Minerals and Nutritional Composition of Camel (*Camelus dromedarius)* Meat in Pakistan

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Summary: The quality of camel meat has received little attention so far in Pakistan. It is nutritionally as good as that of the major sources of red or white meat. Camel is a desert animal but is not less than other red meat animals (beef, lamb and goat) in its composition. The proximate composition, fatty acid profile and mineral contents of the local camel (*Camelus dromedarius)* meat have been investigated. It contained 72.03 ± 0.014% water, 4.45 ± 0.011% ash, 5.79 ± 0.012% fat and 66.42 ± 0.534% protein. It has been found that camel meat has relatively more moisture, less fat, less ash and similar protein content than that of beef, lamb and goat [1]. It has similar mineral composition (Na, K, Ca, Fe, Zn, P, Mg, Cd, Cr, Co, Mo, Ni, and Pb) to beef except for sodium. Fatty acid profile for camel meat oil showed high content of palmitic acid and oleic acid. These two fatty acids are essential in human nutrition. In view of the above, it is possible that camel meat could make a greater contribution to the growing need for meat in developing countries like Pakistan.

Introduction

Camel is a good source of meat in areas where climate adversely affects the production efficiency of other animals. Camel can provide a considerable amount of high quality meat. The demand for camel meat appears to be increasing due to health reasons, as it contains less fat as well as less cholesterol and relatively high poly unsaturated fatty acids than other animal's meat. Camels continue to be the preferred livestock species for exploiting extreme dry land areas. They are part of the culture of pastoralists and make up over 30% of the livestock biomass in desert**.** The *Camelus genus* of family Camelidae have two species *Camelus dromedarius,* the Dromedary, single humped or the Arabian camel and the *Camelus bactrianus*, the Bactrian or the double humped camel. The habitat of the dromedary is the dry hot zones of Asia and Africa where it is used as a vital source of food and milk. The cold deserts of southern areas of the former Soviet Union, Mongolia, East Central Asia and China are home for Bactrian camel. The camel possesses unique traits which makes it superior to other domestic animals e.g. transportation, racing and an important source of meat, milk and hide in several countries [2-7].

The world population of camels is estimated to be 17 million. Dromedary, the single humped camels comprises about 91% of this figure and are mainly concentrated in the Arab world, predominantly in the Arabian countries of Africa. In the world, Pakistan is the fourth largest camel raising country with a population of over one million and having an annual increase of 1.62 % [6]. Average daily milk production of camel resides in the range between 3.5 to 35.0 kg per animal. The composition of camel milk in different parts of the world with a range of 3.5 to 4.5 % protein, 3.4 to 5.6 % lactose, 3.075 to 3.50 % fat, 0.7 to 0.95 % ash and 12.1 to 15 % total solid. Camel milk is also used as a source of Vitamin D, salt, iron and minerals such as Na^+, and K^+ having magnitudes, 163.67 mmol/L and 4.07 mmol/L respectively [8-15]. The quality of camel meat has received little attention and is wrongly believed to be of lower nutritive value and quality than other types of meat [16, 17]. Camel meat is in fact leaner than other red meats, has fewer calories and is low in cholesterol. Compared to beef, camel meat tastes sweeter due to high glycogen and has a higher level of protein. Studies have revealed that camel meat is healthy and nutritional as it contains reduced fat contents in comparison to other meats especially beef. It also contains a healthy level of minerals. This is an important factor in combating the risk of cardiovascular disease, which is attributed to saturated fat consumption. Camel meat is also used for remedial purposes for diseases such as hyperacidity, hypertension, pneumonia and respiratory disease as well as an aphrodisiac [5, 16, 18]. The nutrient content of meat depends upon age, sex, carcass weight, the degree of fatness of the animals, the type of cut, the extent of cutting and trimming, and the methods of packaging and storage. As the age of camel increases, the fat content also increases to a parallel level but on the other hand,

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protein content of meat is decreased. Research studies proven that camel meat contains antioxidant properties that fight cancer. The meat is not much affected by weather conditions because of the presence of anti-bacterial properties in camel meat, which makes it ideal for the consumption of desert dwellers that don't have preservatives or fridges [19, 20]. Although camel is an active member of the food producing family of farm animals but over the years it has been the most neglected animal in terms of its improvement and scientific research. The versatility of camel to survive and execute various activities in the hard arid and semi arid regions and its matchless physiological system should inspire the researchers to study it more closely to further exploit its potential. It is capable of converting the cover of these regions into animal products suitable for human consumption. At the age of seven years a fattened camel can produce a carcass of about 260 kg with a meat: bone ratio of 3:1. Hence the camel as a meat source seems to present a viable alternative to cattle. The habit of eating fatty meat may predispose to health risks. The decline of saturated fat level in the diet is a primary step in avoiding artery-sclerosis. As a result, now, the general trend in the world is to have tagged lean meat as it is synonymous with the good health [21, 22]. The purpose of this study was to evaluate the physico-chemical composition, mineral status and constituents of the camel meat and produce awareness in people about its usefulness.

Results and Discussion

Physiochemical characteristics such as moisture, ash, fat and protein of camel meat are presented in Table-1. Results in the present study were slightly lower than the values reported for camel meat [23-25]. The reason for this difference is that the moisture, ash, fat and protein contents of animal meat differ by animal age, feed and type of habitat. These results depicted that nutrient contents of camel meat are similar to those of other red meat [26].

Table-1: Physicochemical characteristics of camel meat.

Sr. No.	Parameters	Percentage values ± SD
1	Moisture %	72.03 ± 0.014
2	Ash %	4.45 ± 0.011
3	Fat %	5.79 ± 0.012
4	Protein%	66.42 ± 0.534

*SD= standard deviation

The fatty acid profile of camel meat oil is given in Table-2. It is evident from results that camel meat oil has high content of palmitic acid and oleic acid. These two fatty acids are essential in humans. The analysis showed that camel meat oil is rich in fatty acid.

Table-2: Fatty Acid Composition of Camel Fat.

Sr. No.	Fatty acids	Carbon atoms	Percentage in camel fat
1	Lauric acid	C_{12}	1.49
2	Myristic acid	C_{14}	7.46
3	Palmitic acid	C_{16}	33.00
4	Palmitoleic acid	C_{16}	7.32
5	Stearic acid	C_{18}	19.87
6	Oleic acid	C_{18}	26.79
7	Linoliec acid	C_{18}	3.41
8	Arachidic acid	C_{20}	0.57

The mineral contents in camel tissues are given in Table-3. Mineral concentration given in Table-3, has shown that camel meat like other types red meat contained higher level of potassium than the other minerals. It also contains significant level of iron as compared to beef [27]. There is a little information in the literature about mineral content of camel meat.

Table-3: Mineral Content of Camel Meat (Dry-Weight, Fat-Free Basis).

Sr. No.	Elements	Concentration (mg/100g)	Sr. No.	Elements	Concentration (mg/100g)
1	Sodium	252	8	Cadmium	0.019
2	Potassium	1008	9	Chromium	0.027
3	Calcium	27	10	Cobalt	0.006
4	Iron	16	11	Molybdenum	0.103
5	Zinc	15	12	Nickel	0.104
6	Phosphorus	549	13	Cobalt	0.009
7	Magnesium	56.7	14	Lead	0.094

Experimental

Reagents Required

Sulphuric acid, nitric acid, hydrogen peroxide, ethanol, n-hexane, boron triflouride, methanol, petroleum ether, sodium chloride, potassium chloride, calcium carbonate, iron sulphate, potassium dihydrogen phosphate, ammonium molybdate, ammonium vanadate, magnesium sulphate, zinc sulphate, cadmium chloride, molybdenum oxide, cobalt chloride, chromium chloride, nickel chloride and lead nitrate were of reagent grade (Sigma-Aldrich) and used without any further purification.

Materials and Methods

Foss Tecator Kjeltec 2300 Nitrogen/Protein Analyzer was used for protein determination. Muffle furnace was used for the digestion of meat samples. Mineral concentration was determined by UV-Vis Double Beam spectrophotometer (UVD-3500, Labomed), flame photometer (Corning model 410) and flame atomic absorption spectrophotometer, (Perkin Elmer AAnalyst 100). Shimadzu GC-14A

chromatograph with flame ionization detector was used for fat analysis. The percentage of various acids was determined by Shimadzu CR4-AD integrator.

Sample Collection

Five samples were randomly collected from single humped camels (2-4 years old) slaughtered at the local slaughterhouse. Samples were kept in zipped plastic bags and transported in an insulated cool box. They were then transferred to a chiller (2-3^{o}C) within about 2-2.5 hrs post mortem for 48 hrs before analysis.

Chemical Analysis

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 were placed in airtight glass containers, frozen, and later chemically analyzed.

The proximate chemical composition of the camel meat was determined according to standard methods of AOAC [28]. Crude protein was determined using a Foss Tecator Kjeltec 2300 Nitrogen/Protein Analyzer. 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 550ºC for 24 hours [16].

Determination of mineral contents of camel meat was carried out after complete digestion in muffle furnace with a maximum temperature of 200^{o}C. A mixture of concentrated HNO_3 and 30% H_2O_2 was used for the complete digestion of samples [16]. Phosphorus was determined by phosphovanadomolybdate method using UV-Vis Double Beam spectrophotometer [30]. Sodium, potassium and calcium were determined by using flame photometer and all other elements (Fe, Zn, Mg, Cd, Cr, Co, Mo, Ni, and Pb) were determined by atomic absorption spectrophotometer using air-acetylene flame for mineral analyses using standard methodologies [29, 30].

Fat Analysis

Methyl ester of fatty acids was prepared by extracting oil from camel meat with n-hexane. They were treated with Boron triflouride-methanol reagent in a test tube with teflon lined screw cap for half an hour. The methyl esters so formed, were extracted with n- hexane and solvent was removed by distillation to get pure methyl esters for gas liquid chromatography [31]. Methyl esters of fatty acids were analyzed on Shimadzu GC-14A chromatograph with flame ionization detector using 1.6m.3mm (I d.) glass column packed with GP (15% OV -275) coated on chrome *PAW-DMCS (100/120 mesh) column. Temperature was kept at 200^{0}C, injector and detector temperatures were 220^{0}C and 250^{0}C respectively. Nitrogen was used as a carrier gas with flow rate of 40 ml per minute. The methyl esters were identified by comparing their retention times with those of pure methyl fatty esters under the same conditions. The percentage of various fatty acids was determined by Shimadzu CR4-AD integrator .Chromatograms are integrated and reported in Table-2.

Conclusion

This study indicated that camel meat has a very high nutritive value. Moreover, it is also beneficial for heart patients due to its low fat contents. In view of the findings of present study and its unique adaptability to the harsh environmental conditions, the camel probably is a useful potential source of meat particularly in the arid tropics and developing countries like Pakistan.

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