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Original Contribution

FACTORS AFFECTING BODY WEIGHT OF NORDUZ LAMBS

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ABSTRACT

The aim of this study was to examine the effects of sex, maternal (dam) age, birth type on body weights in growth periods by Logistic Regression. The data consisted of approximately 84 Norduz breed lambs born in early march of 2004. Male lambs showed more increase in body weight for all periods than female lambs. The effect of single-born on body weight at 60th day and after 60th day was significant ($p<0.001$). No significant effect of maternal age was found on all periods.
As a result, single-born and male lambs had positive effect on body weight at all periods.

Key words: Norduz Sheep, Logistic Regression, Environmental factors.

INTRODUCTION

Sheep breeding contributes considerably to the economy and nutrition of people in Turkey and the world (1) The fat-tailed Norduz sheep raised in Van, the Eastern Anatolian province of Turkey are a subtype of Akkaraman breed and have the best adaptation to harsh environmental and management conditions, poor feeding, and diseases (1, 2).

In sheep breeding, investigation on birth, weaning and mature weights provides useful data for breeding proposes. Body weights at early phases of sheep are influenced by environmental factors such as sex, age, breed, birth type (single, twin), birth weight, and dam age (3-5). Correction of these environmental factors with the statistically significant effect was important in order to realize an effective selection programme. Although studies on body weights of various breeds are many, knowledge on body weights at early phases of Norduz lambs is relatively few.

Therefore, the aim of this study was to determine the effects of sex, birth type, dam age, and weight at birth on body weights with respect to various growth periods using Logistic Regression.

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MATERIALS AND METHODS

The materials comprised both sex types of the sheep, with single and twin births. Parameters measured were: body weights, and age of dam (young, old) at various growth periods of 84 Norduz lambs, born in March 2004. The fat tailed Norduz sheep, a subtype of Akkaraman breed, have been raised in Van Provinces of Eastern Anatolia in Turkey.

The lambs were fed with 250-300 g barley and 300-350 g trefoil hay per lamb/day. As of 6 weeks of age, the lambs were grazed during daylight and housed at night. The lambs were weaned at 3rd month of age.

Body weights of the lambs were recorded monthly from birth to 180th days. Averages of body weight for each period were found; then the values of body weight of each lamb in all periods were coded as binary (low is little than average, high is more than average).

Logistic Regression model is determined as:

$$Log\left[\frac{P}{1-P}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \mathrm{K} + \beta_p X_p \quad (5)$$

Where, P is the occurrence of high body weight at any period, β_0, intercept parameter; β_1, i. the slope value of discrete independent variable (parameter value of the reference value in sex or birth type, age of dam) ($i = 1,2,3\mathrm{K}\ p$)

X_i, i. the value of discrete independent variable, for example: birth type (single (1), twin (0)) or sex (male (1), female (0)) and p, the number of parameters.

References for each independent variable, namely sex, birth type, age of dam, were determined as male, single, old dam, respectively.

The values of odds ratio were calculated for corresponding references. Odds Ratio $= e^{\beta_j}$

The parameters in Logistic Regression as well as model fit criteria (score, deviance, concordant) were estimated by using the procedure Logistic of SAS statistical package program (6).

RESULTS and DISCUSSION

Model criteria calculated for environmental factors such as sex, birth type, dam age, birth weight affecting body weights at birth weight, body weight at 30th, 60th, 90th, 120th, 150th and 180th days are presented in **Table 1**. According to **Table 1**, Deviance and Score statistics for all body periods were found to be much more significant ($p<0.001$). This means that the effects of sex, age of dam, and birth type on body weight of all periods in logistic regression model were significant. Concordant values for all periods ranged from 75.3 % to 83.4. It is meant that those values were sufficient to provide goodness of fit in all periods.

Table 1. *Model Fit Criteria for all periods*

Model Fit Criteria	Chi-Square	Probability	Concordance (%)
Birth Weight			76.0%
Deviance	24.124	0.0001	
Score	22.607	0.0001	
Body Weight at 30th day			78.9%
Deviance	36.291	0.0001	
Score	31.771	0.0001	
Body Weight at 60th day			83.4%
Deviance	39.026	0.0001	
Score	34.051	0.0001	
Body Weight at 90th day			79.8%
Deviance	34.523	0.0001	
Score	29.912	0.0001	
Body Weight at 120th day			80.6%
Deviance	34.418	0.0001	
Score	29.785	0.0001	
Body Weight at 150th day			76.1%
Deviance	27.726	0.0001	
Score	24.592	0.0001	
Body Weight at 180th day			75.3%
Deviance	24.885	0.0001	
Score	22.525	0.0001	

The parameter values calculated for all periods of body weights are given on **Table 2**. According to **Table 2**, the odds of having high birth weight for single lambs were 15.537 times higher than those for twin lambs ($p<0.001$). This finding is consistent with the literature (5, 7). However, it was reported by Arslan et al (7) that the effect of birth type, sex, and maternal age on birth weight of Morkaraman and Corriedale x Morkaraman (F_1) crossbred lambs was significant. ($p<0.01$).

The odds of having high body weight at 30th day for single lambs were 13.483 times higher than that for others ($p<0.001$) as seen on **Table 2.** This finding was also in agreement with those reported (7), who studied on Morkaraman and Corriedale x Morkaraman (F_1) crossbred lambs from birth to 90th days.

On **Table 2**, The odds of having high body weight at 60th, 90th,120th ,150th and 180th days of single lambs were 10.992, 10.545, 7.639, 8.345, 5.418 higher than those for other, respectively ($p<0.001$). Our results were in agreement with those reported by Özbey *et al.,* (8), who found to be more significant the effect of single birth on birth weight ($p<0.01$), body weight at 14th ($p<0.01$, 28th ($p<0.01$), 42nd ($p<0.05$), 56th ($p<0.01$),

70th (p<0.001), 84th (p<0.001), 90th (p<0.001) and 108th (p<0.001) days than those of others. Except for birth and 30th day periods, the odds of being male for body weights at other periods were 4.206, 7.109, 9.587, 6.083 and 6.614 higher than those of other, respectively (**Table 2**). The results were in agreement with those reported by Yılmaz *et al.*, (1), who found body weights of lambs with male and single birth type at birth weight, 90th and 180th of age to be heavier than those of female and twin (p<0.01).

***Table 2**. Analysis of Maximum Likelihood Estimates for each variable*

Variables in Logistic Regression Model for each periods	Parameter Estimate $\beta_j + SE$	Probability	Odds Ratio e^{β_j}	Odds Ratio Sig.
Birth Weight				
Intercept	-1.2738 ± 0.6059	0.0355		
Sex (Male)	0.4657 ± 0.5587	0.4045	1.593	NS
Birth Type (Single)	2.7432 ± 0.6795	0.0001	15.537	***
Age of Dam (Old age)	1.2582 ± 0.6621	0.0574	3.519	NS
Body Weight at 30th day				
Intercept	-1.7290 ± 0.8400	0.0396		
Sex (Male)	0.9998 ± 0.5728	0.0809	2.718	NS
Birth Type (Single)	2.6015 ± 0.7385	0.0004	13.483	***
Birth Weight (High)	-1.1991 ± 0.6292	0.0567	0.301	NS
Age of Dam (Old age)	1.0005 ± 0.7162	0.1624	2.720	NS
Body Weight at 60th day				
Intercept	-1.4559 ± 0.8080	0.0715		
Sex (Male)	1.4366 ± 0.6087	0.0183	4.206	*
Birth Type (Single)	2.3972 ± 0.6892	0.0005	10.992	***
Birth Weight (High)	-1.1346 ± 0.6434	0.0778	0.322	NS
Age of Dam (Old age)	0.0800 ± 0.6395	0.9005	1.083	NS
Body Weight at 90th day				
Intercept	-2.0976 ± 0.8191	0.0104		
Sex (Male)	1.9614 ± 0.5930	0.0009	7.109	***
Birth Type (Single)	2.3556 ± 0.7029	0.0008	10.545	***
Birth Weight (High)	-0.5155 ± 0.6271	0.4110	0.597	NS
Age of Dam (Old age)	0.6160 ± 0.6268	0.3258	1.851	NS
Body Weight at 120th day				
Intercept	-1.795 ± 0.7907	0.0232		
Sex (Male)	2.2604 ± 0.6073	0.0002	9.587	***
Birth Type (Single)	2.0332 ± 0.6879	0.0031	7.639	**
Birth Weight (High)	-0.5486 ± 0.6280	0.3823	0.578	NS
Age of Dam (Old age)	0.4575 ± 0.6132	0.4556	1.580	NS
Body Weight at 150th day				
Intercept	-2.3597 ± 0.8060	0.0034		**
Sex (Male)	1.8055 ± 0.5413	0.0009	6.083	***
Birth Type (Single)	2.1217 ± 0.6814	0.0018	8.345	**
Birth Weight (High)	-0.0965 ± 0.6180	0.8758	0.908	NS
Age of Dam (Old age)	1.0222 ± 0.6142	0.0960	2.779	NS
Body Weight at 180th day				
Intercept	1.8892 ± 0.5306	0.0069		
Sex (Male)	1.6897 ± 0.6490	0.0004	6.614	***
Birth Type (Single)	-0.0517 ± 0.6110	0.0092	5.418	**
Birth Weight (High)	0.9635 ± 0.5905	0.9325	0.950	NS
Age of Dam (Old age)	-2.0634 ± 0.7641	0.1027	2.621	NS

**:p<0.05; ** :p< 0.01 ; ***:p<0.001*
NS: Non-Significant

Kuçuk, (9) stated that body weights of male and single lambs in Hamdani, Karakul and Morkaraman breeds at 30th, 60th and 90 days of age were higher than those of female and

twin. The results were consistent with those reported on **Table 2**. The effect of being single-lambs on all periods was more positive and advantageous than that of other ($p<0.001$).

Eyduran *et al.,* (5) reported that lambs of Hamdani having single and high birth weight on body weight at 60^{th} and 45^{th} day of age were higher than those having female and low birth weight. These findings were not in agreement with those reported by Eyduran *et al.*, (5). The differences may be due to the factors of breeds and management.

As a result, it was concluded that single lambs had increased growth on all growth periods and this increased effect was more on male lambs and showed in the body weight from 30^{th} to 180^{th} days, although old age of dam was non-significant on body weight for all periods.

The difference in studies on factors influencing weight at early phases might have arisen from variation among breeds, environmental factors, and different rearing systems.

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