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TÜBİTAK

Research Article

Improvement studies on mutton sheep for Marmara region conditions: I. fertility, lamb survival, and growth traits of lambs

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Abstract: The present study was conducted to compare the fertility of ewes, the survival rates, and the growth performance of lambs that were crossbred by mating German Black-Headed Mutton (GBM) rams with Kıvırcık ewes. The average lambing rates of the GBM × K(F_1), Bandırma-I and Bandırma-II genotype, and Kıvırcık ewes were 80.00%, 75.73%, 76.78%, and 83.72%, respectively. The differences in lambing rates between the genotypes were significant ($P < 0.01$). The genotypes had a significant effect on litter size at birth, but not on fecundity. The differences in lambs' survival rates between the genotypes were significant ($P < 0.05$). The birth weight (BW), weaning weight (WW), and yearling live weight (YLW) of the lambs were 3.77 kg, 34.11 kg, and 43.71 kg for the GBM × K (F_1); 3.74 kg, 32.98 kg, and 44.91 kg for the Bandırma-I; 3.73 kg, 33.18 kg, and 45.71 kg for the Bandırma-II; and 3.45 kg, 30.92 kg, and 42.22 kg for the Kıvırcık lambs. The results of this study showed that crossbreeding between the GBM and Kıvırcık breed did not significantly increase lamb production. However, crossbred lambs did not have significant survival problems when compared to native Kıvırcık lambs and had higher growth performance than purebred Kıvırcık lambs.

Key words: Sheep, fertility, survival rate, growth traits

Marmara bölgesi şartlarına uygun etçi tip koyun geliştirme çalışmaları: I. dölverimi, kuzularda yaşama gücü ve büyüme performası

Özet: Bu araştırma, Alman Siyah Başlı Et (ASB) ırkı koçlar ile Kıvırcık ırkı koyunların melezlerinde döl verimi, kuzuların yaşama gücü ve büyüme özelliklerini karşılaştırmak amacı ile yürütülmüştür. Çalışmada, ASB × K (F_1), Bandırma-I, Bandırma-II ve Kıvırcık koyunlarının doğum oranı sırasıyla % 80,00, % 75,73, % 76,78 ve % 83,72'dır. Doğum oranı bakımından genotipler arasındaki farklılıklar önemlidir ($P < 0,01$). Doğumda kuzu verimi üzerine genotiplerin etkisi önemli ($P < 0,05$) ancak, koçaltı koyuna göre kuzu verimi üzerine etkisi önemsizidir ($P > 0,05$). Sütten kesimde yaşama gücü oranı bakımından genotipler arasındaki farklılıklar önemlidir ($P < 0,01$). Kuzuların doğum ağırlığı, sütten kesim ağırlığı ve bir yaş canlı ağırlıkları ASB × K (F_1)'ler için sırasıyla; 3,77 kg, 34,11 kg ve 43,71 kg, Bandırma-I kuzuları için 3,74 kg, 32,98 kg ve 44,91 kg, Bandırma-II kuzuları için 3,73 kg, 33,18 kg ve 45,71 kg ve saf Kıvırcık kuzuları içinde kg 3,45 kg, 30,92 kg ve 42,22 kg'dır. Bu araştırmadan elde edilen bulgular, Kıvırcık koyunların ASB ırkı ile melezlenmesinin kuzu verimini artırmadığını, ancak elde edilen melez kuzuların yerli ırk Kıvırcıklar ile karşılaştırıldığında önemli yaşama gücü problemine sahip olmadığını ve Marmara Bölgesi koşullarında Kıvırcık ırkından daha yüksek büyüme performansına sahip olduğunu göstermiştir.

Anahtar sözcükler: Koyun, döl verimi, yaşama gücü, büyüme özellikleri

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Introduction

Sheep breeding is an important agricultural activity in Turkey due to its relation with the socio-economic conditions of the country. Sheep have the ability to transform poor grasslands, widespread in Turkey, into valuable products like meat, milk, wool, skin, and manure. The greatest proportion of the income from sheep breeding is supplied through lamb production. The population of sheep has fallen from 40 million to 25 million (37.6%) since 1990 (1).

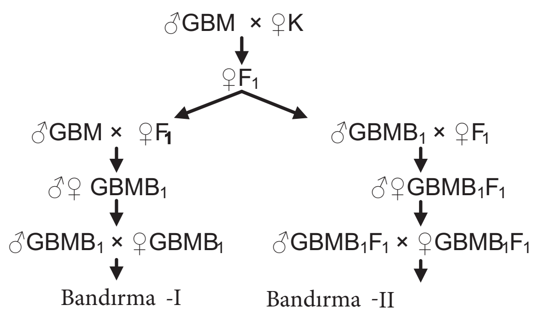
The Kıvırcık breed is a native predominating sheep of the Marmara region making up 6.2% of Turkey's total sheep population (1) and is characterized with low litter size at birth and lamb growth performance. In order to improve native sheep breeds in Turkey, a comprehensive study was initiated by the Turkish universities and farms belonging to the Ministry of Agriculture and Rural Affairs. For this purpose, different prolific sheep breeds were imported from Britain, Germany, and France, such as German Mutton Merino, German Black Headed (GBM), Hampshire Down, Dorset Down, Lincoln, Border Leicester, East Friesian, Rambouillet, and Ile de France.

In most countries, good quality commercial lambs are produced by using various commercial crossbreeding models instead of pure sheep breeding to increase lamb production. For this purpose, pure or crossbreed ewes that have high milk yield and litter size have been crossbred with native rams in low-land farms. The aim of this rearing technique was to get 1.5-2.0 lambs per ewe, to get these lambs to slaughter weight in shorter periods, and get high quality carcasses. The most important maternal characteristic is undoubtedly the number of lambs sold per ewe. This in turn is the result of a number of related features, starting with fertility, ovulation rate, litter size, lambs survival rate, milking, and mothering ability (2). In various studies, lambing rate and litter size of some crossbreed ewes were 65.67%-93.33% (3,4) and 1.26-1.41, respectively (3-7). The survival rates of lambs until weaning were reported as 73.6%-95.3% for different sheep crossbreeds (3,8). Birth weight and weaning weight means of various genotype crossbreed lambs were 3.59-4.40 kg and 17.50-24.90 kg (5,6,8).

The objective of the present study was to compare the reproductive performance of ewes, lamb survival rates, and growth traits of native Kıvırcık sheep, and crossbreed Bandırma-I and Bandırma-II genotypes.

Materials and methods

The study was carried out at the Marmara Livestock Research Institute in the Marmara region of Turkey, over 9 years: 1999 through 2007. The farm is located at lat 27°57′N, long 40°21′E and 65 m altitude, and annual precipitation is 500-800 mm. The material of this study consisted of German Black-Headed Mutton (GBM) rams; Kıvırcık (K) ewes and lambs; GBM x Kıvırcık (F_1) crossbred ewes and lambs; and Bandırma-I and Bandırma-II ewes, rams, and lambs. At the beginning of the study, German Black Headed Mutton (GBM) × Kıvırcık (K) crossbreed has been obtained F_1 genotype. Then F_1 ewes were divided into 2 groups. GBM rams were mated first F_1 ewes and were obtained first back cross to $GBMB_1$ ewes, which were called "Bandırma-I" genotype. The Bandırma-I new type would have 75% GBM and 25% Kıvırcık. Second group F_1 ewes were mated with $GBMB_1$ rams and obtained $GBMB_1F_1$, which was called "Bandırma-II" genotype and would have 62.5% GBM and 37.5% Kıvırcık (Figure).



GBM × K = F_1: 50% GBM + 50% K

GBM × F_1 = $GBMB_1$: 75% GBM + 25% K

GBM × K = F_1: 50% GBM + 50% K

$GBMB_1$ × F_1= $GBMB_1$ F_1: 62.5% GBM + 37.5% K

Figure. The breeding scheme and genotypic proportions of the Bandırma-I and Bandırma-II.

The ewe flock was kept indoors during the winter months and then taken to pasture as the weather conditions improved. Before the mating season, 400-600 g concentrate feed was given per animal. A similar program was also carried out to prepare the ewes for parturition. Sheep were shorn approximately 1 month before the mating season.

Estrus detection was performed daily by using teaser rams and ewes were mated with selected rams (GBM and Bandırma-I, Bandırma-II and Kıvırcık rams). Hand mating was applied between 15 June and 15 August and continued for 45-60 days for 9 years: 1999 through 2007. All lambs were weighed and ear tagged within 12 h of birth. Lambs were kept alone with their mothers in stalls for 3 days after lambing. The lambs were allowed to suckle their mothers twice a day. When the lambs reached 15 days old they were fed ad libitum a creep-feed concentrate and good quality alfalfa hay for 3 months. The lambs were weaned at 90 days of age. Then weaning male and female lambs were reared separately by sex groups. After this period, the roughage was given ad libitum, but the concentrate feed was approximately 200 g per lamb per day.

Methods in order to determine the fertility characteristics of the ewes, lambing, infertility of the ewes, rate of single births, rate of prolific births, fecundity, and litter size traits were determined for each genotype groups. The survival rates of the lambs were evaluated up to 90 days of age and all the lambs in the study were taken into consideration.

The statistical analyses for fertility and survival rate traits were done using the chi-square test. The lambs BW, weaning weights at 90 days (WW), 180 day live weights (LW180), and yearling live weights (YLW) were taken using a scale sensitive to 50 g. The absolute WW (90 day live weights) of the lambs was calculated by the interpolation method. The effects of some environmental factors that affect lamb growth were determined using the least-squares means method and the significance between the groups was determined with Duncan's test using SPSS (9). The model below was used to determine the extent to which the factors affected different age of lambs.

$$Y_{ijklm} = \mu + a_i + b_j + c_k + d_l + z_m + e_{ijklm}$$

The symbols in this model are: Y_{ijklm} = live weight of lamb at the age examined, μ = average of the population for the characteristic examined, a_i: effect of genotypes (Kıvırcık, GBM x K (F_1), Bandırma-I and, Bandırma-II), b_j: Effect of dam ages (2, 3, 4, 5, 6, 7, and ≥8 ages), c_k: effect of birth types (single, twin, and triplet born), d_l = effect of sex (female and male), z_n: years (1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, and 2007), and e_{ijklm}: random error. In the model used, it was assumed that there were no significant interactions between the factors investigated and the sum of the effects of the subgroups of factor was assumed to be zero.

Results

Fertility: The average fertility results for the GBM × K (F_1), Bandırma-I and Bandırma-II genotypes, and purebred Kıvırcık ewes are given in Table 1. The average lambing rate in GBM × K (F_1), Bandırma-I and Bandırma-II genotypes, and purebred Kıvırcık ewes were 80.00%, 75.73%, 76.68%, and 83.72%, respectively. The average difference between the GBM × K (F_1), Bandırma-I and Bandırma-II genotypes, and purebred Kıvırcık ewes were significant ($P < 0.01$). The average infertility rates were 20.00%, 24.27%, 23.22%, and 16.28%, respectively. There was a significant ($P < 0.01$) effect of genotypes on infertility rate. High infertility rate can be affected by the mating method. It is known that for the Kıvırcık dam line the mating is best in October. However, the Marmara Livestock Institute applied hand mating in June and August in the Merino herd each year. The average fecundity of the GBM × K (F_1), Bandırma-I and Bandırma-II genotypes, and purebred Kıvırcık ewes were 1.06, 0.99, 1.00, and 1.02, respectively, and the average litter size at birth was 1.32, 1.31, 1.30, and 1.21, respectively. There were significant ($P < 0.05$) effects of genotypes on litter size at birth. According to these results, it is determined that crossbreeding groups produced slightly higher values for the fecundity and litter size traits than purebred Kıvırcık ewes (Table 1).

Survival of lambs: The survival rates of lambs at weaning age (90 days) are presented in Table 2. The average survival rates of the lambs of the GBM × K (F_1), Bandırma-I and Bandırma-II genotypes,

Table 1. Fertility of GBM × K(F_1), Bandırma-I and Bandırma-II crossbreds, and purebred Kıvırcık.

Years	Genotypes	Ewes exposed	Lambing rate	Infertility	Single lambing	Prolific lambing	Fecundity	Litter size
1999	GBM × K(F_1)	85	67.06**	32.94**	87.72^{ns}	12.28^{ns}	0.71**	1.05^{ns}
	Bandırma-I	31	58.06**	41.94**	88.89^{ns}	11.11^{ns}	0.58**	1.00^{ns}
	Kıvırcık	303	83.83**	16.17**	86.22^{ns}	13.78^{ns}	0.95**	1.14^{ns}
2000	GBM × K(F_1)	82	68.29^{ns}	31.71^{ns}	85.71^{ns}	14.29^{ns}	0.80**	1.78*
	Bandırma-I	13	61.54^{ns}	38.46^{ns}	87.50^{ns}	12.50^{ns}	0.69**	1.25*
	Kıvırcık	278	93.17^{ns}	6.83^{ns}	83.40^{ns}	16.60^{ns}	1.09**	1.66*
2001	GBM × K(F_1)	164	70.12^{ns}	29.88^{ns}	77.39*	22.61*	0.87^{ns}	1.23^{ns}
	Bandırma-I	21	61.90^{ns}	38.10^{ns}	46.15*	53.85*	0.95^{ns}	1.54^{ns}
	Bandırma-II	3	66.67^{ns}	33.33^{ns}	50.00*	50.00*	1.00^{ns}	1.50^{ns}
	Kıvırcık	251	70.52^{ns}	29.48^{ns}	78.53*	21.47*	0.86^{ns}	1.21^{ns}
2002	GBM × K(F_1)	150	87.33^{ns}	12.67^{ns}	70.23^{ns}	29.77^{ns}	1.14*	1.31^{ns}
	Bandırma-I	35	80.00^{ns}	20.00^{ns}	57.14^{ns}	42.86^{ns}	1.17*	1.46^{ns}
	Bandırma-II	9	66.67^{ns}	33.33^{ns}	66.67^{ns}	33.33^{ns}	0.89*	1.33^{ns}
	Kıvırcık	198	79.80^{ns}	20.20^{ns}	74.05^{ns}	25.95^{ns}	1.01*	1.26^{ns}
2003	GBM × K(F_1)	137	85.40^{ns}	14.60^{ns}	54.70**	45.30**	1.25**	1.46**
	Bandırma-I	31	77.42^{ns}	22.58^{ns}	62.50**	37.50**	1.06**	1.38**
	Bandırma-II	18	66.67^{ns}	33.33^{ns}	66.67**	33.33**	0.89**	1.33**
	Kıvırcık	169	78.11^{ns}	21.89^{ns}	81.82**	18.18**	0.92**	1.18**
2004	GBM × K(F_1)	100	91.00**	9.00**	62.64^{ns}	37.36^{ns}	1.27**	1.40^{ns}
	Bandırma-I	55	70.91**	29.09**	74.36^{ns}	25.64^{ns}	0.89**	1.26^{ns}
	Bandırma-II	36	61.11**	38.89**	77.27^{ns}	22.73^{ns}	0.75**	1.23^{ns}
	Kıvırcık	134	85.07**	14.93**	63.16^{ns}	36.84^{ns}	1.16**	1.37^{ns}
2005	GBM × K(F_1)	82	78.05^{ns}	21.95^{ns}	62.50^{ns}	37.50^{ns}	1.07^{ns}	1.38^{ns}
	Bandırma-I	48	81.25^{ns}	18.75^{ns}	74.36^{ns}	25.64^{ns}	1.02^{ns}	1.26^{ns}
	Bandırma-II	45	86.67^{ns}	13.33^{ns}	66.67^{ns}	33.33^{ns}	1.16^{ns}	1.33^{ns}
	Kıvırcık	125	86.40^{ns}	13.60^{ns}	74.07^{ns}	25.93^{ns}	1.06^{ns}	1.22^{ns}
2006	GBM × K(F_1)	75	92.00**	8.00**	56.52^{ns}	43.48^{ns}	1.32*	1.43^{ns}
	Bandırma-I	108	83.33**	16.67**	66.67^{ns}	33.33^{ns}	1.11*	1.33^{ns}
	Bandırma-II	100	81.00**	19.00**	71.60^{ns}	28.40^{ns}	1.04*	1.28^{ns}
	Kıvırcık	182	93.96**	6.04**	73.68^{ns}	26.32^{ns}	1.19*	1.26^{ns}
Overall	GBM × K(F_1)	875	80.00**	20.00**	68.43**	31.57*	1.06^{ns}	1.32*
	Bandırma-I	342	75.73**	24.27**	68.73**	31.27*	0.99^{ns}	1.31*
	Bandırma-II	211	76.78**	23.22**	70.37**	29.63*	1.00^{ns}	1.30*
	Kıvırcık	1640	83.72**	16.28**	78.44**	21.56*	1.02^{ns}	1.21*

**: ($P < 0.01$), *: ($P < 0.05$): The differences between the means of genotype groups in the same columns are significant , ns: non-significant.

and purebred Kıvırcık at weaning (90 days) were 97.49%, 93.40%, 93.57%, and 94.00%, respectively. This result showed that the crossbreeding did not have any negative effects on the survival rate of the crossbred lambs. According to Table 2, Bandırma-I lambs had a higher survival rate than Bandırma-II and Kıvırcık lambs. The effect of genotype on lambs' survival rate was significant ($P < 0.05$). The male lambs had a higher survival ability than the female lambs at weaning ages. The survival ability is slightly different between male and female lambs. It was found that the GBM × K (F_1) lambs showed a higher survival rate than Kıvırcık, Bandırma-I, and Bandırma-II lambs (Table 2).

Table 2. Survival rates of lambs at weaning ages (90 days).

Years	Genotype	Number of lambs born		Survival rates		
		Male	Female	Male	Female	Average
1999	GBM × K (F_1)	128	123	98.44^{ns}	98.37^{ns}	98.41^{ns}
	Bandırma-I	27	31	96.30^{ns}	100.0^{ns}	98.28^{ns}
	Bandırma-II	11	9	100.0^{ns}	88.89^{ns}	95.00^{ns}
	Kıvırcık	21	17	100.0^{ns}	94.12^{ns}	97.37^{ns}
2000	GBM × K (F_1)	60	72	98.33^{ns}	93.06^{ns}	95.45^{ns}
	Bandırma-I	16	24	93.75^{ns}	83.33^{ns}	87.50^{ns}
	Bandırma-II	20	15	85.00^{ns}	100.00^{ns}	91.43^{ns}
	Kıvırcık	88	82	97.73^{ns}	96.34^{ns}	97.06^{ns}
2001	GBM × K (F_1)	6	9	100.00^{ns}	100.00^{ns}	100.00^{ns}
	Bandırma-I	51	49	90.20^{ns}	87.76^{ns}	89.00^{ns}
	Bandırma-II	26	39	88.46^{ns}	87.18^{ns}	87.69^{ns}
	Kıvırcık	104	96	96.15^{ns}	93.75^{ns}	95.00^{ns}
2002	Bandırma-I	64	58	98.44^{ns}	100.00^{ns}	99.18^{ns}
	Bandırma-II	44	54	100.00^{ns}	92.59^{ns}	95.92^{ns}
	Kıvırcık	98	101	96.94^{ns}	97.03^{ns}	96.98^{ns}
2003	Bandırma-I	37	30	94.59^{ns}	93.33^{ns}	94.03^{ns}
	Bandırma-II	81	72	96.30^{ns}	98.61^{ns}	97.39^{ns}
	Kıvırcık	83	73	95.18^{ns}	95.89^{ns}	95.51^{ns}
2004	Bandırma-I	53	50	98.11^{ns}	96.00^{ns}	97.09^{ns}
	Bandırma-II	57	43	92.98^{ns}	88.37^{ns}	91.00^{ns}
	Kıvırcık	77	79	88.31^{ns}	89.87^{ns}	89.10^{ns}
2005	Bandırma-I	46	53	97.83^{ns}	96.23^{ns}	96.97^{ns}
	Bandırma-II	45	45	97.78^{ns}	95.56^{ns}	96.67^{ns}
	Kıvırcık	55	77	96.36^{ns}	94.81^{ns}	95.45^{ns}
2006	Bandırma-I	70	99	91.43^{ns}	83.84^{*}	86.98^{ns}
	Bandırma-II	86	68	86.05^{ns}	97.06^{*}	90.91^{ns}
	Kıvırcık	108	108	91.67^{ns}	86.11^{*}	88.89^{ns}
Overall	GBM × K (F_1)	194	204	98.45^{*}	96.57^{ns}	97.49^{*}
	Bandırma-I	364	394	95.05^{*}	91.88^{ns}	93.40^{*}
	Bandırma-II	370	345	92.97^{*}	94.20^{ns}	93.57^{*}
	Kıvırcık	634	633	94.79^{*}	93.21^{ns}	94.00^{*}

*: The differences between the means of genotype groups in the same columns are significant ($P < 0.05$), ns: non-significant.

Table 3. Least-square means (LSM) and standard errors (SE) of the live weights of lambs at different ages (kg).

Investigated factors	BW		WW		LW180		YLW		ADG	
	n	LSM ± SE	n	LSM ± SE	n	LSM ± SE	n	LSM ± SE	n	LSM ± SE
Genotype		**		**		**		**		**
GBM × K(F_1)	398	3.77 ± 0.07 ^{a}	376	34.11 ± 0.67 ^{a}	110	38.38 ± 0.89 ^{b}	159	43.71 ± 0.94 ^{a}	376	0.33 ± 0.01 ^{a}
Bandırma-I	758	3.74 ± 0.05 ^{a}	649	32.98 ± 0.55 ^{b}	401	39.01 ± 0.61 ^{a}	427	44.91 ± 0.62 ^{b}	649	0.32 ± 0.01 ^{b}
Bandırma-II	715	3.73 ± 0.05 ^{a}	543	33.18 ± 0.55 ^{a}	401	38.51 ± 0.58 ^{b}	414	45.71 ± 0.58 ^{b}	543	0.32 ± 0.01 ^{b}
Kıvırcık	1267	3.45 ± 0.05 ^{b}	1081	30.92 ± 0.54 ^{c}	871	33.90 ± 0.56 ^{c}	778	42.22 ± 0.58 ^{c}	1081	0.29 ± 0.01 ^{c}
Age		**		**		**		**		**
2	90	3.05 ± 0.10 ^{c}	21	40.44 ± 1.40 ^{a}	14	33.31 ± 1.76 ^{c}	24	33.26 ± 1.60 ^{c}	21	0.38 ± 0.02 ^{a}
3	513	3.26 ± 0.06 ^{c}	398	31.45 ± 0.57 ^{c}	227	35.86 ± 0.65 ^{b}	261	42.53 ± 0.65 ^{c}	398	0.29 ± 0.01 ^{c}
4	707	3.60 ± 0.05 ^{b}	610	31.62 ± 0.53 ^{b}	387	37.59 ± 0.58 ^{a}	392	46.28 ± 0.59 ^{b}	610	0.30 ± 0.01 ^{b}
5	609	3.89 ± 0.05 ^{a}	528	31.76 ± 0.52 ^{b}	328	38.86 ± 0.58 ^{a}	368	47.21 ± 0.59 ^{a}	528	0.31 ± 0.01 ^{b}
6	556	3.91 ± 0.06 ^{a}	482	32.14 ± 0.53 ^{b}	328	38.77 ± 0.59 ^{a}	321	46.95 ± 0.60 ^{a}	482	0.31 ± 0.01 ^{b}
7	371	3.93 ± 0.06 ^{a}	338	32.13 ± 0.57 ^{b}	276	39.39 ± 0.62 ^{a}	200	46.72 ± 0.70 ^{a}	338	0.31 ± 0.01 ^{b}
≥8	292	4.07 ± 0.06 ^{a}	272	30.03 ± 0.58 ^{c}	223	38.35 ± 0.63 ^{a}	212	46.00 ± 0.67 ^{b}	272	0.29 ± 0.01 ^{c}
Year		**		**		**		**		**
2000	367	3.88 ± 0.07 ^{a}	311	31.39 ± 0.66 ^{b}	–	–	143	47.57 ± 0.80 ^{b}	311	0.30 ± 0.01 ^{c}
2001	377	3.78 ± 0.06 ^{b}	352	38.91 ± 0.59 ^{a}	286	38.18 ± 0.64 ^{c}	242	46.76 ± 0.68 ^{b}	352	0.38 ± 0.01 ^{a}
2002	380	3.55 ± 0.06 ^{d}	335	33.65 ± 0.61 ^{c}	159	39.14 ± 0.76 ^{c}	259	46.25 ± 0.72 ^{b}	335	0.32 ± 0.01 ^{cd}
2003	419	3.63 ± 0.06 ^{d}	405	31.35 ± 0.58 ^{d}	361	44.05 ± 0.63 ^{a}	329	50.42 ± 0.69 ^{a}	405	0.29 ± 0.01 ^{e}
2004	375	3.74 ± 0.06 ^{c}	266	29.51 ± 0.63 ^{e}	156	37.27 ± 0.76 ^{d}	243	41.55 ± 0.74 ^{c}	266	0.27 ± 0.01 ^{f}
2005	360	3.72 ± 0.06 ^{d}	305	33.28 ± 0.62 ^{c}	265	32.83 ± 0.66 ^{e}	252	39.50 ± 0.71 ^{d}	305	0.32 ± 0.01 ^{cd}
2006	321	3.58 ± 0.06 ^{c}	309	34.86 ± 0.61 ^{b}	275	40.44 ± 0.66 ^{b}	103	43.01 ± 0.87 ^{c}	309	0.33 ± 0.01 ^{b}
2007	539	3.50 ± 0.06 ^{e}	366	29.42 ± 0.59 ^{e}	281	30.22 ± 0.65 ^{f}	207	38.03 ± 0.75 ^{e}	366	0.30 ± 0.01 ^{d}
Birth type		**		**		**		**		**
Single	1839	4.42 ± 0.02 ^{a}	1577	34.01 ± 0.24 ^{a}	1031	40.55 ± 0.33 ^{a}	1054	44.17 ± 0.32 ^{b}	1577	0.34 ± 0.00 ^{a}
Twin	1266	3.71 ± 0.03 ^{b}	1054	32.50 ± 0.28 ^{b}	732	37.69 ± 0.37 ^{ab}	705	41.71 ± 0.36 ^{c}	1054	0.31 ± 0.00 ^{b}
Triplet	33	2.88 ± 0.14 ^{c}	18	31.88 ± 1.41 ^{b}	20	34.11 ± 1.42 ^{b}	19	46.54 ± 1.51 ^{a}	18	0.29 ± 0.02 ^{b}
Sex		**		**		**		**		**
Female	1553	3.53 ± 0.02	1333	31.32 ± 0.53	933	34.39 ± 0.57	940	41.29 ± 0.59	1333	0.30 ± 0.01
Male	1585	3.82 ± 0.03	1316	34.28 ± 0.52	850	40.51 ± 0.57	838	46.99 ± 0.58	1316	0.33 ± 0.01
Overall	3138	3.67 ± 0.05	2649	32.80 ± 0.51	1783	37.45 ± 0.55	1778	44.14 ± 0.57	2649	0.32 ± 0.01

a,b,c,d,e: The differences between the means of groups marked by various letters in the same column are significant **: $P < 0.01$

Growth of lambs: The least square means and standard errors of the live weights of the lambs at BW, WW, LW180, YLW, and ADG90 are shown in Table 3.

The live weights of lambs in the GBM × K (F_1), Bandırma-I and Bandırma-II genotypes, and purebred Kıvırcık were 3.77, 3.74, 3.73, and 3.45 kg for BW; 34.11, 32.98, 33.18, and 30.29 kg for WW; 38.38, 39.01, 38.51, and 33.90 kg for LW180; 43.71, 44.91, 45.71, and 42.22 kg for YLW; and 0.33, 0.32, 0.32, and 0.29 kg for ADG, respectively.

The live weights of the lambs in crossbreed genotypes at all ages were higher than those in purebred Kıvırcık lambs. The effects of genotypes, sex, age of dams, birth years, and type of birth on BW, WW, LW180, YLW, and ADG90 were statistically significant ($P < 0.01$). Furthermore, the birth and the weights at different periods until yearling age of the female lambs were lower than the males, and prolific born lambs were lower than single born lambs (Table 3). According to growth traits results, it is clear that the crossbreeding groups showed higher results for lamb weaning weight that is suitable for starting fattening live weight than purebred Kıvırcık lambs. The average daily weight gains of the GBM × K (F_1), Bandırma-I and Bandırma-II genotypes, and purebred Kıvırcık lambs were 0.32, 0.32, 0.33, and 0.29 kg, respectively. With regard to the ADG the male lambs were heavier than the females, and single born lambs were heavier than the twin and triplet lambs. The effects of genotypes, sex, age of dams, birth years, and type of birth on average daily weight gains were significant ($P < 0.01$).

Discussion

In terms of the fertility characteristics of crossbred genotypes and purebred Kıvırcık ewes, lambing and infertility rates were found between 75.73% and 83.72%, and 16.28% and 24.27%, respectively. In crossbreed (GBM × K (F_1), Bandırma-I and Bandırma-II) ewes the number of prolific births was higher than in the Kıvırcık ewes. The fertility rate was lower than that of crossbred and purebred ewes in some other studies (8,10,11,13), but was higher than what was reported for crossbreeding studies (3,12), and was similar to the result of 2-way and 3-way crossbreeding with German Black-Headed Mutton, Kıvırcık, and Chios sheep breeds (19). The litter sizes were 1.32 to 1.30 in the crossbreeding groups and were similar to the results reported in some crossbreeding studies (3,10,19), and were lower than the results for crossbreed and purebred genotypes (3,4,7,8,10-13), and were higher than those of different sheep genotypes (5,6,14). One of the important characteristics of crossbreed lambs is a high survival rate at the age of weaning. In this study, the survival rates of the GBM × K (97.00%) and Kıvırcık (94.00%) lambs were higher than for the crossbred Bandırma-I (93.40%) and Bandırma-II (93.57%) lambs. The survival rates until weaning age of the crossbred lambs in the present study were similar to those of Kıvırcık × (Chios × Red Karaman) F_1 and Chios × (Kıvırcık × Red Karaman) F_1 crossbred lambs (16) and were lower than crossbreeding Turkish Merino × Chios and Turkish Merino × Kıvırcık lambs (4) and German Black-Headed Mutton × Kıvırcık and Chios lambs (19), but were higher than those of the crossbred lambs in some other studies (3,8,10,12-15). In the present study, the Bandırma-I and Bandırma-II crossbred lambs had better results than the purebred Kıvırcık lambs in terms of BW, WW, LW180, and YLW. The Bandırma-I and Bandırma-II crossbred lambs showed similar growth performance with GBM × K (F_1) lambs. The BW of the GBM × K (F_1), Bandırma-I and Bandırma-II crossbred lambs were higher than what was reported for purebred Kıvırcık lambs (19). The BW of the GBM × K (F_1), Bandırma-I and Bandırma-II crossbred lambs were similar to that of crossbred lambs in other studies (3,14,19), but was higher than that of crossbreeds lambs in some other studies (3,6,7,10,12,16,18,20). The WW for the Bandırma-I and II crossbreds lambs were lower than that of different crossbred lambs in some other studies (3,5-7,10,12,13,15,16,18,19); however, our findings for the LW180 and YLW were similar to the results of East Friesian × Awassi crossbred (F_1) lambs (18). The LW180 and YLW of the crossbred lambs in the present study were lower than those of Sakız × Akkaraman F_1 and Kıvırcık × Akkaraman F_1 lambs (10), and Bafra genotype (13,21), but were higher than those reported in different crossbreeding studies (12,17) of crossbred lambs.

Conclusion

The results of this study showed that crossbred lambs of Bandırma-I and Bandırma-II genotype, which carry the GBM genotype, had better growth performance than purebred Kıvırcık lambs and had similar survival rates in the Marmara region. However, the crossbreeding did not increase lamb production.

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References

1. Kaymakçı, M.: İleri Koyun Yetiştiriciliği. Genişletilmiş İkinci Baskı. İzmir İli Damızlık Koyun-Keçi Yetiştiricileri Birliği Yayınları No:1. Bornova, İzmir. 2006.
2. Croston, D., Pollott, G.: Planned Sheep Production. Second Edition. Oxford Blackwell Scientific Publications. 1994.
3. Altınel, A., Evrim, M., Özcan, M., Başpınar, H., Deligözoğlu, F.: Studies on Possibility of Producing High Quality Lambs by Crossbreeding Among Sakız, Kıvırcık and German Black Headed Mutton Sheep. Turk. J. Vet. Anim. Sci., 1998; 22: 257-265.
4. Özcan, M., Yılmaz, A., Akgündüz, M.: Investigations on improving the meat production of slaughter lambs by crossbreeding studies between Turkish Merino, Chios and Kıvırcık sheep breeds 1. fertility, lamb survival and growth of lambs. Turk. J. Vet. Anim. Sci., 2002; 26: 517-523.
5. Kaymakçı, M., Koşum, N, Taşkın, T., Akbaş, Y., Ataç, F.E.: A Study on Determining of Some Production Traits for Menemen Sheep Types. 4. National Animal Science Congress. 1-4 September 2004.
6. Kaymakçı, S., Sönmez, R., Kızılay, E., Taşkın, T., Ergül, N.: Investigation on developing sire lines for lamb production (first stage). Turk. J. Vet. Anim. Sci., 1999; 23: 255-259.
7. Özder, M., Kaymakçı, M., Taşkın, T., Köycü, E., Karaağaç, F., Sönmez, R.: Growth and milk yield traits of Türkgeldi sheep. Turk. J. Vet. Anim. Sci., 2004; 28: 195-200.
8. Demir, H., Ekiz, B., Yilmaz, Y., Elmaz, Ö.: The fertility of Kıvırcık and Sakız x Kıvırcık crossbred F_1 ewes and survival rates of their lambs. The Journal of Faculty of Veterinary Medicine, İstanbul University. 2002; 28: 155-161.
9. Özdamar, K.: Statistical Data Analysis-1. Published by Kaan Book Store. 2004; Eskişehir- Turkey.
10. Akçapınar, H., Özbeyaz, C., Ünal, N., Avcı, M.: The possibilities of developing dam and sire lines using Akkaraman, Sakız and Kıvırcık sheep breeds for lamb production i. fertility in Akkaraman sheep, survival rate and growth characteristics of Sakız x Akkaraman F_1 and Kıvırcık x Akkaraman F_1 Lambs. Turk. J. Vet. Anim. Sci., 2000; 24: 71-79.
11. Esen, F., Özbey, O.: Fertility and milk yield characteristics in White Karaman and Chios x White Karaman (F_1) crossbred sheep. Turk. J. Vet. Anim. Sci., 2002; 26: 503-509.
12. Koyuncu, M., İpek, A., Tuncel, E., Akgündüz, V.: Some yield characteristics of genotype groups obtained by crossbreeding Kıvırcık with imported mutton sheep breeds (Hampshire Down, Lincoln and Blackhead German) Turk. J. Vet. Anim. Sci., 1999; 23: 423-427.
13. Ünal, Ü., Atasoy, F., Akçapınar, H., Erdoğan. M.: Fertility traits, survival rate and growth characteristics of Karayaka and Bafra (Chios x Karayaka B_1) genotypes. Turk. J. Vet. Anim. Sci., 2003; 27: 265-272.
14. Ateş, C. T., Arslan, M., Yılmaz, O.: The effects of some factors on birth weight, survival rate and litter size, pregnancy period in Redkaraman and Redkaraman x Dorset Down cross-breed lambs (F_1). Turk. J. Vet. Anim. Sci., 2003; 27: 1311-1318.
15. Ekiz, B., Altınel, A.: The growth and survival characteristics of lambs produced by commercial crossbreeding Kıvırcık ewes with F_2 rams with the German Black-Headed mutton genotype. Turk. J. Vet. Anim. Sci., 2006; 30: 507-512.
16. Özbey, O., Esen, F., Aysöndü, M.H.: Production characteristics of Kıvırcık x (Chios x Red Karaman) F_1 and Chios x (Kıvırcık x Red Karaman) F_1 crossbred lambs. I. growth, survival ability and body measurements. Journal of Agricultural Science. 2000; 11: 27-33.
17. Esen, F., Yıldız, N.: Production characteristics of White Karaman, Chios x White Karaman (F_1) crossbred lambs. i. growth, survival ability and body measures. Turk. J. Vet. Anim. Sci., 2000; 24: 223-231.
18. Kul, S., Akcan, A.: Survival ability, growth and some body measurements in Awassi and East Friesian x Awassi crossbred (F_1) lambs. Uludag Univ. J. Fac. Vet. Med., 2002; 21: 109-114.
19. Özcan, M., Altinel, A., Yılmaz, A., Güneş, H.: Studies on the possibility of improving lamb production by two-way and three-way crossbreeding with German Black-Headed Mutton, Kıvırcık and Chios sheep breeds 1. fertility, lamb survival and growth of lambs. Turk. J. Vet. Anim. Sci., 2001; 25; 687-694.
20. Tekin, M.E., Gürkan, M., Karabulut, O., Düzgün, H.: Performance testing studies and the selection of Hasmer, Hasak, Hasiv and Linmer crossbreed sheep types: II. pre-weaning growth. Turk. J. Vet. Anim. Sci., 2005; 29: 59-65.
21. Atasoy, F., Ünal, Ü., Akçapınar, H., Mundan, D.: Fertility traits, survival rate and growth characteristics of Karayaka and Bafra (Chios x Karayaka B_1) genotypes. Turk. J. Vet. Anim. Sci., 2003; 27: 259-264.