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Study on Influence of Environmental Effect on Birth Weight, Weaning Weight and Daily Growth of Baluchi Sheep

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Abstract: This study investigates different environmental effects on birth and weaning weight and daily growth of Baluchi lambs. For this purpose, we analyzed 10680 records that collection within a period of 21 years (1983-2003) in Abbasabad Sheep Breeding Station, located in northeast of Mashhad, Iran. Three different statistical models with considering effects of flock, litter size, sex, ewe age in parturition, lamb age in weaning weight and their interaction were used for parameters measurement. Except for effect of flock on weaning weight and daily growth, other effects were significant ($p<0.01$). For statistical analyses SAS software was used and coefficients of determination (R^2) and coefficients of variance (CV) were estimated 0.47 and 12.88 for birth weight, 0.54 and 16.43 for weaning weight, 0.44 and 19.62 for daily growth, respectively. Male lambs in comparison with female lambs and single-born lambs in comparison with multiple-born lambs had higher birth weight and daily growth, however, effect of litter size on birth and weaning weights was higher in young ewes.

Key words: Baluchi lamb, environmental effect, birth weight, weaning weight, daily growth

Introduction

All around the world, sheep are maintained for different reasons, but in our country meat production is most important. Regarding the FAO statistics in 1994, about 40% of meat production in Iran that contain 254 million kilogram in each year, is related with this domesticated animal (Yazdi *et al*., 1997). Adjustment of performance records for non-genetic effects is necessary in genetic evaluation schemes. Birth and weaning weights of lambs were usually influenced by physiological, environmental and genetic effects (Dickerson and Glimp, 1975). Environmental effects including ewes age, litter size, growth type and lamb sex (Notter *et al*., 2005). Growth curve analysis in many species clearly indicates direct relation between birth weight, weaning weight and daily growth (Fitzhugh, 1976).

The main objective of this study was to determine different environmental factors affecting birth and weaning weights and daily growth of Baluchi sheep breed.

Materials and Methods

In this study were used than 10680 records of Baluchi breed lambs that exist in two flocks, first flock (4761 records) and second flock (5919 records) were issued from 232 rams with (3513) ewes. These records were collected within a period of 21 years (1983-2003) in Abbasabad Sheep Breeding Station, located in northeast of Mashhad, Iran. The Baluchi sheep is a fat-tail breed well adapted to a wide range of harsh environmental conditions in eastern Iran, one of the arid subtropical areas of the world. The fleece is white with pigmented head and legs (Yazdi *et al*., 1997). Breeding system of lambs is along ewes until weaning age (third month) and then lambs were fed on natural pasture. Using coincident pregnancy, lambs were weaning in beginnings of spring and were derive a benefit from spring pasture with high quality. The lambs were weighed after birth and weaning.

Birth weight was analyzed by following linear model:

$$Y_{ijklmn} = \mu + sire_i + yb_j + sex_k + lsb_l + damage_m + sire_i * yb_j + sire_i * lsb_l + sire_i * damage_m + yb_j * sex_k + yb_j * lsb_l + yb_j * damage_m + sex_k * lsb_l + e_{ijklmn}$$

And for weaning weight analyses, age of lambs on weaning time (agew) was used as covariate.

$$Y_{ijklmn} = \mu + sire_i + yb_j + sex_k + lsb_l + damage_m + agew (x_{ijklm} - \bar{x}) sire_i * yb_j + sire_i * lsb_l + sire_i * damage_m + yb_j * sex_k + yb_j * lsb_l + yb_j * damage_m + sex_k * lsb_l + e_{ijklmn}$$

also for daily growth estimation, used than following linear model:

$$Y_{ijklmn} = \mu + sire_i + yb_j + sex_k + lsb_l + damage_m + agew (x_{ijklm} - \bar{x}) sire_i * yb_j + sire_i * lsb_l + sire_i * damage_m + yb_j * sex_k + yb_j * lsb_l + yb_j * damage_m + e_{ijklmn}$$

where
μ: population mean
$sire_i$: sire fixed effect I=1,……,232
yb_j: birth year fixed effect j=1,……,20
sex_k: sex fixed effect k=1,2
lsb_l: litter size fixed effect l=1,2
$damage_m$: ewes age category fixed effect m = 1,…,6

agew (X_{ijklm} - $\bar{x}$): covariate of lamb age on weaning time
$sire_i$*yb_j: Interaction of *i*th sire with *j*th birth year
$sire_i$*lsb_l: Interaction of *i*th sire with *l*th litter size
$sire_i$*$damage_m$: Interaction of *i*th sire with *m*th ewes age
yb_j*sex_k: Interaction of *j*th birth year with *k*th sex
yb_j*lsb_l: Interaction of *j*th birth year with *l*th litter size
yb_j*$damage_m$: Interaction of *j*th birth year with *m*th ewes age
sex_k*lsb_l: Interaction of *k*th sex with *l*th litter size
e_{ijklm}: random error

Total records of sex and type of birth in five different ewe's age are shown in Table 1. In this table type of birth is show single and multiple-born lambs and sex 1 and sex 2 is female and male, respectively.

For data analysis used than Version 7 of SAS Software (SAS, 1995; Yazdi *et al*., 1997).

Table 1: Records of sex, type of birth and different ewe's age

sex	1		2	
Type of birth	1	2	1	2
Ewes age class (year)				
2	1064	322	1038	302
3	890	540	888	537
4	551	529	616	582
5	370	416	357	366
6 ≤	303	332	324	353
All	3178	2139	3223	2140

Table 2: Analysis of variance for birth weight, weaning weight and daily growth

Variables	Birth weight	Weaning weight	Daily growth (birth to weaning time (g/day)
Flock			
1	4.27±0.69^{a}	22.21±4.77^{ns}	191.15±45.37$^{n.s}$
2	4.24±0.71^{b}	22.18±5.19$^{n.s}$	191.25±47.97$^{n.s}$
Type of birth			
1	4.50±0.63^{a}	23.71±4.64^{a}	205.02±43.82^{a}
2	3.82±0.58^{b}	19.94±4.67^{b}	170.55±43.45^{b}
Sex			
1	4.12±0.67^{b}	21.30±4.53^{b}	182.75±42.38^{b}
2	4.39±0.71^{a}	23.09±5.27^{a}	199.60±49.49^{a}
Ewes age			
2	4.13±0.67^{b}	22.08±4.88^{b}	191.75±44.89^{ab}
3	4.30±0.72^{a}	22.59±4.89^{a}	194.08±45.70^{a}
4	4.30±0.71^{a}	22.41±5.19^{a}	190.98±48.42^{b}
5	4.29±0.70^{a}	21.80±5.07^{a}	188.22±48.72^{c}
6	4.31±0.71^{a}	21.68±5.03^{a}	187.65±47.77^{c}

Results and Discussion

Considering elected linear model, results of analyses for each parameters of birth weight, weaning weight and daily growth are shown in Table 2. However, only effect of flock on weaning weight and daily growth is not significant and other studied effects for three stated parameters were significant ($p<0.01$). Coefficients of determination (R^2) and coefficients of variance (CV) were estimated 0.47 and 12.88 for birth weight, 0.54 and 16.43 for weaning weight, 0.44 and 19.62 for daily growth, respectively. Single born lambs have rather birth weight, weaning weight and daily growth in comparison with multiple born lambs. Results of other studies show that type of birth on birth weight and weaning weight was observed more in young ewes (Notter *et al*., 2005). Also, male lambs have higher birth weight mean, weaning weight and daily growth in comparison with female lambs that was corresponds with Josefina *et al*. (1980); Gonzalez *et al*. (1972) and Reveron *et al*. (1978). Most mean of parameters in this study were shown in 3 years old ewes that Notter (2005) reported similar issues (Dickerson and Glimp, 1975). Daily growth trend between 1983-2003 is shown in Fig. 1.

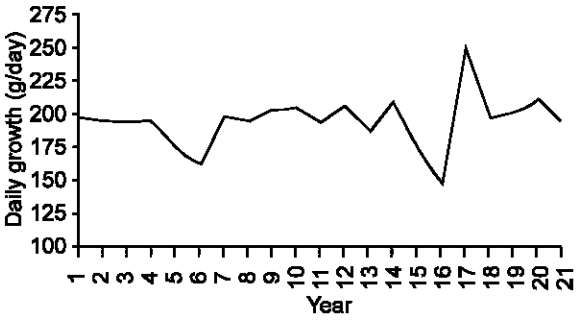

Fig. 1: Daily growth trend between 1983-2003 years

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