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RESEARCH ARTICLE

Reproductive Performance of Ewes and Growth Characteristics of Lambs in Zom Sheep Reared in Karacadağ District [1]

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Summary

This is the first study and report in which some ewe reproductive and lamb growth performances of Zom sheep were investigated and described in Turkey. The research was carried out on three different flocks randomly chosen among the Zom sheep flocks in the district of Karacadağ surrounded by Diyarbakır, Şanlıurfa and Mardin provinces, and lasted for two years, 2010 and 2011. The data consisted of 242 and 254 heads of lamb born from 226 and 214 heads of ewe in 2010 and 2011, respectively. Lambing rate (LR), twinning rate (TW), fecundity (FEC) and litter size (LITS) were found as 94%, 17%, 1.09 and 1.17 on average, respectively. There was no significant difference among flocks within years or among years within flocks in terms of ewe reproductive performance, except for the flock 2 in terms of TW. Average means of the birth weight (BWT), weaning weight (WWT) at 90th day and 6th month live weight (SMLW) were 4.00 kg and 22.06 kg, 36.11 kg, respectively. The effects of age of dam, type of birth and sex of lambs were significant on BWT, WWT and SMLW ($P<0.05$). Besides the WWT was also significantly affected by the year ($P<0.05$), every 1 kg increase in BWT caused 2.02±0.281 kg increase on average in WWT of lambs ($P<0.01$). In addition, it was observed that the havier lambs at birth were havier in terms of SMLW ($P<0.01$). The average daily weight gain (ADWG1) and survival rate (SR) of lambs at weaning were 200 g/day and 90%, respectively.

Keywords: *Zom sheep, Reproductive performance, Lamb growth, Lamb survival*

Karacadağ Yöresinde Yetiştirilen Zom Koyunlarının Üreme Performansı ve Kuzularının Büyüme Özellikleri

Özet

Bu araştırma, Zom koyunlarında bazı döl verimi ve kuzularda büyüme özelliklerini araştıran ve tanımlayan Türkiye'deki ilk çalışmadır. Araştırma, 2010 ve 2011 yıllarında, Diyarbakır, Şanlıurfa ve Mardin şehirlerinin çevrelediği Karacadağ bölgesinde Zom koyunu yetiştiriciliği yapan işletmeler arasından rastgele belirlenen 3 sürüde yürütülmüştür. Veriler, 2010 ve 2011 yıllarında doğum yapan sırasıyla 226 ve 214 baş koyun ve bunlardan doğan 242 ve 254 baş kuzularadan elde edilmiştir. Kuzulama oranı (KO), ikizlik oranı (İO), koçaltı koyun başına doğan kuzu sayısı (KKKS) ve doğuran koyun başına kuzu sayısı (DKKS) ortalamaları sırasıyla %94, %17, 1.09 ve 1.17 olarak tespit edilmiştir. İkinci sürüdeki İO hariç, koyun üreme performansı bakımından değişik yıllarda sürü içinde ya da aynı yılda sürüler arasında farklılık gözlemlenmemiştir. Ortalama doğum ağırlığı (DA), sütten kesim ağırlığı (SKA) ve altıncı ay canlı ağırlık (AACA) ortalaması sırasıyla 4.00, 22.06 ve 36.11 kg olarak tespit edilmiştir. DA, SKA ve AACA, ana yaşı, doğum tipi ve cinsiyet faktörlerinden önemli derecede etkilenmişlerdir ($P<0.05$). SKA üzerine yıl faktörünün de önemli etkisi tespit edilmiş ($P<0.05$), bunun yanında, DA'da meydana gelen her 1 kg'lık artışa karşılık SKA'da ortalama olarak 2.02±0.281 kg'lık bir artışın meydana geldiği gözlenmiştir ($P<0.01$). Buna ek olarak, doğumda daha ağır olan kuzuların AACA bakımından da daha ağır oldukları tespit edilmiştir ($P<0.01$). Sütten kesime kadar günlük canlı ağırlık artışı (GCAA) ve yaşama gücü sırasıyla 200 g/gün ve %90 olarak belirlenmiştir.

Anahtar sözcükler: *Zom koyunu, Üreme performansı, Kuzu büyüme, Kuzu yaşama gücü*

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INTRODUCTION

During the past 50 years, it has been a loss in livestock genetic resources in Turkey due possibly to reason that the economic, social and environmental developments in animal husbandry have caused to decrease in quantity of native breeds of animals by replacing them with high producing breeds. On the other hand, the native breeds are well adapted to harsh environmental conditions and continue to maintain their presence and to produce milk, meat and wool with little care and inputs [1].

Protection of genetic resources of indigenous breeds of animals is important for the future creation of new types and necessary genetic material for the concerns that may arise in the future due to environmental conditions. In addition, examination and evaluation of the infrastructure of the traditional sheep breeding are important for breeding programs [2].

From this point of view, it is necessary to identify and describe our native genetic resources of the nation, such as fat tailed Zom sheep intensly raised by farmers in Karacadağ district surrounded by Şanlıurfa, Diyarbakır and Mardin provinces. This sheep was first identified and described, and its morphological characteristics were reported [3] based on the results of a project supported by General Directorate of Agricultural Researches and Politics (GDARP). They reported that average live weights, wither heights and body lengths of mature males and females of this sheep were 71.7±2.67 kg and 48.8±0.57 kg, 77.1±2.01 cm and 68.3±0.43 cm, 65.4±1.16 cm and 60.3±0.25 cm, respectively. Given the climate and geographical condition of the region, Zom sheep has an ability of grazing in the stepped, arid and rocky areas.

The GDARP have also started a new project in the year of 2011 for the purpose of genetic improvement of Zom sheep in farmer conditions. Some of the main goals of that project are to improve ewe reproductive performances, lamb survival rate and some growth characteristics of lambs. Reproductive performance of a ewe is determined by several components; such as fertility, litter size and lamb survival [4]. In addition, productivity and profitability of a sheep enterprise are highly influenced by number of lambs weaned per breeding ewe than any other trait [5]. If selective breeding for ewe reproductive performance, lambs' growth and survival rate until weaning are to be implemented into a selection program, then it is necessary to identify the amount and direction of the effects of environmental factors on these traits.

Therefore, the main objectives of the present study are to investigate the reproductive performance of Zom ewes and some growth characteristics and survival rate of Zom lambs, and to explore the effects of environmental factors on these traits in farmer conditions.

MATERIAL and METHODS

Location and Management

Generaly in this region, the flocks consist of 50 to 250 heads of sheep. Matings are started in July and lasted at the end of August and ram/ewe rate is generally 1/25 during this period. The ewes are not provided any additional feed supplemets before or during the matings but the rams are provided crushed barley and lentil hay beside pasture starting 10 days prior to the matings. The rams stay in the flocks during the mating period. During the time this research was carried out, the ewes were also given crushed barley and lentil hay and sometimes mixed feed during 30 days before lambing. The lambings are occured generally at night and in primitive conditions of the farms. As a general practise in this region, ewes and her lamb(s) were transfered to a stall prepared in the sheep barn right after lambing. Then, a little milk from mother at first is discarged and ensured the lamb suckles its mother within 2 h. After ten days the ewes and their lams were kept in this place, they were transferred to a common holding pen in which the other ewes are kept. The lambs are kept with their mothers for about 30 days after lambing, then the ewes and lambs are seperated and gathered together 1 to 2 hours in each morning and evening for suckling for about 2 months. The lambs are weaned around 90 days after lambing and given crushed barley and wheat, lentil hay and wheat straw starting from about 3 weeks after lambing and taken to pasture starting at the end of March.

The animals included in the study were consisted of Zom sheep and lambs born in 2010 and 2011 in three flocks randomly chosen among the Zom sheep flocks in Çınar County in the district of Karacadağ surrounded by Diyarbakır, Şanlıurfa and Mardin provinces. The data were belonged to 242 and 254 Zom lambs born from 226 and 214 ewes in 2010 and 2011, respectively. In the first year, the lambing started on the 27th day of December in 2009 and ended on 28th day of February in 2010, and in the second year the lambing started on the 17th day of November in 2010 and ended on 7th day December in 2010.

Reproductive Traits of Ewes

Reproductive traits of ewes in this study were lambing rate (LR), infertility rate (IR), single lambing rate (SLR), twinning rate (TW), fecundity (FEC) and litter size (LITS) and calculated as:

LR = the number of ewes lambed/the number of ewes in the flock

IR = the number of ewes not lambed/the number of ewes in the flock

SLR = the number of ewes with single live lamb/the number ewes lambed

TR = the number of ewes with twin live lambs/the number ewes lambed

FEC = the number of live lambs/the number of ewes in the flock

LITS = the number of live lambs/the number of ewes lambed

Lambs Growth and Survival Traits

The lambs are weighed using a scale with 50 g sensitivity and ear tagged within 12 h after the lambing and recorded as birth weight (BWT), and their live weights were measured and recorded every 30 days until they were about six months of age. Weaning weights (WWT) and sixth month live weights (SMLW) were adjusted to 90-day and 180-day of age, respectively, and average daily weight gains (ADWG1) from birth to weaning, and from weaning to six months of age (ADWG2) were calculated and used in the analysis. The survival rate (SR) was calculated as the ratio of the number of live lambs at weaning to the number of live lambs at birth.

Statistical Analysis

The analyses were carried out using SAS [6] statistical package program where LSMEANS statement with Tukey-Kramer multiple comparison test option was included in the analysis. The effects of year, sex, age of dam and type of birth of lambs were included in the model. BWT was also included in the analyses of WWT and SMLW as a covariate. Based on the preliminary analysis, the effect of flock was not significant on any growth traits in the study, thus this effect was excluded from the model. Pairwise t-test [7] was used to test the SR of lambs and the significance of differences among the reproductive performences of the ewes between years within flocks and between flocks within years.

RESULTS

The reproductive performance of Zom ewes are given in *Table 1*. There was no significant differences between years within flock in terms of LR, IO, FEC and LITS. The only significant difference was observed between years in TW and/or SLR in the flock 2 due might be to improved management within the flock from 2010 to 2011 (P<0.05). The lambing rate (LR), twining rate (TW), fecundity (FEC) and litter size (LITS) were 94%, 17%, 1.09 and 1.17 lambs on average, respectively.

The least square means and standard errors of BWT, WWT and SMLW are shown in *Table 2*. The overall BWT, WWT and SMLW were 4.00, 22.06 and 36.11 kg, respectively. The significant effects of the all the factors, except year effect, were observed on BWT, WWT and SMLW (P<0.05). Single born and male lambs are havier than twin born lambs and female lambs in terms of BWT, WWT and SMLW (P<0.05), respectively. The ewes at first lambing (2 years old ewes) produced lighter lambs at birth than those at second or more lambing (P<0.05). However, at weaning, the lambs born from modarate age of dam (3, 4 or 5 years old) were havier than those born from young or older dams (2 or 6 years old) (P<0.05) while in terms of SMLW the only significant difference was observed between 2 and 4 years old dams (P<0.05). The effect of year was significant only on WWT (P<0.05) that the lams born in 2010 were havier then those born in 2011. WWT and SMLW were also affected from the variation among the BWT that, on average, every 1 kg increase in BWT caused 2.02±0.281 and 2.26±0.502 kg increase in WWT and SMLW, respectively (P<0.01).

SR, ADWG1 and ADWG2 are presented in *Table 3*. The overall mean of SR was 90% and there was no significant difference between the sexes. However, SR was significantly affected from the type of birth, age of dam and year (P<0.05). The single born lambs have higher (91%) survival rate than twin born lambs (85%) (P<0.05). Lambs born from young or old dams (2 or 6 years old) have higher SR than those born from moderate age of dam (3, 4 and 5 years old) (P<0.05). The significant difference was observed also between the years 2010 (86%) and 2011 (93%) (P<0.05). This might be the result of improved management and feeding conditions in 2011 comparing to the year 2010. According to these results, the Zom lambs have quite high survival rate at farmer condition.

Table 1. *Reproductive performance of Zom sheep*
Tablo 1. *Zom koyunlarının üreme performansı*

Traits	Flock 1		Flock 2		Flock 3		Overall
	2010	2011	2010	2011	2010	2011	
Lambing %	95^{a1}	91^{a1}	96^{a1}	95^{a1}	94^{a1}	91^{a1}	94
Infertility %	5^{a1}	9^{a1}	4^{a1}	5^{a1}	6^{a1}	9^{a1}	6
Single Lambing %	88^{a1}	86^{a1}	90^{a1}	77^{b1}	83^{a1}	75^{a1}	83
Twinning %	12^{a1}	14^{a1}	10^{a1}	23^{b1}	17^{a1}	25^{a1}	17
Fecundity	1.07^{a1}	1.04^{a1}	1.06^{a1}	1.16^{a1}	1.10^{a1}	1.14^{a1}	1.09
Litter Size	1.13^{a1}	1.14^{a1}	1.10^{a1}	1.23^{a1}	1.17^{a1}	1.25^{a1}	1.17

^{a,b}Years with different letter are significantly different within flocks (P<0.05), ^{1,2}Flocks with different number are significantly different within years (P<0.05)

Table 2. *Least square means of birth weight (BWT), weaning weight (WWT), six month live weight (SMLW) and their standart errors in Zom sheep*
Tablo 2. *Zom koyunlarında, doğum ağırlığı (DA), sütten kesim ağırlığı (SKA), altıncı ay canlı ağırlığı (AACA)'nın en küçük kareler ortalamaları ve standart hataları*

Factors	BWT					WWT					SMWT				
Year	**N**	**X±Sx**	**Min**	**Max**	**CV%**	**N**	**X±Sx**	**Min**	**Max**	**CV%**	**N**	**X±Sx**	**Min**	**Max**	**CV%**
2010	242	4.0±0.06	2.1	7.7	19	208	24.1±0.35^{a}	14.1	40.0	20	59	36.3±0.95	22.0	52.4	17
2011	254	4.0±0.05	2.2	6.2	20	237	21.8±0.32^{b}	11.0	39.1	23	236	37.4±0.50	18.4	57.0	20
Type of Birth															
Single	379	4.4±0.04^{a}	2.1	7.7	18	346	24.4±0.25^{a}	12.2	40.0	20	213	38.0±0.60^{a}	18.4	57.0	19
Twin	117	3.6±0.07^{b}	2.2	5.6	17	99	21.5±0.47^{b}	11.0	32.8	23	82	35.7±0.80^{b}	22.6	52.5	18
Age of Dam															
2	57	3.7±0.09^{a}	2.2	5.6	18	55	21.0±0.53^{a}	11.0	33.1	22	48	35.0±0.83^{a}	22.0	48.9	17
3	145	4.0±0.06^{b}	2.1	6.2	20	130	24.0±0.36^{b}	14.2	37.3	19	94	37.6±0.69^{ab}	23.7	54.5	17
4	200	4.0±0.06^{b}	2.3	7.7	20	174	24.8±0.38^{b}	11.7	40.0	20	91	38.7±0.74^{b}	18.4	57.0	20
5	77	4.1±0.08^{b}	2.8	5.9	17	69	23.8±0.47^{b}	12.4	39.1	23	51	37.5±0.87^{ab}	24.2	53.0	18
6≤	17	4.2±0.13^{b}	3.1	5.5	14	17	21.4±0.83^{a}	14.5	29.9	20	11	35.5±1.72^{ab}	30.8	47.3	14
Sex															
Male	236	4.2±0.05^{a}	2.1	7.7	20	211	23.8±0.34^{a}	11.0	40.0	23	150	40.2±0.66^{a}	18.4	57.0	18
Female	260	3.8±0.05^{b}	2.2	6.2	18	234	22.1±0.36^{b}	12.9	39.1	20	145	33.5±0.66^{b}	22.6	51.6	14
BWT	--	--	--	--	--	--	2.02±0.281*	--	--	--	--	2.26±0.502*	--	--	--
Overall	496	4.0±0.04	2.1	7.7	19	445	22.1±0.26	11.0	40.0	22	295	36.1±0.42	18.4	57.0	19

N: *number of lambs;* ***Min:*** *minimum value;* ***Max:*** *maximum value;* ***CV%:*** *coefficient of variataion;* ^{a,b,c}*Means with different letter within traits and factors are significantly different (P<0.05), * P<0.01*

Table 3. *Least square means and standart errors of average daily weight gain from birth to weaning (ADWG1) and from weaning to six month of age (ADWG2) with survival rate of lambs (SR) from birth to weaning in Zom lambs*
Tablo 3. *Zom kuzuların doğumdan sütten kesime kadar (GCAA1) ve sütten kesimden altıncı ay yaşa kadar (GCAA2) günlük canlı ağırlık atışlarının en küçük kareler ortalamaları ve standart hataları ile sütten kesime kadar yaşama gücü (YG)*

Factors/Levels		ADWG1		SR	ADWG2	
		N	**X±Sx**		**N**	**X±Sx**
Overall		445	0.200±0.003	90	295	0.165±0.007
Year	2010	208	0.222±0.004^{a}	86^{a}	59	0.156±0.008^{a}
	2011	237	0.196±0.004^{b}	93^{b}	236	0.177±0.004^{b}
Type of Birth	Single	346	0.225±0.003^{a}	91^{a}	213	0.163±0.005
	Twin	99	0.193±0.005^{b}	85^{b}	82	0.169±0.007
Sex	Male	211	0.217±0.004^{a}	89	150	0.196±0.006^{a}
	Female	234	0.200±0.004^{b}	90	145	0.136±0.006^{b}
Age of Dam	2	55	0.188±0.006^{a}	96^{a}	48	0.167±0.007
	3	130	0.221±0.004^{b}	90^{b}	94	0.162±0.006
	4	174	0.231±0.004^{b}	87^{b}	91	0.160±0.006
	5	69	0.217±0.005^{b}	90^{b}	51	0.166±0.007
	6≤	17	0.188±0.009^{a}	100^{a}	11	0.176±0.015
BWT	---	---	0.012±0.003*	---	---	0.001±0.004^{ns}

^{a,b,c}*Means with different letter within traits and factors are significantly different (P<0.05),* * *P<0.01,* ^{ns} *nonsignificant*

The ADWG1 was affected from the all the factors in the study (P<0.05). The lambs born in 2010, males, single borns and those born from 3 or older dams have higher ADWG1. There was no significant differences among dams older than 2 years old in terms of ADWG1. Weight at birth had also significant effect on ADWG1 that, on average, heavier lambs at birth grew faster until weaning by the amont of 0.012±0.003 kg daily (P<0.01). On the other hand, type of birth, age of dam and weight at birth had no significant effect on ADWG2. The effects of year and sex were significant on ADWG2 (P<0.05) but the type of birth, age of dam and weight at birth had no significant effects.

DISCUSSION

Reproductive Performance of Ewes and Lamb Survival Rate (SR)

The average lambing rate (LR), twinning rate (TW), fecundity (FEC) and litter size (LITS) were 94% (91% to 96%) and 17% (10% to 25%), 1.09 (1.04 to 1.16) and 1.17 (1.10 to 1.25), respectively, according to flocks and years. This results are higher than those reported for TW and LR on Akkaraman sheep [8], and for FEC, LITS and LR [9] on Karakaş sheep and for LR [10,11] on Ramlıç and Tushin sheep.

The SR was estimated as 90% (85% to 100%) according to year, type of birth, sex and age of dam. There was no significant difference between male and female lambs in terms of SR. The effects of year, type of birth and age of dam on SR were significant (P<0.05). SR in the year 2011 was higher than that in 2010. Single born lambs had significantly higher SR than twin born lambs. Similar results were reported for Morkaraman and Kangal-Akkaraman lambs [12] and for various pure or crossbred sheep [13-15] while lower SR was reported on Akkaraman [12]. The variation among the research results in terms of SR of lambs could be related to differences in managemental conditions in the flocks and the care that the lambs have been subjected to until weaning.

Lambs Growth Performance

Birth Weight (BWT): In the present study, the average BWT were found as 4.0±0.04 kg varied between 3.6±0.07 and 4.4±0.04 kg based on type of birth, age of dam and sex of lamb. Our results are similar to reports in previous studies [8,12,16-19]. They reported that BWT were significantly affected by age of dam, type of birth and sex of lamb; females, twin borns and lambs born from young dams were lighter. However, in this study the effect of year was not significant on BWT. Nonsignificant effect of age of dam on BWT was reported in some other researches [20]. This results were similar to the reports in some studies [16,21] while were different from those in some other studies [11,20-23]. The mean BWT was havier in males than females and similar to prior reports [20,22,23]. On the contrary, insignificant effect of sex on BWT was reported on Anatolian Merino sheep [24]. The effect of type of birth on BWT was significant and similar to the findings on Ramlıç, Karacabey Merino, Akkaraman, Morkaraman, Awassi, Konya Merino and Anatolian Merino sheep [11,16,20-23].

Weaning Weight (WWT) and Six Month Live Weight (SMLW): For WWT (22.1 kg), our results are similar to reports [12] in previous studies on Morkaraman and Kangal-Akkaraman lambs. The effect of year was significant and similar to those reported on Konya Merino, Karacabey Merino, Akkaraman and Awassi sheep [25] while insignificant effect of year was reported on WWT [16,20]. This can be explained as that environmental and managemental conditions varies from year to year. The effects of sex on WWT were significant (P<0.05) and males were havier at weaning than females. This result is similar to previous studies [11,19,20,23] but different from some others [8] in which the sex effect was not significant on WWT. The effect of type of birth on WWT was significant (P<0.05) and similar to the results in the studies conducted on Karacabey Merino, Akkaraman, Morkaraman, Ramlıç, Awassi, Konya Merino and Anatolian Merino sheep [11,16,20]. The effect of age of dam on WWT was significant and contradicts with some previous reports [20]. For SMLW (36.11 kg), similar values were reported on Morkaraman and Kangal-Akkaraman lambs [12].

Average Daily Weight Gains (ADWGs): The least square means and standart errors of ADWG1 and ADWG2 are presented in *Table 3*. The all factors in this study were significant on ADWG1 (P<0.05), but only the effects of year and sex were significant on ADWG2 (P<0.05) showing that males grow faster than females between weaning to six month of age. For ADWG1, significant effects of year, sex, and type of birth were reported in previous studies [20,25] and in agreement with our results. However, the effect of age of dam was not significant in this study conratdicting to previous reports [20].

In conclusion, lamb's sex was significant for all traits except SR. For all growth traits in this study, males had higher values then females. Differences in body weight between male and female could be occuring due to the reason that males and females differ in sexual chromosomes, physiological characteristics and endocrinal system [26]. In this study, the effect of type of birth was significant on BWT, WWT, SMLW, ADWG1 and SR. Single borns' body weight in all ages and their average daily weight gain were higher than twins due possibly to reason that the ewes with single lamb give all its care to one lamb comparing to ewes with multiple lambs. Thus, single born lambs receive more care and milk from their mother and ends up with high WWT, ADWG1, consequently high SMLW and ADWG2 due to the reason of high correlation between WWT and SMLW [27,28]. The effect of age of dam was significant on WWT, SMLW, ADWG1. The lambs produced by dams of moderate ages (3, 4, and 5) have more weight than other lambs produced by young or old dams (2 or 6 and older). This difference could be related to lower capacity of milking in association with young or old ewes in comparison to ewes of moderate ages. Environmental factors are significant sources of variation for growth traits including body weight and average daily gains, and play an important role in expression of genetic potential. On the basis of analyses and regarding to high variation observed in the traits in question in this study, genetic improvement of Zom sheep in terms of growth trait and lamb survival rate are highly possible with a planned and continious selection program.

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