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## Short Communication

# The Prevalence of *Salmonella* Infection among Gastroenteritis Patients in Nyala City, Southern Darfur, Sudan

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**ABSTRACT**

This study was conducted in Nyala town, South Darfur State, Sudan, during a period from 2008 - 2010. A total of 200 stool samples were collected from patients suffering from gastroenteritis hospitalized in Nyala Teaching hospital and Yashfein Health Care Centre. The samples were subjected to bacteriological investigation and serological confirmation to study the prevalence rate of enteric fever (EF) in the city. EF prevalence rate was found to be as 13% (26 isolates). The recovered *Salmonella* isolates were identified to *S. typhi* 15 (57.7%) and *S. paratyphi* 11 (42.3%). The isolates were found sensitive to trimethoprim and ciprofloxacin resistant to ampicillin and tetracycline. According to sex, age, and seasonal observation, EF infection was found to be highest in male 16.5% (13/79) and young 65.38% (17/26) patients with high prevalence in autumn 25.54% (14) and water source direct from wells represented highest percentage 17.4 (15/86). This study indicated that there are causes for gastroenteritis other than *Salmonella* infection in Nyala city.

**Key words:** Salmonella, Typhoid fever, Paratyphoid, Enteric fever

## INTRODUCTION

Salmonellosis is a worldwide Food- borne disease of man and animals caused by species of the genus *Salmonella* (Scherer and Miller, 2001). *Salmonella typhi*, *S. choleraesuis*, *S. paratyphi A* and *S. paratyphi B* are primarily infect human leads to sever clinical infections. According to WHO (2007) data, typhoid fever considered as an important cause of illness and death in the overcrowded and unsanitary urban conditions. In study conducted from 2001 to 2007 in 37 countries, *Salmonella serovars enteritidis* (43.5%) and *S. typhimurium* (17.1%) are the most common species isolated from humans while, *Salmonella enterica* was found to be the main source of food contamination and is an important cause of illness worldwide according to World Health Organization Global Foodborne Infections Network (Rene *et. al*., 2011). The disease has three forms; gastroenteritis, septicemia and Enteric fever (typhoid fever) (Todar, 2005). Some patients after recovering from infection became permanent or temporary carriers (Yousefi-Mashouf *et al*., 2003). Domestic and wild animals are also considered as carriers of Salmonellae (Zhao *et al*., 2005) and Stein (2011) stated that some infected individuals become carriers and persistently shed Salmonella in their feces for long periods of time, and act as a reservoir for the pathogen; they are a crucial target for disease control and play a potential source in environmental contamination.

Typhoid fever continues to be a public health problem and it is of global distribution in some developing countries of Asia and Africa. It is estimated that there are approximately 22 million typhoid cases and ~200,000 deaths per year worldwide and 400,000 cases occur annually in Africa, an incidence of 50 per 100,000 persons per year (Crump *et al*., 2004). School-age children, especially those from resource-poor settings with inadequate water and sanitation systems, are disproportionately affected. In Egypt, John *et al.* (2003) reported that the incidence of typhoid fever was 13/100,000 persons per year. Kayode *et al*. (2010) reported 18% of (*S. typhi*) from human salmonellosis in Nigeria. Infants and elder patients were found more affected by *Salmonella* species than adult (Matkowskyj *et al*., 2009 and Weam *et al*., 2016). In South Africa, 92 patients were enrolled: 53 (58%) were found to be positive

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for Salmonellosis, 25 (27%) patients were under the age of 15 years, and 42 (46%) patients were female; 28 (78%) of cultures grew *Salmonella typhi* (WHO, 2011). Study conducted in Bangladesh by Sumon Kumar Das, *et al*., (2014) explained that *Salmonella typhi* was reached (57%) in Dhaka; while *Salmonella paratyphi* was (43%) and increased to (96%) in Matlab. In Qatar, Banjar Weam, *et al*., (2016) reported that, 109 (26%) out of 423 gastroenteritis patient were positive for *Salmonella spp*. and male were higher rate than female. In Sudan, Khartoum State, El-Hussein *et al*. (2010) reported 70.34% (19 from 27 human stool samples). Strong evidence was found with an association between climatic factors and food- and waterborne diseases; air temperature and humidity seem to be important climatic factors (Hedlund *et al*., 2014).

Previous studies conducted in Southern Darfur states reported isolation of some Enterobacteriaceae; coliform bacteria from contaminated water sources (Elamin, 2003 and Amira, 2009), and that may explain signs for environmental contamination by others Enterobacteria. Therefore the present study aimed to screen the incidence rate of salmonellosis in patients with gastrointestinal disorders and to study the sensitivity of the isolates to the commonly used antibiotics and this study (human salmonellosis) seems to be the first of its kind in the area of study.

## MATERIALS AND METHODS

### Study area

The study was conducted in Nyala city the capital of South Darfur State, western Sudan during June 2008 to July 2010.

### Isolation and identification

A total of 200 stool samples were collected in a clean sterile container from patients suffering from gastroenteritis disturbances with special consideration to season, water source, sex and age factors. Samples were subjected to routine bacteriology and different culture media were used in this study according to Old (1996) and Barrow and Felltham (2003).

The isolates were identified according to phenotypic criteria; including Gram staining bacterioscopy, motility, appearance and color of the colonies on DCA and XLD media and biochemical reactions stated by Dealer (1992) and Barrow and Felltham (2003).

### Identification of *Salmonella*

All Gram negative rods that showed colonial morphology like Salmonella were tested for oxidase production. All Gram negative rods oxidase negative organisms were identified by various biochemical tests and confirmed serologically (Karpov *et al*., 2014).

### Serological method

Serological confirmation test was carried out to that biochemical resembling *Salmonella* by using Mast Diagnostic *Salmonella* anti-sera. A drop of polyvalent O, H typhi and paratyphi anti-sera (O factor 9 H, b from Becton and Dickinson Company) were added to the suspensions of two species separately, usually approximately in equal volume then mixed. In the positive reactions clumping appear within 30 seconds to one minute. Any positive colonies were tested with specific monovalent antisera typhi and paratyphi A (O factor 2 H, a) and B (O factor 4 H, b from the same company) as described by Karpov *et al*., (2014).

### Antibiotic Susceptibility Testing

Identified *Salmonella spp*. were determined for antimicrobial susceptibility by the Kirby-Bauer disc-diffusion method using Muller Hinton Agar (MHA) plates against the most antibiotics used for *Salmonella* treatment in the study area such as ampicillin (20 mcg), ciprofloxacin (5 mcg), trimethoprim (10 mcg) and tetracycline (30 mcg) (Hi Media Laboratory Ltd., Mumbai, India) (Khanal *et al*., 2007).

## RESULTS

### Bacteriological findings

Bacterioscopy of Gram stained stool films demonstrated 26 (13%) Gram negative rods smears (*Salmonella*-shape like), which were produced visible growth in culture medium. The growth was purified and confirmed as *Salmonella* organisms according to microscopy, cultural and biochemical characteristics. The isolates were subsequently identified to *S. typhi* as 15(57.7%) and *S. paratyphi* as 11(42.3%) by the means of phenotypic criteria according to Barrow and Felltham (2003).

### Factorial findings

According to sex, age, water source and seasonal observation, EF infection was found to be highest in young (65.38%) 17/26 and male (16.5%) 13/79 patients; with high prevalence in autumn (25.54%) 14 and water source direct from wells represented highest percentage (17.4) 15/86 as demonstrated in Table 1 and Fig. 1.

### Serotyping

All 26 positive *Salmonella* cultures were found positive for *Salmonella* anti-sera (15 *typhi* and 11 *paratyphi*).

### Sensitivity reaction

*Salmonella* isolate were found to be sensitive to ciprofloxacin and trimethoprim resistant to tetracycline and ampicillin.

## DISCUSSION

In this study the incidence rate (13%) was found to be higher than the finding of John (2003) in Egypt and below the results obtained by El-Hussein *et al*. (2010) in Khartoum, WHO (2011) report in South Africa, Sumon Kumar Das *et al*., (2014) in Bangladesh and by Banjar Weam *et al*., (2016) in Qatar, but it approximately matched with Kayode *et. al*. (2010) result in Nigeria. This variation may be due to reliability of diagnostic method "Widal test" which may give false positive result in case of previous *Salmonella* infection or for climatic variation (Hedlund *et al*., 2014).

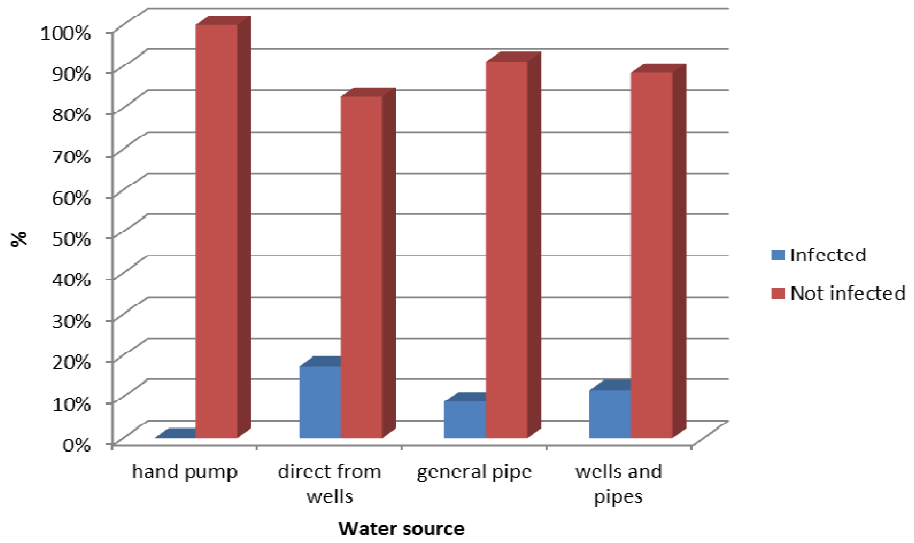


**Fig. 1:** The relationship between the water sources and infection.

**Table 1:** Seasonal, sex and age factors influencing prevalence of salmonellosis

| Patient /season | | Male (79) | | Female (121) | |
|---|---|---|---|---|---|
| Season (TN) | + Ve (%) | Young | adult | Young | adult |
| Autumn (55) | 14 (25.5) | 6 | 2 | 4 | 2 |
| Winter (54) | 3 (5.6) | 1 | 1 | 1 | 0 |
| Summer (91) | 9 (9.9) | 2 | 1 | 3 | 3 |
| Total (200) | 26 (13) | 9 | 4 | 8 | 5 |

Key words: TN = Total Number

The infection rate of *Salmonella* was found to be higher in youngers and men rather than in women. This may be due to the lacking of awareness among children and in the case of male this returned to that, males take their meals in the opened places (markets) which may expose them to contamination, these results agreed with the findings reported by Matkowskyj *et al.* (2009), WHO (2011) and Banjar Weam *et al*., (2016).

According to season and water source, infection rate increased in autumn because the people and their animals drink from lakes and wells where the water is not chlorinated and is contaminated by the stool of the swimmers around the water sources area, in addition to, poor hygienic measures and sometimes animals drink from the same water source of human. In the contrary the rate of infection decreased in summer because of high temperature and the dryness kills the bacteria. The results agreed with results reported by Hedlund *et al*. (2014), who stated that there is strong relationship between climatic factors and food- and waterborne diseases (air temperature and humidity are the most important ones).

**Conclusion and recommendation**

We concluded that prevalence of Enteric fever in Nyala City was very high (13%) especially, among children and men due to lack of sanitary measurements. Isolated Salmonellae were found sensitive to trimethoprim and ciprofloxacin resistant to tetracycline and ampicillin therefore, other antibiotics must be try for treatment. Sanitary measurements and Health education must be applied to reduce Salmonella infection in the study area.

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