Turkish Journal of Agriculture - Food Science and Technology

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Turkish Science and Technology

Effect of Different Slaughter Weights on Slaughter and Carcass Traits of Male Karayaka Lambs Reared under Intensive Production System

Yüksel Aksoy[1*], Zafer Ulutaş[2]

[1]*Department of Animal Science, Faculty of Agriculture, University of Gaziosmanpaşa, 60250 Tokat, Turkey*
[2]*Department of Animal Production and Technologies, Faculty of Agricultural Sciences and Technologies, Universty of Niğde, 51200 Niğde, Turkey*

ARTICLE INFO

Article history:
Received 12 March 2015
Accepted 18 March 2015
Available online, ISSN: 2148-127X

Keywords:
Karayaka
Lamb
Slaughter weight
Carcass traits
Dissection

* Corresponding Author:
E-mail: yuksel.aksoy@gop.edu.tr

ABSTRACT

The present study was conducted to investigate the carcass traits of Karayaka lambs slaughtered at different slaughter weights (SWs) and to find out optimum SWs. Male Karayaka lambs with 20 kg live weight (n=30) constituted the animal material of the study. Lambs were randomly divided into five SW groups; 30 (GI; n=6), 35 (GII; n=6), 40 (GIII; n=6); 45 (GIV; n=6) and 50 (GV; n=6) kg. Lamb fattening feed (concentrate feed, *ad libitum*) and forage (lentil straw, 100g/lamb/day) were used as the feed material. Lambs were sent to slaughter at target SWs. Following the slaughter, non-carcass components, tailless hot and cold carcass weights were taken. Carcasses were separated into six sections as leg, foreleg, back, loin, neck and others. Physical dissection was performed to investigate carcass composition. Only the differences in carcass dressing and skin percentages of slaughter groups were not found to be significant. Increasing carcass fat percentages and decreasing carcass lean and bone percentages were observed with increasing SWs. Considering the consumer preferences, current findings revealed that Karayaka lambs should be sent to slaughter at weights between 30-35 kg. However, considering the red meat deficit of the country, current market conditions and producer preferences, the optimum SW for Karayaka lambs were recommended to be between 40-45 kg.

Entansif Şartlarda Yetiştirilen Karayaka Erkek Kuzuların Kesim ve Karkas Özellikleri Üzerine Farklı Kesim Ağırlığının Etkisi

MAKALE BİLGİSİ

Geliş 12 Mart 2015
Kabul 18 Mart 2015
Çevrimiçi baskı, ISSN: 2148-127X

Anahtar Kelimeler:
Karayaka
Kuzu
Kesim ağırlığı
Karkas özellikleri
Diseksiyon

* Sorumlu Yazar:
E-mail: : yuksel.aksoy@gop.edu.tr

ÖZET

Bu araştırma, farklı kesim ağırlıklarında Karayaka kuzuların karkas özelliklerinin araştırılması ve kuzularda uygun kesim ağırlığının belirlenmesi amacıyla yapılmıştır. Araştırma hayvan materyalini, 20 kg canlı ağırlığında Karayaka erkek kuzular (n=30) oluşturmuştur. Kuzular 30 (GI; n=6), 35 (GII; n=6), 40 (GIII; n=6); 45 (GIV; n=6) ve 50 (GV; n=6) kg. olmak üzere beş farklı kesim ağırlığı grubuna rastgele dağıtılmıştır. Besi süresince yem materyali olarak kuzu besi yemi (*ad libitum*) ve mercimek samanı (100 g/kuzu/gün) kullanılmıştır. Hedeflenen kesim canlı ağırlığına ulaşılan kuzular kesime gönderilmiştir. Kesim sonrası sakatat ağırlıkları, kuyruksuz sıcak ve soğuk karkas ağırlıkları alınmıştır. Karkaslar but, kol, sırt, bel, boyun ve diğerleri olmak üzere altı parçaya ayrılmıştır. Kuzularda karkas kompozisyonunu araştırmak amacıyla fiziksel olarak diseksiyon yapılmıştır. Araştırmada, kesim özelliklerine ait oranlardan sadece karkas randımanları ve deri oranları bakımından kesim grupları arasında farklar önemsiz bulunmuştur. Kesim ağırlığın artışıyla karkas yağ oranı artmış, karkas et ve kemik oranı azalmıştır. Sonuç olarak, tüketicilerin yağsız eti tercih etmeleri durumunda Karayaka kuzular 30-35 kg arasında kesime sevk edilmeleri uygundur. Ancak, ülkemizdeki kırmızı et açığı ve pazar durumu ile yetiştirici tercihleri de göz önünde bulundurulduğunda bugünkü şartlarda en uygun kesim aralığının 40-45 kg arasında olabileceği ifade edilebilir.

Introduction

Humans should consume a certain amount of red meat daily for a sufficient and balanced nutrition. Not only the amount, but also the quality of red meat should meet daily sufficient and balanced nutritional needs of humans. Prolonged fattening periods may deteriorate carcass morphology and thus the carcass quality of lambs. Although low carcass fat percentages reduce the fattening costs, fats preserve carcass freshness and prevent loss and color problems. However, rapid increase in fat storage slows down muscle growth and development. Prolonged fattening periods beyond a certain period ultimately results in excessive fattening (Tekel et al., 2007). Therefore, optimum slaughter weights breeds should be determined for indigenous sheep breeds

Karayaka lambs are widely reared along Black Sea coastline. They constituted the subject matter of the present study and they are breeds indigenous of Turkey (Akçapınar, 2000; Kaymakçı, 2006). The breed is primarily reared for meat, then for milk and wool (Kaymakçı, 2006). They are known with their small sizes and low yields. Mature live weights of Karayaka rams vary between 40–50 kg and live weights of sheep vary between 35–40 kg (Akçapınar, 2000; Kaymakçı, 2006). Average fertility rates are around 1.00–1.29 (Baş et al., 1993; Olfaz and Saylam, 1996; Akçapınar et al., 2002a; Ünal et al., 2003). Previous studies revealed the lactation periods of Karayaka sheep as between 100-160 days and lactation milk yields as between 60-90 kg (Akçapınar, 2000; Kaymakçı, 2006).

There are several previous studies about slaughter and carcass characteristics of Karayaka lambs and their crossbreds (Olfaz, 1997; Oğan, 2000; Akçapınar et al., 2002b; Sen et al., 2011). However, a comprehensive study has not be carried out about slaughter and carcass traits of Karayaka lambs reared under intensive production systems and slaughtered at different slaughter weights (SWs). Therefore, the present study was conducted to investigate the slaughter and carcass traits of Karayaka lambs at different SWs and to find out the optimum SW.

Materials and Methods

The present study was conducted out at the experimental farm of Gaziosmanpaşa University Agricultural Faculty, Tokat, Turkey, (40°31' N, 36°53' E, and 650 m above the sea level). The study was approved by Ethical Committee of Gaziosmanpaşa University for Experimental Animals (with the protocol number: 2011/046). Male lambs born as singleton, average 20 kg live weight (n=36) constituted the animal material of the study. The lambs were reared with their dams and had ewes' milk from birth to weaning, with an age of 90 days. Lambs were randomly assigned to one of five following SWs: 30 (GI; n=6), 35 (GII; n=6), 40 (GIII; n=6); 45 (GIV; n=6) and 50 (GV; n=6) kg of live weight. Before fattening period, lambs were treated for parasites, drenched with anthelmintic preparation (Triclabendazole 12 mg/kg; Levamisole 7.5 mg/kg) and housed together in 5x8 m pens. Lamb fattening feed (concentrate feed) and forage (lentil straw) were supplied as the feed material. Concentrate feed, mineral stone and fresh water were supplied *ad libitum* throughout the fattening period, whereas lentil straw was supplied only 100 g/lamb/day during the experimental period. The chemical composition of the feed supplements is provided in Table 1.

The lambs with desired SWs were taken into private pens. Animals were not fed for 12 hours ahead of the slaughter; they were transported to a local licensed abattoir for 10 minutes. After holding in paddock of slaughterhouse for 2 hours, they were slaughtered following standard commercial slaughter procedures (TSI, 1987). Lambs were brought to slaughter within ±1 kg of the expected SWs. Following the slaughter, the weights of hot carcass, skin, head, feet, omental-mesenteric fats and visceral organs (heart, liver, lungs plus trachea, spleen and kidneys) were recorded and the carcasses were cooled at +4°C for 24 h and then cold carcass weight was recorded. The hot, cold dressing (tailless) and non-carcass components percentages were calculated on SW and the kidneys percentages were expressed as a percentage of cold carcass weight.

Carcass measurements were taken over cold carcasses (Russo et al., 2003; Vacca et al., 2008; Carrasco et al., 2009; Teklebrhan et al., 2012). Carcass conformation coefficients were calculated in accordance with Russo et al. (2003), Peña et al. (2005), Vacca et al. (2008), and Önenç et al. (2009).

Kidneys, perinephric-pelvic fat and tail fat were separated before jointing. Cold carcasses were separated into neck, leg, foreleg, back, loin and other sections in accordance with carcass separation method described in Akçapınar (1981). Following the separation, back fat thickness was measured between 12^{th} and 13^{th} ribs (over *m. longissimus et thoracis* (MLD)) with a digital caliper. The MLD muscle cut out from this section was drawn over a tracing paper and muscle area was measured with a digital planimeter (Yakan and Ünal, 2010). Weights of carcass sections were measured with a precise balance (±1.0 g). Following the weighing, physical dissection was performed to determine lean, fat and bone percentages of each section (Öztürk et al., 2012).

Statistical Analyses

In order to determine the effects of SWs on slaughter and carcass traits one-way ANOVA was performed by using SPSS (1999) software. Duncan's test was used to present the differences among the means (Düzgüneş et al., 1987).

Table 1 The chemical composition of concentrate feed and forage (lentil straw)

Nutrient content	Concentrate feed	Lentil straw
Dry matter (%)	92.0	91.3
Crude protein (%)	20.63	5.78
ADF (%)	26.39	55.59
NDF (%)	37.96	56.29
Crude oil (%)	2.60	1.49
Crude ash (%)	10.40	9.60
Metabolic energy (kcal/kg)	2658	2012

ADF: Acid Detergent Fiber; NDF: Neutral Detergent Fiber

Results

The results for slaughter traits according to SWs are provided in Table 2. Except for hot, cold dressing and skin percentages, significant differences were observed in other percentages of slaughter groups (P<0.05). The highest hot and cold dressing percentages (49.70% and 48.66%) were obtained from GIV and the lowest dressing percentages (46.73% and 45.34%) were obtained from GI slaughter weight group.

The mean value for percentages of carcass cuts, carcass measurements and indices according to SW groups are summarized in Table 3. The differences in carcass length (P<0.001), external hindquarter length (P<0.001), pelvic limb length (P<0.01), hindquarter perimeter (P<0.001), hindquarter width (P<0.001) and chest width (P<0.01) of SW groups were found to be significant. Increasing carcass compactness was observed with increasing SWs of Karayaka lambs (P<0.001). However, carcass compactness coefficients of the groups GIV and GV were similar to each other. The differences in carcass and leg conformation of slaughter groups were not found to be significant (P>0.05). Except for foreleg (P<0.01) and neck (P<0.05) percentages, differences in carcass cut percentages of slaughter groups were also found to be insignificant (P>0.05).

The means for lean, fat and bone percentages of carcass and cuts are provided in Table 4. The differences in carcass fat (P<0.001), bone (P<0.001), lean/fat (P<0.01) and lean/bone (P<0.001) percentages of slaughter groups were found to be significant. The differences in fat and bone percentages of entire carcass cuts of slaughter groups were also found to be significant (P<0.05). Only the differences in loin lean percentages of slaughter groups were also found to be significant (P<0.01).

Discussion and Conclusion

Carcass dressing percentage is a significant factor for meat production and carcass quality (Tufan and Akmaz, 2001). Increasing hot and cold carcass dressing percentages were observed in this study with increasing SWs (Table 2). The cold carcass dressing percentage of GV slaughter group was lower than the dressing percentage value of GIV slaughter group. Such a case may be resulted from increasing skin and head percentages through increasing SWs from 45 to 50 kg live weight. Cold carcass dressing percentages of Karayaka lambs of the present study were similar to values reported for the same breed by Oğan (2000) (at 51 kg SW; 47.91%) and Akçapınar et al. (2002b) (at 40 kg SW; 47.15%). But they were different from Bandırma-I (at 41 kg SW; 50.19%) and Bandırma-II (at 40 kg SW; 50.63%) crossbred lambs (Ceyhan et al., 2008).

Except for skin percentage, the differences in other non-carcass components of slaughter groups were found to be significant. Similar to current findings, Teke and Ünal (2009) also reported insignificant effects of SWs on skin percentages. However, Perez et al. (2007), and Yakan and Ünal (2010) contrarily indicated the significant effects of SWs on skin percentages. The highest skin and head percentages of the present study were obtained from GV slaughter group. Among the indigenous breeds of Turkey, Karayaka has long hair slice and horn (Akçapınar, 2000) which may explain the high skin and head percentages of the breed. Head and testicles percentages increased but feet, liver, kidney and heart percentages decreased with increasing SWs of the present study. Similar to current findings, Teke and Ünal (2009), and Yakan and Ünal (2010) in a study about the effects of SWs on some carcass traits of Akkaraman, Morkaraman, Turkish Merino and Bafra (Sakız x Karayaka (B_1)) lambs, reported decreased non-carcass components with increasing SWs.

Table 2 Means for slaughter traits of lambs

Traits	Slaughter weight groups					MSE[1]	P
	GI	GII	GIII	GIV	GV		
Slaughter weight (kg)	30.15	35.58	40.40	45.12	50.16		
Age at final weight (day)	42.29	58.87	77.50	96.33	110.60		
Hot carcass weight (kg)	14.03^{e}	16.97^{d}	19.45^{c}	22.43^{b}	24.55^{a}	0.30	***
Cold carcass weight (kg)	13.61^{e}	16.72^{d}	19.13^{c}	21.96^{b}	23.95^{a}	0.31	***
Hot dressing percentage (%)	46.73	47.67	48.17	49.70	48.27	0.78	-
Cold dressing percentage (%)	45.34	46.50	47.16	48.66	47.09	0.80	-
Non-carcass components (as % of slaughter weight)							
Head	5.14^{bc}	4.94^{c}	5.17^{bc}	5.55^{ab}	5.72^{a}	0.17	**
Skin	13.91	14.22	13.49	13.60	14.79	0.26	-
Feet	2.65^{a}	2.45^{b}	2.24^{c}	2.11^{d}	2.12^{d}	0.01	***
Liver	2.10^{a}	2.02^{a}	1.81^{b}	1.74^{b}	1.65^{b}	0.03	**
Spleen	0.15^{ab}	0.14^{abc}	0.12^{c}	0.14^{bc}	0.16^{a}	0.01	*
Kidneys	0.37^{a}	0.34^{ab}	0.31^{bc}	0.30^{bc}	0.29^{c}	0.01	**
Heart	0.44^{a}	0.45^{a}	0.40^{ab}	0.38^{b}	0.39^{b}	0.01	*
Lungs	0.87^{d}	0.92^{cd}	1.05^{bc}	1.09^{ab}	1.23^{a}	0.02	***
Testicles	0.20^{b}	0.33^{b}	0.49^{a}	0.48^{a}	0.55^{a}	0.01	***
Omental-mesenteric fat	0.81^{c}	1.11^{bc}	1.33^{ab}	1.57^{a}	1.41^{ab}	0.06	***
Back fat thickness (mm)	2.78^{c}	4.39^{b}	4.42^{b}	6.57^{a}	7.25^{a}	0.19	***
Eye muscle area (cm^2)	10.67^{c}	12.51^{b}	12.96^{b}	15.04^{a}	15.09^{a}	0.32	***

[1]Mean Standard Error, -: Non-significant, *: P<0.05, **: P<0.01, ***: P<0.001
[a,b,c,d]: The differences indicated by different letters on the same line are significant

Table 3 Means for carcass traits of lambs

Traits	Slaughter weight groups					MSE[1]	P
	GI	GII	GIII	GIV	GV		
Carcass measurements (cm)							
Carcass length	60.22^{c}	63.43^{b}	64.86^{b}	64.73^{b}	68.40^{a}	0.39	***
External hindquarter length	35.75^{c}	36.60^{c}	38.06^{b}	38.68^{ab}	39.40^{a}	0.19	***
Pelvic limb length	36.27^{c}	37.45^{bc}	38.11^{b}	39.04^{ab}	40.00^{a}	0.49	**
Chest width	24.90^{b}	26.05^{b}	27.58^{a}	28.28^{a}	28.62^{a}	0.20	***
Hindquarter perimeter	56.82^{d}	60.17^{c}	61.91^{bc}	63.24^{b}	66.95^{a}	0.42	***
Hindquarter width	20.51^{c}	21.92^{b}	22.60^{ab}	23.02^{a}	23.17^{a}	0.13	***
Carcass indices							
Compactness (kg/cm)	0.22^{d}	0.25^{c}	0.29^{b}	0.33^{a}	0.34^{a}	0.01	***
Carcass conformation	0.41	0.41	0.42	0.44	0.41	0.01	-
Leg conformation	0.56	0.58	0.59	0.58	0.57	0.01	-
Individual cuts in left half carcass (out of 100)							
Leg	36.05	35.06	36.93	35.60	35.68	0.50	-
Foreleg	18.57^{a}	17.33^{b}	17.02^{b}	16.71^{b}	17.11^{b}	0.33	**
Loin	6.71	6.80	7.01	7.29	6.91	0.15	-
Back	9.49	9.79	9.46	9.39	9.09	0.29	-
Neck	7.24^{b}	7.34^{b}	7.65^{ab}	8.61^{a}	8.59^{a}	0.32	*
Breast+flank	22.44	23.19	22.97	23.30	22.32	0.29	-
Tail fat	2.61	2.93	3.39	3.74	3.80	0.13	-

[1]:Mean Standard Error, -: Non-significant, *: P<0.05, **: P<0.01, ***: P<0.001
[a,b,c,d]: The differences indicated by different letters on the same line are significant

Table 4 Means for carcass lean, fat and bone percentages of lambs

Traits	Slaughter weight groups					MSE[1]	P
	GI	GII	GIII	GIV	GV		
Composition of the left carcass (out of 100)							
Lean	52.83	49.45	50.00	48.51	48.95	0.49	-
Fat	30.95^{b}	36.05^{a}	37.54^{a}	40.20^{a}	39.80^{a}	0.61	***
Bone	16.20^{a}	14.49^{b}	12.45^{c}	11.27^{c}	11.24^{c}	0.22	***
Lean/Fat	1.73^{a}	1.39^{b}	1.33^{b}	1.21^{b}	1.24^{b}	0.04	**
Lean/Bone	3.28^{b}	3.42^{b}	4.02^{a}	4.31^{a}	4.35^{a}	0.05	***
Composition of the left carcass cuts (out of 100)							
Leg							
Lean	53.97	51.13	49.12	50.03	50.81	1.29	-
Fat	14.94^{a}	12.91^{b}	11.47^{bc}	10.38^{c}	11.22^{c}	0.52	**
Bone	31.08^{b}	35.94^{a}	39.40^{a}	39.57^{a}	37.96^{a}	1.44	***
Foreleg							
Lean	55.48	52.81	53.31	52.57	53.00	0.98	-
Fat	17.49^{a}	15.85^{ab}	14.71^{bc}	13.44^{c}	13.91^{c}	0.52	***
Bone	27.02^{b}	31.32^{a}	31.96^{a}	33.98^{a}	33.08^{a}	1.31	**
Loin							
Lean	54.66^{a}	51.62^{ab}	49.36^{b}	43.58^{c}	48.89^{b}	1.67	**
Fat	12.44^{a}	11.21^{a}	9.49^{b}	8.21^{b}	8.81^{b}	0.52	***
Bone	32.89^{c}	37.15^{bc}	41.14^{b}	48.20^{a}	42.28^{ab}	2.05	***
Back							
Lean	42.82	38.56	41.08	38.20	43.54	1.71	-
Fat	18.95^{a}	16.73^{b}	15.06^{bc}	13.51^{cd}	12.77^{d}	0.69	***
Bone	38.22^{b}	44.68^{a}	43.84^{ab}	48.27^{a}	43.68^{ab}	1.97	*
Neck							
Lean	47.02	41.76	45.82	44.47	45.26	1.83	-
Fat	17.84^{a}	14.58^{b}	14.64^{b}	11.55^{c}	10.28^{c}	0.71	***
Bone	35.13^{b}	43.65^{a}	39.53^{ab}	43.96^{a}	44.44^{a}	1.96	**
Breast+Flank							
Lean	44.31	42.06	43.10	41.53	41.89	1.24	-
Fat	14.25^{a}	11.88^{b}	9.51^{c}	8.86^{c}	8.51^{c}	0.59	***
Bone	41.42^{b}	46.05^{ab}	47.37^{a}	49.59^{a}	49.59^{a}	1.62	**

[1]:Mean Standard Error, -: Non-significant, *: P<0,05, **: P<0,01, ***: P<0,001
a,b,c,d: The differences indicated by different letters on the same line are significant

Back fat thickness, MLD sectional areas and lean, bone, fat percentages of carcass cuts are the significant quality parameters for carcasses. While larger MLD sectional areas yields of the lambs percentages and thicker back fat are thickness the indicators of poor carcass quality (Şahin, 2002). Ceyhan et al. (2008) reported that MLD sectional area is an important characteristic for determining the valuable meat content of the carcass. MLD sectional area results of Karayaka lambs of the present study were lower than the Bandırma-I (18.71 cm^2) and Bandırma-II (17.39 cm^2) crossbred lambs. Increasing MLD areas were observed with increasing SWs of Karayaka lambs. This result was in agreement with the results obtained by Perez et al. (2007) working on suckling lambs from four different genotypes (Suffolk Down, Merino Precoz Aleman, Suffolk Down x Merino Precoz Aleman crosses and Suffolk Down x Corrriedale slaughtered at weights 10 and 15 kg) and Yakan and Ünal (2010) working on Bafra (Sakız x Karayaka (B_1)) lambs slaughtered at 30, 35, 40 and 45 kg live weights.

Carcass compactness coefficient was calculated as the ratio of cold carcass weight to carcass length. The differences in carcass compactness coefficients of slaughter groups were found to be significant (Table 3). Except for 50 kg SW of the present study, compactness coefficients were similar to values reported by Yakan and Ünal (2010) for Bafra (Sakız x Karayaka (B_1)) lambs. Önenç et al. (2012) reported carcass compactness value of Sakız lambs (at 50 kg SW) as 0.34. This value was similar to value observed for Karayaka lambs at the same SW. The differences in carcass conformation and leg conformation values of slaughter groups of Karayaka lambs were not found to be significant. The leg conformation of GV slaughter group was similar to the value reported by Önenç et al. (2012) for Sakız lambs at the same SW.

In lamb carcasses, the percentages of other sections as leg, back, loin and foreleg are desired to be high (Altın et al., 2005). The percentages significantly affect the quality and quantity of the meat to be obtained from the carcass. In general, decreasing leg, back and foreleg percentages but increasing loin percentages were observed in this study with increasing SWs.

Leg percentages of slaughter groups were higher than the values reported by Olfaz (1997) for Karayaka lambs and by Altın et al. (2005), and Karabacak (2007) for Kıvırcık lambs at the same SWs. Tekin (1991) slaughtered Turkish Merino lambs at 35, 40 and 45 kg weights and reported leg percentages as 35.44, 34.67, and 34.44%, respectively. Tailless carcass leg ratio of the present study was similar to value reported by Tekin (1991) for Turkish Merino lambs at the same SW. In studies carried out with intensively reared thin tailed lambs slaughtered at 30-45 kg live weights, Tekin (1991), Köycü and Özder (2004), Altın et al. (2005), and Karabacak (2007) reported similar carcass foreleg percentages with the lower limit values and higher values than upper limit values of the present study for Karayaka lambs. Carcass back percentage of the present study was higher than the values reported by Tekin (1991) for Turkish Merino lambs (8.06-8.46%) (at 35, 40 and 45 kg SWs), by Oğan (2000) for Karayaka lambs (at 50 kg SW) (8.82%), by Yakan and Ünal (2010) for Bafra (Sakız x Karayaka (B_1)) lambs; lower than the values reported by Akçapınar et al. (2002b) for Bafra (Sakız x Karayaka (B_1)) lambs (11.42%) (at 40kg SW). Carcass loin percentages (6.71-7.29%) of the present study were similar to values reported by Tufan and Akmaz (2001) and Şahin (2002) for local sheep breeds (slaughtered at 30, 35, and 40 kg) and were lower than the values reported by Tekin (1991) for Turkish Merino lambs (8.06-8.46%) (35, 40, and 45 kg SW).

Determination of total lean, fat and bone percentages through dissection without deteriorating the usability of the meat is a significant issue to find out optimum SWs for quality carcass and lean meat (Demir, 2001). Carcass lean and bone percentages decreased but fat percentage increased in this study with increasing SWs (Table 4). Similarly, Tufan and Akmaz (2001), and Şahin (2002) carried out studies with fat tailed sheep breeds and reported higher fat and lower lean and bone percentages at higher SWs. Also, some studies reported that meat and bone percentages decreased with increasing carcass weights (Díaz et al., 2003; Perez et al., 2007; Santos et al., 2007). Karayaka is a small-size local breed. Sañudo et al. (1998) reported that when lambs were at slaughtering age, small breeds had lower weights and more fat than large breeds. Carcass fat percentages of Karayaka lambs at all SWs were lower than the values reported by Tufan and Akmaz (2001), Şahin (2002), Yakan and Ünal (2010), and Tekin (1991) for intensively reared Güney Karaman, Akkaraman, Bafra (Sakız x Karayaka (B_1)) and Turkish Merino lambs (at 30, 35 40 and 45 kg SWs). Such differences may be because of genotypes, tails and yields of the lambs. Olfaz (1997) reported the lean, bone and fat percentages of Karayaka lambs fattened for 63 days (at 29 kg SW) as 51.16, 21.66, and 27.33%, respectively. Carcass lean percentages of the present study were lower than the values reported by Santos-Silva et al. (2002) for Merino Branco lambs (slaughtered at 24 and 30 kg live weight), by Díaz et al. (2003) for Manchego lambs (at 10, 12, and 14 kg SW), by Perez et al. (2007) for four different lamb genotypes (slaughtered at 10 and 15 kg), and higher than the values reported by Tufan and Akmaz (2001) for Güney Karaman and Kangal Akkaraman (at 35 and 40 kg SW) lambs.

Carcass lean/fat ratios of Karayaka lambs decreased and lean/bone ratios increased with increasing SWs (Table 4). Previous researchers also reported decreasing carcass lean/fat ratios (Yakan and Ünal, 2010; Kremer et al., 2004) and increasing lean/bone ratios (Mahgoub and Lodge, 1994; Díaz et al., 2003; Santos-Silva et al., 2002) with increasing SWs. Such cases may be related to faster increases in carcass fat percentages than bone percentages with increasing SWs. Lean/fat ratios of Karayaka lambs at all SWs were lower and lean/bone ratios were higher than the values reported by Yakan and Ünal (2010) for Bafra (Sakız x Karayaka (B_1)) lambs at the same SWs. Carcass lean/bone ratios of the present study were higher than the values reported by Santos et al. (2007) for Churra da Terra Quente lambs at different SWs (<8 kg, 8-11kg, and >11 kg) (2.6, 2.9 and 3.1) and lean/fat ratios were lower than the values reported by Díaz et al. (2003) for Manchego.

As to conclude, the highest cold carcass dressing percentage of Karayaka lambs at different SWs was observed in GIV SW group. The greatest increase in back fat thickness was observed between GIII-GIV SW groups. The highest carcass fat percentages and the lowest lean percentages were observed in GIV SW group. Decreasing lean/fat rations were observed with increasing SWs. Therefore, it was concluded considering the consumer preferences that Karayaka lambs should be slaughtered at SWs of between 30-35 kg. However, considering the red meat deficit of Turkey, current market conditions and producer preferences, the optimum SW of Karayaka lambs should be between 40-45 kg.

Acknowledgements

The present research was derived from the Ph.D. thesis entitled as "Determination of carcass and meat quality characteristics of Karayaka lambs with different slaughter weights". Authors wish to thank TUBITAK (Project no: TOVAG-111O848) and General Directorate of Agricultural Researches and Policies Public Small-Head Animal Breeding "Karayaka Sheep Breeding II – University Nucleus Herd (Project no: 60KYK2005-01)" for their financial support the present research.

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