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A study of total bacterial count and organoleptic examination of different types of sausages in the Sudan

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Abstract: *This study was aimed to evaluate the average bacterial load of the fresh and frozen samples of camel, beef and goat sausages. The result showed the average bacterial load of the fresh and frozen camel sausages were (3 x 10^{6-} and 2x10^{6-} CFU/gm), beef sausages were (2 x 10^{6-} and 1 x 10^{6-} CFU/gm) and goat sausages were (2x10^{6-} and 1x10^{6-} CFU/gm) respectively. In general there was considerable decrease in the bacterial count with increase in storage period. The results indicated that, meat products contamination occurred at various stage of processing. This calls for proper and good manufacturing procedure during processing of meat products. Results of organoleptic tests were shown that all samples qualified as good by the Sudanese panelists.*

Keywords: *total bacterial count, organoleptic examination, sausages*

I. Introduction

Sudan is situated in northeast of Africa, lying between latitudes 4^0 and 22^0 North and longitudes 22^o and 38^0 East. The country is traversed by the River Nile and its tributaries which have varying influences on irrigated agriculture and livestock production systems. In recent years, there has been an increased demand for convenience meat and meat products requiring minimal home preparation (Stubbs et al., 2002). Meat processing is the manufacture of meat products from meat, animal fat and certain non meat additives. The additives are used to enhance product flavor, appearance and to increase product volume. The advantage of meat processing is integration of certain animal organs and trimmings that are not usually sold in fresh meat marketing chain as valuable protein rich products. Meat is a nutritious, protein-rich food which is highly perishable and has a short shelf-life unless preserved. Shelf life and maintenance of meat quality are influenced by a number of interrelated factors including holding temperature, which can result in detrimental changes in quality attributes of meat (Olaoye, et al., 2010). Grancy, (1981) stated that meat undergoes certain superficial changes as the result of storage. The most of which are shrinkage, sweating and loss of bloom. The major chemical change is breakdown in proteins. Jay, (1996) stated that the important to keep microorganisms at low for reasons of aesthetics, public health and products shelf-life. Ray and Bhunia, (2008) and Pesavento, et al., (2010) reported that the contamination of meat is a continuing possibly from the moment of Bleeding until consumption. Judge et al., (1990) reported that the spoilage of meat was defined as the state at which meat become unfit for human consumption.

The Objectives of this study are to evaluate hygienic properties of fresh and frozen sausages processed from different types of meat as well as to evaluate the organoleptic characteristics of frozen sausages samples.

II. Materials And Methods

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

Meat samples: 21 kg of fresh deboned camel, beef and goat meat were obtained. Camel meat was purchased from ‘‘Soug Elnaga‘‘ which is a local camel market located at the west of Omdurman. The beef was obtained 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.

Fillers: The preparation methods of fillers: The following fillers were used:
1. Bread Crumbs: was used after being ground through plate of 0.5 cm diameter.
2. Sweet Potato: was cooked under pressure for 10 minutes and ground through plate of 0.5 cm diameter.

Sausages preparation: Three types of sausages were prepared using two types of fillers (bread crumbs and sweet potato). The ingredients were added equally to the treatments as shown in (Table 1). The Sausage consist of minced meat to which salt (NaCl), garlic, coriander, cinnamon, black pepper, nutmeg, fat, cold water, skim milk and filler 15% were added. The whole mixture was mixed well in a chopper after adding skimmed milk

powder to the dough. The mixture was stuffed in sheep casings using piston stuffer, then linked, placed in polythene bags, labeled and frozen at -20^{o}C to wait the following tests.

Table 1. Ingredients of the sausage recipe:

Ingredients	(%)
Fillers(bread crumbs or sweet potato)	15
Ice water	20
Salt	2
Black pepper	0.5
Coriander	0.5
Sugar	0.5
Garlic	0.3
Skimmed milk powder	0.3
Cinnamon	0.1

(All ingredients are percentage from the formulated products)

Bacteriological Assessment of sausages:

Total viable bacterial counts of fresh and refrigerated samples of camel, beef and goat sausages were done after variable periods of storage. The fifty grams obtained from sausages sample were excised from the conditioned quarters immediately and child for 24hrs. The samples were then blended with 270 ml sterile distilled water by using electric blender (Homogenizer MSE) for 3 minutes. Duplicate samples were taken. Serial dilutions were made for each sample and each dilution was plated in standard plate- count Agar. Duplicates of each sample were incubated at 37 c^{0} for 48 hours. Bacterial colony count was expressed as log 10 /10 per gm colony count.

Culture Media: Plate count agar (Difco): The medium was in form of dehydrated powder. It was composed of Bacto-tryptone-yeast extract, Dextrose and agar. It was prepared by dissolving 23 gm of medium in one liter of distilled water.

Culture method: Ten gram of each sample was taken aseptically, cut into small pieces and blended with 90 ml sterile cooled normal saline for 3–4 minutes at high speed. The homogenized suspension was allowed to stand for 10 minutes to allow the foam to subside and heavy particles to settle.

Total viable counts: Using sterile pipette 1.0 ml of the supernatant was transferred to a test tube containing 9.0 ml sterile normal solution. The contents were mixed by another sterile pipette and 1.0 ml of the mixture was transferred to a second tube until the fifth tube thus decimal serial dilutions up to 10^{-6} were prepared. Using sterile pipettes 1.0 ml of the dilutions10^{-2}, 10^{-3} ,10^{-4} and 10^{-5} was transferred into duplicate sterile Petri dishes. Fifteen to twenty milliliters of molten plate count agar cooled to 42 –45^{o}C, in a water bath, were poured into each plate containing the inoculums. Plates were then rotated from side to side and then left to dry and incubated in inverted position (Cruickshank, 1975). The dilutions 10^{-3}, 10^{-4} and 10^{-5} were used for samples stored.

Organoleptic Test of stored samples of sausage: Organoleptic examination based on: (a) off-odor (b) color and texture was done by a panel of six persons. Samples were examined visually for color change and by smelling to detect any abnormal odor based on the previous experience of the examiners with normally consumed-able meat (Banwart, 1981).

Statistical analysis: The data collected were subjected to statistical analysis using complete randomized design and subjected to ANOVA followed by Least Significant Difference test (LSD) using the SPSS analysis program (Version 17.0, 2008).

III. Results

The Bacterial count of fresh and frozen samples from camel, beef and goat sausages were presented in Tables 1.2 and figures 1, 2 and 3. Initially on first day, TBC for the samples were significantly higher ($P < 0.05$) compared to treatments on week 4. The average bacterial loads of the fresh and frozen samples of camel sausages were 3 x 10^{6-} and 2x10^{6-} respectively. The average load of the fresh and frozen samples of beef sausage was 2 x 10^{6-} and 1 x 10^{6-} respectively. Whereas, the average load of fresh and frozen samples of goat sausage was 2x10^{6-} and 1x10^{6-} respectively. In general, there was decreased in the bacterial count in sausage with increase of the freezing time. The fresh samples have the higher bacterial count compared to samples that stored at deep-freeze temperature (-18c^{o}). In general, total bacterial count (TBC) decreased for all treatments as storage time increased. The Results of organoleptic tests are given in Table 4. All samples qualified as good by the panelists according to criteria given in materials and methods.

Table 2. Mean values (± SD) of total bacterial count (TBC) of fresh and frozen samples of camel, beef & goat sausages after variable periods of storage (0-4 week) at -18 C°:

Factors		**Parameters**
Sausages type	Storage period	Sausage TBC × 10^{-5}
Camel sausages	1st day	15±2.83
	7 days	15±1.41
	15 days	5±2.83
	21 days	5±2.83
	28 days	10±1.41
Beef sausages	1st day	10±2.83
	7 days	5±1.41
	15 days	15±4.24
	21 days	0
	28 days	0
Goat sausages	1st day	10 ± 1.41
	7 days	10 ± 1.41
	15 days	0
	21 days	5 ± 0
	28 days	10±2.83
Main effect		
Sausages type		
Camel sausages	10^{a}	
Beef sausages	6^{b}	
Goat sausages	7^{b}	
Standard Error	0.67	
Level of Significant	**	
Storage time		
1st day	11.67^{a}	
7 days	10^{a}	
15 days	6.67^{b}	
21 days	3.33^{c}	
28 days	6.67^{b}	
Standard Error	0.87	
Level of Significant	**	
Meat type × Storage time		
Level of Significant	**	

NS = No significant difference between the two means. * = ($P< 0.05$)
** = ($P< 0.01$) a, b and c = Means within the same row with different superscripts differ $P < 0.05$).

Table 3. Mean values (± SD) of total bacterial count (TBC) of fresh and frozen Samples of camel, beef and goat sausage after variable periods of storage (0-4 weeks) at -18c°:

Site of collection	No. of samples	Average total count in gram (CFU/g) Sausages (TBC) in 10^{-5}				
		Fresh samples	After 7 days of storage	After two weeks of storage	After three weeks of storage	After four weeks of storage
Camel sausage	3	3 x 10^{-6}	3 x 10^{-6}	1 x 10^{-6}	1 x 10^{-6}	2x10^{-6}
Beef sausage	3	2x 10^{-6}	1x 10^{-6}	3 x 10^{-6}	1 x 10^{-6}	1x10^{-6}
Goat sausage	3	2x 10^{-6}	2x 10^{-6}	1x 10^{-6}	1x 10^{-6}	1x 10^{-6}

CFU/g =Colony forming unit per gram

Table 4. Affect of storage period on results of some organoleptic characteristics of fresh and frozen camel, beef and goat sausage samples:

Samples	State of sausage samples	Organoleptic Test			
		Off odor	Color	Texture	Judgment
Samples of camel, beef and goat sausages	Fresh	None	Red	Normal	Good
	After 7 days of freezing	None	Red	Normal	Good
	After 15 days of freezing	None	Red	Normal	Good
	After 21 days of freezing	None	Red	Normal	Good
	After 28 days of freezing	None	Red	Normal	Good

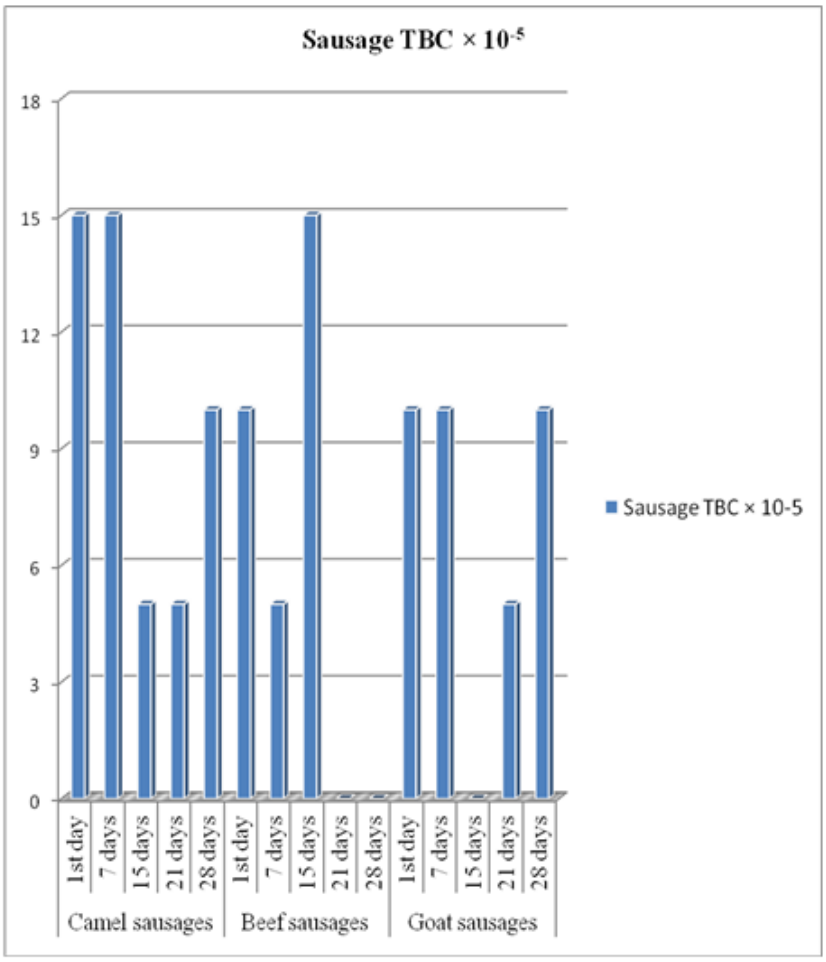

Figure 1. Total bacterial counts (CFU/gm) for different types of sausage in different storage periods:

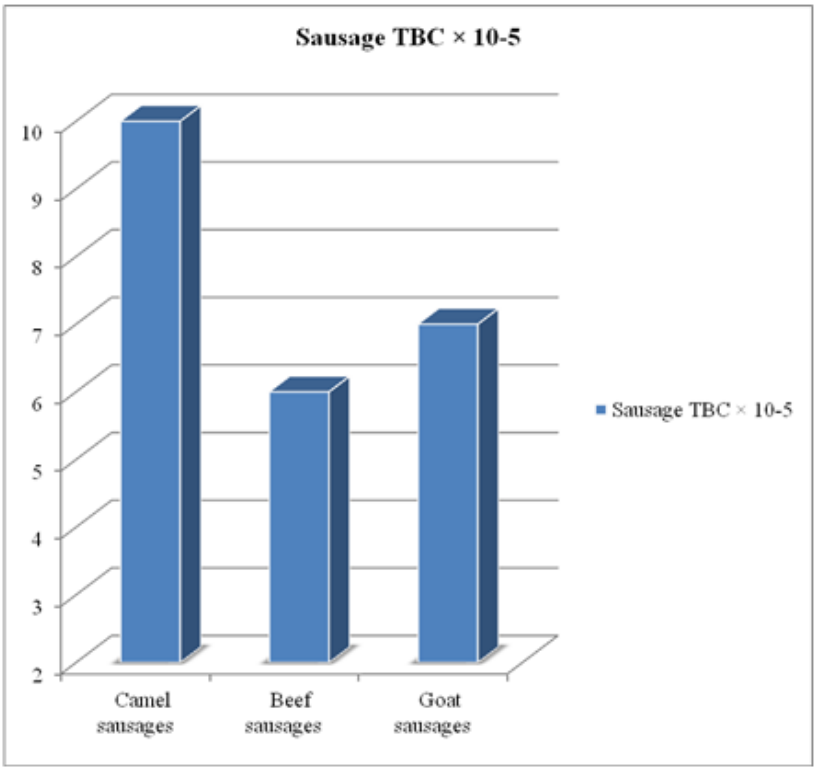

Figure 2. Total bacterial counts (CFU/ml) for different types of sausage

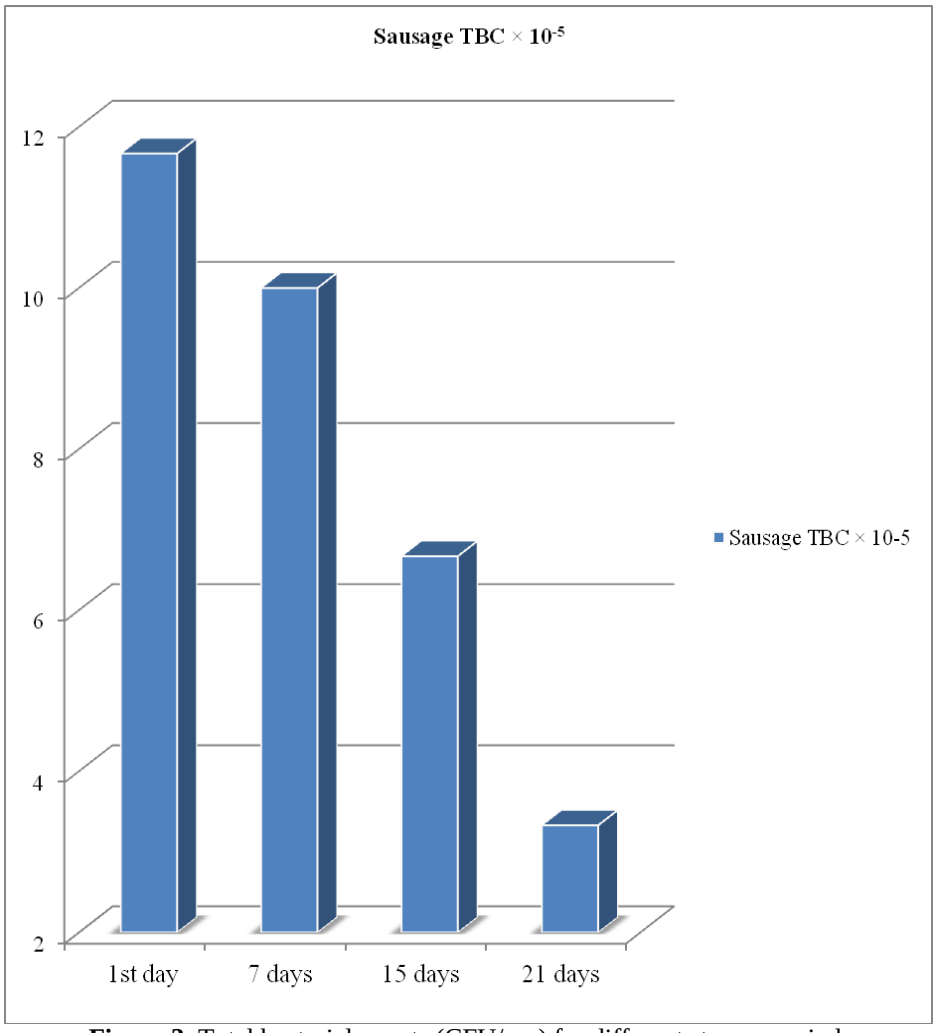

Figure 3. Total bacterial counts (CFU/gm) for different storage periods

IV. Discussion:

The present results showed that the total bacterial count decreased significantly (P<0.01) with storage period as the average bacterial load of the fresh and frozen samples of camel sausages were (3 x 10^{6-} and 2x10^{6-} CFU/gm) respectively. The average load of the fresh and frozen samples of beef sausage was (2 x 10^{6-} and 1 x 10^{6-} CFU/gm) respectively. Whereas, the average load of fresh and frozen samples of goat sausage were (2x10^{6-} and 1x10^{6-} CFU/gm) respectively. In general, there was decreased in the bacterial count in sausage with increase of the freezing time. The fresh samples have the higher bacterial count compared to samples that stored at deep-freeze temperature (-18c^{o}). This result was matching to that reported by Abass, (2009) as (3.9 x10^{-1} CFU/gm) and (3.78 x 10^{-1} CFU/gm) in zero and 7 days respectively. In general, results in this study showed that the total viable count for the fresh sausage was ranged between (2 x 10^{6-} and 3 x 10^{6-}CFU/gm), these results in line with the findings of SSMO, (2008) who reported that for fresh sausage the total aerobic plate count should not exceed than (5.25×10^{-5}CFU/gm). The present results showed that total bacterial count decreased significantly (P<0.01) with storage period, this result is matching with that reported by Abass (2009) as (3.9 ×10^{-1} CFU/gm) in the first day and (3.78 ×10^{-1}CFU/gm) in day7. The contamination comes from different sources, mainly hides, hoofs, air, water, equipments, intestinal contents and slaughtering floor as reported by Empey and Scott, (1939). Results indicated that storage at (-18°C) for four weeks significantly decreased bacterial counts. This may be due to the freezing condition. Freezing is known to injure bacterial cells and it is known to decrease the number of viable bacterial cells. Very few bacterial genera can thrive under freezing conditions Judge et al., (1989). Results of the total viable bacterial counts obtained in the present study were agreed 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 (5x10^{-6} CFU/gm).

V. Conclusion:

Bacteriological assessment were done on camel, beef and goat sausages to evaluate the level of contamination and its effect on the keeping quality of the sausages after storage at -18^{o}C for 1, 7, 15, 21 and 28 days. The average bacterial count for fresh and frozen camel sausages were (3 x 10^{6-} and 2x10^{6-} CFU/gm), of beef sausage were (2 x 10^{6-} and 1 x 10^{6-} CFU/gm) and goat sausage were (2x10^{6-} and 1x10^{6-} CFU/gm) respectively. In general there was a decrease in the bacterial load with increase in storage period.

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References:

[1]. **Abbas, M. O., (2009).** Effect of adding different levels of citric acid on quality Attributes of fresh beef sausage. M. Sc. U of K.
[2]. **Banwart, G.J. (1981).** Food spoilage. Chap. 8, p. 254-270. In: Basic Food Microbiology.
[3]. **Cruickshank, R. (1975).** Medial Microbiology, 12th end. Churchill Livingstone, Edinburgh and London.
[4]. **Empey, W.A. and Scott, W.J. (1939).** Investigation on chilled beef I. Microbial contamination acquired in the meat works. Bull. Council Sci. and Res. No. 126.
[5]. **Grancy, F.H. (1981).** Thornton's Meat Hygiene. The preservation of meat. P. 204. 7th Ed. The English Language Book Society and Bailliers Tindall, London.
[6]. **Jay, J.M. (1996).** Modern Food Microbiology, 5th ed. International Thomson publishing Hentuchv.
[7]. Judge, M. D.; Aberle, E. D.; Forrest, J. C.; Hedrick, H. B. and Merkel, R. A. (1989). Principles of Meat Science kendall/Hut publishing Company. Iowa, USA.
[8]. **Judge, M.D.; Aberle, E.; Forrest, J.; Hedrick, H. and Merkel, R. (1990).** Principles of meat Sci. (2nd end.), Kendall/Hunt, Iowa, USA.
[9]. **Olaoye, O.A. and Onilude, A.A. (2010).** World Journal of Microbiology and Biotechnology 26: 1445–1454.
[10]. **Olaoye, O.A., Onilude, A.A. and Idowu, O.A. (2010).** Food and Bioprocess Technology. 25: 15-21.
[11]. **Oregon Department of Agriculture (1973).** Oregon meat bacterial criteria. Cited by Michael, H.W. In: Attitudes and policies of state governments. J. Food Technol. (1978) 32, 63-67.
[12]. **Pesavento, G.; Ducci, B.; Nieri, D.; Comodo, N. and Lo Nostro, A., (2010).** Food Control 21: 708–713.
[13]. **Ray, B. and Bhunia, A. (2008).** Foodborne infections. In: Fundamental food microbiology, 4th edition, pp. 283–313. Boca Raton: CRC.
[14]. **Stubbs, R.I.; Morgan, J.B.; Ray, K.F. and Dolezal, H.G. (2002).** Effect of supplemental vitamin E on color and case life of top lion steaks and ground chuck patties modified atmosphere case-ready retail packaging systems. Meat Sci. 61: 1-5.
[15]. **SPSS, (2008).** Statistical Package for the social sciences. Version 17.0 SPSS Inc. Chicago.
[16]. **SSMO, (2008).** Sudanese Standards Meteorology Organization. Khartoum, Sudan.