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A Study of Total Bacterial Count of Some Types of Red Meat in Khartoum State

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ABSTRACT

This study was conducted in the College of Animal Production Science and Technology, Sudan University of Science and Technology, to evaluate the average bacterial load of fresh and frozen camel, beef and goat meat. The samples were analyzed in three different brands of these raw cuts or muscles in duplicate. The average bacterial load of the samples done as reported by (Cruickshank, 1975).This study showed no significant differences ($p > 0.05$) in the bacterial count of the three samples but there was high significant difference ($P< 0.01$) between the three samples of meat during storage period. The result showed the average bacterial load of the fresh and frozen samples for camel meat were (3.5 x 10-6 and 2.5 x 10-6 CFU/ gm). Also the result in this study showed the total bacterial count in beef samples were (2.5 x 10-5 and 1.5 x 10-5 CFU/gm) and for the samples of goat meat were (2 x 10-6 and 1.5 x 10-6 CFU/gm). In general there was considerable decrease in the bacterial count with increase in storage period. The study also showed that there was a decreased in the number of bacteria with freezing storage period.

Keywords: *camel meat. Beef. Goat meat, Total bacterial count*

INTRODUCTION

Sudan is situated in northeast of Africa, lying between latitudes 4^0 and 22^0 North and longitudes 22^0 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 as reported by (Stubbs, et. al. 2002). Jay (1996) reported that the important to keep the microorganisms at low for reasons of aesthetics, public health and the products shelf- life. Also according to the study by (FSIS, 1999)there was an increased number of reported cases of illness due to *Literia monocytogenes* which the Centers for Disease Control and Prevention as well as state and local health departments in the U. S. attributed to the consumption of cooked hot dogs and deli meats. Shehu and Adesiym (1990) reported that the *Enterotoxigenic Escherichia Coli* has been involved in food- born illness and recovered from various food types, processed or raw. Also the study of (Firstenberg and Sullivan , 1997) showed that the fact cannot be overemphasized that raw or pre – processed foods sold in supermarkets pose a direct health hazard to the consumers if they contain an infective dose of pathogens or toxic levels of their toxins. According to (Kuku , 1985), the presence of bacteria could be as a result of it being a common organism on the skin, hands and boil so the hence of their presence in the sausages may be as a result of the contamination due to handling , processing, transportation and storage. Its presence in high load or numbers is a good indication of law or poor hygiene and the control of the temperature. Also the presence of bacteria in a high load or numbers in the cured meat may indicate the presence of enterotoxin producing the strains of *s. aureus* (AS/NZS, 1999), thus the data generated are of great importance to inform public health authorities, to detect the food - borne disease outbreaks early and to implement and evaluate the food safety programmes. Ray and Bhunia , (2008) and Pesavento *et. al.*, (2020) reported that the contamination of meat is a continuing possibly from the moment of the Bleeding until the consumption. Judge *et. al.* (1990) reported that the spoilage of meat was defined as the state at which the meat become totally unfit for the

human consumption. Nercelloti, *et. al.*, (1992) reported that post – mortem factors can influence lipid oxidation and decrease shelf life of the meat products. Mona, (2000) stated that improvement in the water holding capacity, a decrease in cooking loss, shear force and increase of the total bacterial counts occurs with increasing storage time of sausage, burger and minced meat. Meat and meat products are very perishable, so deterioration begins after exsanguinations, resulting in microbial, chemical and physical changes.

The results reported by Olaoye, and Onilude, (2010) mentioned that the initial load plays a role in the determination of meat product' s shelf – life. Spoilage can be defined as any change in a food product that makes it unacceptable to the consumer from a sensory point of view.

GRAM *et. al*. (2002) reported that the microbial spoilage is by far the most common cause of spoilage and may manifest itself as visible growth (slime, colonies), as textural changes (degradation of polymers) or as off-flavors. According to Lloyd – Puryear, *et. al.* (1991) and Cocolin, *et. al* .(2004) who reported that in case of meat and meat products, microbial spoilage leads to the development of the off – flavor, oxidative rancidity, discoloration, gas production and often, slime formation. Hansen; Huss, 1998 reported that the knowledge of the specific spoilage organisms (SSOs) can ultimately be used to predict the shelf – life of a product, to aid the microbiological inspections and to design new preservation or production methods.

Due to the limitations of conventional microbiological methods, molecular methods, independent of cultivation, have become a very important tool and Denaturing Gradient Gel Electrophoresis (DGGE) is perhaps the most commonly used (Ercolini, 2004; Iacumin; Manzano; Comi, 2012).

Though concern about microbial contamination of meat and concomitant standards for microbial contamination of meat and concomitant standards for microbiological quality, can be trace to the turn of the century, as far as can be ascertained there are no microbiological standards that are presently being enforced for fresh meat. Elliott and Michener (1961) reviewed the literature relative to microbiological. Mossel, (1969) suggests that the first step in developing microbiological criteria should be a careful study of the microorganisms associated with a particular food.

The objectives of this study are:

- To evaluate the hygienic properties of fresh and frozen of different types of red meat (camel, beef and goat meat) from Sudanese local market.
- To highlight the importance of keeping meat in frozen storage.

Materials And Methods

This study was conducted at the laboratory of meat science and technology and the laboratory of the microbiology at the College of Animal Production Science and Technology, Sudan University of Science and Technology (2019).

Meat Samples

5 kg of fresh deboned meat from each three types of meat (Camel, Beef and goat meat)was purchased from the Sudanese local market.

Bacteriological Assessment of Meat Samples

Total viable bacterial counts of fresh and frozen samples of camel, beef and goat meat was done after variable periods of storage (3 weeks), meat samples were placed in icebox during transport to the laboratory and kept in a deep freezer at temperature -18 C0. Then thirty grams obtained from meat samples were excised from the conditioned quarters immediately after 3 and 5hours postmortem, after that the samples child for about 24 hours.

Then the samples were blended with 270 ml sterile distilled water by using the electric blender (Homogenizer MSE) for about three minutes. Then 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 c0 for about 48 hours. Bacterial colony for account was expressed as log 10 / 10 per gram 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 gram of medium in one liter of distilled water.

Culture method: ten gram of each sample was taken aseptically, then cut into small pieces and blended with 90 ml sterile cooled normal saline for 3 - 4 minutes at high speed.

Then the homogenized suspension was allowed to stand for 10 minutes to allow the foam to

subside and to allow the heavy particles to settle down.

Total viable counts of the three samples: using sterile pipette 1.0 ml of the supernatant was sterile pipette 1.0 ml to put 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 sixth tube thus decimal serial dilutions up to 10-6 were prepared.

Then by using sterile pipettes 1.0 ml of the dilutions10-2, 10-3, 10-4,10-5 and 10-6, was transferred into the duplicate sterile Petri Dishes. Fifteen to twenty milliliters of molten plate count agar cooled to 42 – 45 C0, in the water bath, were poured into each plate containing the inoculums.

Then the plates were rotated from side to side and then all the plates were left to dry and incubated in inverted position as reported by (Cruickshank, 1975). The dilutions 10-3, 10-4, 10-5 and 10-6were used for the samples stored.

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, Version 17.0, 2008).

RESULTS

Table (1 and 2) and Figure (1) shows the bacterial count of fresh and frozen meat samples (camel meat, beef, and goat meat) obtained from local Sudanese markets.

Initially on the first day, the total bacterial count (T. B. C.) for the meat samples were significantly higher (P< 0.05) compared to the treatments of meat samples on week tow and week three. In this study the average bacterial load of the fresh samples of camel meat were (3.5 x 106- CFU/gm) but for the Frozen samples were (2.5 x106- CFU/gm).In this study the average bacterial loads of the fresh samples of beef were (2.5 x10-5CFU/gm), and the average bacterial loads of the frozen samples of beef were (1.5 x 10-5 CFU/gm). Also the study showed the average bacterial loads of the fresh samples of goat meat were (2x10-6CFU/gm) but for the frozen samples of goat meat were (1.0 x 10-6 CFU/gm).The fresh samples showed higher bacterial count compared to the samples which stored at deep – freezer temperature at -18 C˚ . Also the statistical analysis showed high significant difference (P<0.01) between the types of meat in bacterial load. Also the storage periods revealed high significant difference (P<0.01) on total bacterial count between meat samples.

Table 1. *Mean values (±SD) of the Total Bacterial Count(TBC) of Fresh and Frozen samples of Camel, Beef and Goat meat after variable periods of storage (3 weeks) at -18 C0*

Type of meat	No. of samples	Fresh samples CFU/gm	After one week of storage CFU/gm	After two weeks of storage CFU/gm	After three weeks of storage CFU/gm
Camel meat	3	$3.5 \times 10^{6-}$	3×10^{-6}	1×10^{-6}	2.5×10^{6}
Beef	3	2.5×10^{-5}	$2x\ 10^{-5}$	3×10^{-6}	1.5×10^{-5}
Goat meat	3	2×10^{-6}	$2x\ 10^{-6}$	$1x\ 10^{-6}$	$1x10^{-6}$

CFU/gm =Colony forming unit per gram

Table 2. *Mean values (± SD) of total bacterial count (TBC) of fresh and frozen samples of camel, beef & goat meat after variable periods of storage (3 weeks) at -18C°*

Camel meat	1st day	250±53.74
	7 days	25 ±4.24
	15 days	10 ±2.83
	21 days	0
Beef	1st day	50±22.63
	7 days	15±1.41
	15 days	10±1.41
	21 days	5±1.41
Goat meat	1st day	150 ±7.07
	7 days	20 ±2.83
	15 days	10 ±1.53
	21 days	0
Main effect/ Meat type		

Camel meat	69[a]	
Beef	21[c]	
Goat meat	47[b]	
Standard Error	4.93	
Level of Significant	**	
Storage time		
1st day	165[a]	
7 days	19.33[b]	
15 days	6.67[b]	
21 days	9.33[b]	
Standard Error	5.63	
Level of Significant	**	

** = (P< 0.05) ** = (P< 0.01)*

a, b and c = Means within the same row with different superscripts differ P < 0.05).

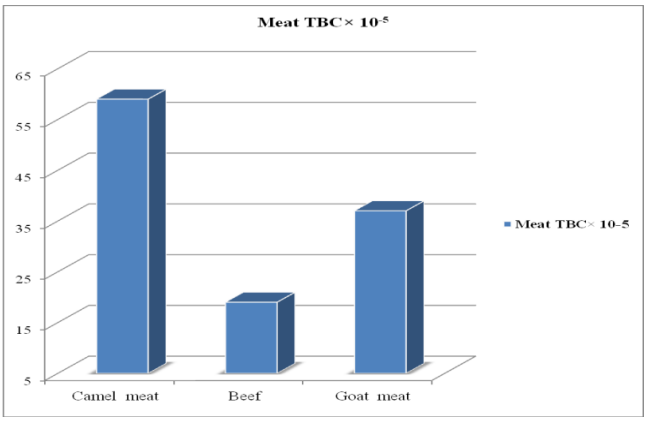

Figure1. *Total bacterial counts (CFU/gm) for different types of meat in different storage periods*

DISCUSSION

In the present results the average bacterial load of the fresh samples of camel meat were (3.5 x 10^{6-} CFU/gm) but for the Frozen samples were (2.5 x10^{6-} CFU/gm).

In this study the average bacterial loads of the fresh samples of beef were (2.5 x10^{-5} CFU/gm), and the average bacterial loads of the frozen samples of beef were (1.5 x 10^{-5} CFU/gm). Also the study showed the average bacterial loads of the fresh samples of goat meat were (2x10^{-6} CFU/gm) but for the frozen samples of goat meat were (1.0 x 10^{-6} CFU/gm).

Also the present result showed that the fresh samples had the higher bacterial count compared to samples stored at deep-freeze temperature at (-18c^{o}). 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).

Also at the end of the storage periods no organoleptic changes were detected. Also these results were similar to that stated by Rajkumar *et al.*, (2004) who reported low bacterial count in goat meat patties under freezing. This lower bacterial count with storage period may be due to lower water activity during freezing. Also the results in this study were in line with the findings of Khalifa, (2002) who reported that the effect of storage of beef on total viable count was as follows (5.75×10^{-4} CFU/gm) at first day and (4.25x10^{-4} CFU/gm) at month for beef. These results were similar to that stated by Rajkumar *et al.*, (2004) who reported low bacterial count in goat meat patties under freezing.

CONCLUSION

In general there was a decrease in the bacterial load with increase in storage period.

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