Determination of fattening performance with some body measurements and carcass traits of Malya lambs at the open sheepfold

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SUMMARY

This research was carried out to determine fattening performance with some body and carcass traits of Malya lambs at the open sheepfold. 8 Malya male lambs were used in the study. Lambs were averagely fattened at 20 kg of live weights (2.5 months of age) and 150 g alfalfa was daily given to the lambs in addition ad-libitum concentrate feed for 58 days. Daily live weight gain, total feed intake and feed conservation ratio of the per Malya lamb were found 319 g, 155.4 kg and 4.38, respectively. In addition to these, both pH, hardness and colour values of *Longissimus dorsi* and colour values of subcutaneous fat were identified.

Keywords: Malya lambs, open sheepfold, meat colour, hardness, fattening performance

INTRODUCTION

The most important part of the income from ewe breeding is obtained from its meat. When lamb meat production is considered, lamb meat production stands out. In traditional ewe breeding, meat production is done through yearling lamb breed. However, in meat production 2 to 2.5 month old lambs which were fed intensively for 8 to 10 weeks and which were weaned. In yearling breed the live weight increase in the animals which have almost completed their growth is low and feed consumption is high. A significant amount of live weight gain this period is fat storage. However, in lamb fattening, live weight gain is high and feed consumption is relatively low, and a significant amount of live weight gain is meat rather than fat. Traditional sheepfolds are indoor, dim, unventilated with limited place for animals to move where animal's environmental needs are not met. To increase lamb

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meat production must be appropriate genotype, age and optimal environmental conditions. With this aim in mind, some studies were carried out to obtain genotypes suitable for meat production in Turkey (Düzgüneş and Eliçin 1986, Akçapınar 1994). Malya genotype is crossbreed of Turkey. Malya (5/8 Akkaraman, 3/8 German Mutton Merino) is one of the semi-fat tailed sheep breeds of Turkey. Although Malya ewes are developed as a material to be used to improve Akkaraman ewe, they are a genotype which can also be used to increase meat production.

Studies in Malya sheep have been conducted in closed shelter conditions in general. The aim of this research is to the determination of fattening performance with some body measurements and carcass traits of Malya lambs at the open sheepfold.

Material and Methods

The animal material of the study is composed of 8 Malya male lambs which were weaned at 2.5 to 3 months old. These lambs are from Malya herd which is bred in Prof. Orhan Düzgüneş Application and Research Farm of Animal Science Department at Faculty of Agriculture, University of Selçuk.

The fattening feed used throughout the research was prepared in feed unit at the facilities. The analysis of the feed was carried out in Konya Provincial Control Laboratory of Ministry of Agriculture and Forestry (Anonymous 1984; Akyıldız 1992). According to this analysis, fattening feed included 2505 kcal/kg metabolic energy, 14.14% crude protein, 9.81% crude cellulose, 6.96% crude ash, 4.5% crude fat, 1.5% calcium and 0.74% phosphorous.

During the research, the lambs were kept in individual divisions in open shelter conditions. Two lambs were placed in each division which is 1.5x2 m size. After 10 days of adaptation period, lambs fattening were started. Fattening was lasted at the end of eight weeks. Live weight, feed consumption and body measurements of lambs at twice week were measured early in the morning after a night of hunger as reported by Ertuğrul (1996). While feeding was done ad-libitum, 150g dried alfalfa was given daily to each animal to prevent some metabolic diseases.

Temperature and humidity were recorded hourly with data logger device during fattening period. A temperature-humidity index (THI) calculated by the following formula (West 1994). THI = td-*(0.55*-0.55xRH) x (td – 58), where td is the dry temperature, and RH is relative humidity. Some climatic factors during fattening period are given in Table 1.

Table 1. Some climatic factors during fattening period

	Min.	Max.	$\overline{X} \pm S_{\overline{X}}$
Temperature ^{0}C	8.28	35.54	21.75±0.146
Humidity %	10.50	87.76	38.40±0.428
THI	48.00	78.22	65.93±0.152

After fattening period, lambs were slaughtered in small ruminant slaughterhouse in the facilities. Hot carcass weights and the weights of some body parts (head, post, foot etc.) were measured immediately after slaughter. Cold carcass weights and some carcass sizes were determined after carcasses were kept in cold storage (+4 ^{0}C) for 24 hours. The cold carcass parts were measured as reported by Hankins et al. (1959), Eliçin et al. (1976) and Ertuğrul (1985).

Carcasses were separated into parts according to standard carcass discerned method reported by Colomer–Rocher et al. (1987) and the weights of the carcasses were determined in scales sensitive to 1 g. Electrical saw was used to chop carcasses. Eye-muscle areas drawn on tracing paper between 12th –13th ribs were measured with digital planimeter and the area between 6 and 12 ribs was taken as sample. The meat colour in muscle-eye area, pH and hardness were measured.

Colour measurements were performed using a Minolta Chroma Meter CR-400 (Konica Minolta, Inc., Osaka, Japan). Eye muscle area, the outer and inner surfaces of the subcutaneous fat layer were were exposed to air for at least a day at 4 ºC before colour measurement. The L^*(darkness-lightness), a^* (± red-green) and b^* (± yellow-blue) colour values at three locations the eye muscule area and of the thickest part of ventral surface fat under eye muscule area of the cuts were averaged and recorded (Hunt *et al*., 1991). Hue^0 (redness-yellowness) ve Chroma (vividness-dullness) values were calculated using the formula as Hue^0 = Tan-1 x (b/a) and Chroma= $\sqrt{a^2+b^2}$.

The pH values were measured with a pH meter (WTW, 315 i set model, Weilheim, Germany) in 24 h after hand deboning process.

Penetrometer test is considered among the most common methods which measures meat hardness, one of the indicators in meat tenderness quality. The penetrometer measurements were carried out using a penetrometer (Koehler K 19500, USA) equipped with a total 100 g load according to ASTM D 1321 standard method. To measure hardness, needle is released vertically from the penetrometer and allowed to drop freely on cores (2.5×2.5 cm) obtained from the mid-portions of the raw breast and drumstick muscle samples by cutting them perpendicularly to the fibre direction for 5 seconds at constant temperature in order for the needle to place at the cross section surface of the cuts and to produce puncture longitudinally. The depth of penetration of the

needle into each cut was measured in millimetre in triplicate for each cut. A lower depth of penetration indicates a harder structure (Anonymous 1975).

RESULTS AND DISCUSSION

Fattening performance and some body measurements

To best of our knowledge, there is not a study on fattening Malya genotype in open sheepfold conditions, the data obtained as a result of this study were compared with studies carried out in closed barn conditions. Descriptive values of fattening performance and some body measurements were given in Tables 2 and 3. Average live weight of Malya lambs was 37.94 kg at the end of the fattening. These values are lower than that reported by Karabacak and Boztepe (2008) as 40.8 kg and by Cangir et al. (1982) as 39.43 kg for Malya lambs and higher than by Eliçin et al. (1984) as 36.73 kg. In the study, average daily gain was 319 g. This value is higher than that reported by Cangir et al. (1982) as 235.6 g, by Eliçin et al (1984) as 230 g and by Karabacak and Boztepe (2007) as 303 g. The feed conversion ratio was 4.38 kg is higher than that reported by Karabacak and Boztepe (2007) and Eliçin et al. (1984) as 4.53 and 4.83, respectively, and lower than by Cangir et al. (1982) as 3.09.

Table 2. Description Statistics of Fattening Performances of Malya Male Lambs

Traits	Min.	Max.	$\overline{X}$	S $\overline{X}$
Live Weight (kg)	34.30	46.40	37.94	1.315
Daily live weight gain(g)	242	373	319	0.016
Feed intake(kg)	146.95	162.65	155.4	3.642
Feed conversion ratio	3.77	4.78	4.38	0.220

Table 3. Description Statistics of Some Body Measurements of Malya Male Lambs (cm)

Traits	Before Fattening				After Fattening				Absolute	Relative
	Min.	Max.	$\overline{X}$	S $\overline{X}$	Min.	Max.	$\overline{X}$	S $\overline{X}$	increase	increase (%)
Withers height	49	59	53.25	1.048	60	67	64.13	0.854	10.88	20.58
Rump height	50	60	54.50	1.069	61	70	64.88	0.934	10.38	19.14
Heart girth	63	77	66.50	1.711	80	87	83.50	0.886	17.00	26.02
Chest depth	18	22	20.13	0.515	23	26	24.36	0.324	4.25	21.60
Leg girth	50	64	57.38	1.647	63	82	71.13	2.240	13.75	24.13
Body length	45	57	50.00	1.535	55	62	57.00	0.779	7.00	14.61

Withers height and rump height, heart girth, chest depth, leg girth and body length of the lambs were 64.13, 64.88, 83.50, 24.36, 71.13 and 57.00 cm, respectively. The increases in the same characteristics before and after fattening were 10.88, 10.38, 17.00, 4.25, 13.25 and 7.00 cm, respectively. These values were reported by Karabacak et al. (2010) as 64.6, 64.6, 88.5, 24.8 78.3 and 61.3 cm, respectively. They were also reported differences before and

after fattening as 10.5, 12.5, 23.9, 4.7, 21.1 and 13. 8 cm. These results were similar to reported by Karabacak et al. (2010).

Slaughter and carcass traits

Slaughter traits

Descriptive statistics of slaughter traits were given in Table 4. Skin weight, feet weight, head weight, heart+lungs+liver weight and tail weight were determined to be 3.94, 0.99, 1.99, 1.75 and 1.124 kg, respectively. Kidney weight, testis weight, spleen weight and internal fat weight were 129.5, 136.6, 91.5 and 390 g, respectively. Eliçin et al. (1984) reported that skin weight, head-feet weight and tail weight to be 4.24, 2.65, and 1.63 kg, respectively. The data obtained as a result of the study were similar to Eliçin et al. (1984). Cangir et al. (1982) reported that skin weight and head-feet weight to be 4.05 and 2.78 kg, respectively. Karabacak and Boztepe (2008) reported that skin weight, feet weight, head weight, heart+lungs+liver weight and tail weight to be 5.18, 1.03, 2.07, 1.75 and 1.06 kg, respectively. They reported that kidney weight, testis weight, spleen weight and internal fat weight 121, 154, 80 and 314 g, respectively.

Table 4. Description statistics of slaughter traits of Malya male lambs

Traits	Min.	Max.	$\overline{X}$	S $\overline{X}$	Relative to slaughter weight (%)
Skin weight (kg)	3	5.35	3.94	0.296	10.38
Feet weight (kg)	0.85	1.25	0.99	0.042	2.61
Head weight (kg)	1.80	2.40	1.99	0.070	5.25
Kidney weight (g)	100	140	129.5	4.792	0.34
Heart+Lungs+Liver weight (kg)	1.59	1.95	1.75	0.050	4.61
Testis weight (g)	30	353	136.6	40.480	0.36
Spleen (g)	70	113	91.5	5.412	0.24
Internal fat weight (g)	230	890	390	79.685	1.03
Tail weight (kg)	0.710	1.376	1.124	0.122	2.96

Carcass traits

Descriptive statistics with regard to carcass characteristics of Malya male lambs were given in Table 5. According to Table 5, warm carcass weight, cold carcass weight, left-half carcass (lhc) weight, back-loin weight, leg weight, fore rib weight, neck weight, shoulder weight and flank weight were found to be 18.88, 18.59, 8.37, 1.76, 3.08, 0.43, 0.71, 1.76 and 0.62 kg, respectively. Dressing percentage and cooling loss were to be 48.98 and 1.50 %, and kidney and pelvic fat weight was found to be 204.3 g. Karabacak and Boztepe (2008) reported these values to be 18.88, 18.55, 8.69, 1.88, 3.02, 0.47, 0.65, 1.68 and

0.87 kg, 45.69 and 1.84 % and 197 g for Malya lambs. Cold carcass weight in this study was found higher than reported by Karabacak and Boztepe (2008). Other values were found to be similar to those they reported. Cangir et al. (1982) reported that warm carcass weight, cold carcass weight, leg weight in carcass, back-loin weight, dressing percentage, cooling loss and kidney and pelvic fat weight to be 18.02, 17.64, 7.09, 3.06 kg, 50.14%, 3.80% and 227 g. While fore ribs and cooling loss values were found to be lower than values reported, other values were found similar to values reported. For Malya lambs Eliçin et al. (1984) reported that warm carcass weight, cold carcass weight, back-loin weight, dressing percentage and kidney and pelvic fat weight were 19.29, 18.80, 5.94, 3.41 kg, 50.81% and 306 g, respectively. Dressing percentage and kidney and pelvic fat weight were found to be lower than values reported.

Table 5. Description statistics of traits of Malya male lambs

Traits	Min.	Max.	$\overline{X}$	S $\overline{X}$	%
Warm carcass weight (kg)	16.65	23.00	18.88	0.727	-
Cold carcass weight (kg)	16.40	22.65	18.59	0.723	-
Dressing percentage (%)	46.86	52.07	48.98	0.597	-
Cooling loss (%)	1.23	2.04	1.50	0.092	-
Kidney and pelvic fat weight (g)	136	390	204.3	28.715	1.10
Left half carcass weight (kg)	7.44	10.25	8.37	0.325	-
Back-Loin weight (kg)	1.512	2.186	1.76	0.079	21.03
Leg weight (kg)	2.75	3.63	3.08	0.108	36.80
Fore ribs weight (kg)	0.33	0.52	0.43	0.023	5.14
Neck weight (kg)	0.58	0.99	0.71	0.048	8.48
Shoulder weight (kg)	1.50	2.16	1.76	0.076	21.03
Flank weight (kg)	0.54	0.74	0.62	0.024	7.41

Tissue composition in carcass

Descriptive statistics with regard to tissue compositions of samples taken from between 6th and 12th ribs in left-half cold carcass were given in Table 6. Accordingly, sample weight, muscle weight, bone weight, subcutaneous fat weight, inter-muscular fat weight and residue weight were determined to be 830.1, 391.4, 201.1, 119.3, 81.9 and 36.5 g, respectively. Fat thickness over eye muscle area and fat thickness over rib were found to be 2.80 and 7.29 mm, respectively. The eye muscle area was found to be 16.6 cm^2. Karabacak and Boztepe (2010) reported the same characteristics of Malya lambs to be 896, 414, 204, 187, 49 and 27 g, 6.43, 10.9 mm, 13.94 cm^2, respectively.

Meat colour is one of the most important quality characteristics that affect consumer demand. Also, the view and the situation of subcutaneous fat in carcass affects meat quality and price. Meat and subcutaneous fat colour in

livestock are affected by several factors such as genotype, age, sex, feeding, disease treatment, some factors of preslaughter and postslaughter (Hopkins and Nicholson, 1999; Alcalde and Negueruela, 2001; Diaz et al., 2002; Altan et al., 2001; Bekhit et al., 2005; Cividini et al., 2007).

Table 6. Description statistics of tissue composition in carcass of Malya male lambs

Features	Min.	Max.	$\overline{X}$	S $\overline{X}$	%
Cutlet sample weight (g)	733	1000	830.1	32326	-
Muscle weight (g)	299	507	391.4	21.551	47.15
Bone weight (g)	165	258	201.1	12.004	24.23
Subcutaneous fat weight (g)	69	166	119.3	13.949	14.37
Inter-muscular fat weight (g)	58	102	81.9	6.078	9.87
Residue weight (g)	20	61	36.5	5.120	4.40
Eye muscle area (cm^2)	14.6	20.1	16.6	0.694	-
Fat thickness over eye muscle (mm)	1.73	3.85	2.80	0.250	-
Fat thickness over rib(mm)	4.63	10.16	7.29	0.635	-

Colour parameters in this study are given in Table 7. The L*, a*, b*, H* and C* values of *longissimus dorsi* muscle were found as 39.53, 15.46, 2.22, 7.99 and 15.65 respectively. The inner and outer surface parts of subcutaneous fat were found 70.41, 3.93, 5.22, 53.69, 6.57 and 64.83, 7.45, 9.48, 51.78 and 12.08, respectively. Caneque et al. (2004) stated that L*, H* and C* values after 24 h of hair exposure were determined as 49.59, 27.71 and 11.95 for Manchego lambs, respectively. Bessa et al. (2005) stated that the L*, a* and b*, values were determined from Merino Branco ram lambs divided into four different diets such as 39.1-43.3, 15.9-17.9 and 6.5-7.8, respectively. Russo et al. (1999) reported that results gave overall means of L*, a*, b*, H* and C* values of Apennine lambs fed three different diets as 41.58, 17.18, 6.53, 20.10 and 18.39, respectively. Present study L* values (39.53) for Malya lambs is similar to the Bessa et al. (2005) and Russo et al. (1999) studies. However, Caneque et al. (2004) are found as higher than our study. a*, b* and H* values in this study are lower than Caneque et al. (2004) and Russo et al. (1999) findings. C* value of Malya lambs is higher than Caneque et al. (2004), but lower than Russo et al. (1999).

In this study, the pH and hardness values of l*ongissimus dorsi* muscle were determined such as 5.61 and 415.54, respectively. Rizzi et al. (2002), Caneque et al. (2004), Hopkins and Nicholson (1999) found the pH values as a 5.60, 5.57, 5.53-5.62 at 24 hours after slaughter from Sadra, Manchego, SuffolkxMerino cross lambs, respectively. We found similar results in terms of pH values via these authors.

Table 7. Colour (L*, a*, b*, C*and H* values), pH and hardness of Malya eye muscle area and the thickest part of ventral surface fat under eye muscule area

	Eye muscule area			Outer surface parts of subcutaneous fat			Inner surface parts of subcutaneous fat		
	$\bar{X} \pm S\,\bar{X}$	Min.	Max.	$\bar{X} \pm S\,\bar{X}$	Min.	Max.	$\bar{X} \pm S\,\bar{X}$	Min.	Max.
pH	5.61±0.253	5.50	5.73	-			-		
Hardness	415.54±4.530	389.33	429.67	-			-		
CIE L^*	39.53±0.511	37.84	42.16	64.83±0.648	63.31	68.39	70.41±1.410	61.93	74.60
a^*	15.46±0.322	13.95	16.43	7.45±0.371	5.83	8.94	3.93±0.543	2.17	7.28
b^*	2.22±0.421	0.27	4.31	9.48±0.459	7.65	11.20	5.22±0.455	3.66	7.98
H^*	7.99±1.390	1.06	14.70	51.78±1.390	47.26	60.68	53.69±2.200	47.63	66.41
C^*	15.65±0.369	14.06	16.10	12.08±0.516	10.00	14.33	6.57±0.664	4.78	10.80

As a result, colour, pH and hardness values in studies are affected by several factors and it can be said that these parameters may be given information about meat freshness of Malya lambs for consumers.

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