

Original Research Article

# Prevalence of *Salmonella* species in raw egg based salad (mayonnaise) from fast food restaurants in Khartoum state 2016

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Abstract

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Microbial pathogen of genus *Salmonella* are among the leading causes of food borne illness globally. Between 696,000 and 3,840,000 cases of food born Salmonellosis occur each year causing mild to acute gastrointestinal symptoms, such as abdominal pain frequent diarrhea, vomiting, fever and chills. Salmonellosis can be acquired through consumption of infected raw eggs based salad mayonnaise. This study conducted to determine the prevalence of *Salmonella* species in raw egg based salad (mayonnaise) from fast food restaurants in Khartoum state. A descriptive cross-sectional study was conducted at University of Medical Sciences and Technology, Department of Microbiology. A total number of 113 samples of salad mayonnaise was collected from fast food restaurants in Khartoum state and processed for the presence of *Salmonella* spp. using conventional culture method and serological test. Out of 113 samples from salad mayonnaise collected, 71.4% *Escherichia coli* and 28.6% *Salmonella Typhimurium* isolated and identified. Presence of *Salmonella Typhimurium* in raw egg based salad (mayonnaise) from fast food restaurants in Khartoum state.

**Keywords:** Prevalence, *Salmonella Typhimurium*, Raw egg, Mayonnaise, Fast food restaurants, Khartoum

## INTRODUCTION

Microbial pathogen of genus *Salmonella* are among the leading causes of food borne illness globally. Between 696,000 and 3,840,000 cases of food born Salmonellosis occur each year causing mild to acute gastrointestinal symptoms, such as abdominal pain frequent diarrhea, vomiting, fever and chills (McGhie et al., 2009). Foodborne illness (also foodborne disease referred to as food poisoning) is any illness resulting from the food spoilage of contaminated food, pathogenic bacteria, viruses, or parasites that contaminate food, as well as chemical or natural toxins such as poisonous mushrooms (Foodborne Illness, 2010).

Symptoms vary depending on the cause; a few broad generalizations can be made the incubation period

ranges from hours to days, depending on the cause and on how much was consumed (Foodborne Illness, 2010). The incubation period tends to cause sufferers to not associate the symptoms with the item consumed, and so to cause sufferers to attribute the symptoms to gastroenteritis (Foodborne Illness, 2010). Symptoms often include vomiting, fever, and aches, and may include diarrhea. Bouts of vomiting can be repeated with an extended delay in between, because even if infected food was eliminated from the stomach in the first bout, microbes can pass through the stomach into the intestine via cells lining the intestinal walls and begin to multiply (Foodborne Illness, 2010). Some types of microbes stay in the intestine, some produce a toxin that is absorbed

**Table 1.** Show the distribution of area their collected samples were from total of 113 samples, 94 samples collected from Khartoum, 8 samples collected from Bahri and 11 sample collected from Omdurman:

	Frequency	Percent %
Khartoum	94	83.2
Bahri	8	7.1
Omdurman	11	9.7
Total	113	100

into the bloodstream, and some can directly invade deeper body tissues (Foodborne Illness, 2010).

### Mode of transmission

Foodborne illness usually arises from improper handling, preparation, or food storage (Foodborne Illness, 2010). Good hygiene practices before, during, and after food preparation can reduce the chances of contracting an illness (Foodborne Illness, 2010). There is a consensus in the public health community that regular hand washing is one of the most effective defenses against the spread of foodborne illness (Foodborne Illness, 2010). The action of monitoring food to ensure that it will not cause foodborne illness is known as food safety (Foodborne Illness, 2010). Foodborne disease can also be caused by a large variety of toxins that affect the environment<sup>(2)</sup>. Foodborne illness can also be caused by pesticides or medicines in food and naturally toxic substances such as poisonous mushrooms or reef fish (Foodborne Illness, 2010).

### Most common bacterial foodborne pathogens

*Campylobacter jejuni*, *Clostridium perfringens*, *Salmonella spp.* its *S. Typhimurium* infection is caused by consumption of eggs or poultry that are not adequately cooked or by other interactive human animal pathogens, *Escherichia coli* O157:H7 enterohemorrhagic (EHEC) which can cause hemolytic uremic syndrome (Foodborne Illness, 2013; Tribe et al., 2002; Salmonella Infection (Salmonellosis) and Animals, 2007).

## MATERIALS AND METHODS

A descriptive cross-sectional study which had been conducted during period from October to February 2016. A total of 113 Salad mayonnaise samples were collected from fast food restaurants in Khartoum state in clean, sterile universal bottle container, immediately transferred to microbiology department laboratory at

University of Medical Sciences and Technology for process (Collee et al., 2007).

50g Salad mayonnaise sample were homogenized in 100 ml 0.1% sterile peptone water, then culture on Deoxycholate Citrate Agar and incubate the plate at 37°C, then examine for *Salmonella* colonies after 24 hours (Collee et al., 2007).

### Serology for Identification of *Salmonella* species

Sub cultured tested organism in nutrient agar slope and incubated at 37°C for 24 hours, after incubation added sterile normal saline for suspension and mixed carefully. In clean slide put one drop from prepared sera and one drop from polyvalent and monovalent antibodies (O, H) for *Salmonella* species (Collee et al., 2007).

### Control Organisms

Standard strains of *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853), and *Staphylococcus aureus* (ATCC 29213), were obtained from Department of Microbiology, from Central Lab in Sudan.

#American Type Culture Collection (ATCC) Rockville, Maryland, USA.

### Data analysis

Statistical analysis data was tabulated and analyzed using the version 21-Statistical Package for Social Sciences (SPSS) software was presented as frequencies

## RESULT

Out of 113 samples from salad mayonnaise collected, 71.4% *Escherichia coli* and 28.6% *Salmonella Typhimurium* isolated and identified.

**Table 2.** Show the Culturing Result where from total of 113 samples, 7 Growth and 106 No Growth:

	Frequency	Percent %
Growth	7	6.2
No Growth	106	93.8
Total	113	100

**Table 3.** Show the Type of bacterial isolated from total of 7 growth, 5 *Escherichia coli* and 2 *Salmonella spp*:

Isolated organisms		
	Frequency	Percent %
<i>Escherichia coli</i>	5	71.4
<i>Salmonella spp</i>	2	28.6
Total	7	100

**Table 4.** Show the distributions of area their collected sample with culturing growth

Area		Frequency	Percent %
Khartoum	Growth	5	5.3
	No Growth	89	94.7
	Total	94	100
Bahri	No Growth	8	100
	Growth	2	18.2
Omdurman	No Growth	9	81.8
	Total	11	100

**Table 5.** Show the distributions of area their collected sample with isolated organisms:

Area		Frequency	Percent %
Khartoum	<i>Escherichia coli</i>	4	80
	<i>Salmonella spp</i>	1	20
	Total	5	100
Omdurman	<i>Escherichia coli</i>	1	50
	<i>Salmonella spp</i>	1	50
	Total	2	100

**Table 6.** Show the type of mayonnaise used in Restaurant where from total of 113, 79 Restaurant made mayonnaise, 29 Commercial mayonnaise and 5 Both

	Frequency	Percent %
Restaurant made mayonnaise	79	69.9
Commercial mayonnaise	29	25.7
Both	5	4.4
Total	113	100

**Table 7.** Show type of mayonnaise used in Restaurant against Culturing growth:

		<b>Frequency</b>	<b>Percent</b>
<b>Restaurant made mayonnaise</b>	Growth	7	8.9
	No Growth	72	91.1
	Total	79	100
<b>Commercial mayonnaise</b>	No Growth	29	100
<b>Both</b>	No Growth	5	100

**Table 8.** Show the Serological test for identify the *Salmonella Spp*, where from total of 2 *Salmonella spp* isolated, 2 was *Salmonella Typhimurium*

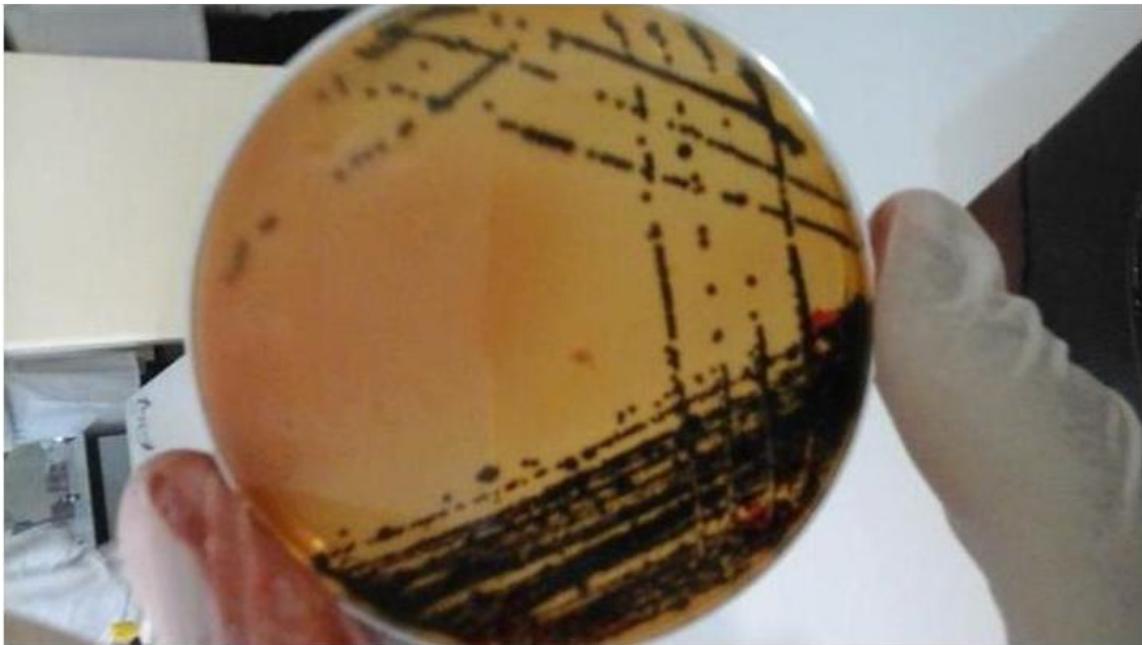
<b>Serology Of <i>Salmonella</i> species</b>		
	<b>Frequency</b>	<b>Percent %</b>
<i>Salmonella Typhimurium</i>	2	100



**Figure 1.** Show growth of *Salmonella Typhimurium* on Deoxycholate Citrate Agar (Non lactose ferment and produce H<sub>2</sub>S)



**Figure 2.** Show growth of *Escherichia coli* on Deoxycholate Citrate Agar (lactose ferment and without H<sub>2</sub>S production)



**Figure 3.** Show growth of *Salmonella Typhimurium* on Deoxycholate Citrate Agar (Non lactose ferment and high production of H<sub>2</sub>S).

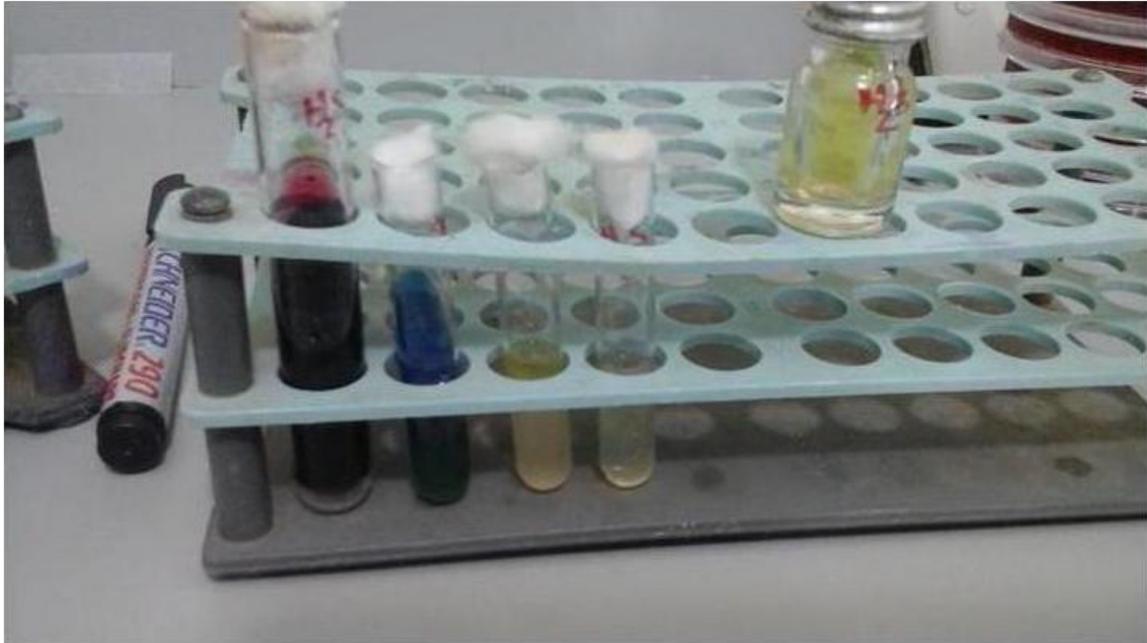


Figure 4. Show biochemical tests for *SalmonellaTyphimurium*.



Figure 5. Show biochemical tests for *Escherichia coli*.



**Figure 6.** Show serological test for *Salmonella Typhimurium*(positive for monovalent O,H antigens of *Salmonella Typhimurium*).

## DISCUSSION

This study was conducted to determine prevalence of *Salmonella* species in raw egg based salad (mayonnaise) from fast food restaurants in Khartoum state. From this study were 113 salad mayonnaise was collected from fast food restaurants in Khartoum state and processed to isolate and identify for presence of *Salmonella* species. The result showed 71.4% *Escherichia coli* and 28.6% *Salmonella Typhimurium*. This study similar with studies done by (Moffatt et al., 2016; Issack et al., 2013; Sasaki et al., 2011; García et al., 2011) in isolated organism which is *Salmonella Typhimurium*. But differ from study done by Moosavy et al. (2015) which isolate two organisms, *Salmonella Typhimurium* and *Salmonella Enteritidis*. Also differ from study done in Sudan by Peter, (2013), where result was no growth of *Salmonella spp.*

## CONCLUSION

The study revealed that 2% of the contaminated mayonnaise by *Salmonella* species, the major *Salmonella* species that was reported is *Salmonella Typhimurium*.

## Ethical consideration

Approval to carry out research was obtained from the Sudan Ministry of Health-research and Ethics Committee.

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