IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 6 Issue 6, June 2019
ISSN (Online) 2348 – 7968
www.ijiset.com

Microbial Characteristics of Meat Products in Khartoum State

Azza M. Khalid, Asmahan A. Ali, Samah K. Hussain, Faisal N. Awad, Ibtisam H. Elhassan, Ahmed El. Ismaiel and Eiman O. Basheer

NFRC/ National Food Research Center, Shambat, Khartoum State, Sudan.

*Corresponding author E- mail:azzamutwakil@yahoo.com

Abstract

In this study, the microbial characteristics (such as Total Viable Bacterial Count (TVBC*), Coliform bacteria, E.coli, Staphylococcus aureus*, *Clostridium perfringens* and Salmonella) of the processed meat at Khartoum state were investigated. The results revealed that the significant differences in TVBC ($P \leq 0.05$) were detected among the meat samples. Minced beef, beef sausage, beef burger, beef balls, chicken burger and beef cubes samples had TVBC of 0.58, 2.40, 3.26, 1, 3.21 and 2.40 log10cfu/g, respectively. No significant differences ($p \geq 0.05$) were observed in coliform bacteria among meat samples 140 MPN. Fifty percent of processed meat collected from Khartoum state (minced meat and meat cubes) was E. coli present. It worth nothing that, frankfurter and martadella were *E.coli* free. It worth noted that, *Staphylococcus aureus* and *Clostridium perfringens* were not detected among all processed beef sample. In contrast, Salmonella were positive test among all processed meat.

Keywords: Beef cubes, Burger, *Clostridium perfringens*, E.coli, Meat balls, Minced beef, Sausage, *Staphylococcus aureus.*

I. Introduction:

Sudan has a huge animal resource, which estimated to be more than 106 million head, 30.37 million cattle, 4.80 million camel, 40.21 million sheep and 31.32 million goats (MLFR, 2015). Beef meat is recognized as a highly nutritious food being an excellent source of high quality protein, rich in most B complex, vitamins and some types of fats. The nutritive quality attributes of meat include the nutrient content, nutrient availability and caloric value (Basheer, 2017). Meat is high in both protein quality and quantity. The 10 essential amino acids that the body cannot make are found in meat, thus making it a complete protein; meat products are excellent sources of fats, minerals, and vitamins (Eltom, 2017). Meat being a good material for bacterial growth, its quality depends on the initial bacterial contamination. This contamination causes meat deterioration, lower quality and some time illness may be caused by bacterial pathogens or their toxins (Judge et al., 1994). In live animals including cattle, microorganisms usually are present on the crotch, brisket and hind hocks region, and also in the gastrointestinal tract (Elbakheet, 2008). In contrast, bacteria are normally absent in internal tissues, other than the gastrointestinal tract, due to immunological and non-immunological defense mechanisms. The population of microorganisms that contaminate meat is influenced by intrinsic microbiota of the animals and environmental conditions (Basheer, 2017). Contamination initially occurs when pathogenic and spoilage microorganisms are transferred from the outer surface of the carcass to internal tissues during different slaughter processes (Eltom, 2017). Microorganisms are also transferred through direct contact with the hide or indirectly through contact with workers' hands or equipment used, and also through

aerosols and dust generated from the hide during removal process (Elbakheet, 2008). In addition, the water used for cleaning and sanitizing floors, instruments and containers also serve as the sources of contamination (Judge et al., 1994). 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 enterolitica (Eltom, 20017). Pathogenic E. coli such as E. coli O157:H7 and Salmonella spp. are the most frequently associated with fresh meat (Basheer, 2017). Escherichia coli O157:H7 is commonly found among the intestinal flora of cattle, which are the primary reservoir. The present of E.coli in meat products indicates fecal contamination of the meat (Judge et al., 1994). Staphylococcus aureus is one of the most frequent pathogen that causes food-borne out breaks. This microorganism is responsible for staphylococcal food poison by producing heat stable toxin (Eltom, 2017). According to Judge et al. (1994), Salmonella is commonly associated with raw or undercooked meat and egg products.

The objective of the current study was:

To evaluate the microbial aspects load of the processed meat products at Khartoum State.

2. Materials and Methods:

2.1 Samples collection:

Processed beef products in terms of Minced beef, sausage, burger, martadella, beef cubes, frankfurter, meat balls and chicken burger were collected randomly from Khartoum state and transferred immediately in sterilized ice box container to the National Food Research Center (NFRC) for microbial analysis.

2.2 Analytical methods:

Microbial analysis TVBC, E.coli, Staphylococcus aureus, Clostridium perfringens, and salmonella were determined according to Harrigan and McCance (1976).

3. Statistical analysis:

The data collected from the different treatments were subjected to analysis of variance and whenever appropriate the mean separation procedure of Duncan was employed (Steel and Torrie, 1980). The SAS program (SAS, 2002) was used to perform the general of liner model (GLM) analysis.

4. Results and Discussion:

4.2 Microbial characteristics of processed meat in Khartoum State:

4.2.1 Total Viable Bacterial Count (TVBC)

Table 1 shows there were significant ($P \leq 0.05$) differences in TVBC among the processed meat products, which were collected from Khartoum state. Minced beef, beef sausage, beef burger, beef balls, chicken burger and beef cubes samples had TVBC of 0.58, 2.40, 3.26, 1, 3.21 and 2.40$\log_{10}$cfu/g, respectively. Abdalwahab (2017) found that meat samples collected from Khartoum state had TVBC with an average of $3.7x10^4$log10cfu/g. Lower TVBC of sausage was reported by Eltoum (2017) $3.5x10^4$ log10cfu/g, whereas higher TVBC of beef burger was reported by Elsidig (2017) $4.7x10^4$ log10cfu/g. In addition, Basheer (2017) stated that TVBC is a very doubtful value in the examination of food products that reduce or damage of the bacteria, which may have taken place during freezing and cold storage. It worth noted that, TVBC of samples under investigation within SSMO (2008), which recommended that, TVBC of meat products must be not exceed $10^7\log_{10}$cfu/g.

4.2.2 *Coliform* bacteria

Table 2 illustrates there were no significant ($P \geq 0.05$) differences in coliform bacteria of minced beef and beef cubes 140MPN. The current result was lower than the results reported by Abdalwahab (2017), who found that meat samples collected from Khartoum state had coliform bacteria with an average of 148MPN.

Table1: TVBC (log_{10}cfu/g) of meat products in Khartoum state

Item	Minced beef	Beef sausage	Beef sausage	Beef Balls	Chicken burger	Beef Cubes
TVBC	0.58^{d} (±0.12)	2.40^{B} (±0.00)	3.26^{A} (±0.04)	1.00^{c} (±0.00)	3.21^{A} (±0.00)	2.40^{b} (±0.00)

Values are means ± SD.

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

Item	Minced beef	Beef sausage	Beef sausage	Beef Balls	Chicken burger	Beef Cubes
TVBC	0.58^{d} (±0.12)	2.40^{B} (±0.00)	3.26^{A} (±0.04)	1.00^{c} (±0.00)	3.21^{A} (±0.00)	2.40^{b} (±0.00)

Table 2: *Coliform* bacteria (MPN/g) of meat products in Khartoum state

Item	Minced beef	Beef sausage	Beef sausage	Beef Balls	Chicken burger	Beef Cubes
TVBC	0.58^{d} (±0.12)	2.40^{B} (±0.00)	3.26^{A} (±0.04)	1.00^{c} (±0.00)	3.21^{A} (±0.00)	2.40^{b} (±0.00)

Item	Minced beef	Beef cubes
Coliform bacteria	140	140

Values are means ± SD.

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

3.2.3 *E. coli*

As presented in Table 3, Fifty percent of processed meat products collected from Khartoum state (minced meat and meat cubes) was *E. coli* present. It worth nothing that, *frankfurter* and *martadella* were *E.coli* free. Basheer *et al.*, (2017) reported that meat samples collected from Khartoum state was *E.coli* free. *E. coli* is the best indicator of fecal contamination or state hygiene. According to Judge *et al.* (1994), the natural habitat for this organism is the

intestines of human and vertebrate animals. In addition, SSMO (2008) recommended that meat suitable for human consumption must be *E.coli* free.

Table 3*: E.coli* detection of meat products in Khartoum state

Item	Minced beef	Beef cubes	Frankfurter	Martadella
E. coli	-Ve	+Ve	-Ve	-Ve

Values are means ± SD.

Means in the same column bearing the same superscript small letters are not significantly different (P ≥ 0.05).

3.2.4 *Staphylococcus aureus*

All meat products under investigation were *Staphylococcus aureus* free (Table 4). These results accordance with Sudanese standard metrology organization (SSMO, 2008), which mentioned that meat suitable for human consumption must be *Staphylococcus* free. Also similar observation was detected by Srinivassane (2011). In contrast, Basheer (2017) and Eltom (2017) found that processed beef had *Staphylococcus aureus* ranged between 0.11 and 0.21 $\log_{10}$cfu/g. Judge *et al.*, (1994) reported that the presence of *Staphylococci* in beef products indicated the contamination from skin, mouth and nose of employees. All samples under investigation within SSMO (2008) for *Staphylococcus aureus*.

Table 4*: Staphylococcus aureus of* meat products in Khartoum state

Item	Minced beef	Beef sausage	Beef burger	Beef balls	Chicken burger	Beef Cubes	Frank	Martadella
Staphylococcus aureus	-Ve	-Ve	-Ve	-Ve	-Ve	-Ve	-Ve	-Ve

Values are means ± SD.

Means in the same column bearing the same superscript small letters are not significantly different (P ≥ 0.05).

3.2.5 *Salmonella*

As shown in Table 5, *Salmonella* was presence in all processed meat products, which were collected from Khartoum state. These results out of Sudanese standard (SSMO, 2008), which reported that meat suitable for human consumption must be *Salmonella* free (SSMO, 2008). In contrast, Srinivassane (2011) did not detect *Salmonella* in samples under investigation. Similar trend, Basheer *et al.*, (2017) and Eltoum (2017) explained that there was no detected of *Salmonella* in meat samples collected from Khartoum state. The 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 (Judge *et al.*, (1994).

Table 5*: Salmonella* of meat products in Khartoum state

Item	Minced beef	Beef sausage	Beef burger	Beef balls	Chicken burger	Beef Cubes	Frank	Martadella
Salmonella	+Ve	+Ve	+Ve	+Ve	+Ve	+Ve	+Ve	+Ve

Values are means ± SD.

Means in the same column bearing the same superscript small letters are not significantly different (P ≥ 0.05).

3.2.6 *Clostridium perfringens*

Clostridium perfringens was not detected among all processed beef samples at Khartoum state. These results consistent with Sudanese standard (SSMO, 2008), which mentioned that meat suitable for human consumption must be *Clostridium perfringens* free.

Table 6*: Clostridium perfringens* of meat products in Khartoum state

Item	Minced beef	Beef sausage	Beef burger	Beef balls	Chicken burger	Beef cubes	Frank	Martadella
Clostridium Perfringens	-Ve	-Ve	-Ve	-Ve	-Ve	-Ve	-Ve	-Ve

Values are means ± SD.

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

Where:

+Ve: Positive

-Ve: Negative

Conclusions:

This study concluded that, all investigated meat samples collected from Khartoum state had TVBC within SSMO. Furthermore, all investigated meat samples were Staphylococcus aureus and Clostridium perfringens free, as well as Salmonella present.

Acknowledgment

The authors express their sincere gratitude and thanks to the staff and technicians of the Department of Food Safety and Biotechnology, National Food Research Centre-Shambat for their assistance during the implementation of the research.

References

1. S . Abdalwahab, Quality attributes of beef meat at Khartoum state. (Master thesis , Khartoum University). Retrieved from http: //www. Khartoum University, Khartoum, Sudan, 2017 .

2. E. Basheer, Development and quality evaluation of beef frankfurter enriched with Omega-3 Unsaturated Fatty Acids. (Doctoral, thesis, Khartoum University). Retrieved from http: //www. Khartoum University, Khartoum, Sudan, 2017.

3. L . Elsidig , Quality characteristics of beef burger at Khartoum state. (Master thesis, Khartoum University). Retrieved from http: //www. Khartoum University, Khartoum, Sudan,2017.

4. M. Eltom, Assessment of Microbial Growth and Oxidative Rancidity of Beef Sausage Incorporated with Mint (*Mentha spicata*) Powder. (Master thesis, Khartoum University). Retrieved from http: //www. Khartoum University, Khartoum, Sudan,2017.

5. E, Harrigan, and M.McCance, Laboratory Methods in Microbiology. Academic Press purplish, London and New York, PP.27-3003,1976.

6. M.Judge, J. Aberle,H. Forrest, B.Hedrick, and R. Merkel. Principles of Meat Science Kendall/Hunt Publishing Co., Dubuque, IA, USA, pp 99-100,1994,.

7. MLFR. Ministry of livestock, Fishers and Rangelands. Department of information and statistics-Sudan, 2015.

8. SAS. SAS User Guide, Release 6- 03. Edition SAS. Institute Inc. Gray, NC, USA,(2002).

9. SSMO. Sudanese Standards and Metrology Organization, No, 295, 2008.

10. S.Srinivassane, Development and evaluation of Omega-3 fatty acid enrichment chicken frankfurter. (Master thesis, University of Dalhousie, Halifax, Nova Scotia). Retrieved from http: //www. Khartoum University, Khartoum, Sudan, 2011.

11, R. G. D Steel, and J. H. Torrie, Principles and procedures of statistics. MC Grow Hill, New York, USA, pp. 657-633, 1980.