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Typhoid fever prevalence among residents in Gashua, Nigeria

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Abstract
Typhoid fever is a major public health concern in tropical developing countries of which Nigeria is one, especially in areas where access to clean water and other sanitation measures are limited. The aim of the study was to determine the prevalence of typhoid fever among Gashua residents in Yobe State. The subjects are between the age ranges of 1 to 82 years with symptoms clinically suspected to be of typhoid fever visiting the General Hospital at Gashua, Yobe State. Informed consent of volunteers and guardians was obtained. Blood and stool samples from 197 patients were analyzed for typhoid fever infection using Widal test as a pretest and stool culture test as a confirmatory test respectively. Serotyping was performed using agglutination with Salmonella O, H and Vi antisera. An indication of infection was found from isolating Salmonella typhi. The total number of patients positive for typhoid fever was 55 (27.9%).

Keywords: Typhoid fever; Stool culture; *Salmonella typhi*; Serotyping; Prevalence

1. Introduction
Typhoid fever (TF) is a bacterial infection of the intestinal tract (bowels/gut) and occasionally the bloodstream, it's an infection caused by *Salmonella typhi*, (Cheng *et al.*, 2013) [12] a Gram negative bacterium (Manangazira *et al*., 2011) [19]. It is a severe systemic illness characterized by fever and abdominal pain (Parikh, 2012) [23], found only in man (Kalra *et al*., 2003; Ifeanyi, 2014) [18, 17]. In tropical countries including Nigeria where the disease is often encountered, they account for several cases of morbidities and mortalities (Ibekwe *et al.*, 2008) [16]. In 2010, an estimated burden of TF was 26.9 million episodes globally. However, in Africa, a basic prevalence of 362 cases per 100,000 persons is reported every year (Buckle *et al.*, 2012) [8].
Growth period of *Salmonella typhi* is from 3 to 60 days, and signs are usually obtainable from 1 to 14 days of infection (Chatterjee *et al.*, 2016) [10]. Symptoms may vary from mild to severe, and usually begin 6 to 30 days after exposure (Anna, 2014) [7]. Often there is a gradual onset of a high fever over several days (Anna, 2014) [7]. This is commonly accompanied by weakness, abdominal pain, constipation, headaches, and mild vomiting (CDC, 2013) [9]. Some people develop a skin rash with rose colored spots. In severe cases, people may experience confusion (CDC, 2013) [9]. Without treatment, symptoms may last weeks or months, diarrhea is uncommon (CDC, 2013) [9]. Other people may carry the bacterium without being affected however; they are still able to spread the disease to others. As noted, TF is a major public health concern in tropical developing countries, especially in areas where access to clean water and other sanitation measures are limited (Mutua *et al.*, 2015) [21].
The paucity of epidemiological data regarding invasive Salmonella disease in sub-Saharan Africa led the World Health Organization (WHO) to call for a continent wide approach in generating more accurate disease incidence and antimicrobial susceptibility data in 2008 (WHO, 2008) [27]. In Nigeria, TF remains a major disease because of factors such as increased urbanization, inadequate supplies of potable water, regional movement of large numbers of immigrant workers, inadequate facilities for processing human waste, overburdened healthcare delivery systems, and overuse use of antibiotics that contribute to the development and spread of antibiotic resistant *S. typhi* (Akinyemi *et al*., 2005) [4]. According to Crump and Mintz (2010) [13] TF remains a major cause of enteric disease and a significant public health problem and is now highly prevalent in developing world of which Nigeria belongs.
Therefore, it is imperative to study the disease in order to put it under check and thus curtailing its devastating effects. This work aimed at determining the prevalence of TF among patients attending General Hospital Gashua, Yobe State, Nigeria. In order to identify positive subjects, *Salmonella typhi* had to be identified from the stool of each subject that participated in the study using the stool culture test (SCT). Also, the distribution of the disease in relation to age, gender and some risk factors (source of drinking water, treatment of water and sanitation level of the patients) were determined.

Materials and methods

Study area and subject

The study was carried out in General Hospital Gashua Yobe State, Nigeria at Department of Medical Laboratory Parasitology/Microbiology unit. Gashua is a city found in Bade Local Government Area of Yobe State, in North-Eastern Nigeria. It is located 12.87 latitude and 11.04 longitude and it is situated at elevation 339 meters above sea level. A total of 197 subjects attending the General Hospital Gashua, Yobe State, Nigeria for medical consultation were recruited for the study. Their blood and stool samples were collected and tested. Ethical clearance was obtained from the Medical Ethical and Scientific Committee of the General Hospital Gashua, Yobe State before the commencement of this work. Also consent was sought from the participants. Only those who gave their consent were recruited in the study.

Sample collection and laboratory procedure

Blood samples were collected from patients using venipuncture method. Sterile stool bottles were labeled accordingly and given to the patients for the collection of stool sample. The samples were collected and taken to the laboratory immediately for laboratory examinations. Four procedures were used for the identification of *Salmonella typhi*. These are Widal test, stool culture, Gram staining and biochemical tests. Widal test was used as a quick presumptive serological test, while stool culture using Salmonella/Shigella Agar, Gram staining and biochemical tests were used to confirm isolation of *Salmonella typhi* (Cheesbrough, 2005) [11].

Results

All the isolates of *Salmonella typhi* were found to be Gram-negative rods with polar flagellation and negative to indole and urease tests but positive to coagulase and catalase tests. Out of the total 197 patients that were tested for TF using the stool culture test, 55 patients were positive constituting 27.9% prevalence (see Table 1).

Table 1: Prevalence of Typhoid Fever Using Stool Culture Test (SCT)

Method	Number Examined	Number positive (%)	Number negative (%)
SCT	197	55 (27.9)	142(72.1)

Table 2: shows the prevalence of TF in relation to age and gender. Age group of 10 years and below had 15 subjects in which 9 tested positive to TF, out of the 80 subjects in the age group of 11-20 years 10 were tested positive to TF, 11 subjects out of 39 in the age group of 21-30 years tested positive to TF and 25 subjects out of 63 in the age group of above 30 years tested positive to TF. The result showed that subjects in the age group of 1-10 years had the highest prevalence 60.0% while age group of 11-20 years had lowest prevalence of 12.5%. In regards to gender of the patients, majority of the study participants were female with 36 out of 118 tested positive to TF and they had the highest prevalence at 30.5% compared to the 19 out of 79 males that tested positive to TF with the lowest prevalence at 24.1%.

Table 2: Prevalence of Typhoid Fever in Relation to Age and Gender

Biodata(Age)	Number Examined	Number positive (%)	Number negative (%)
1-10	15	9(60.0)	6(40.0)
11-20	80	10(12.5)	70(87.5)
21-30	39	11(28.2)	28(71.8)
>30	63	25(39.7)	38(60.3)
Total	**197**	**55(27.9)**	**142(72.1)**
Gender			
Female	118	36(30.5)	82(69.5)
Male	79	19(24.1)	60(75.9)
Total	**197**	**55 (27.9)**	**142(72.1)**

Table 3: shows the prevalence of TF in relation to some risk factors. The study analyzed patients based on sources of drinking water. It was found that 47 use borehole out of which 10 tested positive to TF, 10 subjects out 77 tested positive to TF for using tap water, 5 subjects out of 33 tested positive to TF for using well water and 30 subjects out of 40 tested positive to TF for using river water. Subjects whose source of water is from river had the highest prevalence of 75.0% compared to patients who had other sources of drinking water. Out of the 197 subjects, 80 of them do treat their water before usage but 15(18.8%) of them were tested positive to TF while 40 subjects out of the remaining 117 subjects that do not treat their water were tested positive for TF. Hence a high prevalence (34.2%) of TF occurs when subjects do not treat their water before usage.

Table 3: Prevalence of Typhoid Fever in Relation to Some Risk Factors

Risk Factors	Outcome	Positive (%)	Negative (%)
Sources of drinking water			
Borehole	47	10(21.3)	37(78.7)
Tap water	77	10(13.0)	67(87.0)
Well	33	5(15.2)	28(84.8)
River	40	30(75.0)	10(25.0)
Total	**197**	**55(27.9)**	**142(72.1)**
Water Treatment			
Yes	80	15(18.8)	65(81.2)
No	117	40(34.2)	77(65.8)
Total	**197**	**55(27.9)**	**142(72.1)**
Sanitation Level			

Better	60	12(20.0)	48(80.0)
Good	20	5(25.0)	15(75.0)
Poor	77	23(29.9)	44(57.1)
Poorer	40	20(50.0)	20(50.0)
Total	**197**	**55(27.9)**	**142(72.1)**

Table 3: clearly shows that subjects with poor and poorer level of sanitation had the highest prevalence of TF with 29.9% and 50% respectively. Also, if sanitation level is collapsed to two levels, that is, to Good and Poor by combining the total of better and good to become 80 and poor and poorer to become 117, it was also found that subjects with poor sanitation level has the highest prevalence of TF at 36.8%.

Discussion

In this study our sample population were all rural residents therefore the high percentage prevalence. This could be explained by suboptimal access to safe water, lack of hygienic environment, lack of toilet and/or hand washing practice after toilet, open defecation practices near to the springs and rivers and inadequate medical care are common in the rural residence that may serve as a carrier for transmission (Dewan *et al.*, 2013) [14].

The findings in this present study revealed a prevalence of 27.9% among patients attending the General Hospital Gashua, Yobe State and this is similar to study carried out by Alhassan *et al.*, 2012 [6] in Sokoto State, Nigeria who reported a prevalence of 26% and contrast study carried out in Minna, Niger State by Adabara *et al.*, 2012 [3] who reported a prevalence of 45.0%. Also, this study presents a confirmatory result based on the SCT and it is supported by the study done by Abioye *et al.*, 2017 [1] who had a higher prevalence in stool culture method compared to widal test method. To avoid poor result both the SCT and Widal test were applied in this study. The Widal test was used as a preliminary test and the SCT as confirmatory. Therefore, stool culture method where the growth of *Salmonella typhi* is evidence of infection is a confirmatory and more reliable method for the diagnosis of TF and should be relied upon.

The findings in the present study suggested that people of all ages are susceptible to infection by *S. typhi*. However, there is a higher prevalence in the age group of 1-10 years (60.0%). These results concur with the study carried out by Abubakar (2015) [2] in Kano State which showed high prevalence among children in Kano metropolis with the disease. Children at early ages are playful, very active and curious and such behaviors expose them to risks of contracting typhoid fever. It is also reasoned that children form the most vulnerable group in environments where inadequate water supply and poor environmental hygiene are problems because of their high level of ignorance. They are usually quick to satisfy their thirst irrespective of the water source especially if the water is apparently clean and without color. However, the result in this study contrasts that of Abioye *et al.*, 2017 [1] who recorded highest prevalence in the age group of 16-20 years and 21-25 years. The lower prevalence in higher age groups in this study could indicate that the group is relatively resistant due to frequent boosting of immunity (Mastroeni and Maskell, 2005 and Parry, 2006) [20, 24].

Although the high prevalence recorded in this work is reflected in both genders, the prevalence is comparatively higher in females than in males (30.5% in females 24.1% in males). This may be due to the fact that most females who perform most of the house chores are the ones who fetch water from polluted water bodies like wells and streams thus making them highly vulnerable to the infection. The assertion that the disease is more prevalent among females than males falls in line with the works of (Udeze *et al.*, 2010) [25] and (Uttah *et al.*, 2000) [26] who reported prevalence rates of 42.4% for females, 33.0% for males and 68.2% for females, 58.0% for males, respectively. This result contrasts the work done by Alajeely *et al.*, 2014 [5] who reported higher prevalence among males than females.

Untreated Water are not safe for drinking because feacal matter may gain access into the water through runoff water or through seepage from sewers and pit latrines which could have been a major contributing factor to the high bacteremia cases. Wild animals and even domestic animals may drink from the same rivers; their feaces and urine contaminate the river water. River water is further contaminated by people who may bath in them (Mweu and English, 2008) [22]. This study showed that people who had their sources of water from the river had highest prevalence and also those that do not treat their water had highest prevalence. This could also be as a result of consumption of unsafe drinking water and food from outside sources (Ibegbulam *et al.*, 2014) [15].

Poor sanitation (as a result of lack of sufficient safe drinking water, toilet and water for hand washing after the toilet) is a major risk factor of typhoid fever and this result revealed that patients who practiced poor sanitation had the highest prevalence.

Conclusion

Typhoid fever is a major public health problem and also a problem in this community. From the investigation carried out the prevalence of TF stood at 27.9% using the SCT which is a more confirmatory method in detecting TF. It is clear that TF is still a serious health problem, therefore, it is recommended that the public should be made aware of the modes of transmission, and the need for proper hygiene and sanitation should be emphasized.

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