



Study on the Bacterial Contamination of Some Animal Products in Khartoum State

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ABSTRACT

This study was carried out to determine the level of contamination (Total bacterial count and the contaminants (*Salmonella* and *E. coli*) in some animal products (meat, milk and egg), that sold in four public markets in Khartoum state (Jackson, Mayo, Alftahab and Souk Seta). The assessment of total bacterial count and the contaminants (*Salmonella* and *E. coli*) of animal product samples was done in the microbiological laboratory (Kuku complex) Sudan University Science and Technology. The result of bacterial contamination revealed no significance difference between meat, milk and egg samples of different markets, hence Souk Seta meat samples reported highest bacterial count $((5.33 \pm 3.06 \text{ CFU/g}) \times 10^6)$, whereas in milk samples Alftahab market recorded the highest bacterial count $((6.00 \pm 2.00 \text{ CFU/g}) \times 10^6)$, similarly, Mayo market reported highest total bacterial count in egg, $((5.00 \pm 1.00 \text{ CFU/g}) \times 10^6)$. The bacterial contaminants results showed the presence of *Salmonella* and /or *E. coli* in meat, milk and eggs samples in the four public markets in Khartoum state.

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INTRODUCTION

Food borne diseases are increasingly recognized problem involving a wide spectrum of illnesses caused by bacterial, viral, parasitic or chemical contamination of food. Although viruses account for half of all the food borne

illnesses, most hospitalizations and deaths related to food borne infections are due to bacterial agents. Diarrheal symptoms are the commonest manifestation of food poisoning and in some cases, can lead to death. The

diseases are caused by either toxin from the “disease-causing” microbes, or by the human body’s reactions to the microbe itself (Tajkarimi, *et al.*, 2009). Infectious diseases along with food can be a source of danger, involving multiple agents, mainly bacterial (*Salmonella*, *Campylobacter*, *Verotoxin producing Escherichia coli*, *Listeria...*), but also parasitic (*Toxoplasma gondii*, *Cyclospora cayetanensis*, *Trichinella spp.*), and viral (Norovirus, hepatitis A virus), as well as non conventional communicable agents and mycotoxins (Korkeala and Lindstrom, 2009; Shahram *et al.*, 2012). An outbreak of listeriosis among hospital patients in 2004 in Wales, United Kingdom, was epidemicologically linked to the consumption of contaminated sandwiches (Meldrum and Smith, 2007; Shahram *et al.*, 2012).

The safety of food of animal origin for human consumption has become an essential part of the public health debate. Several meat processing plants have begun to utilize a program called the Hazard Analysis and Critical Control Point (HACCP) system to reduce pathogenic contamination. This program identifies the steps in the conversion of livestock to human food where the product is at risk of contamination by microorganisms (Anonymous, 2002). Ensuring the microbial safety and shelf life of food depends on minimizing the initial level of microbial contamination, preventing or limiting the rate of microbial growth, or destroying microbial populations. With many foods, these strategies have been practiced successfully for thousands of years. However, in the last decade, the incidence of food borne disease has increased in the industrialized world (Mcmeekin *et al.*, 1997), despite the

introduction of the Hazard Analysis and Critical Control Points (HACCP) concept and the promulgation of regulations in food safety. The increased incidence of food borne disease is caused by changes in agricultural and food processing practices, increasing international trade in food, and social changes (which include changed eating habits and increased population mobility) (Mcmeekin, *et al.*, 1997). The shop keepers sell most of the meat in the open market and even on road side. The contaminated food and water are sources of health hazard in human body (Syed *et al.*, 2003).

Food Safety Inspection Service (FSIS) as one of the most common prevention of food-borne diseases associated with meat and poultry products. *Yersinia enterocolitica* is a salt-tolerant, psychrotrophic rod that is widely distributed in nature, in aquatic and animal reservoir as human pathogenic strains (Hillers *et al.*, 2003 and Oluwafemi and Simisaye, 2006).

Eggs can be contaminated by *Salmonella enteritidis* on the outer shell or inside the egg. Passage of the egg through the contaminated cloaca or contamination with environmentally present *Salmonella* bacteria can cause outer shell contamination. Internal egg contamination can be caused by shell penetration through cracks (horizontal transmission) (Messens *et al.*, 2005; De Reu *et al.*, 2006 and Van, 2011). The term of food poisoning in its widest sense, includes bacterial food poisoning, chemical contamination of food, plant toxin contamination of food, food allergies and food-borne viruses. Almost any agent capable of causing infection can be transmitted by being a contaminant in food (Gracey and Brownlie 1986). Harakeh *et al.* (2005)

reported the isolation of Salmonella and Ecoli isolates from meat-based fast food in Lebanon.

E. coli is easily killed by heating so cooking food properly is a basic method of control. Water can also be a source of the *E. coli* (Hema, 2010).

The Objectives of the study to determine bacterial contamination of beef meat, cow milk and poultry egg using total bacterial count and isolation , identification of their contaminants.

MATERIALS AND METHODS

Collection of Samples: The samples of this study were collected from four open market at public transport stations in Khartoum state (Jackson, Mayo, Alftahab and Souk Seta). twelve samples of beef meat , milk and chicken eggs were taken and labeled for further determination of bacterial assessment, the assessment of total bacterial count and the contaminants of animal product samples was done in the microbiological laboratory(Kuku complex) Sudan University of Science and Technology.

Total Bacterial Count:-

One gram of fresh beef meat, one ml of cow milk and one ml of fresh chicken eggs samples, were homogenized in nine ml of sterile distilled water for 1.5 minute. Ten fold dilutions of homogenate were prepared in 0.5 % peptone water. One ml of suitable dilutions was mixed with 10 ml sterile plate count agar and the plates were incubated at 37°C for 48 hours . After incubation, plates containing colonies were counted from which the number of viable cells per one (gram or ml) of samples were calculated (CFU/g colony forming unit /g for beef meat and unit/ml for milk and egg), Baker and Breach (1980).

Salmonella and Escherichia coli Identification: For selective

enumeration of bacteria, selective plating media was used .MacConkey agar media was used for *salmonella* and *Escherichia coli*. After 48 hours incubation at 37°C, typical colonies of *Escherichia coli* appeared pink color. Were isolated sub-cultured on MacConkey, DCA and blood agar, the salmonella colonies appeared black color in DCA(Deoxycholate citrate agar). Typical colonies were selected for further identification according to Cowan and Steel (1993).

Statistical Analysis: Data collected were presented as mean \pm standard deviation and were analyzed using SPSS (Version 17.0) (2008) computer software program as one way analysis of variance (ANOVA) ($p < 0.05$).

RESULTS

Table (1) showed the mean values of total bacterial count of beef meat. There were no significant differences between the different markets values. However Souk Seta market recorded the highest bacterial count ($(5.33 \pm 1.15) \times 10^6$).

Whereas the values of bacterial count in fresh cow milk samples was high. in Alftahab market had a highest bacterial count per ml of milk ($(6.00 \pm 2.00) \times 10^6$) than other markets samples, hence the statistical analysis showed no significance difference between the markets(table 1).

Table (1) showed the mean values of total bacterial count of chicken egg samples. There was no significant difference between the different open markets. However the total bacterial count per ml of chicken eggs in Mayo open market had the highest total bacterial count ($(5.00 \pm 1.00) \times 10^6$).

Bacterial contaminants of meat, milk and egg samples: Table (2) Showed

that, all samples of beef meat from different open markets had positive *E. coli*. Whereas salmonella was found only in Mayo market samples. Also Samples of cow milk from different open markets had positive *E. coli*, whereas salmonella was found in Mayo and Alftahab markets.

As shown in table (2). Samples of chicken eggs from different open markets were contaminated with *E. coli*, except Jackson market. Salmonella was found in Jackson, Alftahab and Souk Seta market but absent in Mayo market.

Table 1: Total bacterial count of fresh beef meat, cow milk and chicken egg samples (Bacterial count×10⁶):

Collection sites		Meat(TBC/g)	milk(TBC/ml)	Egg(TBC/ml)
Jackson Open Market	Open	2.07 ± 1.72	4.80 ± 1.06	2.53 ± 1.29
Mayo Open Market	Open	3.33 ± 1.15	5.33 ± 3.06	5.00 ± 1.00
Alftahab Open Market	Open	4.20 ± 3.70	6.00 ± 2.00	3.83 ± 2.88
Souk Seta Open Market	Open	5.33 ± 3.06	3.66 ± 2.52	4.00 ± 3.46
Significant		NS	NS	NS

TBC: Total Bacterial Count.

NS: No significant difference

Table 2: Bacterial contaminants in beef meat, cow milk and chicken egg samples

Collection Sites	Meat Samples		Milk Samples		Egg Samples	
	<i>E. coli</i>	<i>Salmonella</i>	<i>E. coli</i>	<i>Salmonella</i>	<i>E. coli</i>	<i>Salmonella</i>
Jackson Open Market	+ve	-ve	+ve	-ve	-ve	+ve
Mayo Open Market	+ve	+ve	+ve	+ve	+ve	-ve
Alftahab Open Market	+ve	-ve	+ve	+ve	+ve	+ve
Souk Seta Open Market	+ve	-ve	+ve	-ve	+ve	+ve
Significant	NS	NS	NS	NS	NS	NS

NS: No significant difference

DISCUSSION

The high total viable counts recorded in this study showed the microbial diversity in these Markets, condition of the market and the hygienic practice employed by animal product sellers. This determined the variation of bacterial contamination; the shop keepers sold most of the meat in the open market and even on road side. The contaminated food and water are sources of health hazard in human body as reported by Syed *et al.*, (2003). Regarding all samples of (meat, milk and egg) in different open markets

showed positive *E. coli*, expect of Jackson market. In spite the presence of *Salmonella* and *E. coli* isolates in meat-based fast food in Lebanon as reported by Harakeh *et al.* (2005), many strains of *E. coli* are harmless and are found naturally in the gut of human and animals can contaminate meat and milk Hema, (2010). The egg samples of Jackson, showed positive salmonella, with absence in meat and milk samples. This findings matches with the report of Van, *et al.*, (2011), who stated that

many *Salmonella* are found in laying hen eggs . In contrast with Jackson samples, this study showed positive *Salmonella* in meat and milk samples in mayo market with absence in egg samples. However, many other foods have been implicated in outbreaks caused by *Salmonella* (mayonnaise, salads, milk, orange juice, sprouted seeds and dairy products), Hema, (2010). *Salmonella* is widely dispersed with human and animals, as the primary hosts Graber, (1991). In Alftahab Open Market positive *Salmonella* in milk and egg samples with absence of *Salmonella* in meat samples. Hence in Souk seta positive *Salmonella* in egg samples were reported, which is similar to the finding of Van *et al.*, (2011).

CONCLUSION

The results of this study revealed that the animal products were contaminated with *Salmonella* and /or *E. coli* in meat, milk and egg samples in the four public markets in Khartoum state.

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