Journal of Animal and Veterinary Advances 10 (10): 1350-1354, 2011
ISSN: 1680-5593

Fattening Performance, Carcass Characteristics and Meat Quality Traits in Hair Goat (Anatolian Black) Male Kids

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Abstract: This study was performed to determine the fattening performance, carcass and meat quality characteristics of male Hair goat kids. A total of 13 kids at about 3 month of age were fattened for 60 day. Average live weight of kids were 14.79±0.68 kg at the beginning of the fattening, 19.72±0.98 kg at the end of the fattening, 0.082±0.010 kg for daily live weight gain, 7.78 kg for concentrate consumption per 1 kg live weight gain. The slaughtering and carcass characteristics of Hair goat kids were found as 19.84±0.95 kg for slaughtering weight 8.93±0.49 kg for warm carcass weight, 8.45±0.47 kg for cold carcass weight, 42.38% for dressing percentage, 0.113±0.021 kg for kidney-pelvic fat weight, 0.136±0.020 kg for internal fat weight, 1.37±0.06 kg for leg weight, 0.677±0.052 kg for back-loin weight, 1.00±0.051 kg for fore-arm weight, 0.278±0.025 kg for shoulder weight, 0.470±0.025 kg for neck weight, 0.384±0.033 kg for flank-chest weight, 8.36±0.80 cm^2 for M. Longissimus dorsi area and 2.56±0.18 cm for M. Longissimus dorsi depth. The rational portions of valuable parts and fats in carcasses of the kids were found as 32.93±0.38, 15.95±0.43, 23.94±0.33, 6.55±0.31, 11.31±0.41, 9.02±0.40, 1.312±0.46 and 1.41±0.15% for percentages of leg, rack-loin, fore-arm, shoulder, neck, flank-chest, kidney-pelvic fat and internal fat, respectively. Average moisture, ash, protein and fat values of meat samples were found as 75.70, 1.04, 18.91 and 3.23%, respectively. pH values of meat samples were found as 5.71. L*(lightness), a*(redness) and b*(yellowness) values were respectively recorded as 50.24, 15.97 and 11.39.

Key words: Anatolian black, carcass, fattening, goat meat, kid, meat quality

INTRODUCTION

Goats draw attention as a species usually bred by poor masses with low education level without using so many inputs in developing countries due to the reasons that they are better benefit from low quality feeds and more resistant against negative environmental conditions compare to other livestock (Koyuncu and Tuncel, 1996). Total 5.5 million goat existence is composed of Hair goats (Anatolian Black) with 97% ratio in Turkey. It is reported that the share of Hair goat meat in total red meat production is 3%. Goat carcass weight average is about 18 kg in Turkey (Anonymous, 2008). However, it can also be said that Hair goat meat production not included in statistics is also in considerably high amounts. In addition such a high carcass weight average is an indicator of the fact that production is not kid-weighted.

Existing species should be benefited in the maximum level to meet animal protein deficit. It is not only necessary to remove prejudices of people about goat (kid) meat and to indicate its positive aspects but also develop the idea of benefiting from kids as a meat source and to make plannings in this direction (Morand-Fehr *et al*., 2004). Scientific studies related with Hair goat in Turkey have mostly taken place in form of cross-breeding efforts orienting to increase fertility and milk yield in Turkey. The number of studies related with fattening and carcass traits of cross-breeds obtained with this cross-breeding efforts is low, additionally it is not wrong to say that the studies orienting to Hair goat kids are also limited in number. If it is considered that goat carcass average of the world does not exceed 12 kg, goat meat production should also be increased for qualified goat meat production in Turkey. Since breeders in Turkey do not have a practice like early weaning or artificial nutrition in kids, kid meat production is realized by marketing kids pastured with their mothers when they are about 6-7 months old as a result of natural nutrition. Weight of kid carcasses producted in this way is about 16-18 kg.

It is remarkable that not only the number of studies related with fattening performance and carcass characteristics of Hair goat kids weaned in early ages in intensive conditions but also the number of studies orienting to determine their meat quality is limited. However, one of the aims in stock farming is to obtain qualified meat.

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This research was made in order to determine fattening, slaughter, carcass characteristics and eat quality traits of Hair goat male kids exposed to intensive fattening in about 3 months age under intensive conditions.

MATERIALS AND METHODS

Animal material of this study is composed of male kids obtained from Hair goat flocks in scope of the Improvement Project named as Kavsit Village and its Vicinity Goat Breeding and Improvement Project. The improvement project started in 2003 and is still carried out in Aydin city Cine district. This study is one of identification purpose studies conducted within the scope of said improvement project. For this aim, single-born male kids of 4-5 years old mothers were determined to be used in the research and these kids were weaned in about 2.5 months age. Following the weaning, the kids were brought to Adnan Menderes University, Cine Vocational School, Practice and Research Unit and exposed to intensive fattening for a period of 60 days in about 3 months age.

The initial weight of the kids were determined. Initial body measurements of kids were determined by taking their height at withers, heart girth, hearth depth, legs girth, hearth width back of withers and body length at the beginning of the fattening. The kids were fed with a thin form concentrate mixture of *ad libitum* containing 90% dry matter, 167.7 g crude protein, 60.9 g crude ash, 24.4 g crude fat, 2407 Kcal ME and 100 g minced qualified clover hay/kid/day during the whole fattening period. Clean drinking water was always available for kids. Kids were weighed in every 14 days during the period of fattening and their live weights and live weight increases given and remained amounts of feeds were weighed and so their feed consumption was calculated. Final body measurements of kids were recorded as defined above and final live weights were determined by weighing at the end of fattening period. Then, the kids were weighed just before slaughter and slaughter weights were determined. Following slaughter, head, all four feet, skin, heart+lungs and liver, internal fat and hot carcass weights were recorded by weighing with a scale precise to 10 g and carcasses were rested in cold storage operating at +4°C for a period of 24 h. At the end of this period, carcass, kidney, kidney-pelvic fats, testis and tail weights were determined, carcass length was recorded by measuring with measuring tape. As a result of this, carcasses were divided into two symmetric parts along the spine, weight of left half carcass was determined and splitting processes were held on the left half carcass. Left half carcasses were divided into parts like leg, back-loin, shoulder, neck, forearm and flank-chesst (Colomer-Rocher *et al*., 1987) and each part was weighed and recorded. Dressing percentage, cooling loss by-products, ratios of different organs and carcass parts were found through calculation from data obtained. Musculus Longissimus Dorsi (MLD) section areas received from the region between 12th and 13th rib from the left half carcass were drawn on tracing study and their areas was measured with planimeter. Moreover, MLD depth was also measured and recorded.

Total fat analyses were held according to AOAC (2000) with specification of total moisture, total ash, crude protein held in order to determine meat quality of kids and with the method of solvent extraction.

The method applied by Tarladgis *et al*. (1960) was used in order to determine fat oxidation degree in samples in Thiobarbituric Acid (TBA) specification. The method is based on spectroscopic measurement of the intensity of red color malonaldehydes as second-order products generated as a result of fat oxidation give with 2-thiobarbituric acid in glacial acetic acid environment at 538 nm. Result was found as mg malonaldehyde per kg meat.

For pH determination, 100 mL distillate water was added on 10 g sample and homogenized in mixer. pH meter electrode standardized with buffer solutions was immersed in this homogenized mixture and measurement was held (AOAC, 2000). Minolta (Model CR 300,Osaka, Japan) brand color meter was used in color measurement of samples and color parameters, L*(lightness), a*(redness) and b*(yellowness) were determined. Meat samples were firmly blundered and homogenized then dispersed on covers of petri plates and bottom of petri plates were inserted in a way no air space will remain. Reading was held by directly contacting optic reader on petri surface. About 6 readings were held on each area and their average was calculated. The data obtained was evaluated with the least squares method (SAS, 1998). Standardization process was applied according to kid age while evaluating data obtained from kids.

RESULTS AND DISCUSSION

The values for initial and final body measurements obtained from Hair goat kids are shown in Table 1 and the values for live weight in different periods, total live weight gains and average daily live weight gain among different periods in hair goat male kids during the fattening period are shown in Table 2. As it is shown in Table 2 total live weight gains of the kids occurred as 4.93±0.66 kg and average daily live weight gain occurred as 0.082±0.010 kg during 60 day of fattening period while initial weight average was 14.79±0.68 kg.

Table 1: Inital and final body measurements of Hair goat kids

	n	$\bar{X}\pm s_{\bar{X}}$ (kg)	Max (kg)	Min (kg)
Initial body measurements				
Height at withers	13	53.31±1.15	44.0	59.0
Body length	13	50.31±0.78	45.0	55.0
Hearth width back of withers	13	13.13±0.40	10.5	15.9
Hearth depth	13	19.99±0.31	17.5	22.0
Hearth girth	13	61.00±1.34	54.0	68.5
Legs girth	13	44.11±0.67	39.0	47.0
Final body measurements				
Height at withers	13	59.23±0.81	55.0	65.5
Body length	13	57.0±1.01	52.0	62.5
Hearth width back of withers	13	14.92±0.42	13.0	19.0
Hearth depth	13	23.73±0.61	20.0	28.0
Hearth girth	13	68.62±1.64	60.0	79.0
Legs girth	13	57.35±1.18	49.5	68.0

Table 2: Live weights, live weight gains ve average daily live weight gains in various periods

Traits	n	$\bar{X}\pm s_{\bar{X}}$ (kg)	Max (kg)	Min (kg)
Initial weight	13	14.79±0.6800	10.830	17.920
Day 14	13	15.47±0.6800	12.400	19.600
Day 28	13	16.06±0.7500	12.000	20.850
Day 42	13	17.74±0.7500	14.300	23.850
Day 60	13	19.72±0.9800	14.900	26.450
Total live weight gain				
Day 0-14	13	0.678±0.324	-1.380	2.070
Day 0-28	13	1.270±0.479	-0.980	3.270
Day 0-42	13	2.946±0.506	-0.170	5.930
Day 0-60	13	4.927±0.657	0.600	8.530
Average daily live weight gain				
Day 0-14	13	0.048±0.022	-0.098	0.148
Day 0-28	13	0.046±0.026	-0.035	0.117
Day 0-42	13	0.070±0.011	-0.004	0.141
Day 0-60	13	0.082±0.010	0.010	0.142

Average daily live weight gains in Damascus×Hair goat cross bred single and twins male kids were respectively determined as 0.153 and 0.106 kg. In a study which compares slaughter and carcass characteristics of Hair goat kids taken into intensive fattening and those breed under rural conditions, average daily live weight gains was respectively found 0.128 and 0.027 kg. In another study held on Hair goats and Saanen×Hair goat (F_1) cross breeds, average daily live weight gains values of kids were determined, respectively 0.123 and 0.108 kg during 98 day of fattening period (Simsek and Bayraktar, 2007). Average daily live weight gains was reported as 102.3 g in hair goat kids taken into intensive fattening in 4 month age for 56 day in a study held by Koyuncu *et al.*(2007).

In this study, the findings obtained for average daily live weight gains were reported generally lower compare to the studies held in the form of intensive fattening in hair goat kids and hair goat crossbreed kids as stated above.

The values for daily feed consumption consumption in Hair goat kids during the fattening period and feed consumption for 1 kg live weight gains (feed conversion efficiency) are shown in Table 3. In this study was

Table 3: Daily feed consumption and feed conversion efficiency in Hair goat kids

Days	Daily feed consumption	Feed conversion efficiency
0-14	0.37	7.61
0-28	0.42	9.36
0-42	0.48	7.97
0-60	0.57	7.78

Table 4: Slaughter and carcass characteristics in Hair goat kids

Characteristics	n	$\bar{X}\pm s_{\bar{X}}$ (kg)	Max. (kg)	Min. (kg)
Slaughter weight (kg)	13	19.84±0.95000	15.00	26.55
Warm carcass weight (kg)	13	8.93±0.49000	6.80	12.80
Cold carcass weight (kg)	13	8.45±0.47000	6.40	12.20
Dressing percentage (%)	13	42.38±0.71000	36.15	46.19
Coolling loss (%)	13	5.43±0.38000	3.39	8.33
Head weight (kg)	13	1.58±0.13000	1.16	3.04
4 feet weight (kg)	13	0.693±0.0190	0.58	0.81
Skin weight (kg)	13	1.715±0.0710	1.19	2.21
Heart, lungs and liver weight (kg)	13	0.407±0.0210	0.29	0.55
Testes weight (kg)	13	0.080±0.0110	0.02	0.19
Kidney weight (kg)	13	0.082±0.0040	0.06	0.12
Kidney and pelvic fat weight (kg)	13	0.082±0.0210	0.03	0.30
Internal fat weight (kg)	13	0.136±0.0200	0.05	0.31
Spleen weight (kg)	13	0.097±0.0520	0.03	0.70
Liver weight (kg)	13	0.394±0.0160	0.30	0.30
Left half carcass weight (kg)	13	4.19±0.23000	3.20	6.00
Leg weight (kg)	13	1.37±0.06000	1.08	1.81
Back-loin weight (kg)	13	0.677±0.0520	0.44	1.06
Forearm weight (kg)	13	1.000±0.0510	0.73	1.36
Shoulder weight (kg)	13	0.278±0.0250	0.18	0.48
Neck weight (kg)	13	0.470±0.0250	0.31	0.64
Flank-chest weight (kg)	13	0.384±0.0330	0.24	0.62
Tail weight (kg)	13	0.033±0.0028	0.02	0.05

determined daily feed consumption of Hair goat male kids as 0.57 kg and feed conversion efficiency as 7.78 kg. This value is similar to other studies held on hair goat kids and hair goat F_1 crossbreed kids (Koyuncu and Tuncel, 1996; Simsek and Bayraktar, 2007).

Slaughter and carcass characteristics for kids slaughtered at the end of fattening are shown in Table 4 and the ratios for different carcass parts are shown in Table 4. Slaughter weight, hot carcass weight, cold carcass weight and dressing percentage of kids were determined respectively as 19.84, 8.93, 8.45 kg and 42.38%. Dressing percentage value obtained in this study was generally found lower compare to other studies (Koyuncu *et al*., 2007; Yilmaz *et al*., 2009).

Kidney and pelvic fat rate and internal fat weight rate was determined, respectively as 1.31 and 1.41% in this study, these values obtained are lower than the values obtained by Koyuncu *et al*. (2007) and Simsek and Bayraktar (2007) who studied on Hair goat kids. Leg, back-loin and fore-arm rates from which valuable meats are obtained were determined, respectively as 32.93, 15.95 and 23.94 as shown in Table 5. This value is also lower than the values found by other researchers in general (Koyuncu *et al*., 2007).

Average values obtained as a result of physicochemical analyses on MLD were determined in Hair goat male kids are shown in Table 6.

Table 5: Proportional yields offal items and wholsale carcass cuts relative to cold carcass weights

Ozellikler	n	$\bar{X}+s_{\bar{X}}$ (kg)	Max. (kg)	Min. (kg)
Offal items				
Head (%)	13	8.04±0.5600	5.35	13.66
4 feet (%)	13	3.56±0.1100	2.91	4.37
Skin (%)	13	8.72±0.2500	7.53	10.61
Heart, lungs and liver (%)	13	2.06±0.0600	1.66	2.27
Testes (%)	13	0.817±0.090	0.29	1.61
Kidney (%)	13	0.999±0.059	0.74	1.56
Kidney and pelvic fat (%)	13	1.312±0.270	0.46	4.17
Internal fat (%)	13	1.41±0.1500	0.66	2.50
Wholesale carcass cuts				
Legs (%)	13	32.93±0.3800	30.17	35.11
Back-loin (%)	13	15.95±0.4300	13.75	18.54
Fore-Arm (%)	13	23.94±0.3300	22.19	25.84
Shoulder (%)	13	6.55±0.3100	4.13	8.25
Neck (%)	13	11.31±0.4100	8.96	13.98
Flank-Chest (%)	13	9.02±0.4000	7.02	10.94
Tail (%)	13	0.816±0.045	0.62	1.23
Carcass length (cm)	13	60.81±1.2700	55.50	69.00
MLD area (cm^2)	13	8.36±0.8000	4.10	13.60
M. Longissimus dorsi depth (cm)	13	2.56±0.1800	1.61	3.62

Table 6: Meat quality traits of Hair goat kids

Traits	n	$\bar{X}+s_{\bar{X}}$ (kg)	Max. (kg)	Min. (kg)
Moisture (%)	13	75.699±0.249	75.334	75.921
Ash (%)	13	1.038±0.048	0.970	1.070
Protein (%)	13	18.912±0.660	18.110	19.950
Fat (%)	13	3.225±0.847	2.280	4.400
pH	13	5.708±0.047	5.650	5.760
TBA (mg malonaldehit kg^{-1})	13	0.073±0.012	0.062	0.094
Colour				
L*	13	50.237±2.045	48.740	53.910
a*	13	15.968±2.694	13.280	18.580
b*	13	11.393±0.350	11.370	11.800

L* = lightness, a* = redness, b* = yellowness

Average moisture, ash, protein and fat values of kids meat samples were, respectively found as 75.70, 1.04, 18.91 and 3.23% in this study. While the protein value obtained in the study was found higher compare to findings of the study held by Darcan and Cankaya (2008) on Hair goat crossbreeds, it was observed that % fat ratio is lower than the value obtained in said study. Fat and protein values (7.9 and 24.83%) in steer South African local goats are higher than the values obtained in this study.

pH values of meat samples were found as 5.71 in average. It was observed that this value is close to the values found by Darcan and Cankaya (2008) in crosbreed goat meats exposed to showering and ventilation and the value found by Yilmaz *et al.*(2009) in hair goat kids.

While the color parameters in kid meat samples are examined (Table 6), average L*, a* and b* values were, respectively recorded as 50.24, 15.97 and 11.39. It was reported that these values is higher than L* and b* values but lower than a* value obtained in a study held in Umman (Kadim *et al.*,2003) while higher than L* and a* values but similar to b* value found by Lee *et al.* (2008). L*, a* and b* values in another study held on Hair goat kids are lower than the values obtained in this study (Yilmaz *et al.*, 2009).

TBA values of the samples were found 0.073 in average in the study (Table 6). This value is considerably lower than 1.0 mg malonaldehyde per kg accepted as the critical value of lipid oxidation for meat and meat products.

It can be said that the values of average daily live weight gain, benefiting from feed and carcass efficiency obtained from Hair goat kids taken into intensive fattening in 3 months age for 60 day period occurred considerably low in intensive fattening conditions. Lower values obtained in this study compare to other studies held on the same strain may be explained by the fact that kids were taken into fattening in a very little age and average temperature was high during the fattening period (Average: 27.2°C, minimum: 19.05°C and maximum 34.8°C). Since the main aim of the study was to contribute in determining the potential and quality owned by Hair goat kids in terms of meat production, results were just compared with findings of other researches held with Hair goats.

Turkey has a significant potential in terms of Hair goat existence. However, goat meat consumption is decreasing. On the other hand, goat meat consumption is increasing in countries with subtropical and arid climate that have 90% of the world goat existence. Western world do not likes goat meat (Teh, 1992; Webb *et al.*, 2005). However, goat meat is consumed in religious holidays, rural areas where goat cultivation is widespread particularly warm Southern regions and with tandoori cooking technique in different regions in Turkey. Since pork meat is not consumed in Muslim countries, sheep and goat meat is the most important alternative of beef. In spite of this, the share of goat meat in total meat production is about 3% in Turkey (Anonymous, 2008). Moreover, it should also be emphasized that there is an informal consumption nor reflected in the statistics. The most important reasons why this ratio is low are those urban people are used to consume beef, there are prejudices about goat meat (like the suggestion that it causes diarrhea) and kid meat supply cannot be provided in markets located in large cities in sufficient amount. The studies held show that kid meat is not worse than lamb meat (Webb *et al.*, 2005). For this reason, efforts to increase goat meat consumption are directly related with regular product flow in the market and informing efforts orienting to remove prejudices. Share of kid meat should be increased in total goat meat production in order to ensure doing qualified production. Hair goat breeding is performed in intensive form in Turkey and kids are marketed as butchery when they are about 5-6 months age as a result of natural nutrition. Therefore, kid fattening is not performed. For this purpose, the methods to enable intensive kid fattening profitable as well as efforts to

increase marketing possibilities should be carried out. Because, it is not only related with the requirement of using protein sources held in the most efficient way but also significant for masses not having alternative production branches as goat breeders.

CONCLUSION

In this study, real potentials of hair goats that constitute 97% of total goat existence should be introduced in terms of meat production potential and meat quality in Turkey. In order to achieve this, different nutrition methods should be applied on kids and a greater number of studies should be held to determine the most appropriate fattening method, initial ages before fattening and fattening period in locality basis by taking kids into fattening in different ages and periods. Meat quality should also be carefully dealt with in these studies.

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