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DETERMINATION OF ORGANIC LAMB FATTENING PERFORMANCE AND SLAUGHTER CHARACTERISTICS IN THE SOUTH MARMARA CONDITIONS IN TURKEY

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This research was carried out to determine the effects of conventional and organic fattening systems on fattening performance, some slaughter and carcass characteristics of lambs in the South Marmara conditions. Conventional fattening groups were fed with concentrate feed mixtures based on conventional barley as *ad-libitum* and dry alfalfa hay was given at 100 g/day/head level to lambs. Organic fattening groups were grazed on pasture and fed with concentrate feed mixtures based on organic barley in the barn. Organic barley haylage was offered in the short period of pasture. All the lambs in the groups were slaughtered when the average live weight of the groups reached 35 kg in the experiment. Organic lambs reached the targeted live weight sooner than conventional lambs. The daily average live weight gain during fattening periods of organic lambs (155.26 g) was higher than that of conventional lambs (114.83 g) (P<0.05). The daily average concentrate feed consumptions of organic and conventional groups were close to each other during fattening periods. The fattening system had an effect on the back fat thickness and back fat thickness of organic lambs was lower than that of conventional lambs (P <0.05).

Key words: organic lamb fattening; conventional lamb fattening; live weight gain; slaughter and carcass characteristics

ОПРЕДЕЛУВАЊЕ НА ГОЈНИТЕ ПЕРФОРМАНСИ И КЛАНИЧНИТЕ КАРАКТЕРИСТИКИ НА ОРГАНСКО ЈАГНЕ ВО УСЛОВИ НА ЈУЖНА МАРМАРА, ТУРЦИЈА

Ова истражување беше спроведено за да се утврдат ефектите од конвенционални и органски системи на гоење, некои карактеристики на колење и на трупот во услови во Јужна Мармара. Конвенционалните групи беа хранети со мешавини од концентрат, базирани на конвенционален јачмен даван *ad-libitum* како и суво луцеркино сено по 100 g/ден/глава на јагне. Органските гојни групи беа напасувани на пасиште и хранети со мешавини од концентрат врз база на органски јачмен во шталата. Органски јачмен беше нуден во краток период на испаша. Сите јагниња во групите беа колени кога просечната телесна тежина во групите достигна 35 kg. Органските јагниња побрзо ја достигнаа очекуваната телесна маса од конвенционалните. Просечниот дневен прираст во текот на периодите на гоење на органските јагниња (155,26 g) беше повисок од оној на конвенционалните јагниња (114,83 g), (p <0.05). Просечната дневна консумација на концентрат на органските и конвенционалните групи беше слична за време на периодите на гоење. Системот на гоење имаше влијание врз дебелината на мастите на грбот, и кај органските јагниња таа беше помала во споредба со таа кај конвенционалните јагниња (P <0.05).

Клучни зборови: органско гоење на јагниња; конвенционално гоење на јагниња; зголемување на телесната тежина; карактеристики на колење и труп

INTRODUCTION

In recent years, meat consumption has dramatically risen worldwide; therefore economic, ecological and ethical sustainability of the production system has been questioned (Kumm, 2002). The residuals that the feed additives used in the conventional production of animal products cause serious health problems in people who consume them; therefore, consumer demand for food products that have been produced without using chemicals and that are free from genetic modification has been on the rise (Wahlshe et al., 2006). On the other hand, especially in Europe, the dramatic increase in scares such as BSE (bovine spongiform encephalopathy), dioxin pollution, foot-and-mouth disease in relation to animal nutrition have led the consumers to buy organic products (Kouba, 2003). Also, in developed countries the animal welfare issue has been gaining in importance due to the respect given to animal rights.

Today, the demand for an alternative system to the conventional meat production has been on the increase (Nilzén et al., 2001). The alternatively raised issue of organic meat production based on chemical-free feed and natural pastures can be considered as a more ethical production system which is less dangerous for the environment. Organic foods are defined as products of a system which avoids the use of chemical fertilisers, pesticides, herbicides, fungicides, veterinarian drugs (antibiotics, growth promoters), additives, synthetic preservatives (Kouba, 2003). Organic production system does not allow the use of genetically modified organisms (Angood et al., 2008), too. Consumers prefer organic meat and meat products since they perceive them to be of higher quality, free of residuals, tasty, low-fat products produced from animals in welfare and in more environmentally-friendly conditions (Kouba, 2003; Van Ryssen, 2003). The diet fed to the animal is one of the most significant factors affecting meat quality and consumer preferences (Kerry et al., 2000), which is the most significant reason underlying the success of organic meat production (Wahlshe et al., 2006)

In Turkey, breeding small ruminants is carried out predominantly on pastures and the majority of the feed requirements are met by natural grazing areas. Breeding is performed with indigenous species which have low production levels but are highly resistant to diseases. Therefore, in Turkey there is a high potential for organic breeding especially in small ruminant breeding (Ak and Kantar, 2007). This research aims to identify the effects of conventional and organic fattening on the fattening performance, some slaughter and carcass characteristics of lambs produced from indigenous Kıvırcık sheep breeds raised in semi-intensive and organic conditions in the South Marmara Region.

MATERIALS AND METHODS

Material

Animal material. The animal material used in the research comprised 40 lambs (weaned approximately at 3 months), produced from the Kıvırcık sheep breed 20 (10 male and 10 female) of which were raised in semi-intensive and 20 (10 male and 10 female) of which were raised in organic conditions in the Marmara Livestock Research Institute.

Feed Material. In the research, the lambs which were applied conventional fattening were given lamb fattening feed containing 15.67% crude protein (CP) and 2457.83 kcal/kg metabolic energy (ME) comprising a mixture of barley produced with conventional agricultural methods, sunflower cake (SC), limestone, salt and vitamin-mineral premix; also 100 g dry alfalfa hay (14.61% CP and 1410.03 kcal/kg ME) was given to each lamb on a daily basis.

The lambs which were applied organic fattening were fed in natural pastures in the Organic Sheep Breeding Unit; in the period when the pasture was insufficient, organically produced barley haylage (11.40% CP and 1735.66 kcal/kg ME) was given in addition to the concentrate feed. As concentrate feed source, lamb fattening feed containing 15.15% CP and 2478.94 kcal/kg ME comprising barley with organic certificate (Ecocert SA F-32600), conventionally produced SC, limestone, salt and vitamin-mineral premix was used. The component and chemical combination of the concentrate feed mixtures used in the lamb fattening trial are presented in Table 1.

Shelter. Conventional fattening was carried out in the Research and Application Barn where the intensive breeding is performed; male and female lambs were kept in separate sections containing a semi-automatic feeder and drinking bowls. As for organic fattening, it was carried out in the Organic Sheep Breeding Unit. The shelter and pasture planning was performed according to the related criteria on minimum open/close areas determined by the Regulation on Organic Agriculture Basics and Application (Anonymous, 2005).

Pasture. In the research, a natural pasture whose botanic composition including 50% of Leguminosae family, 40% Gramineae family and 10% plants from other families was used. In May when the research started, the CP and ME contents (in dry matter) of the grass in the pasture were 8.52% and 1755.5 kcal/kg respectively while they decreased to 6.26% CP and 1280.93 kcal/kg ME level after the end of June when the pasture started to dry.

Table 1

*The component and chemical combination of concentrate feed mixtures used in lamb fattening trial**

Feeds	Conventional fattening feed	Organic fattening feed
Organic barley	–	78.0
Barley	78.0	–
Sunflower cake	20.0	20.0
Limestone	1.4	1.4
Salt	0.5	0.5
Vitamin-mineral premix**	0.1	0.1
Chemical combination		
Dry matter (DM)	87.51	87.46
Ash (A)	3.33	3.30
Organic materials (OM)	84.18	84.16
Crude protein (CP)	15.67	15.15
Crude fat (CF)	1.86	2.18
Crude cellulose (CC)	10.48	10.16
Nitrogen-free extracts (NFE)	56.17	56.66
ME, kcal/kg	2457.83	2478.94

* All data except ME were given as % .
** Every vitamin-mineral mixture of 1 kg contains 15.000.000 mg Vit. A, 3.000.000 mg Vit. D, 30.000 mg Vit. E, 50.000 mg Mn, 50.000 mg Fe, 50.000 mg Zn, 10.000 mg Cu, 200 mg Co, 800 mg I and 500 mg Se.

Method

Lamb fattening. Conventional fattening was carried out with 10 male and 10 female lambs with similar live weight produced from the Kıvırcık sheep breed raised in semi-intensive conditions. As a group, the lambs were fed as ad-libitum and watered in the shelter. In addition, in order to prevent digestion problems, 100 g dry alfalfa hay was given to each lamb on a daily basis.

Organic fattening was carried out with two groups of 10 male and 10 female lambs with similar live weight produced from the Kıvırcık sheep breed raised in organic conditions. Organic fattening groups were fed based on natural pasture and supported in a shelter with mixed feed based on organic barley. In the period when the pasture is insufficient, barley haylage was given. The groups were provided with drinking water in the pasture and shelter.

All lambs were allowed a 2-week period to adjust to the experimental rations. Following the adjustment period, the lambs were group-fed. The concentrate feed consumption and live weight gain were determined by control measurements done every 14 days. In the research, 35 kg live weight which is accepted as the optimum weight in terms of fattening performance, meat quality and cost was targeted and the fattening trial of the groups whose live weight means reached this value was ended.

Chemical analysis of the feeds. The DM, A, CP, CF and CC content of the feed raw materials in the rations was determined according to the analysis methods stated in the AOAC (1990).

Slaughter and carcass characteristics. In the trial, all the lambs in the group whose group mean live weight reached 35 kg in the control measurements were slaughtered. After the carcasses were chilled at +4° C for 24 hours, the Standard Method (Colomer-Rocher et al., 1987) was used in order to identify the carcass characteristics.

Statistical analysis. Variance analysis was used in the statistical analysis of the data obtained from the research. For the control of the significance of the mean differences, the Duncan multiple comparison test was used (SAS, 1988). The data were analyzed according to the mathematical model containing fattening type, sex, fattening type and sex interaction.

RESULTS

The age of reaching the targeted end-of-fattening live weight. The findings related to the age of reaching the targeted end-of-fattening live weight are presented in Table 2. At the end of the fattening, the age means of the groups was 142.89 days in organic males, 174.90 days in conventional males, 186.50 days in organic females, and 211.89 days in conventional females ($P<0.05$). The differences in groups' mean age of reaching fattening target in terms of fattening type, sex factors, interaction effects were found to be significant ($P<0.05$). In terms of fattening type, those which were fed organically reached the targeted end-of-fattening live weight earlier than those which were conventionally fed while in terms of sex factor, the male lambs reached the targeted end-of-fattening live weight earlier than the female lambs.

Table 2

Groups' age of reaching the targeted end-of-fattening live weight, (day)

Fattening type*				Sex**			
Conventional		Organic		Male		Female	
n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx
19	192.42±4.494a	19	165.84±5.233b	19	159.74±3.934b	19	198.53±3.152a
Fattening type x sex interaction ***							
Conventional Male		Organic Male		Conventional Female		Organic Female	
10	174.90±1.716c	9	142.89±1.559d	9	211.89±1.504a	10	186.50±1.416b

* The differences between groups carrying the same letters in the same line are significant in terms of fattening type. ($P < 0.05$).
** The differences between groups carrying the same letters in the same line are significant in terms of sex factor ($P < 0.05$)
*** The differences between groups carrying the same letters in the same line are significant in terms of Fattening type x sex interaction ($P < 0.05$).

Live weight and live weight gain

The results of groups' live weights in various fattening periods and total live weight gain during fattening are presented in Table 3. The conventional and organic fattening groups with equal live weights at the beginning of fattening had significant differences in the first 56 days of fattening in terms of fattening type and the organic lambs had higher live weights (P<0.05). In terms of sex factor, the live weights of male lambs on 28th, 42nd and 56th days were found to be higher than those of female lambs (P<0.05).

The findings related to groups' daily live weight gain in various fattening periods and during fattening are presented in Table 4. In terms of fattening type, daily live weight gain during fattening was found as 155.26 g in those which were fed organically and 114.83 g in those which were fed conventionally; the group means were found to be significant (P<0.05). In terms of sex factor, the live weight gain during fattening was higher in male lambs (P<0.05).

Concentrate feed consumption and feed conversion rate

The mean daily concentrate feed consumption of the organically fed lambs (817.63 g) was found to be close to that of conventionally fed lambs (848.62 g). On the other hand, the mean feed conversion rate (the concentrate feed consumed per 1 kg live weight gain) during fattening was 5.52 in organically fed lambs and 7.52 in conventionally fed lambs.

Slaughter and carcass characteristics

The findings related to lambs' slaughter and carcass characteristics are presented in Table 5. The slaughter and carcass characteristics were not highly affected by the fattening type; only the group mean differences in terms of four stomachs weight (full) and back fat thickness were found to be significant (P<0.05). MLD (*Musculus* longissimus dorsi) section area which is the valuable meat particle of carcass was found to be 13.09 cm2 in the organic group and 12.23 cm2 in the conventional group. In terms of omental and mesenteric fat and kidney-pelvic fat, which are fattiness criteria for carcass, no differences were found between organic and conventional groups; however, back fat thickness was found to be lower in organic lamb carcasses (P<0.05). The highest back fat thickness in the groups belonged to the carcass of conventional female lambs (P<0.05). The sex factor affected most of the slaughter and carcass characteristics except live weight before slaughter, hot carcass weight, chilled carcass weight, chilling loss, MLD section area.

DISCUSSION AND CONCLUSION

The fattening system considerably affected the fattening performance parameters. In organic lambs, the mean daily live weight gain was higher and the targeted fattening live weight was reached in a shorter period (Table 2, 4). This finding is not in line with Fernandez and Woodward (1999), Soysal (2007), Esterhuizen et al.'s (2008) findings which state that in the organic fattening system, animals' growth rate is low and reaching the targeted live weight takes more time. The fact that conventional fattening group's parameters related to fattening performance were low gave rise to this result. For instance, in the male conventional group, the mean daily live weight gain is 128.93 g, the mean daily concentrate feed consumption is 892.50 g, and the feed conversion rate is 6.92. On the other hand, Ak et al. (1996), Altın et al. (2005) and Soysal (2007) found the mean daily live weight gain of the male Kıvırcık lambs which were conventionally fed as 226–250 g; mean daily concentrate feed consumption as 1.071–1.320 g and feed conversion rate as 4.88–5.30.

The extreme weather conditions in 2007 May-September period, in which the study was conducted increased the conventional shelter interior temperature and relative humidity excessively. Apart from the high temperature and humidity, the animal intensity in the shelter where intensive sheep breeding is performed affected the lambs' fattening performance negatively. As a matter of fact, in the first 56 days of fattening, the live weight of the conventional lambs was lower than that of organic lambs (Table 3). The inappropriate shelter conditions decrease conventional lambs' growth rate (De Jonge et al., 2000), and negatively affect feed consumption and live weight gain. (Hahn et al., 1987). The reason why the organic fattening group was not affected by environmental stress factors like temperature as much as conventional lambs was that they moved freely in the pasture and the interior shelter conditions were more appropriate. Broom (1996) and Bartussek (1997) reported that shelter conditions like the availability of enough movement space and environment temperature affect animal welfare. Apart from the differences in shelter conditions, the feeding differences in fattening systems have also been effective over the results.

Contrary to expectations, the performance of the lambs in the conventional group was found to be lower than that of the organic group due to the extreme climate and environment conditions that occurred the year in which the research was conducted. In the study, the mean daily live weight gain of organic male lambs was found as 197.62 g, the mean daily concentrate feed consumption was 843.42 g, feed conversion rate was 4.27. These values are similar to those values (174 g, 794 g, 4.12) which were found in a similar study by Soysal (2007). During the fattening, the mean daily live weight gain was higher in male lambs and this group reached the targeted end-of-fattening live weight faster than female lambs (Table 2, 4). The result is in accordance with the findings given by Altın et al. (2005).

In terms of the omental and mesenteric fat and kidney-pelvic fats' weight stating the fatness condition of the carcass, no difference was found between the organic and conventional groups; however, the back fat thickness was found to be lower in organic lamb carcasses (Table 5). Woodward and Fernandez (1999) found the kidney-pelvic fats' weight of organic and conventional cattle carcasses to be similar; Esterhuizen et al. (2008) found the back fat thickness of organic cattle carcasses to be lower than that of conventional cattle. Grazing and exercise, which are part of organic animal raising system lead to a lower fat formation in the carcass (Sañudo et al., 1998). On the one hand, the animal intensity in conventional shelters and environmental stress factors are effective in the fat level of carcasses (Hansson et al., 2000). On the other hand, Palacios et al. (2008) have stated that different production systems do not affect the fattiness of carcass while Walshe et al. (2006) have reported that fatness in organic cattle carcasses is higher than that of conventional ones.

In terms of the MLD section area, no difference was found between organic and conventional groups (Table 5). However, Woodward and Fernandez (1999) found the MLD section to be higher in conventional carcasses in their study on beef cattle. On the other hand, as it can be seen Table 5, in terms of live weight before slaughter, hot carcass weight, hot dressing percentage, cold carcass weight and cold dressing percentage no difference was observed between organic and conventional groups. The hot dressing percentage seems to be in accordance with the findings given by Woodward and Fernandez (1999). On the other hand, Sargentini et al. (2000) found the live weight before slaughter; Woodward and Fernandez (1999) found the hot carcass weight and Esterhuizen et al. (2008) found the hot and cold carcass weight and dressing percentage to be higher in conventionally fattened cattle.

The findings related to differences in quality features of organic and conventional animal production are highly changeable (Van Ryssen, 2003; Wahlshe et al., 2006). Also, extensive sheep raising applied in various countries, especially in the Mediterranean countries is in fact a raising style that is not very different from organic animal raising and the practices are similar to each other (Barth, 2004). Organic fattening system is a system based on pasture with a limited amount of concentrate feed. This system can be considered as a system in which low-fat and reliable meat production takes place. The producers should choose an alternative fattening system by evaluating environmental stress factors like temperature, economic factors and their own feed sources.

In Turkey, the development of organic animal raising will not only contribute to the evaluation of natural grazing areas, especially in the Eastern Anatolian Region but also to the protection of community health and environment through the production of organic animal products.

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T a b l e 3

Groups' live weights in various fattening periods and total live weight gain during fattening, kg

Fattening period	Fattening type*				Sex**				Fattening type x sex interaction***							
	Conventional		Organic		Male		Female		Conventional Male		Organic Male		Conventional Female		Organic Female	
	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx
Beginning	20	23.29±0.549	20	23.33±0.368	20	23.65±0.490	20	22.98±0.430	10	23.79±0.913	10	23.50±0.419	10	22.79±0.619	10	23.16±0.624
14. day	20	23.70±0.543^{b}	20	25.54±0.431^{a}	20	25.09±0.504	20	24.15±0.540	10	24.33±0.867	10	25.84±0.439	10	23.07±0.635	10	25.23±0.756
28. day	20	24.93±0.614^{b}	20	28.39±0.602^{a}	20	27.74±0.711^{a}	20	25.58±0.653^{b}	10	25.82±0.991	10	29.65±0.582	10	24.03±0.655	10	27.13±0.915
42. day	20	26.86±0.676^{b}	19	30.33±0.745^{a}	19	30.03±0.807^{a}	20	27.14±0.682^{b}	10	28.07±1.022	9	32.21±0.881	10	25.64±0.748	10	28.63±0.953
56. day	20	28.90±0.843^{b}	19	32.26±0.739^{a}	19	32.48±0.831^{a}	20	28.68±0.707^{b}	10	30.73±1.191	9	34.43±0.779	10	27.06±0.914	10	30.30±0.832
70. day	19	31.08±0.805	10	32.12±0.815	10	32.26±1.300	19	31.01±0.606	10	32.26±1.303			9	29.77±0.739	10	32.12±0.815
84. day	19	33.00±0.925	10	33.46±0.800	10	34.62±1.440	19	32.38±0.622	10	34.62±1.440			9	31.19±0.835	10	33.46±0.800
98. day	9	32.34±0.961	10	34.64±0.749			19	33.55±0.644					9	32.34±0.961	10	34.64±0.749
112. day	9	34.11±1.062					9	34.11±1.062					9	34.11±1.062		
119. day	9	34.90±1.318					9	34.90±1.318					9	34.90±1.318		
Total LWG	19	11.29±0.613	19	11.28±0.340	19	10.94±0.476	19	11.63±0.501	10	10.83±0.789	9	11.07±0.543	9	11.80±0.972	10	11.48±0.440

T a b l e 4

Groups' mean daily live weight gain in various fattening periods, g

Fattening period	Fattening type*				Sex**				Fattening type x sex interaction***							
	Conventional		Organic		Male		Female		Conventional Male		Organic Male		Conventional Female		Organic Female	
	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx
Beginning –4.day	20	29.29±5.769^{b}	20	157.50±11.113^{a}	20	102.86±16.547	20	83.93±17.486	10	38.57±9.476	10	167.14±12.150	10	20.00±5.614	10	147.86±18.779
15–28. day	20	87.50±9.966^{b}	20	203.93±19.744^{a}	20	189.29±22.472^{a}	20	102.14±11.874^{b}	10	106.43±16.094	10	272.14±18.610	10	68.57±8.985	10	135.71±16.253
29–42. day	20	137.86±13.059	19	144.36±19.179	19	172.56±17.137^{a}	20	111.07±11.896^{b}	10	160.71±16.878	9	185.71±31.587	10	115.00±17.832	10	107.14±16.598
43–56. day	20	145.71±15.429	19	137.97±12.251	19	175.19±13.146^{a}	20	110.36±10.577^{b}	10	190.00±18.693	9	158.73±17.848	10	101.43±14.861	10	119.29±15.285
57–70. day	19	128.20±13.581	10	130.00±14.736	10	109.29±22.168	19	139.10±9.762	10	109.29±22.158			9	149.21±12.511	10	130.00±14.747
71–84. day	19	136.84±15.371	10	95.71±10.594	10	168.57±23.085^{a}	19	98.50±7.984^{b}	10	168.57±23.089			9	101.59±12.642	10	95.71±10.605
85–98. day	9	82.54±16.767	10	84.29±10.752			19	83.46±9.461					9	82.54±16.756	10	84.29±10.743
99–112. day	9	126.19±17.976					9	126.19±17.976					9	126.19±17.976		
113–119. day	9	112.70±63.014					9	112.70±63.014					9	112.70±63.014		
During fattening	19	114.83±7.038^{b}	19	155.26±10.714^{a}	19	161.47±10.415^{a}	19	108.63±4.880^{b}	10	128.93±9.397	9	197.62±9.699	9	99.16±8.164	10	117.14±4.491

Table 5

Some slaughter and carcass characteristics of the groups

	Fattening type*				Sex**				Fattening type x sex interaction***							
	Conventional		Organic		Male		Female		Conventional Male		Organic Male		Conventional Female		Organic Female	
	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx	n	x ± Sx
Slaughterhouse weight, kg	19	35.58±0.997	19	34.91±0.533	19	35.31±0.857	19	35.18±0.746	10	35.50±1.507	9	35.09±0.797	9	35.67±1.372	10	34.75±0.751
Hot carcass weight, kg	19	17.59±0.623	19	17.24±0.338	19	16.86±0.514	19	17.96±0.456	10	16.99±0.911	9	16.72±0.462	9	18.26±0.836	10	17.70±0.463
Hot dressing percentage, %	19	49.27±0.607	19	49.36±0.525	19	47.64±0.413[b]	19	50.99±0.402[a]	10	47.65±0.714	9	47,62±0,418	9	51.06±0.588	10	50.92±0.581
Cold carcass weight, kg	19	17.19±0.626	19	16.73±0.319	19	16.37±0.524	19	17.54±0.432	10	16.57±0.943	9	16.16±0.426	9	17.88±0.798	10	17.24±0.423
Cold dressing percentage, %	19	48.12±0.645	19	47.91±0.508	19	46.22±0.445[b]	19	49.81±0.347[a]	10	46.41±0.813	9	46.02±0.322	9	50.03±0.532	10	49.60±0.471
Chilling loss, %	19	2.34±0.278	19	2.94±0.220	19	2.98±0.258	19	2.30±0.237	10	2.64±0.401	9	3.35±0.286	9	2.01±0.373	10	2.56±0.292
Four stomachs weight (full), kg	19	4.04±0.175[b]	19	4.90±0.153[a]	19	4.83±0.186[a]	19	4.11±0.160[b]	10	4.45±0.255	9	5.25±0.201	9	3.57±0.112	10	4.58±0.182
Four stomachs weight (empty), kg	19	1.15±0.037	19	1.15±0.060	19	1.23±0.060[a]	19	1.08±0.029[b]	10	1.23±0.043	9	1.23±0.121	9	1.07±0.052	10	1.09±0.032
Omental and mesenteric fat weight, kg	19	0.58±0.061	19	0.56±0.058	19	0.37±0.026[b]	19	0.77±0.044[a]	10	0.38±0.044	9	0.35±0.027	9	0.80±0.060	10	0.74±0.065
Lungs and trachea weight, kg	19	1.68±0.042	19	1.77±0.042	19	1.79±0.046[a]	19	1.66±0.036[b]	10	1.72±0.063	9	1.87±0.059	9	1.63±0.055	10	1.69±0.047
Kidney-pelvic fat weight, kg	19	0.45±0.054	19	0.35±0.049	19	0.25±0.024[b]	19	0.55±0.005[a]	10	0.30±0.038	9	0.20±0.018	9	0.62±0.074	10	0.49±0.067
MLD section area, cm2	19	12.23±0.428	19	13.09±0.345	19	12.65±0.499	19	12.67±0.271	10	12.24±0.774	9	13.11±0.621	9	12.22±0.351	10	13.07±0.378
Back fat thickness, cm	19	0.66±0.060[a]	19	0.47±0.027[b]	19	0.44±0.024[b]	19	0.70±0.053[a]	10	0.47±0.037[bc]	9	0.40±0.029[c]	9	0.87±0.071[a]	10	0.54±0.034[b]

* The differences between groups carrying the same letters in the same line are significant in terms of fattening type. ($P < 0.05$).
** The differences between groups carrying the same letters in the same line are significant in terms of sex factor ($P < 0.05$)
*** In terms of fattening type x sex interaction, the differences between groups having the same letters on the same line are significant.($P < 0.05$)