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GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND COST OF GAIN OF AWASSI AND KARADI LAMBS SLAUGHTERED AT DIFFERENT WEIGHT

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ABSTRACT

The study was carried out to investigate the effect of slaughter weights on growth performance, carcass characteristics and cost of gain of Awassi and Karadi ram lambs. Fifteen male lambs from either Karadi or Awassi were randomly blocked by live weight into three different slaughter weight groups (30, 40 and 50kg). Each lamb was kept in individual pen and offered an iso energetic and iso nitrogenous concentrate diet *ad libitum*. Lambs were slaughtered once they reached a target weight.

Results reported the weight at slaughter increased for both breeds, there were significant reductions in average daily gain, bone percent, lean: fat ratio and increase in rib eye area, feed conversion ratio, fat tail weight and fat thickness. Moreover, Awassi lambs had a higher ($p<0.01$) dressing percentage 1 (49.41±0.32vs.47.69±0.66%) and 2 (58.32±0.45 vs. 56.06±0.51%), fat thickness (3.10±0.24 vs. 2.46±0.15mm) and loin percentage (8.74±0.11 vs. 8.11±0.07%) than Karadi lambs. In contrast, Karadi lambs had a higher ($p<0.01$) proportion of bone and lean: fat ratio and lower ($p<0.01$) proportion of fat than Awassi lambs. There was no significant differences in daily weight gains, rib eye area, the empty body weight, fat tail weight and shrinkage percent between breeds.

In conclusion, the optimal slaughter weight is 40kg for both Awassi and Karadi lambs and cost of gain of Awassi lambs was lower than Karadi lambs and from economic trends lambs slaughtered at 30kg had higher profit potential.

***KEY WORD**:* growth, slaughter weight, carcass traits, Awassi, Karadi, Lambs

1. INTRODUCTION

Small ruminant plays an important role in Iraq and it is primary for food security of the rural population and sheep population (13.025 million head) (Official Iraq Ministry of Agriculture, 2009) are account the most important farm animals and the considerable portion of income from the sale of lambs, and it has a unique niche in small farmers because small investments are required; have shorter production cycles, faster growth rates and greater environmental, adaptability as compared to large ruminants (Hashem et al., 2013). Awassi and Karadi sheep are main important indigenous Iraqi sheep primarily raised for meat (main purpose 60 %) as well as for milk and wool production 20% (Alkass and Juma, 2005).

Awassi is the most widespread sheep breed in the Mediterranean's east. It is the most common sheep breed in Iraq and Syria, as well as the only native breed of sheep in Lebanon, Jordan and Israel (Hailat, 2005). Awassi sheep are medium in size, but the body size varies among flocks in the Middle Eastern countries (Mason, 1967; Fahmy and Shrestha, 2001), Alkass and Juma, 2005; Gursoy (2005). Moreover, Awassi has very desirable characteristics as far as endurance to nutritional variations, resistance to many diseases and parasites, walk long distances over pastures for grazing, (Gürsoy et al., 1992, 1993) and also the most important feature of these sheep is that can farmed in many sheep farms in the form of hot and dry deserts (Gürsu and Aygün, 2014).

The breed known for having the coarsest wool among Iraqi sheep breed and for it is good milking, lambing and meat potential (Juma and Alkass, 2000; Shukor, 1989).

The Karadi breed, which comprise 18-20 percent of the Iraqi sheep population, is native to the Kurdistan region of Iraq's northeastern mountains, villages, and rolling dry farming fields (Alkass et al., 2013). Also, the traditional method of fattening lambs in the Kurdistan region depends primarily on grazing natural

pastures and cereal stubble. Sometimes, fattening of lambs depends on the barely grain and straw in feedlots, for a period of 90 to 120 days (Sadq, 2018).

Lambs body size might be a good indicator for growth performance and it could be a great trait during sheep marketing (Gizaw et al., 2010; Mtimet et al., 2014). Mtimet et al. (2014) observed that in the absence of live body weight data, breed types and visually assessed size are the most important factors in specifying the price for live animals.

Generally, daily live weight gain was decreased as lambs grew up toward heavier weight (Gohler, 1989; Chant, 1977). Sefdeen and Alkass (2009) found that the average daily live weight gain of Karadi lambs decreased over 30 kg slaughter body weights. Also, Oramari et al. (2014) working on Hamdani and Awassi lambs observed that heavier lambs slaughtered at 40kg showed a significantly lower daily gain as compared to lambs slaughtered at 30kg. However, Nakev et al. (1987) concluded that daily gain in weight was increased with increasing slaughter weight in Caucasian lambs fattened until 50kg after weaning. Therefore, the Objective of this study is to investigate the effect of different Slaughter weights on the growth performance, carcass characteristics and economic values of Awassi and Karadi male lambs and to find out the optimum slaughter weight.

2. MATERIALS AND METHODS

2.1. Animals and experimental procedures

Fifteen weaned male lambs (four months age) from each of Awassi and Karadi averaged 22.46±0.26kg and 22.02±0.22kg in live weight, respectively, raised at the Animal Farm, Department of Animal Production, College of Agricultural Engineering Sciences, University of Duhok were used in the study. Following an adaptation period (10 days), lambs from each breed were weighed and divided in to three groups, group 1 (5 lambs from each Awassi and Karadi breeds) slaughtered at 30 kg live body weight, group 2 (5 lambs from each Awassi and Karadi breeds) slaughtered at 40kg live body weight and group 3 (5 lambs from each Awassi and Karadi breeds) slaughtered at 50 kg live body weight. Lamb was raised in an individual pen (1.50 x 1.30m) and had a free access to clean water and a concentrate diet (15.6% crude protein and 2780 k.cal) was offered *ad libitum*. Each group of lambs was offered same concentrate diet at a rate of 500g / lamb/day during the first 2 weeks of the trial, and then the diet was increased gradually *ad libitum* / lambs till slaughtering weight. The diet was offered in two equal meals at 8:00 a.m. and 4:00 p.m. The diet ingredients included 46% barley, 10% corn, 14% wheat bran, 10% wheat straw, 17% soybean meal, 2% CaCo3, 0.4% di-Calcium Phosphate, 0.5% salt and 0.5% multivitamin. The chemical composition of the concentrate ration contained 15.6% crude protein, 5.5% crude fiber, 3.6% ether extract, 4.9% ash and 2780 k.cal energy.

2.2. Slaughter and carcass traits

The day before lambs were slaughtered, lambs were weighed, restricted from a diet and had a free access to water. Following slaughter, hot carcass weight, cold carcass weight (after chilling at 2-4^{o}C for 24 hours) were recorded using a portable electronic scale (capacity 50kg). After chilling the carcass at 2-4^{o}C for 24 hours, chilled carcass was weighted, and then kidney, pelvic and heart fat were removed and weighted separately, by using an electrical saw the carcass was divided along the vertebral column into left and right halves. The right half was separated into eight commercial cuts (leg, shoulder, loin, rack, fore shank, neck, breast and flank). Each cut of right half was weighed and calculated as a percent of cold carcass weight. Ribeye area was evaluated between the 12'"and 13'"ribs, on the cross-section by tracing the *longissumus dorsi muscle* upon waxed paper, and the area was measured by a placom digital planimeter KP – 92 N. Fat thickness over the *longissimu dorsi* perpendicularly was taken by using Calliper device. In order to determine carcass composition each cuts of the right half were dissected physically into lean, fat and bone then lean to fat ratio and lean to bone ratio were calculated.

2.3. Chemical analysis

To determine the chemical analysis (protein, extract fat, moisture, and ash), the homogenous samples of meat from *longissimus dorsi muscle* was collected from each carcass by using standard methods (AOAC, 1990). Crude protein was determined as (N×6.25) (Kjeldahl method).

2.4. Statistical Analysis

Data was analyzed as factorial 2 x 3 (breed and slaughter weight) using a general leaner model (SAS, 2002), to study the impact of unbiased of the breed and slaughter weight on

two studies traits. The differences among the subclass of each factor were tested by using Duncan multiple range tests (1955) within GLM by using SAS (2002).

3. RESULTS AND DISCUSSION

3.1. Growth performance

The effect of slaughter weight and breeds on lamb performance is presented in Table (1). The average daily gain of Awassi lambs was 0.219±0.02kg/day, whereas for Karadi lambs was 0.212±0.06kg/day. However, the difference in daily weight gain between two breeds was not significant. In contrast to the previous result, Alkass et al. (1985); Alkass et al. (1987); Rashid et al. (1987); Al-Jaryan et al. (1995); Esenbuga et al. (2009); Sefdeen and Alkass (2009); Oramari et al. (2014); Jawasreh et al. (2019); Suliman et al. (2021) reported that Awassi and Karadi lambs had a higher average daily gain. Whereas, Macit et al. (2002) and Dosky et al. (2014) recorded a lower average daily gain. Such a results could be related to the genetic of the lambs as well as different nutrition practice in particular. A significant difference ($p<0.01$) in daily gain was noticed among lambs slaughtered at (30, 40 and 50kg) with highest gain (0.282±0.07kg/day) for lambs slaughtered at 30kg and lowest (0.162±0.01 kg/day) for lambs slaughtered at 50kg. The depression in average daily gain of lambs slaughtered at heavier weight (more than 40kg) as noticed in this study may be due to accumulation of fat tissue and that as average daily gain, favors a leaner animal since the feed efficiency to produce lean tissue gain is greater than for fat tissue gain (Rashid et al., 1987; Aksoy., 1995; Balci and Karakas, 2007; Sefdeen and Alkass, 2009).

3.2. Feed Efficiency

It seems that, the differences between feed conversion ratio and feed efficiency were significant between two breeds, the Awassi lambs had significantly ($p<0.01$) better feed conversion ratio and feed efficiency as compared to Karadi lambs. The average feed conversion ratio noticed in the present work for Awassi lambs was lower than to those previously recorded for Awassi lambs (Esenbuga et al., 2009; Suliman et al., 2021) as well as for Karadi lambs (Dosky et al., 2014) and higher than to those reported by (Oramari et al., 2014; Jawasreh et al., 2019) for Awassi lambs and Sefdeen and Alkass (2009), for Karadi lambs. However, Gootwine et al. (1993) and Rodríguez et al. (2011) who observed that feed efficiency were improved significantly in crossbreed. Such differences among breeds could be due to genetic, age of animal, quality of feed and management practice used on the farm, Karadi lambs showed greater daily feed consumption than Awassi lambs. Also, lambs slaughtered at 30kg had significantly ($p<0.01$) preferable feed conversion ratio and feed efficiency as compared to lambs slaughtered at 50kg. This reduction possibly due to deposition of more fat in lambs slaughtered at heavier weights (Oramari et al., 2014). Such result was in agreement with Shelton and Carpenter (1972), Sents et al. (1982) and Sefdeen and Alkass (2009).

Table (1): Fattening performance traits of Karadi and Awassi lambs.

Traits	Overall mean	Breed		Slaughter weight (kg)		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Initial live weight (kg)	22.23±0.17	22.46±0.26a	22.02±0.22a	21.91±0.28a	22.38±0.29a	22.43±0.32a
Final live weight (kg)	40.08±1.52	39.89±2.30a	40.25±2.10a	31.00±0.17c	40.05±0.20b	50.20±0.14a
Total weight gain (kg)	17.85±1.49	17.43±2.27a	18.22±2.03a	9.09±0.23c	17.64±0.39b	27.77±0.34a
Days to slaughter	97.68±11.97	98.31±18.84a	97.13±15.89a	32.20±0.33c	91.44±4.13b	176.67±10.39a
Daily weight gain (kg/day)	0.216±0.01	0.212±0.06a	0.219±0.02a	0.282±0.07a	0.196±0.01b	0.162±0.01c
Total feed intake (kg)	95.85±10.67	99.63±17.49a	92.59±13.46a	32.39±0.50c	98.44±4.54b	163.78±6.19a
Daily feed intake (kg/day)	1.011±0.02	1.043±0.04a	0.984±0.03a	1.006±0.01ba	1.081±0.04a	0.948±0.06b
Feed conversion (kg/kg)	4.97±0.23	5.22±0.36a	4.75±0.29b	3.58±0.09b	5.58±0.25a	5.90±0.24a
Feed efficiency (kg/kg)	0.214±0.01	0.204±0.02b	0.223±0.01a	0.281±0.01a	0.183±0.01b	0.172±0.01b

Means with different letters within each column for Karadi and Awassi male lambs differ significantly ($P<0.01$) according to Duncan's test.

3.3. Carcass characteristics

The results related to slaughter traits (empty body weight, shrinkage percent, dressing percentage, carcass weight and fat tail weight) of different slaughter weights for Awassi and Karadi lambs are given in (Table 2). Dressing percentage 1(based on slaughter weight) and 2 (based on empty body weight) were significantly higher than Karadi lambs. This finding is similar to results observed that dressing percentage was significantly different among studied breeds (Alkass et al., 1987; Snowder et al., 1994; Cloete et al., 2004; Kashan et al., 2005; Ríos et al., 2011). The empty body weight, fat tail weight and shrinkage percent for Awassi lambs were averaged (34.13±1.74 kg, 2.91±0.36kg and 2.62±0.15%), respectively and for Karadi lambs were averaged (33.84±2.10kg, 2.61±0.3kg and 2.81±0.17%), respectively (Table 2), none significant differences were observed between Awassi and Karadi lamb breeds for above traits. It was found that deference in the dressing percentage 1 and 2 between lambs slaughtered at 30, 40kg lacked significance. This result is similar to the finding of Oramari et al. (2014) who concluded that as slaughter weight increases, dressing percentage decreased from 30 to 40kg of slaughter weight. While, lambs slaughtered at 50 kg significantly had higher dressing percentages 1and 2 as compared to lambs were slaughtered at 40kg. Similar results has been reported by Bicer et al. (1995) who noticed that dressing percentages was significantly increased from 40 to 50 kg of body live weight, where after, it remained almost constant. Also, same results were concluded by several authors (Lambuth et al., 1970; Lloyd et al., 1980; Sefdeen and Alkass, 2009; Polidori et al., 2017). While, some researcher approved that dressing percentage was decreased as slaughter weight increased (Jeremiah et al., 1997; Oramari et al., 2014). The shrinkage percent was significantly ($p<0.01$) decreased with increasing slaughter weight from 30 to 50kg of body weight.

Table (2): The effect of breed and different slaughter weights on some carcass characteristics of Karadi and Awassi lambs (Means ± S.E.).

Traits	Overall mean	Breed		Slaughter weight (kg)		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Slaughter weight (kg)	40.08±1.52	39.89±2.30a	40.25±2.10a	31.00±0.17c	40.05±0.20b	50.20±0.14a
Hot carcass weight (kg)	19.49±0.79	18.99±1.22b	19.92±2.10a	14.97±0.29c	19.19±0.20b	24.82±0.28a
Chilled carcass weight (kg)	18.98±0.79	18.48±1.21b	19.42±1.07a	14.48±0.29c	18.67±0.20b	24.30±0.29a
Empty body weight (kg)	33.99±1.33	33.84±2.10a	34.13±1.74a	26.07±0.23c	34.12±0.20b	42.68±0.45a
Shrinkage (%)	2.71±0.11	2.81±0.17a	2.62±0.15a	3.23±0.13a	2.74±0.07b	2.10±0.14c
Dressing percentage (1)	48.61±0.38	47.69±0.66b	49.41±0.32a	48.31±0.82ab	47.88±0.44b	49.68±0.51a
Dressing percentage (2)	57.27±0.40	56.06±0.51b	58.32±0.45a	57.37±0.73ab	56.26±0.54b	58.18±0.69a
Fat tail weight (kg)	2.77±0.24	2.61±0.31a	2.91±0.36a	1.67±0.09c	2.44±0.13b	4.33±0.27a

Means with different letters within each column for Karadi and Awassi male lambs differ significantly ($P<0.01$) according to Duncan's test.

3.4. Rib eye area and Fat thickness

The effects of breeds and slaughter weight on rib eye area and fat thickness are presented in Table (3). The differences between rib eye area was non-significant between two breeds, the result obtained in the current study was in an agreement with the results noticed by Snowder et al. (1994) who noticed a not significant difference in rib eye muscle area among Rambouillet, Targhee, Columbia and polypay lambs. Also, Lloyd et al. (1980); Kashan et al. (2005) and Esenbuga et al. (2009) found that breed does not significantly impact the rib eye area. Similarly, Oramari et al. (2014) indicated that rib eye muscle area was not differ significantly between Hamdani and Awassi breed (11.47 vs. 11.52cm^2). On the other hand, Macit (2002) and Jawasreh et al. (2019) found that a significant differences in rib eye area among studied breeds While, the Awassi lambs had significantly thicker fat over the *rib eye muscle* as compared to Karadi lambs (Table 3). Similarly, Lloyd et al. (1980), Snowder et al. (1994), Kashan et al. (2005) and Oramari et al.

(2014) found that fat thickness was significantly impacted by breed. In contrast, Macit (2002), Esenbuga et al. (2009) and Jawasreh et al. (2019) found that fat thickness over *dorsi muscle* not significantly affected among different breeds of lamb.

It seems that, Rib eye area was expanded significantly ($p<0.01$) by increasing slaughter weights. The lambs slaughtered at 30kg had a significantly lower fat thickness ($p<0.01$) as compared to lambs 40 and 50kg.While no significant differences approved between lambs slaughtered at 40 to 50kg (Table 3). This result was supported by those reported by Sents et al. (1982), Rashid et al. (1987), Macit (2002), Balci and Karakas (2007), Abdullah and Qudsieh (2008), Sefdeeen and Alkass (2009),Oramari et al. (2014) and Aksoy and Ulutaş (2015) who revealed that, rib eye area become more expanded and thicker fat over rib eye muscle when the slaughter weight increased. Adversely, (Rajkumar and Agnihotri 2005; Das et al., 2008 and Rajkumar et al., 2014) approved non-significant impact of slaughter weight on fat thickness and rib eye muscle area when carcass characteristics were studied under the effect of slaughter weight.

Table (3): The effect of breed and different slaughter weights on rib eye area, fat thickness and body wall thickness of Karadi and Awassi lambs (Means ± S.E.).

Traits	**Overall mean**	**Breed**		**Slaughter weight (kg)**		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Rib eye area (cm^2)	11.72±0.30	11.61±0.50a	11.82±0.38a	10.39±0.29c	11.86±0.38b	13.07±0.50a
Fat thickness (mm)	2.80±0.16	2.46±0.15b	3.10±0.24a	2.10±0.15b	2.96±0.21a	3.43±0.26a

Means with different letters within each column for Karadi and Awassi male lambs differ significantly ($P<0.01$) according to Duncan's test.

3.5. Physical dissection (carcass tissue distribution)

It appears from the result presented in Table (4) that lean proportion was not different significantly between the two breeds. While, the Awassi lambs significantly ($p<0.01$) recorded higher fat%, lean: bone ratio and lowest bone%, lean: fat ratio as compared to Karadi lambs (Table 4). The differences between these two breeds is in accordance with the results obtained by Several authors found that breed affects the carcass tissue distribution in studied sheep breeds (Kashan et al., 2005; Rodríguez et al., 2011; Oramari et al., 2014).

Lambs carcasses slaughtered at 40kg significantly ($p<0.01$) leaner as compared to carcasses of lambs slaughtered at 50kg. It appears from the result that lean tissue, increase by increasing slaughter weight till 40kg live weight then decreased by increase weight up to 50kg. Also, lamb carcasses slaughtered at 40kg live weight approved significantly ($p<0.01$) more lean to bone ratio as compared to carcasses of lambs slaughtered at 30 and 50kg and significantly more lean to fat ratio than lambs slaughtered at 50kg live weight. On the same line, Bicer et al. (1995) noticed that carcasses of Awassi lambs slaughtered at 40kg had significantly more lean percent compare to lambs slaughtered at 50, 60 and 65kg live weight. However, with increasing slaughter weight, fat proportion changed significantly from 40 to 50kg live weight, but not significantly from 30 to 40kg. Similar finding has been reported by (Bicer et al., 1995; Abdullah and Qudsieh, 2008; Sefdeen and Alkass, 2009; Aksoy and Ulutaş, 2015).

Table (4): The effect of breed and different slaughter weights on dissected lean, fat and bone of Karadi and Awassi lambs (Means ± S.E.).

Means with different letters within each column for Karadi and Awassi male lambs differ significantly (P<0.01)

Traits	Overall mean	Breed		Slaughter weight (kg)		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Lean %	58.67±0.62	59.21±0.68a	58.20±1.00a	58.77±0.61ba	60.76±0.93a	56.48±1.24b
Fat %	19.66±0.71	17.80±0.86b	21.28±0.93a	17.68±0.91b	19.20±0.84b	22.32±1.45a
Bone %	21.72±11.94	23.08±0.55a	20.54±0.65b	23.55±0.77a	20.13±0.94b	21.27±0.31b
Lean: fat ratio	3.11±0.13	3.44±0.19a	2.83±0.16b	3.41±0.20a	3.22±0.16a	2.66±0.27b
Lean: bone ratio	2.74±0.08	2.58±0.66b	2.88±0.12a	2.52±0.09b	3.08±0.17a	2.66±90.04b

according to Duncan's test.

3.6. Commercial cuts of the carcass

The effects of breeds and slaughter weights on commercial cuts of the carcass are presented in Table (5), with the exception of leg and loin proportion, none of the commercial cuts were impacted significantly by breed of lambs (Table 5). It seems from result that Karadi lambs recorded significantly higher proportion of leg (34.72±0.51 vs. 32.01± 0.40%) and lowest proportion of loin (8.11±0.07 vs. 8.74±0.11%) as compared to Awassi lambs. Therefore, loin, Leg, and rack cuts are predestined more worthy by industry standards (Cameron et al., 2001). These commercial cuts comprise nearly 60 % of lamb carcass (Hale and Griffin, 1992). Moreover, several authors approved significant differences were observed in wholesale cuts among breeds (Fahmy, 1997; Hopkins and Fogarty, 1998; Macit et al., 2002; Kashan et al., 2005; Oramari et al., 2014). Similarly, significant variable between Tushin and Awassi lamb breeds were observed in carcass cuts by Bicer et al. (1995).

It seems from Table (5) that no differences exist in the Leg, Shoulder, Loin, Breast and neck among lambs slaughtered at 30, 40 and 50kg. While, the heavier lambs slaughtered at 50kg recorded significantly higher percent of rack and lower percent of fore shank than those slaughters at 30 and 40 kg. But, the lambs slaughtered 30kg appeared significantly higher proportion of flank than those slaughters at 40 and 50kg are presented in Table (5). The differences among slaughter weighs are in accordance with the results obtained by Several authors who found that the slaughter weigh affects the some commercial cuts of the carcass in studied sheep breeds (Kemp et al. 1981; Sents et al., 1982; Balci and Karakaş, 2007; Abdullah and Qudsieh, 2008; Sefdeen and Alkass, 2009; Oramari et al., 2014; Aksoy and Ulutaş, 2015). Though, such changes reveal the different rates of maturity among the commercial cuts of the carcass previously reported by Pálsson and Verges (1952) that leg mature relatively early and the neck and loin are later maturing regions.

Table (5): The effect of breed and different slaughter weights on the proportion wholesale cuts of Karadi and Awassi lambs (Means ± S.E.).

Traits	Overall mean	Breed		Slaughter weight (kg)		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Leg %	33.27±0.41	34.72±0.51a	32.01±0.40b	33.59±0.64a	33.58±0.81a	32.60±0.70a
Shoulder %	19.01±0.40	18.98±0.65a	19.04±0.48a	18.28±0.57a	19.03±0.89a	19.81±0.51a
Rack %	9.15±0.21	8.95±0.34a	9.32±0.26a	8.87±0.30b	8.48±0.37b	10.14±0.14a
Loin %	8.45±0.09	8.11±0.07b	8.74±0.11a	8.37±0.15a	8.45±0.12a	8.54±0.20a
Breast %	9.04±0.17	8.95±0.27a	9.11±0.22a	8.87±0.30a	9.15±0.29a	9.10±0.32a
Fore shank%	7.33±0.23	7.51±0.41a	7.17±0.26a	7.32±0.27ba	7.98±0.51a	6.68±0.35b
Neck %	6.62±0.28	6.14±0.41a	7.03±0.36a	7.13±0.50a	6.55±0.55a	6.12±0.38a
Flank%	7.24±0.16	7.04±0.26a	7.42±0.20a	7.86±0.16a	6.78±0.30b	7.02±0.27b

Means with different letters within each column for Karadi and Awassi male lambs differ significantly ($P<0.01$) according to Duncan's test.

3.7. Portioning of fat

Fat content in the body of Awassi and Karadi sheep expressed as proportion from total body fat are presented in the Table (6). Carcass fat and non-carcass fat of Awassi lambs were (60.78±1.93% and 39.22±1.93%) respectively, whereas for Karadi lambs were (57.92±2.42% and 42.08±2.42%) respectively. However, the differences in Carcass fat and non-carcass fat between two breeds was not significant. Moreover, among non-carcass fat for Awassi and Karadi lambs, omental and mesenrtic fat had the highest (P value) percent (66.42±1.24 and 69.20±2.46%) respectively, followed by kidney and pelvic fat (25.25±1.07 and 21.35±1.83%), respectively and cardiac fat (8.33±0.75 and 9.46±1.00%), respectively (Table 7). Percentage of total body fat from the right side of carcass weight was not significantly affected by lambs breeds. Moreover, among non-carcass fat Awassi lambs significantly had a more proportion of kidney and pelvic fat (25.25±1.07%) as compared to Karadi lambs (21.35±1.83%). These results disagree with the results of Oramari et al. (2014) reviewed that significant difference was observed in percentages for the portioning of fat for studying breeds, who reported that Awassi lambs deposited more carcass fat and non-carcass fat as compared to Hamdani lambs.

In the current work, total body fat was significantly increased with increasing slaughter body weight from 30 to 50kg of body weight (Table 6). It appears from the result that lambs grew up toward heavier weight percent of carcass fat significantly decreased and the percent of non-carcass fat increased. This result confirms those of Sefdeen and Alkass (2009) who found when lambs enlarged in weight recorded significantly more percent of non-carcass fat.

Table (6): The effect of breed and different slaughter weights on partitioning of fat of Karadi and Awassi lambs (Means ± S.E.).

Traits	Overall mean	Breed		Slaughter weight (kg)		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Total Fat (kg)	2.79±0.22	2.63±0.40a	2.92±0.25a	1.67±0.09c	2.65±0.12b	4.16±0.31a
Carcass Fat %	59.45±1.53	57.92±2.42a	60.78±1.93a	66.05±0.77a	57.85±2.12b	53.71±2.95b
Non-Carcass Fat %	40.55±1.53	42.08±2.42a	39.22±1.93a	33.95±0.77b	42.15±2.12a	46.29±2.95a
Kidney and Pelvic Fat %	23.44±1.07	21.35±1.83b	25.25±1.07a	27.53±0.91a	20.72±1.54b	21.61±2.24b
Omental and Mesenrtic Fat %	67.71±1.32	69.20±2.46a	66.42±1.24a	62.14±1.45b	70.70±1.78a	70.90±2.40a
Cardiac Fat %	8.85±0.61	9.46±1.00a	8.33±0.75a	10.33±1.08a	8.58±1.07a	7.50±0.89a

Means with different letters within each column for Karadi and Awassi male lambs differ significantly (P<0.01) according to Duncan's test.

3.8. Chemical composition

Chemical composition of the *logissmus dorsi muscle* of Awassi and Karadi lambs slaughtered at 30, 40 and 50 kg are shown in Table (7). None significant differences were observed between Awassi and Karadi lamb breeds for (moisture, protein, fat and ash traits) (Table 7). In the term of the impact of breed on meat protein, moisture and fat the results are in accordance with the finding of Suliman et al. (2021). On the other hand, this finding disagree with the results of Kashan et al. (2005) and Esenbuğa et al. (2009) who noticed that the chemical composition of meat samples, especially for moisture, protein and fat percent were significantly affected by the breed of lambs.

The moisture content of lamb meat was decreased significantly when lambs grew up toward heavier weight (Table 7). Lambs slaughtered at 50kg live weight recorded significantly lower moisture percent as compared to lambs slaughtered at 40kg and 30kg. Also, there were significant differences among slaughtere weight for protein percent for lambs slaughtered at 50kg as compared to lambs slaughtered at 40 and 30kg. Additionally, fat percent increased significantly with increasing slaughter weight from 30kg to 50kg live weight. While, no significant difference was found in ash percent among slaughter weights. This result was similar to those reported by Das et al. (2008), Abdullah and Qudsieh (2008) and Rajkumar et al. (2014) who approved that the fat content of *rib eye muscle* increased and moisture content decreased with increasing slaughter weights and also Sen et al. (2004) and Polidori et al. (2017) examined that older animals revealed significantly more depots of lipid and higher content of protein compared to lambs slaughtered at a younger age.

Table (7): Chemical composition of meat samples of Karadi and Awassi lambs slaughtered at different slaughter weights (Means ± S.E.).

Traits	Overall mean	Breed		Slaughter weight (kg)		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Moisture %	74.67±0.35	74.52±0.58a	74.80±0.43a	76.68±0.12a	74.40±0.32b	72.72±0.32c
Dry mater %	25.17±0.39	25.40±0.66a	24.97±0.46a	22.85±0.12c	25.79±0.44b	27.12±0.29a
Protein %	19.71±0.20	19.93±0.37a	19.52±0.20a	18.74±0.23c	19.77±0.20b	20.73±0.25a
Fat %	4.15±0.23	3.94±0.33a	4.34±0.32a	2.87±0.18b	4.60±0.26a	5.14±0.26a
Ash %	1.20±0.07	1.30±0.11a	1.11±0.08a	1.24±0.13a	1.09±0.07a	1.25±0.13a

Means with different letters within each column for Karadi and Awassi male lambs differ significantly (P<0.01) according to Duncan's test.

3.9. Cost of gain of Awassi and Karadi lambs

Cost per day, total feed cost and Iraqi dinar/1kg weight gain for Awassi lambs was averaged (385±10.84, 36,201±5.26 and 1,814±0.11 ID), respectively and for Karadi lambs averaged (408±15.57, 38,954±6.84 and 2,031±0.15 ID), respectively (Table 8). Comparison between the two studied breeds reveals that none significant differences observed in these traits between two breeds, except that for Karadi lambs significantly had a higher Iraq dinar/1kg weight gain ($p<0.01$) as compared to Awassi lambs.

The lambs slaughtered at 40kg significantly had a higher (423±14.80 ID) cost per day ($p<0.01$) compared to lambs slaughtered at 50kg (371±22.12 ID), while there were no significant differences between lambs slaughtered at 40kg and 30 kg (394±5.78 ID). The total feed cost for lambs increased with increasing slaughter body weight from 30 to 50kg (12,665±0.62, and 12,944±0.34 ID), respectively. The lambs slaughtered at 40kg (2.235±0.13) and 50kg (2.201±0.08) significantly had a higher Iraqi dinar/1kg weight gain compared to lambs slaughtered at 30kg (1.368±0.03) (Table 8)

In the same trend, Held (1999) concluded that as lambs increase in weight, the cost of gaining weight tends to increase. The lowest cost of gain is commonly during the early growth period when the lamb is lighter and thinner. Excitingly, the lowest price of weight gain during the finishing period occurred at or before the maximum average daily weight gain. In addition, he clarified that when lambs get heaver it requir more feed to gain pound of body weight since the gain includes more fat tissue and less lean tissue than at a lighter less mature status of growth.

Table (8): Cost of gain of Karadi and Awassi lambs (Means ± S.E.).

Traits	**Overall mean**	**Breed**		**Slaughter weight (kg)**		
		Karadi	Awassi	30	40	50
Animal No.	**28**	**13**	**15**	**10**	**9**	**9**
Ration cost (ID /kg Feed)	391	391	391	391	391	391
Daily feed intake (kg/day)	1.011±0.02	1.043±0.04a	0.984±0.03a	1.006±0.01ba	1.081±0.04a	0.948±0.06b
*Cost per day (ID)	395.5±9.36	408±15.57a	385±10.84a	394±5.78ab	423±14.80a	371±22.12b
Total feed intake (kg)	95.85±10.67	99.63±17.49a	92.59±13.46a	32.39±0.50c	98.44±4.54b	163.78±6.19a
**Total feed cost (ID)	37.48±4.17	38,954±6.84a	36,201±5.26a	12,665±0.62c	38,492±1.78b	64,037±2.42a
Total weight gain (kg)	17.85±1.49	17.43±2.27a	18.22±2.03a	9.09±0.23c	17.64±0.39b	27.77±0.34a
****ID/1kg wt. Gain*	1.914±0.09	2,031±0.15a	1,814±0.11b	1,368±0.035b	2,235±0.13a	2,201±0.08a

Means with different letters within each column for Karadi and Awassi male lambs differ significantly ($P<0.01$) according to Duncan's test

* cost per day (kg/day) =Ration cost (ID/kg feed) X Daily feed intake (kg/day)

** Total feed cost (ID) = Ration cost (ID/kg feed) X Total feed intake (kg)

*** ID/1kg wt.Gain = Total feed cost (ID) / Total weight gain (kg)

4. CONCLUSION

It can be concluded that differences in growth performance, carcass characteristics, carcass tissue distribution, total body fat and total feed cost between two studied breeds exist. Also, total feed intake, feed conversion ratio, fat percentage, total feed cost increased and daily gain in weight, lean percentage, Lean: bone ratio, lean: fat ratio decreased when the slaughter weight was over 40kg. Therefore the optimal slaughter weight is 40kg for both Awassi and Karadi male lambs. The cost of gain of Awassi lambs was lower than Karadi lambs and from economic trends lambs slaughtered at 30kg had higher profit potential.

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