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MEAT QUALITY AND WHOLESALE CUTS OF BARKI LAMBS CARCASS FED AZZAWI DATE

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SUMMARY

Effects of replacing 50 or 100% of corn grains in the concentrate feed mixture by Azzawi date on wholesale cuts and meat quality of Barki lambs were evaluated. Twenty one male Barki lambs (five months old and 24.2 ± 3.0 kg average body weight) were divided into three equal groups (n=seven each). Group 1 (G1) was fed a basal diet consisting of 50% alfalfa hay and 50% concentrate mixture and served as control. The other two groups were fed the basal diet but 50 (G2) or 100 % (G3) of corn grains of the concentrate mixture were replaced by Azzawi date. The experimental period lasted for 173 days and thereafter all lambs were slaughtered after 24 hrs fasting. Carcasses were chilled at 4$^{o\ C}$ for 24 h. Samples of eye muscle (Longsimus dorssi) were collected (rib cut 9-11) from the carcass to evaluate the physical and chemical properties of Barki lambs meat.

Results indicated that significant differences (p <0.05) among dietary groups in wholesale cuts % except shoulder and rack %, which showed no significant difference (p>0.05). Also, results showed a significant difference (P<0.05) among dietary groups for physical components (%) of rib cut (lean meat and fat %). Higher percentages of lean meat and lower fat percentage were observed in G2 and G3 than G1. No significant differences were observed in physical properties (cooking loss%, shear force, water holding capacity, plasticity and color) and chemical composition of meat among dietary groups. Significant differences (p <0.05) for the aroma, flavor, tenderness, and juiciness were observed among dietary groups. G2 and G3 had higher score in meat acceptability than those from the control group.

In conclusion, Azzawi date could replace corn grains and hence can be successfully used in feeding small ruminants with no adverse effects on their physical, chemical and sensory characteristics of Barki lambs meat.

Keywords: Azzawi date, wholesale cuts, meat quality, Barki lambs

INTRODUCTION

Semi-arid and arid regions are characterized by low rainfall that consequently results in low forage production of poor quality. These conditions lead to increase dramatically the cost of energy supplements with the increase of demand for supplementing feeds to animals. The increase in feed cost encouraged nutritionists to search for cheaper high-energy feed ingredients. According to the above mentioned situation, it is the right time to use local unconventional sources of feed to fill the gap between demand and supply of the limited feed resources in addition to substitute the conventional high-priced imported sources. Date palm is one of the unconventional feeds that could be used as a source of energy to replace a part of the concentrates in rations. In recent years, dates are considered as one of the most important food crops in many countries around the world, especially in tropical and subtropical regions. However, a substantial amount of this production is inedible due to its low quality. This portion is used mainly as fertilizer, or animal feed. Discarded dates are characterized by having high Total Digestible Nutrients (TDN) and being palatable for livestock. A number of studies have been conducted on the use of date for sheep (El Hag *et al*,. 1996 and Al-Dobaib *et al*., 2009). Few studies were concerned with the impact of date palm on meat quality.

Hence, the objective of this experiment was carried out to investigate the impact of partially or totally replacing Azzawi date instead of corn grain as a source of energy in the diet on wholesale cuts and meat quality of Barki lambs.

MATERIALS AND METHODS

The experiment was conducted at Maryout Research Station, Desert Research Center, Ministry of Agriculture and Land Reclamation, which is located 35 km south of Alexandria, Egypt.

Animals and feeding treatments:

Twenty-one Barki male lambs aged five months with an average live body weight of 24.2±3.0 kg were used in the present study.

Lambs were fed a basal ration consisting of 50% of alalfa hay and 50% concentrate feed mixture. Experimental lambs were divided according to body weight into three similar groups (seven each) and then randomly allocated to three feeding groups: G1 served as control fed regular ration with no Azzawi date. In the two other groups corn grains were replaced by Azzawi date either partially (50%) or totally (100%) (G3) (Table1). Lambs were fed according to NRC (1985). The experiment period lasted for 173 days. Lambs were housed in shaded pens and fed twice a day (at 09:00 and 15:00 h) and they had free access to fresh water and vitamin/mineral block over the experimental period. Lambs were given a 2-week adaptation period to the pens before receiving the experimental diets. Lambs were weighed at the beginning of the study and biweekly, thereafter, before the morning feeding throughout the study. Average dry matter intake of each group was calculated.

Rations analysis:

Feeds were analyzed in duplicate for proximate chemical analysis according to AOAC (2000). The composition is shown in Table (2).

Slaughter data:

At the end of the experiment, all lambs were slaughtered after 24 h fasting. Carcasses were chilled at an average temperature of 4^{o} C for 24 h (Frild *et al*., 1963). Samples of eye muscle (*Longsimus dorssi*) were collected from the carcass (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 chilled carcass was cut into seven joints (neck, shoulder, rack, flank, loin, leg 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 *Longissimus dorssi* (LD) muscle was measured among 11th and 12th rib using a polar plane meter.

Physical parameters of meat:

Physical properties of meat including color, cooking loss percent, water-holding capacity (W.H.C), plasticity and shear force were determined. 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 11th and 12th rib using polar plane meter.

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).

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 9th 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 h.

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.

Sensory Evaluation:

Samples from loin cut of each lamb were cooked (boiled in tap water for 45 minutes) just after slaughter. After cooking, samples were judged for sensory evaluation by serving to nine panelists in Maryout Research Station to evaluate aroma, flavor, tenderness, juiciness and palatability. Each trait was scored on a scale from 1 to 5 representing the grades of very poor, poor, fair, good and very good, respectively.

Statistical analysis:

The data was subjected to one way analysis of variance using the general linear model (GLM) of Statistical Analysis System (SAS 2004) with level of Azzawi date as the main effect as follows: $Y_{ij} = \mu + d_i + e_{ij}$

Where:

Y_{ij} = the observations,

μ = the overall mean,

d_j = the effect due to i^{th} type of feeding, $_{i =}$ 1,2 ,3,

e_{ij} = random error associated with the $_{ij}^{th}$ observation.

The significant differences were tested according to Duncan's new multiple ranges test (Duncan, 1955).

Some studied data that expressed as a percentages, especially if less than 30% or higher than 70%, were analyzed after transforming percentages by arcsine transform methods.

RESULTS AND DISCUSSION

Wholesale cuts:

Chilled carcass weight and wholesale cut percentages of the three dietary groups are presented in Table (3). Results indicate that chilled carcass weights of all dietary groups were nearly similar with insignificant effects among all groups (P<0.05). This result is in disagreement with Almitiairy *et al.* (2011) who found that lambs fed discarded date have a higher (P<0.05) cold carcass weight than control lambs

Neck, loin, leg and flank percentages differed (P<0.05) due to type of diet, while the other wholesale cuts showed no significance. G2 and G3 had higher leg percentage than G1 (31.24 and 31.47 *vs.* 29.31, respectively). G1 had higher percentages of loin and flank (9.38 and 4.58%) than of G2 (7.96 and 8.13%) and G3,(3.23 and 3.67%), respectively. This is mainly due to the content of lean meat of G2 and G3 was higher than G1.

Physical components of rib cut:

Regarding, the results in Table (4), there were significant differences (P<0.05) among all diets in fat and lean percentages. G1 scored the highest fat % (28.38) than G2 (24.70) and G3 (22.56). The fat percentage declined with the increase of the date level in the rations. These results are in agreement with Almitiairy *et al.* (2011) on Najdi lambs, who found no significant difference among control diet compared two diets containing discarded date (6.05, 5, 92 and 5.74%, respectively).

In this context, the lean meat % of lambs fed Azzawi date (G2 and G3) was higher than those in G1 (48.12 & 51.29 *vs.* 45.12 %). These findings are in agreement with Elgasim *et al.* (1998) who found that the percentage of muscle increased with the increase of the date level in the ration up to 20% (59.4%), then decreased at level of 30 % (52.2%). On the other hand, Almitiairy *et al.* (2011) indicated that the eye muscle area did not reflect significant differences between the treatments although, the group given 30% discarded date attained the highest value (14.58±2.25). In general, this result is totally agreeable with the highest (P<0.05) percentage of carcass muscle attained by the group.

G1 had higher fat percentage (28.38%) than G2 and G3 (24.70 and 22.57%, respectively). In contrary, these results disagree with Elgasim *et al.* (1998), who reported that, the percentage of fat increased progressively with increasing of the date by products in the rations.

Results revealed that, both bone, lean: bone ratio and lean: fat ratio did not differ between G2 and G3, while was (P<0.05) higher in control diet than in G2 and G3 (52.14 *vs.* 30.30 and 35.70), respectively (Table 4).

Eye muscle area did not reflect significant differences between G2 and G3 although G3 attained the highest value (17.78 cm^2). These results are in agreement with results of Almitiairy *et al.* (2011).

Physical properties of meat:

Physical meat quality parameters were comparable among all the diet groups except for the water holding capacity which was more favorable in G2 and G3 compared to G1 (Table 5). Water holding capacity of meat was better in lambs fed Azzawi date possibly because of having more bound water to their muscle fibers. Thus, their ability will be better for retaining more water within its muscle fibers. Tenderness values obtained are considered to be within the acceptable range as well.

No significant differences were observed among dietary groups for shear force, cooking loss and water holding capacity, while, plasticity was significantly different among the three dietary groups. Field *et al.* (1971) stated in his review that shear force values around 3.6 kg/cm^2 or less have acceptable tenderness for goat and sheep meat. These results are comparable with the findings of Qudsieh

(2006) for male lambs slaughtered at different live weights.

Lightness (*L**), redness (*a**) and yellowness (*b**) values of LD muscle were comparable among the three diets groups. These results are in agreement with Mahgoub *et al.* (2005) and Almitiairy *et al.* (2011), who found that there was no effect of feeding discarded date on all meat quality parameters.

Chemical composition of meat:

Results revealed no significant difference among all dietary groups in moisture, protein and fat percentages except for ash (1.5 and 1.6 *vs.* 2.0 %) and collagen (1.68 and 1.81 vs. 1.4 %) for G1. G2 and G3, respectively (Table 6).

The pH value depends on glycogen level at slaughter. Therefore, lack of differences in ultimate pH values among the three dietary groups indicated that diet had no significant effect on the muscle glycogen content at slaughter. The pH values for all dietary groups were within the range at which meat is considered to be tender (Qudsieh, 2006). The results obtained here are comparable to those mentioned by Almitiairy *et al.* (2011) who declared that, meat pH and color components did not differ among dietary groups receiving discarded date.

Sensory properties:

Significant differences ($P < 0.05$) for the aroma, flavor, tenderness, and juiciness were observed among dietary groups. Panelists were able to detect differences among samples of meat. The meat of lambs of G2 had higher score in meat acceptability than those of G1 and G3 (Table 7).

CONCLUSION

Using of Azzawi date as a source of energy in the diet did not affect negatively meat quality traits of Barki lambs. Hence it is recommended to be used in rations to offer cheap feeds as well as to solve feed shortage in semi-arid and arid areas.

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Table1. Dietary ingredients used in formulating the concentrate mixture (% on fresh basis)

Ingredients	Date 0 (G1)	Azzawi date (%)	
		Date 50 (G2)	Date 100 (G3)
Azzawi date	0	27.5	55
Corn grain	55	27.5	0
Soybean meal	16	18	19
Cotton seed meal	10	10	10
Wheat bran	17	15	14
Salt, NaCl	0.7	0.7	0.7
Limestone	1	1	1
Vitamin mineral premix[2]	0.3	0.3	0.3

[1]Diets were: no Azzawi date (Control), 50% Azzawi date (Date50), and 100% Azzawi date (Date100) substitute for corn grain. Composition per 3 kg contained: Vit. A; 10,000,000 IU, Vit. D3; 2,000,000 IU, Vit. E; 10,000 mg, Vit K3; 1000 mg, Vit. B1; 1,000 mg, Vit. B2; 5,000 mg, Vit. B6; 1500 mg, Vit. B12; 10 mg, Biotin; 50 mg, Nicotinic; 30,000 mg, Pantothenic; 10,000 mg, Mn; 60,000 mg, Zn; 50,000 mg, Se; 100 mg, Co; 100 mg, Fe; 30,000 mg, Cu; 4,000 mg, Iodine; 300 mg.

Table 2. Chemical composition of concentrate mixture and berseem hay (on DM basis) of the experimental diets

Chemical Composition	Diets			Alfalfa hay
	Date 0% (G1)	**Date 50% (G2)**	**Date 100% (G3)**	
Dry matter	89.49	88.52	89.53	88.39
Organic matter	94.44	90.69	89.94	90.78
Crude protein	16.66	16.94	16.89	16.05
Ether extract	3.77	3.64	3.54	2.28
Crude fiber	6.71	8.01	9.35	27.35
Nitrogen free extract	67.3	62.1	60.16	45.1
Ash	5.56	9.31	10.06	9.22

Table 3. Chilled carcass weight (Kg) and wholesale cuts (%) of Barki lambs fed different levels of Azzawi date

Item	**Date 0 (G1)**	**Azzawi date (%)**		**±SE**
		Date 50 (G2)	**Date 100 (G3)**	
Chilled carcass wt	23.54 [a]	23.24 [a]	23.71 [a]	1.35
Wholesale cuts (%)[1]				
Neck	7.48[b]	7.12[b]	9.02[a]	0.60
Shoulder	18.07[a]	18.24[a]	18.35[a]	0.70
Rack	26.25[a]	26.18[a]	24.13[a]	1.20
Flank	4.58[a]	3.23 [b]	3.67[ab]	0.60
Loin	9.38[a]	8.75[b]	8.13 [b]	0.40
Leg	29.31[b]	31.24[ab]	31.47[a]	0.50
Tail	4.93[a]	5.24[a]	5.23[a]	1.20

1: Based on chilled carcass wt. Means followed by different superscript letters within the same row are significantly different at P<0.05.

Table 4. Percentages of physical components of 9-10-11 rib cut of Barki lambs fed different levels of Azzawi date

Item	Azzawi date (%)			±SE
	Date 0 ,Control	Date 50	Date 100	
9-10-11 rib cut wt (Kg)	1.134[a]	1.068[a]	1.126[a]	1.01
Physical components (%)[1] of 9-10-11 rib cut				
Lean meat	45.12[b]	48.92[a]	51.29[a]	2.70
Fat	28.38[a]	24.70[ab]	22.57[b]	4.11
Bone	22.59[a]	23.88[a]	22.34[a]	4.09
loss	3.91[a]	2.50[a]	3.80[a]	0.06
Lean : Fat ratio	1.68[a]	2.04[a]	2.35[a]	2.80
Lean : Bone ratio	2.03[a]	2.03[a]	2.32[a]	1.70
L.D muscle area (cm^2)	15.16[a]	16.29[a]	17.78[a]	1.09

1: Based on rib cut wt. Means followed by different superscript letters within the same row are significantly different at P<0.05.

Table 5. Physical properties of meat for Barki lambs fed different levels of Azzawi date.

Parameters	Azzawi date (%)			±SE
	Date 0 (G1)	Date 50 (G2)	Date 100 (G3)	
Cooking loss %	41.28[a]	42.92[a]	43.71[a]	0.82
W.H.C (cm^2)*	5.57[a]	4.34[a]	4.99[a]	0.51
Plasticity(cm^2)	2.32[a]	1.59[b]	2.01[ab]	0.20
Shear force (kg)	2.72[a]	3.80[a]	3.34[a]	0.36
Colour coordinates				
L (lightness)	44.68[a]	46.17[a]	43.64[a]	0.87
a (redness)	13.48[a]	13.45[a]	14.23[a]	0.58
b (yellowness)	2.70[a]	3.70[a]	3.87[a]	0.41

* W.H.C; water holding capacity. Means followed by different superscript letters within the same row are significantly different at P<0.05.

Table 6. Chemical composition of eye muscle (moisture, protein, fat, ash and collagen) and pH value for Barki lambs meat fed different levels of Azzawi date

Item	Azzawi date (%)		±SE
	Date 0 (G1)	Date 50 (G2)	Date 100 (G3)	
Chemical composition of eye muscle				
Moisture	71.89[a]	71.85[a]	72.80[a]	0.01
Protein	20.17[a]	20.68[a]	19.90[a]	0.06
Fat	6.47[a]	6.20[a]	5.30[a]	0.03
Ash	1.50[b]	1.60[ab]	2.00[a]	0.02
Collagen	1.68[a]	1.81[a]	1.40[b]	0.01
pH value				
pH at slaughtering immediately	6.23[a]	6.29[a]	6.27[a]	0.08
pH at 24 hrs after slaughtering	5.24[a]	5.33[a]	5.28[a]	0.04

Means followed by different superscript letters within the same row are significantly different at P>0.05.

Table 7. Sensory scores (flavor, aroma, tenderness, juiciness and palatability) for meat of Barki lambs fed different levels of Azzawi date

Parameters [1]	Azzawi date (%)			±SE
	Date 0 (G1)	Date 50 (G2)	Date 100 (G3)	
Flavor	3.83[ab]	4.17[a]	3.67[b]	0.17
Aroma	3.50[b]	4.17[a]	3.92[a]	0.13
Tenderness	3.50[b]	3.92[ab]	3.67[ab]	0.13
Juiciness	3.59[b]	4.17[a]	3.5[b]	0.12
palatability	3.61[b]	4.10[a]	3.69[b]	0.08

1, Each trait was scored on a scale from 1 to 5 representing the grades of very poor, poor, fair, good and very good, respectively. Means followed by different superscript letters within the same row are significantly different at P<0.05.

جودة اللحوم والقطعيات التجارية لذبائح الحملان البرقى المغذاة على البلح العزاوى

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أجريت هذة الدراسة بهدف تقييم مدى امكانية استخدام البلح العزاوى كمصدر للطاقة وبديل للتغذية فى علائق الاغنام من خلال تأثيره على الخصائص الطبيعية والكيماوية والحسية للحوم الناتجة من الأغنام البرقى تحت الظروف الصحراوية. استخدم فى هذة الدراسة 21 حولى برقى بمتوسط وزن 24,2± 3كجم ومتوسط عمر 5 اشهر. تم تقسيم الحيوانات عشوائيا الى 3 مجموعات (7 حيوانات داخل كل مجموعة) استمرت هذة الدراسة لمدة 173 يوم. غذيت الحيوانات على 3 علائق مختلفة ، العليقة الاولى : تغذية تقليدية 50% دريس برسيم حجازى و 50% مخلوط مركز (كنترول) ، العليقة الثانية : الكنترول ولكن استبدل 50% من حبوب الذره فى المخلوط المركز بواسطة بلح عزاوى ، العليقة الثالثة : الكنترول ولكن استبدل 100% من حبوب الذره فى المخلوط المركز بواسطة بلح عزاوى. وفى نهاية التجربة تم ذبح الحيوانات وأخذت البيانات الخاصة بالذبيحة وبعد التبريد تم دراسة القطعيات التجارية والتحليل الطبيعى لقطعية الضلوع 9-10-11 وأخذت العينات اللازمة لإجراء التحليل الطبيعى والكيماوى للحوم واختبار التذوق وأوضحت الدراسة النتائج التالية:

1- كانت هناك فروق معنوية بين نسب القطعيات التجارية للذبيحة بين المجاميع الثلاثة (عند مستوى 0.05%) فيما عدا قطعية الكتف والضلوع حيث سجلت المجاميع المغذاة على البلح العزاوى أعلى نسبة من قطعية الفخذ وفى المقابل سجلت المعاملة الكنترول أعلى نسبة فى قطعية بيت الكلاوى .

2- كانت هناك فروق معنوية عند مستوى 0.05% بين المعاملات الثلاثة للمكونات الطبيعية لقطعية الضلوع 9- 10- 11 حيث سجلت المجاميع المغذاة على البلح العزاوى نسب أعلى فى اللحم الأحمر ونسب أقل فى الدهن .

3- لم يكن هناك فروق معنوية بين المعاملات فى الخصائص الطبيعية والكيماوية للحوم الناتجة أما بالنسبة للخصائص الحسية كانت هناك فروق معنوية حيث حققت المجاميع المغذاة على البلح العزاوى درجات أعلى من الكنترول

وقد خلصت الدراسة الى أنه يمكن استخدام البلح العزاوى كبديل لحبوب الذرة جزئيا او كليا كمصدر للطاقة فى تغذية الحملان البرقى دون اى تأثيرات سلبية على درجة جودة لحومها من حيث الخصائص الطبيعية والكيماوية والحسية.