

## Effects of different fattening systems on slaughter and carcass traits of male Hemsin lambs

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**Summary:** The objective of this study was to investigate the effect of different fattening systems on the slaughter and carcass traits of male Hemsin lambs. Hemsin lambs were divided into three groups; extensive, semi-intensive, and intensive. Lambs in the extensive group were grazed on pasture. Lambs in the semi-intensive group were grazed on pasture and also fed with concentrated feed. The concentrated feed was given to lambs in the intensive group. The experiment was conducted for 90 days. A total of 24 lambs (8 fattening lambs from each group) were slaughtered. While slaughter weights of extensive, semi-intensive, and intensive fattening groups were 32.71, 41.38 and 41.49 kg, respectively ( $P<0.001$ ), hot carcass weights were 14.24 for extensive group, 19.21 for semi-intensive group, and 20.44 kg for intensive group ( $P<0.001$ ), and also cold carcass weights were 13.73 for extensive group, 18.79 for semi-intensive group, and 19.94 kg for intensive group ( $P<0.001$ ). Results of this study revealed that there was generally no statistically significant difference between intensive and semi-intensive groups in terms of slaughter and carcass traits. The results of this study revealed that semi-intensive group can be said to be more appropriate for fattening the male Hemsin lambs.

Key words: Fattening systems, Hemsin lambs, slaughter and carcass traits.

### Farklı besi sistemlerinin Hemşin erkek kuzularında kesim ve karkas özelliklerine etkisi

**Özet:** Bu araştırma, farklı besi sistemlerinin Hemşin erkek kuzularında kesim ve karkas özelliklerine etkisinin belirlenmesi amacıyla yapılmıştır. Araştırmada ekstansif, yarı entansif ve entansif olmak üzere 3 değişik besi grubu oluşturulmuştur. Ekstansif grup merada otlatılmıştır. Yarı entansif gruba meraya ilaveten konsantr yem verilmiştir. Entansif gruba ise konsantr yem verilmiştir. Araştırma 90 günde tamamlanmıştır. Ekstansif, yarı entansif ve entansif beside her grupta 8, toplamda 24 kuzu kesilerek, kesim ve karkas özellikleri incelenmiştir. Ekstansif, yarı entansif ve entansif beside kesim ağırlığı sırasıyla 32.71, 41.38 ve 41.49 kg ( $P<0.001$ ), sıcak karkas ağırlığı 14.24, 19.21 ve 20.44 kg ( $P<0.001$ ), soğuk karkas ağırlığı 13.73, 18.79 ve 19.94 kg olarak belirlenmiştir. Sonuç olarak; yarı entansif ve entansif gruplar arasında genel olarak kesim ve karkas özellikleri bakımından istatistiki bir fark bulunmamış olup, yarı entansif besi yapılan grubun daha uygun olacağı söylenebilir.

Anahtar sözcükler: Besi sistemleri, Hemşin kuzusu, kesim ve karkas özellikleri.

### Introduction

Sheep breeding plays a significant role in livestock sector. Sheep breeding in Turkey is carried out with native sheep breeds. The breed of Hemsin as one of the native sheep breeds is well adapted to scarcity of feed availability conditions. The Hemsin breed have long fat tail at the base. They have the longest tail among the native breeds. The breed of Hemsin is raised throughout north-eastern Turkey generally for meat production. Breeders are not usually willing to cover any supplementation expense and almost never use any supplement other than hay. Therefore, performance of the lambs depends on the pasture and hay. In order to increase the rate of lambs that reach appropriate weights at sale, supplementary feed could be provided (19, 21, 22).

The production of sheep meat in Turkey is principally based on the use of grass pasture and forage as the most economic feed ingredient. The use of these sources is restricted due to the seasonal fluctuations experienced in nutritive value of grass, nutritional stress and low animal productivity. The quality and quantity in the production of lamb meat along with factors such as fattening method, fattening duration and final fattening weight are required to be determined. Regarding lamb fattening, factors such as business structure, genetic, pasture condition, care, market conditions, and livestock policies of the country must be taken into consideration. Therefore, different fattening systems are used to improve meat yield and quality in lambs. There are different lamb fattening systems under which these factors can be regulated in various ways. These systems

are classified as suckling lamb, pasture (extensive), intensive, and yearling lambs (2, 24).

The grazing area of the Hemsin sheep covers an extensive area, where there is a dominant Black Sea climate consisting of the eastern parts of Rize, Artvin, and northern district of Erzurum, particularly Artvin and its surroundings. This region is rich in terms of meadows and plateaus and utilized very well by the Hemsin sheep. During snowy periods the sheep are accommodated in open or semi open sheepfolds. Feeding consists of heavily roughage in the region (14, 27). The Hemsin sheep is a breed that is demanded by breeders and known for the quality and taste of its meat and preferred more by people in the region compared to other breeds in the region (5). Thus, it is necessary to study the slaughter and carcass traits, which are among the efficiency properties of the Hemsin breed to make a contribution to the literature.

Studies have been conducted on fattening period and slaughter weight of domestic and crossbred sheep breeds reared in Turkey. However, there has been no study on slaughter and carcass traits of Hemsin breed lamb among domestic genetic sources. For this breed, studies are only focused on the growth traits on the pasture conditions. The aim of the present study is to compare the slaughter and carcass traits of male Hemsin lambs fed under extensive, semi-intensive, and intensive fattening conditions.

### Materials and Methods

This study was conducted upon the Board of Ethics Approval received through the Kafkas University Faculty of Veterinary Medicine Board of Ethics resolution no. 2011-005 of 03.03.2011. This study was conducted at the Application and Research Farm of the Faculty of Veterinary Medicine, Kafkas University in 2012. The animals of the study were 39 male Hemsin lambs, with averagely 23 kg live weight, which were purchased from a breeder in the Bereket village of Ardanuç district of Artvin province weaned at the age of 3 months. Before the beginning of the study, the lambs were administered medication against internal and external parasites. The study was started after 10 days adaptation of lambs to pasture and concentrate mixture. The lambs were divided into 3 different fattening groups as extensive, semi-intensive, and intensive. Each group had 13 head lambs.

The lambs in the extensive and semi-intensive fattening groups were grazed on pastures for 8 hours per day. Those in the semi-intensive group were grazed on pasture and additionally concentrated feed was given. For semi-intensive and intensive group, daily feed consumption amounts were 0.70 and 1.14 kg, respectively. The concentrated feed and 270 g grass hay were daily given to each of lambs in the intensive group. Concentrated feed contained 17.1% CP and 2710 kcal/kg

ME (16). Table 1 illustrates the composition of concentrated feed and Table 2 illustrates the nutrient contents of concentrated feed and roughage. While the concentrated feed was prepared by a private feed factory, the roughage was provided by the Farm of Veterinary Faculty. The feed was weighed by using electronic scales with the capacity of 150 kg and sensitivity of 1 g. The natural nutrient contents at various mowing times of the pastures, where the animals grazed, have been given in Table 3. For this purpose, samples were taken from various four locations of the pasture 3 times once a month (between June 5 and August 5) and the fodder of an area of 50 cm<sup>2</sup> of pasture was cut with a weed trimmer from 1 cm above the soil level. The pasture sample's DM (Dry Matter), OM (Organic Matter), CP (Crude Protein), CA (Crude Ash), Crude Cellulose (CC), Crude Fat (CF), and NFE (nitrogen free extract) levels were determined according to AOAC (6). It was provided that the lambs in the extensive and semi-intensive fattening groups drank clean water at least three times a day, lambs in the intensive fattening always had clean drinking water in water troughs on a continuous basis.

Table 1. Composition of the mixed feed used in semi-intensive and intensive fattening.

Tablo 1. Yarı entansif ve entansif beside kullanılan karma yemin bileşimi.

Ingredient	%	Crude protein (%)	Metabolic energy(kcal/kg)
Barley	32	12	3110
Maize bran	10	9.2	2740
Maize	18	10	3300
Vegetable oil	2.6	-	7070
Sunflower cake	6	37	2250
Cotton seed cake	6	34	2300
Soy cake	14	48	3200
Molasses	8.5	7.8	2580
Lime stone	2	-	-
Sodium bicarbonate	0.2	-	-
Salt	0.5	-	-
Vit.-min. premix	0.2	-	-

Table 2. Nutrient contents of concentrate feed and roughage, %.

Tablo 2. Konsantre ve kaba yemin besin madde içerikleri, %.

Ingredient	Concentrate feed	Roughage
Dry matter (%)	88.8	90.69
Crude protein (%)	17.1	10.35
Crude cellulose (%)	5.7	32.38
Crude fat (%)	3.5	2.00
Crude ash (%)	6.4	8.86
Metabolic energy (kcal/kg)*	2710	2000

\* It was determined through calculation over values of the table.

Table 3. Natural nutrients of the pasture at various mowing times, %.  
Tablo 3. Çeşitli biçim zamanlarında meranın doğal besin içeriği, %.

	DM	OM	CA	CP	CF	CC	NFE
I. mow	26.25	23.85	2.30	3.55	0.69	8.40	11.35
II. mow	32.35	30.10	2.30	2.70	0.99	9.70	16.68
III. mow	36.40	33.90	2.75	3.50	1.05	12.66	16.70

Table 4. The slaughter traits of lambs in different fattening groups.  
Tablo 4. Farklı besi gruplarında kesim özelliklerine ait ortamlar.

Traits	Fattening systems			P
	Extensive (n=8)	Semi-intensive (n=8)	Intensive (n=8)	
Initial weight (n=13) (kg)	22.42±0.56	22.99±0.54	22.92±0.55	-
Slaughter weight (kg)	32.71±0.54b	41.38±1.38a	41.49±0.79a	***
Hot carcass weight (kg)	14.24±0.35b	19.21±0.81a	20.44±0.49a	***
Cold carcass weight (kg)	13.73±0.35b	18.79±0.81a	19.94±0.47a	***
Hot dressing percentage (%)	43.49±0.64c	46.36±0.88b	49.25±1.71a	***
Cold dressing percentage (%)	41.93±0.61c	45.35±0.91b	48.05±0.56a	***
Head weight (g)	1878.00±27.17b	2133.75±65.98a	2084.25±59.87a	***
Feet weight (g)	818.00±17.64b	956.75±31.69a	978.75±35.63a	***
Skin weight (g)	4148.88±162.42c	5587.50±143.23b	6200.00±243.49a	***
Heart weight (g)	192.75±6.13b	225.75±6.69a	208.88±10.12ab	*
Liver weight (g)	504.00±10.54b	792.13±35.50a	772.25±20.58a	***
Lung weight (g)	437.75±13.68b	560.25±23.22a	511.63±26.51a	**
Testicles weight (g)	108.75±15.75b	236.63±37.56a	253.25±38.77a	**
Spleen weight (g)	57.00±6.85	64.75±5.34	81.88±10.09	-
Omental weight (g)	50.00±7.07b	170.50±31.70a	229.38±27.18a	***
Full stomach weight (g)	4772.38±194.87a	4750.00±285.98a	3750.00±153.08b	**
Empty stomach weight (g)	1125.13±36.96a	1610.63±44.22a	1371.88±34.23b	***
Full small intestine weight (g)	1491.13±106.01	1962.50±169.86	1633.75±165.50	-
Empty small intestine weight (g)	783.38±42.95b	1148.13±62.19a	1120.00±139.37a	*
Full large intestine weight (g)	1274.25±89.19b	1862.50±106.69a	1386.88±126.06b	**
Empty large intestine weight (g)	412.50±33.74b	575.00±31.34a	475.00±32.73b	**
Back fat thickness (mm)	3.85±0.17b	5.25±0.12a	5.47±0.26a	***
M. longissimus dorsi area (cm <sup>2</sup> )	12.66±0.17	13.39±0.40	13.57±0.19	-

a, b, c: The differences between the means of groups carrying various letters in the same row are significant (P<0.05).

-: P>0.05,

\*: P<0.05,

\*\* : P<0.01,

\*\*\*: P<0.001.

The fattening was completed in 90 days. A total of 24 lambs (8 fattening lambs from each group) were slaughtered. Before the slaughter, the lambs were not fed for 12 hours and were given only water. Their slaughter live weights were recorded. Their slaughtering was conducted at Kafkas University Veterinary Faculty slaughter house. After the slaughter, head, skin, feet, offal, gastro intestinal tract, and testicles were removed and weighed. Then, their hot carcass weights were determined. The carcasses were chilled at 4 °C for 24 h before dissecting taken on the intact cold carcass. Subsequently, carcasses were cut lengthwise in two equal parts. Remaining parts were separated into seven pieces

(shoulder, neck, foreleg, flank-breast, leg, back-loin and tail) according to Colomer-Rocher *et al* (8). Carcass back fat thickness was measured between 12<sup>th</sup>-13<sup>th</sup> ribs by caliper; while the musculus longissimus dorsi (MLD) area was drawn onto the acetate paper, its surface area was calculated using the digital planimeter.

In order to determine the effect of different fattening systems on slaughter and carcass traits, variance analysis method was employed using SPSS 20.0 statistical package software. Carcass cuts were expressed as percentages for carcass weight. Duncan multiple range tests were used to assess significance of the difference among the groups (23).

Table 5. The carcass traits of lambs in different fattening groups, (%).  
Tablo 5. Farklı besi gruplarında kuzuların karkas özellikleri, (%).

Traits	Fattening systems			P
	Extensive (n=8)	Semi-intensive (n=8)	Intensive (n=8)	
Leg (%)	32.86±0.12a	31.54±0.56ab	30.72±0.67b	*
Foreleg (%)	17.41±0.33a	16.16±0.44b	15.36±0.18b	***
Rack-loin (%)	14.56±0.54b	15.47±0.33ab	16.35±0.49a	*
Shoulder (%)	6.39±0.22a	5.04±0.30b	4.84±0.20b	***
Neck (%)	7.77±0.19	7.53±0.40	6.85±0.43	-
Flank-breast (%)	11.55±0.68	11.26±0.50	10.88±0.33	-
Tail (%)	7.68±0.53b	11.02±0.99a	12.90±0.50a	***
Kidney (%)	0.86±0.05	0.89±0.04	0.88±0.04	-
Kidney-pelvic fat (%)	0.93±0.07	1.10±0.10	1.23±0.09	-

a, b: The differences between the means of groups carrying various letters in the same row are significant ( $P<0.05$ ).

-.:  $P>0.05$ ,

\*:  $P<0.05$ ,

\*\*\*:  $P<0.001$

## Results

Table 4 illustrates the slaughter traits of lambs in the extensive, semi-intensive, and intensive fattening groups. The differences among the groups in terms of slaughter weights, hot and cold carcass weights, hot and cold dressing percentages, head, feet, skin, heart, liver, lung, testicles, omental, full and empty stomach, empty small intestine, full and empty large intestine weight and back fat thickness were statistically significant ( $P<0.05$ ,  $P<0.01$  and  $P<0.001$ ). The hot carcass weights were 14.24 kg for extensive fattening group, 19.21 kg for semi-intensive fattening group, and 20.44 kg for intensive fattening group and cold carcass weights were 13.73 kg for extensive fattening group, 18.79 kg for semi-intensive fattening group, and 19.94 kg for intensive fattening group. Table 5 illustrates the carcass traits of different fattening groups according to their slaughter weight. The differences among the groups in terms of leg, foreleg, rack-loin, shoulder, and tail percentages were significant ( $P<0.05$ ,  $P<0.001$ ).

## Discussion and Conclusion

There has been no study investigating the effect of different fattening systems on slaughter and carcass traits of male Hemsin lambs. Therefore, related comparison was conducted with other regional breeds. In this study, the slaughter weight in extensive fattening group was in line with the findings of the study conducted by Uluşan *et al* (25) reporting a slaughter weight of 32.00, 34.70 and 33.70 kg for Morkaraman, Tuj and their cross-breds fed by pasture. Moreover, the slaughter weight in semi-intensive fattening group was similar to the weight reported by Kirmizibayrak *et al* (15) for Tuj and Morkaraman lambs (41.36 and 42.48 kg), and by Ozturk *et al* (18) who reported slaughter weights of 39.83 and 40.97 kg for Morkaraman and Kivircik × Morkaraman

( $F_1$ ) lambs in semi-intensive fattening group. The slaughter weights of all three fattening groups in this study were lower than those determined by Sari *et al* (20) for Tuj lambs in groups of pasture, pasture+200 g concentrated feed and pasture+400 g concentrated feed (44.10, 44.86 and 46.00 kg, respectively). Furthermore these values were higher than those determined by Yarali and Karaca (26) for Karya lambs fed on pasture, pasture and fodder, and intensive fattening group (23.35, 26.84 and 27.53 kg, respectively).

In the study, hot and cold carcass weights were similar to those (13.80 and 13.10 kg for Kivircik lambs in the pasture fed group) reported by Demir (9) but hot and cold carcass weights of intensive fattening groups were higher than those in the study of the same researcher (16.90 and 15.90 kg). Hot and cold carcass weights of semi-intensive fattening group were similar to those reported by Ozturk *et al* (18) (hot and cold carcass weights were 19.32 and 18.47 kg for Morkaraman and Kivircik × Morkaraman ( $F_1$ ) lambs). The hot and cold carcass weights determined for intensive fattening group were similar to the values determined by Akcapinar *et al* (3) for hot and cold carcass weights (19.18 and 19.05 kg) of Bafra lambs in intensive fattening group; however these hot and cold carcass weights were lower than those determined by Kadak *et al* (12) of lambs in intensive fattening group (between 21.13 and 22.38 kg).

The skin weight and MLD area values in extensive fattening group in this study were higher than those reported by Uluşan *et al* (25) (skin weight of 3.77, 3.70 and 3.76 kg and MLD area of 9.50, 10.20 and 9.50 cm<sup>2</sup> for Morkaraman, Tuj, and Tuj crossbred lambs in pasture feed). Ozturk *et al* (18) reported the skin weight as 3.81 and 3.79 kg for Morkaraman and Kivircik × Morkaraman ( $F_1$ ) lambs under semi-intensive conditions; and the skin weight of semi-intensive fattening group in the present

study was higher than those reported by Ozturk *et al* (18). The testicular weight determined in this study was in line with those reported by Ozturk *et al* (18) (0.23 and 0.25 kg for Morkaraman and Kivircik × Morkaraman (F<sub>1</sub>) lambs under semi-intensive conditions). The MLD area and back fat thickness in intensive fattening group in this study were higher than those reported by Altinel *et al* (4) reporting MLD area as 12.10 cm<sup>2</sup> and back fat thickness as 5.30 mm for Kivircik lambs and also those determined by Ogan (17) stating MLD area as 12.96 cm<sup>2</sup> and back fat thickness as 4.6 mm for Karayaka lambs under intensive conditions. In the present study, carcass fat thickness of lambs in intensive and semi-intensive fattening groups were higher than those in extensive fattening group, which could be attributed to higher daily energy level in mixed feed.

Lamb carcasses are often sold by being dissected into different parts because different dishes are made from different parts of the carcass parts. For this reason, the carcass parts are sold with various prices. Leg, rack, and loin of the carcass are accepted as the most expensive parts. Results of this study revealed that while differences among the fattening groups in terms of leg, foreleg, rack-loin, shoulder, and tail percentages were statistically significant ( $P < 0.05$ ), differences among the fattening groups in terms of neck, flank-breast, kidney, and kidney-pelvic fat percentages were not statistically significant ( $P > 0.05$ ). Leg, kidney, and kidney-pelvic fat percentages in extensive fattening group in this study were higher than those reported in the study conducted by Ulsan *et al* (25) (leg percentage of 31.89, 31.24 and 31.45%, kidney percentage of 0.67, 0.66 and 0.62% and kidney-pelvic fat percentages of 0.42, 0.58 and 0.48% for Morkaraman, Morkaraman × Tuj cross-bred in pasture feed) and foreleg percentages in this study were similar to findings of the study conducted by Ulsan *et al* (25) (17.47, 17.78 and 17.45%) but the tail percentage was lower compared to those reported by Ulsan *et al* (25) (tail percentages of 9.52, 9.17 and 10.33%).

Leg, foreleg and tail percentages of lambs in the extensive and semi-intensive group in this study were lower than those reported by Bolat *et al* (7) (leg percentage of 35.85, 35.53, 36.63 and 36.62%, foreleg percentage of 19.83, 19.18, 19.24 and 19.70% and tail percentage of 11.69, 15.35, 16.21 and 17.61% for Morkaraman lambs in pasture, pasture+250 g barley, pasture+500 g barley and pasture+750 g barley feed). However, kidney percentages and kidney-pelvic fat percentages were higher compared to those reported by Bolat *et al* (7) (kidney percentages of 0.80, 0.70, 0.59 and 0.66% and kidney-pelvic fat percentages of 0.60, 0.72, 0.63 and 0.60%).

Leg percentages of lambs in the intensive fattening group in this study were higher compared to those in the study conducted by Kadak (11) (leg percentages as

29.58, 29.93 and 29.56% for Akkaraman, 28.56, 26.51 and 27.57% for Morkaraman and 28.67, 27.99 and 28.58% for Awassi lambs raised under intensive conditions). Akcapinar (1) determined foreleg percentages as 14.00, 12.80 and 16.60% for Akkaraman, Daglic and Kivircik lambs raised under intensive conditions and these values were lower than foreleg percentages of intensive fattening group in this study. Leg and rack-loin percentages of intensive fattening group in this study were higher compared to findings stated by Ogan (17); he reported leg and rack-loin percentages of 29.41 and 17.00% for Karayaka lambs in intensive fattening group. However, the foreleg percentage in this study was lower than percentage stated in the same study (17) (18.04%).

The fact that the differences were observed with other studies in terms of slaughter and carcass traits could be associated with breed effect, initial and final live weights, slaughter weights, fattening periods, pasture and fodder quality, care and feeding, and carcass dissection methods. The fattening lambs are generally reared under the pasture conditions in Kars and its surrounding. However, green pastures and nurture are only possible for a short time of about 3-4 months between May and August (13). Except for this season, the pasture loses its quality considerably. Lambs do not get adequate nutrition and they are slaughtered at early age, which results in body weight loss, large reductions in the quantity and quality of the carcass and consequently high losses in economic aspect (19). Although this is the case, the nutrient content of pasture grazing, climate, vegetation, and flora, varies depending on several factors, as well (10). Results of this study suggested that Hemşin lambs fed in intensive and semi-intensive fattening produced around 40% higher cold carcass weight compared to those fed in extensive fattening. Lambs in the intensive and semi-intensive fattening consumed higher amounts of mixed feed and developed more rapidly. Results of this study revealed that there was generally no statistically significant difference between intensive and semi-intensive groups in terms of slaughter and carcass traits. According to this study, semi-intensive fattening can be said to be more appropriate. Because, the daily concentrated feed consumption amounts in semi-intensive fattening were lower than intensive fattening. But, the carcasses of lambs fed in intensive fattening do not meet the demands of consumers for lean carcass due to their carcass fat thickness. The extensive fattening system satisfies agreed criteria for quality, human and animal welfare and allows for a higher margin because of the lower inputs and the products of higher value. In addition, it could be asserted that lambs of Hemsin breed are similar or slightly lower in comparison with other Turkish native breeds in terms of slaughter and carcass traits in general.

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