

Evaluation of Microbial Aspects and Chemical Composition of Raw Beef Meat at Khartoum State

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Abstract

This study was conducted to evaluate the microbial aspects and chemical composition of raw beef meat collected randomly from markets located at Khartoum State (Khartoum, Khartoum north and Omdurman localities). Twenty samples for each locality were collected. Samples collected were kept in a sterilized container. Microbial examinations in terms of; Total Viable Bacterial Count (TVBC) and Salmonella were determined. In addition, chemical analysis in terms of; Protein, fat and ash content were examined. The obtained results revealed that, significant ($P < 0.05$) differences were detected among samples from the different locations with regard to protein, fat and ash contents. Samples collected had protein content ranged between 17.27% and 19.95%. Samples had fat and ash contents with an average of and respectively. Samples collected had Total Viable Bacterial Count (TVBC) ranged between 4.83 and 7.88 log₁₀cfu/g. It is worth mentioning that, samples under investigation were Salmonella free.

Keywords: Beef meat, Salmonella, Microbial examination, Khartoum State.

1. Introduction

Sudan has a huge animal resource, estimated to be more than 106 million heads 30.37 million cattle, 4.80 million camel, 40.21 million sheep and 31.32 million goats (MLFR, 2015). Red meat is recognized as a highly nutritious food being an excellent source of high quality protein, fat and rich in B complex vitamins (Lawrie, 1991). Meat being a good material for bacterial growth, its quality depends on the initial bacterial contamination. This contamination causes meat deterioration, lower quality and sometime illness may be caused by bacterial pathogens or their toxins (Jay, 2000). Bacteria are normally absent in internal tissues, other than the gastrointestinal tract, due to immunological and non-immunological defense mechanisms (Roller, 2003). The population of microorganisms that contaminate meat is influenced by intrinsic microbiota of the animals and environmental conditions (Shapon and Shapon, 1994). Contamination initially occurs when pathogenic and spoilage microorganisms are transferred from the outer surface of the carcass to internal tissues during the different slaughtering processes (Fung, 2010).

Microorganisms are also transferred through direct contact with the hide or indirectly through contact with workers hands or equipments used, and also via aerosols and dust generated from the hide during removal process (Huffman, 2002). In addition, the water used for cleaning and sanitizing floors, instruments and containers also serve as the sources of contamination (Lim, 2002).

A large variety of pathogenic microorganisms are commonly associated with carcass contamination, these include *Clostridium perfringens*, *Staphylococcus aureus*, *Salmonella* spp., *E. coli*, *Campylobacter* spp., *Listeria monocytogenes* and *Yersinia enterocolitica* (Roller, 2003). Pathogenic *E. coli* such as *E. coli* O157:H7 and *Salmonella* spp. are the most frequently associated with fresh meat (Mead et al., 1999).

Therefore, the objectives of the current study are: to assess the microbial load of raw beef meat from different markets at Khartoum State, and to determine chemical composition of raw beef meat in Khartoum State.

2. Materials and Methods

2.1 Samples collection

Raw beef meat samples were randomly collected from different markets located at Khartoum state (Khartoum, Khartoum north and Omdurman cities) and transferred

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immediately in sterilized ice container to National Food Research Center (NFRC) for microbial examination and chemical analysis.

2.2 Analytical methods

The crude protein, fat and ash content were determined according to the AOAC (2005). Microbial examination TVBC and Salmonella were determined according to Harrigan and McCance (1976).

2.3 Statistical analysis

The data collected from the different treatments were subjected to analysis of variance Duncan multiple range test was employed to separate means (Steel and Torrie, 1980). The SAS program (SAS, 2002), was used to perform the general of liner model (GLM) analysis.

3. Results and Discussion

Chemical composition of meat

The results in (Table 1), show that, there were significant ($P<0.05$) differences in protein content among the different beef meat samples. The highest protein content was 19.95% recorded for beef samples collected from Khartoum north, whereas, the lowest protein content was 16.98% recorded for the samples collected from Omdurman city. In contrast, Abdalwahab (2017) reported that, the beef sample collected from Omdurman city was higher in protein content 18.97% when compared to that collected from Khartoum north one 16.78%. These variations in protein contents could be due to the fact that, meat composition is affected by so many factors such as; breed, age, location and nutrition system (Fung, 2010). The protein content of samples collected from Khartoum locality was similar to that obtained by Basheer (2017) who reported that, the protein content of beef meat collected from Khartoum city was 17.56%. Mohammed (2013) reported that, beef sample collected from Khartoum north locality had protein content of 17.77%.

Fat content

The results of fat content of meat samples are illustrated in (Table 1). It was clear that, samples collected from Khartoum north, Omdurman and Khartoum cities had fat content of 6.20%, 5.78% and 5.20% respectively. Significant ($p<0.05$) differences in fat content among the beef samples from the different locations were observed. However, samples collected from Khartoum north city were found to have the highest mean fat content 6.20% when compared to those collected from Omdurman and Khartoum. The current results of fat content were similar to that reported by Basheer (2017) who found that, beef sample collected from Khartoum state had fat content

with an average 5.2%. It is worth mentioning that, fat content in meat is found between muscles and within muscles. It contributes to overall flavor and juiciness in meats (USDA, 2011).

Significant ($P<0.05$) differences in ash content were observed among the different beef samples. Beef samples collected from Omdurman city had recorded the highest ash content 1.97%, while, samples collected from Khartoum north city recorded the lowest ash content 1.24%. The current results were higher than that reported by Mohammed (2013) who found that, samples collected from Khartoum north had ash content of 1.10%. Abdalwahab (2017) reported that, ash content of samples collected from Khartoum state ranged between 1.46% and 1.78%. In addition, ash can contains a variety of inorganic compounds including oxides, sulphite, silicate and chlorides (Mohammed, 2013). Common salt (sodium chloride) is the major component of the ash in many processed meat products (Basheer, 2017).

Table 1: Chemical composition of beef meat

Parameters %	Khartoum	Khartoum North	Omdurman	Mean
Protein	17.27 ^b (±0.53)	19.95 ^a (±0.67)	16.86 ^c (±0.87)	18.06 ^a
Fat	5.20 ^c (±0.98)	6.20 ^b (± 0.68)	5.78 ^b (0.87)	5.72 ^b
Ash	1.24 ^c (±0.56)	1.38 ^b (.78±)	1.97 ^a (0.89)	1.49 ^c

In this table

Values are means ± SD.

Means in the same row bearing the same letters are not significantly different ($P\geq 0.05$).

Microbial aspects of raw beef meat

The results in (Table, 2) show that, significant ($P<0.05$) differences in Total Viable Bacterial Count (TVBC) were observed among beef samples collected from different locations of Khartoum state (Omdurman, Khartoum north and Khartoum). It was clear that, TVBC of beef meat ranged between 4.83 log₁₀cfu/g and 7.88 log₁₀cfu/g. Khartoum city had recorded the highest TVBC 7.88 log₁₀cfu/g, whereas, Khartoum north city had the lowest TVBC 4.83 log₁₀cfu/g. Mohammed (2013) reported that, TVBC of beef samples collected from Khartoum north had TVBC of 3.78 log₁₀cfu/g. The current results were lower than those reported by Lemia et al., (2004) who found that, TVBC at Khartoum state was TVBC 5.23 log₁₀cfu/g. The results of the present study were similar to those observed by Bogere and Baluka (2014).FAO (1992) reported that, the TVBC in beef products indicated the contamination from skin, mouth and nose of employees. Generally, all the samples under investigation were within SSMO (2008) which recommended that, TVBC should not exceed 3.39x10⁶log₁₀cfu/g. The results in (Table, 2)

showed absence of Salmonella among all samples under investigation. These results were in accordance with SSMO which recommended, meat suitable for human consumption, must be Salmonella free (SSMO, 2010). Srinivassane (2011) did not detect Salmonella in beef meat samples. On the hand, Lemia et al., (2017) reported presence of Salmonella in beef meat collected from Khartoum state. Fung (2010) stated that, presence of Salmonella in beef products is an indication that, the system for controlling contamination is not working. The presence of Salmonella indicates poor food preparation and health status (Tompkin, 1994).

Table 2: Microbial aspects of raw beef meat

Parameters	Khartoum	Khartoum North	Omdurman
TVBC (log10cfu/g)	7.88a (±0.89)	4.83c (±0.77)	5.78b (0.87)
Salmonella	NIL	NIL	NIL

Values are means ± SD.

Means in the same row bearing the same letters are not significantly different ($P \geq 0.05$).

Conclusions

This study was concluded to:

All beef samples under investigation in Khartoum state were highly contaminated. All beef samples under investigation in Khartoum State were Salmonella free. Recommend that, further research to maintain the Sudanese beef meat quality.

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