



Prevalence of Typhoid Infection among Pregnant Women Attending Specialist Hospital Yola, Adamawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration of the authors. Author KHK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KHK and AIA managed the analyses of the study and literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Typhoid fever is one of the major and common health problem worldwide. Typhoid fever caused by *Salmonella typhi* may be a cause of significant morbidity and mortality in both the mother and fetus in developing countries, where sanitation facilities, personal and food hygiene are inadequate. Thus, the present research was a cross-sectional study of Salmonella infection among pregnant women in Specialist Hospital Yola, Nigeria. The objectives of this study is to determine the prevalence of typhoid infection among pregnant women in Adamawa state in relation to age, educational level, occupation and location, explore factors associated with the infection and to provide information on its prevention and control strategies. Serological analyses (Widal test) and bacteriological analyses (stool culture) were carried out and compared among 313 participants. The results obtained showed that 209 (66.77%) of the participants were seropositive for typhoid fever, whereas 188 (60.06%) were positive based on bacteriological technique. Participants between age groups; 26-35 years old had the highest prevalence of 64.10%. There was no statistically significant difference ($P>0.05$) between the prevalence of typhoid fever among the various age groups of the

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pregnant women examined. In relation to Educational level, participants with Non-formal education had the highest prevalence of typhoid infection 75.00%. There was no statistically significant difference ($P>0.05$) between the prevalence of typhoid fever based on the educational level of the pregnant women examined. Based on occupation of the participants, women who were involved in farming recorded the highest prevalence rate of 88.37%. There was statistically significant difference ($P< 0.05$) between the prevalence of typhoid fever and the occupation of the pregnant women examined. With respect to the location of the participants, subjects belonging to Semi-urban areas recorded the highest prevalence of 80.98%. There was statistically significant difference ($P< 0.05$) between the prevalence of typhoid fever and the location of the pregnant women examined. Pregnancy state makes the women more vulnerable to typhoid fever by affecting the physiology of pivotal organs, as such causing complications in pregnant women therefore early and prompt diagnosis of the infection is essential.

Keywords: *Salmonella typhi*; widal test; bacteriological technique; pregnancy; enteric fever.

1. INTRODUCTION

Typhoid fever is amongst the major prevalent disease in Nigeria due to various interconnected factors such as scarcity of social amenities for handling unwanted products, poor hygienic environment, absence of or insufficient clean water supply and abuse of antibiotics; these amongst other factors are responsible for the widespread of typhoid fever affecting both young children and adults [1]. Typhoid fever caused by *Salmonella typhi* is a bacterial, gram-negative anaerobes which is endemic in the tropic and sub-tropic and has become a major health problem in developing countries of the world with an estimated annual incidence of 540 per 100,000 [2].

Each year, typhoid and paratyphoid fever, respectively, cause an estimated 26 million and 5 million illnesses globally [3]. Typhoid fever is a systemic infection, the acute illness is characterized by prolonged fever, headache, nausea, loss of appetite, constipation and sometimes diarrhea. Symptoms are often non-specific and clinically non-distinguishable from other febrile illnesses. However, clinical severity varies and severe cases may lead to serious complications or even death. It is also worth mentioning that cutaneous manifestations (presence of pink spots on the trunk: roseola) and dissociation between pulse and temperature can occur [4].

Salmonella typhi may be a cause of significant morbidity and mortality in both the mother and foetus in developing countries, where sanitation facilities, personal and food hygiene are inadequate [2]. Due to the hormonal changes that suppress immunity, pregnant women are at an increased risk for getting food-borne

infections [5]. Risk factors associated with typhoid infection include eating food prepared outside the home, such as ice creams or flavored ice drinks from street vendors, drinking contaminated water and eating vegetables and salads that have been grown with human waste as fertilizer [6]. Indirect environmental transmission may have also contributed to disease spread and transmission of infection via house flies from human waste to food may also be a possibility in the environment [7].

Humans are the only known hosts of *Salmonella typhi*. Bacteria are shed in the faeces of an infected person and transmitted from person to person via ingestion of food or water contaminated by these faeces (faecal-oral route). Large outbreaks of typhoid fever are often associated with contamination of a drinking water [8].

Typhoid fever in pregnancy is associated with adverse pregnancy outcomes such as premature deliveries, spontaneous abortions, low birth weight babies and intra-uterine foetal deaths [5]. *Salmonella typhi* causes septicemia of digestive origin that can cross the placenta resulting in chorioamnionitis. Vertical transmission of *S. typhi* occurs via transplacental spread of the organism and neonatal infection canals occur by transmission through the lower birth canal or from exposure to maternal blood [9]. The manifestation of *S. typhi* may vary; however abdominal pain, fever, nausea, and vomiting are usually present. In pregnancy, this combination of symptoms presents a diagnostic challenge, as the differential diagnosis of abdominal pain is long [9]. Typhoid and paratyphoid fever are clinically indistinguishable and bacterial culture remains the gold standard for diagnosis [10,11]. Antimicrobial therapy has

reduced typhoid case-fatality rates from 15%–20% to <1% [6]. However, antibiotic resistance is a challenge for effective treatment of typhoid infection and is likely to become increasingly problematic with the spread of multi-drug resistant strains [12].

It is important to screen for *Salmonella typhi* in view of its negative impacts on pregnant women and the high morbidity and mortality rates that characterize the disease, especially in the developing countries like Nigeria. Although, studies have been carried up on typhoid infection in most parts of the country, information is still inadequate on the prevalence of typhoid fever among pregnant women in Adamawa State. The objectives of this study therefore are to determine the prevalence of typhoid infection among pregnant women in Adamawa state in relation to age, educational level, occupation and location, explore factors associated with the infection and to provide information on its prevention and control strategies.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Yola-North Local Government area of Adamawa state Nigeria which has population of 336,648 [13] and it is located in central zone of Adamawa state which lies between latitudes 9° 11'N to 9°N and longitude 12° 20'N to 12° 39'N covering a tropical climate marked by dry and rainy season. Yola has an annual rainfall which usually commences around April and ends in October, and a dry season from the month of November to March. Temperature drops in the rainy season especially in the month of June to October. Yola North is both an administrative Centre and agrarian community. The major occupations of resident are civil servants, Artisans, traders and farmers.

2.2 Sample Collection Site

The samples were collected in antenatal care unit of Specialist Hospital Yola, located at hospital road, Yola-North Local Government Area. The samples were collected between the months of July to September 2019 from 313 pregnant women who reported in the unit for medical care and consented to participate in the study.

2.3 Ethical Clearance

Introductory letter was obtained from the department of Zoology, Mautech Yola. The letter was taken to the hospital management to seek for their permission before the commencement of the research work. Consent was sought and obtained from participants before they were enrolled into this study. Approval for the study was obtained from the hospital management, the approval was on the agreement that good laboratory practice must be ensured, and that every participant's finding would be treated with utmost confidentiality and for the purpose of the research only.

2.4 Blood Collection and Widal Test

The upper part of the arm of each participant was tied, a little above the elbow with a tourniquet to make the vein more prominent. The vein was then traced and the overlying skin was disinfected using cotton wool soaked with methylated spirit. A sterile needle was inserted into the vein horizontally to collect blood, after which the tourniquet was untied and the needle withdrawn from the arm gently. A dry sterile cotton wool was placed over the area to avoid continuous flow of blood. The blood was dispensed gently into an Ethylenediaminetetraacetic acid (EDTA) container and was taken to the laboratory for processing.

Sera obtained from the blood samples and the test reagents (previously stored in the refrigerator at 2-8°C) were brought out of the refrigerator and left on the work bench for an hour to attain room temperature; after which the Widal test was carried out using each participant's serum. A drop of antigens of the chromatest Widal test kit was added to 0.05 ml of test serum on the rocking board. The contents of each circle were mixed separately and spread in the entire circles. The test board or slide was rocked gently for one minute to observe for agglutination. The titre was read before one minute duration as directed by the manufacturer of the Widal kit. No agglutination up to one minute is a negative test, and indicates the absence of corresponding antibodies. Agglutination within one minute is a positive test, and indicates presence of corresponding antibodies. Agglutination titre greater than 1:80 is considered significant and usually suggestive of infection [14].

2.5 Stool Sample Collection and Culture

Patients were instructed on how to collect the early morning stool, which is more concentrated into sterile plastic container. The stool samples were equally transferred to the laboratory for culturing. The culture plates were labeled according to the participant's number, a pinch from each stool sample was inoculated into freshly prepared Deoxycholate Citrate Agar (DCA) and *Salmonella-Shigella* Agar (SSA) using sterilized wire loop and incubated at 37°C for 24 h aerobically in bacteriological incubator [15]. The procedure involved the isolation and identification of *Salmonella* on the basis of their morphology, staining property, motility and biochemical test, for identification of suspected *Salmonella typhi* according to the methods described [16]. Using stool culture technique all positive plates yielded pinkish mucoid colonies with black centers on *Salmonella/Shigella* Agar. The colonies were large with smooth/entire margin and convex in elevation. The biochemical tests revealed the isolates to be catalase positive, oxidase negative, urease negative and motility positive. The Gram reaction and microscopy showed the isolates to be Gram negative rods with polar flagellation.

3. RESULTS

The seroprevalence (Widal test) and prevalence (by bacteriological analysis) of typhoid infection obtained from this study is 66.77% and 60.06% respectively (Table 1).

Three hundred and thirteen (313) samples of pregnant women were tested during this study. Of these a total of 188 samples were found to be positive for *S. typhi* with a general prevalence of 60.06%.

Table 2 shows the prevalence of typhoid infection with respect to age of the pregnant women in the study area; the results shows that *S. typhi* infection was highest in the age group of 26-35 years where 100 out of 156 were positive with a prevalence of 64.10% and the least was found in the age bracket 36- 45 years where 53 out of 98 were positive with a prevalence of 54.08%. The distribution of the infection was statistically insignificant ($p > 0.05$) to the age of the participants. Table 3 shows the prevalence of typhoid infection in relation to educational level of the study participants; the results shows that *S. typhi* infection was highest in those with Non-formal education where 3 out of 4 were positive with a prevalence of 75.00% and the least was found in those with tertiary education where 55 out of 98 were positive with a prevalence of 56.12%. The distribution of the infection was statistically insignificant ($p > 0.05$) to the educational level of the participants. Table 4 shows the prevalence of typhoid infection based on occupation of the study participants; the results shows that *S. typhi* infection was highest in those that are farming where 38 out of 43 were positive with a prevalence of 88.37% and the least was found in those that are employed where 37 out of 101 were positive with a prevalence of 36.63%. The study found a significant association between typhoid ($p < 0.05$) and the occupation of the participants.

Table 5 shows the prevalence of typhoid infection in relation to location of the study participants; the results shows that *S. typhi* infection was highest in those that reside in semi-urban areas where 132 out of 163 were positive with a prevalence of 80.98% and the least was obtained in those that reside in the urban areas where 36 out of 141 were positive with a prevalence of 25.53%. The distribution of the infection was statistically significant ($p < 0.05$) to the location of the participants.

Table 1. Widal test compared with Stool culture

Method adopted	No. examined	No. infected (%)	No. uninfected (%)
Widal test	313	209 (66.77)	104 (33.23)
Stool culture	313	188 (60.06)	125 (39.94)

Table 2. Prevalence of typhoid infection by age among pregnant women in the study area

Age group (years)	No. examined	No. infected (%)	No. uninfected (%)	X ² - value	P-value
16-25	59	35 (59.32)	24 (40.68)	2.536	0.281
26-35	156	100 (64.10)	56 (35.90)		
36-45	98	53 (54.08)	45 (45.92)		
Total	313	188 (60.06)	125 (39.94)		

Table 3. Prevalence of typhoid infection in relation to Educational level of the study participants

Educational level	No. Examined	No. Infected (%)	No. Uninfected (%)	X ² – value	P-value
Primary	42	25 (59.52)	17 (40.48)	0.668	0.881
Secondary	169	96 (56.80)	73 (43.19)		
Tertiary	98	55 (56.12)	43 (43.88)		
Non-Formal	4	3 (75.00)	1 (25.00)		
Total	313	179 (57.19)	134 (42.81)		

Table 4. Prevalence of typhoid infection based on occupation of the study participants

Occupation	No. Examined	No. Infected (%)	No. Uninfected (%)	X ² – value	P-value
Employed	101	37 (36.63)	64 (63.37)	39.956	0.0001
Business	84	57 (67.86)	27 (32.14)		
Student	20	11 (55.00)	9 (45.00)		
Farming	43	38 (88.37)	5 (11.63)		
Unemployed	65	42 (64.62)	23 (35.38)		
Total	313	185 (59.11)	128 (40.89)		

Table 5. Prevalence of typhoid infection in relation to location of the study participants

Location	No. examined	No. infected (%)	No. uninfected (%)	X ² – value	P-value
Urban	141	36 (25.53)	105 (74.47)	96.096	0.0001
Semi-urban	163	132 (80.98)	31 (19.03)		
Rural	9	7 (77.77)	2 (22.22)		
Total	313	175 (55.91)	138 (44.09)		

4. DISCUSSION

The findings in this study correlates with the findings of other researchers and report by the World Health Organization that typhoid infection is endemic in Nigeria and developing countries. A hospital-based cross sectional study was carried out among pregnant women at the antenatal care unit of Specialist Hospital Yola, Northeastern Nigeria. Three hundred and thirteen pregnant women were recruited, their blood and stool analyzed for *Salmonella typhi*, while socio demographic characteristics was assessed using questionnaires. We found typhoid infection rate of 60.06% among the pregnant women tested, indicating that typhoid is endemic in Nigeria which has continued to pose considerable health problems to the pregnant women and the general public. It is caused by *Salmonella* contaminated foods, drinks and poor hygiene, spares no age or sex and poses high risks to the pregnant women. Very few reports are available pertaining to typhoid fever in pregnancy and its effect on physiology of pivotal

organs [17]. In this study, 209 (66.77%) of the 313 blood samples gave positive Widal reaction. This indicates a high prevalence of typhoid infection among pregnant women in the study area. This is in agreement with the results obtained by other researchers who recorded a very high prevalence rate of typhoid infection among pregnant women: [2,18,19,20].

This is also similar to the results obtained among pregnant women [27, 28]. The bacteriological techniques used showed a lower prevalence of 188 (60.06%) out of the total screened. However, some of the participants may not be having the active disease. This is in agreement with the observations of Abioye et al. (2017) and Ezeigbo et al. (2015) [6,10] who recorded a higher positive rate of Widal test compared to stool culture. The higher positive rate of Widal test may be due to prior antibiotic therapy by some subjects that could have hindered the growth of the bacteria on culture medium. On the other hand *S. typhi* shares O and H antigen with other *S. serotypes* and has cross- reacting epitopes

with other Enterobacteriaceae, and this can lead to some false positive results [6]. Typhoid fever presents a greater diagnostic challenge. A single Widal test has even been pointed out to be of diagnostic value in the early stage of disease and thus help in reducing morbidity and mortality from typhoid [21]. This is in agreement with the findings of Reuben et al (2013) and Odikamnoro (2017) [2,21] in a similar study on Widal reaction as being relevance in diagnosing post-infection complications when *S. typhi* may not be isolated. On the other hand awaiting blood or stool culture results takes longer time which poses a significant dilemma [9]. Bacteriological culture remains the gold standard for definitive diagnosis of typhoid fever; lack of its immediate availability during the acute febrile illness may limit its use. Clinicians usually elect to treat, rather than wait for blood or stool culture results, which may take 3-5 days. While there might be some merit in this approach, particularly in areas where culture facilities are either poor or not available, and where Widal testing is the norm, the use of rapid antigen screening directly from the stool of the suspected patient would be more useful [2]. Typhoid fever in pregnancy increases the risk of unfavorable pregnancy outcomes such as preterm labour, intrauterine foetal death and spontaneous abortions [23,24]. Patients who travel to endemic areas during pregnancy should be aware of the risk of acquiring *S. typhi*. To minimize this risk while traveling, patients should practice strict food hygiene and avoid uncooked foods [9].

Participants within the age groups; 26-35 had the highest prevalence (64.10%) of typhoid fever. This might be because women within these age groups perform most household chores and fetch water from polluted source, handle foods that may be liable to contamination and also, the result may be attributed to the fact that the women in this age bracket are more involved in active reproduction than women of other age groups. This is in conformity to MarcChoisy et al (2017) [29]. In relation to educational level, highest typhoid prevalence was found among women with Non-formal education 75.00% and primary education 59.52% and least in women with tertiary education 56.12%. This high prevalence of typhoid infection found among pregnant women with Non-formal and primary education may be associated to the fact that women with low educational level subscribe to local herbs for the treatment of diseases, which may be due to poverty and cultural belief, Meseret et al. [26]. In relation to occupation,

farmers had the highest prevalence of 88.37% whereas the employed had the least prevalence of 36.63% respectively. Farmers spent most of their time involved in farming activity that serves as predisposing factors for Salmonella infection. Most of them are not educated; therefore they lack the basic knowledge of environmental, food and personal hygiene. The employed women that are enlightened had the least prevalence of typhoid fever from this study. They have more idea on sanitation and personal hygiene therefore; most of them carry out certain preventive and/or control measures to reduce their risk of getting exposed to infection. With respect to location of the study participants, those in semi-urban areas had the highest prevalence of 80.98% and the least was obtained among women in urban areas 25.53%. This could be attributed to poor environmental conditions which is associated with semi-urban areas Meseret et al. (2014). The variation in the prevalence of typhoid infection might be due to differences in method of diagnosis, year of study, season, differences in cultural practices and toilet facility Monica, L. Y and Heather E.J [25]. The implication of high percentage of typhoid infection in pregnancy is that, typhoid infection is reported to cause some complications such as spontaneous abortion, stillbirth, preterm labor, low birth weight and intrauterine growth restriction Pam et al. (2018). With respect to the age groups, the current study concord with the results obtained from other researchers where the highest prevalence of typhoid fever was recorded among pregnant women within age group 20-30 years Lilian et al (2015) and Michael, C. (2017) [2, 5]. The result of this study disagrees with the findings of Monica, L. Y and Heather E.J [25] where the highest prevalence of typhoid fever was recorded among pregnant women within age group 41-50 years. With respect to educational level, the result of this study is similar to the result obtained by MarcChoisy et al [29] where the highest prevalence of typhoid fever was found among subjects with low level of education. Regards occupation of the participants, the result of this study disagrees with the findings of Lilian et al [2] where the highest prevalence of typhoid infection was recorded among the House wives and least in students. MarcChoisy et al. [29] also recorded the highest prevalence of typhoid among participants who are involved in business and least among farmers.

For a pregnant patient with *S. typhi* once delivered, the neonate should be monitored for

signs of *S. typhi* respiratory distress; sepsis, icterus and pneumonia can indicate neonatal infection and may occur up to 10 days after birth [9]. The recommended antibiotic regimen for *S. typhi* infection in pregnancy is a third-generation cephalosporin or azithromycin. In the non-pregnant patient, if susceptible, fluoroquinolones such as ciprofloxacin may be given Kaistha N et al. [31]. In pregnancy, hemolysis with fever and hepatic dysfunction has been reported [9]. Pregnancy complications also include second trimester loss. Kaistha et al. [31] and preterm delivery Hasbun et al. [32] *S. typhi* should be included in the differential in pregnant patients who present with abdominal pain and fever after travel to endemic areas. Factors that influence contamination of drinking water are non-availability of piped water, poor sanitation and improper drainage of sewage Adogo, L.Y. [28]. Also individual's risky behaviours such as poor hand washing habit may be associated with typhoid infection Monica, L.Y and Heather E.J [25].

5. CONCLUSION

This present study indicated that the prevalence of typhoid infection in pregnant women in Yola is quite high and alarming and can adversely cause materno-foetal complications during pregnancy. Efforts through enlightenment programs should be made to promote enteric fever awareness - communities should also be educated on the importance of personal hygiene; Washing of hands often, clean household items daily and avoid risky foods and drinks. The government should also improve the living conditions of the people, especially in the areas of environmental sanitation as well as provision of basic life utilities, like the provision of portable water and public toilet most especially in rural and suburban areas where these facilities are lacking. These measures would stem the spread or transmission of the silent killer disease like typhoid and by so reduce the morbidity and mortality rate.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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