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Performance of Karadi Lambs Fed White or Black Whole Barley Grain for Different Fattening Periods

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Abstract: Feeding on white or black whole barley grain and fattening period's effect on the body weight and measurements, as well as carcass quality of Karadi male lambs was investigated in this study. A total of sixty Karadi male lambs aged six month-old was randomly allocated to two feeding systems (white or black barley grain) for four periods of experimental fattening trial (each period was one month). Body weights as well as total body gain for lambs fed white barley were significantly ($P<0.05$) higher than lambs fed black barley during experimental periods. Feeding white barley significantly ($P<0.05$) increased body length at eight-month (second period), nine month (third period) and final weight (fourth period) compared to black barley. Moreover, height at withers and heart girth showed significant differences at the final period (age of 10^{th} months). Result showed a high interaction between fattening periods and feeding regimes on the length of body, wither height and the girth of heart. This may indicate that lambs at different experimental periods responded differently to type of barley. It is concluded that body weights, total body gain and body measurements for lambs fed white barley were significantly higher than lambs fed black barley.

Keywords: Karadi lambs, Black barley, White barley, Body weight.

Introduction

In Iraq, most Sheep's income comes from the sale of lambs (Juma & Alkass, 2000). In lamb production, the daily gain (one of the most important feedlots technical and economic traits) is affected by different factors such as non-environmental (age, sex, breed, nutrition and fattening period) and environmental conditions (Murray *et al*., 2001). The carcass economic value, which is based on its composition, determines meat yield and quality (Teixeira *et al*., 2004). Grazing on natural pastures and the stubble of cereal in the Kurdistan, Iraq, is the traditional usual of fattening lambs and in feeding lots, feed based on barley and straw (Dosky *et al.,* 2014). Barley contains suitable crude protein level and has high energy value. Therefore, it is a useful feed stuff for Sheep. Consequently,

using barley can eliminate the need for protein supplementation (Lardy and Redden, 2013).

Thus, white or black barley feeding influence on the body weight gain, body measurements, slaughter traits and carcass quality of Karadi male lambs as well as the suitable fattening period were determined in current study.

Materials & Methods:

Animals and experimental design

In the current study, a total of sixty Karadi male lambs at Six month-old was randomly allocated into two feeding regimes (30 lambs fed whole black barley grain vs. 30 lambs' fed whole white barley grain). The black barley grain (containing; DM: 91 %, CP: 10 % and ME: 12.2 MJ/kg DM) was 80–85 % of white barley grain (containing; DM: 91, CP: 11.5 and ME: 13.1 MJ/kg DM). All Animals were kept indoors, witch barley given twice-a-day for free, water and straw ad libitum at all time. Ration treatments were offered for two weeks as adaptation period followed by four periods of experimental fattening trial (each period was one month). The lambs were weighed weekly and body measurements were taken monthly.

At the experiment end, twenty lambs from all groups were slaughtered after fasting for 18h (with free access to water). Prior to slaughter lambs were weighed to obtain slaughter body weight (SBW). Slaughtering was performed according to Islamic law. On the floor, the carcasses were skinned partially and then hanged by hind legs in the racks and after that the skinning was completed. After skinning, evisceration was carried out, the digestive tract was removed and then hot carcasses were weighed (HCW) immediately. Fat tail (which was dissected from the carcass), head and visceral organs were recorded. Dressing percentage was calculated according to Rouse *et al.* (1970):

$$\text{Dressing Percentage \%} = \frac{\text{HCW}}{\text{SBW}} \times 100$$

Statistical analysis:

The statistical program, XLSTAT (Addinsoft, version-2014.5.03) was used to statistically analyze the data within the Completely Randomized Design (CRD) as in the model following:

$$\mathbf{Y_{ijk} = \mu + T_i + F_j + TF_{ij} + e_{ijk}}$$

Where:

$\mathbf{Y}_{ijk}$ = Observation of the performance traits.

$\boldsymbol{\mu}$ = Overall mean.

$\mathbf{T_i}$ = Effect of fattening periods (four periods each lasted one month).

$\mathbf{F_j}$= Effect of feeding regimes (black or white barley grain).

$\mathbf{TF_{ij}}$= Interaction between feeding regimes and fattening period.

$\mathbf{e}_{ijk}$ = Experimental error assumed to be NID $(0, \sigma^2 e)$.

Results & Discussion

Body weights, the length of body, wither height and the girth of heart at six-month (initial), seven-month (first period), 8-month (second period), nine-month (third period) and final weights (fourth period) of Karadi lambs are given in table (1). The overall mean of initial weight in the current study was 28.54±0.46 kg. It was higher than what was recorded by Younas *et al.* (2013) in Hissardale sheep. The average of total gain obtained by Karadi lambs was 10.04±0.47 kg, average daily gain was 83.7 g during the experimental period of 120 days. Total body gain of lambs fed white barley and black barley were 12.02±0.12 and 8.07±0.23 kg, respectively. Body weights as well as total body gain of lambs fed white barley were significantly higher than lambs fed black barley during all experimental periods ($P<0.05$). The length of body, wither height and the girth of heart at six-month (initial), and seven-month (first period) showed no significant differences (Table 1). However, feeding on white barley significantly ($P<0.05$) increased body length at eight-month (second period), nine-month (third period) and final weights (fourth period) compared to black barley. Moreover, height at withers and heart girth showed significant ($P<0.05$) differences at the final period of the experiment (Table 1). Table (2) showed a high interaction between

fattening periods and feeding regimes on the length of body, wither height and the girth of heart. This may indicate that lambs at different experimental periods responded differently to type of barley. This interaction may be due to changing in barley efficiency during advancing age or increasing weight of the lambs.

Many studies reported that the live body weight of lambs was affected by different feeding regime and age. Growth rate, body weight gain and feed efficiency were differed according to age and weight of lambs. The trend in growing lambs in the current investigation was similar to what was found by Balci & Karakas (2007) in Karayaka lambs. The result of this study was higher than body length recorded earlier by Handiwirawan *et al.* (2011) in Barbados Black Belly Cross, Garut Local, Garut Composite, Sumatra Composite and St. Croix Cross Sheep and Younas *et al.* (2013) in Hissardale Sheep. On the other hand, the Karadi lambs body length which found in current study was lower than what was reported by Osaiyuwu *et al. (*2010) in Balami Sheep and Petrović *et al.* (2012) in Mernolandschaf Sheep.

Table (1): Effect of feeding regime on body weight and measurements during experimental periods (Mean± S.E).

Period (age of lambs)	Traits	Body weight (kg)	Body length (cm)	height at withers (cm)	Heart girth (cm)
Initial (6 months)					
	White Barley	28.48±0.66 a	57.17±0.54 a	57.05±0.82 a	69.13±0.82 a
	Black Barley	28.60±0.68 a	57.10±0.54 a	57.50±0.96 a	69.25±0.75 a
	Mean	28.54±0.46	57.14±0.37	57.28±0.62	69.19±0.54
1st (7 months)					
	White Barley	29.81±0.66 a	59.04±0.58 a	58.19±0.79 a	74.23±0.78 a
	Black Barley	29.20±0.73 a	58.13±0.53 a	57.70±0.89 a	73.45±0.81 a
	Mean	29.50±0.48	58.59±0.40	57.95±0.61	73.84±0.55
2nd (8 months)					
	White Barley	32.70±0.59 a	61.82±0.60 a	60.79±0.80 a	78.42±0.81 a
	Black Barley	30.64±0.69 b	60.22±0.60 a	59.80±0.92 a	76.75±0.69 a
	Mean	31.67±0.50	61.02±0.44	60.30±0.62	77.59±0.57
3rd (9 months)					
	White Barley	35.80±0.58 a	66.22±0.61 a	64.29±0.83 a	84.81±0.79 a
	Black Barley	33.00±0.82 b	63.42±0.58 b	62.10±0.87 a	81.05±0.74 b
	Mean	34.40±0.58	64.82±0.51	63.20±0.66	82.93±0.69
Final (10 months)					
	White Barley	40.50±0.63 a	70.72±0.60 a	67.69±0.82 a	90.49±0.80 a
	Black Barley	36.67±0.79 b	68.02±0.56 b	64.20±0.95 b	85.85±0.78 b
	Mean	38.58±0.66	69.37±0.50	65.95±0.73	88.17±0.76
Total body gain					
	White Barley	12.02±0.12 a	13.55±0.16 a	10.64±0.08 a	21.36±0.08 a
	Black Barley	8.07±0.23 b	10.92±0.19 b	6.70±0.11 b	16.60±0.09 b
	Mean	10.04±0.47	12.24±0.32	8.67±0.46	18.98±0.55

Means with different letters within each period for each trait differ significantly ($p<0.05$).

Table (2): Mean± S.E of average body weight and body measurements monthly gain during experiment trial across fattening period and feeding regime.

Interactions		Body weight (kg)	Body length (cm)	height at withers (cm)	Heart girth (cm)
Barley	Period				
white	1	1.32±0.05 e	1.87±0.06 d	1.14±0.02 c	5.10±0.41bc
white	2	2.90±0.07 c	2.78±0.10 c	2.60±0.27 b	4.19±0.24 cd
white	3	3.10±0.14 c	4.40±0.11 a	3.50±0.21 a	6.39±0.16 a
white	4	4.70±0.09 a	4.50±0.11 a	3.40±0.17 a	5.68±0.41 ab
black	1	0.60±0.08 f	1.03±0.02 e	0.20±0.06 d	4.20±0.42 cd
black	2	1.44±0.09 e	2.09±0.04 d	2.10±0.17 b	3.30±0.41 d
black	3	2.36±0.10 d	3.20±0.22 b	2.30±0.30 b	4.30±0.46 cd
black	4	3.67±0.09 b	4.60±0.22 a	2.10±0.09 b	4.80±0.45bc

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

The overall mean of wither height of Karadi lambs was higher than those stated earlier by Handiwirawan *et al.* (2011) in Barbados Black Belly Cross, Garut Local and Garut Composite sheep, Abbasi & Ghafouri-Kesbi (2011) in Makooei sheep, Cam *et al.* (2010a) in Karayaka sheep and Younas *et al.* (2013) in Hissardale sheep. On the other hand, lower than height at withers were reported by Handiwirawan *et al.* (2011) in Sumatra Composite and St. Croix Cross sheep, Osaiyuwu *et al.* (2010) in Balami Sheep, Petrović *et al.* (2012) in Mernolandschaf sheep, Melesse *et al.* (2013) in indigenous sheep populations of southern Ethiopia and Salako (2006) in Uda sheep. The heart girth results are higher than those stated by Handiwirawan *et al.* (2011)) in Barbados Black Belly Cross, Garut Local and Sumatra Composite sheep, Abbasi & Ghafouri-Kesbi (2011) in Makooei sheep, Cam *et al.* (2010b) in Kilkeci and Melesse.*et al.* (2013) in indigenous sheep populations of southern Ethiopia. Similar result were found by Agaviezor *et al.* (2012) in Nigerian indigenous sheep and that reported by Salako (2006) in Uda sheep.

Type of feed (white or black barley) affected (P<0.05) carcass characteristics. Lambs fed on white barley recorded higher slaughter weight, hot carcass and higher dressed percent compared to black barley (Table 3). Results indicated that overall mean of lambs' weight at slaughter was 38.17±0.62 kg (Table 3). It was lower than those reported by Peraza-Mercado *et al.* (2010) in Rambouillet lambs and Idahor (2013) in Nigerian, Nasarawa, Keffi (Yankasa with few Balami and Uda Sheep).

Lambs fed white barley recorded 39.76±0.51 kg at slaughter, 18.22±0.29 kg hot carcass and 45.82±0.34 % dressing percentage. Those of lambs fed black barley were 36.58±0.44 kg, 15.82±0.54 kg and 43.20±0.96 % dressing percentage. Overall mean of hot carcass weight was 17.02±0.49 kg (Table 3). It was lower than those reported by Gökdal *et al.* (2003) in Karakas male lambs, Shahrbabak *et al.* (2009) in Kermani male lambs in Iran and Abdel-Moneim (2009) in Ossimi, Barki and Rahmani Ram lambs. In contrast, it was higher than hot carcass weight stated by Peraza-Mercado *et al.* (2010) in Rambouillet lambs and Idahor (2013) in Nigerian, Keffi sheep. An important criterion describing carcass yield is dressing percentage. Many factors influence dressing percentage are fleece or hide weight, alimentary tract size, sex, age, body weight and body condition, type of feed and level of nutrition (Van Niekerk & Casey, 1988). Result revealed that the overall mean of dressing percentage was 44.51±0.65 % (Table 3). It was lower than those indicated by Gökdal *et al.* (2003) in Karakas male lambs, Idahor (2013) in Nigerian, Keffi sheep and Karim *et al.* (2001) in Malpura × Awassi crossbred lambs. The effect of type of barley on dressing percentage was significant (P<0.05). Lambs fed white barley recorded

45.82±0.34 % dressing percent vs. 43.20±0.96 % for lambs fed black barley.

Overall means of offal organs: head, feet, fat tail weight, heart, liver, kidney, testes and spleen were 2.34±0.11, 1.11±0.03, 2.39±0.19, 1.32±0.06, 0.70±0.02, 0.10±0.01, 0.258±0.016 and 0.381±0.005 kg, respectively (Table 4). No significant differences between offal organs of lambs fed white or black barley. Similarly, overall means of carcass parts including leg, shoulder, rack, loin, breast, fore shank, neck, and flank were 2.54±0.08, 1.62±0.05, 0.74±0.04, 0.50±0.03, 0.57±0.03, 0.50±0.03, 0.44±0.03, and 0.25±0.02 kg, respectively (Table 5). Feeding white barley showed higher (P<0.05) weights of some carcass parts including leg, shoulder, breast, fore shank, and flank (Table 5). The Results revealed that overall mean of lamb leg weight was lower than that indicated by Ramírez-Retamal *et al.* (2013) in Chilote sheep. But it was higher than those reported by Ugur *et al.* (2013) in Karayaka female lambs and Júnior *et al.* (2013) in Santa Inês lambs. Results of the current investigation indicated the overall mean of animal loin weight was lower than that of Suffolk (3.68±0.98 kg, Ramírez-Retamal *et al.* 2013). The type of barley effect on loin weight was not significant.

In the current study, results indicated that the overall mean of animal shoulder weight was lower than in Rambouillet lambs (2.300±0.28 kg, Peraza-Mercado *et al.,* 2010), Turkish Tuj lambs docked (2.59±0.07 kg, Tilki *et al.,* 2010) and Chilote (4.55±1.19 kg, Ramírez-Retamal *et al.,* 2013). But it was higher than that of Karakaş male lambs (0.49±0.03 kg, Gökdal *et al.,* 2003) and Turkish Tuj docked lambs (0.44±0.02 kg, Bing¨ol *et al.,* 2005). The effect of type of barley on shoulder weight was significant. Lambs rack weight was almost similar to 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 that 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. Overall mean of neck weight was lower than Kermani male lambs (1.69±0.244 kg, Shahrbabak *et al.,* 2009), Santa Inês lambs (1.59 kg, Garcia *et al.,* 2012) and Ossimi (1.08±0.05 kg, Abdel-Moneim, 2009). Effects of feed on neck weight were not significant. Fore shank weight found in this study was lower than that stated by Bickerstaffe *et al.* (2009). The effect of feeding regime on fore shank was significant.

Table (3): Effect of feeding regime on carcass traits of Karadi lambs (Mean± S.E).

Traits	Overall mean	White Barley	Black Barley
Slaughter Weight (kg)	38.17±0.62	39.76±0.51 a	36.58±0.44 b
Hot Carcass Weight (kg)	17.02±0.49	18.22±0.29 a	15.82±0.54 b
Dressing percentage (%)	44.51±0.65	45.82±0.34 a	43.20±0.96 b

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

Table (4): Effect of feeding regime on offal organs of Karadi lambs (Mean± S.E).

Trait	Overall mean	White Barley	Black Barley
Head (kg)	2.34±0.11	2.35±0.16 a	2.33±0.17 a
Feet (kg)	1.11±0.03	1.13±0.04 a	1.10±0.04 a
Fat tail weight (kg)	2.39±0.19	2.45±0.27 a	2.34±0.29 a
Heart (kg)	1.32±0.06	1.32±0.08 a	1.31±0.09 a
Liver (kg)	0.70±0.02	0.71±0.03 a	0.69±0.04 a
Kidney (kg)	0.10±0.01	0.11±0.01 a	0.10±.01 a
Testes (kg)	0.258±0.016	0.260±0.024 a	0.256±0.023 a
Spleen (kg)	0.381±0.005	0.383±0.007 a	0.379±0.007 a

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

Table (5): Effect of feeding regime on carcass parts of Karadi lambs (Mean± S.E).

Trait	Overall mean	White Barley	Black Barley
Leg (kg)	2.54±0.08	2.72±0.08 a	2.35±0.06 b
Shoulder (kg)	1.62±0.05	1.71±0.05 a	1.53±0.05 b
Rack (kg)	0.74±0.04	0.81±0.05 a	0.67±0.04 a
Loin (kg)	0.50±0.03	0.55±0.03 a	0.46±0.03 a
Breast (kg)	0.57±0.03	0.64±0.04 a	0.51±0.04 b
Fore shank (kg)	0.50±0.03	0.57±0.04 a	0.42±0.03 b
Neck (kg)	0.44±0.03	0.48±0.03 a	0.41±0.03 a
Flank (kg)	0.25±0.02	0.29±0.03 a	0.21±0.02 b

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

The overall mean of lamb's breast weight was lower than that in Awassi× Malpura (41.49 ±0.861kg, Karim *et al.,* 2001) and Turkish Tuj lambs docked (0.98±0.05 Kg. Bing¨ol *et al.,* 2005). The effect of feeding regime was significant on breast weight. Results revealed that animals flank weight was lower than that in Karakaş male lambs (1.15±0.07 kg, Gökdal *et al.,* 2003) and Rahmani (0.50±0.02 kg, Abdel-Moneim. 2009). The effect of feeding regime on flank weight was significant. Sheep or goat meat is eaten in many countries, apart from dressed carcass are consumed with many body parts. These body parts commonly include the head, heart, liver, kidney and testes, and may also include: lunge, brain, fat, spleen and intestines. All offal organs found in this investigation showed no significant differences between types of barley feeding regime.

Conclusion

It is concluded that body weights as well as total body gain for lambs fed white barley were significantly (P<0.05) higher than those of lambs fed black barley during different fattening periods. Moreover, feeding white barley significantly (P<0.05) increased lamb's body measurements at nine-month (third period) and final weights (fourth period) compared to those of lambs fed black barley.

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