conclusion

The estimates of genetic trend obtained for body weight, fat-tail and ultrasonic measurement of soft tissue over the 12th rib traits in present investigation indicated that in Lori-Bakhtiari breed of sheep, genetic improvement through selection could be possible for reducing fat-tail size without loss of body weight and increase subcutaneous fat.

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