Evaluation of amino acids content in camel with red and white meat

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Abstract

The proximate composition, amino acids and inorganic mineral contents of the Arabian camels meat were investigated and compared with red meat (beef, lamb, goat) and white meat (chicken, fish). Camel meat has more moisture, less fat, less ash and similar protein content to beef, lamb, goat and chicken. The highest moisture and lowest protein contents were found for fish.

Except for Na (sodium) camel has similar inorganic mineral composition (Zn, Ca, K, Mg, Cu and Mu).

The ratio of essential to non-essential amino acids (ESAA/NEAA) ranged between a high of 0.90 for goat and a low of 0.81 for fish. Camels had similar ESAA/NEAA value to beef. Based on its possible contribution to the Recommended Dietary Allowances (RDA).

Introduction

Camels belong to the family *camelidae* and genera *Camelus* and *Lama* (Mugerwa, 1981) with two and four species in each genus respectively. These species are *Camelus bacterianum*, *Camelus dromedarius*, *Lama ilama*, *Lama pucos*, Lama guanicoe and *Lama vicugna*.

The world population of the dromedary and bacterianus camels is estimated to be 17 million. Dromedary camels constitute about 91% of this figure and are concentrated mainly in the Arab world, particularly in the Arabian countries of Africa. In addition the ability of the Arabian camel (dromedary camel) to withstand the hot and harsh environmental conditions is not matched by any other red meat animal species. In spite of its potential, the contribution of camel meat to the per capita meat consumption in the Arab world is not impressive. This can be attributed to the fact that camel meat is the least studied type of meat and is wrongly believed to be of lower nutritive value and quality than other types of red meat or white meat.

Few scientific studies have been devoted to camel meat (Khatami, 1970, Knoess, 1977; Williamson & Payne, 1978; Wilson, 1978; Elgasim & Elhag, 1990). Elgasim et al. (1987) concluded that the carcass characteristics of the Arabian camel are comparable to those of the other red meat animal species.

In view of the fact that camel meat potential is not fully exploited and the possibility that it could make a greater contribution to the growing need for meat in developing countries.

The aim of the current study was to shed light on the chemical composition, amino acid profile and possible contribution of camel meat to the Recommended Dietary Allowances (RDA) compared to some other red and white meats.

Materials and methods:

60 fresh meat samples were purchased from different markets at Cairo and Giza governorates (10 from each species camel, beef, lamb, goat, chicken and fish). The samples were chilled for 48 hours at +3C°. External fat and epimysial connective tissue were removed, each meat sample was ground twice in a grinder with a grinder plate having 0.3 cm diameter openings. The ground samples and later chemically analyzed.

1- **Amino Acids Analysis:** It was determined according to Spies, (1967) as follow: Samples for amino acids analysis were homogenized with a tissue mixer is distilled water in ratio of 1:5.
Aliquots of the homogenized samples were hydrolyzed for 22 hr in evacuated sealed ampoules with 6N Hcl at 110 C° in toluene bath. Amino acids content (g/16 g N) was determined in duplicate using a LKB Amino Acid Analyzer (Model 4150 ALPHA). The protein content of each sample used in the amino acids analyzer was determined and expressed on a dry matter and defatted sample basis.

2- **Mineral Analysis:** The ash content of each sample was further analyzed for mineral contents mainly Ca (calcium), K (potassium), Mg (magnesium), Na (sodium), Cu (cupper), Mn (manganese), Fe (iron) and Zn (zinc) using a Perkin Elmer Model 2380 Atomic Absorption Spectrophotometer as described by AOAC (1984).

3- **Proximate Composition:** Samples for proximate composition (protein, fat, ash and moisture content) were determined according to AOAC (1984).

4- Statistically Analysis: The obtained data were statistically analyzed according to SAS (1986).

Result and discussion:

The proximate composition of the camel meat compared to that of other red (beef, lamb and goat) and white meats (chicken and fish) is presented in Table (1). The moisture contents of camel and fish meats were higher than those of beef, lamb, goat or chicken. The importance of moisture in meats lies in its pronounced effects on the shelf-life of meat, its processing potential and sensory 'dry' mouth-feeling meats. With the exception of camel and fish meats, the moisture to protein (M/P) ratios of all species investigated were similar (Table (1)). Camel had a slightly higher M/P than beef or lamb. The M/P ratio is a reflection of the suitability of meat for sausage manufacturing (Forrest *et al.*, 1975). Camel meat has a protein content that is slightly less than that of beef, lamb, goat or chicken meats. Camel meat has a fat content (2.6%) that is higher than fish (2.3%) but less than of beef (4.7%), lamb (6.2%), goat (3.3%) and chicken (5.4%) meats. In

addition, the cholesterol content of camel meat was noted to be lower than that of beef or Jamb (Elgasim and Elhag, 1990), At a time where fatty meats are implicated with heart disease such findings may favour camel meats over other red meats. Also, camel meat has an ash content (0.9%) that is less than that of beef (1.5%), lamb (l.5%), goat (1.4%), chicken (1.3%) and fish (1.3%) meats. Zinn (1967) concluded that anatomical location of muscles and days on feed could affect the chemical composition of meat. Also Stansby (1976) noted that the chemical composition of fish varies according to sex, season, size and geographical location of the catch.

The concentration of minerals in the meat of the Arabian camel and beef is given in Table (2). Comparison of the mineral content (Ca, K, Mg, Na, Cu, Mn, Fe and Zn) of camel meat with beef meat does not reveal striking differences, although beef has slightly higher levels of Zn, Ca, K, Mg, Fe and Mn. The main difference between the two species was that the level of Na in the camel meat was considerably higher than beef (2100 mg/kg versus 1174 mg/kg). It should be emphasized here that Na occurs naturally in meat and is added to meat products for flavoring or preservation purposes. However, sodium may represent a risk factor for some people. Meats from beef and camel were superior in mineral content to that of fish (Table 2). Differences between muscle mineral concentration due to breed, age or weight and diet have been reported by several investigators (Doyle, 1980; Doornenbal & Murray, 1982; Kotula & Lusby, 1982; Marchello *et al,* 1984).

The amino acid composition of the camel meat was compared with that of other red meats (Table (3)) and white meats (Table (4)). The protein on a dry matter and defatted basis of camel meat is similar to that of beef (86.7%) and slightly less than that of lamb (90.8%), goat (90.2%), chicken (88.8%) and fish (90.6%) (Tables (3) and (4)). The essential amino acid content of camel meat is similar to that of beef, higher than that of lamb or white meats (fish and chicken) but less than, that of goat meat. Relatively, camel meat had a higher than mithionine content than beef. Its leucine and histidine contents are also higher than that of goat meat however the latter is superior in lysine content (Table (3)). The histidine content of camel meat is better than that of chicken or fish meats (Table (4)). Relatively camel meat was lower in alanine but higher in glutamic acid than all the red (Table (3)) or white (Table (4)) meats investigated.

The nutrient density of camel meat with respect to protein, Ca, Mg and Zn compares favorably with that of beef. With regard to iron, beef contributes more to the RDA than camel meat. Iron is considered to be the most important trace mineral in meat and is known to be in a highly utilizable form (Monson *et al,,* 1978). Also it appears to assist in the absorption of iron from non-haeme sources. Both camel and beef meat contribute only small amounts of calcium to the human requirements.

In conclusion, camel meat is nutritionally as good as that of the major sources of red or white meats. It may even have an edge over

beef or lamb due to its low intramuscular fat and cholesterol contents. However, its high Na content may represent a risk factor for some people. In view of the above and its unique adaptability to the harsh environmental conditions the value of the Arabian camel as a source of meat should not be underestimated.

Table (1): Proximate composition of camel, beef, lamb, goat, chicken and fish meats.

Species	Moisture (g/100g)	Protin[a]	Fat	Ash	M/P[b]
Camel(n=10)[c]	77.2	19.3	2.6	0.9	4.0
Beef (n=10)	73.4	20.4	4.7	1.5	3.6
Lamb (n=10)	72.2	20.1	6.2	1.5	3.6
Goat (n =10)	74.5	19.8	3.3	1.4	3.8
Chicken(n=10)	73.2	21.2	5.4	1.3	3.5
Fish (n= 10)	78.7	17.8	2.3	1.3	4.4

a Protein = *N* x *6.25.*, *b* M/P = Moisture to protein ratio. *c* n = No. of observations.

Table (2): Mineral levels in the meat of the Arabian camel (camels dromedarius), beef and fish.

Species	Concentration (mg/g)							
	Zn	Ca	K	Mg	Na	Cu	Mn	Fe
Camel(n=10)[a]	141	218	10,000	778	2100	1.8	0.6	85
Beef (n=10)	153	262	10,.425	931	1174	2.2	0.8	100
Fish (n= 10)	17	180	3920	300	580	0.9	0.4	4

a n = No. of observations.

Table (3): Amino acid composition of camel meat compared with that of beef, lamb and goat (g/16 g N)

Amino Acid	Species			
	Camel	Beef	Lamb	Goat
Essrntial				
Lys[a]	8.95 (8.39)	9.13 (7.96)	8.54 (8.00)	10.9 (10.15)
Thr	4.84 (4.53)	5.48 (4.78)	4.24 (4.00)	4.35 (4.04)
Val	6.31 (5.91)	2.65 (2.30)	5.85 (5.53)	6.80 (6.3)
Met	3.46 (3.24)	6.61 (5.76)	3.27 (3.09)	3.88 (3.6)
Ileu	5.89 (5.52)	10.7 (9.34)	5.84 (5.53)	6.04 (5.60)
Leu	9.51 (8.92)	5.65 (4.92)	9.63 (9.10)	7.86 (7.29)
Phe	4.73 (4.43)	6.21 (5.41)	4.86 (4.59)	6.51 (6.04)
His	5.62 (5.27)	35.0 (46.26)	5.90 (5.58)	4.71 (4.37)
Subtotal	49.31 (46.21)	53.0 (46.26)	48.1 (45.42)	51.1 (47.39)
Non-essential				
Arg	7.10	7.05	6.85	7.05
Asp	10.8	10.8	10.3	10.8
Ser	3.18	7.22	2.98	3.56
Glu	18.6	16.5	17.9	15.6
Pro	3.87	4.54	3.81	3.82
Gly	6.11	6.23	5.49	5.21
Tyro	3.81	4.10	3.51	5.92
Ala	3.85	7.74	6.53	4.69
Subtotal	57.4 (53.8)	61.2 (53.8)	57.6 (54.6)	56.6 (52.61)
Total	107 (100)	115 (100)	106 (100)	108 (100)
Protein %[b]	86.7	86.5	90.8	90.2
ESAA/NEAA[c]	0.85	0.86	0.83	0.90

a Values in parentheses indicate content per100 g of amino acid residues.
b On dry and fat free basis.
c ESAA/NEAA = Essential to Non-essential Amino Acid ratio.

Table (4): Amino acid composition of camel meat compared with that of chicken and fish (g/16 g N)

Amino Acid	Species		
	Camel	Chicken	Fish
Essrntial			
Lys[a]	8.95	10.2 (9.50)	10.2 (9.47)
Thr	4.84	4.25 (3.91)	3.80 (3.62)
Val	6.31	5.74 (5.32)	5.48 (5.22)
Met	3.46	3.97 (3.68)	3.28 (3.13)
Ileu	5.89	6.624 (5.78)	5.81 (5.53)
Leu	9.51	9.70 (9.00)	9.42 (8.97)
Phe	4.73	4.85 (4.50)	5.54 (4.33)
His	5.62	3.82 (3.54)	4.57 (4.35)
Subtotal	49.3 (46.21)	48.8 (45.29)	47.1 (44.9)
Non-essential			
Arg	7.10	6.52	7.40
Asp	10.8	10.9	10.5
Ser	3.18	3.05	2.48
Glu	18.6	17.0	17.2
Pro	3.87	4.34	4.07
Gly	6.11	6.58	4.93
Tyro	3.81	3.79	2.29
Ala	3.85	6.80	7.99
Subtotal	57.4 (53.79)	59.0 (54.7)	57.8 (55.1)
Total	107	108	105
Protein %[b]	86.7	88.8	90.6
ESAA/NEAA[c]	0.85	0.82	0.81

a Values in parentheses indicate content per100 g of amino acid residues.
b On dry and fat free basis.
c ESAA/NEAA = Essential to Non-essential Amino Acid ratio.

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