Carcass Characteristics of Barki Lambs Slaughtered at Different Live Weights

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Abstract: This study was carried out at Maryout Research Station, Desert Research Center, Egypt. The main objective of this study was to evaluate the effect of slaughter weight on carcass characteristics of Barki lambs. Lambs were slaughtered at three different final live body weights nearly 30, 40 and 50 kg. One hundred and seventy-three Barki lambs were used to obtain data for this study**.** Increasing average slaughter weight from 30 to either 40 or 50 kg resulted in significant increases in empty body weight, carcass weight and non-carcass components. Dressing percentage was of the highest percentage in 40-kg group (57.19%), while decreased significantly (P<0.01) in both 30-kg (55.69%) and 50-kg (56.09%) groups. As well, absolute weights of wholesale cuts increased significantly with increasing slaughter weight. For cuts percentages, shoulder and leg decreased, while the neck, loin and fat tail increased. The rack% did not change. The bone% in the 9-10-11 rib cut decreased significantly with increasing slaughter weight. On the contrary, fat% increased significantly as slaughter weight increased. However, the percentage of lean meat showed increasing trend from 30-kg to either 40- or 50-kg groups (49.61, 54.69 and 52.44 %, respectively), with highest value for the medium slaughter weight group. As slaughter weight increased, the lean meat to fat ratio decreased (P<0.01), while the lean meat to bone ratio increased (P<0.01). The moisture content of eye muscle meat decreased (P< 0.01) while the intramuscular fat content increased by increasing slaughter weight. On the other hand, the differences in protein and ash % of meat among slaughter weight groups were not significant. In conclusion, the reasonable carcass yield and the relatively better quality of the medium-weighted group make that the average of 40 kg slaughter weight a preferable for Barki lambs.

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1. Introduction

Barki sheep dominate the north western desert of Egypt with population of 470,000 heads (11% of the total Egyptian sheep population), and are known to be well–adapted to the desert harsh conditions and scarce vegetation (El-Wakil, *et al*., 2008). Barki sheep are scattered in the north western coastal zone in flocks up to 500 heads. Meat production represents about 80% of total income of Barki flock, while wool represents a secondary source (Younis, 1996).

Mutton represents the second source of red meat in Egypt (El-Asheeri and Hafez, 2009). The meat from Barki sheep is the most preferred for consumers and has higher market prices compared to other Egyptian sheep breeds. Carcass weight is an important trait in the grading system together with fat content and commercial cut percentage in the categorization of lamb carcasses into commercial types. Usually, consumers prefer to buy lighter carcasses, but this is not justified on the basis of meat quality in local and worldwide markets. In meat production systems, a small increase in lambs' slaughter weight might result in higher productivity, and give more flexibility to the production system (Santos-Silva *et al*., 2002). For lambs of a given breed and sex, carcass weight is the most important factor associated with variation in composition (Black, 1983). Therefore, to give more flexibility to production system, carcass composition should be studied at different slaughter weights to determine at which weight productivity will be maximized with preserving desired carcass quality traits. To date, little information is available on the composition and quality of the Barki sheep meat. Because consumers have become more diet conscious, mainly being concerned with fat content and meat palatability, it is important to provide the information about differences in carcass composition and meat quality at different live weights. Increasing demand for meat and meat products has led to studies on the carcass characteristics of sheep breeds and the effect of age and weight at slaughter. Accordingly, sheep breeders need to know the potential carcass weight, which achieves the highest return from lambs marketing. Therefore, the objective of the present study was to characterize carcass traits of Barki lambs in relation to slaughter weight.

2. Materials and methods

The current study was conducted at Maryout Research Station that located about 35 km south-west of Alexandria and belongs to Desert Research Center, Ministry of Agriculture and Land Reclamation, Egypt.

Experiment design and animals

A total of one hundred and seventy-three Barki lambs were used to obtain data for this study. Lambs were reared with their dams and weaned at age of 90 days. After weaning, each animal was kept in an individually designed independent shed (120 cm width * 150 cm length * 135 cm height) with a dedicated place for feeding. Levels of feeding were calculated according to Kearl (1982) to cover nutritional requirements for 100g gain/day. The lambs were individually fed, and amount of feeds were adjusted every 15 days according to their live body weight. Lambs were randomly selected for slaughtering from the weaned lambs when they reached the previously determined slaughter weights of 30, 40 and 50 kg. These slaughter weights were chosen to represent a range within which local animals are traditionally slaughtered. The numbers of slaughtered lambs were 63, 57 and 53 for 30, 40 and 50 kg groups respectively. The real averages of slaughter weights were 30.14, 40.45 and 50.21 kg, respectively.

Slaughtering procedures

All lambs were slaughtered in the slaughter and meat processing unit at Maryout Research Station to evaluate their carcass characteristics as their weights reached an average of 30, 40 or 50 kg. Lambs were fasted for approximately 18 h before slaughtering. After slaughter and bleeding, carcasses were skinned and eviscerated before weighing.

Weights of all abdominal and thoracic offals (trachea, lungs, heart, liver, testes, spleen, kidneys, abdominal fat and kidney fat) were recorded immediately after removal from the body. The rumen and reticulum were cleaned and washed under cold running water, and then they were weighed. Empty body weights were recorded post-slaughter, and then all carcasses were chilled at an average temperature of 4^{o} C for 24 h to evaluate cold carcass weight (Frild *et al.,* 1963). Samples of eye muscle (*Longsimus dorssi*; L.D.) were collected from rib cut to evaluate the physical and chemical properties of Barki lambs meat**.**

Wholesale cuts and Physical components of 9-10-11 rib cut:

After chilling, each carcass was divided into seven cuts (Legs, Loins, Racks, Flank, Shoulders, Neck and Tail) according to the Egyptian wholesale mutton cuts as described by Hamada (1976). Chilled carcasses and wholesale cut were weighed to calculate percentages of chilled carcass weight.

The 9-10-11 rib cut was separated into its physical components (lean meat, fat and bone), which were expressed as percentages of the weight of the whole rib cut. The area of the cross section of the L.D. muscle was measured among 11^{th} and 12^{th} rib using digital plane meter Kp-90 (PLACOM) according to Henderson *et al*. (1966).

Physical parameters of meat:

Physical properties of meat including pH value, expressible fluid, cooking loss percent, water-holding capacity (W.H.C), plasticity, shear force and color were determined.

The pH value of lamb's meat was determined by using a pH meter (Portable Digital Waterproof HANNA model HI 9025) after slaughter and 24 h from slaughter.

Cooking loss was determined on about 100-grams of L.D. muscle samples (W1) which were boiled in water for 45 minutes, left to be cooled at room temperature and weighed again (W2) to calculate cooking loss percentage (Bouton and Harris, 1989) as (W1-W2) / W1*100.

Water holding capacity (WHC) and plasticity of lambs meat were estimated by the method of Wierbicki and Deatharage (1968) using the following equation:

$WHC = A_2 - A_1$

Where:

A_1 =Inner area of plasticity (area of meat after pressing) cm^2

A_2= Outer area (area of meat plus area of free water after pressing) cm^2

Both areas were determined using a plane meter.

The cooked samples were used for determining the shear force (kg). Samples were kept in refrigerator (4 - 5 ºC) for about 12 h, before estimating shear force using Instron Universal Testing Machine (Model 2519-105, USA). Cores from each sample were taken using cylinder of 0.5 inch in diameter. Cores were removed parallel to the longitudinal orientation of muscle fibers. The shear force machine was adjusted at crosshead speed of 200 mm/min according to the procedure outlined by Shackelford *et al*. (2004)**.**

Meat color was measured using Croma meter (Konica Minolta, model CR 410, Japan) calibrated with a white plate and light trap supplied by the manufacturer. Color was expressed using the CIE L*, a*, and b* color system (CIE, 1976). A total of three spectral readings were taken for each sample on different locations of the muscle. Area of the cross section of L.D. muscle was measured by tracing the exact area of the exposed muscles on acetate paper among 11^{th} and 12^{th} rib using polar plane meter.

Chemical analysis of meat:

Meat chemical analysis of the L.D. muscle was determined using Food Scan™ Pro meat analyzer (Foss Analytical A/S, Model 78810, Denmark). According to the manufacturer's instructions, about 50 - 100 gm of raw meat (obtained from the 9^{th} rib) were minced and put in the meat analyzer cup. The cup was inserted into the meat analyzer for scanning sample with infra-red to determine the chemical components (moisture, protein, fat and collagen). Ash content was determined by burning samples in a muffle furnace at 600˚ C for eight hours.

Statistical analysis

Data obtained was statistically analyzed according to **SAS (2004)** procedure General Linear (GLM). Duncan Multiple Range Test was used to compare the differences among means (Duncan, 1955). The model used was as follows:

$Y_{ij} = \mu + S_i + e_{ij}$, Where,

Y_{ij} = the trait,

μ = Overall mean,

S_i = slaughter weight groups, i=1, 2, 3 (S1=30 kg; S2=40 kg; S3=50 kg; respectively),

e_{ij}= Random error.

3. Results and discussion

1. Slaughter weight, dressing percentage and non-carcass components

Slaughter data in terms of final body weight, empty body weight, hot carcass weight, dressing percentage and non-carcass components as affected by slaughter weight are shown in Table 1.

As expected, increasing live body weight of Barki lambs resulted in increasing the weights of all parameters. Hot carcass weight, empty body weight and non-carcass components weights increased significantly (P<0.01) with increasing slaughter weight from 30- to 50-kg, except for the kidneys and spleen weight, which were not affected significantly by the slaughter weight. The weights of edible parts were 0.70, 0.79 and 0.99 kg for the three weight groups, while non-edible parts weights were 5.50, 7.37 and 9.66 kg, respectively. The total offals weights were 1.67, 2.10 and 2.85 kg for the three weight groups, respectively.

The current results are in agreement with those of Abdullah and Rasha (2008) who reported that empty body weight and non-carcass component weights increased with increasing slaughter weight from 20.9 to 40.2 kg in Awassi sheep. As well, Mahgoub and Lodge (1994) reported that empty body weight and carcass components increased with increasing slaughter weight from 18 to 38 kg in Omani sheep. Moreover, comparable results were found by Faruk and Emin (2007), Gaili and Ali (1985) and Sents *et al*. (1982) in Karayaka sheep, Sudan desert sheep and Hampshire and Suffolk crossbreeds, respectively.

Dressing percentage was of the highest value in 40-kg group (57.19%), and decreased significantly (P<0.01) in both 30-kg (55.69%) and 50-kg (56.09%) groups. Values of dressing percentage obtained in this study were higher than those reported in several sheep breeds by Abdullah and Rasha (2008), Hawkins *et al.* (1985), Kemp *et al.* (1981), Solomon *et al.* (1980) and Wood *et al*. (1980). However, comparable results were observed by Pérez *et al.* (2002), who found high dressing-out percentage in Suffolk Down suckling lambs slaughtered at 10 or 15 kg (54.9% vs. 55.85%).

Each carcass and non-carcass component grows at a different rate in relation to empty body weight, which agreed with previous results with sheep (Hammond, 1932). The carcass grew at a higher rate than empty body weight, whereas internal organs grew significantly more slowly between 30 and 40-kg groups, thus, implying that dressing-out percentage increased with increasing empty body weight and consequently live weight. However, the higher rate of increase in internal organs between 40 and 50-kg groups could explain why dressing-out percentage decreased between these two slaughter weight groups. This explanation is in full agreement with that of Abdullah and Rasha (2008).

2. Wholesale cuts of Carcass

Average slaughter weight of Barki lambs affected significantly (P<0.01) weights of cold carcass and all wholesale cuts (Table 2). Increasing live body weight of Barki lambs resulted in increasing the average weights of all wholesale cuts. However, results of cuts percentages showed different trends. Shoulder and leg percentages decreased, while the rack and loin did not change. Conversely, the percentages of the neck and fat tail increased.

Leg cut was of the highest percentage in 30-kg group (33.91%), and decreased significantly (P<0.01) in both 40-kg (32.91%) and 50-kg (30.68%) groups. On the other hand, the fat tail (The lowest percentage cut), increased significantly (P<0.01) from 30- or 40-kg to 50-kg groups (3.09 or 3.91 to 4.70%). Shoulder cut as one of the main cuts in carcass represented 19.87, 19.51 and 18.65 % in the three group studied, respectively. Loin cut reached 6.68, 6.82 and 7.79 % in 30, 40 and 50 kg group, respectively. Rack cut represented 24.59, 24.68 and 25.27 % in the three groups, respectively. These results were in agreement with those of Abdullah and Rasha (2008) and Faruk and Emin (2007). Abdullah and Rasha (2008) reported that cold carcass and all cuts increased in weight (P<0.01) at a steady rate as slaughter weight increased when Awassi ram lambs slaughtered at 20, 30 and 40 kg. . Also, they found that percentages of shoulders and legs cuts decreased (P<0.01) while racks and loins showed similar percentages and tail fat increased (P<0.01). Figure 1 illustrates the changes in weights cuts in relation to the change in chilled carcass weight. The regression equations calculated for the main wholesale cuts against chilled carcass weights. Wholesale cuts weights increased linearly with increasing chilled carcass weight; R^2 values were 0.873, 0.905, 0.665 and 0.932 for shoulder, rack, loin and leg, respectively. This means that the linear model was appropriate for explaining the growth of the major cuts between 30 and 50 kg slaughter weight.

Similar results were observed by Abdullah and Rasha (2008), who reported that cuts weights increased linearly with increasing cold carcass weight; R^2 values were 0.959, 0.944, 0.923 and 0.971 for shoulders, racks, loins and legs, respectively.

Table (1): Least squares means of final weight, empty body weight, and hot carcass weight, dressing % and non-carcass components for Barki lambs slaughtered at different live weights.

Items	Slaughter weight groups		
	30 Kg	**40 kg**	**50 kg**
No. of Animals	63	57	53
Final weight, kg	30.14±0.38	40.45±0.35	50.21±0.36
Hot carcass wt, kg	13.92^c ±0.23	19.38^b ±0.21	24.20^a ±0.22
Empty body wt, kg	25.03^c ±0.38	33.90^b ±0.35	43.14^a ±0.37
Dressing %[1]	55.69^b ±0.39	57.19^a ±0.36	56.09^a ±0.38
Non- carcass components (kg)			
Head wt	2.07^c ±0.04	2.93^b ±0.04	3.47^a ±0.04
Feet wt	0.60^c ±0.02	0.94^b ±0.02	1.00^a ±0.02
Pelt wt	2.83^c ±0.12	3.51^b ±0.11	5.19^a ±0.12
Lungs & trachea wt	0.50^c ±0.02	0.62^b ±0.02	0.60^a ±0.02
Heart wt	0.14^c ±0.01	0.15^b ±0.01	0.18^a ±0.01
Liver wt	0.39^c ±0.01	0.52^b ±0.01	0.67^a ±0.01
Spleen wt	0.06^a ±0.01	0.08^a ±0.01	0.07^a ±0.01
Kidney wt	0.17^a ±0.02	0.12^a ±0.02	0.14^a ±0.18
Testes wt	0.17^c ±0.01	0.28^b±0.01	0.35^a ±0.01
Dig-tract full wt	8.01^c ±0.16	9.87^b ±0.41	10.67^a ±0.16
Dig-tract empty wt	2.83^b ±0.07	3.29^a ±0.07	3.46^a ±0.07
Abdominal fat wt	0.18^b ±0.02	0.23^b ±0.02	0.49^a ±0.23
Kidney fat wt	0.07^b ±0.02	0.13^b ±0.02	0.35^a ±0.21
Total fat[2]	0.26^b±0.04	0.36^b ±0.33	0.84^a±0.03
Edible parts[3]	0.70^c ±0.03	0.79^b ±0.02	0.99^a ±0.25
Non-edible parts[4]	5.50^c ±0.15	7.37^b ±0.13	9.66^a ±0.14
Total ofalls[5]	1.67^c±0.51	2.10^b ±0.05	2.85^a ±0.49

^{a,b,c} Means with same superscript are not significantly different in the same row.

1, Dressing % = (hot carcass weight/empty body weight)*100. 2, Total fat include kidney fat and abdominal fat weight. 3, Edible parts include heart, liver and kidney weights. 4, Non-edible parts include head, feet and pelt weights. 5, Total ofalls include heart, liver, kidneys, spleen, lungs and trachea, testes, kidney fat and abdominal fat weights.

Table (2): Least squares means of wholesale cuts (weights and Percentages*) for Barki lambs slaughtered at different live weights

Items	Slaughter weight groups		
	30 Kg	**30 Kg**	**30 Kg**
No. of Animals	63	57	53
Chilled carcass wt	13.50^c ±0.21	18.67^b±0.19	23.94^b ±0.20
Wholesale cuts:			
Neck wt, kg	1.01^c ±0.04	1.41^b ±0.03	1.92^a ±0.03
Shoulder wt, kg	2.67^c ±0.05	3.64^b ±0.05	4.47^a ±0.05
Rack wt, kg	3.32^c ±0.08	4.61^b ±0.07	6.05^a ±0.07
Loin wt, kg	0.90^c ±0.04	1.28^b ±0.04	1.86^a ±0.04
Flank wt, kg	0.60^c±0.03	0.87^b ±0.03	1.16^a±0.03
Leg wt, kg	4.57^c ±0.08	6.14^b ±0.07	7.35^a ±0.08
Tail wt, kg	0.42^c ±0.04	0.73^b ±0.04	1.13^a ±0.04
Neck, %	7.47^b ±0.15	7.54^b ±0.14	8.06^a±0.15
Shoulder, %	19.87^a ±0.20	19.51^a±0.18	18.68^b±0.19
Rack, %	24.59^a ±0.25	24.68^a±0.23	25.27^a±0.24
Loin, %	6.68^b ±0.19	6.82^b ±0.18	7.79^a±0.19
Flank, %	4.41^b ±0.14	4.63^{ab}±0.13	4.83^a ±0.14
Leg, %	33.91^a ±0.23	32.91^b±0.21	30.68^c ±0.22
Tail, %	3.09^c ±0.17	3.91^b ±0.15	4.70^a ±0.16

^{a,b,c} Means with same letter are not significantly different in the same row. * Cuts % calculated based on chilled carcass weight.

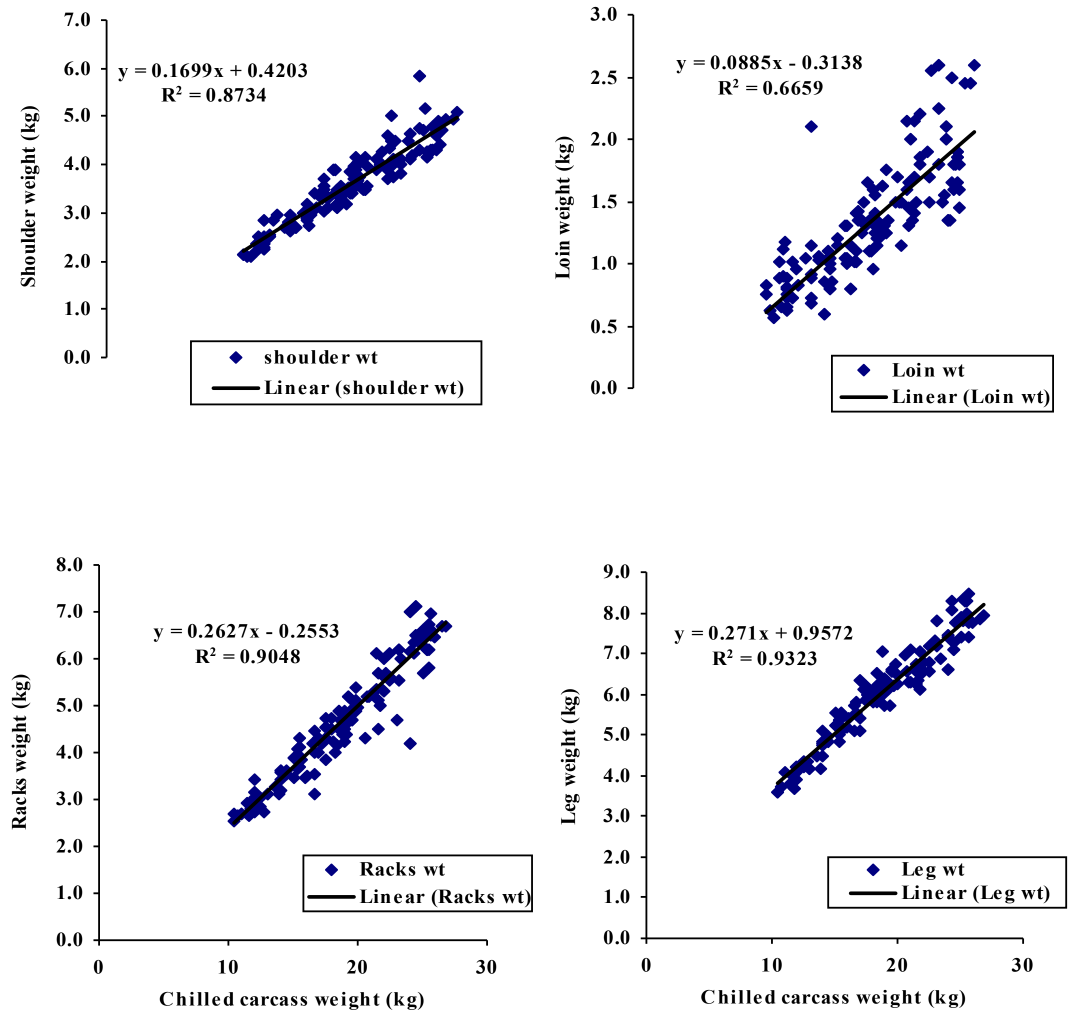

Fig. 1: Main wholesale cuts weight change in relation to change in chilled carcass weight of Barki lambs slaughtered at different live weights.

3. Dissected 9-10-11 rib cut

Table 3 and Fig 2 represent least-squares means for the physical components of 9-10-11 rib cut of Barki lambs slaughtered at different live weights.

Present results indicated that bone % in the 9-10-11 rib cut decreased significantly with increasing slaughter weight from 30- to 40- or 50-kg. On the contrary, fat % increased significantly due to increasing average body weight of lambs. However, the percentage of lean meat showed increasing trend from 30-kg to either 40- or 50-kg groups, with highest value for the medium-weight group (54.69 vs. 49.61 and 52.44 %).

These results are in agreement with those of Abdullah and Rasha (2008), Sents *et al*. (1982) and Kemp *et al*. (1970) who worked with lambs from Awassi, Suffolk and Hampshire sheep, respectively. In agreement with the present results, Pérez *et al.* (1993) found in Manchego suckling lambs that total muscle percent did not change while total bone percent decreased and total fat percent increased with increasing slaughter weight from 10 to 14 kg.

Abdullah and Rasha (2008) demonstrated that lean, bone and fat are the main components of a carcass, therefore, their percentages will change in a pattern that when one component increase, the other will decrease. They added that since fat is a late maturing tissue, its' percent will continue to increase with increasing live body weight on the account of muscle tissue of the carcass.

Results of increasing live body weight from many literatures were found to be contradictory when compared with the present results in different breeds at similar slaughter weights. While some researchers reported higher percentages for total lean (Sen *et al*., 2004 and Sents *et al*., 1982), total bone (Peňa *et al*., 2005), total fat (Mahgoub and Lodge, 1994), others researchers stated lower percentages for total lean (Mahgoub and Lodge, 1994), total bone and total fat (Sents *et al*., 1982).

As slaughter weight increased, the lean meat to fat ratio decreased significantly ($P<0.01$) with values being 2.65, 2.58 and 2.06 for the three weight groups, respectively. On the contrary, the lean meat to bone ratio increased significantly ($P<0.01$) with increasing slaughter weight. It could be noticed that the ratio of lean meat to bone increased with decreasing bone percentage in carcass, while the lean meat to fat ratio decreased with increasing fat percentage in carcass. These results are in agreement with Abdullah and Rasha (2008) who worked on Awassi ram lambs slaughtered at 20, 30 and 40 kg.

Table (3): Least squares means of 9-10-11 rib cut weight and physical components for Barki lambs slaughtered at different live weights

Items	Slaughter weight groups		
	30 Kg	**30 Kg**	**30 Kg**
No. of Animals	63	57	53
9-10-11 rib cut wt	$0.561^{c}\pm0.01$	$0.843^{b}\pm0.01$	$1.142^{a}\pm0.01$
Lean meat wt	$0.279^{c}\pm0.01$	$0.461^{b}\pm0.01$	$0.598^{a}\pm0.01$
Fat wt	$0.116^{c}\pm0.01$	$0.179^{b}\pm0.01$	$0.303^{a}\pm0.01$
Bone wt	$0.166^{b}\pm0.01$	$0.203^{b}\pm0.01$	$0.242^{a}\pm0.01$
Lean meat %	$49.61^{c}\pm0.74$	$54.69^{a}\pm0.67$	$52.44^{b}\pm0.71$
Fat %	$20.48^{b}\pm0.66$	$21.23^{b}\pm0.61$	$26.38^{a}\pm0.64$
Bone %	$29.90^{a}\pm0.48$	$24.08^{b}\pm0.44$	$21.17^{c}\pm0.47$
L /F ratio	$2.65^{a}\pm0.12$	$2.58^{a\,b}\pm0.11$	$2.06^{b}\pm0.11$
L/B ratio	$1.70^{c}\pm0.06$	$2.27^{b}\pm0.06$	$2.55^{a}\pm0.06$
Eye muscle area (cm^2)	$12.38^{c}\pm0.13$	$14.58^{b}\pm0.12$	$16.95^{a}\pm0.12$
Fat thickness (mm)	$1.87^{c}\pm0.05$	$2.62^{b}\pm0.04$	$3.59^{a}\pm0.05$

^{a,b,c} Means with same letter are not significantly different in the same row, wt: weight

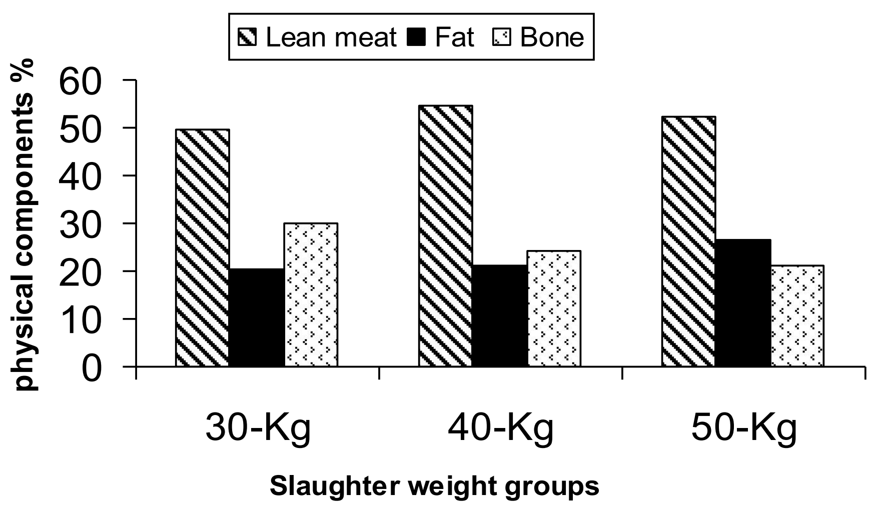

Fig. 2: Physical components of 9-10-11 rib cut of Barki lambs slaughtered at different live weights.

Increasing lean meat to bone ratio might reflect the relative or the pattern of the successive formation of each three components at the different stages of growth. At the same time, lean meat to fat ratio decreased significantly mainly due to increasing fat deposition with advancing age of sheep. The medium-weight group (40 kg) scored the highest percentage of lean meat with intermediate fat proportion as compared to both the lightest and heaviest weight groups.

The eye muscle area in carcass would contribute to somewhat in the prediction of retail yield. The results indicated that the area of eye muscle increased significantly ($P<0.01$) with increasing slaughter weight, where the values are 12.38, 15.58 and 16.95 cm^2 for slaughter weight groups 30, 40 and 50kg, respectively. These were in accordance with lean meat weights, but not with lean meat percentages. The present values of eye muscle area were higher than those reported by Abdullah and Rasha (2008), Pérez *et al* (2007), Faruk and Emin (2007) and Macit (2002).

Also, there were significant differences among slaughter weight groups in fat thickness over eye muscle, where the values are 1.87, 2.62 and 3.59 mm for slaughter weight groups, respectively. This was in accordance with the results of fat weights and percentages.

4. Physical properties of meat

Results in Table 4 show the physical properties of meat (pH, cooking loss, W.H.C, plasticity and color) for Barki lambs as affected by slaughter weight. There were no significant differences among slaughter weight groups in pH values of meat just after slaughter and at 24 hrs of slaughter.

Expressible juice is an important meat quality characteristic because of its influence on the nutritional value, appearance and palatability (Kadim *et al*, 2006). Expressible juice was increased with the increase in slaughter weight, but the difference was not significant.

Values of cooking loss were increased significantly (P<0.01) with increasing slaughter weight, where the values were 40.46, 43.98 and 46.11 % for 30, 40 and 50 kg slaughter weight groups, respectively. The present results indicated no significant difference among slaughter weight groups in water holding capacity (W.H.C) and plasticity. The shear force differed significantly among slaughter weight groups, where, the values were 3.68, 3.97 and 3.29 kg to slaughter weight groups, respectively. Field *et al.* (1971) stated in his review that shear force values around 3.6 kg/cm^2 have acceptable tenderness for goat and sheep meat. Regarding color parameters of meat, live weight at slaughter had a significant effect (P<0.01) on lightness (L*), redness (a*) and yellowness (b*) of Barki lambs meat. L* was decreased, but a* and b* were increased as slaughter weight increased. The same trend was decided by Silvester, *et al* (2003).

Table (4): Least squares means of some physical properties of meat for Barki lambs slaughtered at different live weights

Measurement	**Slaughter weight groups**		
	30 Kg	**30 Kg**	**30 Kg**
No. of Animals	63	57	53
pH value:			
pH just after slaughtering	$6.16^a \pm 0.03$	$6.22^a \pm 0.03$	$6.20^a \pm 0.03$
pH at 24 hrs of slaughtering	$5.28^a \pm 0.03$	$5.33^a \pm 0.03$	$5.32^a \pm 0.03$
Expressible fluid %	$38.72^a \pm 1.06$	$39.63^a \pm 0.79$	$40.15^a \pm 1.02$
Cooking loss %	$40.46^c \pm 0.18$	$43.98^b \pm 0.16$	$46.11^a \pm 0.17$
W.H.C (cm^2)	$4.74^a \pm 0.16$	$4.88^a \pm 0.15$	$4.91^a \pm 0.16$
Plasticity (cm^2)	$2.42^a \pm 0.09$	$2.31^a \pm 0.07$	$2.24^a \pm 0.08$
Shear force (kg/ cm^2)	$3.68^a \pm 0.16$	$3.97^a \pm 0.14$	$3.29^b \pm 0.15$
Colour:			
L (lightness)	$46.70^a \pm 0.13$	$43.36^b \pm 0.12$	$40.89^c \pm 0.10$
a (redness)	$13.04^c \pm 0.10$	$15.98^b \pm 0.09$	$17.57^a \pm 0.11$
b (yellowness)	$2.64^c \pm 0.06$	$3.98^b \pm 0.05$	$5.11^a \pm 0.06$

^{a,b,c} Means with same letter are not significantly different in the same row. W.H.C, Water holding capacity.

5. Chemical composition of meat

Results in Table 5 showed the chemical composition of meat for Barki lambs at different slaughter weights. The moisture content of eye muscle meat decreased (P< 0.01) while the intramuscular fat content increased (P< 0.01) by increasing slaughter weight. There was an inverse relationship between fat and the moisture content of sheep meat. The decrease in moisture and increase in fat percentages are in accordance with the fact that as weight increases, moisture is replaced with fat in the body tissues (Davies, 1989). On the other hand, the differences in protein and ash % of meat among slaughter weight groups were not significant. These results are in agreement with Abdullah and Rasha (2008). In this context, Kashan *et al.* (2005) reported lower moisture and protein percentages and higher fat % in fat-tailed breeds slaughtered at heavier weights. Also, Sen *et al.* (2004) reported lower moisture % and higher fat and protein% in yearling sheep.

Table (5): Least squares means of chemical composition of meat for Barki lambs slaughtered at different live weights.

Component %	Slaughter weight groups		
	30 Kg	30 Kg	30 Kg
No. of Animals	63	57	53
Moisture	76.07^{a}±0.08	75.22^{b} ±0.08	72.86^{c}±0.08
Protein	20.45^{a} ±0.04	20.44^{a}±0.04	20.52^{a} ±0.04
Fat	2.37^{c} ±0.09	3.13^{b}±0.08	4.99^{a} ±0.09
Ash	1.12^{b}±0.04	1.21^{b} ±0.04	1.63^{a} ±0.04
Collagen	1.45^{a}±0.04	1.50^{a} ±0.03	1.42^{a} ±0.04

^{a,b,c} Means with same letter are not significantly different in the same row.

Conclusion

Of the most important results obtained in the present study are the following:

1) Dressing percentage was of the highest percentage in 40-kg group (57.19%), it decreased significantly (P<0.01) in both groups 30-kg (55.69%) and 50-kg (56.09%).

2) The percentage of lean meat showed increasing trend from 30-kg to either 40- or 50-kg groups, with highest value for the medium-weight group (54.69 vs. 49.61 and 52.44 %).

3) Slaughter weight of 40 kg group has physical and chemical properties good for meat.

According to these results, it be concluded that the optimal slaughter weight is 40 kg for male Barki lambs.

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