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A STUDY ON CARCASS CHARACTERISTICS AND MEAT QUALITY OF BALADI GOAT KIDS

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ABSTRACT

Eighteen male Baladi goat kids belonging to the sheep and goat farm of the Faculty of Agriculture, Cairo University, were used to study effects of castration age and slaughter age on carcass characteristics and quality of their meat. Kids were classified into three equal groups, each of six kids. Animals in the first group were castrated at 2 wk of age, those in the second group were castrated at 6 mo, whereas animals in the last group were left intact. Half the animals in each group were slaughtered at 12 mo of age where the others were slaughtered at 16 mo.

Pre-slaughter weight (PSW), empty body weight (EBW), body measurements at slaughter, carcass weight, dressing % on both PSW and EBW, internal offals, non-carcass fat and weights of carcass cuts were, generally, higher for castrated than intact kids and for older than younger ones. Between castrates, these values were mostly higher for 6-mo than for 2-wk castrates. External offals were mostly heavier for entire and older kids. Generally, meat of castrated kids was slightly more tender with higher pH values and lower water holding capacity (WHC) than entire kids. Moisture content was the highest in the meat of 6 mo castrates . Fat and ash contents were higher in castrated than entire kids . However , protein content was higher in intact than castrated kids , particularly in the leg muscle. Older kids had lower tenderness , WHC, marbling fat, protein and ash , but higher moisture than younger ones .

Keywords : Male goats, carcass, castration, slaughter age.

INTRODUCTION

Goats have been considered important meat – producing animals in the tropics and subtropics. The lower fat content of goat carcasses (Babiker *et al.*, 1990) compared to other meat sources may encourage the acceptance of goat meat (Kirton, 1970). The economic benefit of commercial goat meat production may be enhanced by marketing animals at heavier weights with carcass quality maching the consumer desire (Manfredini *et al.*, 1988). Carcass weight and dressing percentage which are important traits in meat production consideration are affected by castration and age at slaughter (Owen and Norman, 1977 and Devendra and Burns, 1983). Louca *et al.* (1977) found the entire Damascus kids, slaughtered before the onset of sexual activity, to be of higher growth rate and heavier carcass weight with more bone and less fat proportions in the carcass than castrates. At the onset of sexual activity, entire male kids are so smelly and very sexually active. The

authors concluded that castration is necessary if animals are to be kept beyond the time of sexual activity since it will improve meat flavour, proportion of lean meat and reduce management troubles. Other workers reported that castration either done at 6 months of age (El-Bayomi and El-Sheikh, 1989) or at one month (Hassan, 1991) had no significant effect on meat production traits when kids were slaughtered at 12 or 18 months of age.

Meat quality is of utmost importance to consumers. Physico-chemical characteristics of meat determine its quality. Castration is one of the most important factors influencing meat quality in animals. Kumar *et al.* (1981) observed high scores for flavour, tenderness and overall satisfaction in carcasses of castrated Barbari kids than those from intact ones.

Thus, this study was designed to investigate the effect of slaughter age (12 or 16 mo) and age at castration (2 wk or 6 mo) on carcass and meat quality characteristics of Baladi kids.

MATERIALS AND METHODS

Eighteen male Baladi kids born during late autumn 1995 , belonged to goats flock of the Faculty of Agriculture, Cairo University, Egypt were used in the present study. Within 24 h after kidding, kids were ear tagged and weighed to the nearest 10 grams using a spring balance. Birth weight averaged 2.08 kg.

Management and feeding:

During the suckling period (12 weeks), kids with their dams were kept in a semi-opened pen with a yard. Beside suckling, kids were creep-fed, starting from the fifth week of age, on a ground grain mixture at an average rate of 100 g per head daily to encourage high growth. The grain mixture consisted of 35% yellow corn, 35% barley and 30% soyabean meal.

After weaning, kids were fed *ad libitum* on Egyptian clover (*Trifolium alexandrinum*) in winter and sorghum (*Sorghum bicolor*) or clover hay in the rest of the year according to their availability. At weaning time, each kid was supplemented daily with 200 grams of the ground grain mixture, increased gradually to reach 400 grams by the sixth month of age. Afterwards, a daily allowance of 500 grams pelleted concentrate mixture plus 250 grams barley was given to each kid till the end of experiment. The pelleted mixture consisted of 42% undecorticated cotton seed meal, 25% wheat bran, 22% yellow corn, 5% rice bran, 3% molasses, 2% lime stone and 1% common salt. Kids had free access to water.

Experimental procedure:

Experimental kids were randomly classified into three equal groups i.e. 1) entire kids, 2) kids castrated at 2 weeks of age and 3) kids castrated at 6 months of age. Castration was practiced using a silk string tied strongly around the neck of testes at their connection point with spermatic cords. About 15-20 days later, the scrotum, including testes, dropped off.

Three kids from each group were randomly chosen to be slaughtered at 12 months of age, whereas the other three were slaughtered at 16 months.

Kids were fasted for about 18h before slaughtering them in the Islamic (Halal) way by severing the throat and major blood vessels in the neck at the allanto-occipital joint. Pre-slaughter body weight (PSW) and body measurements were recorded just before bleeding the animals. Body measurements, recorded by a measuring tape, were body length, height, heart and paunch girths and leg length.

Each carcass was deskinned and decapitated. External offals (head, skin and feet) were removed and weighed. Internal offals (heart, lungs and trachea, liver, kidneys, spleen and full digestive tract) were separated from the dressed carcass and weighed. Gut, kidney and heart fats were separated, weighed and considered as total non-carcass fat. The digestive tract was emptied, drained and weighed. Gut contents were calculated as the weight of full minus empty digestive tract. Empty body weight (EBW) was calculated by subtracting the weight of gut contents from PSW. Carcasses were weighed hot (about 1h after slaughter). Dressed carcass was then longitudinally split into approximately two equal halves and weighed. The right half was cooled at 5C° for 24h. The chilled half of each carcass was reweighed and split into 8 cuts according to Weniger *et al.* (1963). These carcass cuts were leg, loin, flank, shoulder, brisket, neck, middle neck and best end of neck.

In addition to their absolute weights, external offals were expressed as percentages of PSW, whereas internal offals and non-carcass fat were expressed as percentages of EBW. However, carcass cuts were expressed as percentages of chilled carcass weight. Dressing percentage, based on both PSW and EBW, was calculated.

Chemical and physical analysis of meat :

Meat samples from *longissimus dorsi* and *semitendenosus* muscles were prepared after removing fat and tendons around meat and then chemically analysed to determine moisture, fat and ash according to AOAC (1990). Protein was estimated by difference as recommended by O'Mary *et al.* (1979).

pH value was determined in fresh meat (1-hour after slaughter) to the nearest 0.01 using a pH meter.

Expressible fluid (EF) was measured by weighing a sample of about 0.3 g (w1) ,then put on a filter paper under pressure (1000 g) for 10 min. and weighed again (w2). The percentage of EF was estimated as :

$$\frac{W1-W2}{W1} x100$$

Tenderness was tested on cubes of meat cooked for 30 min. in a boiled water containing 9% NaCl, then taken away and left to reach room temperature. Tenderness was measured using Warner Bratzler Shear apparatus. The higher the shear value the less tender the meat.

Longissimus dorsi area was measured in cm^2 using a planometer.

Statistical analysis :

Data were analysed by least squares procedure of the General Linear Models Program of SAS (SAS, 1995). A fixed effects model including age at castration (2 weeks, 6 months and non – castrated kids) and age at slaughter (12 and 16 months) was utilized. Differences among means within each classification were tested using Duncan's New Multiple Range Test. Simple phenotypic correlation coefficients among some traits were calculated.

RESULTS AND DISCUSSION

1- Body weight and body dimensions at slaughter:

Table (1) shows that 6- month castrates had heavier pre-slaughter weight (PSW), empty body weight (EBW) and higher body measurements at slaughter than entire kids, meanwhile those castrated at 2 weeks of age were in between except for leg length where they scored the highest estimate. The significant effect of castration on the above mentioned traits was confined only to EBW and paunch girth. However, least squares menas of PSW and heart girth differed significantly between entire and 6-month castrated kids, though the effect of castration on these traits was not significant. Some authors (Hassan, 1991; Azamel *et al.*, 1992 and El-Feel, 1994) came to different findings and reported that entire male kids had heavier slaughter weight than castrates due to the anabolic effect of testosterone. However, Rhodes (1969) and Fowler (1980) concluded that castrated male pig had a greater appetite than boar. This can reduce, or even reverse , growth superiority exhibited by the boar over castrated male by depositing more adipose tissue, particularly when plenty feed is available. Our findings agree with those of Misra *et al.* (1986) and Prasad *et al.* (1992) who found the slaughter weight of castrated kids to be significantly higher than entire ones.

It was observed from Table (1) that 2-week and 6-month castrates, respectively were 9.9 and 24.6% heavier in PSW and 16.6 and 33.8% heavier in EBW than entire kids. Superiority of castrates over entire kids was more pronounced in EBW than in PSW. This could be due to the low percentages of gut contents, calculated on PSW basis, of castrates compared to that of entire kids. These percentages were 15.34, 10.15 and 9.12% for entire kids, 2-week and 6-month castrates, respectively. This may explain the more pronounced effect of castration on EBW rather than on PSW. The higher body dimensions of castrates over those of entire kids could be attributed to their higher PSW. Correlation coefficients of 0.79, 0.81, 0.97, 0.91 and 0.77 were calculated between PSW and each of body length, height at withers, heart girth, paunch girth and leg length, respectively. All these correlations were significant ($P<0.01$). Singh *et al.* (1994) calculated significant and positive correlations for slaughter weight of kids with their body dimensions.

Kids slaughtered at 16 months of age exhibited higher PSW, EBW and body measurements than those slaughtered at 12 months (Table 1). The influence of slaughter age on these traits was not significant except that on body length which was significant (P<0.01). Agnihotri and Pal (1997) found the slaughter weight of older bucks to be significantly higher than that of younger ones.

2- Carcass weight and dressing %:

Hot carcass weight and dressing percentage, based on both PSW and EBW, were the highest for 6-month castrates (Table 1). The effect of castration was significant (P<0.05) only on dressing % based on EBW. Though the effect of castration on carcass weight was not significant, mean of entire kids differed significantly (P<0.05) from that of 6-month castrates, whereas the difference between means of the two castrated groups was not significant. Carcass weight was 8.05 and 26.0% higher for 2-week and 6-month castrates, respectively over that of entire kids. Misra *et al.* (1986) and Prasad *et al.* (1992) reported significant superiority for carcass weight of castrated kids over that of entire ones. Hassan (1991) found a slight increase in carcass weight of castrated Baladi and their crossbred kids with Anglo-Nubian goats over that of entire ones. Table (1) shows higher values for dressing % based on EBW over those on PSW basis, probably due to large amounts of gut contents as previously indicated by Misra *et al.* (1986) and Ruvuna *et al.* (1992). In the present study, the pronounced significant differences between castrates and entire kids in dressing % based on EBW as compared to those based on PSW could be due to the marked differences in the percentage of gut contents among kid groups. Misra *et al.* (1986) and Hassan (1991) found that dressing % either based on slaughter weight or empty live weight were higher for castrated than for entire kids.

Male kids slaughtered at 16 months of age scored higher hot carcass weight and dressing % on both PSW and EBW basis (Table 1). The difference between the two age groups was significant (P<0.01) only for dressing % on EBW basis. These results support the earlier reports indicating the significant superiority of older over younger kids in their hot carcass weight (Singh *et al.* 1991; Singh *et al.*, 1994 and Agnihotri and Pal, 1997) and dressing % on empty body weight basis (Ruvuna *et al.,* 1992; Singh *et al.*, 1994 and Misra and Prasad, 1996).

3- External offals:

Table (1) shows that means of head and skin weight were significantly higher for entire than for castrated kids. However, weight of four limbs exhibited a reverse trend, being significantly higher for 6-month castrates than entire kids. Percentages of these organs, on PSW basis, were all higher for intact than for castrated males, possibly due to higher weight of external offals or lighter PSW of entire kids. Prasad *et al.* (1992) reported lower proportion of limbs in castrated kids. Furthermore, Mahgoub and Lu (1998) found that proportion of head and feet decreased with increasing body weight of kids. Lawrence and Fowler (1997) stated that androgen hormones have a marked effect on skeletal growth. Castrated animals have bones which are

smaller in diameter than those of intact animals, but the length may actually be increased in castrates if they are retained until mature.

Table (1) also shows slightly heavier weights of head and four limbs, but lighter skin weight in older than in younger kids. However, proportions of external offals were all higher in younger kids. The effect of slaughter age on skin percentage was the only one which was significant ($P<0.01$). Agnihotri and Pal (1997) found the percentages of skin, head and cannons to be significantly higher for younger kids.

4- Internal offals:

Table (2) shows that weights of internal offals were higher for castrated than entire kids. Between castrates, 6-month castrates had mostly heavier offals than those castrated at 2 weeks of age. This finding could be attributed to the heavier empty body weight of 6-month castrates over the other two groups. Correlation analysis confirmed this finding. Positive and significant correlation coefficients of 0.82, 0.73, 0.80, 0.57 and 0.83 were calculated between EBW and weight of each of heart, lungs and trachea, liver, spleen and kidneys, respectively, whereas the correlation between EBW and empty gut was not significant (0.44). The significant effect of castration on weight of individual and total internal offals was confined only to spleen weight. Percentages of internal offals, based on EBW, were slightly and insignificantly higher for 2-week castrates than the other two groups, except those of heart and kidney which were significantly the highest for entire kids, probably due to their lower EBW compared to that of castrates. El-Feel (1994) found that castrated Baladi kids and their crossbreds with Alpine and Anglo-Nubian had significantly higher edible offal percentages than entire kids.

Weights of heart, liver, kidneys and lungs and trachea were heavier for older animals, while that of spleen, empty gut and total internal offals showed a reverse trend (Table 2). Age at slaughter affected significantly weights of lungs and trachea and empty gut, whereas its effect on the other offals was not significant. Younger kids exhibited significantly higher percentages of spleen, kidneys, empty gut and total offals, whereas percentage of lungs and trachea was significantly higher in older kids. However, percentages of heart and liver were similar in both age groups. These findings support those of Agnihotri and Pal (1997) who found that percentages of edible organs were significantly higher in younger animals.

5- Non-Carcass fat:

Weight and percentage, on EBW basis, of fat of heart, kidneys, gut and total fat were significantly higher for castrates than for entire kids (Table 2). Between castrates, 6-month castrated kids had more deposited fat than 2-week castrates except for weight and percentage of heart fat which were higher in the latter group. Fowler *et al.* (1981) concluded that castrated male pigs fed *ad libitum* had heavier slaughter weight than boars due to deposition of more adipose tissue in their bodies. The correlation coefficients of PSW

with each of heart, kidney, gut and total fat weight were 0.32, 0.83, 0.87 and 0.88, respectively. All these estimates were significant (P<0.01) except the first one which was not. Prasad *et al.* (1992) reported that castrated kids either reared individually or in groups had higher kidney and cavity fat than entire ones. Furthermore, Ruvuna *et al.* (1992) found that intact male kids averaged 8% less fat than castrates at 23.9 months of age.

Table (2) also shows that weight and percentage of kidney, gut and total fat increased, while those of heart fat decreased with increasing age at slaughter. The effect of slaughter age was significant on weight and percentage of gut and total fat beside the percentage of heart fat, but was insignificant on weight of heart fat and weight and percentage of kidney fat. Butterfield *et al.* (1983) stated that fat has a tendency to grow unabated even after the growth of muscles and bones is stopped due to its low maturity coefficient. Moreover, Agnihotri and Pal (1997) found that omental fat increased significantly in older kids.

6- Carcass cuts:

Table (3) shows that weights of leg, flank and best end of neck were significantly the highest in 6-month castrates followed by 2-week castrates ,whereas entire kids had the lowest estimates. Other carcass cuts followed, mostly, the previous trend, though insignificantly. These results might be due to heavier carcass weight of 6-month castrates over the other two groups. Correlation coefficients (Table 4) of PSW and carcass weight with weights of different carcass cuts were positive and significant. Hassan (1991) found the regression coefficients of carcass cuts on slaughter weight of kids to be positive and significant (P<0.01). Percentages of carcass cuts in different castration groups showed inconsistent trend. While 6-month castrates scored the highest percentages of flank , brisket and best end of neck , entire kids had the highest percentages of shoulder, neck and middle neck. Meanwhile, percentages of leg and loin were the highest for 2-week castrates. The highest proportion of any carcass cut could be attributed to its heavier weight, lighter carcass weight or both. The significant influence of castration on proportions of carcass cuts was confined only to proportions of leg, flank, neck and middle neck. These results support those of Hassan (1991) and Azamel *et al.* (1992). Hassan (1991) found that castrated Baladi and Baladi x Anglo – Nubian crossbreds scored heavier weights for leg and chine cuts, but lighter weights for shoulder and sets cuts than entire kids. However, effect of castration was significant on sets cuts only. The author reported that sex hormones play a major role in accelerating growth of fore quarters. Azamel *et al.* (1992) found the effect of castration to be positive on loin, leg and flank, but negative on shoulder, rack and neck, though the effect of castration was significant on neck cut only.

Weights of carcass cuts were, almost, higher in kids slaughtered at 16 than at 12 months of age (Table 3), probably due to the heavier carcass weight of the former group. However, the difference between the two groups was significant for neck and best end of neck cuts, but was insignificant for the other cuts. The percentages of flank, neck, middle neck and best end of

neck were higher, whereas those of leg, shoulder, loin and brisket (mostly best and medium quality cuts) were lower in older than in younger kids. The significant effect of slaughter age on percentages of carcass cuts was confined only to those of loin and neck. Singh *et al.* (1994) found that kids older than 12 months had significantly lower proportions of neck with shoulder and loin with flank. Misra and Prasad (1996) attributed the significant reduction in loin percentage with increasing slaughter age of kids to the early maturing property of this muscle, though none of the percentages of other carcass cuts were significantly influenced by age at slaughter. However, Agnihotri and Pal (1997) found the proportions of leg, neck and shoulder to be significantly higher from older carcasses.

Table (4): Correlation coefficients of pre-slaughter weight (PSW) and carcass weight (CW) with weight of different carcass cuts.

Traits	Weight of							
	Leg	Loin	Best end of neck	Middle neck	Shoulder	Flank	Brisket	Neck
PSW	0.89 **	0.69 **	0.75 **	0.51 *	0.88 **	0.88 **	0.88 **	0.65 **
CW	0.90 **	0.73 **	0.75 **	0.57 *	0.90 **	0.86 **	0.88 **	0.67 **

*** P < 0.05** **** P < 0.01**

7- Physical properties of meat :

In the meat of both eye muscle (*Longissimus dorsi*) and Leg (*Semitendenosus muscle*), pH values were, in general, slightly higher for castrates than for entire kids (Table 5). Means of pH values in eye muscle were the same for 12-and 16-month old kids, whereas in leg muscles, younger kids scored slightly higher pH value than older ones. Swan *et al.* (1998) reported that high ultimate pH values in the meat can indicate stressed and excited animals. Water holding capacity (WHC) in both eye and leg muscles as well as area of the eye muscle were slightly higher for entire than for castrated kids and for younger than older ones. Misra *et al.* (1986) and Prasad *et al.* (1992) found that entire male kids had significantly higher WHC values than castrates . Misra *et al.* (1986) added that early castrated kids (at 7 days of age) had higher WHC than those castrated at later ages (15 or 30 days of age), a trend that agrees with our finding which indicated that 2-week castrates exhibited higher WHC than 6-month castrates. Azamel *et al.* (1992) showed that eye muscle area was not significantly affected by castration. The correlation between non-carcass fat and eye muscle area in the present study was – 0.17. A negative correlation of – 0.44 was previously calculated between kidney fat and eye muscle area (Preston and Willis, 1972), a finding that indicates a decrease in carcass muscling with increasing non-carcass fat, particularly in older ages.

Tenderness has been and still the most important single characteristic influencing the acceptability of meat. Tenderness in the leg muscle was significantly ($P<0.01$) better in 2-week and 6-month castrates than entire kids (Table 5). Also , the shear value in the meat of younger kids was lower , but insignificantly , than that for older kids (Table 5). Kumar *et al.* (1981), Azamel

et al. (1992) and Misra *et al.* (1992) reported a superiority of castrated kids in tenderness of their meat over that of entire ones. Romans *et al.* (1965) and Swan *et al.* (1998) found that tenderness was closely and negatively correlated with age, meat became less tender as animal age increased.

8- Chemical properties of meat :

In general , moisture content in the meat of both eye and leg muscles was higher for castrated kids , particularly those castrated at 6 months of age , than for intact ones (Table 5) . Effect of castration was significant ($P < 0.05$) on moisture content of eye muscle only , but was not significant in the case of leg muscle .

In the meat of eye muscle , protein , fat and ash contents were , in general , slightly higher for castrated kids , particularly those castrated at 2 weeks of age , than entire ones . In the leg muscle, while entire kids exhibited the highest protein content , castrated ones had the highest fat content (6 – month castrates) and the highest ash content (2 – week castrates) . However , the effects of castration on contents of protein , fat and ash either in eye muscle or leg were all insignificant . Kumar *et al.* (1981) found no significant differences in moisture, protein and ash in the meat of Barbari kids due to castration, though castrated kids showed a little more fat content than entire ones. Hassan (1991) and Azamel *et al.* (1992) reported that moisture, protein and ash contents were higher while fat was lower in the meat of entire than castrated kids. Differences in these traits due to castration were significant except for the difference in ash content which was insignificant (Hassan, 1991), whereas those reported by Azamel *et al.* (1992) were all non-significant . El-Feel (1994) found that moisture content in the meat of rib cut was significantly higher, while fat content was significantly lower for entire than castrated kids.

With increasing age of kids, moisture content in the meat of leg muscle increased, while those of protein , fat and ash decreased (Table 5). The same trend was observed in the meat of eye muscle except that ash content was slightly higher in older kids. However, the effect of slaughter age on chemical composition of meat in both eye muscle and leg was not significant except that on moisture content in eye muscle ($P<0.05$). Mowlem (1992) stated that proportion of intramuscular fat in goat carcasses do not change very much with increasing age or weight of animals. Furthermore, Agnihotri and Pal (1997) found that moisture and ash contents were slightly higher while ether extract was slightly lower in the meat of older than younger Barbari kids, a result which agrees with that of the present study for the meat of eye muscle .

CONCLUSION

Castration , particularly that practiced at 6 months of age , increased slaughter weight , carcass weight , dressing percentage , edible offals , carcass cuts and slightly improved meat quality . The increase in deposited non-carcass fat due to castration appeared to play an important role in increasing slaughter weight . The changes in carcass characteristics due to

age at slaughter were less pronounced . Furthermore, the average daily weight gain of kids from birth to 12 months of age was 63.21 g., whereas that from 12 to 16 months was 24.08 g. Thus , the results of the present study recommend slaughtering Baladi kids, for meat production purposes ,at 12 months of age rather than older ages .

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دراسة عن صفات الذبيحة ونوعية اللحم فى جداء الماعز البلدى

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استخدم 18 ذكراً من جداء الماعز البلدي بمزرعة الأغنام والماعز بكلية الزراعة - جامعة القاهرة وذلك لدراسة تأثيركل من عمر الخصي وعمر الذبح على خصائص الذبيحة ونوعية اللحم. وقد قسمت الجداء إلى ثلاثة مجاميع متساوية تحتوي كل منها على 6 جداء، وقد خصيت جداء المجموعة الأولى عند عمر أسبوعين من الميلاد بينما خصيت جداء المجموعة الثانية عند عمر 6 شهور. في حين تركت حيوانات المجموعة الثالثة بدون خصي. وتم ذبح نصف عدد الجداء بكل مجموعة عند عمر 12 شهر، في حين ذبح النصف الآخر من الحيوانات عند عمر 16 شهر.

كان كل من وزن الجسم قبل الذبح ووزن الجسم الفارغ ومقاييس الجسم عند الذبح ووزن الذبيحة ونسبة التصافي محسوبة على أساس وزن الجسم قبل الذبح ووزن الجسم الفارغ وكذلك الأحشاء الداخلية ودهن الأحشاء وأوزان قطعيات الذبيحة أعلى في الجداء المخصية عنها في الجداء غير المخصية وكذلك أعلى في الجداء المذبوحة على عمر 16 شهر عنها في المذبوحة على عمر 12شهر. كما كانت أغلب تلك الصفات أعلى في الجداء المخصية على عمر 6 شهور عنها في الجداء المخصية على عمر أسبوعين. أما أغلب الأحشاء الخارجية فكانت أكبر وزناً في الجداء السليمة والجداء الأكبر عمراً.

وبصفة عامة كانت لحوم الجداء المخصية أعلى في درجة الحموضة وأقل في قدرتها على الاحتفاظ بالماء عنها في الجداء السليمة. وكان محتوى اللحم من الرطوبة أعلى ما يمكن في الجداء المخصية على عمر 6 شهور.وبصفة عامة ، كان محتوى البروتين ،وخاصة فى عضلة الفخذ ، أعلى فى الجداء السليمة عن الجداء المخصية . وكانت لحوم الجداء الكبيرة العمر أقل طراوة وقدرة على الاحتفاظ بالماء وأقل في محتواها من الدهن الخلوى والبروتين والرماد ، بينما كانت أعلى في محتواها من الرطوبة عن لحوم الجداء الصغيرة العمر.

Table (1) : Least squares means of body weight (kg) , carcass weight (kg) , body measurements (cm), dressing percentage and weights (Kg) and percentages of external offals in Baladi kids.

Traits	Castration			Sig.	Slaughter age		Sig.
	Entire kids	2-week castrates	6-month castrates		12 months	16 months	
Slaughter weight	23.86 a ± 1.72	26.2 l ab ± 1.72	29.73 b ± 1.72	NS	25.15 a ± 1.41	28.04 a ± 1.41	NS
Empty body weight	20.20 a ± 1.93	23.55 ab ± 1.52	27.02 b ± 1.52	*	21.84 a ± 1.47	25.34 a ± 1.24	NS
Hot carcass weight	11.92 a ± 0.94	12.88 ab ± 0.94	15.02 b ± 0.94	NS	12.48 a ± 0.76	14.06 a ± 0.76	NS
Dressing % (PSW)	49.65 a ± 0.65	49.12 a ± 0.65	50.52 a ± 0.65	NS	49.45 a ± 0.53	50.08 a ± 0.53	NS
Dressing % (EBW)	52.21 a ± 0.88	54.68 b ± 0.70	55.65 b ± 0.70	*	52.84 a ± 0.67	55.52 b ± 0.57	**
Body length	63.83 a ± 1.14	64.00 a ± 1.14	66.58 a ± 1.14	NS	62.83 a ± 0.93	66.78 b ± 0.93	**
Heart girth	68.67 a ± 1.66	71.33 ab ± 1.66	74.00 b ± 1.66	NS	69.89 a ± 1.35	72.78 a ± 1.35	NS
Height at withers	64.33 a ± 1.37	65.67 a ± 1.37	67.83 a ± 1.37	NS	65.22 a ± 1.12	66.67 a ± 1.12	NS
leg length	42.27 a ± 1.07	43.50 a ± 0.97	42.67 a ± 1.07	NS	42.19 a ± 0.90	43.44 a ± 0.79	NS
Paunch girth	65.17 a ± 2.34	72.17 b ± 2.34	76.17 b ± 2.34	*	69.67 a ± 1.91	72.67 a ± 1.91	NS
External offals :							
Head weight	1.88 a ± 0.07	1.63 b ± 0.07	1.79 ab ± 0.07	NS	1.71 a ± 0.06	1.82 a ± 0.06	NS
Head %	8.03 a ± 0.28	6.27 b ± 0.28	6.08 b ± 0.28	**	6.90 a ± 0.22	6.68 a ± 0.22	NS
Four limbs weight	0.62 a ± 0.03	0.67 ab ± 0.03	0.75 b ± 0.03	*	0.66 a ± 0.02	0.70 a ± 0.02	NS
Four limbs %	2.67 a ± 0.09	2.55 a ± 0.09	2.53 a ± 0.09	NS	2.65 a ± 0.07	2.52 a ± 0.07	NS
Skin weight	1.98 a ± 0.08	1.59 b ± 0.08	1.66 b ±0.08	*	1.83 a ± 0.07	1.66 a ± 0.07	NS
skin %	8.46 a ± 0.31	6.15 b ± 0.31	5.68 b ± 0.31	**	7.41 a ± 0.26	6.12 b ± 0.26	**

- Within each classification, means in rows followed by the same letter do not differ significantly .
- Sig. : Significance, NS: not significant, * P<0.05, ** P<0.01

Table (2): Least squares means of weights (kg) and percentages (on EBW) of internal offals and non-carcass fat in Baladi kids.

Traits	Castration			Sig.	Slaughter age		Sig.
	Entire kids	2-week castrates	6-month castrates		12 months	16 months	
A. Internal offals:							
Heart weight	0.116 a ± 0.010	0.124 a ± 0.010	0126 a ± 0.010	NS	0.117 a ± 0.008	0.127 a ± 0.008	NS
Heart %	0.55 a ± 0.02	0.53 a ± 0.02	0.46 b ± 0.02	*	0.52 a ± 0.02	0.51 a ± 0.02	NS
Lungs and trachea weight	0.318 a ± 0.022	0.348 a ± 0.022	0.362 a ± 0.022	NS	0.294 a ± 0.018	0.391 b ± 0.018	**
Lungs and trachea %	1.44 a ± 0.08	1.48 a ± 0.070	1.33 a ± 0.07	NS	1.26 a ± 0.06	1.57 b ± 0.05	**
Liver weight	0.396 a ± 0.042	0.499 a ± 0.042	0.479 a ± 0.042	NS	0.422 a ± 0.034	0.494 a ± 0.034	NS
liver %	1.96 ab ± 0.12	2.10 a ± 0.10	1.76 b ± 0.01	NS	1.93 a ± 0.09	1.95 a ± 0.08	NS
Spleen weight	0.045 a ± 0.005	0.065 b ± 0.005	0.065 b ± 0.005	*	0.060 a ± 0.004	0.057 a ± 0.004	NS
spleen %	0.23 a ± 0.02	0.28 a ± 0.02	0.24 a ± 0.02	NS	0.28 a ± 0.02	0.23 b ± 0.01	*
kidneys weight	0.078 a ± 0.004	0.084 ab ± 0.004	0.093 b ± 0.004	NS	0.083 a ± 0.003	0.086 a ± 0.003	NS
kidneys %	0.40 a ± 0.02	0.36 b ± 0.01	0.35b ± 0.01	*	0.39 a ± 0.01	0.35 b ± 0.01	**
Empty gut weight	1.75 a ± 0.17	2.05 a ± 0.17	2.20 a ± 0. 17	NS	2.36 a ± 0.14	1.64 b ± 0.14	**
Empty gut %	7.99 a ± 0.51	8.70 a ± 0.40	8.32 a ± 0.40	NS	10.31 a ± 0.39	6.37 b ± 0.33	**
Total offals weight	2.70 a ± 0.24	3.17 a ± 0.24	3.32 a ± 0.24	NS	3.33 a ± 0.19	2.79 a ± 0.19	NS
Total offals %	12.58 a ± 0.56	13.44 a ± 0.44	12.46 a ± 0.44	NS	14.69 a ± 0.43	10.97 b ± 0.36	**
B. Non-carcass fat:							
Heart fat weight	0.044 a ± 0.009	0.100 b ± 0.009	0.074 b ± 0.009	**	0.079 a ± 0.007	0.067 a ± 0.007	NS
Heart fat %	0.26 a ± 0.03	0.42 b ± 0.03	0.28 a ± 0.03	**	0.38 a ± 0.02	0.26 b ± 0.02	**
Kidneys fat weight	0.382 a ± 0.119	0.737 b ± 0.119	0.918 b ± 0.119	*	0.577 a ± 0.097	0.781 a ± 0.097	NS
Kidneys fat %	1.56 a ± 0.47	3.05 b ± 0.37	3.30 b ± 0.37	*	2.39 a ± 0.36	2.88 a ± 0.30	NS
Gut fat weight	0.745 a ± 0.180	1.253 ab ± 0.180	1.673 b ± 0.180	**	0.891 a ± 0.147	1.556 b ± 0.147	**
Gut fat %	3.02 a ± 0.65	5.26 b ± 0.51	5.98 b ± 0.51	*	3.72 a ± 0.49	5.79 b ± 0.42	**
Total fat weight	1.17 a ± 0.290	2.09 b ± 0.290	2.66 b ± 2.290	**	1.55 a ± 0.240	2.40 b ± 0.240	*
Total fat %	4.83 a ± 1.05	8.74 b ± 0.83	9.55 b ± 0.83	*	6.49 a ± 0.80	8.93 b ± 0.67	*

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Table (3) : Least squares means of weights (Kg) and percentages (based on cold carcass weight) of different carcass cuts in Baladi kids.

Traits	Castration			Sig.	Slaughter age		Sig.
	Entire kids	2-week castrates	6-month castrates		12 months	16 months	
Hot Carcass right side weight	5.87 a ± 0.46	6.31 ab ± 0.46	7.33 b ± 0.46	NS	6.10 a ± 0.37	6.90 a ± 0.37	NS
Cold Carcass right side weight	5.71 a ± 0.44	6.16 ab ± 0.44	7.21 b ± 0.44	NS	5.97 a ± 0.36	6.75 a ± 0.36	NS
Leg weight	1.65 a ± 0.13	2.05 b ± 0.13	2.17 b ± 0.13	*	1.86 a ± 0.11	2.06 a ± 0.11	NS
Leg %	28.61 a ± 0.69	33.42 b ± 0.69	30.32 a ± 0.69	**	31.09 a ± 0.57	30.48 a ± 0.57	NS
Loin weight	0.30 a ± 0.03	0.33 a ± 0.03	0.38 a ± 0.03	NS	0.35 a ± 0.03	0.32 a ± 0.03	NS
Loin %	5.18 a ± 0.33	5.41 a ± 0.33	5.30 a ± 0.33	NS	5.86 a ± 0.27	4.74 b ± 0.27	**
Best end of neck weight	0.41 a ± 0.04	0.49 a ± 0.04	0.63 b ± 0.04	**	0.44 a ± 0.03	0.58 b ± 0.03	**
Best end of neck %	7.42 a ± 0.60	7.93 a ± 0.60	8.69 a ± 0.60	NS	7.37 a ± 0.49	8.66 a ± 0.49	NS
Middle neck weight	0.44 a ± 0.06	0.36 a ± 0.06	0.39 a ± 0.06	NS	0.38 a ± 0.05	0.41 a ± 0.05	NS
Middle neck %	7.37 a ± 0.49	5.91 ab ± 0.49	5.38 b ± 0.49	*	6.20 a ± 0.40	6.24 a ± 0.40	NS
Shoulder weight	1.18 a ± 0.09	1.26 a ± 0.09	1.41 a ± 0.09	NS	1.24 a ± 0.07	1.32 a ± 0.07	NS
Shoulder %	21.05 a ± 0.66	20.37 a ± 0.66	19.61 a ± 0.66	NS	21.02 a ± 0.54	19.67 a ± 0.54	NS
Flank weight	0.36 a ± 0.05	0.42 a ± 0.05	0.65 b ± 0.05	**	0.42 a ± 0.04	0.54 a ± 0.04	NS
Flank %	6.35 a ± 0.58	6.68 a ± 0.58	8.92 b ± 0.58	*	6.98 a ± 0.48	7.66 a ± 0.48	NS
Brisket weight	0.64 a ± 0.07	0.72 ab ± 0.07	0.89 b ± 0.07	NS	0.73 a ± 0.05	0.77 a ± 0.05	NS
Brisket %	11.26 a ± 0.58	11.67 a ± 0.58	12.22 a ± 0.58	NS	12.08 ± 0.47	11.34 ± 0.47	NS
Neck weight	0.73 a ± 0.06	0.61 a ± 0.06	0.73 a ± 0.06	NS	0.60 a ± 0.05	0.78 b ± 0.05	*
Neck %	12.81 a ± 0.54	10.01 b ± 0.54	9.92 b ± 0.54	**	10.10 a ± 0.44	11.73 b ± 0.44	**

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- **Sig. : Significance, NS: not significant, * P<0.05, ** P<0.01**

Table (5): least squares means of some physical and chemical properties of eye and leg muscles of Baladi kids .

Traits	Castration			Sig.	Slaughter age		Sig.
	Entire kids	2-week castrates	6-month castrates		12 months	16 months	
A. Physical Properties :							
1- Eye muscle :							
pH (hot muscle)	6.07 a ± 0.11	6.04 a ± 0.11	6.26 a ± 0.11	NS	6.12 a ± 0.09	6.12 a ± 0.09	NS
WHC	23.16 a ± 2.13	22.02 a ± 2.13	19.17 a ± 2.13	NS	23.21 a ± 1.74	19.69 a ± 1.74	NS
Area at 10th rib (cm)	11.27 a ± 1.15	8.92 a ± 1.15	9.66 a ± 1.15	NS	10.57 a ± 0.94	9.33 a ± 0.94	NS
2- Leg muscle :							
pH (hot muscle)	6.06 a ± 0.09	6.13 a ± 0.09	6.26 a ± 0.09	NS	6.21 a ± 0.08	6.08 a ± 0.08	NS
WHC	32.78 a ± 1.50	32.46 a ± 1.50	32.21 a ± 1.50	NS	33.97 a ± 1.23	30.99 a ± 1.23	NS
Tenderness	5.13 a ± 0.13	4.43 b ± 0.13	4.52 b ± 0.13	**	4.59 a ± 0.11	4.80 a ± 0.11	NS
B. Chemical Properties :							
1- Eye muscle :							
Moisture %	71.49 a ± 0.57	69.18 b ± 0.57	71.61 a ± 0.57	*	69.96 a ± 0.47	71.57 b ± 0.47	*
Protein %	18.74 a ± 0.84	20.24 a ±0.84	18.50 a ± 0.84	NS	19.25 a ± 0.68	19.07 a ± 0.68	NS
Fat %	9.36 a ± 0.79	10.12 a ± 0.79	9.48 a ± 0.79	NS	10.37 a ± 0.64	8.93 a ± 0.64	NS
Ash %	0.40 a ± 0.03	0.46 a ± 0.03	0.41 a ± 0.03	NS	0.42 a ± 0.02	0.43 a ± 0.02	NS
2- Leg muscle :							
Moisture %	70.31 a ± 0.50	70.93 a ± 0.50	71.31 a ± 0.50	NS	70.28 a ± 0.41	71.42 a ± 0.41	NS
Protein %	20.52 a ± 0.65	20.30 a ± 0.65	19.45 a ± 0.65	NS	20.23 a ± 0.53	19.96 a ± 0.53	NS
Fat %	8.75 a ± 0.54	8.35 a ± 0.54	8.85 a ± 0.54	NS	9.06 a ± 0.44	8.23 a ± 0.44	NS
Ash %	0.42 a ± 0.02	0.43 a ± 0.02	0.40 a ± 0.02	NS	0.43 a ± 0.02	0.40 a ± 0.02	NS

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