J. Agric. Sci. Mansoura Univ., 30 (4): 1929 - 1942, 2005

CARCASS TRAITS AND MEAT QUALITY OF ONE- HUMPED CAMELS FED DIFFERENT HALOPHYTIC FORAGES: 1- WHOLESALE CUTS AND PHYSICAL COMPONENTS OF CAMEL CARCASS.

Shehata, M.F.; Safinaz M. Shawket and A.A. Azamel
Animal and Poultry Division, Desert Research Center, El-Mataria, Cairo, Egypt.

ABSTRACT

Twelve male one-humped camels aged 10 – 12 months and average body weight of 250 ± 3.27 kg were fed *Acacia saligna* (AS) and/or *Atriplex nummularia* (AN) as roughage component. Ground date stones and olive cakes were added as concentrate to the traditional concentrate mixture formula at the rate of 20 and 10%, respectively. Camels were divided into four equal groups (3 each). The first group (control) was fed traditional concentrate mixture (TCM) and berseem hay. The second group was fed untraditional concentrate mixture (UCM) and AS. The third group was fed UCM and AN. The fourth group was fed UCM, AS and AN. Camels were salughtered after 240 days and carcasses were chilled and used to observe the effect of camels feeding on halophytic plants on wholesale cuts, physical components and fat deposits in camel carcass. Results showed that the brisket and shoulder cuts weight differed significantly ($P<0.05$) due to type of feeding, while the other wholesale cuts, high-priced cuts, fore- and hind-quarters showed no significant differences. The weights of high-priced cuts as a percent of chilled carcass weight were 42.00, 43.27, 43.58 and 40.87% for BH, AS, AN and AS-AN groups, respectively. Hind-quarters mean weight (53.76%) recorded higher values than fore-quarters (46.23%) but there were no significant differences among all groups studied. Regardless of the feeding groups, the present study showed that fore-quarters attained higher lean meat, less fat and higher bone contents when compared to the hind-quarters. However, the hind-quarters yield higher percentages of boneless meat than the fore-quarters. Camel groups which were fed halophytic forages had similar results to camels in the control group which were fed berseem hay in the lean meat, fat and boneless meat for both fore- and hind-quarters. The percentages of lean meat, fat, bone and boneless meat (based on chilled carcas weight) in whole carcass were significantly ($P \leq 0.05$) affected by type of feeding. The AN group that was fed *Atriplex nummularia* had higher lean meat percentage (58.13%) and lower fat percentage (22.01%) than the other groups. Also, the AN group had lower total body and carcass fat values (17.60 and 7.18%) than the BH, AS and AS-AN groups (21.90 and 12.37; 20.05 and 8.98; and 20.01 and 9.99 %), respectively which considered more acceptable than other groups. Accoding to the present results, the untraditional concentrate mixture (UCM) and edible parts of the halophytic plants in feeding growing camels can be successfully used in feeding growing camels for a period of eight months with no adverse effects on their wholesale cuts, physical components (lean meat, fat, bone and boneless meat) and fat deposits.

Keywords: One-humped camel, wholesale cuts, lean meat, boneless meat, fat deposits, halophytic forages.

INTRODUCTION

Producing high quantities of meat for human consumption is vital in developing countries. The dromedary camel receives much appreciation as a valuable meat-producing animal in many parts of Egypt, Saudi Arabia and

Libya (Wardeh, 1992). Male camels are mostly imported to Egypt and other Arab countries. The different wholesale cuts proportions are economically important. Arabian camels bodies are chatacterized by a sizeable portion in hump and neck. The high-priced cuts in carcass are known to be one of the primary measures for carcass quality, which define the value of the carcass.

Estimates of different physical components (lean meat, fat and bone) from animal carcass are of a major interest to both producers and livestock improvement programs. Distribution of both lean and fat tissues in camel carcass depend on the actual size and/or weight. Lean meat in camel carcass is around 60%, while fat levels vary from 4.70 to 16.9% (Wardeh, 1989; Yousif and Babiker, 1989; Biala *et al.*,1990 and Kamoun, 1995). Most of the body fat of camels is stored in the hump rather than being diffused throughout the body (Wilson, 1984). Fatty tissues percentage is highly changeable in comparison to lean and bone. Body weight at slaughter, age, sex and type of feed influence the fat proportion in the carcass. The bone component in camel carcass ranged from 15.9 to 38.7% (Wilson, 1984).

Halophytic plants used as animal feed have good potentials as feed resources (El-Shaer, 1995 and El-Shaer and Ismail, 2002). Feeding halophytes is a feasible solution to minimize the problem of feed shortage in Egyptian arid and semi-arid regions, where desert represents 96% of the total area. *Atriplex nummularia* is an important saltbush, with a great biomass yield, high crude protein, low crude fiber and high resistance to salinity (El-Hyatemy *et al.*, 1987; Le Houerou, 1992). *Acacia saligna* is an ever-green legume shrub that extensively grows in arid and semi-arid zones. It contains high crude protein, high fiber content and condensed tannins, which decreases the availability of protein (Ramirez and Lara, 1998). No research information is avaiable concerning the effect of feeding such halophytic plants on wholesale cuts, physical components and fat deposits of one-humped camels.

The present study is carried out to classify wholesale cuts of camel carcass and evaluate the effects of feeding young male camels on fresh *Acacia saligna, Atriplex nummularia*, ground date stones and olive cake as feedstuffs on wholesale cuts, physical components (leam meat, fat and bone) and fat deposits in camel carcass.

MATERIALS AND METHODS

Animals and Management

This study was carried out at Maryout Research Station, 35 km. South of Alexandria, Desert Research Center, Ministry of Agriculture and Land Reclaimation, Egypt. Twelve growing male one-humped camels (*Camelus dromedarius)* aged 10 – 12 months with average body weight 250.23 ± 3.27kg were used. Some non-conventional feeds, which are available in the local area were used instead of conventional feeds for feeding the growing camels. The study lasted for 240 days. Camels were divided into four equal groups (3 each) and similar in average body weight. They were individually housed in closed pens throughout the experimental period and randomly assigned to the four experimental rations.

Treatments

Camels of the first group (control) were fed traditional concentrate mixture (TCM) that consists of soybean meal, 15%; yellow corn, 25%; barely grains, 30%; wheat bran, 25%; molasses, 3%; lime stone, 1%, and common salt, 1%), while the other three groups were fed untraditional concentrate mixture (UCM) by including both ground date stones and olive cake (20 and 10%, respectively) as shown in Table (1) to completely replace wheat bran and partly barley grains, while soybean meal and yellow corn were increased. Both concentrate mixtures were offered to camels at the level of 125 % of maintenance requirements (Farid *et al.*, 1990). In addition to the concentrates, all camels were fed roughages of different sources *ad libitum*. The control group was offered berseem (*Trifolium alexandrinum*) hay (BH), while the other three groups were offered fresh *Acacia saligna* (AS), *Atriplex nummularia* (AN), or *Acacia saligna* along with *Atriplex nummularia* (AS-AN, were offered separately without mixing).

Table (1): Feed ingredients of the experimental rations (% on fed basis).

Feed ingredients	Experimental Rations*			
	BH	AS	AN	AS-AN
Concentrated mixture:				
Soybean meal (SM)	15	20	20	20
Yellow corn grains (YC)	25	27	27	27
Barley grains (BG)	30	18	18	18
Olive cake (OC)	-	10	10	10
Ground date stones (GDS)	-	20	20	20
Wheat bran (WB)	25	-	-	-
Molasses	3	3	3	3
Lime stone	1	1	1	1
Common salt	1	1	1	1
Experimental roughages:				
Berseem hay (BH)	+	-	-	-
Acacia saligna (AS)	-	+	-	+
Atriplex nummularia (AN)	-	-	+	+

* The experimental rations, BH, Berseem hay; AS, *Acacia saligna*; AN, *Atriplex nummularia*; AS-AN, were offered separately.

Slaughter Data

At the end of the experiment, all camels were fasted for 24 hrs then weighed and slaughtered. Wholesale cuts, physical components and fat deposits in the carcasses camels were studied.

Cutting and Chilling of Carcasses

Camel carcass was longitudinally split down at the middle line of the backbone into right and left sides. Right and left carcass sides were divided into fore- and hind-quarters by cutting between the 7^{th} and 8^{th} ribs.

Neck and hump were separated during the cutting process. Weights of the fore- and hind-quarters for both sides, neck and hump were recorded.

The carcasses were transferred to a cooler and kept for 24 hrs period in 4° C ambient temperature. The chilled carcass weight was recorded after cooling and before any further treatment.

Wholesale Cuts

The fore and hind-quarters for the left side of the carcasses were cut into different wholesale joints. Cutting procedure adopted was that of El-Asheeri (1992) and Shehata (1999). The fore-quarter cuts were neck, shoulder, brisket, flat ribs and fore ribs, while the hind-quarter cuts were round, fillet, sirloin, best ribs, flank and hump to produce a total of eleven wholesale cuts (Fig. 1). The wholesale cuts weights were recorded and percentages of chilled carcass weight were calculated.

Dissection of Wholesales Cuts

Wholesale cuts for the left sides of camel carcasses were dissected into their physical components (lean meat, fat and bone). The components weights were recorded and expressed as percentages of chilled cut weight. The weights of each component in wholesale cuts were added together to get the weights of physical components in the whole carcass. The percentage of lean meat, fat and bone in whole carcass were then obtained.

High-Priced Cuts

The high-priced cuts included the round, tenderloin, sirloin, best ribs and fore ribs cuts. The high-priced cuts weights were recorded and the percentages of chilled carcass weights were calculated. Also, the lean meat, fat, bone and boneless meat percentages in high-priced cuts were calculated.

Boneless Meat Percentage

The weights of lean meat, fat, bone and boneless meat (lean meat plus fat) in whole carcass were obtained as percentages of the chilled carcass weight. Lean: bone and lean: fat ratios were also calculated.

Eye Muscle Area

The eye muscle (*Longissimus dorsi*) area was measured in cross section between the 11^{th} and 12^{th} rib. The outline of eye muscle of both sides was drawin on a plastic sheet. The mean area of both drawings was measured by digital planimeter Kp-90 (PLACOM) according to Henderson *et al.* (1966).

Statistical Analysis

Results were subjected to one-way analysis of variance according to SAS (2000). Statistical analysis was based on the following model:

$$Yij = \mu + Ri + Eij$$

Where:

Yij = The observation on the ij^{th} traits,
μ = general mean,
Ri = effect due to the i^{th} rations i=1-4,
Eij = random error.

Duncan's Multiple Range Test was used to compare the differences among experimental treatments.

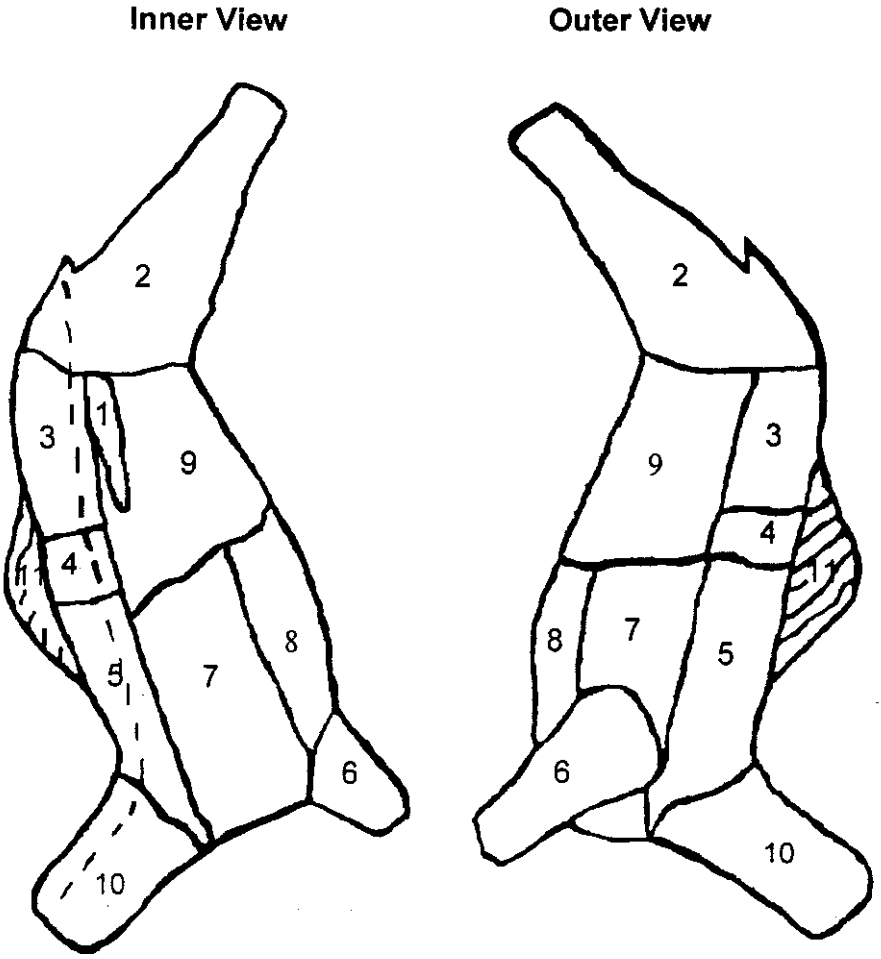

Fig. 1: Diagram of the Camel Carcass showing the separation of Wholesale cuts used in the study. 1, Tenderloin (Fillet); 2, Round; 3, Sirloin; 4, Best ribs; 5, Fore ribs; 6, Shoulder; 7, Flat ribs; 8, Brisket; 9, Flank; 10, Neck and 11, Hump.

RESULTS AND DISCUSSION

Slaughter Weight and Dressing Percentage

Results of slaughter weight, empty body weight, hot carcass weight, dressing percentage, chilled carcass weight, and boneless meat percentage are presented in Table (2). The slaughter weights were 445.5, 433.0, 385.0 and 390.0 kg. for BH, AS, AN, and AS-AN, respectively. Dressing percentage based on slaughter and empty body weight ranged from 60.26 – 63.94% and 70.70 – 72.35%, respectively. The values of dressing percentage either based on the slaughter or empty body weight were superior to those reported in the literature, which ranged from 48.2 – 56.8% and 60.1 – 63.6%, respectively (Morton, 1984; Wilson, 1984; Wardeh, 1989; Babiker and Yousif 1990 and El-Gaseim and El-Hag, 1992). The group of camels fed AN-AS had significantly ($P \leq 0.05$) higher dressing percentage than those of the other groups either based on slaughter body weight. It was noticed that even the lowest dressing percentage values of camel groups fed on BH were slightly higher than those values obtained by Shawket (1999) on yearling male camels fed on *Atriplex halimus* being 59.02 and 66.10 %, as based on slaughter and empty body weight, respectively. The present results clearly indicated that dressing percentages of growing male camels were superior to those reported by Bendary et al. (1992) and El-Gasim and El-Hag (1992) on camel calves fed concentrate mixture with hay or rice straw which had dressing percentage ranged from 51.10 – 52.66 and 61.00 – 62.71% either based on slaughter or empty body weight, respectively.

Table (2): Least square means of slaughter wt, empty body wt, hot carcass wt, chilled carcass wt, dressing % and boneless meat % for of camels fed different types of forages.

Item	BH	Type of forages			± SE
		AS	AN	AS-AN	
Slaughter wt (kg)	445.50	433.00	385.00	390.00	21.58
Empty body wt (kg)	379.30	374.67	322.73	352.67	19.24
Hot carcass wt (kg)	268.87	264.90	233.57	249.20	13.95
Dressing percentage**					
(1)	60.26^{b}	61.19^{b}	60.66^{b}	63.94^{a}	0.59
(2)	70.84	70.72	72.35	70.70	0.65
Chilled carcass wt (kg)	262.40	254.47	222.33	243.93	13.69
Left side of chilled carcass wt (kg)	129.00^{a}	129.40^{a}	111.93^{b}	122.17^{a}	5.71
Boneless meat percentage***	82.64^{a}	81.74^{ab}	80.25^{b}	80.55^{b}	0.45

*, BH, Berseem hay; AS, *Acacia saligna*; AN, *Atriplex nummularia*; AS-AN, were offered separately. **, (1) Based on slaughter weight. (2) Based on empty body weight. ***, Based on the left side of chilled carcass weight. left side of chilled carcass weight. a and b: Means followed by different superscripts within each row are significantly different ($P \leq 0.05$).

Wholesale Cuts

Percentages of wholesale cuts, high-priced cuts, fore- and hind-quarters of chilled carcass weight are shown in Table 3. Brisket and shoulder cuts percentages differed significantly ($P<0.05$) due to type of feeding, while

the other wholesale cuts, high-priced cuts, fore- and hind-quarters showed no significance. The shoulder cut in AS-AN group had the highest weight (24.10%), however it decreased in the BH, AN, AS (23.01, 22.23 and 20.17%), respectively. The brisket cut increased from 4.79% in AN group to 5.06, 5.59 and 6.39% in BH, AS-AN and AS groups, respectively.

Table (3): Least square means of percentages[1] of wholesale cuts, high-priced cuts, fore-quarters and hind-quarters for carcasses of camels fed different types of forages.

Item	BH	Type of forages[2]			± SE
		AS	AN	AS-AN	
Round	23.19	22.65	24.20	24.23	0.87
Tenderloin	1.66	1.43	1.26	1.57	0.12
Sirloin	4.89	5.07	4.68	4.33	0.81
Best ribs	5.44	5.14	4.92	4.87	0.47
Fore ribs	6.82	8.98	8.52	5.86	1.01
Flat ribs	3.43	3.74	3.48	2.57	0.37
Brisket	5.06^{ab}	6.39^{a}	4.79^{b}	5.59^{ab}	0.38
Shoulder	23.01^{a}	20.17^{b}	22.23^{ab}	24.10^{a}	0.80
Flank	8.86	6.41	7.47	7.62	0.78
Neck	7.33	7.11	7.96	7.86	0.46
Hump	10.28	12.49	11.66	11.39	0.74
High-priced cuts	42.00	43.27	43.58	40.87	1.24
Fore-quarters	45.68	46.39	46.98	45.98	0.39
Hind-quarters	54.32	53.61	53.10	54.02	0.37

1, Based on left side of chilled carcass weight. 2, BH, Berseem hay; AS, *Acacia saligna*; AN, *Atriplex nummularia*; AS-AN, were offered separately. a and b: Means followed by different superscripts within each row are significantly different (P ≤ 0.05).

The percentage of high-priced cuts were 42.00, 43.27, 43.58 and 40.87% for BH, AS, AN and AS-AN groups, respectively. Shehata (1999) showed similar results on one-humped camels. These values were lower than those of Friesian cattle (49.51) and buffaloes (50.81) as reported by Sami (1996).

Hind-quarters mean recorded higher values (53.76%) than fore-quarters (46.23%) but there were no significant differences among all groups studied. Biala *et al.* (1990) showed the fore- (without neck) and hind-quarters of camels to be 63.2, 63.8% and 63.76, 63.18% at 1 and 2 years of age, respectively in the Megherbi camels. In Sudanese camels, Shareha (1990) found that the fore- and hind-quarters percentages were 58 and 42%, respectively.

Physical Components in Fore- and Hind-Quarters

The percentage means of physical components in the camel fore-quarters cuts are shown in Table 4.

Table (4): Least square means of percentages[1] of physical components (lean meat,fat and bone) of fore-quarter cuts for carcasses of camels fed different types of forages.

Item	BH	Type of forages[2]			± SE
		AS	AN	AS-AN	
Neck (kg)	9.53	9.20	8.87	9.63	0.80
Lean meat (%)	70.83	71.09	70.72	71.66	0.64
Fat (%)	5.61^{a}	7.03^{b}	5.30^{a}	5.08^{a}	0.51
Bone (%)	23..56	21.88	23.98	23.26	0.66
Shoulder (kg)	29.77	26.88	24.87	29.40	1.65
Lean meat (%)	66.80^{c}	72.40^{ab}	73.59^{a}	68.68^{bc}	1.41
Fat (%)	13.36^{b}	8.31^{ab}	5.79^{b}	11.99^{a}	1.56
Bone (%)	17.84	19.29	20.63	19.33	0.92
Brisket (kg)	7.00	6.65	5.64	5.93	0.64
Lean meat (%)	43.73	40.14	40.30	35.37	4.00
Fat (%)	39.84	34.85	35.16	43.77	5.42
Bone (%)	16.43	25.02	24.54	20.86	3.87
Flat ribs (kg)	4.70	4.83	3.90	3.12	0.53
Lean meat (%)	58.92	61.78	57.58	57.78	3.08
Fat (%)	23.58	17.42	16.82	17.73	2.32
Bone (%)	17.50	20.80	25.60	24.49	2.73
Fore ribs (kg)	8.67^{ab}	11.63^{a}	9.57^{ab}	7.07^{b}	1.20
Lean meat (%)	53.34	51.37	49.90	43.90	3.27
Fat (%)	21.40^{a}	14.14^{bc}	11.51^{c}	18.64^{ab}	1.80
Bone (%)	25.27^{b}	34.49^{ab}	38.59^{a}	37.45^{a}	3.02
Fore-quarter (kg)	59.33	66.03	52.60	56.17	2.90
Lean meat (%)	62.75	64.00	65.33	63.04	1.26
Fat (%)	16.34^{a}	12.65^{a}	8.75^{b}	13.09^{a}	1.15
Bone (%)	20.91^{c}	23.35^{b}	25.70^{a}	23.87^{ab}	0.62
Boneless meat[3] (%)	79.03^{a}	76.65^{b}	74.30^{c}	75.42^{bc}	0.64

1, based on the cut weight. 2, BH, Berseem hay; AS, *Acacia saligna*; AN, *Atriplex nummularia*; AS-AN, were offered separately. 3, equal lean meat % + fat %. a, b and c: Means followed by different superscripts within each row are significantly different (P ≤ 0.05).

The lean meat (shoulder cut) and fat (neck, shoulder, brisket and fore ribs) were significantly (P < 0.05) different among the four groups. In shoulder cut, the AN group had higher percentage lean meat 73.59% than the BH, AS and AS-AN groups (66.80, 72.40 and 68.68%, respectively). The corresponding fat percentages were 5.79, 13.36, 8.31 and 11.99%. It was noticed that neck and shoulder cuts contained the highest percentage lean meat (66.80 - 72.40%) among the fore-quarters cuts. The brisket and flat ribs cuts contained the highest percentage of fat (16.82 - 39.84%).

The physical components percentages of hind- quarters cuts for camels are shown in Table (5). There were significant differences (P < 0.05) among the four groups in lean meat (round, tenderloin and flank cuts), fat (flank cut) and bone (round and flank cuts). The round cut in AN group had higher lean meat 74.74% than BH, AS and AS-AN groups (68.64, 74.48 and

70.80%, respectively). The corresponding fat percentages were 5.05, 8.94, 7.59 and 8.69%. The round and sirloin cuts contained the highest percentages (above 50 %) of lean meat in the hind-quarters cuts. Sirloin cut had 57.36, 55.88, 57.68 and 54.98% lean meat for BH, AS, AN and AS-AN groups, respectively The BH and AN groups had the highest lean meat percentages (43.73 and 40.30%) in best ribs cut. Flank cut contained the highest levels of fat.

Table (5): Least square means of percentages[1] of physical components (lean meat,fat and bone) of hind-quarter cuts for carcasses of camels fed different types of forages.

Item	BH	Type of forages[2]			± SE
		AS	AN	AS-AN	
Round (kg)	30.07	29.32	27.37	29.61	2.00
Lean meat (%)	68.64^{b}	74.48^{a}	74.74^{a}	70.80^{b}	0.98
Fat (%)	8.94	7.59	5.05	8.69	1.38
Bone (%)	22.42^{a}	17.94^{b}	20.22^{ab}	20.52^{ab}	1.07
Tenderloin	2.14^{a}	1.85^{ab}	1.42^{b}	1.90^{ab}	0.15
Lean meat (%)	100	100	100	100	-
Sirloin (kg)	6.19	6.49	5.18	5.22	0.90
Lean meat (%)	57.36	55.88	57.68	54.98	6.19
Fat (%)	20.92	13.19	15.92	15.19	2.73
Bone (%)	21.72	30.94	26.41	29.83	4.99
Best ribs (kg)	7.00	6.65	5.64	5.93	0.64
Lean meat (%)	43.73	40.14	40.30	35.37	4.00
Fat (%)	39.84	34.85	35.16	43.77	5.42
Bone (%)	16.43	25.02	24.54	20.86	3.87
Flank (kg)	11.34^{a}	8.30^{b}	8.25^{b}	9.33^{ab}	0.80
Lean meat (%)	34.66^{b}	46.47^{ab}	48.20^{a}	41.84^{ab}	3.66
Fat (%)	59.05^{a}	47.03^{ab}	34.69^{b}	45.59^{ab}	4.10
Bone (%)	6.29^{b}	6.50^{b}	5.71^{b}	12.57^{a}	1.37
Hump (kg)	13.27	16.17	13.10	14.00	1.29
Fat (%)	100	100	100	100	-
Hind-quarter (kg)	70.00^{a}	69.37^{a}	59.73^{b}	66.00^{ab}	2.99
Lean meat (%)	47.30^{b}	49.42^{ab}	51.65^{a}	48.04^{ab}	1.09
Fat (%)	38.41	36.70	33.72	36.66	1.55
Bone (%)	14.28	13.88	14.63	15.30	1.02
Boneless meat[3] (%)	85.72	86.12	85.40	85.03	0.90

1, based on the cut weight. 2, BH, Berseem hay; AS, *Acacia saligna*; AN, *Atriplex nummularia*; AS-AN, were offered separately. 3, equal lean meat % + fat %. a, b and c: Means followed by different superscripts within each row are significantly different (P ≤ 0.05).

In fore- and hind-quarters, the lean meat, fat, bone and boneless meat percentages were not significantly affected by type feeding except the lean meat percentage in hind-quarters. The lean meat percentages were 62.75, 64.00, 65.33 and 63.04 in BH, AS, AN and AS-AN groups, respectively. The corresponding values in hind-quarters were 47.30, 49.42,

51.65 and 48.04%. Biala *et al.* (1990) reported that the lean meat percentages (based on the carcass weight) in fore- quarters were higher (38.8 and 39.6% at 1 year and 2 years of age) when compared with the hind-quarters (22.7 and 23.97 at same ages) in the Megherbi camels. Fat percentages in fore-quarters were 16.34, 12.65, 8.75 and 13.09% in BH, AS, AN and AS-AN groups, respectively. The corresponding values in hind-quarters were higher being 38.41, 36.70, 33.72 and 36.66%. Biala *et al.* (1990) found that fat percentages (based on carcass weight) were higher (3.22 and 6.33%) in fore-quarters than in the hind-quarters (2.91 and 4.88%) for 1 and 2 years of age, respectively. However, the percentages of boneless meat in fore-quarters were 79.03, 76.65, 74.30 and 75.42% and the hind-quarters were 85.72, 86.12, 85.40 and 85.03% in the BH, AS, AN and AS-AN groups, respectively.

Regardless of the feeding groups, the present study showed that fore-quarters attained higher lean meat, less fat and higher bone contents when compared to the hind-quarters. However, the hind-quarters yielded higher percentages of boneless meat than the fore-quarters. The hind-quarters cuts included hump cut which may attribute to the increase in fat and boneless meat. Camel groups which were fed halophytic forages had similar results to camels in the control group which were fed berseem hay in the lean meat, fat and boneless meat for both fore- and hind-quarters.

Physical Components in Whole Carcass

The distribution of lean meat, fat and bone in whole carcass as well as, lean: bone ratio, lean: fat ratio are demonstrated in Table 6.

The lean meat, fat, bone and boneless meat were significantly ($P \leq 0.05$) affected by type of feeding. The AN group that was fed *Atriplex nummularia* had higher lean meat percentage (58.13%) and lower fat percentage (22.01%) than the other groups. Values of lean meat, fat, bone and boneless meat of camels fed experimental diets showed ranges from 54.35 - 58.13, 22.01 -28.70, 17.34 - 19.85, and 80.25 - 82.64%, respectively. These values were approximately ranges similar to the found by Yousif and Babiker (1989) for fattened male camels, being 43.60 – 67.00%, 7.00 – 18.40, 13.40 – 23.30 and 49.60 – 88.00 % for lean meat, fat, bone and boneless meat, respectively. Close ranges were reported by El-Kholy *et al.* (1997) for buffalo calves, where the lean meat, fat, bone and boneless meat percentages were 61.88, 17.48, 20.64 and 79.36, respectively. In the present study, values of lean meat percentages were less than 76.2 and 76.6%, which were reported by Wardeh (1989) and Kuznetsov and Trelyakov (1972), respectively for camels. Results were in agreement with those reported by Biala et al. (1990), on Megherbi camels (lean meat percentages were 59.0%, 61.5% for 1 and 2 years of age, respectively). Yuosif and Babiker (1989) reported 56.0% lean meat in fattened male camels slaughtered at 456 kg, while Kamoun (1995) reported 57% at the same weight. Babiker (1984) reported that, the proportion of edible lean meat in camels was comparable to that of cattle.

Table (6): Least square means of percentages[1] of physical components of whole carcass, eye muscle area and fat deposits for carcasses of camels fed different types of forages.

Item	BH	Type of forages[2]			± SE
		AS	AN	AS-AN	
Physical components % of whole carcass					
Lean meat	54.35^{b}	56.19^{ab}	58.13^{a}	54.94^{b}	0.84
Fat	28.30^{a}	25.54^{ab}	22.01^{b}	25.83^{ab}	1.27
Bone	17.34^{b}	18.28^{ab}	19.85^{a}	19.24^{a}	0.54
Boneless meat	82.64^{a}	81.74^{ab}	80.25^{b}	80.55^{b}	0.45
Lean meat : fat ratio	1.93^{b}	2.21^{ab}	2.65^{a}	2.15^{b}	0.14
Lean meat :bone ratio	3.14^{a}	3.07^{a}	2.93^{ab}	2.86^{b}	0.06
Eye muscle area (cm^2)	67.50^{c}	126.96^{a}	92.37^{b}	62.07^{c}	7.46
Physical components % of high- priced cuts[3]					
High Priced cuts (kg)	54.06^{ab}	55.99^{a}	48.76^{b}	49.77^{ab}	2.04
Lean meat	62.68	65.21	64.88	61.91	1.38
Fat	17.19^{a}	12.18^{ab}	10.75^{b}	14.30^{ab}	1.52
Bone	20.13^{b}	22.60^{a}	24.38^{a}	23.80^{a}	0.69
Boneless meat	79.87^{a}	77.40^{b}	75.62^{b}	76.20^{b}	0.69
Fat deposits %[4]					
Carcass fat	12.37^{a}	8.98^{bc}	7.18^{c}	9.99^{ab}	0.80
Hump fat	7.01	8.65	8.09	7.89	0.54
Kidneys fat	0.45	0.60	0.52	0.65	0.10
Visceral fat	2.08	1.82	1.82	1.47	0.23
Total body fat	21.91^{ab}	20.05^{ab}	17.60^{b}	20.01^{ab}	0.91

1, based on left side of chilled carcass weight. 2, BH, Berseem hay; AS, *Acacia saligna*; AN, *Atriplex nummularia*; AS-AN, were offered separately. 3, based on high- priced cuts weight. 4, based on empty body weight. a, b and c: Means followed by different superscripts within each row are significantly different (P ≤ 0.05).

It was noticed that lean meat to bone ratio increased with the decrease in carcass bone percentage, while the lean meat to fat ratio decreased with the increase in carcass fat percentage. The present values of lean meat, fat, bone and boneless meat were in agreement with those reported by Shawket (1999) and Shehata (1999).

Eye Muscle Area

The eye muscle area in camel carcases is shown in Table (6). The AN group had higher eye muscle area (117.8 cm^2) than AS, AS-AN and BH groups (92.4, 87.6 and 84.3 cm^2, respectively). The differences among experimental groups in eye muscle area might be attributed to the variation in carcass weight and lean meat percentage (Bendary *et al.*, 1992 and El-Gasim and El-Hag, 1992). Values of eye muscle area obtained in this study were higher than those reported by El-Gasim and El-Hag (1992), Shawket (1999) and Shehata (1999).

Fat Deposits

Fat deposits in camel body as percentage from empty body weight are presented in Table 6. There were no significant differences among

groups in the hump, kidney and visceral fat percentages. However, the carcass and total body fat percentages were significantly ($P < 0.05$) affected by the type of feeding. It was clear that the AN group which was fed *Atriplex nummularia* had lower total body and carcass fat values (17.60 and 7.18%) than the BH, AS and AS-AN groups (21.90 and 12.37; 20.05 and 8.98; and 20.01 and 9.99 %), respectively. Values were in agreement with those reported by Shehata (1999), and higher than those obtained by Wardeh (1989), Biala *et al.* (1990), El-Gasim and El-Hag (1992) and Shawket (1999).

Accoding to the present results, The untraditional concentrate mixture (UCM) and edible parts of the halophytic plants can be successfully used in feeding growing camels for a period of eight months with no adverse effects on their wholesale cuts, physical components (lean meat, fat, bone and boneless meat) and fat deposits.

REFERENCES

Babiker, M. M. (1984). Abundance and economic potential of camels in the Sudan. J. of Environments. 7 (4): 377-394.

Babiker, M. M. and Yousif, O. Kh. (1990). Chemical composition and quality of camel meat. Meat Sci., 27:283-287.

Bendary, M. M.; Koriet, I. S. and Abdel-Raouf, E. M. (1992). Nutritional studies on using sugar beet tops in animal feeding. 1- Fatting Friesian calves on different forms of sugar beet tops. Agric. Sci. Mansoura Univ. 17(9): 2871-2880.

Biala, A. S.; Shareha, A.; Harmas, S.; Khalifa, S. and Aboussaod, F. (1990). Dressing percentage proportions of edible and non-edible portions of camel carcasses. Proc.Int. Con. Camel Prod. Improv., 10-13 Dec. 1990 Tobruk, Libya, 187-198.

El-Asheeri, A.K.A. (1992). Effect of slaughter age and freezing period on buffalo meat production and characteristics. Ph. D. Thesis, Fac. of Agric., Cario Univ., Egypt.

El-Gasim, E. M. and El-Hag, G. A. (1992). Carcass characteristics of the Arabian camel. Camel Newsletter, 9:20-24.

El-Hyatemy, Y.; Younis, A. A.; Belal, A. H. and Rammah, A. M. (1987). Chemical analysis of *Atriplex* species grown at Nubaria in a calcareous soil. 2nd Intern. Conf. On Desert Development, Cairo, Egypt, 25 – 31 Jan. 1987.

El-Kholy, A. F.; Salem, M. A. I.; Abdel-Latif, H. A. and Sami, A. S. (1997). Daily gain, feed conversion and carcass characteristics of Friesian and Buffalo males implanted with anabolic agents. Egyptian J. Anim. Prod., 34(1):1-10.

El-Shaer, H. M. (1995). Potential use of cultivated range plants as animal feed in the Mediterranean zone of Egypt. Proc. of the 8th Meeting of the FAO working group on Mediterranean Pasture and Fodder Crops. Sylivo Pastoral Systems, Environmental, Agricultural and Economic sustainability, Avignon, France, 29 May- 2 June.

El-Shaer, H. M. and Ismail, S. A. A. (2002). Halophytes as animal feeds: potentiality, constraints and prospects. Int. Symp. on Optimum Resources Utilization in Salt-Affected Ecosystems in Arid and Semi-Arid Regions, Cairo, 8 – 11 Apr., 2002.

Farid, M. F. A.; Shawket, S. M. and Abou El-Nasr, H. M. (1990). The maintenance requirements of camels : a preliminary evaluation. Alex. J. Agric. Res., 35:59.

Henderson, W. D.; Goll, D. E.; Stromer, M. H. and Walter, M. I. (1966). Effect of different measurement techniques and operators on bovine *Logissimus dorsi* area. J. Anim. Sci., 25, 334-339.

Kamoun, M. (1995). Dromedary meat: production, qualitative aspects and capacity for conversion. Options Mediterraneennes Serie-B, Etudes Et Recherches. 13:105-130.

Kuznetsov, V. A. and Tretyakov, V. N. (1972). Carcass classification in the Turkmen single-humped camel. Anim. Breed. Abst., 40: 361.

Le Houerou, H. N. (1992). The role of saltbushes (*Atriplex spp.*) in arid land rehabilitation in the Mediterranean Basin: A review, Agroforestry systems, 18: 107 – 148.

Morton, R. H. (1984). Camels for meat and milk production in Sub-Sahara Africa. J. Dairy Sci., 67(7): 1548-1553.

Ramirez, R. G. and J. A. Lara. (1998). Influence of native shrubs *Acacia rigedula*, *Cercidium macrum* and *Acacia farnesiana* on digestibility and nitrogen utilization by sheep. Small Ruminants Research, 28: 39 – 45.

Sami, A. S. (1996). The use of growth promotants for cattle and buffaloes. M. Sc. Thesis, Fac. of Agric. Cairo university. Egypt.

SAS Institute, Inc. (2000). SAS Users Guide Statistics. SAS Institute, Inc.Cary,NC.

Shareha, A. (1990). Camel, the milk and meat in the Arab world. Proc. Int. Conf. Camel. Prod. Improv., 10-13 Dec. 1990.Tobruk, Libya. 149-158.

Shawket, Safinaz, M. (1999). Fattening of camel calves on saltbush (*Atriplex halimus*) with different energy sources. J. Agric. Sci. Mansoura Univ., 24(4):1751 - 1764.

Shehata, M. F. (1999). Studies on meat production from camels. Ph. D. Thesis, Fac. Agric., Cairo Univ., Egypt.

Wardeh, M. F. (1989). Arabian Camels: Origin, Breeds and Husbandry. Al-Mallah publ., Damascus, Syria.(500 PP Arabic).

Wardeh, M. F. (1992). The importance of dromedary camel in the Arab countries. Camel Newsletter. 2:15-19.

Wilson, R.T. (1984). The Camel. Harlow, Essex, UK; Longman Group Ltd. UK.

Yousif, O. K. and Babiker, S. A. (1989). The desert camel as a meat animal. Meat Sci., 26(4):245-254.

صفات الذبيحة وجودة اللحم فى ذكورالإبل المغذاة على نباتات ملحية مختلفة:

١- القطعيات التجارية والمكونات الطبيعية لذبائح الإبل

محمد فرج شحاتة ، سافيناز محمد شوكت ، عبد الحميد أحمد أزامل
شعبة الإنتاج الحيوانى والدواجن – مركزبحوث الصحراء – المطرية – القاهرة

أستخدم فى هذه الدراسة عدد ١٢ من ذكور الإبل النامية (عمرها ١٠ –١٢ شهر ومتوسط وزنها ٢٥٠,٢٣ كجم) تم تغذيتها على بعض العلائق الغير تقليدية من النباتات الملحية (الأكاسيا ، القطف) والتى تنتشر فى منطقة الساحل الشمالى الغربى وبعض المخلفات الزراعية (نوى البلح المجروش ، تفل الزيتون) لمدة ٢٤٠ يوم بهدف دراسة تأثير هذه الأعلاف على القطعيات التجارية والمكونات الطبيعية (لحم أحمر– دهن– عظم) ومخازن الدهن لذبائح هذه الأبل ومقارنتها بالعليقة الكنترول .

قسمت حيوانات التجربة إلى أربعة مجموعات ، المجموعة الأولى غذيت على علف مركز تقليدي مع دريس برسيم بينما المجموعات الثلاثة الأخرى فقد غذيت على عليقة مركزة غير تقليدية (مكونة من نوى بلح مجروش، تفل زيتون، شعير مجروش، ذرة صفراء و كسب فول صويا) بينما اختلفت فى نوعية العلف المالئ حيث غذيت المجموعة الثانية على نبات الأكاسيا ، المجموعة الثالثة على نبات القطف الملحى ، بينما غذيت المجموعة الرابعة على كل من القطف الملحى والأكاسيا.

أوضحت النتائج أن كل من قطعية الكتف والصدر تأثرت معنويا بينما بقية القطعيات التجارية والقطعيات الممتازة والأرباع الأمامية والخلفية لم تتأثر معنويا بنوع التغذية. وبلغت نسب القطعيات الممتازة ٤٢,٠ ، ٤٣,٢٧ ، ٤٣,٥٨ ، ٤٠,٨٧ % من وزن الذبيحة البارد فى المجاميع التجريبية المختلفة (الكنترول ، الأكاسيا، القطف ، الأكاسيا مع القطف على التوالى) . وسجلت الأرباع الخلفية نسب أعلى (٥٣,٧٦ %) من الإرباع الأمامية (٤٦,٢٣ %) دون إختلافات معنوية بين المجاميع التجريبية ، وبغض النظر عن نوع التغذية ، فإن الأرباع الإمامية كانت ذات لحم أحمر أعلى ودهن أقل وكذلك نسبة تشافى أقل عند مقارنتها بالأرباع الخلفية ويتضح من النتائج أن الإبل التى تتغذى على النبانات الملحية تعطى نتائج مشابهة لتلك التى تتغذى على العليقة الكنترول فى النسب المئوية لكل من اللحم الأحمر والدهن والتشافى فى كلا الأرباع الأمامية والخلفية.

ونجد أن أوزان المكونات الطبيعية فى الذبيحة الكاملة منسوبة إلى وزن الذبيحة البارد تأثرت معنويا بنوع التغذية فالمجموعة التى تغذت على القطف كانت أعلى فى نسبة اللحم الأحمر (٥٨,١٣ %) وأقل فى نسبة الدهن (٢٢,٩٠ %) مقارنة بباقى المجاميع التجريبية. وبالنسبة لأوزان مخازن الدهن فى جسم الجمل منسوبة لوزن الجسم الفارغ فإنها لم تتأثرمعنويا بنوع التغذية ماعدا دهن الذبيحة ودهن الجسم الكلى وحققت مجموعة القطف قيم أقل فى هذين النوعين من الدهن

وبناء على نتائج هذه الدراسة فان العلف المركز الغير تقليدى مع النباتات الصحراوية الملحية يمكن أن تستخدم بنجاح فى تغذية الإبل النامية لفترة ٨ شهور دون تأثيرات عكسية على القطعيات التجارية والمكونات الطبيعية و نسبة التشافى ومخازن الدهن فى ذبائح هذه الإبل.