İstanbul Üniv. Vet. Fak. Derg.
38 (1), 43-50, 2012
Araştırma Makalesi

J. Fac. Vet. Med. Istanbul Univ.
38 (1), 43-50, 2012
Research Article

Carcass Composition of Finished Goat Kids from Indigenous and Dairy Breeds[#]

Hülya YALÇINTAN[1], Bülent EKİZ[1], Mustafa ÖZCAN[1]*

[1]Department of Animal Breeding and Husbandry, Istanbul University, Veterinary Faculty, 34320 Avcılar, Istanbul

**Corresponding Author: Hülya YALÇINTAN Department of Animal Breeding and Husbandry, Istanbul University, Veterinary Faculty, 34320 Avcilar, Istanbul*
e-mail: hyalcint@istanbul.edu.tr, Tel: +90 212 4737070

Geliş Tarihi /Received: 27.04.2011

ABSTRACT

In this study, meat production characteristics of Saanen, Gokceada, Maltese and Hair Goat breeds were investigated by using forty male kids. There were significant differences among breeds in shoulder, flank, neck, ribs and long leg weights (P<0.001). Saanen kids had significantly higher flank, neck, ribs and long leg weight compared with the other breeds in the study. On the other hand, the differences among breeds with respect to percentage of carcass joints except long leg percentage were not significant (P>0.05). In general, muscle, bone, subcutaneous fat, intermuscular fat and other tissues weights were higher in carcass joints of Saanen kids than those from the other breeds. The percentage of muscle in the flank was significantly higher in Gokceada kids in comparison with Maltese and Hair Goat kids (P<0.05). Hair Goat kids had lower muscle percentage in the loin than those of Saanen, Gokceada and Maltese kids (P<0.01). Hair Goat kids had significantly lower muscle percentage in long leg compared with Saanen and Gokceada kids.

Key Words: Carcass composition, dissection, breed effect, goat kids

ÖZET

YERLİ VE SÜTÇÜ IRK OĞLAKLARIN BESİ SONRASI KARKAS KOMPOZİSYONLARI

Bu çalışmada, Saanen, Gökçeada, Malta ve Kıl Keçisi ırklarının et üretim özelliklerini belirlemek amacıyla kırk baş erkek oğlak kullanılmıştır. Çalışmada, kol, etek, boyun, kaburgalar ve uzun but ağırlıkları bakımından ırklar arasındaki farklılık istatistiki olarak önemli bulunmuştur (P<0,001). Saanen oğlaklara ait karkaslarda etek, boyun, kaburga ve uzun but ağırlıklarının diğer ırklarla kıyaslandığında daha yüksek olduğu gözlenmiştir. Karkas parçalarının oranları bakımından ise uzun but oranı hariç ırklar arasında önemli bir farklılık tespit edilmemiştir (P>0,05). Genel olarak Saanen oğlaklara ait karkas parçalarında kas, kemik, subcutan yağ, intermuscular yağ ve diğerleri ağırlıklarının daha yüksek olduğu tespit edilmiştir. Gökçeada oğlaklar etekte kas oranı bakımından Malta ve Kıl Keçisi oğlaklardan daha yüksek değerlere sahiptir (P<0,05). Belde kas oranı bakımından ise Saanen, Gökçeada ve Malta oğlaklar ile kıyaslandığında Kıl Keçisi oğlaklar en düşük değerlere sahiptir (P<0,01). Ayrıca uzun butta kas oranı bakımından Kıl Keçisi oğlakların, Saanen ve Gökçeada oğlaklardan daha düşük değerlere sahip olduğu gözlenmiştir.

Anahtar Kelimeler: Karkas kompozisyonu, diseksiyon, ırk etkisi, oğlak

[#] This study was arranged from the first author's PhD thesis.

Introduction

In Turkey, goat breeding sustains its importance particularly for people living in rural areas as it is one of the primary protein and financial income sources for these people. Furthermore, goats benefit more efficiently from natural sources such as grassland and bushes when compared with other livestock animals. Goat breeding also is a part of the local culture. The primary income of goat breeders is milk selling being followed by kid production. Although Hair Goat is the main breed in goat population of Turkey, there are other indigenous goat breeds in the country such as Kilis, Gürcü, Abaza, Halep, Norduz and Gokceada (Ekiz et al., 2010; Yalcin, 1986). Indigenous breeds are not outstanding with any production type but these breeds are well adapted to the harsh environment (bushy areas, adverse climate condition, bad management etc.). In recent years, there is an increasing demand towards goat milk and milk products such as cheese and ice cream in Turkey. So, there is a tendency to breed dairy type goats, such as Saanen and Maltese. In the dairy type goat production system, most of the breeders sell kids at early age and low weight in order to get more milk from their mothers. Hence, these kids produce low weight carcasses. On the other hand, numerous authors have reported that carcass weight of kids might be increased by finishing kids in semi-intensive or intensive production systems (Johnson and McGowan, 1998; Sebsibe et al., 2007).

This study is a part of the project aiming to investigate comparatively meat production and meat quality characteristics of Saanen, Gokceada, Maltese and Hair Goat kids. In this part, the carcass composition of Saanen, Gokceada, Maltese and Hair Goat kids was investigated.

Materials and methods

The research protocol of the current study was approved by the Ethic Committee of Istanbul University (Approval number: 2008/76)

Animals, management and slaughter procedures

The present study was conducted with eleven male kids from Saanen and Maltese, nine male kids from Gokceada and Hair Goat breeds (a total of 40) at Istanbul University Veterinary Faculty in 2009. Kids were purchased from commercial farms at Tekirdağ province, Turkey. Kids were selected according to age (weaned at 3-3.5 months of age) and average live weight reflecting their breed. After the kids were carried to Veterinary Faculty, each breed was placed into for separate pens. Kids were fed *ad libitum* with grower concentrate feed (16.9% CP, 29.41% NDF, 13.3% ADF and 2820 kcal/kg ME) and alfalfa hay (7.34% CP, 70.23% NDF, 41.15% ADF and 2050 kcal/kg ME) and they were supplied with clean/fresh water during the 56 days finishing period. At the end of the finishing period, kids were slaughtered after electrical stunning at the experimental slaughterhouse of Istanbul University Veterinary Faculty.

After the removal of non-carcass components, carcasses were chilled at 4 °C for 24 h. Before carcass jointing, tail, kidneys and kidney knob and channel fat (KKCF) were removed from carcasses. Chilled carcasses were then separated into right and left halves from the median line of carcasses. Right side of each carcass was then weighted and was separated into five joints (shoulder, neck, flank, ribs (loin and sirloin) and long leg) according to methodology described by Colomer-Rocher et al. (1987). Percentages of carcass joints were calculated based on weight of right side carcass.

Dissection of carcass joints

In order to estimate carcass composition, the right side of each carcass was used. After carcass jointing, carcass joints were vacuum packed and then kept at -18 °C until dissection. The day before dissection, carcass joints were thawed at 4 °C for 24 h. Carcass compositions

were evaluated by the dissection method described by Fisher and De Boer (1994). Each carcass joint was dissected into muscle, bone, subcutaneous fat, intermuscular fat and other tissues. During the dissection process evaporation losses also occurred. Other tissues included blood vessels, tendons, nerves and lymph nodes. In the dissection process, firstly subcutaneous fat was removed, then muscles were removed from bones and finally intermuscular fat and other tissues were removed from muscles and bones. Percentages of muscle, bone, subcutaneous fat, intermuscular fat, other tissues and evaporation losses were calculated based on weights of carcass joints before dissection. Although percentages of muscle, bone, subcutaneous fat, intermuscular fat and other tissues were presented in the tables, the percentages of evaporation losses were not given in the tables.

Statistical analyses

In order to determine the effect of breed on carcass composition, one-way ANOVA was performed using SPSS 10.0 statistical package (SPSS, 1999). If the effect of breed was found significant, Duncan's multiple range tests was used to evaluate the significance of the difference (Özdamar, 2003).

Results

The weights and percentages of carcass joints in Saanen, Gokceada, Maltese and Hair Goat kids are presented in Table 1. There were significant differences among breeds in weights of shoulder, flank, neck, ribs and long leg joints ($P<0.001$). Saanen kids had significantly higher flank, neck, ribs and long leg weight compared with other breeds. On the other hand, there were no significant differences among breeds in respect to percentage of carcass joints except long leg percentage ($P>0.05$). Gokceada kids had higher long leg percentage than Saanen and Hair Goat kids.

Muscle, bone and fat weight in carcass joints from Saanen, Gokceada, Maltese and Hair Goat kids are presented in Table 2. In general, muscle, bone, subcutaneous fat, intermuscular fat and other tissues weights were higher in carcass joints of Saanen kids than those of other breeds. There were no significant differences between breeds in terms of intermuscular fat weight in carcass joints except flank.

Muscle, bone and fat proportions in carcass joints from Saanen, Gokceada, Maltese and Hair Goat kids are presented in Table 3. The percentage of muscle in the flank was significantly higher in Gokceada compared with Maltese and Hair Goat kids ($P<0.05$). Hair Goat kids had lower muscle percentage ($P<0.01$) and higher bone ($P<0.001$) and other tissues ($P<0.05$) percentages in the loin compared with Saanen and Maltese kids. Hair Goat kids had significantly lower muscle percentage in long leg compared with Saanen and Gokceada kids.

Discussion

In the present study, Gokceada and Hair Goat kids had lower weights of carcass joints than those of Saanen and Maltese kids (Table 1). Weights of first quality carcass parts, such as long leg and ribs were also higher in Saanen kids than those of other breeds. Hence, Saanen kids had higher meat yield compared with indigenous breeds and Maltese kids. Moreover, Maltese kids had higher weight of first quality carcass joints than Gokceada kids. Similar to the current study, Özcan et al. (2010) reported that weights of carcass joints in Saanen and Maltese suckling kids were higher than those of Gokceada suckling kids. Cameron et al. (2001) also observed that weights of primal cuts were significantly or numerically higher for Boer crossbreds than for Spanish goats. However, Yılmaz et al. (2010) found no significant differences between Hair Goat and Hair Goat × Saanen F_1 and B_1 crossbred kids in terms of carcass part weights being in contrast to the present study. The differences between studies could be explained by different pre-slaughter live weights and slaughter ages or different breeds investigated in the studies.

Table 1. Means and standart errors (SE) for weights and percentages of carcass joints in Saanen, Gokceada, Maltese and Hair Goat kids.
Tablo 1. Saanen, Gökçeada, Malta ve Kıl Keçisi oğlaklarda karkas parçalarının ağırlık ve oranlarına ait ortalama değerler ve standart hatalar (SE).

Characteristics	Saanen		Gokceada		Maltese		Hair Goat		Sig
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Right half carcass weight (kg)	4.71^{a}	0.25	2.66^{c}	0.23	3.90^{b}	0.21	3.34^{bc}	0.29	***
Shoulder weight (g)	1044.18^{a}	57.33	596.00^{c}	46.10	891.82^{ab}	46.60	766.22^{b}	63.17	***
Flank weight (g)	469.27^{a}	31.52	254.89^{c}	19.35	375.64^{b}	24.44	312.67^{bc}	29.78	***
Neck weight (g)	421.82^{a}	23.57	241.56^{c}	19.48	338.91^{b}	25.28	292.67^{bc}	19.50	***
Ribs weight (g)	1148.18^{a}	63.15	622.22^{c}	62.82	925.64^{b}	45.97	817.11^{b}	81.13	***
Sirloin weight (g)	724.36^{a}	37.86	388.00^{c}	40.06	578.00^{b}	31.10	493.78^{bc}	46.03	***
Loin weight (g)	424.00^{a}	28.22	233.56^{c}	24.77	348.00^{ab}	16.18	324.00^{b}	36.19	***
Long leg weight (g)	1514.73^{a}	83.85	883.33^{c}	81.07	1278.18^{b}	68.40	1068.00^{bc}	86.96	***
Tail weight (g)	14.27^{a}	1.43	9.11^{b}	1.09	12.82^{a}	0.96	10.67^{ab}	1.23	*
Shoulder (%)	22.19	0.86	22.62	1.13	22.92	0.81	23.01	0.70	NS
Flank (%)	9.94	0.33	9.70	0.34	9.57	0.26	9.36	0.42	NS
Neck (%)	8.98	0.85	9.22	1.19	8.60	0.91	8.88	0.75	NS
Ribs (%)	24.42	1.55	23.21	1.49	23.84	1.64	24.27	1.09	NS
Sirloin (%)	15.47	1.39	14.47	1.12	14.85	1.02	14.72	0.82	NS
Loin (%)	8.96	0.26	8.71	0.35	9.01	0.29	9.57	0.31	NS
Long leg (%)	32.16^{b}	0.23	33.13^{a}	0.33	32.79^{ab}	0.23	32.09^{b}	0.37	*
Tail (%)	0.30	0.02	0.34	0.02	0.33	0.02	0.32	0.02	NS

^{a,b,c} Differences between the means of breed groups carrying various letters in the same line are significant.
NS: Not significant (P>0.05) *P<0.05; ***P<0.001

Table 2. Means and standart errors (SE) for muscle, bone and fat weight in carcass joints from Saanen, Gokceada, Maltese and Hair Goat kids.
Tablo 2. Saanen, Gökçeada, Malta ve Kıl Keçisi oğlakların karkas parçalarında kas, kemik ve yağ ağırlıklarına ait ortalama değerler ve standart hatalar (SE).

Characteristics	Saanen		Gokceada		Maltese		Hair Goat		Sig
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Neck									
Muscle (g)	229.76^{a}	17.62	137.18^{c}	12.07	187.28^{b}	12.62	166.61^{bc}	13.00	***
Bone (g)	77.02^{a}	4.68	41.12^{c}	3.61	62.14^{b}	6.25	50.13^{bc}	3.99	***
Subcutaneous fat (g)	5.78	0.75	2.52	0.55	4.79	1.41	4.48	0.49	NS
Intermuscular fat (g)	22.17	3.42	12.93	2.15	16.19	1.26	18.45	2.31	NS
Other tissues (g)	39.96^{a}	3.65	19.62^{b}	2.59	27.86^{b}	4.29	29.58^{ab}	3.35	**
Shoulder									
Muscle (g)	590.95^{a}	37.51	350.79^{c}	28.65	490.83^{b}	28.95	432.93^{bc}	37.88	***
Bone (g)	222.70^{a}	10.42	128.21^{c}	7.82	186.12^{b}	10.14	166.43^{b}	10.45	***
Subcutaneous fat (g)	34.41	7.18	14.21	4.93	25.77	4.90	18.31	3.80	NS
Intermuscular fat (g)	57.66	6.52	31.34	4.37	49.18	4.09	50.07	9.09	NS
Other tissues (g)	49.28	4.48	30.22	4.80	37.43	3.81	42.48	7.01	NS
Flank									
Muscle (g)	237.14^{a}	15.04	134.84^{c}	11.95	181.52^{b}	12.95	145.33^{bc}	16.29	***
Bone (g)	83.25^{a}	5.60	46.57^{c}	3.35	70.39^{ab}	4.15	59.68^{bc}	5.48	***
Subcutaneous fat (g)	23.73^{a}	3.10	7.98^{b}	2.56	16.62^{ab}	3.47	17.25^{ab}	3.95	*
Intermuscular fat (g)	52.20^{a}	6.49	22.19^{c}	3.05	42.45^{ab}	4.98	34.00^{bc}	8.12	**
Other tissues (g)	29.16^{a}	2.38	16.38^{b}	2.41	20.38^{b}	2.58	21.67^{b}	2.24	**
Sirloin									
Muscle (g)	371.19^{a}	21.82	206.02^{c}	20.81	303.88^{b}	18.65	261.13^{bc}	26.45	***
Bone (g)	156.36^{a}	9.36	90.38^{c}	10.29	125.23^{b}	8.50	109.77^{bc}	8.78	***
Subcutaneous fat (g)	15.94	4.28	4.42	1.38	8.01	3.36	6.22	1.95	NS
Intermuscular fat (g)	44.37^{a}	6.05	19.19^{b}	4.98	31.73^{ab}	1.87	31.60^{ab}	5.76	*
Other tissues (g)	61.99^{a}	11.20	27.70^{b}	4.66	41.09^{ab}	5.23	36.77^{b}	4.56	*
Loin									
Muscle (g)	275.37^{a}	18.24	150.38^{c}	16.44	225.61^{ab}	13.00	184.24^{bc}	21.36	***
Bone (g)	60.49^{a}	5.85	41.61^{b}	5.32	43.46^{b}	4.97	67.83^{a}	7.42	**
Subcutaneous fat (g)	9.41	1.71	2.81	0.74	10.31	5.44	5.24	1.41	NS
Intermuscular fat (g)	28.29^{a}	4.79	11.10^{b}	2.22	21.36^{ab}	2.80	20.54^{ab}	4.26	*
Other tissues (g)	16.59^{ab}	2.33	8.97^{b}	1.94	14.66^{ab}	1.87	21.47^{a}	3.95	*
Long leg									
Muscle (g)	905.76^{a}	53.76	531.95^{c}	52.97	741.00^{b}	45.70	605.46^{bc}	56.05	***
Bone (g)	321.15^{a}	16.76	193.58^{c}	14.71	268.16^{b}	13.31	244.87^{b}	13.56	***
Subcutaneous fat (g)	33.87	8.42	19.63	6.94	35.15	6.12	22.21	3.74	NS
Intermuscular fat (g)	79.01^{a}	5.95	42.82^{b}	6.52	66.34^{a}	3.09	63.16^{a}	9.36	**
Other tissues (g)	66.82	5.73	46.99	6.00	59.77	4.31	62.33	6.68	NS
Tail									
Muscle (g)	5.41^{a}	0.52	3.49^{b}	0.31	5.08^{a}	0.39	4.19^{ab}	0.49	*
Bone (g)	4.90^{a}	0.55	3.01^{b}	0.35	3.92^{ab}	0.29	3.80^{ab}	0.42	*
Subcutaneous fat (g)	1.94	0.34	1.14	0.26	1.39	0.10	1.27	0.27	NS
Intermuscular fat (g)	0.11	0.02	0.17	0.07	0.08	0.03	0.17	0.06	NS
Other tissues (g)	0.67	0.09	0.65	0.20	0.43	0.08	0.62	0.09	NS

^{a,b,c} Differences between the means of breed groups carrying various letters in the same line are significant.
NS: Not significant (P >0.05); *P < 0.05; **P < 0.01; ***P < 0.001

Table 3. Means and standart errors (SE) for muscle, bone and fat proportion in carcass joints from Saanen, Gokceada, Maltese and Hair Goat kids.
Tablo 3. Saanen, Gökçeada, Malta ve Kıl Keçisi oğlakların karkas parçalarında kas, kemik ve yağ oranlarına ait ortalama değerler ve standart hatalar (SE).

Characteristics	Saanen		Gokceada		Maltese		Hair Goat		Sig
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Neck									
Muscle (%)	54.31	1.67	58.07	2.11	56.94	1.98	57.76	1.33	NS
Bone (%)	18.44	0.65	17.91	1.44	18.44	0.69	17.59	1.21	NS
Subcutaneous fat (%)	1.35	0.12	1.00	0.19	1.49	0.46	1.56	0.14	NS
Intermuscular fat (%)	5.23	0.77	5.48	1.01	5.42	0.88	6.44	0.81	NS
Other tissues (%)	9.53	0.66	8.15	0.68	8.36	1.07	10.28	0.93	NS
Shoulder									
Muscle (%)	56.80	1.45	59.20	0.85	55.78	1.91	57.22	0.95	NS
Bone (%)	21.57	0.38	21.97	0.54	21.10	0.47	22.35	0.66	NS
Subcutaneous fat (%)	3.30	0.62	2.28	0.66	2.84	0.52	2.26	0.33	NS
Intermuscular fat (%)	5.49	0.50	5.24	0.53	5.61	0.41	6.31	0.66	NS
Other tissues (%)	4.74	0.38	5.05	0.56	4.29	0.42	5.42	0.43	NS
Flank									
Muscle (%)	51.09^{ab}	1.14	53.30^{a}	1.83	48.37^{b}	1.69	46.53^{b}	1.77	*
Bone (%)	17.87	0.36	18.82	0.98	19.14	0.94	19.46	0.73	NS
Subcutaneous fat (%)	5.06	0.54	3.04	0.85	4.56	1.02	5.32	0.95	NS
Intermuscular fat (%)	10.91	0.87	8.49	0.67	11.00	0.95	10.14	1.36	NS
Other tissues (%)	6.28	0.37	6.62	0.86	5.59	0.77	7.14	0.64	NS
Sirloin									
Muscle (%)	51.75	0.73	54.59	1.17	53.56	1.67	53.85	1.44	NS
Bone (%)	21.92	0.80	23.79	1.08	22.03	0.89	23.07	1.32	NS
Subcutaneous fat (%)	2.14	0.52	1.02	0.27	1.43	0.64	1.71	0.27	NS
Intermuscular fat (%)	6.13	0.76	4.48	0.82	5.67	0.33	6.13	0.65	NS
Other tissues (%)	8.51	1.18	7.21	0.93	7.24	0.85	7.59	0.84	NS
Loin									
Muscle (%)	64.40^{a}	1.31	66.13^{a}	1.59	66.22^{a}	1.76	57.84^{b}	1.74	**
Bone (%)	14.45^{b}	0.91	18.28^{a}	0.98	12.94^{b}	1.40	21.53^{a}	1.76	***
Subcutaneous fat (%)	2.37	0.41	1.25	0.31	2.95	1.54	1.61	0.35	NS
Intermuscular fat (%)	6.67	0.91	4.53	0.59	6.36	0.87	6.20	0.79	NS
Other tissues (%)	3.96^{b}	0.48	3.76^{b}	0.52	4.45^{b}	0.63	6.45^{a}	0.64	*
Long leg									
Muscle (%)	60.08^{a}	0.68	60.71^{a}	1.04	58.13^{ab}	0.93	57.12^{b}	0.97	*
Bone (%)	21.43	0.52	22.57	0.66	21.29	0.60	23.63	0.81	NS
Subcutaneous fat (%)	2.19	0.43	2.03	0.57	2.68	0.44	2.03	0.28	NS
Intermuscular fat (%)	5.27	0.34	4.75	0.45	5.32	0.26	5.80	0.41	NS
Other tissues (%)	4.52	0.44	5.38	0.46	4.71	0.22	5.86	0.30	NS
Tail									
Muscle (%)	37.65	2.15	40.46	1.75	40.03	1.31	38.97	1.68	NS
Bone (%)	33.97	1.60	34.69	1.88	31.08	1.43	35.49	1.86	NS
Subcutaneous fat (%)	12.69	1.34	11.81	1.75	10.98	0.35	10.92	1.48	NS
Intermuscular fat (%)	0.82	0.21	1.69	0.56	0.64	0.19	1.68	0.66	NS
Other tissues (%)	4.70	0.65	6.71	1.79	3.68	0.83	6.15	1.40	NS

^{a,b} Differences between the means of breed groups carrying various letters in the same line are significant.
NS: Not significant (P >0.05); *P < 0.05; **P < 0.01; ***P < 0.001

The percentages of the carcass joints were not affected by breed except long leg in the present study. Similar to the current study, various authors found no significant differences between breeds / genotypes in proportions of carcass joints (Cameron et al., 2001; Dhanda et al., 1999; Dhanda et al., 2003; Özcan et al., 2010; Yılmaz et al., 2010). Sebsibe et al. (2007) also reported similar proportions of the primal cuts between Afar, Central Highland goat and Long-eared Somali goat breeds except the loin percentage. However, Santos et al. (2007) found significant genotype effect on the percentage of carcass joints, except neck and rib, for the same hot carcass weight in Serrana, Bravia and Bravia × Serrana crossbred kids. In the current study, the contribution of long leg and ribs to the carcass side were higher than those of other carcass joints. Similar results were also reported by Dhanda et al. (2003), Özcan et al. (2010) and Yılmaz et al. (2010).

As a result of dissection, muscle tissue weight from Saanen and Maltese kids' carcasses were significantly or numerically higher in all carcass joints (Table 2). Supporting this result, Özcan et al. (2010) reported that muscle tissue weight in half carcasses from Maltese and Saanen suckling kids were significantly higher than Gokceada kids.

There were no significant differences between breeds in terms of muscle, bone and fat percentages in neck, shoulder, sirloin and tail (Table 3). On the other hand, Hair Goat kid carcasses had significantly lower muscle percentage in loin and long leg. Linear increases in lean and fat percentage with body weight, and decrease in percentage of bone in carcasses of dairy goats were reported by Warmington and Kirton (1990). A significant effect of breed / genotype on the carcass muscle content was reported in goats by Dhanda et al. (1999), Dhanda et al. (2003), Tshabalala et al. (2003). However, Yılmaz et al. (2010) did not find significant effect of genotype on muscle percentages in long leg from Hair Goat and Saanen × Hair Goat (F_1 and B_1) crossbred kids. Cameron et al. (2001) also did not observe any significant differences between genotypes in terms of muscle content of carcass joints except shoulder. Dhanda et al. (1999) observed an increase in the proportion of muscle and fat in carcass joints with increasing age while a decrease in bone content with age. In the current study, the differences between breeds in muscle content of long leg and loin could be explained by breed effect.

There are variations in the muscle percentages among different carcass joints such as shoulder (56-59%), loin (57-66%) and long leg (57-61%) in the present study. Long leg had the highest percentages of muscle while flank had the lowest percentages of muscle in all breeds in accordance with reports by Dhanda et al. (1999), Dhanda et al. (2003) and Oman et al. (2000).

The bone proportion in loin was significantly higher in Gokceada and Hair Goat kid carcasses than those of dairy breeds. Dhanda et al. (1999) reported that the percentage of bone decreased significantly with age and weight. Yakan and Ünal (2010) observed that slaughter weight affected carcass composition and the percentage of carcass bone decreased with slaughter weight in Bafra lambs. In the current study, the high bone content of indigenous goat breeds in the loin can be explained by different slaughter weights or breed effect.

There were no significant differences among breeds in subcutaneous and intermuscular fat proportions. The development of subcutaneous fat in goats is slow (Warmington and Kirton, 1990) and, goats also tend to deposit most of their fat internally (omental, mesenteric, kidney knob and channel fat) and these effects make goat meat leaner (Tshabalala et al., 2003).

As a conclusion, the results of the current study indicate that Saanen and Maltese dairy breed kids were superior to indigenous Gokceada and Hair Goat kids in meat production by a 56 d finishing after weaning.

Acknowledgement

The authors would like to thank Ismail Kaş and Gökhan Çiçek for their assistance in tissue dissection. The present study was supported by the Research Fund of Istanbul University (Project No: 3098).

REFERENCES

Cameron, M.R., Luo, J., Sahlu, T., Hart, S.P., Coleman S.W., Goetsch A.L., 2001. Growth and slaughter traits of Boer × Spanish, Boer × Angora, and Spanish goats consuming a concentrate-based diet. Journal of Animal Science 79, 1423-1430.

Colomer-Rocher, F., Morand-Fehr, P., Kirton, A.H., 1987. Standard methods and procedures for goat carcass evaluation, jointing and tissue separation. Livestock Production Science 17, 149-159.

Dhanda, J.S, Taylor, D.G., McCosker, J.E., Murray, P.J., 1999. The influence of goat genotype on the production of Capretto and Chevon carcasses. 3. Dissected carcass composition. Meat Science 52, 369-374.

Dhanda, J.S., Taylor, D.G., Murray, P.J., 2003. Part 1. Growth, carcass and meat quality parameters of male goats: effects of genotype and liveweight at slaughter. Small Ruminant Research 50, 57-66.

Ekiz, B., Özcan, M., Yılmaz, A., Tölü, C., Savaş, T., 2010. Carcass measurements and meat quality characteristics of dairy suckling kids compared to an indigenous genotype. Meat Science 85, 245-249.

Fisher, A.V., de Boer, H., 1994. The EAAP standart method of sheep carcass assessment. Carcas measurement and dissection procedures. Report of the EAAP working group on carcass evaluation, in cooperation with the CIHEAM Instituto Agronomico Mediterraneo of Zaragoza and the CEC Directorate General for Agricultute in Brussels. Livestock Production Science 38, 149-159.

Johnson, D.D., McGowan, C.H., Nurse, G. ve Anous, M.R., 1995. Breed and sex effects on carcass traits, composition and tenderness of young goats. Small Ruminant Research 17, 57-63.

Oman, J.S., Waldron, D.F., Griffin, D.B., Savell, J.W., 2000. Carcass traits and retail display-life of chops from different goat breed types. Journal of Animal Science 78, 1262-1266.

Özcan, M., Yılmaz, A., Ekiz, E., Tölü, C., Savaş, T., 2010. Slaughter and carcass characteristics of Gokceada, Maltese and Turkish Saanen suckling kids. Archiv Tierzucht 53, 318-327.

Özdamar, K., 2003. SPSS ile Biyoistatistik. Kaan Kitabevi, Eskişehir.

Santos, V.A.C., Silva, A.O., Cardoso, J.V.F., Silvestre, A.J.D., Silva, S.R., Martins, C., Azevedo, J.M.T., 2007. Genotype and sex effects on carcass and meat quality of suckling kids protected by the PGI "Cabrito de Barrosa". Meat Science 75, 725-736.

Sebsibe, A., Casey, N.H., Van Niekerk, W.A., Tegegne, A., Coertze, R.J., 2007. Growth performance and carcass characteristics of three Ethiopian goat breeds fed grainless diets varying in concentrate to roughage ratios. South African Journal of Animal Science 37, 221-232.

SPSS, 1999. Statistical Package for the Social Sciences, Release 10.0. SPSS Inc., Chicago, IL, USA.

Tshabalala, P.A., Strydom, P.E., Webb, E.C., de Kock, H.L., 2003. Meat quality of designated South African indigenous goat and sheep breeds. Meat Science 65, 563-570.

Warmington, B.G., Kirton, A.H., 1990. Genetic and non-genetic influences on growth and carcass traits of goats. Small Ruminant Research 3, 147-165.

Yakan, A., Ünal, N., 2010. Meat production traits of a new sheep breed called Bafra in Turkey 1. Fattening, slaughter, and carcass characteristics of lambs. Tropical Animal Health and Production 42, 751-759.

Yalcin B.C., 1986. Sheep and Goats in Turkey. Food and Agriculture Organization of The United Nations (FAO), Animal Production and Health Paper 60, Rome

Yılmaz, A., Ekiz, B., Özcan, M., Kaptan, C., Hanoğlu, H., Yıldırır, M., Koçak, Ö., 2010. Carcass quality characteristics of Hair Goat and Saanen × Hair Goat crossbred kids from intensive production system. Journal of Animal and Feed Sciences 19, 368-378.