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The Effect of Gender, Genotype, Dam Age, Birth Year and Birth Type on Birth Weight: Norduz and Karakas Lambs

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Abstract: The present study was conducted to determine the effects of several environmental factors on 572 lambs (229 Karakas and 343 Norduz) raised at Research and Application Farm of Agricultural Faculty, Yuzuncu Yil University, Van, Turkey. In this study, birth type (single and twin), gender (male and female), dam age at lambing (1, 2, 3, 4, 5, 6 and 7) and birth year (2004, 2005, 2006 and 2007) and birth weights (kg) of Norduz and Karakas Lambs were recorded. According to results obtained from the present study, genotype factor on birth weight of Norduz lambs was non-significant, the influences of gender ($p<0.001$), dam age ($p<0.01$), birth type ($p<0.001$) and birth year ($p<0.05$) on it were found significant. As a result, the birth weight trait provides useful information for early selection criteria in breeding program.

Key words: Norduz lamb, Karakas lamb, birth weight, environmental factors

INTRODUCTION

All around the world sheep are maintained for different reasons. Sheep breeding has been great importance for economy and nourishment of all people in Turkey and World. The fat-tailed Norduz and Karakaş sheep which are subtypes of Akkaraman breed raise in Van, the Eastern Anatolian province of Turkey and have the best adaptation to harsh environmental and management conditions, poor feeding and diseases (Aygun and Bingol, 1999; Bingol *et al*., 2006; Yilmaz *et al*., 2007; Eyduran *et al*., 2008).

Various studies have reported the results of analyses of birth weight. Factors known to predominate in determining sheep productivity are year of birth, age of dam, birth type, gender and differences between breeds. Knowledge of economic traits such as birth weight and weaning weight provides useful clues for doing effective selection program on improvement of live weight in a flock. Effects of all the factors (birth type, birth year, genotype, gender, rearing systems etc.) influencing birth weight used as early selection should be examined. The factors with significant effect on birth weight should be corrected (Cemal *et al*., 2005; Eyduran *et al*., 2008).

There were numerous studies on determination of significant factors influencing birth weight of various breeds (Koyuncu *et al*., 1999; Thieme *et al*., 1999; Morris *et al*., 2000; Esenbuga and Dayıoglu, 2002; Ates *et al*., 2003; Matika *et al*., 2003; Ekiz *et al*., 2004; Emsen *et al*., 2004; Hassen *et al*., 2004; Cemal *et al*., 2005; Gootwine and Rozov, 2006; Yilmaz *et al*., 2007; Eyduran *et al*., 2008).

The study was conducted to determine the influences of several environmental factors such as birth type, birth year, genotype, gender and dam age on birth weight.

MATERIALS AND METHODS

The experimental data were composed of 572 lambs (229 Karakas and 343 Norduz) raised at Research and Application Farm Faculty of Agriculture, University of Yuzuncu Yil, in Van, Turkey during 2004-2007. Gender (male and female), birth type (single and twin), dam age (1, 2, 3, 4, 5, 6 and 7 years) and birth year (2004, 2005, 2006 and 2007) of lambs of Norduz and Karakas breeds were recorded.

The linear model for analyzing the data can be written as follows:

$$Y_{ijklmn} = \mu + b_i + g_j + z_k + t_l + y_m + e_{ijklmn}$$

Where:

Y_{ijklmm} : Birth weight associated to n. lamb with i. Genotype, j. Gender, k. dam age, l. Birth type and m. birth year.
μ : Expected mean of birth weight.
b_i : Effect of genotype (i = 1, 2; Norduz and Karakas).

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g_j : Effect of gender (j = 1, 2; male and female).
z_k : Effect of dam age (k = 1, 2, 3, 4, 5, 6 and 7).
t_l : Effect of birth type (l = 1, 2; single and twin).
y_m : Birth year effect (m =1, 2, 3, 4; 2004, 2005, 2006 and 2007.
e_{ijklmm} : The random error normally distributed with mean zero and variance σ^2_e.

Statistical analysis was done by using GLM procedure of SAS (2005) statistical package program and significant differences were determined by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Table 1 presents descriptive statistics and Duncan Multiple Range Test results for birth weight of Norduz and Karakas Lambs. As seen from Table 1, it is clear that genotype effect on birth weight was non-significant, but the effects of gender ($p<0.001$), dam age ($p<0.01$), birth type ($p<0.001$) and birth year ($p<0.05$) could be said to be significant. The birth weight varied from a year to another. The heaviest birth weight was recorded in 2007, but the lowest birth weight was recorded in 2004 and 2005 (Table 1). Average of single-born lambs found higher than that of twin-born lambs ($p<0.001$). Male birth weight average was heavier than female birth weight average. Birth weight increased to 4 dam age, but the weight decreased after the age (Table 1).

Table 1: Descriptive statistics for birth weight of Norduz and Karakas Lambs

Factors	N	$\bar{X} \pm S_x$
Overall mean	572	4.80±0.04
Genotype		(ns)
Norduz	343	4.90±0.05
Karakas	229	4.65±0.05
Year		*
2004	203	4.59±0.06c
2005	154	4.50±0.06c
2006	106	4.98±0.09b
2007	109	5.46±0.07a
Dam age		**
1	9	4.18±0.30bc
2	151	4.78±0.06ab
3	197	4.87±0.06a
4	112	4.91±0.09a
5	94	4.69±0.09ab
6	6	4.51±0.38ab
7	3	3.70±0.75c
Birth type		***
Single	382	5.04±0.04a
Twin	190	4.33±0.06b
Gender		***
Male	296	4.97±0.05a
Female	276	4.62±0.05b

ns: non-significant; *$p<0.05$; **$p<0.01$ ***$p<0.001$; ^{a,b,c} Difference between column means with the different letters for each factor was significant ($p<0.05$)

Our finding on insignificant effect of genotype on birth weight was not in consistent with Thieme *et al.* (1999), Boujenane and Kansari (2002), Ates *et al.* (2003), Matika *et al.* (2003), Hassen *et al.* (2004), Emsen *et al.* (2004), Emsen (2005) and Cemal *et al.* (2005), but does agree with the results of Esenbuga and Dayıoglu (2002).

Our finding on significant effects of gender and birth type factors on birth weight were in disagreement with those reported by earlier studies (Koyuncu *et al*., 1999; Thieme *et al*., 1999; Esenbuga and Dayıoglu, 2002; Ates *et al*., 2003; Matika *et al*., 2003; Emsen *et al*., 2004; Hassen *et al*., 2004; Cemal *et al*., 2005; Gootwine and Rozov, 2006; Yilmaz *et al*., 2007; Saghi *et al*., 2007).

The significant effect of dam age for birth weight was in consistent with the findings of Ates *et al.* (2003) and Matika *et al.* (2003), but in disagreement with the findings of Thieme *et al.* (1999), Morris *et al.* (2000), Esenbuga and Dayıoglu (2002), Cemal *et al.* (2005) and Eyduran *et al.* (2008).

The differences obtained in literature could be said due to environmental and genetic factors.

It was concluded that, genotype factor on birth weight of Norduz lambs was non-significant, the influences of gender ($p<0.001$), dam age ($p<0.01$), birth type ($p<0.001$) and birth year ($p<0.05$) on it were found significant.

As a result, correction of these effects impressing weights at the growth periods of lambs is important for effective breeding program.

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