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RESEARCH ARTICLE

A Study on Growth, Slaughter and Carcass Traits of Morkaraman and Kivircik x Morkaraman (F_1) Lambs in Semi-Intensive Condition

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Summary

This study was carried out to compare the growth, slaughter and carcass characteristics of Morkaraman (Pure) and Kivircik X Pure (F_1) (Cross-bred) lambs in semi-intensive condition. At this study 20 Pure and 22 Cross-breed lambs were used for growth traits; 6 male lambs from each group were slaughtered for slaughter and carcass traits. Growth was investigated from the birth to 150th day. The lambs were fed with alfalfa and lamb fattening feeds (days 45). The least squares mean of birth weight and 30, 60, 90, 120 and150th day weight were 4.06±0.10 and 4.25±0.11, 9.93±0.26 and 8.76±0.26 (P<0.01), 16.87±0.45 and 14.40±0.45 (P<0.001), 23.21±53 and 21.72±0.52 (P<0.05), 29.62±0.64 and 26.69±0.63, 34.93±0.80 and 35.85±0.79 kg. Dressing percentages were 48.49 and 45.03% (P<0.01); the percentages of leg were 28.36 and 32.23% (P<0.001); shoulder were 17.04 and 17.51%; back were 5.67 and 7.38% (P<0.001); loin were 6.14 and 6.26%; others were 24.31 and 28.62% (P<0.001); kidney were 0.63 and 0.72% (P<0.001); kidney-pelvic channel fat were 0.64 and 0.95 (P<0.01); internal fat were 1.21 and 1.73%; fat tail were 15.72 and 4.64% (P<0.001). The percentages of lean meat in the leg were 64.20 and 65.57%; fat were 15.55 and 13.42%; bone were 20.25 and 21.02%. The percentages of lean meat in the shoulder were 65.64 and 63.00%; fat were 13.55 and 13.90%; bone were 20.82 and 23.11%. The percentages of total meat in the carcass were 48.01 and 55.09% (P<0.05); fat were 16.21 and 16.96%; bone were 19.55 and 21.44%; and fat percentages in the tailed carcass were 31.93 and 21.55% for pure and Cross-breed lambs respectively. In conclusion; it has been though that Kivircik rams can be utilized for breeding with Pure Morkaraman ewes, commonly found in the region, to obtain lambs with high quality meat at slaughtering age without adaptation problem; and desired lean meat can be obtained via grazing in addition to cross breeding.

Keywords: *Morkaraman, Kivircik, Growth, Carcass traits*

Yarı Entansif Şartlarda Yetiştirilen Morkaraman ve Kıvırcık x Morkaraman (F_1) Kuzularda Büyüme, Kesim ve Karkas Özelliklerinin Araştırılması

Özet

Bu çalışma yarı entansif şartlarda yetiştirilen Morkaraman (Saf) ve Kıvırcık x saf (F_1) (Melez) kuzularının büyüme, kesim ve karkas özelliklerinin karşılaştırmak amacıyla yapılmıştır. Büyüme için 20 baş Saf 22 baş Melez, kesim ve karkas özellikleri için her iki genotipten 6'şar baş erkek kuzu kullanılmıştır. Büyüme doğumdan itibaren 150. güne kadar incelenmiştir. Kuzulara büyüme döneminin ilk 1.5 aylık kısmında yonca ile birlikte kuzu büyütme yemi verilmiş ve sonrasında anaları ile birlikte meraya çıkarılmıştır. Büyüme döneminde doğum, 30, 60, 90, 120 ve 150 gün ortalama canlı ağırlık Saf ve Melez kuzularda sırasıyla 4.06±0.10 ve 4.25±0.11, 9.93±0.26 ve 8.76±0.26 (P<0.01), 16.87±045 ve 14.40 (P<0.001), 23.21±0.53 ve 21.72±0.52 (P<0.05), 29.62±0.64 ve 26.69±0.63, 34.93±0.80 ve 35.85±0.79 kg olarak bulunmuştur. Saf ve Melez kuzularda soğuk karkas randımanı sırasıyla %48.49 ve 45.03 (P<0.01); karkasta but oranı %28.36 ve 32.23 (P<0.001); kol oranı %17.04 ve %17.51; sırt oranı %5.67 ve 7.38 (P<0.001); bel oranı %6.14 ve 6.26; diğerleri oranı %24.31 ve 28.62 (P<0.001); böbrek oranı %0.63 ve 0.72; böbrek-leğen yağı oranı% 0.64 ve 0.95 (P<0.01); iç yağı oranı % 1.21 ve 1.73; kuyruk yağı oranı %15.72 ve 4.60 (P<0.001) olarak bulunmuştur. Yine aynı genotip sırasıyla butta et oranı %64.20 ve 65.57, butta yağ oranı %15.55 ve 13.42 butta kemik oranı %20.25 ve 21.02; kolda et oranı %65.64 ve 63.00 kolda yağ oranı %13.55 ve 13.90 kolda kemik oranı %20.82 ve 23.11; karkasta et oranı %48.01 ve 55.09 karkasta yağ oranı %16.21 ve 16.96 karkasta kemik oranı %19.55 ve 21.44; karkasta kuyruk yağı dahil yağ oranı %31.93 ve 21.55 (P<0.001) olarak tespit edilmiştir. Sonuç olarak; Doğu Anadolu Bölgesinde yaygın olarak yetiştirilen Saf ırkın et kalitesi yüksek kesim kuzuları elde etmek için adaptasyon sorunu olmayan Kıvırcık ırkından yararlanılabileceği; günümüzde yağsız ete olan talep nedeniyle de melezlemenin yanında merada otlatılarak etteki yağ miktarının düşürüleceği kanaatine varılmıştır.

Anahtar sözcükler: *Morkaraman, Kıvırcık, Büyüme, Karkas özellikleri*

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INTRODUCTION

Whereas wool production has been considered important for the production of sheep wool previously, production of sheep meat has become a most important production component nowadays. Turkey is one of the foremost countries in terms of sheep number, but the production of animals per unit is not enough [1] Turkey has a potential to develop a veal production system that is similar to that of England. To evaluate this potential, it is necessary to develop a dame with a high fertility and milk production and a sire with high meat production. In recent years, cross-breeding studies have been conducted to obtain new sheep types with high meat production. However, the studies using domestic breeds with high production as sire are rather insufficient [2-5].

Kivircik breed used as sire in this study is raised in Turkey, Bulgaria and Greece. Kivircik is mainly raised up in the South East of the Marmara and some cities of the Aegean region in Turkey. Kivircik makes up 6% of the Turkish sheep population and is a long-tail breed. Because Kivircik sheep shows a seasonal breeding, this breed can be fertilized at any season. Because of this feature it can be used in forward lambs production. Ewes of Kivircik sheep weigh approximately 40-50 kg, whereas rams of Kivircik weigh approximately 50-70 kg. Twinning rate is similar to that of Morkaraman and about 4-5%. Kivircik sheep is number one among the local sheep breeds in terms of meat quality. Lambs can yield a 17-18 kg of carcass with two months of fattening nurture after weaning [2].

The dominant sheep breed in Eastern Anatolia region is Morkaraman. This breed is rated second after Akkaraman breed, forming 21.85% of total sheep population. Ewes of Morkaraman sheep weigh approximately 50-60 kg, while rams of Morkaraman weigh approximately 90-100 kg. Twinning rate is approximately 4-5%. Even though the body of Morkaraman is heavier than other local breeds, their meat quality is not good since body fat is accumulated in the tail. Meanwhile, the greater fat accumulation in the tail also decreases carcass quality [2,6].

Crossing studies carried out with Kivircik sheep in the region showed that daily live weight gains of Kivircik x Morkaraman (F_1) were 219.04 g [7], and 137.46 [8] g. On the other hand, the mean daily live weight gains were approximately 227.70 [7] and 137.67 [8] g for pure Morkaraman lambs.

Özbey and Akcan [9] noted that dressing percentage, percentage of meat and fat in carcass were 48.70%, 42.3%, and 20.55%, respectively in Kivircik x Morkaraman (F_1). However, Bayram [7] determined the same parameters in the same genotype as 48.7%, 61.6%, and 14.6%.

While Bayram [7] reported that dressing percentage, percentage of meat and fat in carcass were 50.76%, 57.23%, and 20.14%, respectively, they were 50.82%, 43.18% and 20.71% in the study of Özbey and Akcan [9], and 46.15, 48.45% and 13.52% in the study of Küçük et al.[3] in Morkaraman sheep.

In spite of the fact that the studies with Morkaraman sheep, dominant fat tail sheep in the region, are insufficient, the studies are generally carried out under intensive conditions, resulting in increased fat deposition in the body. Thus, the aim of this study was to compare slaughtering and carcass features of Morkaraman and Morkaraman x Kivircik (F_1) lambs geared up under the semi-intensive condition.

MATERIAL and METHODS

Animal material of the study consisted of 3 Kivircik and 2 Morkaraman rams, 8 (2-2.5 year-old), 18 (3-3.5 year-old), and 20 (4 and above year-old), a total 46 ewes. This study was carried out in the experimental farm of Veterinary Faculty, Yüzüncü Yıl University. The Kivircik rams used in the experiment were brought from İnanlı Agricultural Enterprise. During pre-weaning period, 20 Pure, 22 Cross-bred lambs were used to evaluate growing performance and 6 lambs from each group, a total of 12 lambs were utilized to determine the slaughtering and carcass features.

Lambs were weighed within 12 h after birth following drying with a digital scale with a sensitivity of 10 g and then, numbered with two plastic ear tags. The birth date, birth weight, sex, birth type, mother age, and mother numbers of lambs were recorded into the registration notebook. In the period between birth and 45th day *ad libutum* alfalfa hay and 200 gr/per/head lamb grower feed were given, in addition Vitamin-mineral blocks together with fresh water were present in front of them. Then, they started to go pasture with their dams. When they were grazing no additional feed was supplied. Lambs were weighed bi-weekly starting 15th day of experiment and lasted 150 days. Lambs were fasted for 12 h and allowed to drink water before weighting.

To identify the slaughtering and carcass features of the lambs whose mean weight is 39-40 kg, six lambs were slaughtered from each genotype. Lambs were fasted 12 h before slaughtering. During slaughtering the lambs, skin, head and feet, edible inner organ, testicle, spleen, abdominal fat and full and empty digestive system were weighted to identify slaughtering features. After determining of hot carcass weight, carcass was let to rest for 24 h at cold room at +4°C. Then, cold carcass weights were determined and carcass were dissected into parts according to Akçapınar [10] namely, leg, shoulder, back, loin, and others. Each part was further dissected into meat, fat and bone to determine amounts of meat, fat and bone within each part.

The effects of factors affecting growth such as genotype, sex, dame age, and birth weight during suckling were analyzed using Least Squares Method [11].

For birth weights, a linear model of "$Y_{ijkl}= \mu + a_i + b_j + c_k + e_{ijkl}$", and for growing weights, a linear model of "$Y_{ijkl} = U + a_i + b_j + c_k + d_{zijkl} + e_{ijkl}$" for for slaughtering and carcass feature, a t-test was used.

At models;

Y_{ijkl} = the live weight of a lamb at the given period

μ = the expected mean of population at the given period

U = the term used for calculation of population mean ($\mu = u + d_{zijkl}$)

a_i = i. the effect of the genotype

b_j = j. the effect of the sex

c_k = k. the effect of the mother age

d = the regression of the birth weight

z= the birth weight of a lamb

e_{ijkl} = random error

It was assumed that there was no an important interaction among the examined factors in the used models and the effects of sub-groups was accepted as a zero value

In the growth period from the values obtained the live weights of lambs in 15, 30, 45, 60, 75, 90, 105, 120, 135 and 150 days were interpolated.

Means were separated with Duncan's-t test. For the comparison of the properties analyzed within the context of slaughtering and carcass features, T test was used [12].

RESULTS

Live weight gains of lambs are given at *Table 1*. Live weight gains of pure Morkaraman lambs were significantly greater compare to cross-breed lambs starting 15th day of birth up to 105 day of birth (P<0.05). Live weights of cross-breed lambs started to catch up those of Morkaraman lambs from that point on, even passed at age of 150 days, but these differences were not statistically different (P>0.05). There was a significant sex effect on live weight of lambs throughout the experiment (P<0.05). Live weights of male lambs were significantly higher compared to female lambs throughout the experiment (P<0.05). The effect of dame age on live weights of lambs were only seen at birth (P<0.05) but not later on. Older dames had heavier lambs at birth (P<0.001).

The slaughtering features of lambs are shown at *Table 2*. While full and empty digestive system weight were higher, dressing percentage was less in cross-breed lambs compared to Morkaraman lambs (P<0.01). The other slaughtering features were similar between two groups (P>0.05).

Carcass features of lambs are presented at *Table 3*. While the tail fat weight, and the tail fat rate was significant in favor of Morkaraman; the back weight of the carcass and the back rate of the carcass, thigh rate in carcass, and tallow rate was statistically important in favor of cross-breed (P<0.05-P<0.001).

The carcass meat fat and bone weight and rates were given at *Table 4*. Carcass meat, fat, bone weights were statistically similarity between groups, however, when tail fat was included in the carcass, fat weight and rate in carcass were statistically higher in Morkaraman lambs compared to cross-breeds (P<0.01).

Table 1.*The least squares means (LSM) of the live weights of lambs in different periods of growth (kg)*
Tablo 1. *Kuzuların çeşitli dönemlerdeki ortalama canlı ağırlıkları (kg)*

Items	N	Birth Weight	15th Day	30th Day	45th Day	60th Day	75th Day	90th Day	105th Day	120th Day	135th Day	150th Day
			X±sx	X±sx	X±sx	X±sx	X±sx	X±sx	X±sx	X±sx	X±sx	X±sx
Genotype		-	*	**	***	***	***	*	-	-	-	-
Morkaraman	20	4.06±0.102	7.09±0.178	9.93±0.264	13.47±0.381	16.87±0.453	20.17±0.507	23.21±0.527	26.38±0.607	29.62±0.642	32.79±0.720	34.93±0.795
K X M(F_1)	22	4.25±0.108	6.61±0.176	8.76±0.261	11.46±0.376	14.40±0.447	17.64±0.501	21.72±0.520	25.90±0.600	26.69±0.634	32.91±0.711	35.85±0.785
Sex		*	**	***	***	***	***	***	***	***	***	***
Male	23	4.32±0.095	7.23±0.154	10.18±0.229	13.79±0.424	16.86±0.393	20.36±0.440	24.22±0.457	27.97±0.527	31.68±0.556	35.29±0.624	38.28±0.885
Female	19	3.99±0.111	6.47±0.198	8.51±0.294	11.13±0.330	14.40±0.504	17.45±0.564	20.83±0.586	24.32±0.676	27.63±0.715	30.34±0.802	32.51±0.689
Age of Mother		***	-	-	-	-	-	-	-	-	-	-
2-2.5	7	3.65±0.174 b	6.41±0.332	8.81±0.493	11.58±0.711	14.59±0.846	17.70±0.947	21.49±0.983	25.27±1.134	29.32±1.198	32.14±1.344	34.89±1.484
3-3.5	16	4.28±0.112 a	7.17±0.181	9.76±0.268	13.19±0.387	16.48±0.460	19.72±0.514	23.43±0.534	26.77±0.616	30.01±0.651	33.19±0.731	35.70±0.807
4- ≤	19	4.54±0.105 a	6.96±0.181	9.54±0.269	12.62±0.388	15.81±0.461	19.30±0.516	22.75±0.536	26.39±0.618	29.64±0.653	33.25±0.733	35.59±0.810
Overall Mean (μ)	42	4.16±	6.85±	9.35±	12.47±	15.64±	18.91±	22.47±	26.14±	29.66±	32.85±	35.39±

a,b, The differences between the means of groups carrying various letters in the same column are significant
**** P<0.001, ** P<0.01, * P<0.05, -: insignificant*

Table 2. *Slaughtering features of groups*
Tablo 2. *Gruplarda kesim özellikleri*

Items	Morkaraman (n = 6)		K X M F_1 (n = 6)		P
	LSM	SE	LSM	SE	
Slaughtering live weight, kg	39.83	1.61	40.97	0.82	-
Hot carcass weights, kg	19.68	0.84	18.92	0.62	-
Skin weights, kg	3.81	0.16	3.79	0.09	-
Head-leg weights, kg	3.05	0.16	3.36	0.10	-
Testicle weights, kg	0.23	0.03	0.25	0.03	-
Edible inner organ[1] weights, kg	1.48	0.08	1.55	0.04	-
Spleen Weights, kg	0.13	0.01	0.24	0.07	-
Digestive system weights (full) [2], kg	7.65	0.35	9.32	0.26	**
Digestive system weights (empty) [2], kg	3.29	0.08	3.84	0.12	**
Hot carcass, %	49.41	0.55	46.15	0.81	**
Skin, %	9.64	0.56	9.27	0.20	-
Head-leg, %	7.71	0.51	8.20	0.11	-
Testicle, %	0.57	0.08	0.60	0.07	-
Edible inner organ [1], %	3.76	0.25	3.78	0.09	-
Spleen, %	0.33	0.03	0.60	0.19	-
Digestive system (full) [2], %	19.32	1.05	22.81	0.81	*
Digestive system (empty) [2], %	8.34	0.42	9.39	0.34	-

*** P<0.01, * P<0.05, -: insignificant , [1] Edible inner organ: heart + lung + liver, [2] Digestive system (4 stomach + intestine)*

Table 3. *Carcass features of groups*
Tablo 3. *Gruplarda karkas özellikleri*

Items	Morkaraman (n = 6)		K X M F_1 (n = 6)		P
	LSM	SE	LSM	SE	
Pre-slaughtering live weight, kg	39.83	1.61	40.97	0.82	-
Cold carcass weight, kg	19.32	0.85	18.47	0.66	
Cold dressing percentage	48.49	0.52	45.03	0.93	**
Carcass leg weight, kg	5.51	0.15	5.96	0.25	-
Carcass shoulder weight, kg	3.28	0.11	3.22	0.06	-
Carcass back weight, kg	1.10	0.06	1.36	0.03	**
Carcass loin weight, kg	1.19	0.07	1.16	0.06	-
Other weight in carcass, kg	4.67	0.11	5.28	0.21	*
Kidney weight, kg	0.12	0.01	0.13	0.01	-
Kidney and pelvic fat weight, kg	0.12	0.01	0.17	0.01	*
İnternal fat weight, kg	0.24	0.05	0.32	0.03	-
Tail fat weight, kg	3.09	0.37	0.85	0.08	***
Carcass leg (%)	28.36	0.54	32.23	0.26	***
Carcass shoulder (%)	17.04	0.41	17.51	0.34	-
Carcass back (%)	5.67	0.13	7.38	0.16	***
Carcass loin (%)	6.14	0.19	6.26	0.20	-
Other weight in carcass (%)	24.31	0.55	28.62	0.27	***
Kidney (%)	0.63	0.06	0.72	0.04	-
Kidney and pelvic fat (%)	0.64	0.07	0.95	0.07	**
İnternal fat (%)	1.21	0.20	1.73	0.13	-
Tail fat (%)	15.72	1.28	4.60	0.37	***

*** P<0.001, ** P<0.01, * P<0.05, -: insignificant*

Table 4. *Carcass composition of groups*
Tablo 4. *Gruplarda karkas komposizyonu*

Items	Morkaraman (n=6)		K X M F_1 (n=6)		P
	LSM	SE	LSM	SE	
Leg meat (%)	64.20	1.49	65.57	0.47	-
Leg fat (%)	15.55	1.43	13.42	0.95	-
Leg bone (%)	20.25	0.62	21.02	0.88	-
Shoulder meat (%)	65.64	1.54	63.00	0.42	-
Shoulder fat (%)	13.55	1.52	13.90	0.73	-
Shoulder bone (%)	20.82	0.72	23.11	0.86	-
Back meat (%)	52.38	1.36	52.22	0.66	-
Back fat (%)	16.11	1.57	16.96	0.70	-
Back bone (%)	31.51	0.53	30.83	0.61	-
lion meat (%)	51.32	6.07	55.54	1.50	-
lion fat (%)	21.27	3.40	23.67	2.13	-
lion one (%)	27.41	8.87	20.80	1.54	-
Meat (%)	51.26	1.87	50.84	1.76	-
Fat (%)	27.69	2.00	25.76	1.89	-
Bone (%)	21.05	0.51	23.40	1.10	-
Meat weight at carcass (kg)	9.24	0.45	10.15	0.29	-
Fat weight at carcass (kg)	3.13	0.25	3.15	0.24	-
Bone weight at carcass (kg)	3.72	0.26	3.94	0.14	-
Meat at carcass (%)	48.01	2.13	55.09	1.13	*
Fat at carcass (%)	16.21	1.07	16.96	0.91	-
Bone at carcass (%)	19.55	1.98	21.44	0.84	-
Carcass in fat weight [1] (kg)	6.22	0.54	4.00	0.28	**
Carcass in fat [1] (%)	31.93	1.72	21.55	0.95	***

** P<0.05, ** P<0.01, *** P<0.01, -: insignificant [1]: including tail fat*

DISCUSSION

In growing period, the growth performance was significantly higher at the beginning of experiment, but the growth performance of cross-breed lambs passed that of pure Morkaraman lambs at the end of the experiment, indicating that cross-breed lambs might gain better than pure breed upcoming months. It has been reported that cross-breed lambs utilized pasture better than their dame and sire [2,3,9,13]. The better performance of cross-breed compared to pure breed can be explained by heterosis. Among factors affecting growth performance, sex was in favor of male lambs and young dame had lighter lambs compared to older dame in the present study, which are consistent with the previous researches [7,14-16]

When slaughtering and carcass features were assessed, both hot and cold dressing percentages of pure Morkaraman was better than that of cross-breed. The dressing percentage obtained in the current study was similar to values reported in studies conducted previously by Bayram [7],Özbey and Akcan [9], Macit [17], and Esenbuga et al.[18].

When looked for other characteristics, cross-breed lambs were better than pure breed, except tail fat. Crossing seemed to be proper method for decreasing tail fat. Moreover, meat quality increases in Kivircik due to a better marbling [2]. This was true for cross-breed. In addition to meat quality, amount of useful meat was significantly greater in cross-breed compared to pure Morkaraman. The decrease in tail fat in different breeds by cross-breeding have been reported by many other researchers [7-9,13], which are consistent with the result of the current study.

A higher amount of meat but fewer amounts of fat and bone is desired in whole carcass. When cross-breed was compared to pure breed in terms of carcass composition, cross-breed was better than pure breed Morkaraman. When looked for the percentages of meat, fat, and bone in whole carcass, they were similar, except tail fat. When tail fat was added into carcass, pure Morkaraman had a 10.38% higher tail fat. The reductions in tail fat and carcass fat observed in the current study were consistent with the results of studies reported in the literature [7,19].

In conclusion, it has been thought that Kivircik rams can be utilized for breeding with Morkaraman ewes,

commonly found in the region, to obtain lambs with high quality meat at slaughtering age without adaptation problem; and desired lean meat can be obtained via grazing in addition to cross breeding.

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