



A Comparative Study on the Chemical Composition and Cholesterol Content of Fresh Camel, Beef and Goat meat

Siham Abdelwahab Alamin*, Daoud Alzubair Ahmed, Hayder Elamin Ahmed

College of Animal Production Science and Technology, Sudan University of Science and Technology, Khartoum – Sudan

* Corresponding author: E-mail: sihamlmn666@gmail.com Mobile: 0912677776

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ABSTRACT

The study was conducted to evaluate the chemical composition and cholesterol level of fresh camel, beef and goat meat. The results showed that chemical composition of camel, beef and goat meat were significantly different ($P < 0.05$). Camel and goat meat had higher moisture content compared to beef as (77.92, 75.55 and 72.12%) respectively. Whereas beef had higher protein content as (21.07%) compared to camel and goat meat as (19.25 and 20.32%) respectively. Camel meat had the lowest fat content (1.17%) compared to beef and goat meat as (2.74 and 1.66%). However, camel meat had the highest ash content (0.78%) followed by beef (0.47%) and goat meat (0.43%). The present result showed that the camel meat had lowest cholesterol content (59.2 mg/100gm) compared to beef and goat meat as (73.6 and 71.2mg/100gm) respectively. The results also showed that myofibrillar proteins, sarcoplasmic proteins and non-protein-nitrogen were not significantly different ($P > 0.05$) among the three types of meat. The results showed that concentration of myofibrillar protein was similar in the camel, beef and goat meat as (11.24, 11.48 and 11.24%) respectively. The sarcoplasmic proteins values were (5.50, 5.35 and 5.40%) for camel, beef and goat meat respectively. The non-protein-nitrogen values were (1.35, 1.05 and 1.16%) in camel, beef and goat meat.

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INTRODUCTION

Sudan is situated in northeast Africa between latitudes 4⁰ and 22⁰ north and longitudes 22⁰ and 38⁰ East. The country is traversed by the River Nile and its

tributaries which have varying influences on irrigated agriculture and livestock production systems. Meat consumption in developing countries has been continuously

increasing from annual per capita consumption of 10 kg in 1960s to 26 kg in 2000 and expected to reach 37 kg in 2030 according to FAO projections (FAO, 2007). Meat is defined as the whole of the carcass of cattle, sheep, goat, camel, buffalo, deer, hare, poultry or rabbit (Williams, 2007). Meat is the one of the most nutritive foods used for human consumption. Quantitatively and qualitatively meat and other animal food are better sources for high quality protein than plant food, for its richness in essential amino acids and organic acids that cannot be synthesized in human are available in well balanced proportions and concentration. 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 meat animal's (Zidan *et al.*, 2000). Recently, more attention has been paid to the nutritional value of camel meat, with the aim of creating additional value for various camel meat products (Ulmer *et al.*, 2004). On the other hand, goat meat is less preferred for its lower in tenderness and flavor compared to mutton and beef (Webb *et al.* 2005). Goat meat has been established as a lean meat with favorable nutritional quality and it is considered an ideal choice of the health-conscious consumer (Correa, 2010). Furthermore goat meat is preferred in most African and Asian countries for its taste, higher lean ground, due to the high price of beef and mutton, coupled with low incomes.

The Objectives of this study was to determine the physicochemical properties of camel, beef and goat fresh Meat.

MATERIALS AND METHODS

The study was conducted at the laboratory of Meat Science and Technology, College of animal Production Science and Technology, Sudan University of Science and

Technology and Meat laboratory Khartoum University.

Meat samples: Thirty kg of fresh deboned camel, beef and goat meat was obtained. Camel meat was purchased from "Soug Elnaga" local market, west Omdurman, beef from kuku research centre, and goat meat from local market. The meat was trimmed to small pieces and ground through 0.5 cm plate using meat grinder.

Samples for physicochemical analysis: Moisture content, crude protein, Fat, Ash, Protein Fractionation and pH were determined according to AOAC (2002).

Moisture Determination: Moisture content was determined as weight loss of 5 gm of each sample (5 cm length and one cm thickness). The fresh samples were put in an oven at 100°C for 24 hrs. Consequently the samples were cooled in desiccators and their weights were determined as described by AOAC (2002).

Moisture%=

$$\frac{\text{Fresh sample weight-dried sample wt.} \times 100}{\text{Fresh sample weight}}$$

Crude protein: Kjeldahl method was used to determine nitrogen content. The crude protein was determined by multiplying the amount of nitrogen times 6.25. The formula used for calculation of Nitrogen content was:

$$\text{Nitrogen content \%} = \frac{TV \times N \times 14 \times 100}{\text{Weight of sample} \times 1000}$$

Where:

TV = Actual volume of HCL used for titration.

N = Normality of HCL.

14= each ml is equivalent to 14 mg nitrogen.

1000 = to convert from mg to gm.

6.25= constant factor.

Protein content%=Nitrogen content%×6.25

As described by AOAC (2002).

Fat Determination: Fat was determined by ether extract. Two gm from each Sample were taken to soxhlet apparatus. The

samples were subjected to continuous extraction with ether for 5 hrs. The samples were then removed from the extractor and allowed to dry for 2 hr at 100°C in drying oven till no traces of ether remained. The calculation was as follows:

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

As described by AOAC (2002).

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

Determination of cholesterol:

Total cholesterol concentration in the three different types of meat (Camel, beef and goat meat) were quantified using high performance liquid chromatography (HPLC). HPLC has been used to separate cholesterol (Fenton 1992). Cholesterol by HPLC technique with a 25-cm Zorbax RX-Sil. Column (particle size of 5 µm). The compounds were detected with an ultraviolet (UV) detector at (202nm) for cholesterol. The column was made of ultra-clean porous silica micro particles. The mobile phase was 99% hexane and 1% iso-propanol. Most HPLC methods use the polar stationary phase column made of highly pure, porous silica micro particles (Ponte, *et. al.*, 2004, 2008 and Costa, *et. al.*, 2006).

Protein Fractionation:

Samples for protein fractionation were prepared by trimming off excessive subcutaneous fat and connective tissues then minced. Five gm from the sample was weighed and fractionated into sarcoplasmic and myofibrillar proteins according to the procedure described by Babiker and Lawrie (1983).

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

Ash Determination: Two gm of fat free sample were placed into dried crucible of known weight. The crucible was placed inside a muffle furnace at 150°C. The temperature was increased gradually till it reached 600°C for 3 hrs. Then the crucible was taken out, cooled into desiccators and weighed. The ash % was calculated by the following formula as described by AOAC (2002).

significant difference test (LSD) using the (SPSS, Version 17.0, 2008).

RESULTS

Table (1) and figure shows the mean values (±SD) of chemical composition of camel, beef and goat meat. The moisture content showed significant difference ($P < 0.05$) among the meat sample used. Camel and goat meat had higher moisture content than beef. Protein content was highly significant difference ($P < 0.01$) among the three types of meat. Beef had higher protein content compared to camel and goat meat. Fat content was not significantly different ($P > 0.05$) among the meat sample used. However, the fat content of beef was the highest followed by goat and camel meat respectively. Ash content was highly significant difference ($P < 0.01$) among the three species studied. Camel meat had the highest amount of ash followed by beef and goat meat respectively. The cholesterol content of the three species showed high significant difference ($P < 0.01$) among the meat sample used. Camel meat had significantly lower cholesterol content than beef and goat meat. Myofibrillar proteins of the samples were not significantly different ($P > 0.05$) among the three species. Similarly sarcoplasmic proteins were not significantly different ($P > 0.05$) among the three species. Also non-protein-nitrogen was not significantly different ($P > 0.05$) among the three treatments.

Table 1: Mean values (\pm SD) of chemical composition of camel, beef & goat meat

Parameters	Camel meat	Beef	Goat meat	Significant level
Moisture %	77.92 \pm 0.60 ^a	72.12 \pm 0.95 ^c	75.55 \pm 0.70 ^b	*
CP %	19.78 \pm 0.77 ^b	21.07 \pm 0.44 ^a	20.32 \pm 0.71 ^b	**
Fat %	1.17 \pm 0.26 ^b	2.74 \pm 0.80 ^a	1.66 \pm 0.17 ^b	NS
Ash %	0.78 \pm 0.47	0.47 \pm 0.03	0.43 \pm 0.02	**
Cholesterol(mg/100gm)	59.2 \pm 4.66 ^b	73.60 \pm 6.73 ^a	71.20 \pm 5.81 ^a	**
Myofibriller protein%	11.24 \pm 0.27	11.48 \pm 0.06	11.36 \pm 0.25	NS
Sarcoplasmic protein%	5.50 \pm 0.35	5.35 \pm 0.21	5.40 \pm 0.32	NS
NPN %	1.35 \pm 0.26	1.05 \pm 0.16	1.16 \pm 0.11	NS

* = Significance different P<0.05

** = Significance different P<0.01

NS = No significant

a, b = means the mean with different superscript in the same row are significantly different at P<0.05

DISCUSSION

The moisture content was significantly different (P< 0.05) among the three different types of meat. Camel and goat meat had higher moisture content compared to beef. The moisture content of camel meat was (77.9 %) and this agrees with the results of Dawood and Alkanhal, (1995), Al-Sheddy *et al.*, (1999), Al-Owaimer, (2000); Kadim *et al.*, (2006), and Siham (2008) who reported a value ranging between (70 and 77%). The moisture content of beef in this study was (72.2%). This finding was lower than the value reported by Agranosa and Bandian, (1978) who reported moisture content of beef as (74.2%). The moisture content of goat meat was (75.6%). This result was higher than the findings of Schonfeldt, (1989) as (64.6- 65.4 %). Also higher than the result of Shija *et al.*, (2013) who reported moisture in goat meat as (70.65%). and lower than the findings of Arguello *et al.*, (2004) who reported the moisture content in goat meat as (76.63%). The protein content showed high significant difference (P< 0.01) among the three types of meat.

Beef had higher protein content as (21.07%) compared to camel and goat meat as (19.25 and 20.32%) respectively. The protein content in camel meat was (19.78%). This result was almost inline with the findings of

Mohammad and Abu-Bakr, (2011) as (19.25%) and Adim *et al.*, (2008) as (19%). The protein content in beef was (21.07%), this result was less than that stated by (USDA, 2001) as (25%) and higher than the findings of Lee, (2012) as (17.4%).

The protein content was (20.3%) in goat meat, this result was in line with the findings of Arguello *et al.*, (2004) as (20.1%) and USDA, (2007) as (20.6%). The fat content in this study showed no significant difference (P>0.05) between camel, beef and goat meat.

Fat content was (1.2%) in camel meat which was in line with the findings of Zamil El-Faer *et al.*, (1991) as (1.2 - 1.8%), and Kadim *et al.*, (2006) as (1.1 - 10.5%). The fat content in beef was (2.7%). This result agreed with the result reported by (Sadler *et al.*, 1993 and Williams *et al.*, 2007) as (2.8%). The fat content of goat meat in the present study was (1.7%), which was in line with the findings of Arguello *et al.*, (2004) as (1.5 %) and Mohammad *et al.*, (2010) as (1.8%). The ash content in this study revealed high significant difference (P< 0.01) among the three types of meat. Camel meat had the highest ash content (0.79) followed by beef (0.47%) and goat meat (0.43%) respectively. The ash content of fresh camel meat was (0.78%) which was in

line with the result found by Gulzhan *et al.*, (2013) as (0.9%) and Nasr *et al.*, (1965) as (0.76 - 0.86%). The ash content of beef was (0.47%), this result agreed with the findings of IJFSN, (2010) as (0.9%). The ash content in goat meat was (0.43%), which agreed with the result of Wattanachant *et al.*, (2008) as (0.45%). The cholesterol content in this study was highly significant difference ($P < 0.01$) among the three types of meat. The camel meat had lower cholesterol content as (59.2 mg/ 100 gm) compared to beef and goat meat as (73.6 and 71.2 mg /100 gm) respectively. These results were similar to that reported by Elgasim and Elhag, (1982); Fallah *et al.*, (2008); Kadim *et al.*, (2009) who found that the camel meat was leaner than beef and goat meat. The present result indicated that goat meat had lower cholesterol concentration than beef. This result was inline with the findings of USDA, (2001) who reported the goat meat was lower in cholesterol content than beef as value of (63.8 and 73.1 mg/100 gm) respectively.

The present result showed cholesterol content in goat meat was (71.2mg/100gm) which was slightly similar to that finding of Park *et al.*, (1991) as (57.8 to 70 mg/100gm). The myofibrillar proteins, sarcoplasmic proteins and non-protein-nitrogen were not significantly different ($P > 0.05$) among the three types of meat. The result in this study was in line with the findings of Nafiseh *et al.*, (2010) who reported that there was no significant difference between myofibrillar proteins in camel meat and beef as (10.89 and 10.58%) respectively.

The chemical composition of meat is influenced by different factors such as species, breed, age, and lower fat content compared to mutton and beef. Meat production from goat in Sudan is gaining new sex, anatomical location of muscle and nutrition (Lawrie, 1998). Tornberg, (2005)

stated that the muscle consists of 75% water, 20% protein, 3.5% fat and 2% soluble non-protein substances. Mohammed, (1993) reported that the chemical composition of camel meat and beef were not significantly different but the camel meat score was higher in moisture. Elgasim and Elhag (1982) stated that the cholesterol concentration in camel meat was noted to be lower than that of beef. Beserra *et al.*, (2004) reported that cholesterol concentration of goat meat was affected by goat genotypes.

CONCLUSION

Chemically camel meat had low fat (1.17%) and cholesterol content (59.2 mg/100gm) which makes it an ideal healthy meat. Goat meat has been established as a lean meat with favorable nutritional quality. However, goat meat contains low fat (1.66%) and cholesterol content (71.2 mg/100gm) compared to beef which had (2.74%) fat and (73.6 mg/ 100 gm) cholesterol.

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