PPROXIMATE COMPOSITION, AMINO ACID AND MINERAL CONTENT OF FRESH AND COOKED ARABIAN CAMEL (CAMELUS DROMEDARIES) MEAT

Isam T. Kadim[1]*, Osman Mahgoub[1], Waleed Al-Marzooqi[1], Majeed Al-Ani[2] Rabea . S. Al-Maqbaly
[1]Department of Animal and Veterinary Sciences, [2] Department of Food Science and Nutrition, College of Agricultural and Marine Sciences, Sultan Qaboos University, PO Box 34 Al-Khoud, Muscat, Sultanate of Oman. Email:isam@squ.edu.om

Keywords: Meat, Amino acids, Minerals, Camel, Cooking, Fresh

Introduction

The dromedary camel is one of the most important domestic animals in the arid and semi arid regions of the world. Compared to other livestock, camel has great tolerance to high temperatures, high solar radiation, water scarcity, sandy terrain and poor vegetation. It relays on feeds and fodders unutilised by other domestic species either due to their size or feed habits (Shalash, 1983). In Middle East, camels are regularly slaughtered for marketing, social and religious occasions to supply high quality meat, which is an essential source of protein, energy, vitamins and minerals for human nutrition. The amino acid and inorganic mineral contents of camel meat are higher in the meat of the dromedary than beef (Alkanhal, 1994; Kurtu, 2004). There has been a concern about the health hazards of diets containing high levels of animal fat, which constitute a risk factor for many health disorders such as cardiovascular disease. Camel meat is leaner as camels produce less carcass fat as well as having less levels of cholesterol in fat (El-Faer *et al*., 1991; Elqasim and Alkanhal, 1992; Dawood and Al-Alkanhal, 1995). Both chemical composition and the method of cooking influence meat nutritive value. Cooking temperature induce changes in muscle components that may influence its nutritive value. There is little information on chemical composition, amino acid and minerals contents of camel meat. Details of the composition response to cooking temperature are not available. The objective of this study was to evaluate the effects of cooking temperature on the proximate composition, amino acids and minerals contents of the dromedary *longissimus thoracis* muscle.

Materials and Methods

Muscle samples were randomly collected from five intact male Omani camels (*Camelus dromedaries*) slaughtered at the Muscat Municipality slaughterhouse, Sultanate of Oman. Five-hundred grams from each left longissimus thoracis muscles (ribs 8-13 region) were removed within 60 minutes post slaughter. They were kept in zipped plastic bags in a chiller (1-3ºC) for 48 hours before being stored at –20ºC, then each sample divided into two halves. The first half was placed in plastic bag and cooked in water bath at 70^0C for 90 minutes, while the second half was kept as fresh before being stored at -20^0C. Both samples were dried in an Edward freeze dryer (Modulyo) for 5 days under 80-mbar pressure at –60ºC. Samples were then ground to a homogenous mass and used for chemical analyses. The proximate chemical composition of the muscle tissue was determined according to standard methods of AOAC (2000). Dry matter was determined by drying in an oven for 24 hours at 80ºC. Crude protein (CP) was determined using a Foss Tecator Kjeltec 2300 Nitrogen/Protein Analyser. Fat was determined by Soxhlet extraction of the dry sample, using petroleum ether. Ash content was determined by ashing samples in a muffle furnace at 500ºC for 24 hr.

Evaluation of minerals was carried out after complete digestion using a mixture of concentrated HNO_3 and 30% H_2O_2 in a microwave laboratory system type Milestone 1200 MDR, with a maximum temperature of 200ºC in closed polytetrafluoroethylene bombs. An Inductively Coupled Plasma Optical Emission Spectrometer type Perkin Elmer Model 3300, equipped with a low- flow Gem Cone nebulizer in addition to an ultrasonic nebulizer for the detection of very low concentrations was used for chemical analyses. All reagents used were of certified analytical reagent grade and in-house reference materials were used in the analysis.

Amino acid contents of duplicate meat samples were determined using a Waters ion-exchange HPLC system, utilizing post-column ninhydrin derivatisation and fluorescence detection, following hydrolysis in 6M glass distilled hydrochloric acid containing 0.1% phenol for 24 h at 110 ± 2^0C in evacuated sealed tubes. Lysozyme was used as an external sealed for the amino acid analysis. Performic acid oxidation was not undertaken. Performic acid oxidization was not used in the study, cysteine in the samples was not determined.

Results and Discussion

Fresh camel meat values for dry matter, protein, fat and ash (Table 1) were within the range reported for

camel meat (Babiker & Yousif, 1990; El-Faer *et al*., 1991; Elgasim & Alkanhal, 1992; Kadim, *et al*., 2006). In the present study, cooking led to significant changes in meat proximate composition, which attributed to protein denaturation (Brewer and Novakofski, 1999). Per unit fresh weight, the variations of the proximate composition mainly reflect the water loss and possibility the fat loss of the meat during cooking. Following cooking at 70^0C for 90 minutes, the cooked meat samples had significantly (P<0.001) higher by 27.6% in dry matter, higher by 31.2% in protein, higher by 23.5% in fat and lower by 11.7% in ash than fresh meat samples. Similarly, Greenwood *et al.* (1951) reported that cooked beef meat had significantly higher dry matter by 19.1%, fat by 18.8% and protein by 27.8% than fresh samples. During cooking, the losses of aqueous origin, or cooking juices, are composed of water and molecules such as myofibrillar or sarcoplasmic proteins, collagen, lipids, minerals, polyphosphates (Ortigues-Marty, *et al.,* 2006). However, the amount of protein and fat losses are less than the amount of water losses, which led to concentrate the protein and fat contents.

Table 1. Proximate composition of fresh and cooked camel meat.

	Dry matter%	Protein%	Fat%	Ash%
Fresh	24.32±0.386	19.49±0.664	2.05±0.121	1.20±0.031
Cooked	33.59±0.289	28.34±0.549	2.68±0.109	1.06±0.027
Significant[1]	***	***	***	***

[1] Significant:*** P<0.001.

The mineral content (Tables 2) for the Omani camel meat were within the range reported for camel (El-Faer, *et al*., 1991, Elgasim and Alkanhal, 1992; Kadim, *et al*., 2006). It indicates that camel meat is compared in mineral composition to other red meats i.e. beef, veal, and lamb (Elgasim and Alkanhal, 1992). Camel meat likes other red meats, contained higher levels of potassium in the current study. Potassium was the most abundant element followed by phosphorus, sodium, magnesium and calcium, respectively in addition to smaller percentages of the other trace elements. Similar findings were reported by Dawood and Alkanhal (1995) and El-Faer *et al*. (1991) for Saudi Arabian camel. With the exception of iron, aluminum and copper, the cooked camel samples had significantly lower macro- and micro-elements contents than the fresh samples. The influence of cooking on minerals contents may be associated with loss of water and lipids.

Table 2. Mineral levels in the meat of the fresh and cooked camel meat

	Minerals (mg/100g)					
	Calcium	Phosphorus	Magnesium	Sodium	Potassium	Sulfur
Fresh	5.4±0.39	676±11.6	74.5±2.02	312±4.0	1560±28.9	562±9.7
Cooked	3.1±0.29	493±10.7	38.4±2.19	148±3.6	930±30.1	5202±9.6
Significant[1]	***	***	***	***	***	**
	Iron	Zinc	Barium	Boron	Aluminum	Copper
Fresh	7.4±0.48	14.9±0.22	5.9±0.25	3.8±0.13	2.4±0.35	0.34±0.031
Cooked	6.30±0.49	13.2±0.24	4.6±0.23	3.30±0.10	2..3±0.34	0.29±0.028
Significant[1]	NS	***	**	*	NS	NS

[1] Significant: NS not-significant, ** P<0.001, *** P<0.001.

The protein quality of muscle lies in the extent of the availability of essential amino acids in proportions required by human (Casey, 1993). The amino acid values for camel meat in the present study (Table 3) were in agreement with values reported by Dawood & Alkanhal, (1995); Elgasim and Alkanhal, (1992). Except for a significant (P<0.05) lower Histidine content (3.53 vs. 3.21) the amino acid composition of the protein of the cooked meat is similar to that for the fresh camel meat. These findings indicate the average amino acid composition of the muscle is quite uniform and that the amino acids are stable to cooking. This was confirmed by comparing the total amount of each amino acid in camel meat samples before and after cooking. These results are consistent with those obtained for the same amino acids in beef (Greenwood, *et al*., 1951), pork and lamb cuts (Schweigert, *et al*., 1949). Tandford (1968) also stated that protein denaturation during cooking is the major change from the original native structure, without alteration of the amino acid sequence.

Table 3. Amino acid composition of fresh and cooked camel meat (mg/100 mg)

	Amino acid (mg/100g)							
	Leucine	Valine	Isoleucine	Threnonine	Arginine	Histidine	Lysine	Methionine
Fresh	6.65±0.09	4.49±0.08	3.82±0.09	3.57±0.11	5.29±0.09	3.53±0.10	7.50±0.13	2.34±0.09
Cooked	6.82±0.08	4.52±0.07	3.82±0.07	3.79±0.10	5.46±0.07	3.21±0.11	7.61±0.12	2.32±0.06
Significant[1]	NS	NS	NS	NS	NS	*	NS	NS
	Glycine	Alanine	Proline	Phenylalanine	Serine	Gultamic A.	Aspartic A.	Tyrosine
Fresh	3.44±0.10	5.24±0.12	3.17±0.10	3.47±0.09	2.86±0.09	12.86±0.13	7.49±0.13	2.81±0.11
Cooked	3.64±0.11	5.26±0.15	3.39±0.11	3.52±0.07	2.97±0.06	12.77±0.12	7.87±0.14	2.91±0.10
Significant[1]	NS	NS	NS	NS	NS	NS	NS	NS

[1] Significant: NS not-significant, * P<0.05.

Conclusions

Cooking of camel meat resulted in an greater increase in dry matter, protein and fat contents and in significant changes in the proportions of macro- and micro-minerals. Amino acids studied were stable to cooking.

References

Alkanhal, A. (1994). Nutrient composition of Najdi camel meat. Meat Science, 39:71-78.

Association of Official Analytical Chemists (2000). *Official Methods of Analysis.* (17th Edition), AOAC International. Gaithersburg, Maryland, 20877-2417. USA.

Babiker, S.A. & Yousif, K.H. (1990). Chemical composition and quality of camel meat. Meat Science, 27, 283-287.

Brewer, M.S. and Novakofski, J. (1999). Cooking rate, pH and final endpoint temperature effects on color and cook loss of a lean ground beef model system. Meat Sci, 52:443-451.

Casey, N.H. (1993). Carcass and meat quality. In C. Maree and N.H. Casey (Editors). Livestock production systems. Principles and practice. Agri-Development Foundation, Brooklyn, South Africa. Pp. 306-333.

Cristofaneli, S., Antonini, M., Torres, D., Polidori, P. & Renieri, C. (2004). Meat and carcass quality from Peruvian llama (Lama glama) and alpaca (Lama Pacos). Meat Science, 66:589-593.

Dawood, A. & Alkanhal, M.A. (1995). Nutrient composition of Najdi-Camel Meat. Meat Science, 39:71-78.

El-Faer, M., Z., Rawdah, T.N., Attar, K.M. & Dawson, M. V. (1991). Mineral and proximate composition of the meat of the one-humped camel (Camelus dromedaries). Food Chemistry. 42: 139-143.

Elgasim, E.A. & Alkanhal, M.A. (1992). Proximate composition, amino acids and inorganic minerals content of Arabian camel meat: comparative study. Food Chemistry, 45:1-4.

Greenwood, D.A., Kraybill, H. R. and Schweigert, B.S. (1951). Amino acid composition of fresh and cooked beef cuts. The Journal of Biological Chemistry, 191:23-28.

Kadim, I. T., Mahgoub, O., Al-Marzooqi, W., Al-Zadgali, S., Annamali, K. and Mansour, M. H. (2006). Effects of age on composition and quality of muscle *Longissimus thoracis* of the Omani Arabian camel (Camelus dromedaries). Meat Science, 73:619-625.

Kurtu, M.Y. (2004). An assessment of the productivity for meat and carcass yield of camel (*Camelus dromedarious*) and the consumption of camel meat in the Eastern region of Ethiopia. Tropical Animal Health and Production, 36:65-76.

Ortigues-Marty, I., Thomas, E., Preveraud, D.P., Girard, C.L., Bauchart, D., Durand, D. and Peyron, A. (2006). Influence of maturation and cooking treatments on the nutritional value of bovine meats: Water losses and Vitamin B12. Meat Sci., 73:451-458.

Schweigert, B.S., Guthneck, B.T., Kraybill, H.R., and Greenwood, D.A. (1949). The amino acid composition of pork and lamb cuts. The Journal of Biological Chemistry, 180:1077-1083.

Shalah, M.R. (1983). The role of camels in overcoming world meat shortage. Egypt. J. Vet. Sci., 20:101-110.

Tandford, C. (1968). Protein denaturation. Advanced Protein Chem., 23:121-282.