Available online at www.worldscientificnews.com

World Scientific News

An International Scientific Journal

WSN 200 (2025) 132-140 EISSN 2392-2192

Malaria *Parasitaemia* Among Pregnant Women in Akure South Local Government, Ondo State, Nigeria.

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ABSTRACT

Malaria infection during pregnancy is a significant public health problem with substantial risks for the pregnant woman, her foetus, and the newborn child. Malaria complicates up to 58.1% of pregnancies in Nigeria. Its pathogenesis and clinical consequences further complicate diagnosis, treatment, and prevention, particularly in endemic regions. This study aimed to determine malaria *parasitaemia* among pregnant women in Akure South Local Government, Akure, Ondo State. A cross-sectional study was conducted at the University of Medical Science Hospital, Mother and Child Hospital, Sijuwade Specialist Hospital and Fatunla Hospital all in Akure South Local Government Area, Ondo State, Nigeria. Ethical clearance was obtained from the Ethical Review Committee of the Ondo State Ministry of Health, Akure (OSHREC). A total number of 509 pregnant women attending antenatal clinics in the four health centres in the study area were enrolled for the study. Blood samples were obtained from each of the pregnant women via venipuncture. Venous blood samples collected were transfered into Ethylene Diamine Tetra-Acetic acid (EDTA) anticoagulant bottles. Blood samples were examined for malaria parasite using thin and thick blood film microscopy method. Data analysis was done using SPSS 20.0. Chi-square (χ^2) to analyse the data generated at $P<0.05$ significance level. Result showed that out of 509 pregnant women sampled, 351 pregnant women tested positive for malaria infection, resulting in prevalence rate of 69.0%.The 351 infected pregnant women were further examined to check the level of *parasitaemia* (intensity).The intensity was classified into Low<1,000 Parasites/µl (%), Moderate 1,000 – 9,999 parasites/ µl (percentage) and Severe ≥ 10,000 parasites/ µl (%). This study identified a high prevalence of malaria *parasitaemia* among pregnant women with demographic factors such as age, marital status, trimester, and parity of the pregnant women. The study reveals a concerning prevalence of malaria infection among pregnant women in Akure South LGA.

Keywords: Blood samples, Intensity, Malaria, *Parasitaemia*, Pregnant Women, Akure South LGA

(Received 10 December 2024; Accepted 20 January 2025; Date of Publication 4 February 2025)

1. INTRODUCTION

Malaria is a life-threatening disease of public health problem caused by a protozoan parasite of the genus *Plasmodium* belonging to the Apicomplexans. Four species namely*, P. vivax*, *P. ovale*, *P. malariae* and *P. falciparum* are responsible for human malaria (WHO, 2015). The most serious forms of the disease are caused by *P. falciparum* and this accounts for about 80% morbidity and 90% mortality (Carter *et al.*, 2005). *Plasmodium* parasites are transmitted to people through the bites of infected female Anopheles mosquitoes called "malaria vectors." Though malaria is a curable and preventable disease, malaria continues to have an overwhelming effect on people's health globally, particularly among pregnant women and children in rural and urban areas (WHO, 2018). Recent World Malaria Report indicated that Nigeria accounts for 39 % of all malaria cases in the 45 malaria-endemic countries in Africa, showing clearly the challenge of malaria in Nigeria (Ivoke *et al*., 2013; WHO, 2014; Afolabi *et al*., 2015). *Plasmodium falciparum* is responsible for the majority of malaria infections that occur in pregnancy as compared to other species of the parasite (Nwonwu *et al*., 2009) Its rate of infection in pregnancy is twice that in non-pregnant women due to physiological changes and suppressed immunity during pregnancy (Okonofua *et al*.,2008). In pregnancy, a woman's risk of having infection increases due to changes in her hormone levels and immune system (Ribera, 2007). Malaria during pregnancy can result in serious consequences for both the mother and the foetus, including intrauterine growth restriction, congenital malaria, low birth weight, abortion, and stillbirth. In Nigeria, 11% maternal deaths are attributed to malaria (Federal Ministry of Health, 2010; WHO, 2014).

2. MATERIALS AND METHODS

2.1. Study Area

The study area is Akure South Local Government Area, domiciled in Akure, Ondo State, Nigeria. Samples were collected from University of Medical Sciences Teaching Hospital, Mother and Child Hospital, Fatunla Hospital, and Sijuwade Specialist Hospital.

2.2. Study Design and Blood Sample Collection

A cross-sectional study was conducted in four major maternity centres in Akure South Local Government Area, Akure, Ondo State, Nigerian. The blood sample collection followed the vein puncture technique of Epidi *et al. (*2008). With the help of a qualified Phlebotomist, puncture site was swabbed with cotton wool dipped in methylated spirit (methanol) and the puncture was made using a new sterile 2ml syringe.

The blood was transfered into a sterile Ethylene Diamine Tetra Acetic acid (EDTA) anticoagulant container. Each sample was labelled correctly with the patient's personal data like age, date of collection, and as well numbered to avoid any mix up.

Demographic data such as age, marital status, trimester, parity, blood groups, occupation, and educational background were obtained from the respondents using well-structured questionnaires.

2.3. Inclusion Criteria

Only pregnant women who reported themselves to the four major maternity centres and were voluntarily willing to participate actively in the study were recruited.

2.4. Screening for Malaria Parasite

Two separate drops of blood were placed on sterile microscope slides to prepare thin and thick blood films. Blood films were air-dried at room temperature and the thin blood film was fixed with absolute methanol. Then, blood films were stained with 10% Giemsa stain for 10 minutes (WHO, 2010). The stain was washed off with distilled water and allowed to dry after 10 minutes. Two drops of immersion oil were added to the film, and then viewed under the microscope at X100 oil immersion lens (Adeoye and Nga, 2007).

2.5. Malaria Parasite Intensity Determination

As described in a recent study (Umeh *et al*., 2012) parasite density per microlitre of blood was estimated by multiplying the number of parasites counted by 40, assuming a leucocyte count of 8000 cells µl of blood. The thick film was used for detection and counting of malaria parasite density. The degree of *parasitaemia* was graded as low, moderate, and severe (WHO, 2008). The formula used is stated as follows:

$$\textit{Parasite/µl blood} = \frac{\textit{No. of parasites counted x 8000 white cells/µl}}{\textit{No. of white cells counted}}$$

2.6. Ethics Committee Approval and Consent to Participate

The study was granted ethical approval from the Ondo State Health Research Ethics Committee of the Ondo State Ministry of Health, Akure (OSHREC) on 23rd April, 2021 with assigned number NHREC/18/08/2016 and protocol number OSHREC 16/4/2021/310. Participants were thoroughly informed about the study procedures and allowed to participate voluntarily. Written consents were obtained from the pregnant women who agreed to participate after they have been properly enlightened on the aims and objectives of the research before the commencement of the study.

2.7. Statistical Analysis

Results were analyzed using SPSS version 20.0. Chi-square test was used to determine significant differences. Significant difference in the prevalence of this categorized intensity in relation to the above stated variable was also checked using chi-square test. Statistical significance was set at $P<0.05$

3. RESULT

3.1. Intensity of Malaria Infection Among Pregnant Women in Relation to the Study Area.

Table 1 shows the intensity of malaria *parasitaemia* among the pregnant women examined in the study area. The result showed that low (<1,000 parasites/µl) to moderate (1,000 – 9,999 parasites/ µl) *parasitaemia* were observed among the pregnant women infected in the four hospitals. However, severe intensity (≥ 10,000 parasites/ µl) was observed in three pregnant women attending Mother and Child Hospital in Akure.

Table 1. Intensity of Malaria Infection among Pregnant Women in Akure South LGA.

Hospital	Number Examined	Number Positive	Intensity (parasites/µl)			χ^2	df	*P*-value
			Low<1,000 Parasites/µl (%)	Moderate 1,000 – 9,999 parasites/µl (%)	Severe≥ 10,000 parasites/ µl (%)			
FATUNLA	100	70	60(85.8)	10(14.3)	0(0.0)	16.631	9	0.055
MOTHER AND CHILD	150	103	73(70.9)	27(26.2)	3(2.9)			
SIJUWADE	100	70	53 (75.7)	17 (24.3)	0 (0.0)			
UNIMED	159	108	86 (79.6)	22 (20.4)	0 (0.0)			
Total	**509**	**351**	**272 (77.5)**	**76 (21.7)**	**3 (0.9)**			

3.2. Intensity of Malaria Infection Among Pregnant Women in Relation to Age Groups.

Intensity of malaria infection across different age groups of pregnant women in Akure South LGA was shown in Table 2. The result shows that out of the examined 351 pregnant women infected with malaria, 8 pregnant women between age group 16-20 years were infected with malaria parasite, 4(50.0%) out of these 8 infected pregnant women had low *parasitaemia* and 4(50.0%) had moderate *parasitaemia.* This age group (16-20 years) had no cases of severe *parasitaemia.* Tn age group 21-25 years, 34 pregnant women were observed to be infected with malaria parasite, of which 27(79.4%) and 7(20.6%) had low and moderate *parasitaemia* respectively. In age group 26-30 years, 144 were positive to malaria test, of which 116(80.6%), 26(18.1%) and 2(1.4%) had low, moderate and severe *parasitaemia* respectively. Of the pregnant women infected in age group 31-35 years, 65(73.2%), 22(25%) and 1(1.1%) pregnant woman had low, moderate and severe *parasitaemia* respectively in their blood samples examined. Similarly, age group 36-40 years with 66 infected pregnant women had 51(77.3%); 15(22.7%) and 0(0%) low, moderate and severe *parasitaemia* respectively. The last age group (41-45 years) in the study area had 11 infected pregnant women, of which 9(81.8%), 2(18.2%) and 0(0%) low, moderate and severe *parasitaemia* respectively. Generally, severe *parasitaemia* (≥ 10,000 parasites/ µl) was only observed in pregnant women in age groups 26-30 years and 31-35 years.

Table 2. Intensity of Malaria Infection across different Age groups of the Pregnant Women in Akure South LGA.

Age Group (Years)	Number Positive	Intensity (parasites/µl)			χ^2	df	*P*-value
		Low<1,000 Parasites/µl (%)	Moderate 1,000–9,999 parasites/µl (%)	Severe≥ 10,000 parasites/µl (%)			
16-20	8	4 (50.0)	4 (50.0)	0(0.0)	9.045	15	0.875
21-25	34	27(79.4)	7 (20.6)	0(0.0)			
26-30	144	116 (80.6)	26 (18.1)	2(1.4)			
31-35	88	65 (73.2)	22 (25.0)	1(1.1)			
36-40	66	51 (77.3)	15 (22.7)	0(0.0)			
41-45	11	9 (81.8)	2 (18.2)	0(0.0)			
Total	**351**	**272 (77.5)**	**76 (21.7)**	**3 (0.9)**			

3.3. Intensity of Malaria Infection Among Pregnant Women in Relation to Trimester.

The intensity of malaria infection with respect to trimester was also observed and recorded in Table 3. The result showed that 65(83.3%), 135(76.3%) and 72(75%) infected pregnant women in their first, second and third trimesters had low *parasitaemia* (<1,000 parasites/µl) respectively. Also, 13(16.7%); 39(22%) and 24(25%) infected pregnant women in their first, second and third trimesters had moderate *parasitaemia* (1,000 – 9,999 parasites/µl) respectively. However, the three infected pregnant women observed to have high intensity (≥10,000 parasites/µl) were in their second trimester.

Table 3. Intensity of Malaria Infection across the Trimester of Pregnant Women in Akure South LGA.

Trimester	Number Positive	Intensity (parasites/µl)			χ^2	df	*P*-value
		Low<1,000 Parasites/µl (%)	Moderate 1,000 – 9,999 parasites/µl (%)	Severe≥ 10,000 parasites/µl (%)			
First Trimester	78	65 (83.3)	13 (16.7)	0(0.0)	6.708	6	0.349
Second Trimester	177	135 (76.3)	39 (22.0)	3 (1.7)			
Third Trimester	96	72 (75.0)	24 (25.0)	0(0.0)			
Total	**351**	**272 (77.5)**	**76 (21.7)**	**3 (0.9)**			

3.4. Intensity of Malaria Infection Among Pregnant Women in Relation to Parity.

Table 4 shows the prevalence of malaria based on parity of the pregnant women. The results revealed that the primigravidae had 113 infected pregnant women of which 94(83.2%), 19(16.8%) and 0(0%) pregnant women had low, moderate, and severe parasitaemia, respectively. Among the 238 multigravidae infected pregnant women 178(74.8%), 57(23.9%) and 3(1.3%) had low, moderate, and severe parasitaemia, respectively. This result revealed that severe cases of parasitaemia was only recorded in multigravidae.

Table 4. Intensity of Malaria Infection across the Parity of Pregnant Women in Akure South LGA.

Parity	Number Positive	Intensity (parasites/µl)			χ^2	df	*P*-value
		Low<1,000 Parasites/µl (%)	Moderate 1,000–9,999 parasites/µl (%)	Severe≥ 10,000 parasites/µl (%)			
Primagravida	113	94 (83.2)	19 (16.8)	0 (0.0)	4.307	3	0.230
Multigravida	238	178 (74.8)	57 (23.9)	3 (1.3)			
Total	**351**	**272 (77.5)**	**76 (21.7)**	**3 (0.9)**			

4. DISCUSSION

Results showed that the intensity of malaria varied considerably between ages, trimester, parity, and blood group of pregnant women examined. This study revealed that the overall prevalence 351(69.0%) examined had detectable *Plasmodium falciparum* in their blood sample.

This is a reflection of the high rate of asymptomatic malaria *parasitaemia* in endemic malaria regions of which Ondo State is one. This correlates with a study reported in Awka, Anambra State where 64% prevalence was recorded (Aribodor *et al.*, 2009). This finding (69.0%) is higher than those of Kisumu 95(51.1%) of the 186 pregnant women screened; 62(40.5%) of the 153 pregnant women screened in Mombasa, Kenya (Praise *et al.*, 2003) and 41% reported in Uyo, Nigeria (Opara *et al*., 2004). The prevalence recorded in this study (69.0%) is lower than 83.9% report of Ito *et al*., (2014) among pregnant women in Eku and Abraka in Delta state. It is also lower than the 89% affected in Ibadan (Falade *et al*., 2008). The differences in the prevalence of malaria in these areas could be attributed to the climatic differences. It has been recognized that a temperature ranges of 16°C - 38°C and relative humidity of 60% were suitable for malaria parasite transmission (WHO, 2008). The result also revealed severe *parasitaemia* of infection between age groups 26-30 years and 31-35 years with no severe cases recorded in age groups 36-40 years and 41-45years while low and moderate *parasitaemia* were observed among pregnant women in all age groups. It was noted that people in the older groups apply preventive measures against mosquito bites as a result of their knowledge of the mode of transmission. Immunity in the younger groups is low, but as the age increases, stronger immunity for the disease is built up as a result of frequent exposure to the ailment, hence low severe *parasitaemia* among the older groups. The finding of this study contradicts the findings of Abdullahi *et al*., **(**2009) in Sokoto and Askling *et al*., (2005) in Sweden, reported the highest prevalence of malaria among those with lesser age. Studies indicated that young women of childbearing age are more susceptible to malaria than older women because they are still in the process of acquiring natural immunity to malaria (Shi, *et al.*, 2004, Oeuvray *et al*., 2006). Furthermore, asymptomatic low malaria *parasitaemia* occurred more in the first and second trimesters than third trimester, with severe malaria *parasitaemia* in women in their second trimester. This is similar to other studies, which showed that susceptibility is more marked in the second trimester than during the third trimester (Odikamnoro *et al*., 2014; Nwagha *et al.*, 2009). This may be attributed to the expression of adherent proteins on the surface of infected red blood cells (IRBCs), enabling the IRBCs to adhere to micro vascular capillaries of vital organs, causing severe pathological conditions (Okpere *et al*., 2010).

In relation to parity, higher severe malaria parasitaemia was revealed among the multigravidae 3(1.3%) than the primigravidae 0(0.0%) with none recorded (P>0.05).

These results were not in accordance with the findings from similar studies conducted in many other malarious areas of the tropics where *parasitaemia* was significantly higher in primigravidae than in multigravidae (Oladehinde *et al*., 2012; Rogerson *et al*., 2000; Odikamnoro *et al*., 2014), indicating a strong relationship between parity and malaria infection with mean parasite density levels decreasing as the number of gestation increased, thus confirming that the African primigravidae remain unquestionably the most susceptible (Rogerson *et al*., 2000) but this is contrary to this particular work, which showed that the multigravidae are the most susceptible group, which inversely agrees with (Dicko *et al*., 2003) that the protective immunity in pregnancy is not a function of parity. The association between parity and malaria prevalence among pregnant women is important for malaria prevention and control strategies.

5. CONCLUSIONS

This research illustrates high malaria infection among pregnant women living in Akure South Local Government. Malaria in pregnancy is a complex and multifaceted issue requiring a comprehensive approach to prevention, control measure, diagnosis, and treatment to avert the deadly menace among pregnant mothers and their foetus.

Acknowledgement

The authors thank the health workers of Mother and Child Hospital, Fatunla Hospital, University of Medical Sciences Teaching Hospital and Sijuwade Specialist Hospital for their contribution during Data collection. The authors are grateful to the ethical review boards of the Ondo State Health Research Ethics Committee of the Ondo State Ministry of Health Akure (OSHREC) for giving ethical clearance. The authors appreciate the pregnant women for giving their consent to participate in the study.

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