

Study of Salmonellosis among Population of Abushouk Internal Displaced Persons Camp, Alfashir, North Darfur State, SudanElrasheid E. M. Ali¹, Mohammed I. A. Ibrahim²¹Assistant Professor, Faculty of Health and Environmental Sciences, University of Gezira, Sudan²M.Sc. Faculty of Health and Environmental Sciences, University of Gezira

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Abstract

Salmonellosis considered one of the most serious infectious disease threats to public health on a global scale. World-wide typhoid fever affects about 6 million people with more than 600,000 deaths a year. Community base cross sectional descriptive study was carried out among the population in Abushouk Internal Displaced Persons camp (IDPs) Alfashir North Darfur State-Sudan, aimed to study Salmonellosis among the study population. The sample size of (399) households were taken by using systematic random sampling; the data was collected using structured questionnaire, and observation check list. Data were analyzed using SPSS version 16. The study revealed that, the prevalence of Salmonellosis was (9%) among the study population. Most of the infected respondents (40%) attained primary school level and (60%) had low income in average of (300-400) SDG. Most of the infected respondents (60%) were male and (40%) were in the age group (5-18) years old. The study showed poor environmental condition of the households, where most of the respondents (75%) were using local latrines, and observed that they were discharging waste in an open space in front of the houses and no policy for vector control activities seen. The knowledge toward Salmonellosis was good most of the respondents(74.6%) aware about the mode of transmission, but the hygiene practice was poor majority of the respondents (49.8%) were not using water and soap for hand washing after visiting toilet. The study recommended raising awareness toward prevention and control of Salmonellosis. Rehabilitation of the latrines and encourage community participation to maintain good hygiene condition of the latrines. Additional research to be carried out on screening tests for the detection of *Salmonella typhi* for those who are living in the study area for further study of prevalence of Salmonellosis.

Dedication

To my family

Acknowledgements

I take this opportunity to thank Allah for giving all the energy, ability and support both seen and unseen. My appreciation and acknowledgement to the Faculty of Health and Environmental Sciences. University of Gezira

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CHAPTER ONE

Introduction

1.1 Preface:

Salmonellosis is an acute, life threatening, febrile illness caused by the bacterium *Salmonella* sub species *enterica* serotype *typhi*. Because humans are the only known natural host for salmonella typhi, fecal-oral transmission through contaminated food and water is the most common mode of infection (Wallace, 2008).

Salmonellosis is one of the leading causes of morbidity and mortality across the world. Salmonella infection in humans can be categorized into two broad types, that caused by low virulence serotypes of *Salmonella enterica* which cause food poisoning, and that caused by the high virulence serotypes *Salmonella enterica typhi* (*S. typhi*), that causes typhoid, and a group of serovar, known as S Paratyphi A, B and C, which cause Paratyphoid . An estimated 21 million cases of Salmonellosis and 200,000 deaths occur annually worldwide and the incidence is high in burden area such as South and Southeast Asia, which estimated to be greater than 100 cases per 100,000 person (WHO, 2010).

Salmonellosis occurs at any age, highest incidence of this disease occurs in the (5-19) of age group after age 20 years. More cases are reported among males than females probably as the result of increased exposure to infection, but carrier rate is more in female. High risk occupations include food service, child care, and health care (Park, 2009).

Prevention is in safe food handling, refrigeration, sanitary preparation and storage, protection against insect contamination and use of sterile techniques during patient care (Theodor, *et al.*, 2009). It is important to emphasize good personal and environmental hygiene practices and people should always wash their hands with soap and water after using the bathroom and before preparing food and eating (Park, 2009).

1.2 Problem statement:

Salmonellosis is considered one of the most serious infectious disease threats to public health on a global scale, with particular concern over the rapid and widespread emergence of resistance to multiple antibiotics (Akinyemi,*etal.*, 2005). Salmonellosis remains a global health problem, it is difficult to estimate the real burden of Salmonellosis in the world because the clinical picture is confused with many other febrile infections because of the lack of appropriate laboratory resources in most areas in developing countries (Connolly, 2005). In 2004 WHO estimated the global Salmonellosis burden at 21 million cases annually, resulting in an estimated 216,000-600,000 deaths per year (Park, 2009). An estimated 700,000 deaths occur from an annual incidence of approximately 21 million cases (Smith,*etal.*, 2010).

The global concern over Salmonellosis is reflected in perceptions that Salmonellosis is a common and serious disease among children and adults in Kenya, where highly publicized outbreaks have strengthened this view among the public and health professionals (Chart, *etal.*, 2000). An estimation of a moderate incidence of Salmonellosis of 10–100 cases/100,000 person years in most African countries, with the incidence highest in childhood. In East Africa, incidence was estimated at 39/100,000 person years. Recently, increasing amounts of data on the prevalence of different pathogens found in sick children presenting to health facilities in Africa have been reported (Graham,*et al.*, 2000).

The proportional morbidity of typhoid have been increased in the last years in Alfashir Town North Darfur state, 11.2% 2012, 13% 2013 and 15.1 % up to June 2014 respectively (SMOH, 2014).

1.3 Objectives

1.3.1 General objective:

Study of Salmonellosisamong Population of Abushouk Internal Displaced Persons Camp, Alfashir, North Darfur State, Sudan, 2014.

1.3.2 Specific objectives:

1. To measure the prevalence of Salmonellosisamong the study population.
2. To identify the common risk factors influencing the occurrence of Salmonellosis.
3. To assess the knowledge, behavior and hygiene practices of the population toward occurrence of Salmonellosis.

CHAPTER TWO

Literature Review

2.1 Definition of Salmonellosis:

Salmonellosis is a bacterial disease, transmitted by the ingestion of food or water contaminated with the faeces of an infected person, which contains the bacterium *Salmonella enterica, serovar typhi*, the organism is a Gram-negative and grows best at 37°C / 98.6°F – human body temperature. Salmonellosis is still one of the severe epidemic diseases in certain developing countries and found sporadically in developed ones, on the other hand, *salmonella gastroenteritis* is common frequently foodborne disease in many countries (Moselio, 1989). The less severe disease is caused by the *salmonella* serotype *paratyphi* (Connolly, 2005). Salmonellosis is the result of systemic infection mainly by salmonella found only in man. The term enteric fever includes both typhoid and paratyphoid fever (Park, 2009).

2.1.1 Case definition of Salmonellosis:

Probable case: A patient with fever (38°C and above) that has lasted for at least three days, with a Positive serodiagnosis or antigen detection test but without *S. typhi* isolation (WHO, 2010). A clinically compatible case epidemiologically linked to confirmed case in outbreak (Jeremy, *et al.*, 2005).

Confirmed case: A patient with fever (38°C and above) that has lasted for at least three days, with a Laboratory-confirmed positive culture (blood, bone marrow, bowel fluid) of *S. typhi* (WHO, 2010).

2.2 Salmonellosis case and history:

Ms. Janet, a Southeast Asian exchange student, returned home for a three-month visit. Near the end of her visit, she cared for her aunt who had high fevers and some diarrhea. Three weeks later, when back in the United States, Ms. Janet had a shaking chill and fever to 38.5°C, with headache, myalgia, and anorexia. Fever continued and progressively increased over the next several days. When seen at the Student Health Service, she appeared ill and confused. The abdomen was diffusely tender, and the liver and spleen were enlarged, although there was no evident jaundice. In spite of the high fever, the pulse was relatively low at 90, and the white blood cell count was only 3000 with a moderate monocytosis. The initial blood cultures grew *typhi* and therapy trimethoprim-sulfamethoxazole was initiated and continued for a total of 14 days. The fever gradually abated over the next 5 days, and the patient made an uneventful recovery. However, 6 weeks later, all of her symptoms recurred, including a maximum daily fever of 38.5°C. *S. typhi* was again isolated from blood culture, and it was still sensitive to trimethoprim-sulfamethoxazole. She was treated again for 2 weeks with the same drug with a rapid response. There were no further recurrences (Moselio, *et al.*, 1993).

2.3 Epidemiological Determinants of Salmonellosis:

2.3.1 Agent Factor:

Salmonella enterica serovar typhi is a causative of Salmonellosis. Typhoid germ is passed in the faeces and urine of infected people. People become infected after eating food or drinking beverages that have been handled by a person who is infected or by drinking water that has been contaminated by sewage containing the bacteria. Once the bacteria enter the person's body they multiply and spread from the intestines, into the bloodstream. Even after recovery from typhoid or paratyphoid, a small number of individuals (called carriers) continue to carry the bacteria (WHO, 2010).

2.3.2 Host factors:

Age:Salmonellosis occurs at any age; highest incidence of this disease occurs in the 5-19 years of age group after age 20 years, the incidence falls probably due to acquisition of immunity from clinical or sub clinical infection (Park, 2009). In endemic area the peak of infection is in children 5 -15 years of age (Roger, 2012).

Sex: more cases are reported among males than females probably as the result of increased exposure to infection. But carrier rate is more in females (Park, 2009).

Immunity:All ages are susceptible to infection. Antibody may be stimulated by the infection or by immunization; however, the antibody to the somatic antigen (O) is higher in the patient with the disease, and antibody to the flagellar antigen (H) is usually higher in immunized individuals (Park, 2009).

Occupations:High risk occupations include: food service, child care, and health care. In general, individuals infected with *Salmonella serotype typhi* may return to work or school when their diarrhea has stopped, but they must be sure to carefully wash their hands after using the bathroom. Special precautions are indicated for food handlers, health care workers and child care workers and children who attend child care. Food handlers, health care workers and child care workers must not work directly with food or patients and children until they have three negative stool tests for *Salmonella serotype Typhi* (CDC, 2005).

Carriers: The carrier state is the most important epidemiological feature, with persistence of the organism in some individuals for periods in excess of 50 years. Three per cent of typhoid cases are found to still be excreting organisms after 1 year (Connolly, 2005).

2.3.3 Environmental and social factors:

Enteric fevers are observed all through the year. High incidence reported during rainy season where the increase of fly intensity. Bacilli are found in water, ice cream, food, milk and soil (Park, 2009).*Salmonella typhi* bacteria can survive in water for days, contaminated surface water such as sewage, freshwater and groundwater would act as etiological agents of typhoid (Roger, 2012). Food being a bad conductor of heat, sometimes provides condition for bacilli to multiply and survive. Salmonellosis bacilli grow rapidly in milk without make any change in the test or appearance, these factors are compounded by such social factors as pollution of drinking water supply, open air defecation and urination, low standard of food and personal hygiene and health ignorance (Park, 2009).Although contaminated food and water have been identified as the major risk factors for Salmonellosis prevalence, a range of other factors have been reported in different endemic settings such as poor sanitation close contact with typhoid cases or carriers level of education and larger household size (Tran, *et al.*, 2005).Salmonellosis may therefore be regarded as an index of general sanitation in any country (Park, 2009).

2.3.4 Socioeconomic impact:

It still remains the important public health problems in many developing countries (including Indonesia) of the world. The socioeconomic impact of the disease is significant because most of the time, several months are necessary for the patients to recover completely and resume normal work again (Singh, 2007).

2.3.5 Incubation period:

Usually 10 -14 days, but it may be as short as 3 days or as long as 3 weeks depending upon the dose of the bacilli ingested (Park, 2009). Three to thirty days, with a mean of 8 -14 days and the length period depend on infecting dose. Period of communicability is from one week after the start of illness for a period of three months, except in the chronic carrier where it continues for years (Roger, 2012).

2.3.6 Mode of Transmissions:

The main method of transmission is water, contaminated by faecal material from a carrier. These water-borne outbreaks may not always be explosive and where low-grade infection of the water source is taking place, groups of cases, spread over time, may occur (Roger, 2012). *Salmonella enterica* has been found to survive periods of four weeks in fresh water, but if the water is stored in bright sunlight (as in a reservoir), then the number of organisms rapidly dies off. It can survive in aerobic conditions with organic nutrient present, as found in contaminated streams. If the stream is polluted with raw sewage, then the organism can survive over five weeks and within solid faecal material for considerable periods of time. Seawater is bactericidal, but where a sewage outfall in near a shellfish bed, then the organism is filtered and concentrated providing a potent source of infection if the shellfish are eaten raw. Milk and dairy products provide ideal culture media and can become infected during handling by a carrier, or rinsing of containers with polluted water. Contaminated ice cream has been responsible for several outbreaks. Pasteurization of milk at 60°C is effective in killing *S. enterica*. Infection of meat products and canned foods is less common, but can occur in the cooling process (if carried out in polluted water). Flies can transmit the organism from faeces to food, whereas person-to-person infection is uncommon. Secondary cases form a very small proportion of an epidemic, so serial transmission in an unhygienic environment is not a feature (Roger, 2012).

2.3.7 Occurrence and Distribution:

Salmonellosis is a common in less-industrialized countries, principally owing to the problem of unsafe drinking-water, inadequate sewage disposal and flooding (WHO, 2001). In most tropical areas, the disease is endemic with seasonal outbreak. Water is the main vehicle of transmission but occur may be more related to the collection of people gathering at scarce water source as occur in dry season. Salmonellosis is a worldwide disease and serious outbreaks, generally epidemic in nature have occurred in developed countries from contamination of water supply or food produce (Roger, 2012).

2.4 Diagnosis:

Definitive diagnosis of typhoid is by culture of the organism from a normally sterile site (blood). Blood, urine and faeces should be cultured; faeces are usually positive after the first week of illness and result should be available in 72 hours. Culture of a bone marrow aspirate may be positive when there is no growth from the other site. The widal agglutination test detects antibody to the somatic O⁺, flagellar H⁺ and Vi antigens of typhoid bacilli (Jeremy, *et al.*, 2005).

2.5 knowledge, attitude and practice toward Salmonellosis:

A previous study was conducted in Pakistan, Islam Abad urban areas, showed that, the general community was well aware regarding relationship of typhoid fever, diarrheal diseases and hepatitis with unhygienic food and unboiled water, but the

practices did not match the level of knowledge and un-able to apply the principles of hygiene in their daily lives (Alam, *etal.*, 2008).

2.6 Hygiene and Practice:

Having access to safe water source or a latrine does not automatically mean that hygiene and health will improve. The crucial issue is human behavior, that is, what people do. Elimination from the infectious can be by practice such safe disposal of excreta, washing hand after defecation, food hygiene such as eating from vendors who have good hygiene practices (Arlex, *et al.*, 2005).

Health education is paramount to raise public awareness on all the above mentioned prevention measures. Health education messages for the vulnerable communities need to be adapted to local conditions and translated into local languages. In order to reach communities, all possible means of communication (e.g. media, schools, women's groups, and religious groups) must be applied (Alam, *etal.*, 2008). There is a well-known, large and persistent association between education and health, education plays an important role in response of individual to live in a good environmental and housing condition that may prevent them against Salmonellosis infection (WHO, 2010).

2.7 Previous study

Study conducted in Kenya revealed that, the prevalence of typhoid was found to be (6.3%). The risk factors which were revealed by the study included low education level. As indicated that, (57.7%) of the respondents had attained primary education, while 33.0% had secondary level, 6.5% college level and 2.8% non-formal education. These results suggested that more than half of the respondents had attained primary levels of education indicating a low level of education in the study area (Kibiru, 2011).

2.7 Prevention and Control:

2.7.1 Prevention:

People must avoid eating food that has been handled or prepared by persons suffering from typhoid fever, drinking contaminated water, eating fruits and vegetables that are not being properly washed or have been washed with contaminated water, visiting areas with poor sanitation and poor water supply and eating raw shellfish. Personal hygiene is very important. It is good practice to wash hands with clean running water and soap after using the toilet and before eating, touching or handling food (James, 2007). Vaccination has had a limited effect as a control measure, although it provides useful protection in individual and recommended for travelers to endemic countries (Jeremy, *et al.*, 2005). Protection of water supply and sanitary disposal of faeces, placing latrines a way from water source and maintenance of water network to avoid cross contamination. Where the outbreak can be traced to food source, then a search for carriers can be made and if discovered, they should be prohibited from preparing food (Roger, 2012).

2.7.2 Control:

Cases: Early diagnosis of blood and stool culture is important as the early symptoms are non-specific.

Notification: should be done where is mandatory.

Isolation: patients are better transferred to a hospital for treatment as well to prevent spread of infection. As a rule, cases should be isolated till three bacteriologically negative tests are obtained in separated three days.

Treatment: the fluoroquinolones are widely regarded and choice drug for treatment of typhoid fever. There are relatively inexpensive, well tolerated and more rapidly and reliably effective than the former first line drugs (chloramphenicol, ampicillin, amoxicillin and trimethoprim and sulfamethoxazole). The antibiotics used in uncomplicated cases (Park, 2009).

Source of infection:Stools and urine should be received in close container and disinfected. All soiled clothes and linen should be sterilized. Follow up examination of stools and urine should be done for *S.typhi* three to four months after discharge of the patient, and again after (12) months to prevent the development of the carrier stat. Since carriers are the ultimate source of Salmonellosis, their identification and treatment is one of the most radical ways of controlling typhoid fever (Park, 2009).

CHAPTER THREE

Materials Andmethods

3.1 Study Design:

Community base cross sectional descriptive study was conducted in Abushouk Internal Displaced Persons (IDPs) camp Alfashir town North Darfur State, aimed to study Salmonellosisamong population during November and December 2014.

3.2 Research Questions:

What are the magnitudes of Salmonellosis? What the most common risk factors influencing the occurrence of Salmonellosis? In which status of knowledge, behavior and hygiene practices are? To answer these questions, a cross sectional descriptive study will be conducted, targeting population living in Abushouk IDPs camp and excluding those come from another area and its surrounding villages.

3.3 Study area:

Darfur lies in the west of Sudan, bordering Chad. The region is a harsh desert area characterized by economic and political marginalization and underdevelopment. The main ethnic groups are the native Africans who are primarily farmers and the tribes of Arab descent who are nomadic herdsman. Competition over the use of scarce productive land and water resources has been the cause of rivalry, ultimately resulting in armed conflicts since 2003. The state North Darfur has 18 localities with the estimated population of 2, 24855.This study targets the internal displaced persons in Abushouk camps located in Alfashir town with an estimated population of 54,000 (SMOH, 2014).

3.4 Sampling techniques:

3.4.1 Sample size:

The total population of Abushouk camp was **54,000** (SMOH, 2014).

And the total of households was **9000** (calculated according to WHO standard).

Using the statistical equation sample size of **399** was obtained as explained below;

$$n = \frac{N}{1 + N(e)^2}$$

Where;

n= sample size

N= total population of three IPDs camp.

e= degree of accuracy = 0.05.

A systematic random sample used for targeting the households within the camp.

3.5 Data collection:

The data was collected using Questionnaire, interview and observation check list include water sanitation, general hygiene and environmental condition within the camp.

3.5.1 Data collection techniques:

Qualitative data was collected using observational check list and interview. Also quantitative data was collected by administering the questionnaire only once to the head of the households visited.

3.5.2 Reliability:

The study adopted the face- validated questionnaire after the approval of both supervisors. A pilot study was conducted before the actual data collection. The observation check list was filled by the researcher himself.

3.5.3 Validity:

A standardized way of asking the questions and recording answers of the respondents were shared with the research assistants, and check daily to ensure they are appropriately filled. All the missed data confirmed before the start of the next day's interviews.

The research assistants were trained in the following contents:

- 1- Explained the objective of the study and methodology.
- 2- Trained on interview approach and recording skills.
- 3- Assured with them the standard way of asking the respondents and selected language.

3.6 Data analysis:

Statistical Package for Social Science (SPSS) version 16 used for the analysis and interpretation of data.

CHAPTER FOUR

RESULT & DISCUSSION

4.1 Results:

Table No (4.1.1) shows the educational level of the household population in Abushouk IDPs camp.

Educational level	Frequency n=	Percent %
Illiterate	38	9.5
Khalwa	69	17.3
Basic –primary	133	33.3
Secondary	131	32.8
University	17	4.3
Post graduate	11	2.8
Total	399	100

Data displayed on tableNo (4.1.1) showed that most of the respondents (33.3) were primary level, followed by (32.8%) secondary level, (17.3%) khalwa, (9.5) % illiterate, (4.3%) university level and (2.8%)were post graduate level.

These results indicated various education levels among the population and showed that most of the respondents (93%) were under university level, which may effects their health aspect negatively. Possibly a person with a better knowledge of disease transmission avoids contact with patients or takes precautions to prevent infection. These findings supported by which is mentioned by (WHO, 2010) that, education level plays an important role in responses of individual to live in a good environmental condition that may prevent them against Salmonellosis infection.

Table No (4.1.2) shows the income level of the household population in Abushouk IDPs camp.

Income	Frequency	Percent
300__400SDG	216	54.1
401__500SDG	100	25.1
More than 500SDG	73	20.8
Total	399	100

Results on table No (4.1.2) showed that most of the respondents (54.1%) had monthly income (300 - 400SDG), (25.1%) from (401- 500SDG) and (20.8%) had monthly income (more than 500SDG).

These results revealed that, low economic status have high impact on the increase of typhoid fever, and agreed with (Crump,et al., 2004) stated that, Salmonellosis infection is mainly associated with low socio-economic status and poor hygiene.

Table No (4.1.3) shows the family size of the household population in Abushouk IDPs camp.

Family size	Frequency	Percent
2-3 person	47	11.8
4-6 person	222	55.6
More than 7 person	130	32.6
Total	399	100

Table No (4.1.3) revealed that most (55.6%) of the household consisted (4 - 6 individual), followed by (32.6%) more than seven individual and (11.8%)(2 - 3 individual).

These results laid at the standard level of the household family size of WHO and indicated that has positive impact on health status of the population (WHO, 2010).

Table No (4.1.4) shows the status knowledge of the respondent toward the mode of transmission of Salmonellosis in Abushouk IDPs camp.

Mode of transmission	Frequency	Percent
Contaminated water & polluted food	147	36.8
Mosquito	81	20.3
Flies	117	29.3
Faeces	34	8.5
Other specified	20	5.1
Total		100

Information on table No (4.1.4) showed that most of the respondent (36.8%) were knowledgeable about the mode of transmission of Salmonellosis

These findings have a major role in the prevention and control of Salmonellosis as mentioned by (James, 2007) that, people must avoid eating food that has been handled or prepared by persons suffering from Salmonellosis, drinking contaminated water, eating fruits and vegetables that are not being properly washed or have been washed with contaminated water, visiting areas with poor sanitation and poor water supply and eating raw shellfish.

Table No (4.1.5) shows the source of drinking water in Abushouk IDPs camp

Source of drinking water	Frequency	Percent
Hand dug well	138	34.6

Ground water (Emergency station)	259	64.9
Other specified	2	.5
Total	399	100

Results on table No (4.1.5) revealed that the common source of drinking water was a ground water, where most (64.9%) of the population supplied from the station, (34.6%) from hand dug well and the least were supplied from other sources. These results reflected positively to what mentioned by (Park, 2009) that ground water is pure in compare to surface water due to its natural purification during the settlement into ground.

Table No (4.1.6): shows the means of transportation of drinking water from the distribution points to the household.

Means of transportation	Frequency	Percent
On foot (Head)	136	34.0
On donkey	181	45.4
Wheelbarrow	82	20.6
Total	399	100

Data displayed in table No (4.1.6) indicated that most of the respondents(45.4%)were using donkeys, (34%) on foot and the least (20.6% use)using Wheelbarrow for transporting water from the distribution points to the household.

These results may increase the possibility of cross contamination during the transportation especially if water vendors are infected or carrier person had a contact to drinking water, in addition to that the distribution points were crowded which considered risk factors influenced the spread of Salmonellosis and these finding agreed with (Roger, 2012), that main method of transmission of typhoid is water contaminated by fecal material from a carrier, and the protection of water supply and sanitary disposal of faces, placing latrines a way from water source and maintenance of water network played role in the prevention of Salmonellosis.

Table No (4.1.7) shows the accessibility of drinking water.

Distance of water source from the household	Frequency	Percent
50-100 meters	73	18.3
100-200 meters	87	21.8
More than 200 meters	239	59.9
Total	399	100

Results on table No (4.1.7)showed that most of the household (59.9%)were far from the source of water (more than 200meters) and(21.8%)(100-200 meters) whereas the least (18.3%) close to the source of water (50 -100 meters).

These results certified that, respondents were getting difficult to be supplied from water sources due to far distance from the households, since cross contamination may occur and decrease the quantity of water in the house. This finding effect negatively on health status of the respondents due to the scarcity of water, and that corresponded to which is mentioned by (Park, 2009) Salmonellosis regarded as an index of general sanitation in any country.

Table No (4.1.8) shows the type of storing containers of drinking water for daily consumption in the household.

storing containers	Frequency	Percent
Vessels	110	27.6
collapsible jerry cans	173	43.4
Barrel	116	29.0
Total	399	100

Data displayed in table No (4.1.8) illustrated that majority of the respondents(43.4%) store water in jerry can, followed by (29%)store water in barrel and 27.6% store water in vessels.

These results indicated that, there is inadequate storage facility with the exception of availability of collapsible jerry cans which are most exposed to the frequent movement and if not proper handled and cleaned may increase the possibility of cross contamination. This is in consistent to the findings reported by (Park, 2009), pollution of drinking water is one of the compounded environmental factors that leading to occurrence of Salmonellosis.

Table No (4.1.9) shows the store condition of food at kitchen within the household.

Things to store food at kitchen.	Frequency	Percent
Cupboard	133	33.3
Table	185	46.4
Other specified	81	20.3
Total	399	100

Table No (4.1.9) demonstrated that most of the respondent (46.4%) used to store food on table, followed by (33.3%) store food in cupboard and the least (20.3%) store in other local things.

These results indicated the possibility of food pollution due to the poor storage condition at the kitchen, and may contribute to spread of Salmonellosis. This finding agreed with (Park,2009) that, Food being a bad conductor of heat, and poor preparation sometimes provides condition for bacilli to multiply and survive.

Table No (4.1.10): shows the behaviors of the population toward food hygiene and safety.

reheating food	Frequency	Percent
Sometimes	162	40.3

Always	193	46.4
No	44	20.3
Total	399	100

Results on table No (4.1.10) showed that most of the respondents (46.4%) were always reheat the leftover food before eating, followed by (40.3%) reheat sometimes and the least (20.3%) were not reheat the leftover food.

These results considered positive health practice toward food safety which play role in decreasing the risk of the food contamination and responded to the precaution that mentioned by (Park, 2009); Food being a bad conductor of heat sometimes provides condition for bacilli to multiply and survive and the low standard of food preparation and personal hygiene and health ignorance are factors leading to occurrence of Salmonellosis.

Table No (4.1.11) shows the place respondents prepare or take meals in usually time.

Place	Frequency	Percent
Home	302	75.7
Restaurants	70	17.5
Food handler	26	6.5
Other specified	1	.3
Total	399	100

Table No (4.1.11) showed that most of the respondent (75.7%) were having their meal at home in usual time, whereas (17.5%)were eating from the restaurant, (6.5%) from food handlers and 0.3% specified other places.

These results have a positive indication that, most of the respondent were preparing their meal and eating at home in usual time that is more sanitary than eating out in the market/restaurant or from food handler. These findings responded to which is mentioned by (James, 2007) that, people must avoid eating food that has been handled or prepared by persons suffering from typhoid fever, drinking contaminated water, eating fruits and vegetables that are not being properly washed or have been washed with contaminated water, visiting areas with poor sanitation and poor water supply and eating raw shellfish.

Table No (4.1.12) shows the type of latrine within the household.

Type of latrine	frequency	Percent
Local	299	75.0
VIP	68	17.0
Other specified	32	8.0
Total	399	100

Date on table No (4.1.12) showed that most of the respondent (75%) were using local latrine, followed by (17%) were using ventilated improved pit latrine (VIP) and the least (8%) were using other type of latrines.

This type of latrine creates suitable environmental condition for vehicles transmission to food that are not covered. This result is considered factors associated to spread of typhoid infection as mentioned by (Park, 2009) that, Salmonellosis may regarded as an index of general sanitation in any country. Protection of water supply and sanitary disposal of faces, placing latrines away from water source will prevent the spread of Salmonellosis (Roger, 2012)

Table No (4.1.13) shows the personal hygiene practice toward hand washing before eating.

Hand washing before eating	Frequency	Percent
Use water only	168	42.1
Use water & soap	231	57.9
Total	399	100

Table No (4.1.13) revealed that most of the respondent (57.9%) were doing good health practice of washing hand using water and soap before eating while the least were doing negative health practice that were not using soap.

These results responded positively to which is mentioned by (Park, 2009) that, It is important to emphasize good personal practices and people should always wash their hands with soap and water after using the toilet and before preparing food and eating.

Table No (4.1.14) shows the personal hygiene practice toward hand washing after visiting toilet.

Hand washing after use toilet	Frequency	Percent
Use water only	199	50
Use water & soap	195	49
Other specified	5	1
Total	399	100

Data displayed on table No (4.1.14) showed that most of the respondent (50%) were using water only after visiting toilet, (49%) using water & soap and (1%) used other things.

This result affect negatively in the health status of the respondents as viewed by (James, 2007) Personal hygiene is very important. It is good practice to wash hands with clean running water and soap after visiting the toilet and before eating, touching or handling food.

Table No (4.1.15) shows the statistical relationship between occurrence of Salmonellosis and education level of the infected respondent.

Educational level	Salmonellosis			
	Infected		Not infected	
	No	%	No	%
Illiterate	7	20	62	17
Khalwa	4	11.4	34	9.3
Basic /primary	14	40	119	32.7
Secondary	5	14.3	126	34.6
University	5	14.3	12	3.3
Post graduate	0	.0	11	3.0
Total	35	9%	364	91%

X2	P
14.947	0.011

Data displayed on table No (4.1.15) revealed that there was association between the occurrence of Salmonellosis and education level of the infected respondent (p value= 0.011).

The current study association agreed with the findings of study conducted in Kenya revealed that, the prevalence of typhoid was found to be (6.3%). The risk factors which were revealed by the study included low education level. As indicated that, (57.7%) of the respondents had attained primary education, while 33.0% had secondary level, 6.5% college level and 2.8% non-formal education. These results suggested that more than half of the respondents had attained primary levels of education indicating a low level of education in the study area (Kibiru, 2011).

Table No (4.1.16) shows the statistical relationship between Salmonellosis infection and income level of the infected respondent.

Income	Salmonellosis			
	Infected		Not infected	
	No	%	No	%
300__400SDG	21	60	195	53.6
401__500SDG	8	22.9	92	25.3
More than 500SDG	6	17.1	77	21.2
Total	35	9%	364	91%

X2	P
.565	.754

Data displayed on table No (4.1.16) indicated that, there was no statistical association between income level of the infected respondent and Salmonellosis (p value= 0.754). This study result is contradicted with (Crump,*et al.*, 2004) stated that the disease is mainly associated with low socio-economic status and poor hygiene.

Table No (4.1.17) shows the statistical relationship between Salmonellosis and family size of the infected respondent

Family size	Salmonellosis			
	Infected		Not infected	
	No	%	No	%
2-3 person	6	17.1	41	11.3
4-6 person	18	51.4	204	56
More than 7 person	11	31.4	119	32.7
Total	35	9%	364	91%

Data displayed on table No (4.1.17) revealed that there was no statistical association between the household family size among the infected respondent (p value= 0.7584).

The current study agreed with the standard level of household family size recommended by WHO. The statement mentioned by (Tran, *et al.*, 2005) that, although contaminated food and water have been identified as the major risk factors for Salmonellosis prevalence, a range of other factors have been reported in different endemic settings such as poor sanitation close contact with Salmonellosis cases or carriers level of education and larger household size.

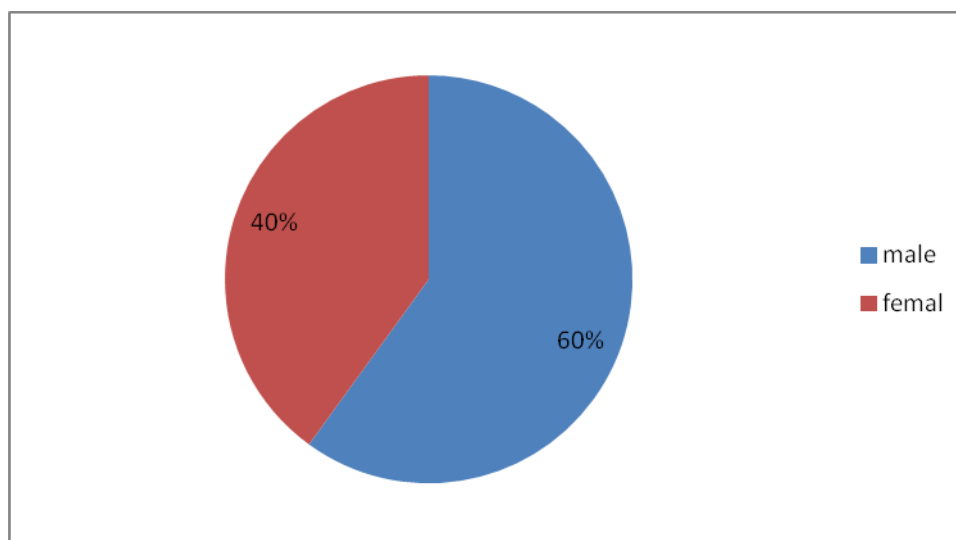


Figure No (4.1.1) shows the sex of the infected respondents in Abushouk IDPs camp 2014.

The study revealed that most of the infected respondents (60%) were male. This result agreed with (Park, 2009) stated that, more cases are reported among males than females probably as the result of increased exposure to infection. But carrier rate is more in females.

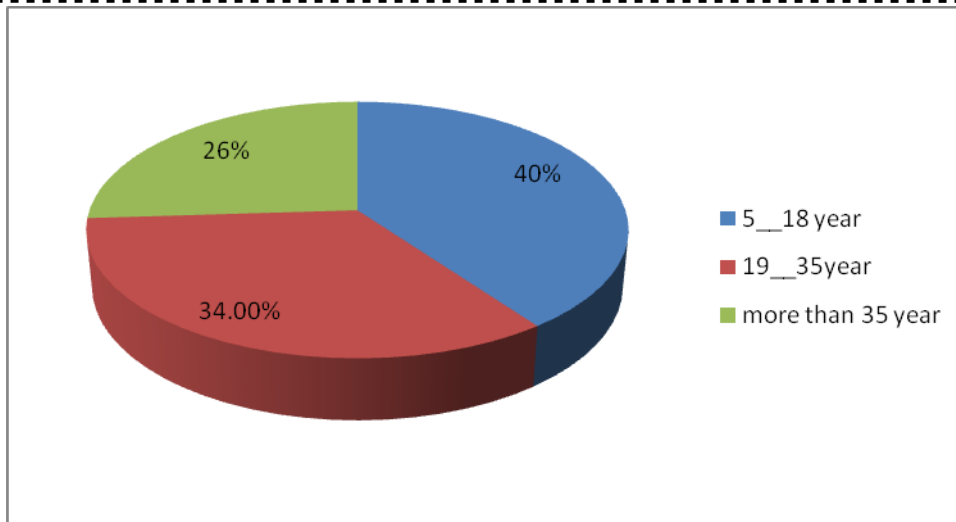


Figure No (4.1.2) shows the age group of the infected respondent in Abushouk IDPs camp 2014.

The age groups (5-18 years) of the respondent were higher (40%) than (34%) compare to age groups (more than 35 years), where the incidence of typhoid increases because the personal hygiene was poor according to observation findings. These findings agreed with (Roger, 2012) said; typhoid fever occurs at any age; highest incidence of this disease occurs in the 5-19 years of age group after age 20 years, the incidence falls probably due to acquisition of immunity from clinical or sub clinical infection. In endemic area the peak of infection is in children 5 -15 years of age.

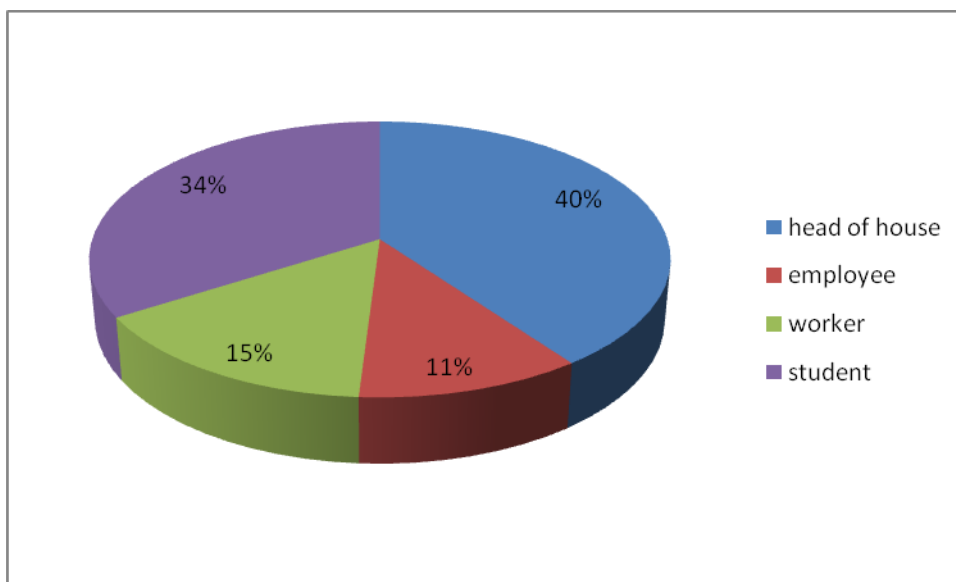


Figure No (4.1.3) shows the occupation of the infected respondent in Abushouk IDPs camp 2014.

Base on the study viewed that occupation has a relative relation to the spread of Salmonellosis, where the Head of households were closed to take care of patient and likely to put him/her to the risk of getting infection or transmit to other. These findings agreed with (CDC, 2005), High risk occupations include, food service, child care, and health care. In general, individuals infected with *Salmonella serotype typhi* may return to work or school when their diarrhea has stopped, but they must be sure carefully to wash their hands after visiting the toilet.

4.2 Observation results:

- **Chlorination:** tests done three times a day from different points of distribution using pool test, residual chlorine was Nil (0.00).
- **Acceptability:** water at acceptable level no smell, test, color.
- **Quantity:** one day of consumption and crowding at water distribution points obviously observed.
- **Sanitation:** traditional local design of latrines was the most type set up within the camp. It is accessible for both adults and children.
- **Solid waste management:** in general the houses were seen cleaned inside but they were discharging waste in open space near to the shelters.
- **Vector control:** no vector control scheduled intensity of house fly and cockroach was not high.

Remarks:

- Absence of residual chlorine at the distribution point will probably decrease the prevention of further contamination during transportation or in water containers in the household.
- Crowdedness at water distribution points reflected to the scarcity of water, which effect on the health status of the study population.
- Poor sanitary facilities and disposal of waste system are factors contributing to occurrence of diseases among the study population.

CHAPTER FIVE

Conclusion And Recommendation

5.1 Conclusion:

- The prevalence of Salmonellosis among the study population was (9%).
- Most of the infected respondents (40%) attained primary school level.
- Low income level among the respondent, most were in average (300-400SGD).
- Male were more than female and most of cases in age group (5-19 years).
- Most of the households (75%) were using traditional local latrine.
- Most of the respondents (74.6%) were aware about mode of transmission of Salmonellosis.
- Poor waste disposal system within the camp, discharging waste in open space near the shelters obviously observed.

5.2 Recommendation:

- Raise awareness toward prevention and control of Salmonellosis.
- Rehabilitation of the latrines that have been set-up earlier and encourage community participation and effort to maintain good hygiene condition of the latrines.
- Additional research is needed to carry out screening test for the detection of Salmonella typhi for those who are living in Abushouk IDPS camp, for further measurement of the prevalence of typhoid fever.
- Activate the vector control activities within the camp in regular bases.
- Identify final disposal side and set-up containers for the collection of the waste or emphasis the idea of discarding and burning the waste in a safe pit as alternative option to manage the solid waste within the camp.
- There is need to train the water vendors on chlorination techniques for water source and a distribution point.

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University of Gezira

Faculty of Health and Environmental Science

Post Graduate Studies

Study of Salmonellosis among Population in Abushouk IDPs camp Alfashir North Darfur State 2014.

Questionnaire:

Section one: Socioeconomic Status:

1- Educational level:

- A) Illiterate (), b)Khalwa (),c) Basic/primary School (), d) Secondary School (), e) University (),f) Post graduate ().

2- Occupation of household responsible:

- A) Head of house (), b) Employee (), c) Daily worker (), d) Student (), e) Other specify ().

3- Family size:

- A) 2_3 (), b) 4_6 (), c) more than seven ().

4- The monthly income:

- A) 300_400SDG (), b) 401_500SDG (), c) more than 500SDG ().

Section two: Prevalence of Salmonellosis:

5- Are there any person in the house got infected withSalmonellosis?

- a) Yes (), b) No ().

If yes:

6- Sex of infected person: a) Male (), b) Female ().

7- Age of infected person: a) 5__18 years (), b) 19__35 years (), c) more than 35 years ().

8- Occupation of infected person: a) House-keeper (), b) Employee (), c) Daily worker (), d) Student (), e) Other specify ().

9- The mode of transmissions of Salmonellosis is?

- a) Contaminated Water and food (), b) mosquito (), c) Flies (), d) faeces (), E) other specify ().

Section three:

10- Source of drinking water:

- a) Hand dug well (), b) emergency station (), c) other specify ().

11- Ways of transportation of drinking water:

- a) No foot (), b) on donkey (), c) wheelbarrow (), d) other specify ().

12- Distance from water source to the house:

- a) 50-100 m (), b) 100 -200 m (), c) more than 200 m ().

13- Ways of storing water:

- a) In the vessel (), b) Jeri cans (), c) water barrels (), d) other specify ().

14- Where do you keep the food in the kitchen?

- a) In the Cupboard (), b) on table (), c) other specify ().

15- Do you heat reserved food when you back to eat?

- a) Yes sometimes (), b) yes always (), c) No ().

16- Where does your family member eat usually?

- a) In the house (), b) in the restaurant (), c) food handler (), d) other specify ().

17- Type of latrine in house:

- a) Local (), c) VIP (), d) other specify ().

18- Hand washing before eating?

- a) Use water only (), use water and soap ().

19-- Hand washing after visiting the toilet:

- a) Use water only (), use water and soap (), c) other specify ().

Observation check list

	Ranking			
1- Water quality and quantity	0%	50%	100%	remarks
Chlorination	Nil	0.02-0.03	0.05	Test done three times in one day from different sources (Pool test)
Acceptability smell, test ,color	Poor	acceptable	Very good	
Quantity	Non	One day of consumption	2 days of consumption	Crowding have been observed in the distribution points
Latrine	0%	50%	100%	remarks
Hygiene condition	Poor	acceptable	Very good	Local latrine were the most type and without roof
Accessibility (distance from the shelters)	Over 5m	Between 30__50 m	Between 5__30m	Close to the shelter.
Waste management and vector control	0%	50%	100%	remarks
Frequency of collection in the house	Weekly or longer	Each another day	Daily	Used to collect waste in the morning
Final treatment and disposal	Dumped in an open space	Dumped and burned in open pit	Burned in safe pit or by waste company	See appendix Picture took from the camp.
General state of hygiene	Poor	acceptable	Very good	
Intensity of house fly	High	Midd	Non	
presence of cockroach in the latrines	High	Midd	Non	
insecticide residual spray	Never done	One a year or more	Regularly or by season	

List of Abbreviation

CDC Centre for disease and control

WHO World Health Organization

SMOH State Ministry of Health

IDPs Internal Displaced Persons

VIP Ventilated Improved Pit

S. typhi *Salmonella Typhi*