Growth, fattening, slaughter and carcass characteristics of Manavlı goat kids

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Received March 17, 2025
Accepted July 8, 2025

Abstract

The study was designed to determine the growth, fattening, slaughter and carcass traits of Manavlı goat kids reared purely under breeder conditions in Denizli province, Türkiye. Average birth weights of kids in three herds were detected as 3.93 kg, 4.06 kg and 4.02 kg, respectively. While the average live weights of male kids on 30th, 60th, 90th, 120th and 150th day of age were determined as, 10.45 kg, 16.61 kg, 22.37 kg, 28.20 kg ve 34.27 kg respectively, the differences between herds (except 30th day of age) were significant ($P < 0.05$). In the study, initial and final average live weights were detected as 35.03 kg and 49.13 kg for male Manavlı goat kids. While average daily live weight gains were 251.84 g, the feed conversion rate was determined 4.16 kg during the fattening period. While the hot dressing percentage was 45.94%, the cross-sectional area of the m. longissimus thoracis was found to be 14.03 cm² and the back fat thickness value was determined to be 1.06 mm. Additionally, the percentages of valuable carcass parts, such as the shoulder, ribs, and long leg, were determined to be 21.06%, 26.06%, and 32.05%, respectively. The study is the first research to consider the growth, fattening performance, slaughter and carcass characteristics of Manavlı male kids as a whole. It is believed that the results obtained from this study could make a positive contribution to biodiversity and the production spectrum.

Finishing, goat, performance, trait

For each region where breeding is undertaken, its own genetic resources are of great importance. Indigenous breeds that support people with their products have an important and special place in the livestock policies of countries with their ability to adapt to the geographical and climatic conditions that they are in. Many countries, including Türkiye, signed the 'Convention on Biodiversity' at the United Nations Rio summit in 1992, pledging to contribute to the conservation of indigenous gene resources. Accordingly, these countries were asked to assess their current situation and take measures aimed at enhancing conservation (Çanta and Oğuz 2004). Goats are raised in various geographical regions around the world, with a higher number in temperate climate zones. Given that more than half of the global goat population is found in arid regions with low rainfall, it is evident that goats exhibit a higher adaptability to thermal stress than other species (Günlü and Alaşahan 2010).

Growth is one of the most important economical traits in animal breeding. Various factors, such as body conformation, nutritional level, age, and type of birth, affect both prepartum and postpartum growth (Yılmaz et al. 2006). One of the most important indicators of growth performance in livestock, particularly in fattening studies, is the live weight of the offspring (Ortega-Jimenez et al. 2005).

Meat production from animals is fundamentally based on understanding the carcass characteristics of these animals as they reach maturity for slaughtering to intensive-feeding

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methods applied by focusing on the growth traits of offspring (Zurita- Herrara et al. 2011). In terms of goat meat production, it is important to understand the fattening, slaughter and carcass characteristics of kids. Additionally, determining the fattening performance of the animals is crucial, especially for economic purposes and for assessing their productive potential (Güney 2006).

The Manavlı goat, a newly recorded native goat genotype, is believed to have been raised for many years in certain areas of Western Anatolia. It is claimed that this genotype, named after the Manavlı Nomads, has a high birth weight, a rapid growth capacity and a large body structure (Akbaş et al. 2023). The aim of this study was to determine the growth, fattening, slaughtering, and carcass traits of male Manavlı goat kids for which no features have yet been revealed under breeder conditions. The study is the first research to consider the aforementioned characteristics as a whole.

Materials and Methods

The study area, animals, and data collection

The study was conducted with 60 male Manavlı goat kids in three herds from Çal and Güney, districts of Denizli province, Türkiye, that were born in 2024. In determining the Manavlı goat farms, three different farms with similar management and environmental conditions that would not affect the measurements were selected; the aim was to study only the effect of the goat breed characteristics on the performance. In addition, the effect of the dam's age, which is an important factor in breeder conditions, was also taken into account as reported in the statistical analysis section. All births were completed within a week. Individual male kids were numbered with ear tags. The kids were kept with their mothers at morning and night until the suckling period ended (approximately 75–90 days of age). Then the kids had an opportunity to graze together with the flocks. The birth weights of 60 percent of kids were defined on the same day of birth, 40 percent of them were in the first 3 days after birth. In the current study, live weights were defined at 30-day intervals from birth up to 5 months of age. Considering the field conditions and the market supply of kid meat in the Teke Region, the age of approximately 5.5–6.0 months with 30–40 kg pre-slaughter weight, when they are sold before mating period, was determined as the criterion. In order to reveal the fattening, slaughter and carcass characteristics, a total of 12 male kids reaching a pre-slaughter live weight of 34–36 kg were purchased from the breeders. After a 15-day adaptation period during which the kids received antiparasitic treatments and supportive vitamin applications, their initial weights were determined. During the 56 days fattening period, the kids were fed *ad libitum* with concentrated feed (crude protein 16.9% and 2810 kcal ME) and limited to 200 g/head/day of roughage (chopped dry alfalfa + barley straw). Throughout the fattening period, all kids were regularly weighed weekly in the mornings to determine the live weight gains achieved. The amount of concentrated feed remaining in the feeders on the weighing days was recorded and weighed. Weekly feed consumption was calculated, and the final live weights of the kids at the end of the fattening period were determined.

After the pre-slaughter live weights of kids were detected, noncarcass components such as skin, feet, head and red organs (lungs and trachea, liver, heart, spleen) were recorded. Then the hot carcass weights were detected. Hot carcass dressing percentages were calculated based on live weight before slaughter. After these measurements, the carcasses were chilled at 4 °C for 24 h. At the end of this process, cold carcass weights were determined. Some cold carcass traits were determined based on their live weight values before the slaughter, and the chilling loss occurring during the waiting period was also calculated. Additionally, some of the carcass measurements such as the carcass length, rump circumference, rump width, chest circumference and chest width were carried out. Then carcasses were split into two equal parts. The left side was separated into five joints as described by Colomer-Rocher et al. (1987) which were weighed. Additionally, the surface area of the m. longissimus thoracis between the 12th and 13th ribs was detected by using drawing software as stated by Akbaş and Saatcı (2016). A digital caliper was also used in order to determine the backfat thickness.

Statistical analysis

Minitab statistical software packaged was used for examining the data. A statistical model with the fixed effects (herd and dam age) was used to determine the least square (LS) means for growth traits of male single kids using the generalised linear model (GLM) procedure. When the dual interactions between the groups were examined, interaction analyses were not performed since no statistical significance was found. Additionally, Tukey's analysis was employed to determine the significance of differences between sub-groups ($P < 0.05$). Additionally, an intense descriptive statistical analysis was applied on the data with the means and standard errors of means.

The study was approved by the Burdur Mehmet Akif Ersoy University Local Ethics Committee on Animal Experiments (29.03.2023, resolution number: 1036).

Results

Table 1 presents the effects of herd and dam age on birth and live weights of male Manavlı goat kids. The birth weight values of the kids in the three herds were 3.93 kg, 4.06 kg, and 4.02 kg, respectively. The average live weights in all herds at 30, 60, 90, 120, and 150 days of age were determined to be 10.45 kg, 16.61 kg, 22.37 kg, 28.20 kg, and 34.27 kg, respectively. Significant differences ($P < 0.05$) between the herds were observed in live weight values (except for the first 30 days). The effect of dam age on the live weights of the kids was found to be significant only during the period between days 30 and 90 ($P < 0.05$).

The values for the Manavlı goat kids after 56 days of the fattening period are presented in Table 2. While the initial and the final live weights were 35.03 kg and 49.13 kg; the total live weight gain and the average daily live weight gain during the fattening period were found to be 14.10 kg and 251.84 g, respectively. The feed conversion rate and daily concentrate consumption of the kids were 4.16 and 1,050.39 g during the 56-day finishing period, respectively.

Table 1. The effects of herd and dam age on growth characteristics of male Manavlı goat kids (mean ± standard deviation).

	n	Birth weight (kg)	30th day live weight (kg)	60th day live weight (kg)	90th day live weight (kg)	120th day live weight (kg)	150th day live weight (kg)
Herd							
1	20	3.93 ± 0.11	10.19 ± 0.39	16.23 ± 0.55^{b}	21.92 ± 0.44^{b}	27.75 ± 1.20^{b}	33.14 ± 1.52^{c}
2	20	4.06 ± 0.07	10.90 ± 0.21	17.07 ± 0.33^{a}	23.09 ± 0.53^{a}	28.83 ± 0.61^{a}	35.41 ± 0.78^{a}
3	20	4.02 ± 0.10	10.25 ± 0.24	16.52 ± 0.48^{b}	22.09 ± 0.64^{b}	28.04 ± 0.81^{b}	34.28 ± 1.04^{b}
P		NS	NS	*	**	**	***
Total		4.00 ± 0.15	10.45 ± 0.18	16.61 ± 0.29	22.37 ± 0.42	28.20 ± 0.44	34.27 ± 0.56
Dam's age							
3	19	3.89 ± 0.11	10.27 ± 0.29	16.01 ± 0.38^{b}	21.83 ± 0.46^{b}	27.91 ± 0.71	33.88 ± 0.82
4	23	3.95 ± 0.09	10.43 ± 0.23	16.84 ± 0.36^{a}	22.46 ± 0.51^{a}	28.32 ± 0.66	34.32 ± 0.74
5	18	4.18 ± 0.07	10.62 ± 0.21	17.97 ± 0.26^{a}	22.76 ± 0.52^{a}	28.39 ± 0.65	34.66 ± 0.76
P		NS	NS	*	*	NS	NS

^{a,b,c} Values with different superscripts within the same column are significantly different ($P < 0.05$).

NS: non-significant ($P > 0.05$); *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$

Table 2. Fattening performances of male Manavlı goat kids (mean ± standard deviation).

Fattening period (day)	n	Live weight (kg)	Fattening period (day)	Daily live weight gains (g)	Daily concentrate feed consumption (g)	Feed conversion rate
1		35.03 ± 0.65				
7	12	36.75 ± 0.59	0–7	245.83 ± 23.11	971.02 ± 43.10	3.95 ± 0.23
14	12	38.28 ± 0.60	8–14	218.62 ± 20.25	860.28 ± 37.20	3.93 ± 0.18
21	12	39.97 ± ± 0.56	15–21	241.43 ± 18.17	996.30 ± 49.31	4.13 ± 0.19
28	12	41.75 ± 0.62	22–28	254.31 ± 17.36	1,068.12 ± 43.40	4.20 ± 0.17
35	12	43.57 ± 0.69	29–35	260.09 ± 15.48	1,096.24 ± 42.18	4.21 ± 0.20
42	12	45.43 ± 0.71	36–42	265.72 ± 16.20	1,140.13 ± 52.43	4.29 ± 0.32
49	12	47.30 ± 0.70	43–49	267.14 ± 14.26	1,121.36 ± 47.07	4.20 ± 0.37
56	12	49.13 ± 0.64	50–56	261.42 ± 15.15	1,149.71 ± 39.71	4.39 ± 0.28
			0–56	251.84 ± 17.21	1,050.39 ± 43.16	4.16 ± 0.21

Feed conversion rate: kg of concentrate feed needed to produce 1 kg live weight gain.

Slaughter and carcass characteristics of male Manavlı goat kids s are presented in Tables 3–5. The average pre-slaughter weights were found to be 48.82 kg. The hot carcass weight was determined to be 22.43 kg, with a dressing percentage of 45.94%. In the study, the average cold carcass weight was found to be 21.72 kg, with a chilling loss of 1.55%, and a cold dressing percentage of 44.49%. The surface area of the m. longissimus thoracis was found to be 14.03 cm², and the back fat thickness value was determined to be 1.06 mm. The study also showed that the carcass length, rump circumference, rump width, chest circumference, and chest width were 79.50 cm, 63.21 cm, 21.35 cm, 81.59 cm, and 22.09 cm, respectively.

Table 3. Selected slaughter and carcass characteristics of male Manavlı goat kids (mean ± standard deviation).

Trait	Value	CV%
Slaughter weight (kg)	48.82 ± 1.39	6.88
Hot carcass weight (kg)	22.43 ± 0.71	8.91
Dressing percentage[DP1] (%)	45.94 ± 0.77	8.19
Dressing percentage[DP2] (%)	44.49 ± 0.71	8.25
Head weight (g)	2,772.53 ± 33.51	7.48
4 Feet weight (g)	1,490.20 ± 15.29	9.28
Skin weight (g)	3,995.17 ± 22.30	10.05
Lungs and trachea weight (g)	951.23 ± 20.41	9.22
Heart weight (g)	219.08 ± 3.45	9.77
Liver weight (g)	1,050.37 ± 25.09	8.36
Spleen weight (g)	99.60 ± 0.29	9.05
Full stomach weight (g)	5,814.23 ± 34.05	10.19
Full intestine weight (g)	3,418.16 ± 34.10	8.74
Internal fat weight (g)	341.13 ± 4.77	9.18

CV: Coefficient of variance

[DP1](hot carcass weight/slaughter weight)*100; [DP2](cold carcass weight/slaughter weight)*100

Table 4. Selected cold carcass characteristics of male Manavlı goat kids (mean ± standard deviation).

Trait	Value	CV%
Cold carcass weight (kg)	21.72 ± 0.63	9.21
Chilling loss (%)	1.55 ± 0.06	7.79
Left half of carcass weight (kg)	10.65 ± 0.31	7.01
Shoulder weight (g)	11.04 ± 0.27	8.87
Flank weight (g)	2325.10 ± 38.43	9.62
Neck weight (g)	1088.09 ± 24.01	9.39
Ribs weight (g)	1205.09 ± 39.20	7.89
Sirloin weight (g)	2877.59 ± 50.29	9.91
Loin weight (g)	2196.38 ± 41.08	9.65
Long leg weight (g)	681.21 ± 17.34	9.38
Back fat thickness (mm)	3539.36 ± 88.59	8.17
M. longissimus thoracis area (cm²)	1.06 ± 0.03	10.21
Carcass length (cm)	14.03 ± 0.66	7.39
Rump circumference (cm)	79.50 ± 1.10	9.01
Rump width (cm)	63.21 ± 0.71	9.47
Chest circumference (cm)	21.35 ± 0.28	8.38
Chest width (cm)	81.59 ± 1.03	9.20

CV: Coefficient of variance

Table 5. Percentages of the valuable parts and non-carcass components in male Manavlı goat kids (mean ± standard deviation).

Trait	Value	CV%
Percentages (%) relative to cold carcass weight		
Shoulder	21.06 ± 0.32	9.10
Flank	9.86 ± 0.20	7.39
Neck	10.91 ± 0.27	8.73
Ribs	26.06 ± 0.83	8.14
Sirloin	19.89 ± 0.30	9.47
Loin	6.17 ± 0.07	9.39
Long leg	32.05 ± 0.44	8.12
Percentages (%) relative to slaughter weight		
Head	5.68 ± 0.06	9.18
4 Feet	3.05 ± 0.07	9.41
Skin	8.18 ± 0.21	9.34
Lungs and trachea	1.95 ± 0.07	8.18
Heart	0.45 ± 0.04	9.25
Liver	2.15 ± 0.11	10.34
Spleen	0.21 ± 0.03	9.31
Internal fat	11.90 ± 0.13	8.43

CV: Coefficient of variance

The proportions of certain non-carcass parts in male Manavlı goat kids such as head, legs, skin, lungs and trachea, full stomach, full intestines, and omental and mesenteric fat were found to be 5.68%, 3.05%, 8.18%, 1.95%, 11.90%, 7.00%, and 0.69%, respectively. Additionally, the percentages of valuable carcass parts, such as the shoulder, ribs, and long leg, were determined to be 21.06%, 26.06%, and 32.05%, respectively.

Discussion

Monitoring the growth periods of goat kids is crucial for ensuring consistency in the offspring yields, which are one of the main revenue sources for the farms, contributing to the sustainability of the enterprise. Determining the birth weights of kids is a significant factor in calculating their growth rates. This study found that the birth weight examined as a growth trait was 4 kg in male kids, which was higher than birth weight values reported by various researchers (Alaşahan and Öztürk 2010; Atay and Gökdal 2016; Erduran 2017) for Turkish Hair kids which was between 2.19 and 3.17 kg. The weight values found in the present study were higher than those (3.2 kg, 3.2 kg and 2.6 kg) reported for Saanen × Kilis, German Fawn goat × Turkish Hair goat and Hatay goat crossbred kids (Gül et al. 2010), respectively. In the present study, the average live weights of male Manavlı goat kids aged 30–150 days were determined for three herds as follows: 10.19–10.90 kg; 16.23–17.07 kg; 21.92–23.09 kg; 27.75–28.83 kg; and 33.14–35.41 kg. The effect of the herds in which the kids were located on their average live weights during the growth period (after the 30th day) was found to be significant ($P < 0.05$). Since the part of the study reflecting the growth characteristics was conducted under breeder conditions, it was observed that the care and feeding conditions applied by the breeders created relatively distinct differences in the growth traits of the animals. In this study, dam's age had a significant effect on some of the live weight values (60th and 90th days) of the kids. However, the minor effect of three-year-old dams on the growth of kids compared to older animals can be associated with

being younger and producing relatively less milk. The lowest live weights, obtained in the kids of three-year-old dams, rose as the age of the dams increased.

In the present study, which is the first to examine the fattening performance of male Manavlı goat kids, it was determined that the initial live weight of the kids at the beginning of the fattening period was 35.03 kg on average, whereas their final live weight after a 56-day fattening period was found to be an average of 49.13 kg. The daily live weight gain values showed a general increase during the later stages of the fattening period (except for the final week). The average daily live weight gain during the fattening period for male Manavlı goat kids was 251.84 g. This value was found to be higher than those reported by Aktaş et al. (2015) for Honamlı kids during a 60-day fattening period (197 g) and by Elmaz et al. (2017) for Honamlı kids after a 56-day fattening period (203 g). Additionally, the values were higher than those reported by Şimşek and Bayraktar (2007) and Karadağ and Köycü (2011), and for various levels of crossbreeds between local breeds and Saanen goats. Throughout the fattening period, a relative increase in the amount of concentrate feed was observed starting from the first 15-day period. The average daily concentrate feed intake during the fattening period was 1,050.39 g. During the fattening period, male Manavlı goat kids consumed 4.16 kg of concentrate feed for each kilogram of live weight gain. The feed conversion rate was found to be lower for Manavlı kids compared to the values reported by Atay et al. (2011a) for Kilis goats, as well as the values reported by Aktaş et al. (2015) for Honamlı goat kids.

In the present study, hot and cold dressing percentage values were found to be 45.94% and 44.49%, respectively. These values are in line with the reports by different researchers (Koyuncu et al. 2007; Yılmaz et al. 2010; Atay et al. 2011b) for male Kilis goat kids, as well as those reported by Akbaş and Saatcı (2016) and Elmaz et al. (2017) for male Honamlı goat kids. However, the values were found to be higher than those reported by Gökdal (2013) for Kilis male goats, and for Alp × Kilis (F1) and Saanen × Kilis (F1) crossbred kids. It has been stated that the dressing percentages in goats can vary between 35% and 53% due to the influence of several different factors, including the proportion of non-carcass components, carcass fatness, and the content of the gastrointestinal tract (Warmington and Kirton 1990; Yalçıntan et al. 2018). It is considered important in this study to present the slaughter and carcass characteristics of the Manavlı goat for the first time, using different experimental designs.

The subcutaneous fat thickness value (1.06 mm) was higher than the values reported by Koşum et al. (2003), Yılmaz et al. (2010), and Özcan et al. (2010). In contrast, Gül et al. (2010) reported higher values than the current study. The m. longissimus thoracis area value (14.03 cm²) is relatively in line with the values reported by Akbaş and Saatcı (2016) for Honamlı × Hair goat crossbred kids. However, it is higher than the values reported by Aktaş et al. (2015) for Honamlı goat kids. Furthermore, it is higher than the values reported by Erol (2015) for Ankara goat kids with pre-slaughter live weights of around 30–31 kg. Carcass measurements can be influenced by factors such as breed, sex, slaughter age, live weight at slaughter and feeding conditions (Erol 2015). When the carcass measurements in this study are examined, the results are better expressed than the carcass measurements determined by various researchers (Cameron et al. 2001; Dhanda et al. 2003; Koşum et al. 2003; Şimşek and Bayraktar 2007; Gökdal 2013). However, they were generally in agreement with the values reported by Akbaş and Saatcı (2016) and Elmaz et al. (2017) for Honamlı goat kids. When considering the percentages of significant carcass parts for consumption, the determined values for the shoulder (21.06%), ribs (26.06%), and long leg (32.05%) were found to be lower than the values reported by Akbaş and Saatcı (2016) and Aktaş et al. (2015) for the long leg percentage in Honamlı male kids. Additionally, Koşum et al. (2003), Pena et al. (2007), Bonvillani et al. (2010) and Daşkıran et al. (2010) reported higher values than these. However, they were in line with

the values reported by Kor et al. (2011) and Atay et al. (2011b). The value for the percentage of the head (5.68%) determined in this study is relatively lower than the values reported by Atay et al. (2011). Additionally, the skin percentage (8.18%) is consistent with the values reported by Koyuncu et al. (2007) for Turkish Hair goats at various slaughter weights, as well as by Özcan et al. (2010) for Saanen, Gökçeada, and Maltız kids.

In conclusion, the findings of the first study examining the growth, fattening performance, slaughter and carcass characteristics of male Manavlı goat kids raised in rural areas on the whole highlight the growth rates of Manavlı goat kids, particularly after weaning. Additionally, it has been observed that the average live weight values of male Manavlı goat kids at different stages of fattening are higher than those of many local goat breeds, particularly the Hair (Kıl) goat. Furthermore, in terms of carcass measurements, positive differences were found in Manavlı goat kids compared to the reports on Hair goats in the literature. It is believed that the results obtained from this study could make a positive contribution to biodiversity and the production spectrum.

Acknowledgements

This study was prepared from the first author's Master thesis and was supported financially by the Burdur Mehmet Akif Ersoy University Scientific Research Projects Commission, Project No: 0930-YL-23.

Conflict of interest

The authors declare no conflict of interest.

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