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PHENOTYPIC AND GENETIC CHARACTERISTICS OF LONGEVITY IN LORI-BAKHTIARI SHEEP**

M. Vatankhah[1,2,*], F. Zamani[1,2]

[1] Islamic Azad University of Sharekord, Iran.
[2] Agriculture and Natural Resources Research Center, Sharekord, Iran.
*Corresponding author:vatankhah_mah@yahoo.com
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Abstract: Longevity records of 978 Lori-Bakhtiari ewes were collected from a research flock at the Lori-Bakhtiari sheep breeding station during 1989 to 2006. Single-trait animal model used to analyze trait, included fixed effects of year of production, ewe body weight as covariable and random effects additive genetic of animal and residual effects. Phenotypic and genetic trends were estimated as regression of average phenotypic value and breeding value by birth year of ewe. Results show that, 49.80%, 22.49% and 27.71% of breeding ewes left the flock for illness, low production and oldness respectively. The overall mean (± s.e.) of ewe's longevity was 1779.91 (22.10) days. The effect of year of production and ewe's body weight on longevity were significant ($p<0.01$), and longevity increased by 41.84 ± 2.80 days with 1 kg of ewe body weight. Estimation of heritability for longevity was 0.33 ± 0.07. The phenotypic and genetic trends of longevity were significant ($P<0.01$) and estimated as –84.65 and -19.02 days, respectively. Thus, illness is very important reasons to removed ewes from flock. Longevity could be improved by selection, but early life traits is needed to indirect selection for longevity.

Keywords: longevity, heritability, genetic trend, sheep.

Introduction and literature review

The longevity is normally defined as the length of its productive life in the flock, which is the amount of time an animal spends producing (*Raden Van and Klaaskate*, 1993). Longevity reflects the ability of a ewe to avoid being culled for low production, low fertility, or illness and influences the number and cost of replacements required to maintain the flock size. The

benefits of increasing longevity are increased average age of the flock, having more ewes available for sale at the end of their fourth parity, having more ewe lambs to sell, and higher productivity from a slightly older flock age profile (*Conington et al*, 2004). From the perspective of a selection program, longevity increases the efficacy and intensity of selection and the generation intervals. The joint influence of these factors on the genetic progress is often negative. However, despite this negative influence on genetic progress, the optimum net benefit per productive female is obtained with high longevity (*Lobo and Allaire*, 1995). The mean of ewe longevity according to the definition of longevity and culling policy are different in various breed and ranged from 3.43 to 4.83 years (*Brash, et al*, 1994; *Dixit and Singh*, 1998; *Conington et al*, 2001). The magnitude of heritability estimates vary between different ewe longevity trait definitions and among populations studied. They range from 0 to 0.39, most frequent values being around 0.05 (*Burnside et al*, 1984; *Jairath et al*, 1994).

The Lori-Bakhtiari sheep is one of the most common native breeds in the south western part of Iran, with more than 1.7 million head population that having the largest fat-tail size among all of breeds in Iran. As in sheep production, longevity has an important influence on the economic returns, reliable estimates of non genetic effects and genetic parameters of longevity are needed to aid establishing an efficient selection program for improving ewe productivity. Thus, the objective of this investigation was the study of phenotypic and genetic characteristics of longevity in Lori-Bakhtiari sheep.

Materials and methods

The number of 978 records from 298 sires and 440 dams with progeny records used in this study were collected from a research flock at the Lori-Bakhtiari sheep breeding station during 1989 to 2006. The project was started in the Sholi sheep breeding station located in Charmahal and Bakhtiari province, in the spring of 1989 by forming the research flock with about 206 ewes, which had successfully reared at least one lamb, and 28 rams of typical Lori-Bakhtiari type. Flock has been kept under semi-migratory or village system (*Vatankhah et al*, 2007). Ewes were generally removed from flock due to low production, low fertility, or illness and culled at 8 to 9 years of age due to oldness. Rams were kept until a male offspring was available for replacement. In this study longevity was defined as the age of a ewe (day) when it leaves the flock. It is affected by a combination of culling policies and ewe death rates (Table 1).

Mixed model methodology used to analyze trait, included fixed effect year of production, ewe body weight as covariable and random effects additive genetic of animal and residual effects. The choice of fixed effects to be considered was made after testing whether the effects were statistically significant with a linear fixed effects model analyzed with procedure GLM of SAS (*SAS*, 1996). (Co)Variance components and genetic parameters were estimated using the restricted maximum likelihood method based on derivative-free algorithm (*DFREML program of Meyer*, 2000). Fitting a single-trait animal model as follow:

$$\mathbf{y = Xb + Za + e}$$

Where, **y**, **b**, **a** and **e** are the vectors of observations, fixed effects, direct additive genetic effects and residual effects, respectively. Incidence matrices **X** and **Z** related the observations of the trait to the respective fixed effects and additive genetic effects, respectively. The Best Linear Unbiased Prediction (BLUP) of breeding value from trait was prediction. Phenotypic and genetic trend were estimated as regression of average phenotypic and average breeding value by birth year of ewe.

Results of investigation and discussion

The results showed that 49.80%, 22.49% and 27.71% of breeding ewes left the flock for illness, low production and oldness respectively. Table 1 show that 85% of breeding ewes left the flock when they had equal and lower than 7 years of age, which due to reasons of illness and poor production. These values indicated that illness is very important reasons that breeding ewes left the flock and to improve longevity, first of all one should be decreased incidence of illness by improvemet of environmental factors (feeding, health, ...) and genetic resistance to disease.

The mean (± s.e.) of ewe's longevity was 1779.91 (22.10) days, which was higher than 4.4 years for Dorset sheep (*Brash, et al*, 1994), 3.43 and 4.3 years for Bharat Merino and Tsigai crossbred sheep (*Dixit and Singh*, 1998), but approximately equal with 1756 days for Scottish Blackface sheep (*Conington et al*, 2001). The effect of year of production on ewe's lingevity due to variation in climatic, incidence of disease, environmental conditaions and culling policy was significant ($p<0.01$). The least square means of ewe's longevity ranged from 1413.79 days in 2004 to 2162.88 days in 1996. The regression coefficient of longevity on ewe body weight was very significant ($p<0.01$), and longevity increased by 41.84 ± 2.80 days with 1 kg of ewe

longevity ranged from 1413.79 days in 2004 to 2162.88 days in 1996. The regression coefficient of longevity on ewe body weight was very significant ($p<0.01$), and longevity increased by 41.84 ± 2.80 days with 1 kg of ewe body weight. The estimation of heritability (± s.e.) for ewe's longevity was 0.33 ± 0.07, which is in range of reported in literature (0 to 0.39). However estimates for heritability of ewe longevity (defined as days or years in the flock) are 0.06 for Australian Dorset sheep (*Brash et al*, 1994), 0.08 for Scottish Blackface (*Conington et al*, 2001). Estimates are somewhat higher for continuous than for discrete measures. Higher estimates (0.12 to 0.35) have been obtained for lifetime profits. There exist many inconsistencies among different estimates of heritability in the literature. A reason could be the different methods used to get these estimates. The estimation of heritability of ewe's longevity indicated that response to selection for this trait is not slow, but further study are needed to properly address genetic and environmental effects on early growth and ewe productivity to account for their influence on ewe's longevity. Figures 1 and 2 showed the phenotypic and genetic changes and trends of ewe's longevity in different year of ewe birth, respectively. The phenotypic and genetic trends of ewe's longevity were estimated as –84.65 and -19.02 days, respectively. The negative trends (phenotypic and genetic) of ewe's longevity could be due to culling policy, selection strategy and correlated response to direct selection for other traits.

Table 1. Number of ewes in each age group (2 to 9 years of age)[1]

Ewe Age (yr)	No. ewes	Ewes remmoved from flock[2]	Frequency of ewes removed from flock	
			Marginal loss[3]	Cumulative loss[4]
2	978	19	0.019	0.019
3	959	170	0.174	0.193
4	789	178	0.182	0.375
5	611	161	0.165	0.540
6	450	139	0.142	0.682
7	311	165	0.169	0.851
8	146	85	0.087	0.938
9	61	61	0.062	1.000

1) A total of 978 ewes lambed at 2 years of age and had opportunity to remain in the flock until 9 years of age.
2) Ewes that lambed at the given age but were removed from the flock before their next lembing opportunity.
3) Proportion of ewes within an age group that were removed from the flock.
4) Cumulative proportion of ewes removed from the flock after each year of production.

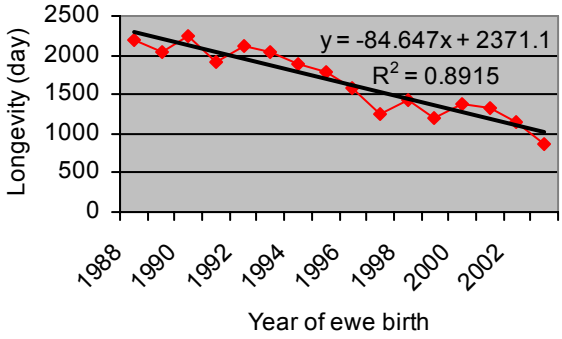

Figure 1. Phenotypic changes and trend of ewe's longevity in different year of ewe birth

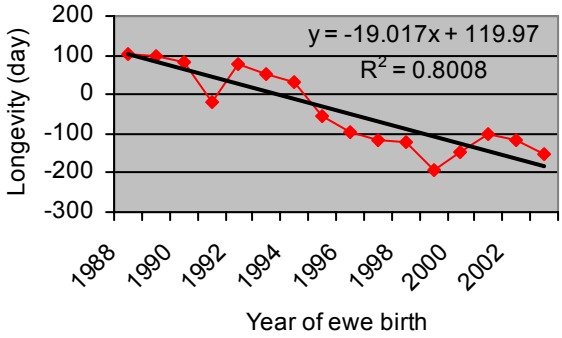

Figure 2. Breeding value changes and trend of ewe's longevity in different year of ewe birth

Conclusion

Illness is very important reasons that breeding ewes left the flock.The heritability of longevity implies that selection for ewes that stay in the flock for a longer of time could incorporate in breeding program. However, the genetic relationships between longevity and other production traits are unclear and currently do not provide a good indicator for early life traits for selection to improve longevity.

FENOTIPSKE I GENETSKE KARAKTERISTIKE OSOBINE DUGOVEČNOSTI OVACA RASE LORI-BAKHTIARI

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Rezime

Dugovečnost je definisana kao uzrast ovce (dana) kada napusti stado. U ovčarstvu, dugovečnost ima značajan uticaj sa ekonomskog stanovišta. Pouzdane procene negenetskih i genetskih parametara na dugovečnost su neophodne kako bi se ustanovio program selekcije sa ciljem poboljšanja produktivnosti ovaca. Podaci o dugovečnosti za 978 lori-bakhtiari ovce, 298 ovnova-očeva i 440 ovaca-majki sa podacima za potomstvo su korišćeni u ovom ispitivanju i dobijeni u stanici za odgoj ovaca rase lori-bakhtiari u periodu od 1989 do 2006. Korišćen je animal model sa jednom osobinom za analizu, uključujući fiksne uticaje godine proizvodnje, telesne mase ovaca kao kovarijabilne vrednosti i slučajni aditivni genetski efekti životinje i rezidualni efekti. Fenotipski i genetski trendovi su ocenjivani kao regresija prosečne fenotipske vrednosti i priplodne vrednosti u godini rođenja ovce. Rezultati pokazuju da 49.80%, 22.49% i 27.71% priplodnih ovaca je napustilo stado zbog bolesti, niske proizvodnje i starosti, respektivno. Ukupna srednja vrednost (± s.e.) za osobinu dugovečnosti ovce je bila 1779.91 (22.10) dana. Uticaj godine proizvodnje i telsne mase ovce je bio značajan ($p<0.01$), i dugovečnost se povećavala za 41.84 ± 2.80 dana sa svakim 1 kg telesi i genetski trendovi za ovu osobinu su bili signifikantni ($P<0.01$) i procenjeni u vrednosti –84.65 i -19.02 dana, respektivno. Znači, bolest je veoma važan razlog zbog kojeg su ovce napuštal stado. Naslednost dugovečnosti ukazuje da selekcija ovaca koje ostaju u stadu duži period bi mogla da bude uključena u odgajivački program. Međutim, genetski odnosi između dugovečnosti i ostalih proizvodnih osobina nisu jasni i trenutno ne obezbeđuju dobrog indikatora za osobine u ranijem periodu života koji bi se mogao iskoristiti u slekeciji radi poboljšanja dugovečnosti.

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