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Comparative study on Chemical Composition and Keeping Quality of Camel Meat and Beef sold in Khartoum State, Sudan

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ABSTRACT

This study was aimed to evaluate the quality, characteristics and the average bacterial load of fresh and refrigerated camel meat and beef. Chemically camel *Longissmus dorsi* (L.D) muscle had significantly (P< 0.05) higher moisture content than L.D of beef. On the other hand camel L.D muscle had lower fat content than that in beef muscle. The protein and ash content were not significantly (P> 0.05) different among the two muscles. Non-protein-nitrogen were not significantly (P> 0.05) different among the two muscles studied. Sarcoplasmic protein and myofibrillar protein were significantly (P< 0.01) lower in camel meat than that of beef. The bacteriological test of meat was done on the fresh meat and after 7, 10 and 15 days of refrigeration storage (at 4°C). The average bacterial load of the fresh and refrigerated samples of camel meat was (3.5 x 10^6 and 5 x10^6) respectively. Also the average bacterial load of the fresh and refrigerated samples of beef was (3 x 10^6 and 5.5 x 10^6) respectively. In general there was increase in the bacterial number with increase of time of refrigerator storage. Results of organoleptic tests showed that all refrigerated samples were qualified as good.

INTRODUCTION

Sudan is situated in northeast Africa between latitudes 4° and 22° North and longitudes 22° and 38° East. The country is traversed by the River Nile and its tributaries which have varying influences on irrigated agriculture and livestock production systems. There are also number of seasonal rivers and water sources as the Gash and Baraka, which originate from the

Ethiopian highlands and form two inland deltas in Sudan. An animal resource in Sudan far exceeds that of the all Arab countries and ranks second in Africa. Livestock production forms an important component of the agricultural sector, which mainly based on traditional pastoral systems. The animal censuses in Sudan according to MARFR (2011) and AAS (2012) were estimated the cattle, sheep, goat and camel population in Sudan as 29.2 million/heads of cattle, 39.3 million/heads of sheep, 30.6 million/heads of goat and 4.7 million/heads of camel's. Camel meat is preferable by the people who live in Gulf Country, Saudi Arabia and Libya. Many variables and alternatives can be exploited to bridge the gap between the world population need and the available resource of red meat.

Camel Newsletter (2000) stated that camel meat is popular and cheaper source of red meat in arid and Semi-arid areas that can compensate beef shortage to a large extent. Camel meat is characterized by low percentage of fat and high percentage of lean, also it was found that camel fat has low level of saturated fatty acids, this is considered as an advantage since consumers seek leanness above all other meat attributes this because that animals fats are associated with heart disease in man due to deposition of cholesterol in coronary arteries (Camel Newsletter 2000). Ingram (1972) reported that the nature and degree of initial contamination of the carcass surface mainly determine the keeping quality of meat.

Prevention of contamination during slaughtering and subsequent processing has therefore been identified as the most important factor in safeguarding the micro-biological quality of meat. Grancy, (1981) stated that meat undergoes certain superficial changes as the result of storage. Judge *et al*., (1990) reported that the spoilage of meat was defined as the state at which meat become unfit for human consumption. Stringer *et al*. (1969) reported that contamination of carcass come from different sources including environment and equipments with which meat comes in contact during slaughtering and processing; but hides remain an important source of contamination of carcass. The aim of this study was:

1. To determine the chemical composition of camel meat and beef.
2. To evaluate some hygienic properties of fresh and refrigerated camel meat and beef.
3. To compare the total bacterial count between camel and beef meat stored at 4°C.

MATERIALS AND METHOD

Study was conducted at the Laboratory of Meat Science and Technology, College of Animal Production Science and Technology, Sudan University of Science and Technology.

Meat samples: A total of 10 kg fresh deboned camel meat was obtained from camels slaughtered at local market "*Soug Elnaga"* west Omdurman, meat trimmed to a minimum amount. Camel fat of 3kg was separately ground & mixed with the lean meat. A total of 10 kg fresh deboned beef meat was obtained from kuku Research Centre and was trimmed to a minimum amount.

Each muscle sample was freed from external visible fat and connective tissue. This was sub sampled for chemical analysis. Samples for chemical analysis were immediately minced and stored at -10^{o}C till analysis.

Chemical composition (Proximate Analysis): Determination of total moisture, ash, total protein and fat (ether

extract) were performed according to AOAC (2000) methods.

Crude protein: Kjeldahl method was used to determine nitrogen; crude protein was determined by multiplying the amount of nitrogen times 6.25. The fresh meat sample was minced and 1 gm was digested in kjeldahl flask by adding mercury tablets as catalysts and 25 ml Conc.H2SO4. the mixture was heated for 3 hr. The digested samples were cooled and transferred to volumetric flasks. Nitrogen was distilled from the flask in the percentage of 40% NaOH solution and received in 4% boric acid. The mixture was titrated against 0.1 N HCl solutions (AOAC, 2000). The formula used for calculation of crude protein was as follows:

$$\text{Crude protein \%} = \frac{T \times 0.1 \times 14 \times 100 \times 6.25}{\text{Weight of sample} \times 1000}$$

T=Titration volume

Moisture Determination: Moisture content was based on weight loss of 5 gm of sample (5 cm Length and cm thickness). The fresh muscle samples were put in an oven at 100^{o}C for 24 hrs. Consequently the samples were cooled in desiccators and their weights were determined (AOAC, 2000). The moisture content was calculated according to the following equation:

$$\text{Moisture \%} = \frac{\text{Fresh sample weight} - \text{dried sample weight}}{\text{Fresh sample weight}} \times 100$$

Fat Determination: Fat was determined by the ether extract (AOAC, 2000). Two grams from the sample were taken to soxhlet apparatus. The sample was subjected to continuous extraction with ether for 5 hrs. The sample was then removed from the extractor and allowed to dry for 2 hr at 100^{o}C in drying oven till no traces of ether remained. The sample was then cooled and weighed for ether extraction percentage; the calculation was done by the following:

$$\text{Fat\%} = \frac{\text{Fat weight} \times 100}{\text{Sample weight}}$$

Ash Determination: Two grams of fat free sample were placed into dried crucible of known weight. The crucible was placed inside a muffle furnace at 150^{o}C. The temperature was increased gradually till it reached 600^{o}C and the sample was heated at that temperature for 3 hrs. Then the crucible was taken out, cooled into desiccators and weighed (AOAC, 2000). The ash percentage was calculated by the following formula:

$$\text{Ash \%} = \frac{\text{Weight of crucible before ashing} - \text{weight of crucible after drying} \times 100}{\text{Sample weight}}$$

Protein Fractionation: Samples for protein fraction were trimmed of excessive subcutaneous connective tissue before mincing. The fractionation procedure was as described by Lawrie (1961). Sarcoplasmic proteins were determined on1 ml sample of this filtrate using Biuret method (Gornal *et al.,* 1949). Myofibrillar protein determination by Biuret method (Gornal *et al*., 1949).

pH Determination: For pH determination, sample (weighing approximately 1 g) was homogenized in 20 ml distilled water for 1 minute. The pH was then read on a laboratory pH meter, (adjusted with buffer, pH 7.0) at room temperature.

Specimens for Bacteriological Examination: A total of 10 samples were collected randomly from camel meat which was purchased from "Sough Elnaga". Also A total of 10 samples were collected at random from beef carcass was obtained from kuku research centre. Samples were taken from *longissmus dorsi*

muscle. Samples were then placed in icebox and transported to laboratory and kept in a refrigerator at 4°C. The storage temperature s was read daily using a fixed in thermometer for 15 days. Samples were examined bacteriologically at day 0, 7, 10 and 15.

Total viable counts: was done as described by Cruickshank, (1975).

Organoleptic test of stored samples: Organoleptic examination based on: (a) off-odour (b) colour and texture this was done by a panel of three persons. Samples were examined visually for colour change and by smelling to detect any abnormal odour based on the previous experience of the examiners with normally consumed-table meat (Banwart, 1981).

Statistical analysis: The data collected were subjected to statistical analysis by using complete randomized design used to analyze the results obtained from this study and subjected to ANOVA followed by Least significant difference test (LSD) using the (SPSS, 2007).

RESULTS

Table (1) shows the average moisture, fat, protein and ash content of the fresh camel meat and beef. Camel meat had significantly (P< 0.05) higher moisture content than beef meat. The protein content of the two species were not significantly (P> 0.05) different among the two types of meat. The fat content was highly significant (P< 0.01) in the tested muscles. However, the fat content of beef high was while camel meat had the low fat content.

The ash content was not significantly (P> 0.05) different among the two species meat. Sarcoplasmic proteins and non-protein-nitrogen were not significantly (P> 0.05) different among the two species, sarcoplasmic proteins were higher in beef and lower in camel meat. Also non-protein-nitrogen was higher in beef meat than in camel meat. Myofibrillar proteins were not significantly different among the two species. Myofibrillar proteins were not significantly different among the two species.

Table 1: The mean value of chemical composition of camel meat and beef

Parameters	Camel meat	Beef	Standard Error (SE)	Level of significance (L.S)
Moisture %	77.00[a]	70.47[b]	0.48	*
Protein %	22.00	20.50	0.44	N.S.
Fat %	1.63[a]	4.88[b]	0.10	**
Ash	1.35	0.92	0.07	N.S.
Sacroplasmic protein %	6.11[a]	26.00[b]	0.32	**
Myofibrillar protein %	11.64	11.50	0.28	N.S.
Non-protein-nitrogen %	1.48[a]	11.60[b]	0.33	**
Muscle pH %	5.75	6.20	0.15	N.S.

* = (P< 0.05), ** = (P< 0.01), N.S. = No significant different between the two means.

There was no significant (P> 0.05) different between the two types of meat in pH. Bacterial counts of fresh and refrigerated samples from camel meat and beef are presented in Table (2). The average bacterial load of the fresh and refrigerated samples of camel meat was 3.5×10^6 and 5×10^6 respectively. Also the average bacterial load of the fresh and refrigerated samples of beef meat was 3×10^6 and 5.5×10^6 respectively. There was a general increase in the bacterial numbers with increase of the refrigeration time. Also the fresh samples had the lowest

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bacterial count compared to samples which was stored for 15 days at refrigerator temperature ($4^{o}C$).

Table 2: Average Bacterial Counts of Fresh and Refrigerated Samples of camel meat and Beef after variable periods of storage

Site of collection	No. of samples	Average total count in gram (CFU/g)			
		Fresh samples	After 7 days of refrigeration	After 10 days of refrigeration	After 15 days of refrigeration
Longismuss dorsi of camel meat	3	3.5×10^6	4×10^6	4.5×10^6	5×10^6
Longismuss dorsi of beef	3	3×10^6	4×10^6	5×10^6	5.5×10^6

CFU/g =Colony forming unit per gram

Results of organoleptic tests are given in Table (3), all samples qualified as good by the panellists according to criteria given in materials and methods.

Table 3: Results of Organoleptic Test of Fresh and Refrigerated Camel meat and Beef samples

Samples	**State of samples**	**Organoleptic Test**			
		Off odor	**Colour**	**Tenderness**	**Judgment**
10 samples of camel meat and beef	Fresh	None	Red	Normal	Good
	After 7 days of refrigeration	None	Red	Normal	Good
	After 10 days of refrigeration	None	Red	Normal	Good
	After 15 days of refrigeration	None	Red	Normal	Good

DISCUSSION

In this study the chemical composition and bacterial count of camel and beef meat were examined. The results showed that the average moisture content was significantly ($P< 0.05$) different between camel meat and beef, moisture content higher in camel meat as compared with beef, these results are in accord with corresponding value reported by Babiker and Tibin (1986) this could be explained by the lower content of intramuscular fat of camel meat than that of beef. The average moisture contents of fresh camel meat was 76.5 and this similar with the results of Abdelbaki (1957) and Hamman *et al*. (1962) who reported a value of 76.21% and in line with the results of Babiker and Yousif (1989) who found a value of 75.81%, this result lower than that reported by Suad (1994) who reported moisture content of 78.45%; and is slightly higher than that reported by Lawrie (1979) who reported moisture content of 75%. This difference might be due to differences in age and degree of fatness of the camel meats used in these studies. There was no significant different in the protein content between camel meat and beef. The protein content of the camel meat was greater than that of beef, this result is in line with the result of Babiker and Tibin (1986). The crude protein content found in this study is similar to values reported by Babiker and Yousif (1989) who reported a value of 21.41%. However, it is slightly higher than that reported by Suad (1994) who reported values of 20.98 and 19.8% respectively. Dawood and Alkanhal, (1995); El-Faer *et al*., (1991); Elgasim and Alkanhal, (1992); Kadim *et al*., (2006) reported that the

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camel meat contain less fat and higher moisture than beef. Fat content was significantly ($P< 0.01$) higher in beef than in camel meat, this result is similar with the results of Nasr *et al.* (1965). Also in line with the result of Babiker and Yousif (1989), who reported that camel meat had more moisture, less fat, less ash and similar protein content as beef, lamb, goat and chicken? The fat content of camel meat in this study (1.63%) is similar to a value of 1.4% reported by Babiker and Yousif (1989). Ash content of the fresh camel meat in this study is similar to a value of 1.38% reported by Babiker and Yousif (1989) but slightly higher than the value of 1.17% reported by Suad (1994). The result of protein fractionation in Table (2) showed that camel meat had significantly lower sarcoplasmic proteins and non-protein-nitrogen compared with beef. The concentration of sarco-plasmic proteins was significantly ($P< 0.001$) higher in beef than that of camel meat, this was a reflection of species differences in chemical composition of the muscles, reported by Lawri (1979). The concentration of sarcoplasmic proteins found in this study in line with a value reported by Babiker and Yousif (1989). The concentration of myofibrillar protein was similar in the camel meat and beef muscle. Camel meat had more moisture and significantly ($P< 0.001$) less fat content than that of beef (Babiker and Tibin, 1985). However, there was no significant different in the concentration of myofibrillar proteins among the two muscles, the concentration reported in this study is in line with corresponding values reported by Babiker and Tibin (1985) for camel *L. dorsi* muscles. In the present results the average bacterial load of the fresh and refrigerated samples of camel meat was (3.5×10^6 and 5×10^6 CFU/gm)**.** The average bacterial loads of the fresh and refrigerated samples of beef were (3×10^6 and 5.5×10^6 CFU/gm). Results of the total viable bacterial counts obtained in the present study are similar with standards suggested by Oregon Department of Agriculture, (1973) who reported that the total aerobic plate count of fresh and refrigerated meat should not exceed as (5×10^{-6} CFU/gm). Also the results in this study are in line with the findings of Khalifa, (2002) who reported that the effect of storage of beef on total viable count was as follows (5.75×10^{-4} CFU/gm) at first day and (4.2×10^{-4} CFU/gm) at month for beef. Results in this study was higher than that reported by Ayres (1955) who suggested that the total aerobic plate count for fresh meat should not exceed $10^4 - 10^5$ CFU /gm. The higher bacterial counts obtained during this work may be due to surface contamination of meat.

CONCLUSION

Chemically camel meat had low fat content (1.63%) which makes it an Ideal healthy food. The average bacterial count for fresh meat was (3.5×10^6) cfu/g in camel meat and (3×10^6) in beef meat which showed increased during refrigeration for 7, 10 and 15 days.

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