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Comparison of Fattening Performances and Meat Yield in Meat Type Kids and Lambs

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ABSTRACT

The aim of the present study was to compare the fattening performance and carcass characteristics of the offsprings obtained from meat-type crossbreed sheep and goats. For this purpose, 10 head of lambs of the Cukurova Assaf type (75% Ost-Friz + 25% Awassi) and 10 head kids of Improved Cukurova Boer type (10% Native Hair Goat + 90% Boer) were used as animal material in the experiment. Kids and lambs were housed in two different paddocks during the eight-week trial period and performance data such as feed consumption and live weight gain were recorded during the trial. Four head animals, of which closest to the average live weight of each group in the final of the fattening period were slaughter and then carcass parameters were evaluated. According to the obtained results, there was no statistically significant difference between lambs and kids in terms of initial and final live weights and feed conversion ratios (P>0.05). However, the difference between the two species with regard to feed consumption and live weight gains during the 8-week fattening period were found to be significant (P<0.05). Considering slaughtering data, the difference between lambs and kids in terms of hot and cold carcass weights, head weights, feet weights and leather weights were found to be significant (P<0.05). Kid and lamb meat were found to be similar with regard to parameters such as color (Brightness, redness and yellowness) and cutting force (P>0.05); however, the difference in meats in terms of softness and juiciness parameters were determined to be significant (P<0.05).

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MD and NK conducted the experiments in this study. MD and NK contributed to the design and interpretation of the current study and wrote the article.

Key words
Kids, Lambs, Performance, Carcass, Breeding, Texture

INTRODUCTION

Goat meat consumption in the world is affected by some social, cultural and geographical factors. In some countries, goat meat is among the luxury foodstuffs. Young kid meat is a nutrient wanted in many Mediterranean countries (Italy, Greece, France, Spain, Portugal, Morocco) (Boyazoglu and Morand-Fehr, 2001). For example, only kid meat is eaten on thanksgiving in Greece. Young kid carcasses (capretto or cabritos) with 5-12 kg live weight in Mexico, Italy and Spain and goat carcasses (chevon) with 16-20 kg live weight in France are the privileged products of the sector. Some products manufactured by using goat meat and goat meat in European countries and America are among the luxury consumption products that can be sold at a very high price. People living in marginal areas generally evaluate goat meat as a source of red meat at all periods and ages. It is consumed more because it is preferred by people with low-income levels in Southeast Asia and Africa, especially in tropical regions. People living in the tropics prefer goat meat to sheep and beef. The reason for this, breeding with minimal input costs of goats in tropical areas, goat meat is less fatty and therefore it can be kept for longer periods (Kirton, 1988). Although the protein content of goat, sheep and cattle meat is similar (approximately 19.5, 16.4 and 19.0 %, respectively), the fat content of goat meat is significantly lower than sheep and cattle meats (Anonymous, 2021). Also, the calorie value of 1 g goat meat is significantly lower than sheep and cattle meats. Due to lower than the sheep of meat yield in goats, studies on fattening in kids remained at a lower level than sheep (Koşum *et al*., 2005). It is possible to produce economic meat by feeding with intensive feed in the short and medium-term of male and female kids in goat production farms. New Zealand and Australia are among the leading countries, providing improvement of kid meat exports with this application. It is possible to export kid meat to many countries (especially European countries) in the middle east. Turkey has an important potential in world goat meat exports due to its production and geographical location (Karadağ and Köycü, 2011). Small ruminant animals among the resources of red meat are widely used to meet red meat needs. While sheep and goat meat in developed countries are processed with technological

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methods and take place in the market as special food, it is the only source of red meat for low-income people in underdeveloped countries. Goat meat is a type of red meat fondly consumed and preferred by the people living in the Mediterranean and Eastern Anatolia region for centuries. However, there are many negative prejudices (bad smell, hardness, abdominal pain, etc.) in the Turkish public about goat meat. Therefore, today goat meat has not gained deserved value in the economy size. Recently, while the number of goat farms increased rapidly with intensive breeding of dairy goats, because of failure to create the market to the male kid and goat meat, farms began to lose economically.

The current study aims to compare the fattening performance and carcass characteristics of the lamb and kids obtained from meat-type crossbreed sheep and goats.

MATERIALS AND METHODS

The present study was carried out on 10 heads of lambs of Cukurova Assaf type (75% Ost-Friz+25% Awassi) and 10 heads of kids of Improved Cukurova Boer type (10% Local Hair Goat + 90% Boer) grown at Cukurova University, Faculty of Agriculture, Small Ruminant Research Practice Farm. Male offsprings of breeders who gave a single offspring in their second birth were used as animal material in the experiment. Lambs and kids used in the trial were weaned according to farm routines. Accordingly, the kids were fed with colostrum during the first week after birth. Then, the kids were kept together with their mothers until the age of one month and they began to consume roughage and concentrate feed after the second week. When the kids reached the age of one month, they were separated from their mothers during the day and they were kept together with their mothers all night following the evening milking. Then, when the kids reached 1.5 months of age, they were kept together with their mothers for two hours after morning and evening milking, and when kids reached three months of age, they were completely weaned. The lambs fully sucked the colostrum, they were kept together with their mothers until the age of one month and they began to consume roughage and concentrate feed after the second week. When the lambs reached the age of one month, they were separated from their mothers during the day and they were kept together with their mothers all night following the evening milking. Then, lambs were completely weaned when they reached the age of two months. After weaning, lambs and kids were housed in two separate paddocks and they were fed *ad libitum*. Before initializing the fattening process, the adaptation feeding was given to animals for one week followed by fattening feed for eight weeks. During this period, animals were fed with concentrated feed having 12% HP and 2300 kcal/kg energy content and alfalfa hay as roughage.

During the experiment, live weight gains and feed consumptions of the animals were determined by weekly weighing. The carcass parameters determined according to the Standard Mediterranean Carcass Shredding method (Colomer-Rocher, 1987) at the final of the fattening period were measured by slaughtering four lambs and four kids closest to average live weight from treatment groups. Live weight before slaughter on animals, measurements such as hot carcass weight, head weight, feet weight, leather weight and offal weight after slaughter were taken. Besides, after the carcasses waited in cold storage for 24 h at +4°C, measurements such as cold carcass weight, body length, breast width, rump length, eye muscle depth, eye muscle width, eye muscle fat thickness were taken. (L*), (a*) and (b*) values in color measurements of meats were registered by using a color meter (Konica Minolta CM-5). The device before starting the analysis was calibrated with a white plate and black plate. The value “L” in this device represents the transition from brightness to darkness; the value “+a” represents the transition to redness; the value “-a” represents the transition to Greenish; the value “+b” represents the transition to yellowness and the value “–b” represents the transition to blueness. Texture profile analysis of meats was made according to the Warner-Bratzler Shear Force method (Warner, 1929; Bratzler, 1932).

For comparison of continuous variables between two groups, the t-test with the help of the SPSS package program was used depending on whether the statistical hypotheses were fulfilled or not. Numerical measurements obtained study were summarized as mean and standard error. The statistical level of significance for all tests was considered to be 0.05.

RESULTS

Table I shows the fattening performance of kids and lambs. There was no significant difference between lambs and kids in terms of the live weight values and feed conversion ratio at the initial and final of the trial ($P>0.05$). However, the differences between the two species in terms of feed consumption and live weight gain during the eight-week fattening period were found to be significant ($P<0.05$). It was determined that the live weights of lambs at the end of the trial were numerically higher than kids. This result can be attributed to the higher live weights at the initial of the trial of the lambs compared to the kids and the higher feed consumption during the trial.

Some slaughter and carcass values of lambs and kids are summarized in Table II. The differences between lambs and kids in terms of hot and cold carcass weight, head

Table I. Fattening performance of lambs and kids.

Parameters	Cukurova assaf	Cukurova boer	P
Initial live weight (kg)	22.98±1.48	19.44±1.13	0.090
Feed consumption (0-8 weeks, g/day)	1469.31±16.07	1110.38±55.41	0.023
Live weight gain (0-8 weeks, g/day)	366.00±11.60	269.00±9.72	0.034
Feed conversion ratio (0-8 weeks, kg/day)	4.01±0.40	4.13±0.41	0.216
Final live weight (kg)	37.64±1.58	32.45±1.31	0.068

Table II. Some slaughter and carcass traits of lambs and kids.

Parameters	Cukurova assaf	Cukurova boer	P
Slaughter weight (kg)	35.33±1.17	34.60±0.15	0.124
Hot carcass weight (kg)	19.03±0.90	17.77±0.09	0.051
Cold carcass weight (kg)	18.23±0.92	16.97±0.38	0.050
Carcass yield (%)	51.59±2.97	49.05±1.16	0.237
Head weight (kg)	2.30±0.10	1.83±0.03	0.012
Feet weight (kg)	1.03±0.09	0.67±0.03	0.024
Leather weight (kg)	5.33±0.90	2.53±0.19	0.011
Lung weight (kg)	1.73±0.03	1.23±0.07	0.089
Rumen and ıntestinal weight (kg)	5.10±0.15	4.00±0.45	0.094
Carcass length (cm)	61.67±1.20	57.33±0.88	0.031
Chest circumference (cm)	77.50±2.29	69.00±0.58	0.043
Chest depth (cm)	23.50±0.76	21.67±0.88	0.052
Distance between oars (cm)	17.83±1.48	15.83±0.60	0.071
Rump circumference (cm)	69.33±1.45	65.00±1.53	0.060
Rump width (cm)	23.00±0.50	21.00±0.00	0.054
Rump length (cm)	40.67±0.33	37.67±0.88	0.051
Gigot (cm)	30.67±1.45	28.00±0.58	0.162
12^{th} rib top fat (cm)	0.67±0.19	0.10±0.00	0.044
Eye muscle depth (cm)	3.53±0.29	3.23±0.28	0.067
Eye muscle width (cm)	8.10±0.06	7.96±0.73	0.275
Eye muscle fat thickness (cm)	1.30±0.20	0.13±0.03	0.014

weight, feet weight and leather weight among the carcass parameters were found significant (P<0.05). According to this result, the body parts that are thrown out of the carcass such as head, leather and feet are determined to be more than kids in lambs; however, it was determined that this did not significantly affect the carcass yield. Besides, lambs were revealed to higher values in terms of the data obtained from carcass measurements such as carcass length, chest circumference and depth, rump width and length (P<0.05). However, when the muscle and fat ratios in the carcass are examined, it was seen that the fat ratios in the carcasses of the kids are lower than lambs and the muscle ratios are higher (P<0.05).

Color and texture analysis of the lamb and kid meats are given in Table III. According to the analysis results, it was determined that lamb and kid meats were similar in terms of color (Brighness, redness and yellowness) and cutting force (P>0.05). However, the differences between softness and juiciness values of meats were revealed to be significant (P<0.05). According to these results, it was determined that kid meat was softer and lamb meat was juicier.

Table III. Color and texture analysis of the lamb and kid meats.

Parameters	Cukurova assaf	Cukurova boer	P
Brightness (L*)	89.55±0.01	89.57±0.01	0.150
Redness (a*)	0.47±0.00	0.49±0.00	0.123
Yellowness (b*)	0.10±0.01	0.12±0.00	0.068
Cutting force (kg)	7.49±0.11	7.73±0.17	0.252
Softness	5.46±0.10	4.32±0.04	0.014
Juiciness	9.34±0.05	7.57±0.10	0.011

(L*): the transition from brightness to darkness; (a*): the transition to redness; (b*): the transition to yellowness; Juiciness: not juicy to extremely juicy; Softness: soft to hard.

DISCUSSION

Although there was no significant difference between species in terms of live weight values at the final of the current study; feed consumption, live weight gain, hot carcass weight and cold carcass weight were significantly different. Because lambs consumed more feed than kids, the live weight gain of their was higher than kids. Although the non-carcass waste parts such as head, 4 foot and leather were significantly higher in lambs; it was determined that the effect of this on carcass yield was not significant. However, the differences observed for carcass length, chest circumference and depth, rump width and length,

12th rib top fat, and eye muscle fat thickness were found to be significant between species. These results can be explained by the fact that Assaf lambs had more length and more developed bone structure than Boer kids due to the body characteristics of Ost-Frieze sheep. In addition, it can be said that the differences observed between species in terms of 12th rib top fat and eye muscle fat thickness were caused by the fact that kids have a much more mobile structure than lambs. While there were no significant differences in terms of color (brightness, redness and yellowness) and cutting force in lamb and kid meats, it was recorded to be significant differences in terms of the softness and juiciness of meats between species. According to these findings, the water retention capacity of muscle fibers in lambs was higher than kids; however, the marbling rate of Boer kids' meat was higher than Assaf lambs. Normally, considering the active structure of the goat, it can be expected that kid meat will be harder than lamb meat. However, meat obtained from Cukurova Boer kids in the present study was determined softer. This finding may be explained by the use of pure Boer types at a high rate such as 90% in crossbreeding in order to benefit from superior meat quality. Due to the comparison of breed performances within mostly species in previous studies on small ruminant animals, the current study conducted between species was important. In the study conducted by Özbey and Akcan (2003), fattening performance and carcass characteristics of Morkaraman, Sakız × Morkaraman (F1) and Kıvırcık × Morkaraman (F1) crossbreed lambs were examined. Daily live weight gain (g) and feed conversion ratio (kg) of lambs in the final of the study were stated 232.91, 231.73, 245.62 and 6.47, 5.86, 5.10 kg respectively. Also, hot carcass weight, cold carcass weight, leather weight, head + 4 foot weight, chest depth, chest circumference and rump width among some carcass characteristics of lambs were reported as 23.18, 22.01, 22.57 kg, 23.05, 22.31, 22.48 kg, 7.69, 7.09, 7.50 kg, 3.36, 3.27, 3.15 kg, 28.30, 30.18, 29.38 cm, 76.03, 77.49, 76.54 cm and 26.04, 24.90, 24.40 cm, respectively. Another study by Akmaz *et al.* (2000) compare the fattening performance and carcass characteristics of German Black Headed (ASB) × Awassi (A) (F1), Hampshire Down (HD) × A (F1) and HD × (HD × A) (G1) male crossbreed lambs were sustained until reached 45.00 kg live weight. Daily live weight gains during the fattening of lambs were reported 362.79, 351.07, 345.18 g respectively and feed conversion ratios were stated 3.30, 3.76, 3.59 respectively. In the same study, the hot carcass weights, the cold carcass weights, carcass yields, the leather weights, the head weights, the 4 foot weights, the body lengths, the chest circumferences, the chest depths and the rump widths of crossbreed lambs were declared 21.93, 23.51, 23.23 kg, 21.70, 23.02, 22.88 kg, 48.22, 51.16 50.84%, 6.07, 5.56, 5.24 kg, 2.02, 2.00, 2.10 kg, 1.14, 0.99, 1.05 kg, 56.17, 57.00, 55.67 cm, 78.00, 78.00, 77.25 cm, 27.17, 25.92, 27.67 cm and 25.83, 26.17, 28.33 cm, respectively. Pırlak, Central Anatolian Merino and Central Anatolian Merino × Pırlak crossbreed lambs were fed to compare the fattening performance, slaughter and carcass characteristics (Koçak *et al*., 2016). Daily live weight gain and feed conversion ratios of lambs in the final of the study were reported 248.04, 289.82, 278.31 g and 5.17, 4.76, 5.11 kg, respectively. Among carcass characteristics were declared hot carcass weight 16.55, 20.50, 19.33 kg respectively, cold carcass weight 16.15, 20.10, 18.88 kg, carcass yield (%) 43.79, 45.66, 45.31, head weight 1.85, 2.10, 1.88 kg, 4 foot weight 0.72, 0.86, 0.77 kg and leather weight 4.47, 4.87, 5.37 kg. Another study by Yılmaz *et al.* (2009), the carcass characteristics of Turkish Merino, Ramlıç, Kıvırcık, Sakız and Imroz lambs were compared. Cold carcass weights of lambs were declared 23.35, 22.33, 23.51, 14.33, 13.75 kg respectively, carcass yields (%) were 49.27, 48.88, 49.74, 46.11, 46.11, head weights were 2.89, 2.75, 2.79, 2.04, 1.87 kg, leather weights were 5.28, 5.25, 4.61, 3.29, 3.25 kg, 4 foot weights were 1.33, 1.16, 1.13, 0.88, 0.75, carcass lengths were 36.67, 37.00, 37.28, 35.88, 35.33 cm, chest depths were 27.46, 27.40, 28.24, 24.84, 25.33 cm and chest circumferences were 78.62, 77.74, 78.48, 67.70, 67.03. In the same study, according to the color analysis making in meats, the brightness, redness and yellowness values of meats were reported 69.40, 68.08, 67.64, 67.40, 68.41 respectively; 4.59, 4.65, 4.68, 5.31, 3.61 and 7.74, 8.23, 8.72, 9.20, 7.63. In a similar study, Karayaka male lambs were used to determine the fattening performance and carcass characteristics (Olfaz *et al*., 2005). The daily live weight gains and the feed conversion ratio of lambs were reported 211.70 g and 7,06 kg respectively. Carcass characteristics such as hot carcass weight (kg), carcass yield (%), head weight (kg), 4 foot weight (kg), carcass length (cm), breast height (cm) and chest width (cm) of lambs declared 18.80, 45.30, 2.56, 0.78, 62.70, 29.60 and 23.70 respectively. In the same study, brightness, redness, yellowness and juiciness values of meats obtained lambs were reported 38.90, 17.20, 10.40 and 5.20 respectively. According to the findings of the present study, fattening performance values such as daily live weight gain and feed conversion ratio of Cukurova Assaf lambs were found to be similar to the results of the study carried out by Akmaz *et al.* (2000). However, it was higher than pure and crossbreed lambs such as Karayaka (Olfaz *et al*., 2005), Pırlak, Central Anatolian Merino and Central Anatolian Merino × Pırlak (Koçak *et al*., 2016), Morkaraman, Kıvırcık × Morkaraman and Sakız × Morkaraman (Özbey

and Akcan, 2003). Although various values in studies assessing the carcass characteristics of lambs were determined, it was observed to be similar in terms of non-carcass parts such as head, 4 foot and leather weights in most breeds. The brightness value (L*) of the meat in Cukurova Assaf lambs found similar to the values obtained from Turkish Merino, Ramlıç, Kıvırcık, Sakız and Imroz lambs (Yılmaz *et al*., 2009); however, it was higher according to the values reported in Karayaka (Olfaz *et al*., 2005) lambs. Also, the redness (a*) and yellowness (b*) values in the meat of Cukurova Assaf lambs were lower than reported for Turkish Merino, Ramlıç, Kıvırcık, Sakız, Imroz and Karayaka breeds. The water content determined in meats of the Cukurova Assaf lambs was higher than the recorded for Karakaya lambs (Olfaz *et al*., 2005). In a study comparing the fattening performance and carcass characteristics of Alpine × Hair goat (F1), Saanen × Hair goat (F1) and Hair goat kids, daily feed consumption, daily live weight gain and feed conversion ratio were stated 820.00, 795.00, 936.00 g, 104.00, 104.00, 121.00 g and 7.92, 7.51, 7.71 kg respectively (Atay, 2016). The carcass yield, carcass lengths, eye muscle depths of kids were declared 46.43, 47.23, 46.06 (%), 74.65, 73.23, 70.64 cm and 3.00, 3.91, 3.08 cm, respectively. Also, brightness, redness, yellowness and cutting force values of meats obtained from kids were reported 43.65, 44.87, 51.75; 18.90, 20.41, 18.24; 5.31, 6.90, 7.09 and 4.00, 8.41, 7.86 kg respectively. In another study conducted in Saanen and Alpine kids, the fattening performance and carcass characteristics of kids were compared (Yaralı *et al*., 2018). Daily feed consumptions and daily live weight gains of kids were stated 741.00, 963.00 g and 96.00, 89.00 g respectively. In the same study, the hot carcass weights of kids were reported 10.69, 15.12 kg respectively, the cold carcass weights were 10.42, 14.66 kg, the carcass yields (%) were 46.45, 49.57, the head weights were 1.52, 2.23 kg, the leather weights were 1.63, 2.46 kg, the 4 foot weights were 0.63, 0.80 kg, the carcass lengths were 57.89, 62.00 cm, the rump lengths were 33.64, 36.50 cm, the rump widths were 16.88, 18.75 cm, respectively. The values obtained in terms of feed consumption, daily live weight gain and feed conversion ratio of Cukurova Boer kids in the present study were better than pure or crossbreed breeds such as Hair goat, Saanen × Hair goat (F1) and Alpine × Hair goat (F1) (Atay, 2016), Saanen and Alpine (Yaralı *et al*., 2018). When the findings of the current study are compared with the literature, although the kids have similar values in terms of some carcass characteristics depending on their breed and yield direction, it was seen different values in terms of some carcass characteristics. The brightness (L*) value of meat in Cukurova Boer kids was higher than the brightness of meats obtained from Hair goat, Alpine × Hair goat (F1) and Saanen × Hair goat (F1) breeds used in the study conducted by Atay (2016); however, it was lower than redness (a*) and yellowness (b*) values. In addition, it was determined that the cutting force value of the meats obtained from Cukurova Boer kids was found to be higher that of the meat obtained from Hair goat kids; however, it was determined similar to Alpine × Hair goat (F1) and Saanen × Hair goat (F1) crossbreed.

CONCLUSIONS

As a result, the current study examined the fattening and carcass characteristics of lamb and kid types, which improved fattening characteristics. In terms of quality of meat, kid meat has been found to be almost as good as lamb meat, and these findings are thought to be derived from the genotype characteristics of the Boer type. It can be said that the potential of local hair goats and Awassi sheep for red meat production can be increased with this type of study. In addition, important findings were obtained towards change the consumer's negative perception (goat meat smell, hardness, and negative effect on intestinal health, etc.) on the consumption of goat meat in the market. According to these findings, it can be said that the current study was successful in terms of increasing yield quantity and meat quality in native goat genotypes especially.

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Statement of conflict of interests

The authors have declared no conflict of interests.

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