Turk J Vet Anim Sci
27 (2003) 331-337

Research Article

Growth and Carcass Characteristics of Three Fat-Tailed Pure Breeds Under Grazing with Concentrate Supplementation

Muhlis MACİT
Department of Animal Science, Faculty of Agriculture, Atatürk University, 25240 Erzurum - TURKEY
Sırrı ŞAHİN
Department of Agricultural Structures and Irrigation, Faculty of Agriculture, Atatürk University, 25240 Erzurum - TURKEY
Nurinisa ESENBUĞA, Mevlüt KARAOĞLU
Department of Animal Science, Faculty of Agriculture, Atatürk University, 25240 Erzurum – TURKEY

Received: 17.08.2001

Abstract: Growth performance, carcass measurements and carcass characteristics of three fat-tailed Turkish breeds (Awassi = A, Morkaraman = M and Tushin = T) weaned at 2.5 months of age and subjected to semi-intensive feeding during a grazing period on pasture for 70 days were evaluated. At the end of the 70-day grazing period, M lambs showed the highest performance for daily weight gain and the amount of concentrate consumed per bodyweight gain in addition to grazing on pasture. The effects of the breed and sex of lambs on daily weight gain on pasture were significant ($P < 0.05$) and highly significant ($P < 0.01$), respectively. Male lambs were superior to female lambs with respect to daily weight gain on pasture. The slaughter traits, carcass measurements and carcass characteristics of 14 male lambs representing three fat-tailed breeds were compared at the end of the grazing period of the year in which they were born. After slaughter, carcasses were chilled at +4 ˚C for 24 h and measurements were taken on the intact cold carcasses. The carcasses were then dissected into wholesale cuts. The hot carcass weight and hindshank weight of M lambs were heavier than those of A and T lambs. M had a higher hot dressing percentage and larger M. longissimus dorsi (LD) area than those of A and T lambs. Most of the weights of wholesale cuts such as foreshank and breast, sirloin, leg, rib and hindshank were significantly ($P < 0.05$; $P < 0.01$) affected by sheep breed.

It is recommended either that A, M or T male and female lambs weaned at 2.5 months of age in eastern Turkey should be fed with 450 g concentrate per head per day on pasture for 3 to 3.5 months of grazing season, or lambs should be supplemented with more than 450 g concentrate feed on pasture because native fat-tailed Turkish breeds supplemented with 450 g concentrate on pasture did not give carcasses with an adequate commercial weight at the end of a 70-day fattening period.

Key Words: Fat-tailed, Growth performance, Semi-intensive conditions, Carcass characteristics

Yağlı Kuyruklu Saf Irk Kuzuların Kesif Yemle Desteklenen Mer'ada Besi Gücü ve Karkas Özellikleri

Özet: Bu araştırma ile 2,5 aylık yaşta sütten kesilerek 70 gün süreyle mer'ada konsantre yemle desteklenen İvesi (İ), Morkaraman (M) ve Tuj (T) kuzularının besi performansı, karkas ölçüleri ve karkas özellikleri değerlendirilmiştir. Yetmiş günlük otlatma periyodu sonunda, günlük canlı ağırlık artışı ile 1 kg canlı ağırlık artışı için mer'aya ilaveten verilen ek konsantre yem miktarı bakımından M kuzuları diğer ırklara; erkek kuzular da dişi kuzulara üstünlük sağlamışlardır. Irk ve cinsiyetin mer'ada günlük canlı ağırlık artışı üzerine etkisi önemli olmuştur. Kesim karakterleri ile karkas ölçü ve özelliklerinin belirlenmesi amacıyla İ ve M erkek kuzuların ortalama besi sonu canlı ağırlığına en yakın 5 erkek kuzu; T kuzulardan ise materyalin sınırlı sayıda olması nedeniyle 4 erkek kuzu kesilerek ırklar kendi aralarında mukayese edilmiştir. Kesimden sonra karkaslar +4 °C'de 24 saat süre ile dinlendirilmiş ve daha sonra parçalanmamış soğuk karkaslar üzerinden karkas ölçüleri alınarak parçalama işlemine geçilmiştir. M kuzularında sıcak karkas ve arka ayaklar ağırlığı, İ ve T kuzulardakinden daha ağır olmuştur. Yine M kuzuları, İ ve T kuzularından daha yüksek sıcak randıman ve M. longissimus dorsi (LD) alanı değerlerine sahip olmuşlardır. Önkol ve döş, esas bel, but, sırt ve arka bacaklar gibi karkas parçalarının çoğu ırk faktörü tarafından önemli derecede ($P < 0,05$; $P < 0,01$) etkilenmiştir.

Sonuç olarak, mer'ada 450 g konsantre yemle 70 gün desteklenen yağlı kuyruklu İ, M ve T kuzuları arzu edilen kesim ağırlığı (38-40 kg)'na ulaşamadıkları için araştırma bulgularına dayanarak bölgedeki işletmelerin 2,5 aylık yaşta sütten kesilen erkek ve damızlık fazlası dişi kuzuları mer'a + 450 g kesif yemle 3-3,5 aylık bir süreyle besiye almaları veya mer'aya ek olarak hayvan başına verilecek konsantre yem miktarını artırmaları gerektiği sonucuna varılmıştır.

Anahtar Sözcükler: Yağlı kuyruk, Besi performansı, Yarı entansif şartlar, Karkas Özellikleri

Introduction

Approximately 87% of Turkey's sheep population of 30.2 million head consists of fat-tailed breeds. Sheep meat (116,000 tons) is an important contribution (22.5%) to red meat production in Turkey (1). On the other hand, the present meat production performance of native sheep breeds is far from meeting market requirements (2).

One of the factors affecting economical sheep meat production is the higher growth and feed conversion efficiency of the material used. There are two alternatives for the genetic improvement of slaughter lamb production with native sheep breeds: the first is the pure breeding of indigenous breeds and the second one is crossbreeding with a mutton-type sire breed to gain the maximum profit (3).

There have been a number of studies on slaughter lamb production under intensive feeding conditions in Turkey (3-6).

Growth performance, slaughter and carcass characteristics as well as carcass measurements of the indigenous breeds of eastern Turkey were studied by Bayındır (7), Geliyi and İlaslan (8), and Aksoy (9). Such information is essential in planning breeding programs to improve the amount of meat production and quality characteristics of indigenous Turkish breed carcasses.

The objective of this study was to evaluate growth performance, slaughter characteristics, carcass measurements and carcass characteristics of several Turkish pure breeds raised under semi-intensive management.

Materials and Methods

The experiment was conducted at the Research and Application Farm of the College of Agriculture, Atatürk University, Erzurum, and involved 158 fat-tailed Awassi (A), Morkaraman (M) and Tushin (T) male and female lambs. Lambing occurred in March and April. The lambs were kept with their dams until 2.5 months of age. At weaning they were weighed then separated into three treatment groups and subjected to semi-intensive feeding with concentrate consisting of barley (42%), maize (24%), soybean meal (10%), wheat bran (4%), molasses (8%), limestone (3%), sunflower meal (8%), salt (0.9%), and premix (0.1%). The concentrate had 88% DM, 16% CP, 10% CF and 2500 Kcal ME per kg. The concentrate was fed daily and averaged 450 g per lamb during the grazing period on pasture. Primary forage plants of the pasture were *Festuca ovina, Koleleria cristata, Bromus tomentalus, Medicago* sp. and *Onobrychis* sp. The supplement was fed to the lambs in the evening in the open-shed barn used to house them during the night. Feeding and management practices were applied equally to all lambs.

The feed consumption and live weights of the lambs were recorded biweekly. At the end of 70–day fattening period, five male lambs from the A and M breeds, and four male lambs from the T male lamb breed whose weights were closest to the group average final weight of the male lambs were slaughtered for subsequent carcass analysis.

After slaughter, the head, skin, feet and offal were removed and weighed. The carcasses were chilled at +4 ˚C for 24 h before jointing and measurements taken on the intact cold carcass (10). The fat tail was removed from each carcass prior to cutting into wholesale cuts (Figure 1) according to U.S. National Livestock and Meat Board standards (11). The wholesale cuts including fat tail were weighed and recorded. Measurements included fat thickness over the longissimus dorsi (LD), quantity of kidney and pelvic fat, and LD area.

The statistical analysis was conducted using the GLM procedure of SAS (12). Data on growth performance were analyzed by a mathematical model that included the effects of breed (A, M, T), sex (male and female) and type of birth (single and twin). All interactions investigated in this study were not included in the model because they were found not to be significant. Significant differences between means with respect to growth performance were detected using Duncan's multiple range tests (13). Data concerning the slaughter characteristics, carcass measurements and carcass characteristics were analyzed by another linear model that included only the effect of breed.

Results

The results related to initial weight, final weight and daily weight gain of A, M and T lambs are shown in Table 1.

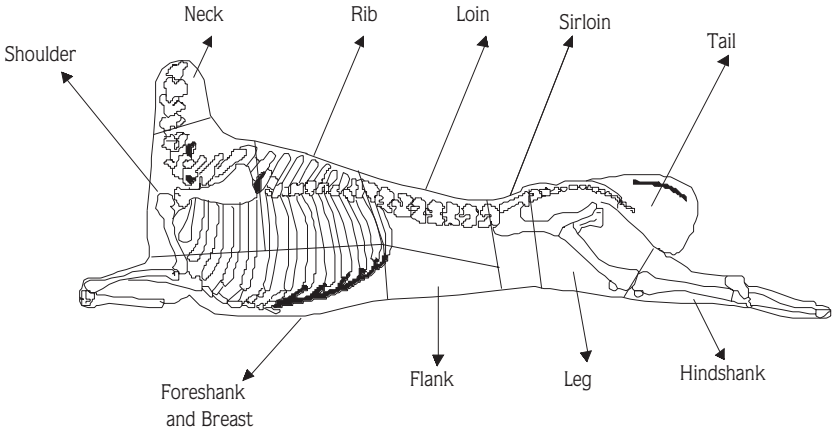

Figure 1. Wholesale cuts of lamb carcass

Table 1. Least squares means and standard errors for fattening performance traits of fat tailed Awassi, Morkaraman and Tushin lambs.

Production trait		N	Initial weight (kg) mean ± s.e.	Final weight (kg) mean ± s.e.	Daily weight gain (kg) mean ± s.e.
Breed			**	**	*
	Awassi	94	18.63 ± 0.63^{b}	29.50 ± 0.65^{b}	0.155 ± 0.005^{ab}
	Morkaraman	52	21.95 ± 0.74^{a}	34.00 ± 0.76^{a}	0.172 ± 0.006^{a}
	Tushin	12	18.69 ± 1.42^{b}	29.07 ± 1.47^{b}	0.148 ± 0.011^{b}
Sex			**	**	**
	Male	79	20.79 ± 0.75	32.55 ± 0.78	0.168 ± 0.006
	Female	79	18.72 ± 0.70	29.16 ± 0.73	0.149 ± 0.006
Type of birth			**	**	NS
	Single	130	22.34 ± 0.60	33.08 ± 0.62	0.154 ± 0.005
	Twin	28	17.17 ± 0.96	28.63 ± 1.00	0.164 ± 0.008

NS= P > 0.05, * = P < 0.05, ** = P < 0.01

^{a,b} : Means in rows with different superscripts are significantly different at P < 0.05 or P < 0.01.

As shown in Table 1, the daily weight gain of lambs subjected to semi-intensive feeding was 0.155 ± 0.006 kg, 0.172 ± 0.006 kg and 0.148 ± 0.011 kg, respectively. The effect of breed on daily weight gain was significant (P < 0.05). The difference between the M and T lamb groups was found to be significant (P < 0.05). The sex of the lamb had a highly significant (P < 0.01) effect on daily weight gain. Male lambs were heavier (P < 0.01) than female lambs, and they also grew faster than females on pasture. The consumption of concentrate supplement on dry matter basis per kilogram of bodyweight gain averaged 2.55 kg for A, 2.30 kg for M and 2.68 kg for T lambs, respectively. There were no significant differences between the lamb groups for concentrate consumption.

The slaughter traits from the three fat-tailed sheep breeds are given in Table 2. The slaughter weights of lambs were not affected by breed of lamb (Table 2). The cold carcass weight for T lambs was significantly (P < 0.05) lighter than that of M lambs. Similarly, T and A lambs had a lower hot dressing percentage, including tail fat, than that of M lambs.

The results pertaining to carcass measurements on the cold carcass are presented in Table 3.

Most of the carcass measurements except for carcass length and internal length of gigot were affected by breed of lamb. In addition, thoracic + lumbar length and depth of gigot measurements for M lambs were found to be higher than those of T lambs.

The average weights of wholesale cuts of carcass weight with tail fat are presented in Table 4.

A lambs had significantly higher (P < 0.05) sirloin weight and rib weight than T lambs. However, the weight

Table 2. Least squares means and standard errors for slaughter traits from three fat-tailed sheep breeds in Turkey.

Slaughter trait	Awassi (n=5) mean ± s.e.	Morkaraman (n=5) mean ± s.e.	Tushin (n=4) mean ± s.e.	P
Slaughter weight (kg)	31.40 ± 1.31	33.30 ± 1.31	30.75 ± 1.46	NS
Hot carcass weight (kg)	16.04 ± 0.51^{b}	17.76 ± 0.51^{a}	15.05 ± 0.57^{b}	*
Cold carcass weight (kg)	15.72 ± 0.51^{ab}	17.30 ± 0.51^{a}	14.60 ± 0.57^{b}	*
Hot dressing percentage (%)	51.45 ± 1.92	53.46 ± 1.92	49.09 ± 2.15	NS
Head weight (kg)	1.53 ± 0.13	1.44 ± 0.13	1.21 ± 0.14	NS
4 foot weight (kg)	0.77 ± 0.03^{a}	0.73 ± 0.03^{ab}	0.65 ± 0.03^{b}	*
Hide weight (kg)	2.16 ± 0.14	1.86 ± 0.14	1.97 ± 0.16	NS
Lungs weight (g)	395.40 ± 25.38	433.40 ± 25.38	400.00 ± 28.38	NS
Liver weight (g)	544.60 ± 26.37^{ab}	604.60 ± 26.27^{a}	510.00 ± 29.37^{b}	*
Heart weight (g)	176.60 ± 11.83	157.40 ± 11.83	160.00 ± 13.23	NS
Spleen weight (g)	110.60 ± 17.29	144.00 ± 17.29	100.75 ± 19.33	NS
Testis weight (g)	126.60 ± 35.75	169.20 ± 35.75	176.75 ± 39.98	NS

NS = P > 0.05, * = P < 0.05, ** = P < 0.01

^{a,b} : Means in rows with different superscripts are significantly different at P < 0.05 or P < 0.01

Table 3. Least squares means and standard errors for carcass measurement of various sheep breeds.

Carcass measurement	Awassi (n = 5) mean ± s.e.	Morkaraman (n = 5) mean ± s.e.	Tushin (n = 4) mean ± s.e.	P
Carcass length (cm)	47.10 ± 1.32	48.90 ± 1.32	44.38 ± 1.47	NS
Thoracic+Lumber length (cm)	31.50 ± 0.91^{ab}	34.20 ± 0.91^{a}	29.88 ± 1.02^{b}	*
Internal length of gigot (cm)	25.10 ± 0.68	25.70 ± 0.68	24.75 ± 0.77	NS
Width of gigot (cm)	20.30 ± 0.35^{b}	22.10 ± 0.35^{a}	20.13 ± 0.39^{b}	**
Depth of gigot (cm)	16.70 ± 0.57^{ab}	17.80 ± 0.57^{a}	15.25 ± 0.64^{b}	*
Heart girth (cm)	67.50 ± 0.98^{b}	72.00 ± 0.98^{a}	64.75 ± 1.09^{b}	**

NS= P>0.05, * =P < 0.05, **=P < 0.01

^{a,b} : Means with different superscripts are significantly different at P < 0.05 or P < 0.01

of hindshank cuts of A and T lambs was significantly lower (P < 0.05) than that for M lambs. M lambs had a significantly higher (P < 0.05; P < 0.01) weight of leg, foreshank and breast, rib and hindshank cuts than that of the T lambs.

The average proportions of wholesales cuts excluding tail fat and distribution of fat in the carcass are presented in Table 5.

A lambs had a significantly higher (P < 0.05) proportion of sirloin than M lambs. On the other hand, the proportion of loin cuts of T lambs was significantly higher (P < 0.05) than in M lambs. The other differences between lamb breeds for proportional weight of carcass cuts were not significant.

Discussion

The effect of breed on daily weight gain was significant (P < 0.05). The results obtained from this study on daily weight gain for A, M and T lambs are in agreement with the results of Büyükburç et al. (14) of 166 g for Akkaraman lambs subjected to semi-intensive feeding on pasture, and Eliçin et al. (15) of 169.41 g for Tushin male lams fed 500 g concentrate per head per day and grazed on pasture. The sex of the lamb had a highly

Table 4. Least squares means and standard errors for carcass traits from fat-tailed sheep breeds.

Wholesale cuts of carcass	Awassi (n = 5) mean ± s.e.	Morkaraman (n = 5) mean ± s.e.	Tushin (n = 4) mean ± s.e.	P
Cold carcass weight (kg)	15.72 ± 0.50[b]	17.38 ± 0.50[a]	14.63 ± 0.56[b]	**
Neck weight (kg)	0.70 ± 0.05	0.77 ± 0.05	0.65 ± 0.05	NS
Shoulder weight (kg)	2.36 ± 0.12	2.64 ± 0.12	2.31 ± 0.13	NS
Foreshank and breast (kg)	2.10 ± 0.10[ab]	2.36 ± 0.10a	1.91 ± 0.11b	*
Loin weight (kg)	2.12 ± 0.09	2.12 ± 0.09	2.05 ± 0.10	NS
Sirloin weight (kg)	0.89 ± 0.04[a]	0.81 ± 0.04[ab]	0.74 ± 0.04[b]	*
Leg weight (kg)	3.16 ± 0.16[ab]	3.67 ± 0.16[a]	2.94 ± 0.18[b]	*
Rib weight (kg)	1.18 ± 0.06[a]	1.25 ± 0.06[a]	0.91 ± 0.07[b]	**
Flank weight (kg)	0.55 ± 0.04	0.56 ± 0.04	0.49 ± 0.04	NS
Hindshank weight (kg)	0.51 ± 0.05[b]	0.69 ± 0.05[a]	0.47 ± 0.05[b]	*
Tail weight (kg)	1.99 ± 0.07	2.22 ± 0.07	2.04 ± 0.08	NS
Kidney weight (g)	78.00 ± 10.79	82.80 ± 10.79	92.50 ± 12.07	NS
Kidney fat (g)	21.20 ± 2.25[ab]	24.80 ± 2.25[b]	15.00 ± 2.51[b]	*
Pelvic fat (g)	24.40 ± 5.01	17.80 ± 5.01	18.50 ± 5.61	NS
M. longissimus dorsi area (cm^2)	11.94 ± 1.08	12.94 ± 1.08	10.25 ± 1.20	NS
Fat thickness over LD (mm)	1.70 ± 0.25	1.90 ± 0.25	1.50 ± 0.28	NS

NS = P > 0.05, * = P < 0.05, ** = P < 0.01

[a,b] Means in rows with different superscripts are significantly different at P < 0.05 or P < 0.01

Table 5. Least squares means and standart errors for proportion of wholesale cuts excluding tail fat.

	Awassi (n = 5) mean ± s.e.	Morkaraman (n = 5) mean ± s.e.	Tushin (n = 4) mean ± s.e.	P
Cold carcass weight (kg)	13.72 ± 0.50[b]	15.16 ± 0.50[a]	12.60 ± 0.47[b]	**
Proportion of cuts (out of%):				
Neck	4.34 ± 0.33	4.38 ± 0.33	4.24 ± 0.37	NS
Shoulder	17.39 ± 0.50	17.55 ± 0.50	18.54 ± 0.56	NS
Foreshank and breast	15.30 ± 0.67	15.67 ± 0.67	15.12 ± 0.75	NS
Loin	15.45 ± 0.59[ab]	13.91 ± 0.59[b]	16.50 ± 0.66[a]	*
Sirloin	6.96 ± 0.27a[a]	5.72 ± 0.27[b]	6.45 ± 0.31[ab]	*
Leg	23.58 ± 0.70	24.85 ± 0.70	23.97 ± 0.78	NS
Rib	8.09 ± 0.51	7.81 ± 0.51	6.54 ± 0.57	NS
Flank	3.13 ± 0.25	2.89 ± 0.25	2.93 ± 0.28	NS
Hindshank	4.00 ± 0.33	4.86 ± 0.33	4.05 ± 0.37	NS
Kidney	0.61 ± 0.08	0.57 ± 0.08	0.80 ± 0.09	NS

NS = P > 0.05, * = P < 0.05, ** = P < 0.01

[a,b] Means in rows with different superscripts are significantly different at P < 0.05 or P < 0.01

significant (P < 0.01) effect on daily weight gain. Male lambs were heavier (P < 0.01) than female lambs. They also had a faster growth rate than females on pasture. Such differences have been well documented by a number of other investigators (16-19). The effect of type of birth on daily weight gain was not significant on pasture (P>0.05). The result obtained from this study on daily weight gain is in agreement with the results of Macit et

al. (19). The slaughter weights of the lambs were similar in the different breeds. The cold carcass weight for T lambs was significantly ($P < 0.05$) lighter than that of M lambs. Similarly, T and A lambs had lower hot dressing percentages, including tail fat than that of M lambs. T lambs had significantly lower ($P < 0.05$) liver weight than M lambs. The dressing percentages obtained in this study of 51.45 ± 1.92, 53.46 ± 1.92 and 49.09 ± 2.15% for A, M and T lambs are similar to the findings of Akçapınar (20) and Okuyan (21) who found a range in values from around 49.60-53.20% for fat-tailed Akkaraman lambs, and Biçer et al. (22) who reported a dressing percentage of 48.7% for Awassi male lambs. Aksoy (9) indicated that the cold dressing percentage in Morkaraman male lambs slaughtered at 40 kg live weight was 50%. In addition, the hot and cold dressing percentages in Tushin lambs slaughtered at 42.8 kg weight were found to be 49.5 and 48.4% by Macit et al. (6).

Most of the carcass measurements except for carcass length and the internal length of gigot were affected by breed of lamb (Table 3). M lambs had significantly higher ($P < 0.01$) gigot width and heart girth measurements than those of A and T lambs.

A lambs had significantly higher ($P < 0.05$) sirloin weight and rib weight than T lambs. However, the weight of hindshank cuts of A and T lambs was significantly lower ($P < 0.05$) than M lambs. M lambs had significantly higher values ($P < 0.05$; $P < 0.01$) in weight of leg, foreshank and breast, rib and hindshank cuts than that of the T lambs. The other differences between the lamb breeds for the average weight of carcass cuts were not significant. Significant differences between indigenous breeds reared in Turkey in terms of weights of wholesale cuts were reported by Geliyi and İlaslan (8), Aksoy (9) and Macit et al. (6).

The LD area and the average fat thickness over LD muscle indicated no significant differences between the breeds (Table 4). The mean values of fat thickness over LD area for M, A and T lambs were lower than those reported by Macit et al. (23) and Biçer et al. (22). In addition, Bayındır (7) suggested that fat thickness over LD was significantly and positively correlated with slaughter weight, and it increased as slaughter weight increased.

The proportions of wholesale cuts such as loin and sirloin were affected by breed. T lambs showed better performance than M lambs in the proportion of loin cuts. In addition, the proportion of sirloin cuts for A lambs was found to be higher than that of M lambs. The other differences among lamb breeds for proportional weight of carcass cuts were not significant. In addition, the proportion of fat in the carcass increases, while those of bone and lean decreases with increasing slaughter weight. In terms of consumer preferences, the optimum slaughter weight for native fat-tailed breeds under grazing with concentrate was reported to be 38-40 kg by Eliçin et al. (24).

The results obtained from this study revealed that M lambs excelled over A and T lambs reared in eastern Turkey in such characteristics as daily weight gain, concentrate feed consumption as well as pasture per live weight gain and in some carcass characteristics. Male lambs were superior to female lambs with respect to daily weight gain on pasture.

In conclusion, it is recommended that either A, M and T male and female lambs weaned at 2.5 months of age in eastern Turkey should be fed with 450 g concentrate per head per day on pasture for 3 to 3.5 months of grazing season, or that the lambs should be supplemented with more than 450 g concentrate on pasture because native fat-tailed Turkish breeds supplemented with 450 g concentrate on pasture did not provide carcasses with an adequate commercial weight after 70 days of fattening.

References

1. DİE: Tarımsal Yapı (Üretim, Fiyat, Değer) T.C. Devlet İstatistik Enst., Ankara, 1997.
2. Biçer, O., Pekel, E., Güney, O.: Effects of docking on growth performance and carcass characteristics of fat-tailed Awassi male lambs. Small Rum. Res., 1992; 8: 353-357.
3. Güney, O., Biçer, O.: Fattening performance and carcass characteristics of Aw x Aw, Ile de France x Aw (F_1) and Chios x Aw (B_1) first back cross ram lambs. Wrld. Rev. Anim. Prod., 1986; 22: 63-67.

4. Eliçin, A., Aşkın, Y., Cengiz, F., Ertuğrul, M., Arık, Z.: Akkaraman ve Ile de France x Akkaraman (F_1) melezi erkek kuzularında besi gücü ve karkas özellikleri üzerinde bir araştırma. Ankara Üniv., Ziraat Fak. Yay., Ankara, 1989a (Yay. No: 1124, Bilimsel çalışmalar: 614).

5. Eliçin, A., Aşkın, Y., Cengiz, F., Ertuğrul, M., Dellal, G.: Karayaka ve Border Leicester x Karayaka (F_1) melezi erkek kuzularında besi gücü ve karkas özellikleri üzerinde bir araştırma. Ankara Üniv., Ziraat Fak. Yay., Ankara, 1989b (Yay. No: 1123, Bilimsel çalışmalar: 613).

6. Macit, M., Karaoğlu, M., Yaprak, M., Kopuzlu, S.: Tuj erkek kuzularin entansif sartlardaki besi performansları ile kesim ve karkas özellikleri. Atatürk Üniv. Zir. Fak. Derg., 1997; 28: 454-463.

7. Bayındır, S.: Morkaraman, Merinos ve bunların, melezlerinde büyüme, besi ve karkas özellikleri ile bunlar arasındaki ilişkiler. (Doçentlik Tezi), Atatürk Üniv. Ziraat Fak., Erzurum, 1980.

8. Geliyi, C., İlaslan, M.: Kaba yem oranları farklı rasyonlarla beslenen Tuj, Merinos, Tuj x Merinos melezi erkek tokluların besi gücü ve karkas özellikleri üzerinde araştırmalar. II. Kesimhane ve karkas özellikleri. Kars Arş. Enst. Yay., 1984; 12: 15.

9. Aksoy, A.R.: Farklı kesim ağırlıklarında Morkaraman ve Tuj erkek kuzularının besi performansı, kesim ve karkas özellikleri. Kafkas Üniv., Vet. Fak. Yıl., 1994; 42: 15-23.

10. Kempster, A.J., Cuthbertson, A., Harrington, G.: Carcass Evaluation in Livestock Breeding, Production and Marketing, Granada Publishing Ltd., St. Albans, Herts, UK, 307, 1982.

11. National Livestock and Meat Board: Uniform retail meat identity standards. A program for the retail meat trade by the industry wide cooperative meat identification standards committee, National Livestock and Meat Board, Chicago, USA, 1973.

12. SAS: SAS Introductory guide. 3rd Ed., Cary, NC., USA, pp 99, 1985.

13. Duncan, D.B.: Multiple range and multiple F tests. Biometrics, 1955; 11: 1-42.

14. Büyükburç, U., İlaslan, M., Cangir, S.: Islah edilmiş ve edilmemiş köy meralarında uygulanan yarı entansif kuzu besisinin entansif kuzu besisi ile karşılaştırılması üzerinde bir araştırma. Publication of Meadow-Pasture and Animal Science Res. Inst., Number. 81, Ankara, 1983.

15. Eliçin, A., Geliyi, C., Ertuğrul, M., Cengiz, F., İlaslan, M., Aşkın, Y.: Tuj kuzularının degiğik miktarda kesif yem ile desteklenen merada besi gücü ve karkas özellikleri. Ankara Üniv. Zir. Fak. Yıl., 1989; 40(1-2): 336-345.

16. Mavrogenis, A.P.: Environmental and genetic factors influencing milk and growth traits of Awassi sheep in Cyprus. Heterosis and maternal effects. Small Rum. Res., 1996; 20: 59-65.

17. Analla, M., Montilla, J. M., Serradilla, J. M.: Analyses of lamb weight and ewe litter size in various lines of Spanish Merino sheep. Small Rum. Res., 1998; 29: 255-259.

18. Doloksaribu, M., Gatenby, R.M., Subandriyo, Bradford, G.E.: Comparison of Sumatra sheep and hair sheep crossbreds. III. Reproductive performance of F_2 ewes and weights of lambs. Small Rum. Res., 2000; 38: 115-121.

19. Macit, M., Karaoğlu, M., Esenbuğa, N., Kopuzlu, S., Dayıoğlu, H.: Growth performance of purebred Awassi, Morkaraman and Tushin lambs and their crosses under semi-intensive management in Turkey. Small Rum. Res., 2001; 20: 59-65.

20. Akçapınar, H.: Dağlıç, Akkaraman ve Kıvırcık kuzularının farklı kesim ağırlıklarında besi performansı ve karkas özelliklerinin karşılaştırılması. Ankara Üniv. Zir. Fak. Yıl., 1981; 28: 112-129.

21. Okuyan, M.R.: Entansif besi uygulanan kuzuların günlük kaba yem ihtiyaçlarının saptanması üzerinde araştırmalar. Ankara Üniv. Zir. Fak. Derg. 1976 (Yayın No: 629, Bilimsel Araş. Seri No. 372).

22. Biçer, O., Güney, O., Pekel, E.: Effect of slaughter weight on carcass characteristics of Awassi male lambs. J. Appl. Anim. Res., 1995; 8: 85-90.

23. Macit, M., Yaprak, M., Aksoy, A.: Morkaraman erkek kuzuların entansif şartlardaki besi performansları ile kesim ve karkas özellikleri. Yüzüncü Yıl Üniv. Zir. Fak. Derg., 1996; 6: 61-74.

24. Eliçin, A., Geliyi, C., Ertuğrul, M., Cengiz, F., İlaslan, M., Askın, Y.: Tuj kuzularının değişik miktarda kesif yem ile desteklenen mer'ada besi gücü ve karkas özellikleri. Ankara Univ. Zir. Fak. Yıl., 1989; 40: 1-2.