International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 1 Jan - Feb 2025, pp: 708-720 www.ijprajournal.com ISSN: 2456-4494

Evaluation of Ready-Made Food Sold at City local Market

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Date of Submission: 20-01-2025 Date of Acceptance: 30-01-2025

ABSTRACT

Background: Food conveys various microorganisms that cause diseases and food poisoning in humans. Low numbers of initial microbial contamination could result in rapid growth of spoilage or pathogenic organisms. Food-borne diseases are rapidly spreading and transmitting causing outbreaks. The amount of foodborne illnesses increases every year.

In Sudan the diarrhoeal disease was the second major diseases during the years from 2003 to 2007 as reported in an annual health statistical report of the Federal Ministry of Health, Sudan.

Methodology:This study was conducted at KRT Locality. A total of one hundred 45 different food samples (Milk and Milk Products, Egg, Red and white meat and their products) were collected randomly. Most Probable Number as traditional method and E. coli, Salmonella Typhiand Shigelladysentery, incidence were done to evaluate the safety of the food samples.

Results: Total coliform bacteria were detected in 53% of total food samples (30%at the level Unsatisfactory and Cautionary 23%). The highest presences of coliform were in red and white meat. While the lowest total coliformwere encountered in eggs and milk samples. E. coli was found in 9.2% of the samples, while Salmonella Typhi found in 3.9% and no presence of Shigella dysentery. The personal hygiene procedures, safety management during the food process, Hazard Analysis Critical Control Points (HACCPs) system and Good Manufacturing Practice (GMP) are the main important roles to prevent food contamination.

Key words:Readymade food, Local market, Coliform.

I. INTRODUCTION

Food supplies the body with nutrients, but at the same time it conveys a lot of microorganisms that cause diseases and food poisoning. Food is usually contaminated via soil, water, sewage, and air, or contaminated during harvesting of raw materials, storage, transport, handling and processing (Lindaset. al., 1978; Fellows, 1995 and Okolieet. al., 2012).

Foodborne illness is a major international public health problem and there are several outbreaks of foodborne diseases that have been documented everywhere. Foodbornediseases seriously affect children, pregnant women, and the elderly besides (WHO, 2010).

FAO and WHO (2006) stated that up to be one-third of the population of developed countries may be affected by food-borne diseases each year, and the figures are more than that in developing countries. Many outbreaks of foodborne diseases are due to poor investigation of early- warning cases (WHO, 2008).

There are several microbiology protocols used in the detection of foodborne pathogens. One of these important groups' pathogens is Enterobacteriaceae (The Centres for Disease Control and Prevention CDC, 2004).

II. OBJECTIVE:

To evaluate the safety of food to the consumer through determining the bacterial load, Coliform bacteria and E- coli presence comparing with the standard.

III. MATERIALS AND METHODS

3.1 Study area

This study was conducted at Khartoum State, Locality of Khartoum in the period from January 2014 to December 2015.

3.2 Inspection of Food Samples from the Market

A total of one hunfredfourty five different food samples (table 1) were collected from Khartoum locality randomly

Food samples were placed in a sterile plastic bag , labelled and transported to the

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laboratory in portable cooler at 4℃ C. Samples were investigated directly in the laboratory.

Table (1) Type of food sample

Type of food	Cooked	Uncooked	Total
Vegetable	0	25	25
Milk and Milk Products	20	10	30
Red meat and their products	25	10	35
White meat and their products	25	10	35
Egg	15	5	20
Total	**85**	**60**	**145**

3.3 Most Probable Number (MPN)

MPN means a statistical estimate of the number of bacteria per unit volume and is determined from the number of positive results in a series of fermentation tubes.

Twenty-five grams of the sample were placed into a stomacher bag with 225 ml of buffer peptone water and blended for 2 min at 230 rpm using a Stomacher (Stomacher 400, Seward, and Norfolk, UK). From the homogenized samples sufficient diluents were made.

A series of nine sets of MacConkey's broth medium containing Durham's tubes were divided into three parts and each was inoculated with 10ml, 1ml and 0.1ml of aliquot sample, then incubated at 37ºC for 48h. Productions of gas and turbidity bubbles were observed after incubation. The number of organisms in the original culture was estimated from an MPN Determination Chart to determine the MPN index per gram (Benson 2002).

3.4 Confirmatory Test

From each positive gassing tube, a loopful of suspension was transferred to a tube of Brilliant Green LB broth, incubated at 35°C for 48 ± 2 h and examined for gas production. Calculation of most probable number (MPN) was done (Benson 2002; Akir, 2002).

IV. RESULTS

4.1 Most Probable Number (MPN) of Coliform bacteria

Coliform bacteria are widely described as an indicator organism for potentially harmful microbial hazards; their presence in food means increased risk of the presence of pathogens (Moore and Griyth, 2002).

According to the results of this study coliform count was detected in different proportions in food samples as shown in table (2).

The highest unsatisfactory concentration of coliform bacteria was found in red meat and their products followed by white meat and their products, while egg and milk samples were less contaminated than other types of food in both cooked and uncooked food samples (Table 2 and figure 3).

In figure (2) the safe and hygienic food samples (satisfactory) were approximately only half of the samples (47%).

Table (2): Comparison of MPN of coliform bacteria in different types of food

Type of food	Cooked			Uncooked		
	Satisfactory	Cautionary	Unsatisfactory	Satisfactory	Cautionary	Unsatisfactory
Vegetable	0	0	0	6	9	10
Milk and Milk Product	13	4	3	6	4	0
Red meat and their product	10	6	9	2	0	8
White meat and their product	13	6	6	2	1	7
Egg	11	4	0	5	0	0
Total	47	20	18	21	14	25

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Key:
Satisfactory <100 - Cautionary < 1,000 - Unsatisfactory ≥ 1,000
(According to British Columbia Centre for Disease Control - BCCDC, 2011; and Wong, 2011).

Table (3): Comparison of MPN coliform bacteria (%) between cooked and uncooked food in different types of food

Type of food	Cooked			Uncooked		
	Satisfactory	Cautionary	Unsatisfactory	Satisfactory	Cautionary	Unsatisfactory
Vegetable	0	0	0	24	36	40
Milk and Milk Product	65	20	15	60	40	0
Red meat and their product	40	24	36	20	0	80
White meat and their product	52	24	24	20	10	70
Egg	73.3	26.7	0	100	0	0
Total	55.3	23.5	21.2	35	23.3	41.7

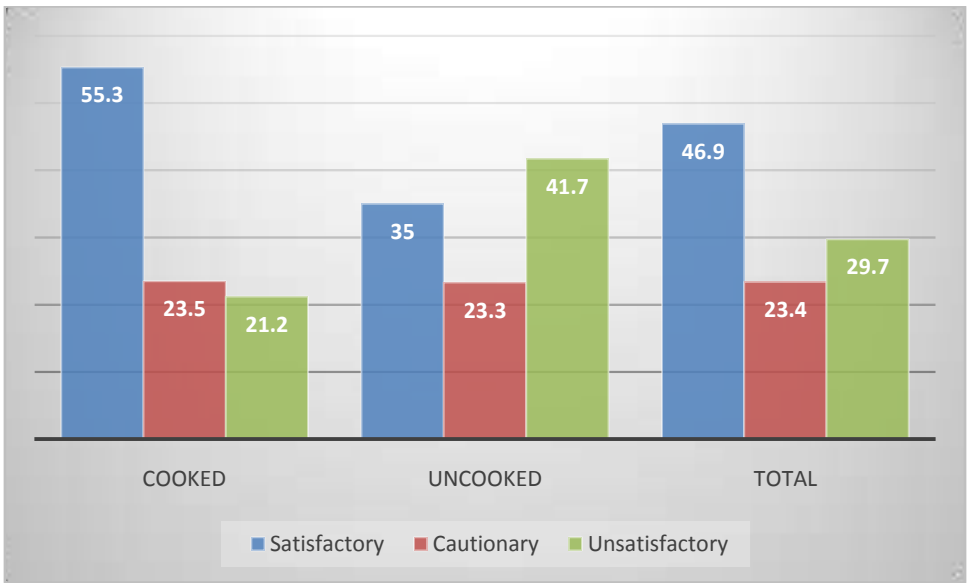

Figure 2: Percentages of Total coliform bacteria for (cooked and uncooked and total food) of food samples

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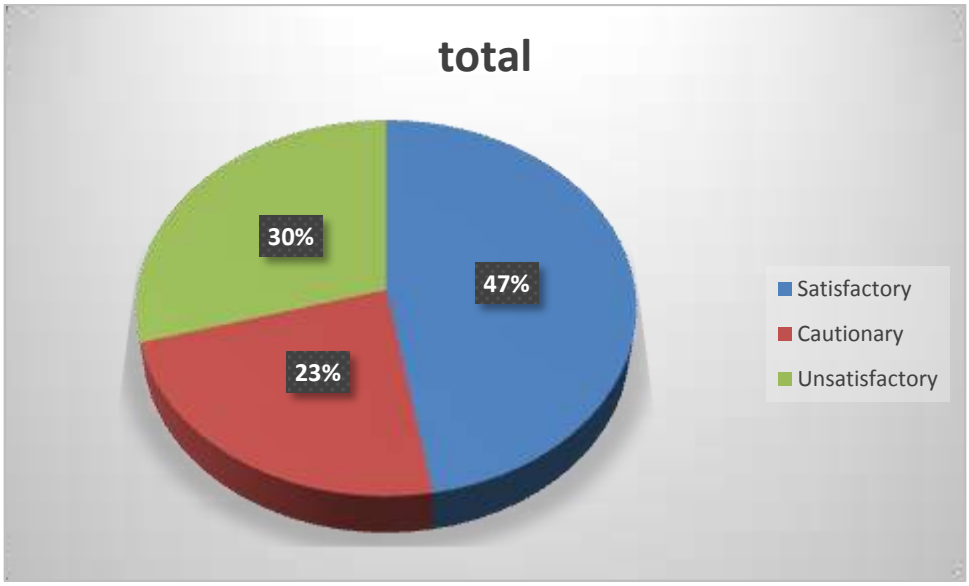

Figure 3: Percentages of Total coliform bacteria for total of food samples

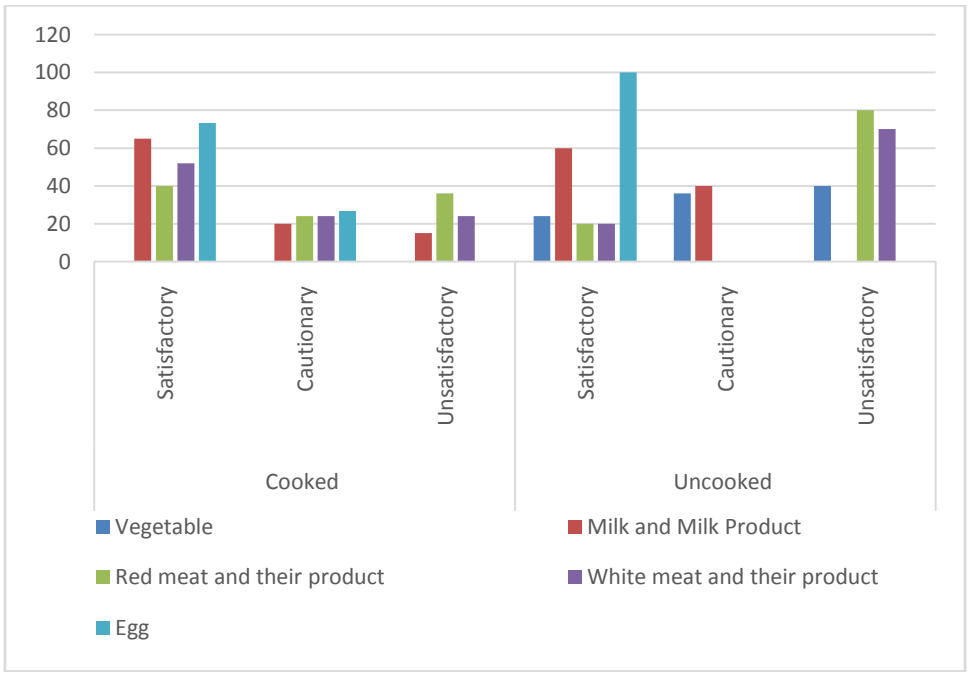

Figure (4) Total coliform bacteria from different types of food samples

The comparison between cooked and uncooked food (tables 1, 2 and figures 3 , 4), shows unsatisfactory coliform levels in uncooked food more than in cooked food, especially in white and red meat and their products. The same MPN result for total samples was shown in figure (2, 3 and 4).

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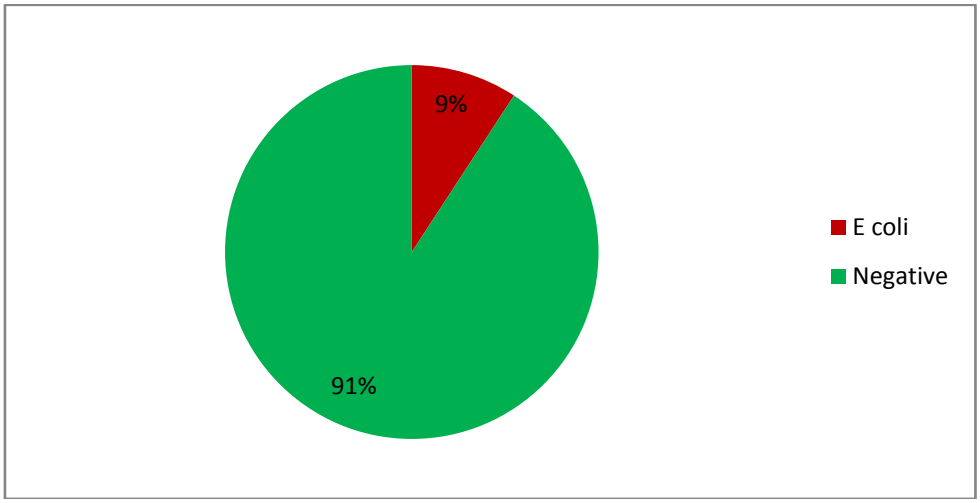

Figure (11) :E. colibacteria from total food samples

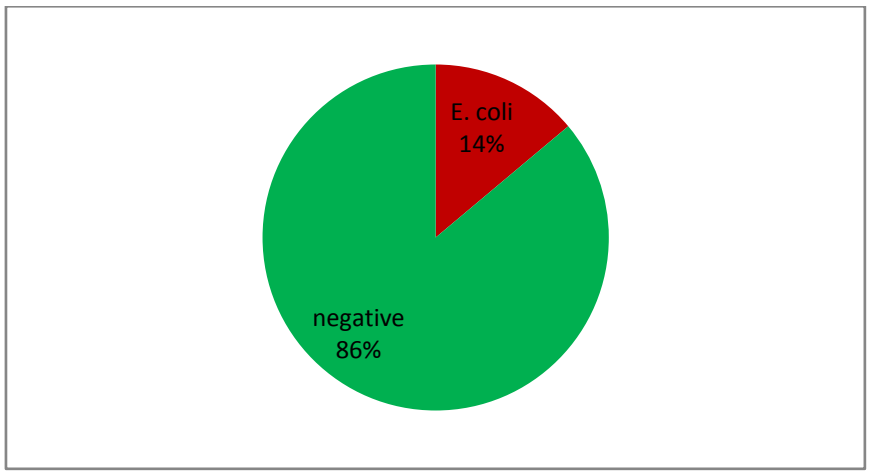

Figure (12) :E. colibacteria from cooked food samples

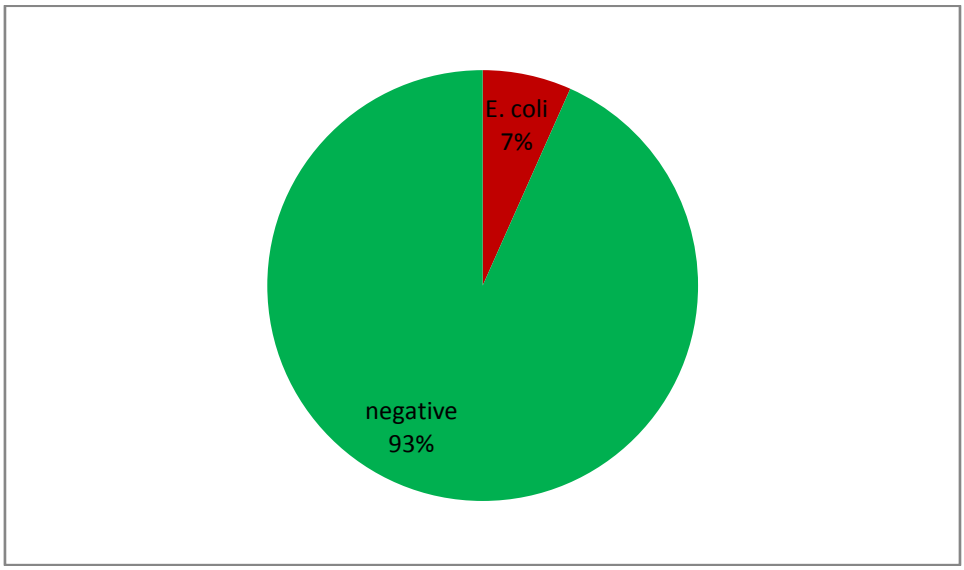

Figure (13) :E. colibacteria from uncooked food samples

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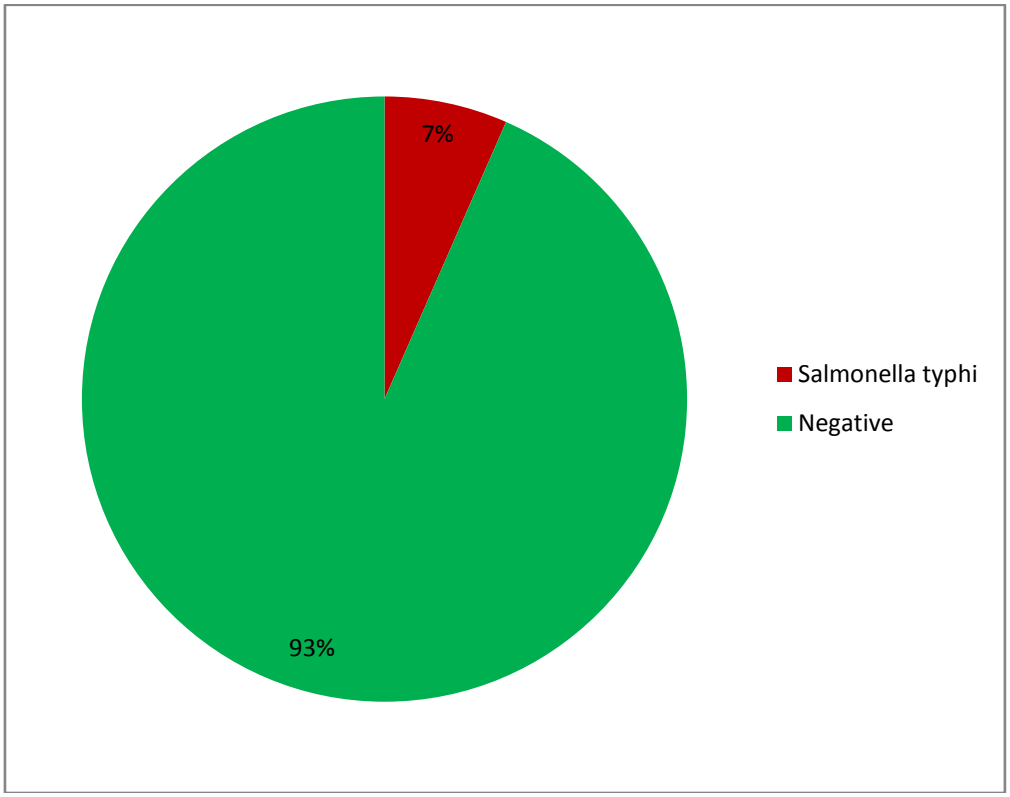

Figure (16) :Salmonella Typhibacteria from total food samples

In all food samples analyzed for bacterial contaminants; the (E. coli, Salmonella Typhi and Shigella dysentery) bacterial species were not found in egg samples. 57.1% of positive E. coli results were detected in red meat, equal positive Salmonella Typhi results were obtained from PCR analysis of white and red meat (50%), table (12).

Eggs and milk were less contaminated than white and red meat, no presence of Shigella dysentery was detected in these food samples(figure 18).

From total Escherichia coli positive samples, 71.4%were identified in cooked food. Salmonella Typhi positive results were divided equally among cooked and uncooked samples table (13) and figure (19).

All positive result samples were detectable effectively without incubation period (table 14).

Table (3): Sorting of (cooked / uncooked) food samples that gave a positive PCR result

Bacteria	Total +ve	Cooked food		Uncooked food	
		+ve	%	+ve	%
Escherichia coli	7	5	71.4	2	28.6
Salmonella Typhi	4	2	50	2	50
Shigella dysentery	0	0	0	0	0

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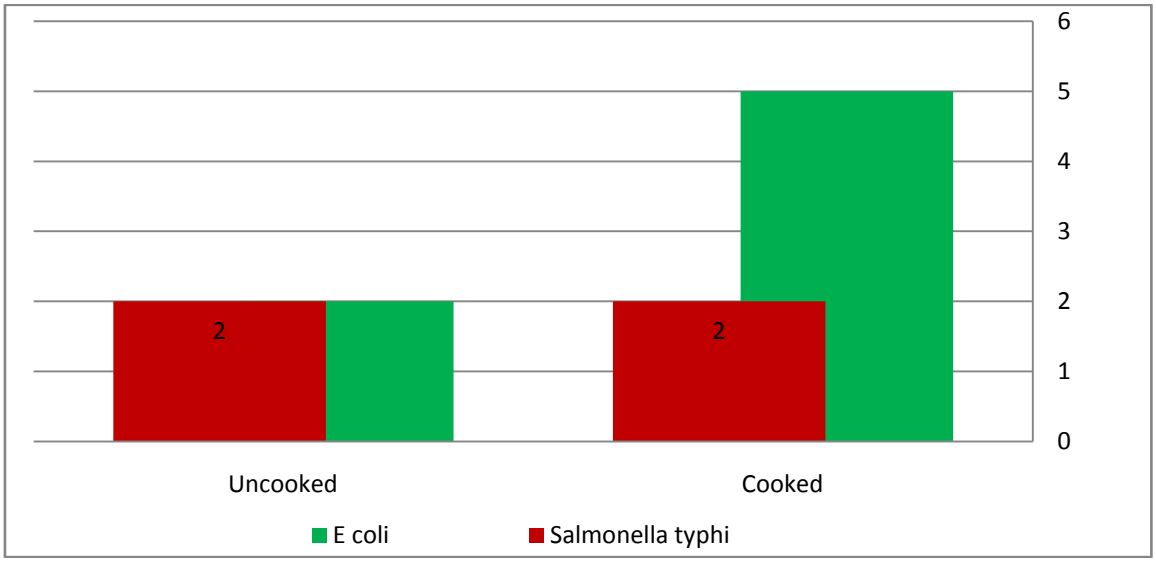

Figure (19): Presence of three bacteria in cooked and uncooked food samples

V. DISCUSSION

Coliform bacteria are used as indicator organisms. In this study coliform bacteria were found at levels that are cautionary and unsatisfactory in 53% of the samples (≥1000/g), this was closely identical to a study done by Charles et. al. (2011), they found coliform bacteria in 51% of the samples. In the present study coliform bacteria were encountered in various types of food similar to results obtained by Odu and Akano (2012) who analyzed the microbial quality of shawarma purchased in Port Harcourtcity, Nigeria and found the total coliform count ranged from $1.9x10^3$ to $9.4x10^5$.

In this study the highest concentrations of coliform were detected in red and white meat. This confirms the high probability of the presence of foodborne bacteria in red or white meat. The contamination may be from personal activities, the meat itself, during slaughtering process or manufacturing, working tables or displays for sale.

Eggs samples analyzed showed the lowest total coliform bacteria (there was no unsatisfactory level detected), this may be due to the nature of egg which have a good protection by their intrinsic parameters that minimize the entry of microorganisms. These intrinsic parameters include the outer waxy shell membrane, lysozyme in egg white, avidin which forms a complex with biotin making this vitamin unavailable to microorganisms, conalbumin which forms a complex with iron making it unavailable to microorganisms and a high pH (about 9.3) of egg white (James, 2000).

Unlike previous studies carried in Sudan, milk samples showed a low level of total coliform bacteria. This might be because the milk samples contain inhibitory substances such as residues of antibiotics used in animal treatment or for preservation purposes. If so, it has health hazards. The use of antibiotic in food leads to increase the number of antibiotic resistant microorganisms which is not responding to traditional antibiotic treatment. Also cause a mutation and plasmid in microorganism which may harm the human and animal (Farzana et. al, 2004; Ray, 2005; Ashraf and Shah, 2011).

The presence of total coliforms bacteria in the samples is considered a hazardous result not only their amounts in food as mentioned before by the Connecticut Department of Public Health – CDPH (2010).

In the present study coliform was detected in uncooked foods more than cooked foods especially in white and red meat and their product. This is obvious as heat treatment destruct all coliform bacteria. Any coliform bacteria occur after heat treatment is definitely referred to cross contamination by handlers, utensils, water and/or insects.

In this study, the presence of E. coli, Salmonella TyphiandShigelladysentery by PCR were detected in samples which had coliform more than Cautionary. E. coli was found in 6 out of 7 at the level of Cautionary and Unsatisfactory. All Salmonella Typhiwere at the unsatisfactory level. It indicates that total coliform is a good indicator for pathogenic bacteria.

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VI. CONCLUSION

This study investigated a total coliform count as traditional method to evaluate the safety of ready to eat food.

Coliform as an indicator organism were found at the level Cautionary and Unsatisfactory in 51% of the samples in the different type food. Their presence was varying from type to type of food. The highest presences of coliform were in red meat and white meat. While the hygienic food samples were eggs which have the lowest total coliform bacteria, this may be due to the nature of the egg.

Milk was also having lower total coliform bacteria and this might be due to addition of antibiotics during milk production.

Coliform was detected in uncooked foods more than cooked foods especially in white and red meat and their product.

E. coli was found in 9.2% of the samples, while Salmonella Typhi found in 3.9% and no presence of Shigella dysentery.

E. coli was identified 71.4% in cooked food from total positive samples (6). Salmonella Typhi divided (50%) in cooked and (50%) in uncooked positive samples. Cooked food was more contamination especially with E. coli. That means the contamination or cross contamination was coming to food due to food handlers, utensils or unsafety ways of food preparations.

The presence of E. coli, Salmonella TyphiandShigelladysentery was detected in samples which had coliform more than 1110/ gram.

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