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Research Article

Live Weights of Kıvırcık Ewes and Lambs in Some Periods under Extensive Management Conditions

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Abstract: The aims of the present study were to evaluate the growth characteristics of Kıvırcık sheep and describe non-genetic factors influencing their expression. Data were collected from 6 flocks including a nucleus flock and 5 breeders' flocks (2 in mountainous and 3 in lowland villages). Flocks raised in extensive conditions were kept in pastures throughout the year. The body weight of ewes at parturition and the birth and weaning weight of lambs were recorded during 2 lambing seasons (1999-2000 and 2000-2001). The least-squares mean of ewe body weight at parturition was 42.2 kg. Lambing season, flock and age of ewe were significant ($P < 0.01$) sources of variation for body weights of ewes at parturition. Mean birth weight of lambs was 3.56 kg. The means of flock, birth type and sex of lambs for birth weight were significantly different ($P < 0.01$); however, the effect of lambing season and age of dam on birth weight was not significant. Birth weight was also significantly ($P < 0.01$) influenced by dam body weight at parturition. Mean weaning weight of lambs weaned at an average age of 66.5 days was 18.5 kg. Weaning weight was influenced significantly by lambing season, flock, sex, birth weight and weaning age ($P < 0.01$) but not by birth type or age of dam. The results of this study indicated that Kıvırcık lambs had a good growth rate.

Key Words: Kıvırcık, ewe, lamb, birth weight, weaning weight

Ekstansif Yetiştirme Koşullarında Kıvırcık Koyun ve Kuzuların Kimi Dönem Canlı Ağırlıkları

Özet: Araştırmanın amacı, Kıvırcık koyunlarında gelişme özelliklerinin değerlendirilmesi ve bu özelliklere etkili genetik temelli olmayan faktörlerin tanımlanmasıdır. Veriler, bir çekirdek sürü ile yetiştiricilere ait beş ayrı sürüden (ikisi dağ ve üçü ova köyünde bulunan) alınmıştır. Ekstansif yetiştirme koşullarındaki sürüler yıl boyu meralarda otlatılmıştır. Koyunların doğumdaki canlı ağırlıkları ile kuzuların doğum ve sütten kesim ağırlıkları, 2 yıllık süreçte (1999-2000 ve 2000-2001 kuzulama mevsimleri) kaydedilmiştir. Doğumda koyun canlı ağırlığının en küçük kareler ortalaması 42,2 kg olarak gerçekleşmiştir. Koyunların doğumdaki canlı ağırlığı için yıl, çiftlik ve koyun yaşı önemli ($P < 0,01$) birer varyasyon kaynağı olmuştur. Kuzu doğum ağırlığı ortalaması 3,56 kg olarak belirlenmiştir. Doğum ağırlığı bakımından çiftlikler, doğum tipleri ve cinsiyetler arasındaki değişimler önemli ($P < 0,01$) bulunurken yıllar ve ana yaşları arasındaki farklar önemsiz olmuştur. Kuzu doğum ağırlıkları ananın doğum ağırlığı tarafından da önemli derecede etkilenmiştir ($P < 0,01$). Yaklaşık 66,5 günlük yaşta sütten kesilen kuzuların sütten kesim ağırlıklarının genel ortalaması 18,5 kg'dır. Sütten kesim ağırlığı kuzulama yılı, çiftlik, cinsiyet, doğum ağırlığı ve sütten kesim yaşı gibi etmenlerden önemli derecede ($P < 0,01$) etkilenirken, kuzu doğum tipi ve ana yaşlarının yarattığı etkiler istatistiki anlamda önemsiz bulunmuştur. Mevcut veriler Kıvırcık kuzularının dikkate değer bir gelişme hızına sahip olduklarını göstermektedir.

Anahtar Sözcükler: Kıvırcık, koyun, kuzu, doğum ağırlığı, sütten kesim ağırlığı

Introduction

Sheep are traditionally raised on smallholder farms in Turkey. The sheep population of Turkey, about 25 million in 2004 (1), has a great genetic potential together with different breeds and local types adapted to different ecological conditions. The studies based on the determination of characteristics of sheep breeds were generally performed on state farms but not under extensive farm conditions (2). Therefore, the genotypes developed or improved on state farms did not show an acceptable performance under the breeder's conditions due to large differences between the environmental and management conditions of the state and breeders' farms.

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The Kıvırcık breed is widespread in the western regions of Turkey (Marmara and some parts of the Aegean region) but the exact size of the purebred population is not known. In the region where the present study was conducted, the prime income of sheep breeders comes from lamb sales. This thin-tailed breed is widely known for its good growth characteristics and is preferred by consumers due to its superior meat quality. However, the litter size of this breed is not high: it is reported to be from 1.00 to 1.18 (3-6). Birth weight, and weaning age and weight for Kıvırcık lambs were reported as 3.68 kg, 105 days and 26.14 kg by Altınel et al. (7), 4.24 kg, 105 days and 27.36 kg by Çelik (5), 2.81 kg, 115 days and 20.34 kg by Altın et al. (8), and 3.79 kg, 75 days and 15.33 kg by Sönmez and Kızılay (9), respectively.

Meat production from lambs is a direct function of their growth characteristics. Growth of lambs is defined by birth weight, live weights at various ages and average daily gain. Moreover, body weights of ewes at the late stages of pregnancy or parturition are also important, because a ewe with a higher body weight gives heavier lambs with a better survival rate. Therefore, heavier lambs grow up faster to weaning or later ages and produce heavier carcasses.

In order to obtain genetic improvement in the growth characteristics of lambs through breeding programs, it is necessary to have accurate estimates of environmental and genetic parameters. Environmental and genetic parameters may be differentiated in time among breeds and environments. Adjustment of data for various environmental effects such as year of birth or lambing season, flock, birth type and sex, age of dam, birth weight and body weight of dam is essential for the prediction of breeding values in selection programs. On the other hand, estimating the environmental effects on the traits is also important for the regulation of management practices to increase breeders' incomes. Effects of the factors mentioned above on the growth of lambs are reported in various studies (7,10-16).

The objectives of the present study were: (a) to evaluate performances of Kıvırcık sheep in different flocks in lowland and highland (mountainous) areas; and (b) to estimate the effect of environmental factors for accurate estimations of genetic parameters and so breeding values for growth traits.

Materials and Methods

Animals and experimental design

The data for the performance of ewes in 6 Kıvırcık flocks including a nucleus flock and 5 breeders' flocks, 2 in a mountainous village (Highland-1 and 2) and 3 in a lowland village (Lowland-1, 2 and 3) in Koçarlı district within Aydın province, were recorded in the lambing seasons of 1999-2000 and 2000-2001. The nucleus flock was formed from 38 breeders' flocks within the framework of the Adnan Menderes University Group Sheep Breeding Program (AMU-GSBP) based on an open nucleus breeding system (2). The performances of ewes in only 4 flocks were recorded in the second year of the study (lambing season of 2000-2001) because 2 of flocks were sold at the end of the first lambing season. All flocks were managed in extensive pastures throughout the year. The grass capacity of the pastures was better in the first lambing season due to high rainfall. In critical periods, such as the breeding season or late stage of pregnancy, some concentrate or barley was supplied to the ewes. In the nucleus flock, the estrus cycles of ewes were synchronized during the breeding season with the application of fluorogestone acetate impregnated intravaginal sponges for 14 days and injection of 500 IU PMSG at the time of sponge removal. The ewes in the nucleus flock were exposed as groups of 6 or 7 ewes in separate pens to breeding with single sires from their own breed. The ewes in the other 5 breeders' flocks were exposed to rams (a ratio of 40 to 50 ewes per ram) during the breeding season that started at the end of June. The lambing season ranged from the end of November to mid February as a result of the extended breeding season. At the time of lambing, each lamb was identified, and the date of birth, sex, birth type and birth weight and body weights of ewes were recorded within 24 h of parturition. In the lambing seasons of 1999-2000 and 2000-2001, body weights of 251 and 172 ewes, birth weights of 304 and 165 lambs and weaning weights of 204 and 145 lambs were recorded, respectively. Weaning occurred an average of 60 and 76 days after lambing (in March) in 1999-2000 and 2000-2001, respectively. Weaning weights of lambs were determined at the mean age of 66.5 days. Average ages of lambs at weaning for the 2 lambing seasons and for each flock are presented in Table 1.

Table 1. Average age of lambs (days) at weaning across flocks in lambing seasons of 1999-2000 and 2000-2001.

Flocks	Weaning ages in lambing seasons		Average weaning ages for flocks
	1999-2000	2000-2001	
Flock-1 (nucleus)	85	98	91.5
Flock-2 (highland-1)	44	53	48.5
Flock-3 (highland-2)	38	-	38.0
Flock-4 (downland-1)	60	59	59.5
Flock-5 (downland-2)	64	93	78.5
Flock-6 (downland-3)	71	-	71.0
Overall mean	60	76	66.5

Statistical analyses

Body weights of ewes at parturition, and weights of lambs at birth and weaning were analyzed using the GLM (Generalized Linear Models) procedure of SAS software (1999, Version 8, SAS Institute Inc., NC, USA) following 3 separate linear models:

Body weights of ewes at parturition: $y_{ijkl} = \mu + a_i + b_j + c_k + e_{ijkl}$

Lamb birth weight: $y_{ijklmn} = \mu + a_i + b_j + c_k + d_l + f_m + b_1(X_{ijklmn} - \bar{X}) + e_{ijklmn}$

Lamb weaning weight: $y_{ijklmn} = \mu + a_i + b_j + c_k + d_l + f_m + b_2(V_{ijklmn} - \bar{V}) + b_3(W_{ijklmn} - \bar{W}) + e_{ijklmn}$

where y_{ijkl} = body weights of ewes at parturition, y_{ijklmn}= birth or weaning weights, μ = overall mean of the trait, a_i = fixed effect of lambing season (i = 1999-2000 and 2000-2001), b_j = fixed effect of herd (j = 1, 2, 3, 4, 5 and 6), c_k = fixed effect of ewe or dam age (k = 2, 3, 4, 5, 6 and ≥7), d_l = fixed effect of birth type (l = 1, 2, 3 and 4), f_m = fixed effect of sex (m = 1 and 2), b_1 = regression coefficient of body weight of dam at parturition on lamb birth weight, b_2 = regression coefficient of lamb birth weight on weaning weight of lamb, b_3= regression coefficent of lamb age at weaning on the weaning weight of lamb, X_{ijklmn}= body weight of dam at parturition, V_{ijklmn}= birth weight of lamb, W_{ijklmn}= weaning age of lamb, $\bar{X}$ = mean body weight of dams at parturition, $\bar{V}$ = mean birth weight of lambs, $\bar{W}$ = mean age of lambs at weaning and e_{ijkl} and e_{ijklmn} = random errors with the assumption of N $(0,\sigma^2)$.

Results

Body weight of ewes at parturition

The least-squares means for body weight of ewes at parturition are shown in Table 2. Body weight of Kıvırcık ewes at parturition was on average 42.2 kg. Body weights were significantly higher in the 1999-2000 lambing season than in 2000-2001 (45.1 vs. 39.3, $P < 0.01$). Ewes in the nucleus flock (Flock-1) and the other lowland flocks (Flock-4, Flock-5 and Flock-6) were significantly heavier ($P < 0.01$) than those in the mountainous flocks (Flock-2 and Flock-3) but the mean body weights of ewes in Flock-4 were lower than those in the nucleus flock and the other lowland flocks. Furthermore, the difference between the mean body weights of ewes in the 2 mountainous flocks was significant. The effect of age was also significant ($P < 0.01$) on body weight.

Birth weight

Table 2 gives the least-squares means for birth weights. The overall mean for birth weights of Kıvırcık lambs was 3.56 kg. There was no significant effect of lambing season (1999-2000 and 2000-2001) on birth weight (3.53 vs. 3.59 kg). However, the effect of flock was significant on birth weight ($P < 0.01$). The highest and lowest performances were observed for lambs in Flock-3 and Flock-1 (4.40 vs. 3.07 kg), respectively. Birth weight decreased significantly ($P < 0.01$) from singles to triplets (4.42, 3.63 and 3.04 kg, respectively), whereas quadruplets were heavier than triplets (3.16 vs. 3.04) but this difference was not statistically significant. Male lambs were about 0.3 kg heavier than females (3.71

Table 2. Least-squares means ± standard errors for birth weight (kg) and weaning weight (kg) of Kıvırcık lambs and body weights of ewes at parturition.

Factor	n	Birth weight of lambs	n	Weaning weight of lambs	n	Ewe body weight at parturition
Lambing season		NS		**		**
1999-2000	304	3.53 ± 0.09	204	16.6 ± 0.52	251	45.1 ± 0.46
2000-2001	165	3.59 ± 0.12	145	20.4 ± 0.55	172	39.3 ± 0.59
Flocks		**		**		**
Flock-1 (nucleus)	152	3.07 ± 0.09e	68	16.1 ± 0.57d	122	47.9 ± 0.60a
Flock-2 (mountainous-1)	64	3.29 ± 0.15de	57	17.4 ± 0.67c	60	34.6 ± 0.81c
Flock-3 (mountainous-2)	22	4.40 ± 0.20a	19	16.8 ± 0.80cd	21	31.2 ± 1.37d
Flock-4 (lowland-1)	130	3.54 ± 0.11bc	128	20.5 ± 0.57a	131	44.4 ± 0.56b
Flock-5 (lowland-2)	65	3.67 ± 0.12b	54	20.6 ± 0.60a	60	47.9 ± 0.82a
Flock-6 (lowland-3)	36	3.39 ± 0.15cd	23	19.5 ± 0.73b	29	47.2 ± 1.21a
Age of dam		NS		NS		**
1	34	3.54 ± 0.18	9	17.4 ± 1.07	25	35.9 ± 1.38c
2	87	3.51 ± 0.13	61	18.0 ± 0.59	88	39.7 ± 0.74b
3	58	3.48 ± 0.12	50	18.6 ± 0.61	55	41.5 ± 0.81b
4	81	3.49 ± 0.12	70	18.7 ± 0.57	77	43.8 ± 0.74a
5	94	3.64 ± 0.10	76	19.1 ± 0.56	83	44.6 ± 0.69a
6	59	3.60 ± 0.13	51	18.6 ± 0.57	52	44.0 ± 0.89a
≥7	56	3.66 ± 0.12	32	18.9 ± 0.67	43	45.8 ± 0.99a
Type of birth		**		NS		**
Single	340	4.42 ± 0.05a	292	18.6 ± 0.24	-	-
Twin	103	3.63 ± 0.09b	53	17.8 ± 0.45	-	-
Triplet	18	3.04 ± 0.17c	4	19.0 ± 1.36	-	-
Quadruplet	8	3.16 ± 0.26c	-	-	-	-
Sex		**		**		
Male	227	3.71 ± 0.10	165	19.2 ± 0.53	-	-
Female	242	3.41 ± 0.10	184	17.8 ± 0.53	-	-
Linear regression						
Dam weight at parturition (kg)		0.04 ± 0.015**			-	- -
Birth weight (kg)		-		2.58 ± 0.211**	-	-
Weaning age (day)		-		0.19 ± 0.005**	-	-
Overall mean	469	3.56 ± 0.10	349	18.5 ± 0.51	43	42.2 ± 0.42

NS: non significant; **: P < 0.01; a,b,c,d,e: Different letters within a factor indicates that means differ significantly

vs. 3.41 kg, P < 0.01). Lambs of ewes at older ages were a little heavier than those of young ewes but these differences were not significant. On the other hand, birth weight was significantly influenced by body weights of dams at parturition, included in the model as a covariate.

Weaning weight

The mean weaning weight was 18.5 kg. Weaning weight was influenced significantly by lambing season, flock, sex, birth weight and weaning age (P < 0.01) but not by birth type or age of dam (Table 2).

Mean weaning weight of lambs was approximately 4 kg lower in the first lambing season than that in the second lambing season (16.6 vs. 20.4 kg, $P < 0.01$). The variation among flocks was significant ($P < 0.01$), varying from 16.1 to 20.6 kg. Single born lambs were a little heavier than twins but this difference was not significant. Unexpectedly, triplets were heavier than singles and twins due to the rather limited number of triplets (only 4 of the triplets were weaned), but these differences were not significant. As expected, male lambs were 1.4 kg heavier than females (19.2 vs. 17.8, $P < 0.01$). The variation caused by age of dam was not significant, but a regular positive trend was observed with an increase in dam age from 1 to 5 (17.4, 18.0, 18.6, 18.7 and 19.1 kg, respectively). Birth weight and weaning age had significant effects on the weaning weight ($P < 0.01$).

Discussion

Body weight of Kıvırcık ewes at parturition averaged 42.2 kg (Table 2), which is lower than that of Karakaş (46.2 to 61.2 kg), Hamdani (70.8 kg) and Merino (65.6 kg) breeds (13,14,17-19) but very close to the results reported by Demir and Başpınar (20) for the same breed (at shearing), i.e. 42.7 kg. No additional feed was supplied to the ewes in the present study. This difference may result from the special feeding of ewes of other breeds at the late stage of pregnancy. The difference in the body weight of about 5.8 kg in performance among lambing seasons may reflect environmental variation resulting from changes in the weather conditions, especially rainfall, which directly affects herbage quantity and quality of the pasture and the change in management by farmers in different years.

Ewes in Flock-2 and Flock-3 in a mountainous village are rather lighter at parturition than those in all the lowland flocks. It is thought that the main reason for this difference is the poor pasture conditions of the mountainous areas and the grazing of sheep on crop fields after harvesting in autumn in lowland areas.

The mean birth weight of Kıvırcık lambs, 3.56 kg in Table 2, is similar to the means 3.79 and 3.68 kg reported by Sönmez and Kızılay (9) and Altınel et al. (7), respectively, lower than the mean 4.24 kg reported by Çelik (5), and higher than the 2.81 kg reported by Altın et al. (8) for the same breed. The similarity of birth weights between the 2 lambing season agreed with the results for Horro and Menz sheep in Ethiopia (21) but not with the findings for the DS synthetic breed of sheep in Morocco (22). While the lowest mean birth weight was observed in Flock-1 (nucleus flock, 3.07 kg) due to the high litter size of nucleus ewes (1.43 lambs per ewe lambing), the highest one was determined in Flock-3 (4.40 kg) including single born lambs only. The higher value for the latest flock may stem from better management of ewes in late pregnancy. The significant differences in body weight among flocks mainly stems from the variability observed in litter size across flocks rather than the management conditions of the flocks. Birth weight of lambs decreased with increasing litter size up to 3 lambs per lambing. Although the weight of quadruplets was a little greater than that of triplets, this difference was not significant. This may be explained by the very limited number of triplets in the study. The effect of birth type on the birth weight of lambs was also reported as significant in the majority of studies (8,9, 13,14,23,24).

Male lambs had significantly higher birth weight (0.3 kg) than females. Numerous studies have documented the superiority of male lambs at birth (21-26). In contrast, similar birth weights have been reported for the 2 sexes (8,13,16,19).

Age of dam was not a significant source of variation for birth weight, which was supported by the findings in the literature (5,12,14,16,23).

However, birth weight was positively and significantly affected by the body weight of ewes at parturition. A similar result in the same breed was reported by Altın et al. (8).

Mean weaning weight was 18.5 kg at an age of approximately 2 months (66.5 days). This age is suitable for weaning but not for marketing due to the lightness of lambs. A short fattening period after weaning may be appropriate to obtain reasonable market weights. The mean weaning weight was lower than those reported by Çelik (5), Altınel et al. (7) and Altın et al. (8) for the same breed, i.e. 27.36, 26.14 and 20.34 kg for weaning ages of 105, 105 and 115 days, respectively. This difference originated from the weaning of lambs at early ages in the present study. In contrast, a lighter weaning weight (15.33 kg at a weaning age of 75 days) was reported for the same breed by Sönmez and Kızılay (9). On the other

hand, average daily gain of lambs from birth to weaning was about 224 g ((weaning weight - birth weight) / weaning age). This mean was higher than the 154, 220, 214 and 152 g reported by Sönmez and Kızılay (9), Çelik (5), Altınel et al. (7) and Altın et al. (8), respectively.

Weaning weight of lambs was higher (about 4 kg) in 2000-2001 than in 1999-2000, because lambs in 1999-2000 were weaned earlier than those in 2000-2001 (60 vs. 76, Table 1). Among the flocks, weaning weight was higher in Flock-4 and Flock-5 and lowest in Flock-1, i.e. the nucleus flock. The lowest weaning weight observed for the nucleus flock probably stems from the high litter size of ewes. The insignificant effect of birth type on weaning weight was in contrast with the literature (5,12-15,23). Surprisingly, triplets were heavier than twins or singles. This may be due to the fostering of triplets by other ewes having a single lamb and the limited number of triplets (n = 4) at weaning.

Males were heavier than females at weaning. Similarly, the superiority of male lambs has been widely reported (5,8,16,23). However, the effect of sex has been reported as nonsignificant in some studies (12,19,24). The effect of dam age on weaning weights was not significant and agreed with previous findings reported by Altın et al. (8). Moreover, birth weight and weaning age had significant positive effects on the weaning weight of lambs. These findings were in agreement with the literature (27).

The results from present study indicated that Kıvırcık lambs had good growth characteristics, but meat production was affected negatively by weaning at early ages. In Aydın, lambs with about 18-22 kg body weights were marketed at weaning ages of 2 to 3 months in most flocks. Then the milking of ewes started with weaning. On the other hand, some breeders marketed their lambs at live weights of 30-35 kg after a short fattening period with concentrate feeds. It was concluded that meat production from Kıvırcık lambs could be increased with marketing of lambs at later ages or shifting of the season of birth and supplying additional feedstuff.

It is impossible to formulate a better breeding plan due to the lack of genetic parameters for Kıvırcık sheep. Therefore, recording of performances in breeders' flocks (members of AMU-GSBP) is a high priority for genetic evaluation and construction of well-defined breeding plans.

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