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SHORT COMMUNICATION

Growth performance and carcass traits of Karadi growing lambs

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ABSTRACT

Carcass yield of fat-tailed Karadi lambs was investigated. A total of 32 The Karadi lambs screened from various commercial sheep flocks from four different geographic zones (Sharazoor, Halabja, Sharbazher, and Penjween) in Sulaimani governorate, Kurdistan, Iraq. Eight lambs from each of the 4 ecological zones were randomly assigned to 2 feeding treatments (concentrate diet vs. whole barley grain) at a level of 2% of their body weights with 4-6 hours a day stubble grazing. Results revealed that overall means weights recorded at slaughter (38.263 ±1.4 kg), hot carcass (17.199 ±0.8 kg), dressing percentage (44.901 ±1.1%), neck (0.436 ±0.02 kg), shoulder (1.633 ±0.1 kg), loin (0.529 ±0.03 kg), rack (0.782 ±0.1 kg), breast (0.577 ±0.03 kg), fore shank (0.448 ±0.03 kg) and flank (0.276 ±0.02 kg). Overall means of fat thickness, rib eye area and kidney and pelvic fat were 1.790 ±0.3 mm, 13.967 ±0.6 cm^2. Types of feed (barley or concentrate) had no statistical effects on carcass characteristics. Lambs fed barley recorded marginally higher weight at slaughtering, neck, head, feet, leg, shoulder, breast and fore shank as well as rib eye area. On the other hand, lambs fed concentrate had unmarked higher weights of hot carcass, heart, liver, kidney, tests, kidney and pelvic fat, tail, loin, rack and flank as well as higher dressing percentage and fat thickness. Geographic location affected weight at slaughter and some other carcass traits. It was concluded that there was a high genetic variation in carcass traits of lambs from different geographic location in Sulaimani province.

***Keywords*:** Karadi sheep, Lambs meat, Carcass yield

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1. INTRODUCTION

Sheep are considered the most important farm animals in Kurdistan, and the greatest portion of the income comes from the sale of lambs. Productivity of Karadi as well as other Iraqi breeds is rather low and likely to cause low efficiency of meat production (Karym, 2016). Karadi sheep do not depend on high inputs of concentrate; make optimal use of local resources and marginal areas. They graze extensively on natural pasture, stubble and crop residues. The carcass yield and nutritional value of meat derived from sheep kept on natural and bio-diverse vegetation versus animals fed with concentrate in a feed lot is a vital issue now a day as evidence, the diet of pastoralists may be much healthier than that of concentrates. However, in Iraq, fattening lambs in a feed lot usually depend on barley to speed up growth rate and shorten feeding period. Sheep owners usually sell their lambs at weaning as they cannot offer concentrate diet or barley for fattening their lambs to slaughter weight of around 40 kg. Nevertheless, increasing the market weight of lambs in a feed lot has generally met with opposition from lamb buyers and consumers due to that carcasses of lambs fattened at feed lot have more wasteful and fatter than those from lambs rose on natural vegetation. This criticism of fatty lambs has in part show that percent retail cuts or edible portion of the carcass tends to decrease. Feeding system is not only improving growth and carcass characteristics, but also enhances the meat quality of lambs (Mahmud, 2007, Alhidary *et al.*, 2016, Karaca *et al*., 2016).

The aims of the present study were to evaluate carcass yield (mainly dressing percentage, rib eye muscle area, subcutaneous fat thickness and carcass composition) as an important criterion describing carcass yield of economic importance to the industry of lambs raised under semi intensive production system through 2 feeding treatments (concentrate diet vs. whole barley grain) at a restricted level of 2% of their body weights with 4-6 hours a day stubble grazing.

2. MATERIAL AND METHODS

This experiment was carried out at the Sheep Farm, Animal Science Experimental Unit, Dept. of Animal Science, College of Agricultural Sciences, University of Sulaimani, Bakrago, Sulaimani, Iraq. Details of the material and method were described by Karym *et al.*, (2016). Lambs were slaughtered, following fasting for 18-h, with free access to water and weighed immediately prior to slaughter to obtain slaughter body weight (SBW). Hot carcasses were weighed (HCW) after slaughtering immediately by portable electronic scale (Model, Wei Heng, capacity 40 kg). Then carcass was then split along the mid line and the left half was cut into neck, shoulder, fore shank, breast, rack, loin, leg, flank and the fat tail. Fat tail was dissected from carcass also fat depots around kidney and pelvic was accurately weighted by electronic balance (model, EK-12KA, capacity 1-12 kg). Dressing percentage was calculated according to the Rouse et al., (1970). Subcutaneous fat thickness was measured by using Vernier device at the cross section of the 12th and 13th ribs. Rib eye area (REA) was measured in square cm by a planometer from a tracing that was taken from the cut surface over the 12th ribs. Carcasses were longitudinally split into two equal sides, right and left, after removing the fat tail from the carcasses. The left side was cut into standardized wholesale cuts (Forrest et al., 1975). The cuts were separately weighed by electronic balance. General Linear Model (GLM) within the statistical program XLSTAT (2004, version-7.5) was used to analyze the factors affecting

carcass traits (geographic location and feeding regime) within the Complete Randomized Design.

3. RESULTS AND DISCUSSION

Results of the present investigation revealed that Mean ±S.E of body weights during experimental period across geographic locations and feeding regime**.** The result of this study showed that body weights at 6-month (initial weight) and 9 month of age (final weights) and total body gain in weight of Karadi lambs are given in Table 1. The overall mean of initial weight in the current investigation for the Karadi lambs was 28.778 ±1.1 kg. It was higher than recorded earlier (Imam *et al.,* 1986; Younas *et al.,* 2013) in Hissardale Sheep (10.87 ±1.82 kg). The average of total body weight gain obtained for Karadi lambs was 9.600 ±0.81 kg, which means that average daily gain was 106.66 g during the experimental period of 90 days. However, daily body gain for lambs fed 2% barley or concentrates were 72.988 and 140.344 g, respectively (Table 1). Furthermore, overall means of weights recorded at slaughter (38.263 ±1.4 kg), hot carcass (17.199 ±0.8 kg), dressing percentage (44.901 ±1.1%), rib eye area (13.967 ±0.6 cm^2) and fat thickness (1.790 ±0.3 mm) (Table 2).

Table 1. Mean ± S.E of body weights (kg) during experimental period across geographic locations and feeding regime.

Body weight (kg) / Age		Start* (5.5 months)	Initial (6 months)	Final (9 months)	Total body weight gain
Overall mean		27.066±1.043	28.778±1.1	38.066±1.5	9.600±0.81
Feed	Barley	27.500±1.585a	26.769±1.7b	33.338±2.1b	6.569±0.6b
	Concentrate	26.631±1.399a	30.788±1.3a	42.794±1.4a	12.631±1.04a
Locations	Sharazoor	30.313+1.278a	31.963±1.4a	42.000±2.4a	10.038±1.7a
	Halabja	26.988±1.203a	29.300±1.9a	38.825±2.9b	9.525±1.2a
	Penjween	20.300±2.393b	21.413±2.1b	29.850±3.3c	9.688±2.5a
	Sharbazher	30.663±0.746a	32.438±0.9a	41.588±1.5a	9.150±0.9a

Means with different letters within each factor for each age differ significantly ($p < 0.05$)
* Weight at beginning of experiment (adaptation period).

Result revealed that overall mean of animals leg weight was 2.623 ±0.13 kg (Table 3). This result was lower than Chilote (3.36 ±0.85 kg) (Ramírez-Retamal *et al.,* 2013). But it was higher than (2.56 ±0.41 kg) that reported by Sen *et al.,* (2012) **and** Santa lambs (2.45 kg) (Júnior *et al.,* 2013). The effect of feed on leg weight was not significant. Leg weight of lambs

purchased from Penjween (2.885 ±0.1 kg) significantly higher than lambs purchased from other locations. Results of the current investigation indicated the overall mean of animals loin weight was 0.529 ±0.03 kg (Table 3).

Table 2. Mean ± (S.E) of carcass traits (kg(of Karadi lambs across geographic locations and feeding regime

Trait		Slaughter Weight (kg)	Hot Carcass Weight (kg)	Dressing percentage (%)	Rib eye area (cm^2)	Fat thickness (mm)
Overall mean		38.263±1.4	17.199±0.8	44.901±1.1	13.96±0.6	1.79±0.3
Feed	Barley	38.55±1.9a	16.860±0.8a	43.765±0.7a	14.81±0.8a	1.38±0.2a
	Conc.	37.97±2.36a	17.538±1.5a	46.038±2.1a	13.11±0.9a	2.19±0.4a
Locations	Sharazoor	37.80±0.3b	17.895±1.5a	47.370±4.3a	14.99±1.7a	2.29±1.1a
	Halabja	32.35±0.9c	14.000±0.9a	43.235±1.5a	13.08±2.1a	1.37±0.3a
	Penjween	41.60±0.3a	18.415±1.0a	44.250±2.1a	15.04±0.2a	1.64±0.4a
	Sharbazher	41.30±0.3a	17.199±0.8a	44.901±1.1a	12.73±0.1a	1.79±0.3a

Means with different letters within each factor differ significantly ($p < 0.05$).

It was lower than that in Suffolk (3.68 ±0.98 kg) (Ramírez-Retamal *et al.,* 2013), Santa lambs (0.53 kg) (Garcia *et al.,* 2012) and **Turkish Tuj** docked lambs (1.49 ±0.10 kg) (Bingol *et al.,* 2005). But it was higher than Malpura (0.516 ±40.07 kg) (Karim *et al.,* 2001). The effect of feed on loin weight was not significant. Loin weight of lambs purchased from Halabja (0.596 ±0.02 kg) was significantly higher than lambs purchased from other locations. In the present study, results indicated that the overall mean of animals shoulder weight was 1.633 ±0.1 kg (Table 3). It was lower than in Pelibuey (2.300 ±0.28 kg) (Peraza *et al.,* 2010), and Chilote (4.55 ±1.19 kg) (Ramírez-Retamal *et al.,* 2013). But it was higher than that in Karakaş male lambs (0.49 ±0.03 kg) (Gökdal *et al.,* 2003) and **Turkish Tuj** docked lambs (0.44 ±0.02 kg) (Bingol *et al.,* 2005). The effects of feed and location on shoulder weight were not significant. Regarding to the animals rack weight, the overall mean was 0.782 ±0.1 kg (Table 3).

It was higher than that in Awassi×Malpura (0.685 ±33.74 kg) (Karim *et al.,* 2001) and of finisher lambs (0.76 ±0.043 kg) (Karim *et al.,* 2007). It was lower than reported earlier by Carter et *al.,* (1973) in Cross breed of Chivolt × leicester (1.98 kg). The effect of feed regime on rack weight was not significant. Rack weight of lambs purchased from Penjween (0.935 ±0.1 kg) significantly higher than lambs purchased from other locations. Overall mean of neck weight was 0.436 ±0.02 kg (Table 4). It was lower than Karakaş male lambs (0.67 ±0.03 kg) (Gökdal *et al.,* 2003), Kermani male lambs (1.69±0.244 kg) (Shahrbabak *et al.,* 2009), and Santa Inês lambs (1.59 kg) (Garcia *et al.,* 2012).

Table 3. Mean ± (S.E) of major cuts (kg) of Karadi lambs across geographic locations and feeding regime.

Trait (kg)		Leg	Loin	Shoulder	Rack
Overall mean		2.623±0.13	0.529±0.03	1.633±0.1	0.782±0.1
Feed	Barley	2.652±0.1	0.515±0.04	1.657±0.01	0.755±0.01
	Conc.	2.594±0.2	0.543±0.1	1.608±0.14	0.809±0.1
Locations	Sharazoor	2.684±0.01	0.561±0.1	1.688+0.02	0.816±0.1
	Halabja	2.097±0.21	0.394±0.01	1.427±0.2	0.608±0.03
	Penjween	2.885±0.1	0.596±0.02	1.768±0.1	0.935±0.1
	Sharbazher	2.827±0.03	0.566±0.02	1.648±0.01	0.770±0.03

Means with different letters within each factor differ significantly ($p < 0.05$).

Effects of feed and location on neck weight were not significant. Results indicated that the overall mean of animals fore shank weight was 0.448 ±0.03 kg (Table 4). It was lower than in retail lamb (0.58 ±0.06 kg) (Bickerstaffe *et al.,* 2009). The effect of feeding regime on fore shank was not significant. Fore shank weight of lambs purchased from Sharbazher (0.506 ±0.1 kg) significantly higher than animals purchased from other locations. The overall mean of lamb's breast weight was 0.577 ±0.03 kg (Table 4).

It was lower than that in Awassi×Malpura (0.861 ±41.49 kg) (Karim *et al.,* 2001) and **Turkish Tuj lambs** docked (0.98 ±0.05 Kg) (Bingol *et al.,* 2005). The effect of feeding regime and location were not significant on breast weight. Results revealed that the overall mean of animals flank weight was 0.276 ±0.02 kg (Table 4). It was lower than that in Karakaş male lambs (1.15 ±0.07 kg) (Gökdal *et al.,* 2003). The effect of feeding regime on flank weight was not significant. Flank weight of lambs purchased from Sharbazher (0.319 ±0.01 kg) significantly higher than lambs purchased from other locations. Type of feed (barley or concentrate) had no significant effect on carcass characteristics. Lambs fed barley recorded marginally higher weight at slaughtering, neck, head, feet, leg, shoulder, breast and fore shank as well as rib eye area. On the other hand, lambs fed concentrate had unmarked higher weights of hot carcass, heart, liver, kidney, tests, kidney and pelvic fat, tail, loin, rack and flank as well as higher dressing percentage and fat thickness. Geographic location affected weight at slaughter and some other carcass traits. Lambs fed barley recorded 38.550 ±1.9 kg slaughter weight. Slaughter weight of lambs purchased from Penjween (41.600 ±0.3 kg) were significantly ($P < 0.05$) heavier than lambs purchased from other locations. Overall mean of hot carcass weight was 17.199 ±0.8 kg. It was higher than hot carcass weight found by Peraza *et al.,* (2010) and that reported by Idahor (2013). Hot carcass weight of lambs purchased from

Penjween (18.415 ±1.0 kg) significantly (P<0.05) higher than lambs purchased from other locations. Result revealed that the overall mean of dressing percentage was 44.901 ±1.1%. It was lower than that of Karakaş lambs (46.8 ±0.49 %) (Gökdal *et al*., 2003), Yankasa (45.4 ±65.7 %) (Idahor, 2013) and of Malpura (50.5 ±0.89 %) (Karim *et al*., 2001). The effect of feeding system on dressing percentage was not significant. Lambs fed concentrate recorded 46.038 ±2.1 % vs. 43.765 ±0.7 for lambs fed barley. Dressing percentage of lambs purchased from Sharazoor (47.370 ±4.3%) significantly higher than the other animals purchased from other locations. Results indicated that overall mean of rib eye area was13.967 ±0.6 cm^2. It was higher than reported by Murphy *et al*., (2003).

Table 4. Mean ± (S.E) of secondary cuts (kg) of Karadi lambs across geographic locations and feeding regime.

Trait (kg)		Neck	Fore shank	Breast	Flank
Overall mean		0.436±0.02	0.448±0.03	0.577±0.03	0.276±0.02
Feed	Barley	0.444±0.04a	0.494±0.02a	0.585±0.01a	0.252±0.03a
	Conc.	0.428±0.03a	0.403±0.03b	0.570±0.1a	0.299±0.02a
Locations	Sharazoor	0.438±0.04a	0.460±0.02ab	0.636±0.04a	0.298±0.04ab
	Halabja	0.357±0.02a	0.383±0.1b	0.496±0.1a	0.208±0.03b
	Penjween	0.476±0.1a	0.446±0.1ab	0.591±0.02a	0.279±0.04ab
	Sharbazher	0.472±0.01a	0.506±0.1a	0.586±0.03a	0.319±0.01a

Means with different letters within each factor differ significantly ($p < 0.05$).

The effect of feed on rib eye area was not significant. Lambs fed concentrate had 14.819 ±0.8 vs. 13.967 ±0.6 cm^2 for lambs fed barley. Geographic locations had no significant effect on rib eye area. Overall mean of fat thickness was 1.790 ±0.3 mm. It was lower than that indicated by Júnior *et al*., (2013) and McClure *et al*., (2013). The effect of feeding regime on fat thickness was not significant. Lambs fed concentrate had 2.195 ±0.4 vs. 1.385 ±0.2 mm for lambs fed barley. The lambs purchased from Sharazoor significantly higher (2.295 ±1.1 mm) than lambs purchased from other locations. Results of the current investigation indicated that overall mean of animal's loin weight was 0.529 ±0.03 kg. It was lower than that of Suffolk (3.68 ±0.98 kg) (Ramírez-Retamal *et al*., 2013), But it was higher than that in Malpura (0.516 ±40.07 kg) (Karim *et al*., 2001). The effect of feed on loin weight was not significant. Loin weight of lambs purchased from Halabja (0.596 ±0.02 kg) was significantly higher than lambs purchased from other locations. In the current investigation, results indicated that the overall mean of lamb's fat tail weight was 2.601 ±0.3 kg. The effects of feed and location on fat tail

weight were not significant. As sheep herders sell their weaned lambs because they have no fund to buy concentrate for fattening the lambs. Therefore, traders buy the lambs at low prices and they fattened the lambs in a feed lot, which usually depend on concentrate to speed up growth rate and shorten feeding period. Traders usually sell the fattened lambs at a market weight of not less than 40 kg. It was clear that there is a correlation between the dietary composition of sheep feed and the nutritional and sensory value of their products. Increasing the market weight of lambs in a feed lot has generally met with opposition from consumers due to that carcasses from lambs fattened at feed lot have more fat and unacceptable taste and flavour than those from lambs raised on natural vegetation. According to the experimental results obtained from the present study, the most important conclusions can be summarized as follows: Feeding barley at 2% of the live body weight plus ad *libitum* straw with grazing for 6 hours a day stubble was fair enough for normal growth without extra fat in carcasses. Such program can be practiced by many sheep owners as the cost is not too high. Therefore, such practice may increase the profit of the sheep owners.

The effect of geographic location on carcass traits, reflect genetic make-up variation among lambs. More investigations dealing with variations of different genetic make-up for better carcass quality may be vital issue, where one can use progeny testing for elite rams for high quality of carcasses. Appropriate economic incentives are necessary to drive for new natural and bio-diverse vegetation production system as a viable option compared to feed lot fattening. Strong extension service is required to convince farmers and to develop interest about the benefits of raising lambs to market weight of at least 40 kg. Incentives might be provided for those keeping their males for market (slaughter) weight.

4. CONCLUSION

It was concluded that there was a high genetic variation in carcass traits of lambs from different geographic location in Sulaimani province. Feeding barley or concentrate had no significant effect on carcass traits. Therefore, appropriate socio-economic incentives are necessary for adoption of natural and bio-diverse vegetation production system for lamb's market (slaughter) weight.

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