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Salmonella Infection and Associated Factors among Antenatal Clinic Attendees in Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria

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Abstract **Original Research Article**

Introduction: Typhoid fever is one of the major and common health problems 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.

Methodology: The is a descriptive cross-sectional study of Salmonella infection among 225 Antenatal clinic attendees in Irrua Specialist Teaching Hospital, Irrua, Nigeria. The objectives of this study is to determine the prevalence of salmonella infection among pregnant women in Irrua in relation to age, educational level, occupation and Gestational age, explore factors associated with the infection and to provide information on its prevention and control strategies.

Result: prevalence of *Salmonella typhi* infection in pregnant women attending antenatal clinic in ISTH is 12.0%). Women age 25-34 years old and those with tertiary education are at greater risk of the infection. However, age, gravidity, parity, level of education and ethnicity were not statistically significant factors determining salmonella infection in pregnancy. Occupation of the participants is the only associated risk factor for Salmonella infection in pregnancy. Unemployed women are more likely to be infected with Salmonella in pregnancy.

Keywords: Salmonella typhi, Serology test, Woman, Pregnancy, Antenatal, Clinic.

INTRODUCTION

Salmonella infections, including Typhoid fever are prevalent in Nigeria due to inadequacy of access to good water supply, poor personal and environmental hygiene practices.[1]Salmonellosis is a major and common health problem worldwide. As a gastrointestinal infection, it is

considered a major risk during pregnancy, as it causes reduced motility in the gastrointestinal and the biliary tracts resulting in biliary sludge, concretions, cholestasis and constipation. It is caused by *Salmonella typhi*, a gram negative rods which is endemic in the tropics and subtropics and has become a disease of public health concern.[1] Antibiotic resistance among salmonella makes the choice of initial treatment of infection difficult and also potentiates risk of using some antimicrobial agent deemed unsafe in pregnancy. The annual incidence is 540cases per 100000 people with about 17million cases worldwide.[1,2] Globally, an estimated 2.2million new cases of typhoid fever occurs with about 200,000 deaths annually.

Typhoid fever is a systemic infection caused by enteric serotype typhi, a human specific pathogen highly adapted for persistence and transmission among humans. The greatest burden of the disease is in regions of developing world where overcrowding, poor sanitation, and poor hygiene persist. It occurs from ingestion of food or water contaminated by gastrointestinal or urinary carriers. 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.[3, 4] *Salmonella typhi* causes septicemia of gastrointestinal origin that can cross the placenta resulting in chorioamniotis. Vertical transmission of *S. typhi* occurs via transplacental spread of the organism and neonatal infection can also occur by transmission through the lower birth canal or from exposure to maternal blood. The manifestations of *S. typhi* may vary; however abdominal pain, fever, nausea, and vomiting are usually present. In pregnancy, this combination of symptoms may present a diagnostic challenge as they are similar to symptoms of other endemic diseases like malaria. Typhoid and paratyphoid fever are clinically indistinguishable and bacterial culture remains the gold standard for diagnosis.[4]

The reduction in peristaltic force and frequency normal for gestation, use of acid reducing medications needed for gastroesophageal reflux in pregnancy increases the risk of gastroenteric infections. In pregnancy uteroplacental infection could lead to fetal loss. Gastrointestinal complications like, gastrointestinal perforation and bleeding could result from delay in presentation, diagnosis and treatment.[5] Confusion, obtundation, and septic shock could also occur leading to death. [6,7,8] Due to the hormonal changes that suppress immunity, pregnant women are at an increased risk for getting food-borne infections . Hormonal changes which occur during pregnancy impair the cell mediated immune response and they increase the susceptibility of pregnant women to various infections.[4] Pregnancy is considered a high risk factor for acquisition of Salmonella infections. Infection is a major cause of maternal, fetal and neonatal mortality and morbidity worldwide. In the developing world, Typhoid infections among pregnant women are maternal systemic infections, and are often caused by poverty, overcrowding, and malnutrition which imposes health costs to the mother and risks to the fetus.[1,2] These risks include spontaneous abortion, stillbirth, preterm labour and preterm birth, low birth weight, intrauterine growth restriction (IUGR), and infection. A systemic review by Akinyemi, gave a prevalence of 12.3% for *Salmonella typhi* in south-south region in the general populace.[8] This is at variance with the results obtained by other researchers who recorded a very high prevalence rate of typhoid infection among pregnant women. This high prevalence rate is also similar to the results obtained among pregnant women in Adamawa, Bauchi, and Niger states where they had 66.77%, 63% and 67.85 %.[1,4,9] In the Keffi and Adamawa study, the highest prevalence was seen among women within the age group 26-30years, and 26-35years.[1,2] This is also in conformity to MarcChoisy et al (2017) but disagrees with the findings of Monica LY and Heather where the highest prevalence of typhoid fever was recorded among women with the age group 41-50years. [11,12]The study done in Adamawa showed that the highest prevalence was seen in

patients with primary education 59.52% and least in women with tertiary education 56.12%, and also at variance with the study done by Hassan, Omar and MarcChoisy et al, where those with lower educational level had higher prevalence rates.[4,12] There is no record of salmonella infection in pregnancy in the study area. This study therefore aimed at determining the prevalence and the risk factors influencing typhoid among pregnant women attending ANC in ISTH.

MATERIALS AND METHODS

Study Design and Setting

This is a descriptive cross-sectional study conducted among pregnant women attending Antenatal Clinic in Irrua Specialist Teaching Hospital, Irrua, in Edo state, a rural community in south-south geopolitical zone, Nigeria. The state is bounded by Delta state to the South, Kogi state to the north, Ondo state to the west and the river Niger to the Eastern border. The hospital is a 550 bed hospital located along Benin Abuja expressway in Irrua, a semi urban area and headquarters of Esan Central Local Government Area of Edo State. It serves all the three senatorial districts as well as Delta, Kogi, and Ondo State, and the people of the region are predominantly farmers and traders from low and medium income settings. There are also civil servants as well as artisans. It is also the centre of excellence for Lassa fever research and other haemorrhagic fevers. It also serves as the teaching hospital for Ambrose Alli University.

Sample Size Determination

The minimum sample size was determined using the formula for estimating a single proportion sample size: $n=Z^2pq/d^2$. In this formula: n=represents the minimum sample size; Z is the standard normal deviate at a 95% confidence level, which corresponds to 1.96; P is the prevalence of *typhoid infection among* pregnant women from a previous study, which is 18.6%[14]; Q is (1-p), i.e. (1-0.186), which is equal to 0.816, and d is precision of 0.05. The estimated sample size was 223.6 and it was rounded up to 225.

Sampling Technique

Consecutive sampling was employed for all patients who met the eligibility criteria and granted informed consent to participate in the study.

Data Collection

Semi-structured interviewer-administered questionnaire containing sociodemographic and clinical information of the participants was administered to respondents who met the inclusion criteria by the researchers and trained assistants. This was done daily between the hours of 8am to 4pm for a period of 3 month. The procedure was explained to the study participants and thereafter a written informed consent was obtained from those who agree to participate. Patients who were recently treated for Salmonella infection or who had received antibiotics in the preceding 4 weeks were excluded. Participants were later tested for Salmonella infection. Data were stored in a pass worded computer to ensure confidentiality.

Testing for *Salmonella typhi*

Under aseptic procedure and strict adherence to standard precautions, venepuncture was done to collect 0.5 ml of blood into an EDTA bottle. A chromatographic lateral flow immunoassay which detects IgM antibodies specific to *Salmonella typhii* was used to verify Salmonella infection. Specifically, Instant- View © *Salmonella typhii* Rapid Test Kit manufactured in the United States with sensitivity of 95.1% and a specificity of 94.1% was used according to the manufacturer's guide

Data analysis

Data was analysed by descriptive and inferential statistics using Statistical Package for Social

sciences (SPSS), IBM SPSS Statistics for windows, Version 20.0, Armonk, NY: IBM Corp. Means and standard deviations (SD) was calculated for continuous variables like age and weight while proportions were calculated for categorical variables. Categorical variables were compared using the fisher's exact test. Level of significance was set at *P* value of less than 0.05 or 95% confidence interval (CI) and variable with *P* value less than 0.05 was considered a risk factor of *salmonella* infection in pregnancy.

Ethical Consideration

Ethical clearance was sought and obtained from the ISTH Hospital Institutional Ethical Review Committee. Patients were recruited after obtaining informed consent from them. The study was conducted in line with the Helsinki guidelines of 1975 on the conduct of human experiments.

RESULTS

Sociodemographic characteristics of the Pregnant Women attending Antenatal Clinic (ANC) in ISTH

Table 1 shows the sociodemographic characteristics of women attending ANC in ISTH. The mean age was 31.53 (SD = 6.03) years, with the majority (54.7%) aged 25–34 years. Most respondents were Christians (95.1%) and married (98.2%). In terms of reproductive characteristics, 38.2% were nulliparous, while 31.1% were primiparous, and majority (59.6%) were in their third trimester. The predominant ethnic group was Esan (65.8%). Most respondents had tertiary education (67.6%), and over half (50.7%) were engaged in trading.

Table 1: Sociodemographic characteristics of Pregnant Women attending ANC in ISTH

N = 225

Variables	Frequency (n)	Percentage (%)
Age (in years)		
15 to 24	28	12.4
25 to 34	123	54.7
35 and above	74	32.9
Mean age 31.53 (± 6.03)		
Religion		
Christianity	214	95.1
Islam	11	4.9
Marital Status		
Single	4	1.8
Married	221	98.2
Parity		
Nulliparous (0 childbirth)	86	38.2
Primiparous (1 childbirth)	70	31.1
Multiparous (2 to 4 Childbirth)	63	28.0
Grand-parous (5 or more childbirth)	6	2.7

Gravidity		
1 to 2	70	31.1
3 to 4	63	28.0
5 or more	6	2.7
Trimester		
First Trimester	10	4.4
Second Trimester	81	36.0
Third Trimester	134	59.6
Ethnicity		
Esan	148	65.8
Bini	14	6.2
Etsako	18	8.0
Igbo	16	7.1
Yoruba	6	2.7
Hausa	1	.4
Others	22	9.8
Level of Education		
Primary	6	2.7
Secondary	67	29.8
Tertiary	152	67.6
Occupational Status		
Unemployed	4	1.8
Self Employed	46	20.4
Student	10	4.4
Business/Trader	114	50.7
Civil Servant	18	8.0
Professional	20	8.9
Teacher	13	5.8

PREVALENCE OF TYPHOID INFECTION AMONG PREGNANT WOMEN ATTENDING ANC in ISTH

Table 2 shows the prevalence of typhoid infection among the respondents. Out of the total respondents, 12.0% tested positive for typhoid, while the majority (88.0%) tested negative.

Table 2: Prevalence of Typhoid Infection among Pregnant Women Attending ANC in ISTH

N = 225

Variables	Frequency (n)	Percentage (%)
TyphoidTest		
Negative	198	88.0
Positive	27	12.0

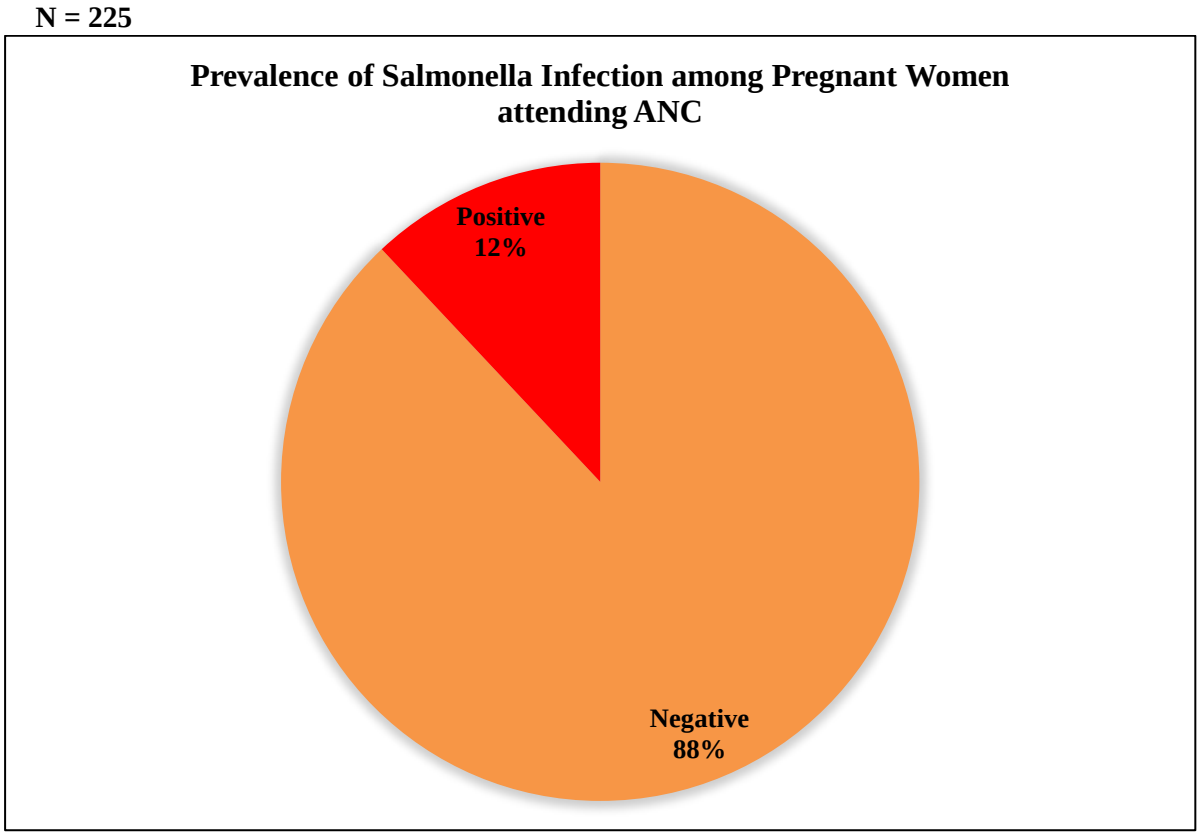

Figure 2: Pie chart of Prevalence of Salmonella Infection among Pregnant Women attending ANC

Sociodemographic Factors Associated with Typhoid in Pregnant Women attending ANC in ISTH

Table 3 shows the association between sociodemographic characteristics and typhoid among pregnant women attending ANC. There was no statistically significant association between age group and typhoid (Fisher's Exact = 0.360, p = 0.878). Similarly, there was no statistically significant association between religion and typhoid (Fisher's Exact = 1.577, p = 0.369), as well as marital status (Fisher's Exact = 0.540, p = 0.600). In terms of reproductive characteristics, parity was not significantly associated with typhoid (Fisher's Exact = 5.785, p = 0.106). Likewise, there was no statistically significant association between gravida and typhoid (Fisher's Exact = 4.633, p = 0.094), nor between trimester and typhoid infection (Fisher's Exact = 1.010, p = 0.676).There was also no statistically significant association between ethnicity and typhoid (Fisher's Exact = 6.285, p = 0.355). Similarly, level of education was not significantly associated with typhoid (Fisher's Exact = 2.986, p = 0.205). However, there was a statistically significant association between occupational status and typhoid (Fisher's Exact = 23.017, p < 0.001). Higher proportions of typhoid were observed among unemployed respondents (100.0%) and teachers (30.8%) compared to other occupational groups.

Table 3: Sociodemographic Factors Associated with Typhoid in Pregnant Women attending ANC in ISTH

Socio-Demographic Characteristics	Typhoid Infections		Total n= 225 (%)	Fisher's Exact	p value
	Absent n = 198 (%)	Present n = 27 (%)			
Age Group					
15 to 24	24 (85.7)	4 (14.3)	28 (100.0)	0.360	0.878
25 to 34	109 (88.6)	14 (11.4)	123 (100.0)		
35 and above	65 (87.8)	9 (12.2)	74 (100.0)		
Religion					
Christianity	187 (87.4)	27 (12.6)	214 (100.0)	1.577	0.369
Islam	11 (100.0)	0 (0)	11 (100.0)		
Marital Status					
Single	4 (100.0)	0 (0)	4 (100.0)	0.540	0.600
Married	194 (87.8)	27 (12.2)	221 (100.0)		
Parity					
Nulliparous	78 (90.7)	8 (9.3)	86 (100.0)	5.785	0.106
Primiparous	58 (82.9)	12 (17.1)	70 (100.0)		
Multiparous (2 to 4	58 (92.1)	5 (7.9)	63 (100.0)		
Childbirth)	4 (66.7)	2 (33.3)	6 (100.0)		
Grand-parous (5 or more childbirth)					
Gravida					
1 to 2	136 (87.2)	20 (12.8)	156 (100.0)	4.633	0.094
3 to 4	50 (94.3)	3 (5.7)	53 (100.0)		
5 or more	12 (75.0)	4 (25.0)	16 (100.0)		
Trimester					
First Trimester	9 (90.0)	1 (10.0)	10 (100.0)	1.010	0.676
Second Trimester	69 (85.2)	12 (14.8)	81 (100.0)		
Third Trimester	120 (89.6)	14 (10.4)	134 (100.0)		
Ethnicity					
Esan	127 (85.8)	21 (14.2)	148 (100.0)	6.285	0.355
Bini	14 (100.0)	0 (0)	14 (100.0)		
Etsako	18 (100.0)	0 (0)	18 (100.0)		
Igbo	14 (87.5)	2 (12.5)	16 (100.0)		
Yoruba	6 (100.0)	0 (0)	6 (100.0)		
Hausa	1 (100.0)	0 (0)	1 (100.0)		
Others	18 (81.8)	4 (18.2)	22 (100.0)		
Level of Education					
Primary	6 (100.0)	0 (0)	6 (100.0)	2.986	0.205
Secondary	55 (82.1)	12 (17.9)	67 (100.0)		
Tertiary	137 (90.1)	15 (9.9)	152 (100.0)		
Occupational Status					
Unemployed	0 (0.0)	4 (100.0)	4 (100.0)	**23.017**	**<0.001**
Self Employed	42 (91.3)	4 (8.7)	46 (100.0)		*****
Student	10 (100.0)	0 (0)	10 (100.0)		
Business/Trader	101 (88.6)	13 (11.4)	114 (100.0)		
Civil Servant	18 (100.0)	0 (0)	18 (100.0)		
Professional	18 (90.0)	2 (10.0)	20 (100.0)		

Teacher	9 (69.2)	4 (30.8)	13 (100.0)

*significant

DISCUSSION

The findings in this study correlate 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 Irrua Specialist Teaching Hospital Irrua, south-south Nigeria. Two hundred and twenty-five pregnant women were recruited; their blood samples were analyzed for *Salmonella typhi*, while sociodemographic and clinical characteristics were accessed using questionnaires. We found typhoid infection rate of 12.0% among the pregnant women tested, indicating that typhoid is endemic in Nigeria and it still 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. In this study, 27 (12.0%) of the 225 blood samples gave positive reaction. This indicates a lower prevalence of typhoid infection among pregnant women in the study area which is comparable to the result of the systemic review by Akinyemi, which gave a prevalence of 12.3% for *Salmonella typhi* in south-south region in the general populace.[8] This is however at variance with the results obtained in Northern Nigeria by other researchers who recorded a very high prevalence rate of typhoid infection among pregnant women in Adamawa, Bauchi and Niger states, 66.77%, 63% and 67.85% respectively.[1,4,9] The variation in the prevalence rates of typhoid infection in pregnancy might be due to the differences in method of diagnosis, year of study, geographical location, seasonal difference, difference in cultural practices and environmental conditions. However, the high prevalence in some of the studies may not be true picture of the prevalence, as the widal test used in determining Typhoid fever is not a reliable test. Single widal test titre is not diagnostic expect the baseline population titre is known or acute and convalescent stage titres were compared. The higher prevalence of typhoid may also be obtained where IgG is the targeted antibody. The kits used in this study targeted IgM and thus provides reliable information on the presence and acuteness of the salmonella infections in the participants. Owing to the endemicity of the disease and possible complications on mother and the unborn child, screening ANC attendees and treating them as appropriate is considered very appropriate in affected regions. This will help in reducing morbidity and mortality from typhoid. Though bacteriological culture remains the gold standard for definitive diagnosis of typhoid fever, its sensitivity is low in early phase of the disease. Blood culture, stool culture and urine culture yields relative reliable results at first, second and third weeks of infection respectively. This lack of immediate usefulness during the acute febrile illness may limit its diagnostic value. While there might be some merit of culture method of diagnosis, in areas where culture facilities are either poor or not available, antibody testing like the one used for this study or the use of rapid antigen screening directly from the stool of the suspected patient would be useful. Typhoid fever in pregnancy increases the risk of unfavorable pregnancy outcomes such as preterm labour, intrauterine foetal death and spontaneous abortions 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.

In this study, age, ethnicity, level of education, parity, gravidity, trimester, marital status and religion are not significantly association with typhoid in pregnancy. The only factor significantly associated with typhoid in pregnancy is participant's occupation. However the follow were observed. Participants, age 25-34 years had the highest prevalence (11.4%) of typhoid fever, which is similar to Keffi and Adamawa studies with highest prevalence seen in women within the age group 26-30years, and 26-35years. It disagrees with the findings of Monica LY and Heather,[11] where the highest prevalence of typhoid fever was recorded among women with the age group 41-50years.This might be because women within these age groups perform most the household chores, handling foods and water that may be contaminated. It may also be attributed to the fact that the women in this age bracket are more involved in active reproduction and childcare than women of other age groups. Some unhygienic practices like, rinse their children anus their bare hands after defecation using water without soap, and eventual use of the dirty hands to eat or prepare food renders them more prone to infection. Proper hand hygiene in accordance with WHO guideline is therefore recommended to reduce incidence and prevalence of typhoid fever.[15]

In relation to educational level, in this study the highest typhoid prevalence was found among women with tertiary education 9.9% , and least in those with primary education which is at variance with the study done in Adamawa, where the highest prevalence was seen in patients with primary education and least in women with tertiary education.[13] It is also at variance with the study done by MarcChoisy et al,[12] where those with lower educational level had higher prevalence rates. This high prevalence of typhoid infection found among pregnant women in this study with 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. In relation to occupation, the unemployed had the highest prevalence of 100% whereas the civil servants and students had the least prevalence of 0% respectively. This is similar to the Omar and Ukwu studies done in Bauchi and Rivers states respectfully where the unemployed had the highest prevalence. [4,7]The civil servants women that are enlightened had the least prevalence of typhoid fever from this study. They probably have more idea on sanitation and personal hygiene and therefore carry out certain preventive and/or control measures to reduce their risk of getting exposed to infection.

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, intrauterine growth restriction, low birth weight and neonatal sepsis.

AUTHORS' CONTRIBUTIONS

Adewuyi BT conceived the idea and conceptualized the study. The two authors were involved in literature search, development of research proposal, data collection and analysis, and writing of manuscript for publication.

DECLARATIONS

Conflict of interest: There is no conflict of interest.

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Ethics: Ethics and Research Committee, Irrua Specialist Teaching

Data availability: Available from the corresponding author on reasonable request.

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