

## The Growth and Survival Characteristics of Lambs Produced by Commercial Crossbreeding Kıvırcık Ewes with F<sub>2</sub> Rams with the German Black-Headed Mutton Genotype\*

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**Abstract:** This study was conducted to compare the growth and survival characteristics of crossbred lambs produced by mating Kıvırcık ewes with German Black-Headed Mutton (GBM) x Kıvırcık (F<sub>2</sub>) rams, GBM x Merino (F<sub>2</sub>) rams, as well as the growth and survival characteristics of purebred Kıvırcık lambs. The data were obtained from 59 (GBM x Kıvırcık) x Kıvırcık, 59 (GBM x Merino) x Kıvırcık, and 60 purebred Kıvırcık lambs.

The birth weights of (GBM x Kıvırcık) x Kıvırcık, (GBM x Merino) x Kıvırcık, and purebred Kıvırcık lambs were 4.08, 4.32, and 3.85 kg, respectively. The differences of birth weight between the genotype groups were statistically significant ( $P < 0.001$ ). The weaning weights of these groups were 19.33, 19.38, and 17.58 kg, respectively. The difference in weaning weights between the crossbred genotypes was not significant ( $P > 0.05$ ), whereas the differences between the crossbred lambs and the purebred Kıvırcık lambs were significant ( $P < 0.05$ ). The effects of genotype, birth type, sex, and age of dam on the growth of lambs were investigated. All these effects, except age of dam, were significant. Among the genotypes, 88.13%, 91.53%, and 90.00% of the lambs survived to be weaned, respectively.

The results of this study showed that crossbred lambs produced by the use of F<sub>2</sub> rams, which carry the GBM genotype, had higher growth performance than purebred Kıvırcık lambs, although they had similar survival rates.

**Key Words:** Sheep, crossbreeding, growth, survival rate

### Kıvırcık Koyunları ile Alman Siyah Başlı Etçi Koyunu Genotipi Taşıyan F<sub>2</sub> Koçlar Arasında Yapılan Kullanma Melezlemelerinde Kuzuların Büyüme ve Yaşama Güçleri

**Özet:** Bu araştırma, Kıvırcık koyunlarının Alman Siyah Başlı Etçi Koyunu (ASB) x Kıvırcık (F<sub>2</sub>) ve ASB x Merinos (F<sub>2</sub>) genotiplerindeki koçlarla birleştirilmesi ile elde edilen melez kuzuların büyüme ve yaşama güçlerinin birbirleri ile ve saf Kıvırcık kuzularla karşılaştırılması amacıyla yürütülmüştür. Araştırma için gerekli veriler, 59'ar baş (ASB x Kıvırcık) x Kıvırcık ve (ASB x Merinos) x Kıvırcık kuzu ile 60 baş saf Kıvırcık kuzudan elde edilmiştir.

(ASB x Kıvırcık) x Kıvırcık, (ASB x Merinos) x Kıvırcık ve saf Kıvırcık kuzularda ortalama doğum ağırlığı sırasıyla 4,08 kg, 4,32 kg ve 3,85 kg olarak elde edilmiştir. Doğum ağırlığı için genotip grupları arasındaki farklar istatistiki açıdan önemli bulunmuştur ( $P < 0,001$ ). Bu gruplarda kuzuların sütten kesim ağırlıkları sırasıyla 19,33 kg, 19,38 kg ve 17,58 kg olarak bulunmuştur. Sütten kesim ağırlığı için melez genotipler arasındaki farklılık önemli bulunmazken ( $P > 0,05$ ), melez kuzular ile saf Kıvırcık kuzular arasındaki farklılık önemli bulunmuştur ( $P < 0,05$ ). Kuzularda büyüme üzerine genotip, doğum tipi, cinsiyet ve ana yaşının etkisi incelenmiştir. Ana yaşı dışındaki diğer etkiler önemli bulunmuştur. Kuzuların sütten kesimdeki yaşama gücü değerleri sırasıyla % 88,13, % 91,53 ve % 90,00 olarak bulunmuştur.

Bu çalışmada elde edilen bulgular, ASB genotipi taşıyan F<sub>2</sub> koçlar kullanılarak elde edilen melez kuzuların saf Kıvırcık kuzulardan daha iyi büyüme performansına ve saf Kıvırcık kuzulara benzer yaşama gücüne sahip olduklarını göstermektedir.

**Anahtar Sözcükler:** Koyun, melezleme, büyüme, yaşama gücü

\* This study is based on Bülent EKİZ's PhD thesis.

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## Introduction

Kıvrıcık, the predominating sheep breed of the Marmara region in Turkey, accounts for 6.2% of the country's total sheep population (1). In the big cities of the Marmara region, the taste of lamb meat is preferred to that of other meats, and lamb meat is more expensive. Additionally, sheep's milk is processed into more valuable products. Because of this, lambs are weaned and slaughtered at early ages and, therefore, the meat production potential of the lambs is not fully realised (2).

A method to prevent the meat loss that results from the early slaughtering of lambs is the production of quality slaughter lambs by crossbreeding. Fast-growing mutton breeds with good carcass quality like Ile de France, Texel, Hampshire Down, Dorset Down, Lincoln, Border Leicester, and German Black-Headed Mutton were brought to Turkey, and the possibility of the improvement of the indigenous breeds by the use of crossbreeding with these mutton breeds was investigated (3-5).

In a study carried out to determine the production characteristics of the mutton breeds that were brought to the Marmara Animal Breeding Research Institute, it was concluded that German Black-Headed Mutton had the best production performance (6). In the next stage, German Black-Headed rams were mated with Kıvrıcık and Merino ewes, which are local breeds of the Marmara region, to obtain slaughter lambs (3,4).

In various studies, the birth weight and 75th day weight of Kıvrıcık lambs were 3.58-4.07 and 16.4-17.5 kg, respectively (4,5,7-9). In crossbreeding studies between different mutton breeds and Kıvrıcık ewes, Bulmuş and Demir (5) reported the birth weight and 90th day weight of Hampshire Down x Kıvrıcık (F<sub>1</sub>) lambs as 4.41 and 22.17 kg, respectively. Özcan et al. (4) found the birth weight and 60th day weight of GBM x Kıvrıcık (F<sub>1</sub>) lambs to be 4.27 and 17.55 kg, respectively, and in the study by Özcan (8), the birth weight and 75th day weight of Texel x Kıvrıcık (F<sub>1</sub>) single-born male lambs were 4.48 and 19.20 kg, respectively.

In crossbreeding studies conducted to produce quality slaughter lambs from the indigenous sheep breeds in Turkey, the birth weight and 75th day weight of crossbred lambs were 4.22-4.67 and 18.51-19.89 kg, respectively (10-12).

Several researchers found the effects of dam age,

birth year, birth type, and sex of lambs on birth weight and weight at different growth periods to be significant. In these studies, it is generally reported that the lambs of older dams were heavier than those of younger dams (4,13), single-born lambs were heavier than twins (7,14-18), and male lambs were heavier than female lambs (7,15,17,18). However, in different studies, the effects of dam age (14-16), birth type (10,12), and sex of lamb (10,12) on the birth weight and weights at different ages of lambs were not significant.

Survival, which is described as the ability to be born alive and remain alive until certain ages, is a significant factor affecting the profitability of animal breeding. The survival rates until weaning of Kıvrıcık lambs in various studies were 86.39%-99.20% (5,7,9,19,20). Kızılay (20) reported a survival rate at the 90th day of Texel x Kıvrıcık (F<sub>1</sub>) lambs of 88.70% and the survival rate at weaning of Hampshire Down x Kıvrıcık (F<sub>1</sub>) lambs in the study by Bulmuş and Demir (5) was 78.30%. In the studies by Altinel et al. (3) and Yılmaz and Altinel (9), the survival rates at the age of weaning of GBM x (Chios x Kıvrıcık) crossbred lambs were 89.66% and 92.11%, respectively.

In the 1990s, to obtain the sire lines that might be used by local breeders to produce slaughter lambs, crossbreeding experiments using the GBM breed with Kıvrıcık and Karacabey Merino breeds were conducted in the Marmara Animal Breeding Research Institute. During these studies, F<sub>2</sub> genotypes, which carry the GBM genotype, were obtained. The aim of the present study was to investigate the possibility of using F<sub>2</sub> rams, which carry the GBM genotype, as a sire line in commercial crossbreeding with Kıvrıcık ewes to produce rapid growing slaughter lambs. For this purpose, the growth and survival characteristics of crossbred lambs produced by the mating of GBM x Kıvrıcık (F<sub>2</sub>) and GBM x Merino (F<sub>2</sub>) rams with Kıvrıcık ewes were investigated and compared to those of purebred Kıvrıcık lambs.

## Materials and Methods

The study included 139 Kıvrıcık ewes and 2 Kıvrıcık rams present in the Sheep Breeding Unit of the Teaching, Research, and Practice Farm of İstanbul University Veterinary Faculty, and as the sire lines 2 GBM x Kıvrıcık (F<sub>2</sub>) rams and 2 GBM x Karacabey Merino (F<sub>2</sub>) rams brought from the Marmara Animal Breeding Research

Institute were used. GBM x Kıvırcık ( $F_2$ ), GBM x Merino ( $F_2$ ), and purebred Kıvırcık rams were mated with 45, 47, and 47 Kıvırcık ewes, respectively. The lamb materials of the study were 59 (GBM x Kıvırcık) x Kıvırcık, 59 (GBM x Merino) x Kıvırcık crossbred lambs, and 60 purebred Kıvırcık lambs.

The ewes in the breeding flock were fed dry alfalfa hay, in addition to grazing, before the mating season. During the breeding season, no additive concentrates were given to the ewes. The addition of concentrates to the feed ration began with 400 g/day at 1.5 months prior to the beginning of births, and was gradually increased to 800 g/day at the beginning of births. The lambs were identified by ear-tags. The birth date, birth weight, sex, birth type, dam age, and genotype of all the lambs were recorded. The lactating ewes were fed 500 g/day concentrates and dry alfalfa hay. The lambs were kept together with their dams for the first month after birth. Afterwards, 2 flocks composed of the lambs and their dams were formed and the lambs were permitted to suckle for 2 h twice per day. During the suckling period, additional dry alfalfa hay and concentrates were given to the lambs. The lambs were weaned at the age of approximately 2.5 months (75 days).

The survival rates of the lambs were evaluated up to weaning at the 75th day of age. The ear-tag numbers, dates, and causes of death were recorded to determine the survival rates. The survival rates of the lambs at the 15th, 30th, 45th, 60th, and 75th days of age were calculated by the division of the number of live lambs by the number of live-born lambs and then multiplying the result by 100.

The birth weights of the lambs were determined when the lambs were completely dry. The growth data of the lambs were determined by the fortnightly weighing of the lambs with scales sensitive to 100 g. The absolute 15th, 30th, 45th, 60th, and 75th day weights of the lambs were calculated by the linear interpolation of the weights obtained in consecutive weight measurements.

In the next stage of the study, 60% of the weaned lambs were fattened for 56 days and then they were slaughtered. Therefore, growth and survival characteristics of the lambs could not be investigated for the post-weaning period.

The statistical analyses of the survival rates before weaning were done by the chi-square test (21). The

growth characteristics and the effects of the factors (genotype, sex, birth type, and dam age) affecting the growth of the lambs were determined by least squares analysis of variance and the significance controls of the differences between the group were done by contrast test (22).

The model below was used for growth characteristics:

$Y_{ijklm} = \mu + gi + aj + tk + sl + e_{ijklm}$ , where  $Y_{ijklm}$  = production of any animal,  $\mu$  = overall mean,  $gi$  = effect of genotype,  $aj$  = effect of dam age,  $tk$  = effect of birth type,  $sl$  = effect of sex of lamb, and  $e_{ijklm}$  = random error. With this model it was assumed that there were no significant interactions between the factors investigated, and the sum of the effects of the subgroups of factors were assumed to be zero. The statistical estimations were performed using SPSS.

## Results

The least squares means (LSM) of weight at birth and at the 15th, 30th, 45th, 60th, and 75th day of (GBM x Kıvırcık) x Kıvırcık, (GBM x Merino) x Kıvırcık, and purebred Kıvırcık lambs are given in Table 1.

The mean birth weights of (GBM x Kıvırcık) x Kıvırcık, (GBM x Merino) x Kıvırcık, and purebred Kıvırcık lambs were 4.08, 4.32, and 3.85 kg, respectively, and the differences between the genotypes were significant ( $P < 0.001$ ). The 75th day (weaning) weights of (GBM x Kıvırcık) x Kıvırcık, (GBM x Merino) x Kıvırcık, and purebred Kıvırcık lambs were 19.33, 19.38, and 17.58 kg, respectively. The difference in weaning weights between the crossbred lamb groups was not significant, whereas the differences between the crossbred lambs and the purebred Kıvırcık lambs were statistically significant.

With regard to the birth weight and weight at different growth periods until weaning, the male lambs were heavier than the females, and single-born lambs were heavier than the prolific-born lambs. The effects of genotype, birth type, and sex were significant during all growth periods. The differences between the growth of lambs having dams at different ages were not significant ( $P > 0.05$ ).

The survival rates until the 75th day of age and the controls of significance between the (GBM x Kıvırcık) x Kıvırcık, (GBM x Merino) x Kıvırcık, and purebred Kıvırcık

Table 1. The least squares means (LSM) and standard errors (SE) of the live weights of lambs in different periods of growth (kg).

Factors Investigated	Birth weight			15 <sup>th</sup> day			30 <sup>th</sup> day			45 <sup>th</sup> day			60 <sup>th</sup> day			75 <sup>th</sup> day		
	n	LSM	SE	n	LSM	SE	n	LSM	SE	n	LSM	SE	n	LSM	SE	n	LSM	SE
Genotype		***			*			*			*			*			*	
(GBMxKıv)xKıv	59	4.08 <sup>b</sup>	0.08	53	7.20 <sup>ab</sup>	0.19	52	10.04 <sup>ab</sup>	0.28	52	13.51 <sup>a</sup>	0.36	52	16.94 <sup>a</sup>	0.46	52	19.33 <sup>a</sup>	0.53
(GBMxMer)xKıv	59	4.32 <sup>a</sup>	0.08	55	7.37 <sup>a</sup>	0.18	54	10.37 <sup>a</sup>	0.26	54	13.60 <sup>a</sup>	0.33	54	16.85 <sup>a</sup>	0.43	54	19.38 <sup>a</sup>	0.50
Kıv x Kıv	60	3.85 <sup>c</sup>	0.08	54	6.86 <sup>b</sup>	0.18	54	9.51 <sup>b</sup>	0.26	54	12.50 <sup>b</sup>	0.33	54	15.47 <sup>b</sup>	0.43	54	17.58 <sup>b</sup>	0.49
Age of dam		NS			NS			NS			NS			NS			NS	
1.5	25	4.12	0.12	24	7.35	0.26	24	10.16	0.38	24	13.49	0.48	24	16.90	0.63	24	19.68	0.72
2.5	30	4.02	0.11	27	7.07	0.24	26	9.77	0.36	26	12.99	0.46	26	16.22	0.60	26	18.76	0.69
3.5	35	4.07	0.10	30	7.32	0.23	30	10.11	0.33	30	13.40	0.43	30	16.93	0.55	30	19.39	0.64
4.5	29	4.17	0.11	27	7.46	0.24	27	10.39	0.35	27	13.73	0.45	27	16.95	0.58	27	19.31	0.67
5.5	33	4.05	0.10	32	6.89	0.23	32	9.54	0.33	32	12.71	0.42	32	15.73	0.55	32	17.85	0.63
6.5	20	3.98	0.13	16	6.96	0.32	15	9.92	0.47	15	12.99	0.61	15	16.13	0.79	15	18.40	0.91
7.5	6	4.17	0.24	6	6.96	0.52	6	9.93	0.76	6	13.11	0.98	6	16.12	1.27	6	17.96	1.47
Birth type		***			***			***			***			***			***	
Single	79	4.40	0.07	75	7.74	0.15	74	10.84	0.22	74	14.21	0.29	74	17.55	0.37	74	19.87	0.43
Prolific	99	3.77	0.07	87	6.55	0.16	86	9.11	0.23	86	12.19	0.30	86	15.30	0.39	86	17.66	0.45
Sex		*			*			*			**			**			**	
Male	86	4.18	0.07	79	7.36	0.16	78	10.36	0.24	78	13.76	0.31	78	17.17	0.39	78	19.68	0.46
Female	92	3.99	0.06	83	6.92	0.15	82	9.59	0.21	82	12.65	0.28	82	15.68	0.36	82	17.85	0.41
Overall Mean	178	4.08	0.05	162	7.14	0.10	160	9.97	0.15	160	13.20	0.20	160	16.42	0.25	160	18.76	0.29

<sup>a,b,c</sup>: The differences between the means of groups carrying various letters in the same column are significant (P < 0.05)

\*: P < 0.05; \*\*: P < 0.01; \*\*\*: P < 0.001; NS: P > 0.05).

lambs according to genotype, dam age, birth type, and sex are presented in Table 2. The survival rates of (GBM x Kıvrıcık) x Kıvrıcık, (GBM x Merino) x Kıvrıcık, and purebred Kıvrıcık lambs were 88.13%, 91.53%, and 90.00%, respectively. During all the growth periods, the differences between the survival rates of the lamb groups, according to the factors investigated, were not significant.

## Discussion

In the present study, the crossbred lambs had better results than the purebred Kıvrıcık lambs in terms of both birth and weaning weights. Although the (GBM x Merino) x Kıvrıcık lambs had higher birth weights than the (GBM x

Kıvrıcık) x Kıvrıcık lambs, this superiority diminished after the 15th day of age. The birth and weaning weights of (GBM x Kıvrıcık) x Kıvrıcık and (GBM x Merino) x Kıvrıcık lambs were similar to the those of crossbred lambs in other studies (4,5,8,10-12) and were higher than what was reported for purebred Kıvrıcık lambs (4,7-9).

The fact that the birth and weaning weights of the crossbred lambs were higher than those of the purebred Kıvrıcık lambs in our study, as well as in other studies, shows that the use of the German Black-Headed Mutton genotype in the production of quality slaughter lambs in the Marmara region can be successful.

The effects of sex and birth type on birth weight and weight at different ages until weaning were significant,

Table 2. Survival rates of lambs in different periods of growth (%).

Factors Investigated	No. of lambs at birth	15 <sup>th</sup> day			30 <sup>th</sup> day			45 <sup>th</sup> day			60 <sup>th</sup> day			75 <sup>th</sup> day		
		n	%	X <sup>2</sup>	n	%	X <sup>2</sup>	n	%	X <sup>2</sup>	n	%	X <sup>2</sup>	n	%	X <sup>2</sup>
Genotype																
(GBMxKiv)xKiv	59	53	89.83		52	88.13		52	88.13		52	88.13		52	88.13	
(GBMxMer)xKiv	59	55	93.22	0.025	54	91.53	0.020	54	91.53	0.020	54	91.53	0.020	54	91.53	0.020
Kiv x Kiv	60	54	90.00		54	90.00		54	90.00		54	90.00		54	90.00	
Age of dam																
1.5	25	24	96.00		24	96.00		24	96.00		24	96.00		24	96.00	
2.5	30	27	90.00		26	86.67		26	86.67		26	86.67		26	86.67	
3.5	35	30	85.71	0.342	30	85.71	0.535	30	85.71	0.535	30	85.71	0.535	30	85.71	0.535
4.5	29	27	93.10		27	93.10		27	93.10		27	93.10		27	93.10	
5.5	33	32	96.97		32	96.97		32	96.97		32	96.97		32	96.97	
6.5	20	16	80.00		15	75.00		15	75.00		15	75.00		15	75.00	
7.5	6	6	100.0		6	100.0		6	100.0		6	100.0		6	100.0	
Birth type																
Single	79	75	94.94	0.125	74	93.67	0.119	74	93.67	0.119	74	93.67	0.119	74	93.67	0.119
Prolific	99	87	87.88		86	86.87		86	86.87		86	86.87		86	86.87	
Sex																
Male	86	79	91.86	0.007	78	90.70	0.006	78	90.70	0.006	78	90.70	0.006	78	90.70	0.006
Female	92	83	90.22		82	89.13		82	89.13		82	89.13		82	89.13	
Total	178	162	91.01		160	89.89		160	89.89		160	89.89		160	89.89	

whereas the effects of dam age on these characteristics were not significant. These results were similar to the results of some previous studies (7,14-18) but were different from the results of some others (10,12,13).

Profitable breeding is possible only if the survival rate of lambs at weaning is high. In the present study the survival rates until weaning of (GBM x Kıvrıcık) x Kıvrıcık and (GBM x Merino) x Kıvrıcık crossbred lambs were similar to those of purebred Kıvrıcık lambs. This result showed that the crossbreeding did not have any negative effects on the survival rates of the crossbred lambs. The

survival rates until weaning of the crossbred lambs in the present study were similar to those of crossbred lambs (3,5,9,20) and purebred Kıvrıcık lambs (5, 9) in some previous studies, but were lower than those of purebred Kıvrıcık lambs in some other studies (7,19,20).

The results of this study showed that crossbred lambs produced with F<sub>2</sub> rams, which carry the GBM genotype, had better growth performance than purebred Kıvrıcık lambs and had similar survival rates in the Marmara region.

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