MAS Journal of Applied Sciences Uygulamalı Bilimler Dergisi ISSN: 2757-5675 masjaps.com

OPEN ACCESS

DOI: http://dx.doi.org/10.5281/zenodo.7933388

Araştırma Makalesi / Research Article

The Effect of Fattening Time on Fattening Performance, Slaughter and Carcass Characteristics in Tuj Male Lambs

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Geliş Tarihi (Received): 12.01.2023 **Kabul Tarihi (Accepted)**: 24.02.2023

Abstract

The research was carried out in 39 Tuj male lambs with an average weight of 29 kg, weaned at the age of 2.5 and 3 months, reared in the Education, Research and Application Farm of the Faculty of Veterinary Medicine of Kafkas University. In the study, intensive fattening was done by using lamb rearing feed and ad libitum roughage in 3 groups, 13 lambs in each group, and 6 lambs were slaughtered on the 60th, 75th and 90th days in the first, second and third groups, respectively. slaughter and carcass characteristics were examined. At the beginning, middle and end of the experiment, body weights and some body measurements were taken from the lambs in the morning before the animals were fed, and the live weights were recorded by weighing the lambs every 2 weeks during the experiment. At the end of the study, the difference between the groups was found to be significant in terms of anterior shank circumference measured in the middle of the trial in the sixty-day fattening group ($P<0.05$). Again, at the end of the experiment, the differences between the groups in terms of anterior shank circumference were significant ($P<0.05$, $P<0.01$). The difference between the groups was found to be significant in terms of anterior shank circumference measured in the middle of the trial in the group that was fed for seventy-five days ($P<0.05$). The difference between the groups was found to be significant in terms of anterior shank circumference measured in the middle of the trial in the group that was fed for ninety days ($P<0.05$). Again, in the 90-day group, the differences between the groups in terms of anterior shank circumference taken at the end of the trial were significant ($P<0.01$), while the differences between other body measurements taken at other periods in all groups were insignificant ($P>0.05$).

Keywords: Tuj lamb, fattening shape, fattening performance, slaughter and carcass characteristics

1. Introduction

Turkey's natural and environmental conditions and family traditions create a favourable environment for sheep and goat breeding to be widely practised and to have an important place in livestock breeding. Because sheep and goat breeding is a lower cost livestock breeding activity compared to cattle breeding (Elmalı Aksu et al., 2010). According to the data of Turkish Statistical Institute (TUIK), a total of 22 million ovine animals were slaughtered in 2021, and 480 thousand 488 tonnes (24.61%) of the 1 million 952 thousand tonnes of red meat production is provided by sheep and goats (TUIK, 2023). The most important income item in sheep breeding is obtained from lamb meat production. In this context, an economically effective fattening practice should be carried out in order to raise lambs to a certain live weight in a certain period of time. The determination and implementation of technical and economic conditions in lamb fattening instead of traditional production will positively affect both the profitability of enterprises and mutton production (Karaoğlu et al., 2001). As there are differences among species in terms of growth and development and thus meat production ability, there are also great differences among breeds and groups within breeds (Laçin and Aksoy, 2003). Differences within the same breed are greatly affected by gender and environmental conditions (Akçapınar, 2000). However, it has been reported that the most economical and fastest lamb fattening is intensive fattening after weaning (Koçak, 2009). As in all livestock farms, the main objective in lamb fattening is to increase profitability. However, for a profitable and efficient breeding, it is necessary to know the cost factors, especially feed costs, and to control the costs (Çiçek and Sakarya, 2003; Demir et al., 2015). In addition, in fattening enterprises, live weight gain in lambs to be fattened, feed consumption, feed utilisation ability and the relationships between them are also important factors that directly affect profitability (Koçak, 2019). Tuj breed, which is the subject of this study, is bred around Kars, Ardahan and Iğdır. Pure breeds are found in Arpaçay District of Kars and Çıldır District and villages of Ardahan (Aksoy et al., 2001). Although 6 months old lambs are sold in Kars province, they are not sent to slaughter. They are sold to breeders or people who breed yearling lambs. Yearling lambs are overwintered by the breeders or the fatteners and sold to slaughterhouses, combines, and slaughterers to be slaughtered when they are 20-21 months old in autumn the following year. This situation increases the costs such as feed, shelter, labour, vaccination and treatment. In addition, since yearling lambs are kept in the pasture period for the second time, the pastures are worn out due to heavy grazing (İlaslan and Geliyi, 1984). Considering these reasons, it is thought that by fattening lambs and yearling lambs in Kars, the pastures will be less worn out and more male lambs will gain more live weight (Aksoy, 1996). In this study, the effect of fattening period on fattening performance and carcass characteristics of Tuj male lambs was investigated.

2. Material and Method

In the study, 39 male lambs raised in Kafkas University Education Research and Application Farm were used. After the lambs were vaccinated against internal and external parasites, a one-week feed acclimatisation period was applied and then they were divided into 3 groups with 13 lambs in each group. These groups were given ad libitum concentrate feed and 300 g of medium quality dry meadow grass daily for each lamb during fattening and clean water was kept in front of them during the experiment. Concentrate feed was prepared in a private feed factory and hay was purchased from the Veterinary Faculty Farm. Body measurements (body height, body length, chest circumference, chest depth, front shank and back shank circumference) were taken three times for each group at the beginning, middle and end of the experiment. During the experiment,

lambs were weighed every 2 weeks in the morning before feeding and their live weights were determined during fattening. At the end of the fattening period determined for each group, lambs were slaughtered after weighing and slaughter and carcass characteristics (hot and cold carcass weights, hot and cold yield, skin, head, feet, heart-lungs, spleen, kidney, kidney fat, stomach (full, empty), small and large intestine weights (full, empty), rump, arm, loin (fillet), back (chop), tail, rump-neck and others weights, MLD cross-sectional area were determined during cold carcass dismemberment. MLD cross-sectional area in the carcass was determined according to the method reported by Colomer-Rocher et al. (1988) by taking a copy of the cross-section made between the 12th-13th ribs on tracing paper and measuring it with the help of millimetre paper. Shell fat thickness was also determined by measuring with callipers from the same place. Carcass measurements were taken after slaughtering. Measuring stick and measuring tape were used to take the measurements. The left side of the carcass was separated into thigh, arm, skirt, neck, shoulder head, back-lumbar and tail and weights were taken. The carcass parts were weighed with an electronic scale sensitive to 1 g. The values obtained from the carcass parts were multiplied by two and the values of the whole carcass were obtained (Colomer-Rocher et al. 1988). Statistical analyses were performed using Minitab 12.0 package programme. The significance of the differences between groups was analysed by ANOVA and the significance of the differences between two groups was analysed by t test.

3. Results

The live weights of lambs weighed every two weeks are given in Table 1. In the analyses, no significant difference was found between the groups in terms of live weights (P>0,05).

Table 1. Live weight of lambs in various periods (kg)

Day	Groups			
	60 day	**75 day**	**90 day**	**importance**
Beginning	35.43±2.49	35.32±2.42	35.70±2.15	-
14	38.68±2.76	38.51±2.53	39.27±2.27	-
28	40.77±2.94	40.22±2.60	41.15±2.27	-
42	43.37±3.05	42.75±2.66	43.11±2.48	-
56	-	44.91±2.75	45.27±2.56	-
70	-	46.15±2.80	46.48±2.51	-
84	-	-	48.89±2.34	-
90	-	-	51.17±2.18	

The difference between groups with different letters on the same line is significant.
-: P>0.05, insignificant *: P<0.05, **: P<0.01, ***: P<0.001.

In Tables 2, 3 and 4, various body measurements taken at the beginning, middle and end of the experiment of the groups fed for different periods are given respectively. The difference between the groups was found to be significant (P<0.05) in terms of forelimb circumference taken in the middle of the experiment in the group fed for sixty days. At the end of the experiment, the differences between the groups were significant (P<0.05, P<0.01), but the differences between the body measurements taken at other periods were insignificant (P>0.05). In the group fattened for 75 days, the difference between the groups was found to be significant (P<0.05) in terms of front shank circumference taken in the middle of the experiment. The differences between the body measurements taken in other periods were insignificant (P>0.05). In the ninety-day fattening group, the difference between the groups was found to be significant (P<0.05) in terms of forelimb shank circumference measurements taken in the middle of the experiment. At the end of the experiment,

the differences between the groups in terms of forelimb circumference were significant (P<0.01), but the differences between the body measurements taken in other periods were insignificant (P>0.05).

Table 2. Various body measurements (cm) determined at the beginning, middle and end of the experiment in the group fattened for sixty days

Features	Chest circumference	Front shank circumference	Rear shank circumference	Body length	Height at Withers	Chest depth
Trial Head	-	-	-	-	-	-
60 day	75.99±2.85	7.44±0.13	8.63±0.15	57.89±1.62	60.98±1.06	27.57±0.78
75 day	74.05±2.04	7.61±0.09	8.74±0.19	58.01±1.04	59.02±0.91	26.35±0.60
90 day	75.39±2.03	7.49±0.11	8.72±0.17	58.72±1.34	59.02±1.05	26.38±0.68
Mid-trial	-	*	-	-	-	-
60 day	79.52±2.71	7.71±0.13^{b}	9.30±0.16	60.55±1.48	61.38±1.12	27.93±0.52
75 day	79.77±2.36	8.18±0.09^{a}	9.37±0.13	60.00±1.14	60.62±0.83	27.34±0.54
90 day	80.55±2.22	8.04±0.12^{ab}	9.30±0.17	60.74±1.11	59.74±0.86	27.38±0.52
End of trial	-	**	-	-	-	-
60 day	83.19±2.66	7.99±0.20^{b}	9.99±0.25	63.30±1.58	61.80±1.25	28.31±0.65
75 day	85.71±2.81	8.77±0.14^{a}	10.02±0.17	62.07±1.54	62.29±0.96	28.37±0.69
90 day	85.89±2.55	8.62±0.14^{a}	9.90±0.20	62.84±1.09	60.50±0.82	28.42±0.54

The difference between groups with different letters in the same column is significant.
-: P>0.05 insignificant,. *: P<0.05, **: P<0.01, ***: P<0.001.

Table 3. Various body measurements determined at the beginning, middle and end of the experiment in the group fattened for seventy-five days

Features	Chest circumference	Front shank circumference	Rear shank circumference	Body length	Height at Withers	Chest depth
Trial Head	-	-	-	-	-	-
60 day	75.99±2.85	7.44±0.13	8.63±0.15	57.89±1.62	60.98±1.06	27.57±0.78
75 day	74.05±2.04	7.61±0.09	8.74±0.19	58.01±1.04	59.02±0.91	26.35±0.60
90 day	75.39±2.03	7.49±0.11	8.72±0.17	58.72±1.34	59.02±1.05	26.38±0.68
Mid-trial	-	*	-	-	-	-
60 day	80.31±2.69	7.77±0.14^{b}	9.45±0.18	61.14±1.48	61.47±1.14	28.01±0.51
75 day	81.04±2.44	8.31±0.10^{a}	9.51±0.13	60.44±1.20	60.98±0.84	27.56±0.56
90 day	81.69±2.28	8.17±0.12^{ab}	9.43±0.17	61.19±1.08	59.91±0.83	27.61±0.51
End of trial	-	-	-	-	-	-
75 day	81.10±6.50	8.64±0.18	10.17±0.21	64.61±1.20	61.65±0.81	29.56±0.65
90 day	88.98±2.60	8.82±0.16	10.26±0.21	63.70±1.10	62.38±1.20	30.78±1.90

The difference between groups with different letters in the same column is significant.
-: P>0.05 insignificant,. *: P<0.05, **: P<0.01, ***: P<0.001.

Table 4. Various body measurements (cm) determined at the beginning, middle and end of the experiment in the group fattened for ninety days

Features	Chest circumference	Front shank circumference	Rear shank circumference	Body length	Height at Withers	Chest depth
Trial Head	-	-	-	-	-	-
60 day	75.99±2.85	7.44±0.13	8.63±0.15	57.89±1.62	60.98±1.06	27.57±0.78
75 day	74.05±2.04	7.61±0.09	8.74±0.19	58.01±1.04	59.02±0.91	26.35±0.60
90 day	75.39±2.03	7.49±0.11	8.72±0.17	58.72±1.34	59.02±1.05	26.38±0.68
Mid-trial	-	**	-	-	-	-
60 day	81.67±2.67	7.88±0.17b	9.71±0.21	62.16±1.51	61.63±1.19	28.15±0.54
75 day	83.25±2.61	8.53±0.12a	9.75±0.14	61.21±1.35	61.60±0.88	27.95±0.61
90 day	83.68±2.40	8.38±0.13a	9.65±0.18	61.97±1.07	60.19±0.81	27.99±0.51
End of trial	-	-	-	-	-	-
90 day	88.83±2.23	8.09±1.14	9.88±0.12	66.02±0.66	61.82±0.91	29.67±0.76

The difference between groups with different letters in the same column is significant.
-: P>0.05 insignificant,. *: P<0.05, **: P<0.01, ***: P<0.001.

Table 5 shows various slaughter characteristics of different groups. When Table 5 was analysed, it was found that the differences between the groups were significant (P<0.05, P<0.01) in terms of hot carcass and large intestine full and empty weights, but the differences between the groups were insignificant (P>0.05) in terms of other characteristics.

Table 5. Various slaughter characteristics of lambs (g, kg)

Features	Fattening time			
	60 day (n=6)	75 day (n=6)	90 day (n=6)	importance
Cutting weight (kg)	46.28±2.97	47.32±2.04	51.98±2.39	-
Hot carcass weight (kg)	16.90±0.92b	18.83±0.93ab	21.43±1.36a	*
Skin weight (kg)	5.65±0.46	6.02±0.54	6.10±0.45	-
Head weight (kg)	2.45±0.08	2.49±0.13	2.73±0.16	-
Foot weight (g)	838.30±50.30	948.30±34.70	898.30±59.70	-
Heart-lung weight (g)	828.30±62.10	836.70±37.50	818.30±24.40	-
Liver weight (g)	680.00±36.10	623.33±36.20	651.67±20.40	-
Spleen weight (kg)	73.33±9.55	76.67±8.03	66.67±4.22	-
Kidney weight (g)	148.33±13.50	141.67±16.20	123.33±5.58	-
Testes weight (g)	366.70±32.60	438.30±71.80	373.30±52.40	-
Stomach full weight (kg)	6.60±0.42	5.47±0.39	5.47±0.38	-
Empty stomach weight (kg)	1.47±0.10	1.43±0.09	1.42±0.07	-
Small intestine full weight (kg)	2.09±0.12	2.02±0.13	2.02±0.15	-
Small intestine empty weight (kg)	1.00±0.14	0.88±0.06	0.68±0.06	-
Large intestine full weight (kg)	1.73±0.26b	1.08±0.11a	1.07±0.07a	*
Large intestine empty weight (kg)	0.55±0.06b	0.34±0.02a	0.36±0.03a	**

The difference between groups with different letters in the same column is significant.
-: P>0.05 insignificant,. *: P<0.05, **: P<0.01, ***: P<0.001.

Carcass parameters of different groups are given in Tables 6 and 7. The differences between the groups were found to be significant (P<0.05) for rump, arm and loin weights in Table 6, significant (P<0.05, P<0.01, P<0.001) for body depth, rump length II and rump circumference I in Table 7, and insignificant (P>0.05) for the other parameters given in Tables 6 and 7.

Table 6. Various carcass parameters of lambs (kg, mm, cm²)

Features	Fattening time			
	60 day (n=6)	75 day (n=6)	90 day (n=6)	importance
Thigh weight (kg)	5.23±0.58b	6.26±0.18ab	7.11±0.38a	*
Arm weight (kg)	3.43±0.39b	4.27±0.24ab	4.74±0.26a	*
Loin (fillet) weight (kg)	1.55±0.17b	2.14±0.30ab	2.50±0.14a	*
Back (chop) weight (kg)	3.39±0.53	4.00±0.15	4.97±0.53	-
Tail weight (kg)	3.94±0.36	3.35±0.39	3.73±0.42	-
Weight of neck and neck (kg)	1.40±0.15	1.72±0.18	2.02±0.20	-
MLD shell oil thickness (mm)	0.30±0.02	0.34±0.03	0.35±0.02	-
MLD cross-sectional area (cm2)	21.10±2.48	18.37±1.22	20.62±1.30	-

The difference between groups with different letters in the same column is significant.
-: P>0.05 insignificant,. *: P<0.05, **: P<0.01, ***: P<0.001.

Table 7. Various carcass parameters of lambs (cm)

Features	Fattening time			
	60 day (n=6)	75 day (n=6)	90 day (n=6)	importance
Karkas uzunluğu I (cm)	50.72±1.86	55.38±1.38	54.02±1.78	-
Karkas uzunluğu II (cm)	71.55±1.27	68.82±1.00	69.90±2.30	-
Gövde derinliği (cm)	26.53±0.40b	25.68±0.36b	23.15±0.74a	**
But uzunluğu I (cm)	39.53±0.77	40.38±0.57	41.12±0.72	-
But uzunluğu II (cm)	60.47±6.38b	72.63±1.06b	33.60±0.91a	***
But çevresi I (cm)	38.35±1.66b	41.87±0.82ab	42.93±0.67a	*
But çevresi II (cm)	31.21±1.33	31.93±0.49	34.38±0.76	-
Kol uzunluğu (cm)	23.20±2.51	21.40±0.33	21.63±0.30	-
Kol çevresi (cm)	15.67±0.73	15.22±0.43	16.40±0.27	-

The difference between groups with different letters in the same column is significant.
-: P>0.05 insignificant,. *: P<0.05, **: P<0.01, ***: P<0.001.

4. Discussion

On days 0, 14, 28, 42, 56, 56, 70, 84 and 90, the mean body weights of lambs belonging to the groups were 35.43±2.49, 35.32±2.42, 35.32±2.42; 38.68±2.76, 38.51±2.53, 38.51±2.53; 40.77±2. 94, 40.22±2.60, 41.15±2.27; 43.37±3.05, 42.75±2.66, 43.11±2.48; 2nd and 3rd groups 44.91±2.75, 44.91±2.75, 46.15±2.80, 46.48±2.51; 3rd group 48.89±2.34 and 51.17±2.18 kg. The average live weight of lambs in the three groups at the beginning of the experiment was 35 kg. Slaughter weights of the three groups were 46.28±2.97, 47.32±2.04, 51.98±2.39, respectively. While there was no significant statistical difference between the groups in terms of slaughter weight, hot carcass weights were determined as 16.90±0.92, 18.83±0.93, 21.43±1.36 kg, respectively, and the difference between the 1st and 2nd groups was found significant (P<0.05). The fact that there was no difference between the groups in terms of slaughter weights is thought to be due to the high variation between the live weights of the lambs in the groups since the birth periods of the lambs were not close to each other and they were at different ages. The end of fattening weights in all three groups were higher than the end of fattening weight (34.24 kg) reported by Işık and Kaya (2011) at the end of 90-day trial in their study on the determination of fattening performance of Tuj breed lambs grazing on pasture, and higher than the end of fattening weight (38 kg) obtained in pasture fattening with Tuj lambs weaned at Kars Experimental and Breeding Station and weighing 19 kg on average (Eliçin et al. 1988). This may be due to the fact that the lambs used in the studies were at different ages and had different starting weights and the studies were conducted as pasture fattening. In some studies (İlaslan and Geliyi 1979, Ulusan and Aksoy 1996), the live weights determined with Tuj and Morkaraman lambs during the pasture period were lower than the results of this study. It can be said that this may be due to the different ages and

weights of the lambs included in the experiment. The differences between the groups were found to be insignificant (P>0.05) in terms of various slaughter characteristics of lambs (skin, head, feet, heart-lung, liver, spleen, kidney, testes, stomach full and empty, small intestine full and empty) except for the weights of large intestine full and empty (P<0.05, P<0.01). This may be due to the fact that the growth in the internal organs and extremities was completed to a great extent when the age and weight of the lambs at the beginning of fattening were considered. In terms of carcass parameters, rump, arm and loin weights were 5.23±0.58, 6.26±0.18, 7.11±0.38; 3.43±0.39, 4.27±0.24, 4.74±0.26 and 1.55±0.17, 2.14±0.30, 2.50±0.14, respectively. While the differences between the groups were significant (P<0.05) in terms of the related traits, the differences between the groups were found insignificant (P>0.05, Table 6) in terms of other carcass parameters (back, tail, rump and neck weight, MLD shell fat thickness and MLD cross-sectional area). Among the carcass parameters expressed in cm units in Table 7, the differences between the groups were significant (P<0.05, P<0.01, P<0.001) for body depth, rump length II and rump circumference I, while the differences were insignificant for the other parameters (P>0.05, Table 7). The hot carcass weight values reported in all three fattening groups were higher than the hot carcass weight values (20.66, 21.36 and 22.15 kg) reported by Sarı et al. (2012) in pasture, pasture+200 and pasture+400 g groups in Tuj lambs. In this study, rump, arm and neck weight values reported in all three groups were higher than the values of rump weight (6.29, 6.36 and 6.47 kg), arm weight (3.51, 3.66 and 3.75 kg) and neck weight (1.52, 1.55 and 1.66 kg) reported by Sarı et al. (2012) in pasture, pasture+200 and pasture+400 g groups in Tuj lambs. In a study conducted in Tuj and Morkaraman lambs reared under semi-intensive conditions (Kırmızıbayrak et al. 2003), the rump weight (5.66 kg) of Tuj male lambs was similar to the group fed for 60 days, while the values reported in the other two groups were higher. The results were higher than the values of arm weight (2.95 kg), back-lumbar weight (2.61 kg) and MLD cross-sectional area (9.84 cm2) determined in the same study, while the values of thigh weight (6.04 kg) reported in Morkaraman breed male lambs were similar in the 75-day group and arm weight (3.26 kg) was similar in the 60-day group. In the same study, back-lumbar weight (2.91 kg) and MLD cross-sectional area (10.46 cm2) were lower than the experimental results. The measurements of chest circumference, anterior shank circumference, posterior shank circumference, body length, body height and chest depth of each group were taken 3 times at the beginning, middle and end of the experiment. In the 60-day fattening group, the difference between the groups in terms of anterior shank circumference at the middle and end of the experiment was significant (P<0.05, P<0.01), while the differences found in terms of different body measurements in other periods were found to be insignificant (P>0.05). Again, the differences between the groups in terms of the front shank circumference measurements taken in the middle of the experiment in the 75 and 90 days fattening groups were significant (P<0.05, P<0.01, respectively), while the differences in the other periods were found to be insignificant (P>0.05). The chest girth measurements obtained at different periods were higher than the values (44.57, 46.49, 57.52, 59.05, 68.67 cm) determined by Akçapınar et al. (2002) at 45th and 90th days in Karayaka and Bafra lambs and at 180th day in Karayaka under the conditions of Lalahan Livestock Research Institute, while the value reported for Bafra at 180th day (71.83 cm) was similar to the value reported at the beginning of the experiment for all three groups. Again, the results of the study were higher than the values (41.12, 42.67; 18.61, 19.72; 42.57, 44.27 cm) determined at 45th day for Karayaka and Bafra lambs in the same study in terms of

body height, chest depth and body length measurements. On the 180th day, the body length (58.06 cm) determined for Bafra sheep was similar to the values reported at the beginning of the experiment for all three groups, while it was found to be lower in other periods. On the 90th day, the measurements of chest girth, body length, body length, chest depth (64.76, 52.34, 51.44, 23.89 cm) determined by Akçapınar et al. (2001) in Sakız × Akkaraman F1s were lower than the values obtained in different periods in all three groups in the experiment. As a result, the differences between the various parameters obtained during the experiment were not significant except for the hot carcass, thigh, arm and loin weights and front shank circumference. This is thought to be due to the high variation in live weights among lambs at the beginning of the experiment.

Declaration of Author Contributions

The authors declare that they have contributed equally to the article. All authors declare that they have seen/read and approved the final version of the article ready for publication.

Declaration of Conflicts of Interest

All authors declare that there is no conflict of interest related to this article.

Funding

This study was supported by the Scientific Research Projects Coordinatorship of Kafkas University (Project No: 2010-VF-22)

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To Cite: Adıgüzel Işık, S., Sarı, M., Tilki, M., Önk, K., 2023. The Effect of Fattening Time on Fattening Performance, Slaughter and Case Features in Tuj Male Lamb. *MAS Journal of Applied Sciences*, 8(2): 256–264.

DOI: http://dx.doi.org/10.5281/zenodo.7933388.