



Study on Some Quality Attributes and Cooking Loss of Red Meat in Khartoum State, Sudan

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ARTICLE INFO

ABSTRACT

ARTICLE HISTORY

Received: 19/07/2017

Accepted: 14/10/2017

Available online: December 2017

KEYWORDS:

Quality Attribute,
Cooking loss of camel meat,
Beef and goat meat.

This study aimed to evaluate the quality attributes and cooking losses of fresh camel, beef and goat meat. The result showed that hunter lightness (L) values were highly significant ($P < 0.001$) between the three types of meat. Beef and goat meat recorded higher values of lightness compared to camel meat as (34.27, 33.44 and 30.76) respectively. Redness (a) values were not significantly ($P > 0.05$) different between the three types of meat studied, hence goat meat recorded the highest values followed by beef and camel meat as (17.53, 16.69 and 16.04) respectively. The yellowness (b) values were significantly ($P < 0.001$) different between treatments, However, beef recorded the highest followed by camel and goat meat as (9.82, 8.48 and 6.82) respectively. In general, camel meat appeared brighter red than beef and goat meat. Water holding capacity (WHC) was highly significant ($P < 0.01$) among the three types of meat. The WHC values were (1.37, 2.44 and 2.19) for camel, beef and goat meat respectively. Camel meat recorded the lowest values compared to beef and goat meat (camel meat had superior WHC compared to beef and goat meat). The results of cooking loss were highly significant ($P < 0.01$) among the three types of meat. Cooking loss percent of camel meat was the highest values followed by goat meat and beef as (36.3, 34.15 and 31.75%) respectively. The pH values in this study showed no significant ($P > 0.05$) different between the three types of meat. However the pH values were (5.88, 5.77 and 5.68) in camel, beef and goat meat respectively.

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INTRODUCTION

All quality attributes are influenced by breed, sex, age, anatomical location, exercise, nutrition and internal variability. Color is an important criterion of raw or cooked meat and meat products. It reflects the proper composition of the products, particularly in relation of meat to other component, freshness of raw materials, texture, taste and proper conditions of storage (Klak *et al.*, 2001; Alberti *et al.*, 2002). Traditionally meat quality is either eating quality or processing quality, therefore quality is directly associated with usage and is a multifaceted concept (Webb *et al.*, 2005). Williamson, *et al.*, (2006) reported that lean red meat has a relatively low fat content, moderate in cholesterol, and is rich in protein, essential vitamins and minerals. Leidner, (1998) and Ringdorfer, (2001) stated that high-quality goat meat produced from kids characterized by high meatiness and low fatness that meets the above requirements, so the demand for this kind of meat is constantly growing both in the EU member states and in the USA. Lawrie, (1991) stated that meat eating quality involves five attributes namely, colour, water holding capacity, tenderness, juiciness and flavour. Water holding capacity is the ability of meat to retain its own or added water during application of external forces such as cutting, heating, grinding, or pressing (Judge *et al.*, 1989). Cooking loss is one of the most important properties of sausage products as it is related to water holding capacity. There is variation in water holding capacity among different types of meat from different animal and muscles (Lawrie, 1991). Mukasa, (1981) defined texture of meat as the sensory manifestation of the structure of the meat

and the manner in which the structure reacts to the force applied during biting. Simela *et al.*, (2003) stated that meat tenderness and flavor are the most important components that determine meat quality.

The Objectives of this study can be summarizing as following:

1. To determine the eating quality attributes of camel meat, beef, and goat meat.
2. To determine the cooking loss of camel meat, beef and goat meat.

MATERIALS & METHODS:

This study was conducted in the laboratory of meat technology, College of animal Production Science and Technology Sudan University of Science and Technology (SUST).

Meat samples: Thirty kg of fresh deboned camel, beef and goat meat were 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.

Colour Measurement: Color measurements were performed using hunter lab Tristimulus colorimeter model D 25 M-2 Hunter. Lightness (L), redness (a) and yellowness (b) were recorded on muscle sample.

Water Holding Capacity (WHC): One gm from minced meat (LD) was used. Each sample was placed on humidified filter paper (Whatman No. 40) in a desiccators over saturated KCl solution) and pressed between two Plexiglas plates for 3 min. at 25 kg load. The meat film area was traced with a ball pen and the filter paper was allowed to dry. Meat and moisture areas were measured with a

compensating Plano-meter (Jauregui, *et al.*, 1981). As follows:

Water holding capacity=

$$\frac{\text{Lose water area-meat film area}}{\text{Meat film area}}$$

Cooking Loss Determination: The cooking loss was determined according to (AMSA, 1995). Meat samples were thawed at 5°C for 24 hr. then cut into samples of equal dimensions and the weighed Samples were cooked in plastic bags in a water bath at 80°C for 90 min., cooled in running tap water for 20 min., then dried from fluids and reweighed. The cooking loss % was also determined by oven according to (AMSA, 1995). Frozen samples randomly selected were used for determining cooking losses and thawed for 24 hours in 4°C refrigerator. Sample allowed to cooling at room temperature, then reweighed. Cooking losses were determined by weight difference between raw and cooked meat sample. The cooking losses were determined according to (Ziprin *et al.*, 1981). Cooking loss was determined as the loss in weight during cooking and expressed as a percent of pre-cooking weight as follows:

Cooking loss% =

$$\frac{\text{weight before cooking-weight after cooking}}{\text{weight before cooking}} \times 100$$

pH determination: One gm of sample was blended with 9 ml of distilled water in a laboratory blender for 2 min, filtered and then the pH of the filtrate was determined by digital pH-meter. The meat samples were packed, labeled and kept frozen in -18 °c (1 g) The procedure at each measurement involved excising of fresh cut surface and sampling it with sterile plate. The area was covered by polyethylene cover to avoid desiccation. Sample

weighing approximately 1 gm was homogenized in 10 ml 5mm iodoacetic acid, 150 mm KCl neutralized to pH7.0 by dilute NaOH and HCL. The pH was then read on laboratory pH meter, (adjusted with buffer, pH 7.0) at room temperature.

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, 2008).

RESULTS

Table (1) shows mean values (\pm SD) of some quality attributes of camel, beef and goat meat. Hunter lightness (L) values were highly significant ($P < 0.01$) between meats studied. Beef and goat meat recorded higher values than camel meat. Redness (a) values were not significant at ($P > 0.05$). Goat meat recorded higher values followed by beef and camel meat. Yellowness (b) values were significantly ($P < 0.01$). Beef recorded higher value followed by camel and goat meat. Water holding capacity (WHC) was highly significantly ($P < 0.01$) different among the three types of meat studied. Camel meat recorded low values compared to beef and goat meat (That meant camel meat had the highest water holding capacity compared with beef and goat meat). Cooking loss was highly significant ($P < 0.01$) among the three types of meat. Cooking loss percent of camel meat was higher followed by goat meat and beef respectively. There was no significant ($P > 0.05$) different between the three types of meat in PH values.

Table 1: Mean values (\pm SD) of some quality attributes of Beef, Camel and goat meat

Parameters	Camel meat	Beef	Goat meat	Significance level
Lightness (L)	30.76 \pm 0.54 ^b	34.27 \pm 1.21 ^a	33.44 \pm 1.02 ^a	**
Redness (a)	16.04 \pm 0.57	16.69 \pm 1.45	17.53 \pm 0.57	NS
Yellowness (b)	8.48 \pm 1.52 ^a	9.82 \pm 0.67 ^a	6.82 \pm 0.27 ^b	**
Water holding capacity (WHC)	1.37 \pm 0.20 ^b	2.44 \pm 0.24 ^a	2.19 \pm 0.30 ^a	**
Cooking loss %	36.30 \pm 0.86 ^a	31.75 \pm 1.20 ^c	34.15 \pm 0.85 ^b	**
pH	5.88 \pm 0.31	5.77 \pm 0.34	5.68 \pm 0.19	NS

L = Degree of lightness at hunter lab colour

a = Degree of redness at hunter lab colour

b = Degree of yellowness at hunter lab colour

* = (P< 0.05)

*** = (P<0.001)

** =

N.S. =

(P< 0.01)

No significant difference between the two means.

DISCUSSION

Goat meat recorded higher values followed by beef and camel meat as (17.53, 16.69 and 16.04) respectively. The yellowness (b) values were significantly (P< 0.001) different between the meat types. Beef recorded higher values followed by camel and goat meat as (9.82, 8.48 and 6.82) respectively. Results showed that camel meat appeared brighter red than beef and goat meat. This result was supported by results of Fox, (1966); Saffle, (1968) and Bennion, (1980) who reported that the camel meat is lighter in color compared with beef and goat meat. The goat meat which recorded highest value in redness compared to beef and camel meat was comparable to those reported by Adim *et al.*, (2008) who reported the camel meat is raspberry red to dark brown in color. The present results disagreed with the finding of Wattanachant, *et al.*, (2008) who reported that goat meat color values as (50.83, 3.82 and 8.06) for (L, a and b) respectively and also disagreed with the findings of Songklanakarinn, (2008) who reported that goat meat had color values

as (L, 50.83; a, 3.82 and b, 8.06). The present results also were in line with the results of Kadim *et al.*, (2006) who reported camel meat color values as lightness (L) ranged from (27.86 to 43.21), redness (a) ranged from (10.46 to 22.81) and yellowness (b) ranged from (4.63 to 10.11). The present results showed value as (32.44) for lightness color in goat meat, these values were lower than that found by Arguello *et al.*, (2004) who reported the lightness value in goat meat color was (50.79) and Arguello *et al.*, (1998) as (50 – 56). The present results were inconformity with the result reported by Siham, (2008) who reported the camel meat color lightness (29.56) and redness (16.45). The present results were almost similar to the results reported by Siham, (2008) as (19.6) for redness and (7.78) for yellowness in beef. Water holding capacity (WHC) was highly significant (P< 0.01) for the three types of meat. Camel meat recorded low value compared to beef and goat meat. The present results were lower than the values reported by Kafe, (2001) in camel meat as (5.8) and that

of Henryk, et. al., (2008) who reported WHC in goat meat as (7) and Arguello et. al., (1998) as (9.7 - 11.8). The results of this study were in line with the findings of Elkhidir *et. al.*, (1998) who reported that the goat meat had WHC of (2.14). The present results disagreed with the result of Arguello *et. al.*, (2004) who reported that the WHC in goat meat (0.59). The present results were in line with the findings of Siham, (2008) who reported that the WHC in beef as (2.67). Differences in water holding capacity of camel meat compared to beef and goat meat might be due to differences in pH level. In the present study cooking loss was highly significantly ($P < 0.01$) among the three types of meat. Cooking loss percent of camel meat was higher followed by goat meat and beef as (36.3, 34.15 and 31.75%) respectively. However these different may be due to moisture content differences in the different meats studied. The cooking loss in camel meat in this study as (36.3%) which was higher than the findings of Kadim *et al.*, (2006) as (13.18 - 29.88). The present result was in agreement with the findings of Siham, (2008) who reported that cooking loss % in camel meat as (35.6%). Cooking loss in beef in this study (31.75%) which was lower than the result reported by Siham, (2008) as (38.6%). Cooking loss was lower in beef muscle than camel meat, probably due to the lower content of intra-muscular fat of camel meat as stated by Kadim, *et al.*, (2006). The goat meat in this study was higher cooking

loss (34.15%) than the findings of Songklanakarin, (2008) and Wattanachant, *et al.*, (2008) who reported that the cooking loss percent in goat meat as (27.77%) also the result of Madruga *et al.*, (2008) who reported values ranged from (26.5 to 29.2%). The cooking loss percentage in goat meat in this study was in line with the result reported by Elkhidir *et al.*, (1998) as (34%). There was no significant ($P > 0.05$) different between the three types of meat in pH values. The pH values in this study were (5.88, 5.77 and 5.68) in camel, beef and goat meat respectively. In the present study, the camel meat recorded higher value of pH compared to beef and goat meat. The pH of camel meat in this study agreed with values found by Al-Sheddy *et al.*, (1999); Cristofaneli *et al.*, (2004) and Kadim *et al.*, (2006) who reported values of pH in camel meat ranged from (5.7 to 6.0). The pH value of camel meat in this study (5.88) was in line with the findings of Kadim *et al.*, (2006) and Siham, (2008) who reported that the ultimate pH of camel meat ranged from (5.46 to 6.64). The pH value of beef in this study was (5.77) which similar to that reported by Lee, (2012) as (5.64) and Siham, (2008) as (6.0). In the present study the pH value in goat meat was inconformity with the result of Zhong *et al.*, (2009) and Arguello *et. al.*, (1998) who reported that the goat meat has pH value of about (5.6) and was in line with the findings of Madruga *et al.*, (2008) as (5.5 - 5.6) and Henryk, *et. al.*, (2008) as (5.78). The

result in this study agreed to the result reported by Arguello *et. al.*, (2004) who found the pH in goat meat as (5.49). The findings in this result was lower than the result reported by Wattanachant, *et al.*, (2008) and Songklanakarin, (2008) as (6.57) pH in goat meat. The present result in line with the findings of IJFS N, (2010) and Snell, (1996) who reported that the values of pH in the meat after chilling were ranged between (5.49 and 5.82).

CONCLUSION

In this study camel meat appeared brighter red than beef and goat meat. Also camel meat had superior WHC compared to beef and goat meat.

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