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EFFECTS OF ENVIRONMENTAL FACTORS ON GROWTH TRAITS IN MAKUIE SHEEP

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Abstract: The Makuie sheep is a fat-tailed sheep breed which can be found in the Azerbaijan province of Iran. non- genetic parameters obtained from data collected from 1993 to 2012 Makuie sheep research station of West Azerbaijan province in Iran were evaluated in the present study. The non- genetic parameters for birth weight, weaning weight (3 months), 6-month, 9-month and yearling weight traits were estimated based on 19 years of data using SAS software**.** Least squares means were 4.11± 0.88, 21.50±3.50, 27.18±3.53, 28.57±4.44 and 34.21±3.88 kg for weight at birth, 3, 6, 9 and 12 month, respectively. The birth year had a significant effect on all traits while the effect of birth type significantly affected all traits ($p<0.05$). The lamb's sex had a significant effect on all traits ($p<0.05$). The effect of dam's age had a significant effect on all traits except 9- month ($p<0.05$). Results showed that non- genetic factors have an important role in expressing of genetic potential in the lambs.

Keywords: Body weight, non- genetic factors, Makuie sheep.

Introduction

Makuie sheep is a native breed of Iran and can also be found in Turkey (called as Ak Karaman). Its total population is estimated at approximately 2.7 million *(Abbasi and Ghafouri Kesbi, 2011)*. They are fat-tailed sheep with a medium- sized body, white in color with black rings around the eyes, nose and feet *(Saadatnoori and Siahmansoor, 1986)*. They are kept in the Eastern and Western provinces Azerbaijan and their main products are meat, wool and milk *(Saadatnoori and Siahmansoor, 1986)*. Whenever the weather condition is suitable, these animals feed after grazing pasture, alfalfa and clover, while in cold seasons they are fed manually, eating alfalfa, wheat straw, barley straw, barley barn and other extra forages *(Nourian, 2000)*. Investigation and determination of environmental factors that have effect on traits and correction of records for these factors cause estimated genetic parameters and breeding value to show animal's

genetic potential *(Osman, 1965; Rashidi et al., 2008)*.

Effect of birth year, lamb's sex and birth type has been reported significantly in breeds like Kermani *(Rashidi et al., 2008)*, Merino *(Dixit et al., 2001)*, Horro *(Abegaz et al., 2005)* and Sabi *(Matika et al., 2003)* and sheep farm of Institutefor Animal Husbandry, Belgrade-Zemun *(Petrović et al.,2009)*. The effect of dam age has been reported significantly more in breeds such as Baluchi *(Fadilli et al., 2000)*, Zandi *(Kalantar, 2003)*, Kermani *(Rashidi et al., 2008)*, Merino *(Dixit et al., 2001; Ozcan et al., 2005)* and Horro *(Abegaz et al., 2005)*. Reference *(Nourian, 2000, Yazdi et al., 1997, Neser et al., 2001)* reported that herd affects body weight significantly. The objective of this study was to identify the effects of non- genetic factors on weight traits and average daily gain in different ages of Makuie sheep.

Material and method

In order to study the effect of non- genetic factors on growth traits in Makuie sheep, we applied information that was collected from 1993 to 2012 (19 years) in Makuie's Breeding Station. This includes number of animal, birth year, lamb's sex, birth type and age of dam. In addition, records of birth weight (BW), weaning weight (WW), weight at month 6 (6 MW), weight at month 9 (9MW) and weight at yearling (YW). Characteristics of the data structure are summarized in table 2. After birth, the lambs feed manually on alfalfa mill, high quality forage and dams accompany their ewes during grazing in pasture. Weaning was at approximately age of month 3. Mating was controlled and at the birth of lambs register pedigree information (animal code, sire and dam), birth information (date of birth, lambs' sex, birth type) and records (birth weight, weaning weight, and month 6 weight, month 9 weight and yearling weight).

A univariate procedure of SAS was used to check for normality. The SAS software was used for normality test. The data of all traits was normal. Statistical model for studying the effect of these factors were:

$y_{ijklm} = \mu + Y_i + A_j + S_k + T_l + H_m +$ interaction between factors $+ e_{ijklm}$

where y_{ijklm} is records on the different traits, μ = mean, Y_i = effect of birth year (1993- 2012), S_k = effect of lamb's sex (male and female), T_l = effect of birth type (single and twin), A_j = effect of dam age at lambing (2 - 6 years old) details of classes in Table 1, H_m = effect of herd and e_{ijklm} is residual effects.

Table 1. Least squares means and their standard error of mean for dam age at lambing of Makuie sheep

Dam age at lambing	N	BW	WW	6WW
2	14399	4.19±0.81	21.06± 3.19	26.71± 3.39
3	6244	4.22± 0.83	22.31± 2.85	27.42± 3.40
4	2397	4.17± 0.84	21.43± 2.78	27.31± 3.56
5	785	4.74± 0.76	20.90± 2.28	26.47± 3.37
6	237	4.25± 1.48	23.00± 2.20	29.30± 3.25

N: observation in dam age at lambing, BW: birth weight, WW: weaning weight (month 3), 6 MW: month 6 weight.

The age of weighting was used as co-variable for correcting phenotype observation of weaning weight and month 12 weight. This is because the lambs did not give birth at the same time but they were weighted together. Therefore they have different ages. Analysis of variance of non-genetic factors and estimation of least square means with their standard error was carried out by general linear model procedure in SAS software.

Results and discussion

The analysis of variance results, least square means and standard error for BW, WW, 6MW, 9MW, YM in Table 2, estimation of non- genetic factors including birth year, age of dam, lamb's sex and birth type are given in Table3.

The least squares means and standard errors for BW, WW, 6 MW, 9MW and YW are presented in Table 4. Lamb gender, type of birth, age of dam, birth year and herd had significant influences on body weight traits *($p<0.01$)*. In all ages, the male and single lambs were heavier than female and twin lambs.

The effect of birth year on BW, 6 MW, 9MW and YW *($p<0.001$)* and weaning weight (WW) *($P<0.05$)* was significant. These results were consistent with the report on Sabi sheep *(Ozcan et al., 2005)*. It could be due to differences in management, food availability, disease, and climatic condition (rate of rainfall, humidity and temperature) that affect the quality and quantity of pasture forage and raising systems in different years. The age of the dam was significant on birth weight (BW) *($P<0.001$)*, weaning weight (WW) *($P<0.01$)*, 6- month weight and yearling weight *($P<0.05$)* traits. Young ewes tend to produce smaller lambs. Primiparous ewes are not at their mature weight and complement their growth in addition to fetal growth. This could affect the lam weight. It is well known that mothering ability, such as milk yield, increases with parity, as older ewes are usually larger and produce more milk *(Dass and Acharya, 1970)*. However, the age of the dam did not have significant effect on 9MW trait. The same results were

reported on the Moroccan Timahdit sheep *(Fadilli et al., 2000)*. Male lambs were heavier than females at all ages and these differences were significant *(P<0.01)*. The effect of lamb sex on body weight traits at different ages has been reported in various sheep breeds *(Rashidi et al., 2008)*.

Table 2. Basic statistical information about the examined traits of Makuie sheep

Trait	BW	WW	6MW	9MW	YM
Number of records	18967	19297	9957	2407	1231
Mean (kg)	4.11	21.50	27.18	28.57	34.21
Standard deviation (kg)	0.88	3.50	3.53	4.44	3.88
Minimum (kg)	2	10	15	20	28
Maximum (kg)	7	28	33	38	42

BW: birth weight, WW: weaning weight (month 3), 6 MW: month 6 weight, 9MW: month 9 weight, YM: yearling weight.

Table 3. Analysis of variance for Birth weight, weaning weight, 6- month weight, 9- month weight, yearling weight traits in Iranian Makuie sheep

Fixed effects	BW	WW	6MW	9MW	YM
Year	**	***	***	***	*
Age of dam	***	*	**	ns	***
Sex	***	***	***	***	***
Birth type	***	***	***	***	***
Herd	***	***	***	***	***

BW, birth weight; WW, weaning weight; 6MW, 6- month weight; 9MW, 9-month weight; YW, yearling weight. Significant at 0.05 probability level; **significant at 0.01 probability level; ***significant at 0.001 probability level; ns, not significant at 0.05 probability level.

Table 4. Least squares means and their standard error of mean for different levels of factors for traits

Trait	BW	WW	6MW	9MW	YM
Sex					
Male	4.22^{a}±0.87	21.6^{a}±3.51	27.47^{a}±3.57	29.67^{a}±4.36	37.02^{a}±3.52
female	4.02^{b}±0.87	21.04^{b}±3.43	26.94^{b}±3.63	27.64^{b}±4.29	33.28^{b}±3.52
Birth type					
Single	4.23^{a}±0.89	21.77^{a}±3.36	27.62^{a}±3.44	29.24^{a}±4.38	33.55^{a}±3.91
Twins	3.69^{b}±0.72	20.23^{b}±3.97	25.67^{b}±4.36	26.91^{b}±4.29	36.61^{b}±3.92

The effect of birth type was significant on all studied traits. The frequency of single birth type was high compared to other types. A low number of triple birth types were seen so it was not included in the models. The significant effect of birth type on body weight can be due to limited uterine space during pregnancy, nutrition of the dam, especially during late pregnancy (regardless of twin or triple pregnant dams), and competition for milk sucking between multiple birth lambs during the birth to weaning period. Similar results have been reported in other breeds, such as the Hungarian Merino sheep *(Komlosi, 2008)*. According to the equation , 16-40% of traits' phenotypic variances were explained by the established factors in Table 3 and the effects of sex and birth type were the most important of the traits studied (P<0.001).

BirthYear

The effect of birth year on birth weight (BW), 3-month weight (WW), 6-month weight (6MW), 9-month weight (9MW), yearling weight (YW) *(P<0.001)* was significant. These results were consistent with the report on Sabi sheep *(Matika et al., 2003)*. Our results confirmed other reports *(Komlosi, 2008; Kalantar, 2003; Ozcan et al., 2005; Matika et al., 2003)*.

Birth year was significant for all traits. Interaction effects were significant between birth year and lamb's sex, birth year and birth type, birth year and herd. Interaction effect between birth year and age of dam was significant.

Age of Dam

Age of dam was was significant for all traits except 9MW. Results were the same as some of other researchers *(Rashidi et al., 2008; Shahrodi Eftekhar et al., 2003; Shahrodi Eftekhar et al., 2002; Kalantar, 2003; Ozcan et al.,2005; Matika et al.,2003; Dixit et al., 2001)* , but have some contradictions with others *(Rashidi et al., 1994; Fadilli et al., 2000; Abegaz et al., 2005)*. Variations of body mass in lambs depending on the mother's age range in the interval from 4.29 kg to 4.52 kg kg and statistically very significant(P<0.01) *(Petrović et al.,2009)*.

Lamb's Sex

Lamb's sex was significant for all traits. Interaction effects were significant between sex of lambs and birth year and also sex of lambs and herd for all traits. For all traits amount of body weight in male was more than female *(Osman, 1965; Rashidi et al., 2008; Nourian, 2000; Shahrodi Eftekhar et al., 2003; Ahmadi et al., 2004; Abegaz et al., 2005)*.

Birth Type

In this study, type of birth was significant for all traits. Interaction effect was significant between types of birth year for all traits. But Reference *(Shahrodi Eftekhar et al., 2003; Matika et al.,2003)* reported that birth type have no

significant effect on body weight in Kurdish (birth and weaning weights) and Sabi (birth weight and daily gain from birth to weaning) breeds, respectively. Type of birth has also expressed a significant effect on the body mass of lambs at birth and variations range from 4.31 kg (twins) to 4.59 kg (single) *(Petrović et al., 2009)*.

Herd

Herd and its interaction effect with birth year, lamb's sex and age of dam were significant for all traits. The same results were shown by the researchers who investigated the effects of herd on body weight *(Nourian, 2000; Neser et al., 2001; Yazdi et al., 1997)*.

Conclusions

Non- genetic factors were significant sources of variation for growth traits Including body weight and average daily gain and play an important role in expression of genetic potential. Therefore, effects of environmental factors need to account for the estimate of the best linear unbiased predicted value (BLUP) of Makuie sheep.

Uticaj faktora životne sredine na osobine porasta ovaca rase makuie

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Rezime

Makuie ovca je rasa ovaca sa debelim repom koje se mogu naći u Iranu, provinciji Azerbejdžana. U istraživanju su ocenjivani ne-genetski parametri dobijeni iz podataka prikupljenih od 1993 do 2012. godine, u istraživačkoj stanici za makuie ovce provincije Iran u Zapadnom Azerbejdžanu. Ne-genetski parametri za težinu na rođenju, težinu na odbijanju (3 meseca), težinu u uzrastu od 6 meseci, 9 meseci i godinu dana, procenjeni su na osnovu podataka prikupljenih za 19 godina, korišćenjem SAS softvera. Srednje vrednosti najmanjih kvadrata bile su 4.11± 0.88, 21.50±3.50, 27.18±3.53, 28.57±4.44 i 34.21±3.88 kg za težinu na rođenju, uzrastu od 3, 6, 9 i 12 meseci, respektivno. Godina rođenja imala značajan uticaj na sve osobine dok je tip rođenja značajno uticao sve osobine ($P < 0.05$). Pol jagnjeta imao je značajan uticaj na sve osobine ($p<0,05$). Efekat starosti majke je bio značajan na sve osobine izuzev težinu u uzrastu od 9 meseci ($p <0,05$). Rezultati su pokazali da ne-genetski faktori imaju važnu ulogu u ispoljavanju genetičkog potencijala u jagnjadi.

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