

## **Placental Malaria Parasitization at Delivery: Experience at a Nigerian Tertiary Hospital**

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### **Abstract**

**Background:** In malaria endemic areas, pregnant women are constantly at risk of repeated malaria infestation which if left untreated, poses a significant threat to the health and survival of the mother and her baby. **Objective:** This study determined the prevalence and risk factors for placental malaria parasitaemia among parturients at the Federal Medical Centre, Yenagoa, Nigeria. **Methodology:** A prospective cross-sectional analytical study of 205 parturients recruited consecutively at presentation for delivery. An interviewer-administered questionnaire was used to collect data. After delivery, placental blood was collected for microscopy to detect malaria parasites. Data was analysed using SPSS version 22. **Results:** The prevalence of placental malaria parasitaemia was 13.7%. Maternal age <25 years ( $P < 0.001$ ), low educational status ( $P = 0.03$ ), low parity ( $P = 0.03$ ), unbooked status ( $P < 0.001$ ) and non-use of intermittent preventive treatment ( $P < 0.001$ ) were significantly associated with placental malaria parasitaemia. Receiving three or more doses of sulphadoxine-pyrimethamine for intermittent preventive treatment of malaria in pregnancy was by far, more protective for placental malaria than receiving 2 doses (odds ratio = 0.25). *Plasmodium falciparum* was the only parasite species detected. **Conclusion:** Malaria still ravages our obstetric population and the significant contributors include low maternal age, low educational status, low parity, unbooked status and non-use of intermittent preventive treatment in pregnancy. Women should be encouraged to utilize antenatal care. There should be a prompt adoption of the

recent WHO recommendations regarding malaria prophylaxis in pregnancy in all obstetric units and the medication should be given as Directly Observed Therapy.

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**Keywords:** Placental malaria, Placental malaria parasitaemia, Placental parasitization

## **Introduction**

Malaria during pregnancy is a global public health problem that remains a significant threat to the health and survival of the mother, foetus and neonate.(Atta & Reeder, 2014; World Health Organization, 2014) The most important complications are maternal anaemia, foetal death and intrauterine growth restriction leading to low birth weight.

The burden is highest in sub-Saharan Africa where it is responsible for 26% of severe anaemia in pregnancy, and up to 1 out of every 4 women have evidence of placental infection at delivery. It is also responsible for 35% of preventable low birth weight neonates; 9-fold risk of neonatal death and 3-17 infant deaths per 1000 live births.(Desai et al., 2007)

These Complications are described as consequences of placental sequestration (also called placental malaria).(Autino et al., 2012) Infected erythrocytes have ability to adhere to chondroitin sulphate A on the syncytiotrophoblasts of the placenta(Autino et al., 2012) and because of this placental sequestration, peripheral blood film microscopy underestimates the prevalence of malaria in pregnancy.(Fried et al., 2012) This also is responsible for missed diagnosis and delay in instituting treatment with resultant potentiation of adverse effects of malaria in pregnancy.(Fried et al., 2012) Because of the above, microscopy of placental blood is thus, more sensitive in the diagnosis of maternal malaria than peripheral blood film microscopy.(Fried et al., 2012) More so, the presence of placental malaria parasitaemia at delivery is an indication that placental sequestration was either not prevented, cleared promptly or recurrent because of poor malaria prevention during pregnancy.

The prevalence of placental malaria varies. Using placental blood film microscopy, it averages 25% in sub-Saharan Africa.(Desai et al., 2007) The prevalence in Nigeria is higher in the South-East region (as high as 64.4%)(Aribodor et al., 2009) than in other regions (11.3 to 25%).(Falade et al., 2007; Falade et al., 2010; Inyang-Etoh et al., 2011; Kolawole, 2009; Mokuolu et al., 2009) A recent study (in 2015) at the University of Portharcourt Teaching Hospital however reported an alarming prevalence of 65.2% among 210 parturients.(Bassey et al, 2015) These variations in prevalence may be due to variations in community acquired immunity, socio-demographic characteristics of study population, case selection, quality of

antenatal care, use of malaria preventive measures, resistance to antimalarial drugs and diagnostic tools employed for parasite detection.(Bassey et al., 2015)

Documented risk factors for placental malaria include young maternal age, nulliparity/primiparity, non-use of malaria preventive measures and HIV infection.(Bassey et al., 2015; Briand et al., 2009; Oraneli et al., 2013; Tako et al., 2005)

The preventive measures postulated by the World Health Organization include use of insecticide-treated bed nets, intermittent preventive treatment of malaria in pregnancy and effective case management with potent antimalarial drugs.(Olumese, 2014) The current intermittent preventive therapy for malaria during pregnancy as postulated by the Nigerian Federal Ministry of Health in 2014, is the use of at least three doses of sulphadoxine-pyrimethamine (SP) combination, given not less than four weeks apart, in the second and third trimesters of pregnancy.(Federal Ministry of Health [Nigeria], 2014) These preventive measures are recommended to be available in every malaria endemic environment.(Olumese, 2014) Meta-analysis of intervention trials(Garner & Gülmezoglu, 2006) suggests that prevention of malaria in pregnancy (with the above measures) reduces the risk of severe anaemia, LBW and perinatal mortality by 38%, 43% and 27% respectively. As such, the World Health Organization encourages local research (such as this) and collaboration between scientists, policy makers and health institutions where the control programs are offered. This helps to guide the prevention programs as well as monitor and evaluate markers of successful prevention.

It is hoped that the findings, conclusions and recommendations from this study serve as additional advocacy for the need for policy makers to institute widespread coverage of malaria prevention strategies in pregnancy; attending physicians to ensure adherence to malaria prevention guidelines; and antenatal clients to comply with malaria preventive measures. These will ultimately lead to reduction in malaria associated morbidity and mortality and improvements in maternal, foetal and child health.

## **Objectives**

The objectives of this study were to determine the prevalence of placental blood malaria parasitaemia at delivery among parturients and determine the risk factors associated with placental malaria parasitization at the Federal Medical Centre, Yenagoa.

## **Methodology**

### **Study location**

This study was conducted at the Federal Medical Centre, Yenagoa, the capital city of Bayelsa State in the South-South region of Nigeria.

### **Study design**

This was a prospective cross-sectional analytical study.

### **Study Population**

This consisted of both booked and unbooked parturients

### **Inclusion Criteria**

All pregnant women presenting to the labour ward (for delivery), who give consent to participate in the study.

### **Exclusion Criteria**

Parturients who declined participation or do not give consent.

### **Sample size calculation**

The sample size for this study was calculated using the formula for cross-sectional studies (Araoye, 2003)  $N = [Z^2 P(1-P)] / d^2$ , Where, N = Sample size; Z = Proportion of normal distribution corresponding to the required (5%) significance level (which is 1.96); P = Prevalence of placental malaria parasitaemia, which is 14% or 0.14 from a previous study (Mokuolu et al., 2009) and d = Degree of accuracy/ precision expected (0.05)

Thus,  $N = 1.96^2 \times 0.14 (1-0.14) / 0.05^2 = 185.5$

The sample size was thus calculated to be 186. Giving allowance for a 10% attrition rate, the minimum sample size for the study was 205 participants.

The data for this study was collected over a period of five months (August 1, 2016 to December 31, 2016).

### **Sampling methodology**

Every consecutive parturient who satisfied the eligibility criteria and gave consent was recruited until the sample size was obtained.

### **Study Protocol**

With the study protocol in mind, standard laboratory methods as described by Cheesbrough (Cheesbrough, 2009) was used.

## **Data collection**

After obtaining a signed informed consent from the eligible participant, a semi-structured interviewer-administered questionnaire was filled. The questionnaire contained information that includes maternal age, marital status, educational status, occupation, gravidity, antenatal care, malaria preventive measures, infant birth weight and placental blood microscopy for malaria parasite detection as well as parasite density.

## **Placental blood collection**

The aspiration method of placental blood collection(Othoro et al., 2006) was employed. This was done immediately after delivery of the placenta. The placenta (with its maternal surface facing up) was placed on a smooth surface. The maternal placental surface was washed with 200 millilitres of normal saline, and pierced (to a depth of about 0.5cm) with a sterile disposable syringe on a 14-gauge hypodermic needle. Two millilitres of placental blood was aspirated and put into an EDTA bottle. The specimen was labelled to correspond with the code on the questionnaire (for easy identification) and sent to the laboratory for processing (smearing, staining and microscopic examination).

## **Laboratory procedure**

### **Preparation and staining of the thick blood smear**

Two drops of placental blood sample were placed on a slide using a small rubber pipette. Using the edge of a second slide, the drops of blood were joined and spread to make an even, thick smear and allowed to air-dry. The slide was immersed in the staining trough, containing 10% of freshly prepared Giemsa solution at pH 7.2 and contact maintained for 10 minutes. The slide was then removed and allowed to dry.

### **Preparation and staining of the thin blood smear**

One drop of placental blood was placed on a clean slide using a rubber pipette. The edge of a second slide held steadily at an angle of 45° to the first was used to spread the drop of blood to create the thin blood film. The thin film was fixed using Methanol (methyl alcohol) by maintaining contact with methanol for 10 seconds. The slide was then immersed in the staining trough containing 10% of freshly prepared Giemsa solution at pH 7.2 and contact was maintained for 10 minutes. The slide was then removed and allowed to dry.

### **Microscopic examination of slides for malaria parasite and determination of parasite density**

The stained placental blood smears were examined under  $\times 100$  oil immersion lens of a light microscope. Malaria diagnosis was based on

identification of asexual stages of Plasmodium species on the thick blood smear while the thin blood smear was used for species identification.

Parasite density was determined by counting the number of parasites per high power field in the thick blood smear and reported as follows: + (1–10 parasites per 100 high power fields), ++ (11 – 100 parasites per 100 high power fields), +++ (1–10 parasites per high power field), and ++++ (>10 parasites per high power field).

The slide was reported as negative if no parasite was identified per 100 high power fields.

### **Data Analysis**

Data regarding maternal age, marital status, educational status, occupation, parity/gravidity, antenatal care, malaria preventive measures, infant birth weight and placental blood microscopy for malaria parasite detection as well as parasite density was entered and statistical analysis done using statistical software (SPSS for windows® version 22.0, SPSS Inc.; Chicago, USA). Univariate analysis for categorical variables was performed using chi-square test. P value less than 0.05 was taken as being statistically significant.

### **Ethical Consideration**

Ethical approval for this study was obtained from the ethical review board of the Federal Medical Centre, Yenagoa. A written informed consent was also obtained from every participating woman. Participants were not responsible for funding the tests.

### **Results**

#### **Maternal socio-demographic characteristics**

The maternal socio-demographic characteristics are shown in Table 1. Two hundred and five parturients participated in the study. Their ages ranged from 14 to 45 years with a mean age of 29.9 years. The modal age group was 30-34 years followed by the 25-29 years age group. The majority of the parturients had tertiary level of education (53.6%), were married (93.7%) and employed (71.7%). Christians constituted 95.6% and the remaining 4.4% were Muslims. More than half (57.1%) were of the Ijaw ethnic group; the rest were Ibo (31.7%), Yoruba (4.9%), Hausa (1%) and other Nigerian tribes (5.3%). The maternal heights ranged from 1.45m-1.66m with an average height of  $1.58 \pm 0.05$ m.

**Table 1: Maternal socio-demographic characteristics**

	Frequency	Percentage
<b>Age group</b>		
10-14	1	0.5
15-19	6	2.9
20-24	32	15.6
25-29	54	26.3
30-34	58	28.3
35-39	50	24.4
40-44	3	1.5
45-49	1	0.5
Total	205	100.0
<b>Educational status</b>		
No formal education	2	1.0
Primary	18	8.8
Secondary	75	36.6
Tertiary	110	53.6
Total	205	100.0
<b>Marital status</b>		
Single	13	6.3
Married	192	93.7
Total	205	100.0
<b>Employment status</b>		
Unemployed	58	28.3
Employed	147	71.7
Total	205	100.0
<b>Religion</b>		
Christianity	196	95.6
Islam	9	4.4
Total	205	100.0
<b>Tribe</b>		
Ijaw	117	57.1
Yoruba	10	4.9
Ibo	65	31.7
Hausa	2	1.0
Others	11	5.3
Total	205	100.0
<b>Maternal height</b>		
Less than 150cm	18	8.8
151-160cm	185	90.2
Greater than 160cm	2	1.0
Total	205	100.0

### Obstetric Profile

As illustrated in Table 2, nearly half (40%) of the parturients were multiparous. The average parity was 2.13 (Range = 0-6). One hundred and eighty one (88.3%) parturients were booked while 24(11.7%) were unbooked. The majority (76.2%) booked for antenatal care during the second trimester of

pregnancy, 8.3% did so in the first trimester while 15.5% booked during the third trimester. The average gestational age at booking was  $22\pm 7$  weeks. Of all the parturients, 76.1% had at least four antenatal clinic visits, 11.7% had none and corresponded to the unbooked parturients. The average gestational age at delivery was  $38.5\pm 1.9$  weeks (Range = 31-42 weeks); of these, 190(92.7%) parturients delivered at term, 13(6.3%) delivered before term and 2(1.0%) delivered post-term.

**Table 2:** Obstetric profile

	<b>Frequency</b>	<b>Percentage</b>
<b>Parity</b>		
Nulliparous	57	27.8
Primiparous	58	28.3
Multiparous	82	40.0
Grand multiparous	8	3.9
Total	205	100.0
<b>Booking status</b>		
Unbooked	24	11.7
Booked	181	88.3
Total	205	100.0
<b>Trimester at booking (n=181)</b>		
First trimester	15	8.3
Second trimester	138	76.2
Third trimester	28	15.5
Total	181	100.0
<b>Number of ANC visits</b>		
None	24	11.7
One	6	2.9
Two	9	4.4
Three	10	4.9
Four and above	156	76.1
Total	205	100.0
<b>Gestational age at delivery</b>		
Preterm	13	6.3
Term	190	92.7
Post term	2	1.0
Total	205	100.0

ANC = Antenatal Clinic

### **Malaria control measures (table 3)**

**a) Intermittent preventive therapy with Sulphadoxine-Pyrimethamine (IPTpSP):** All the 181 booked parturients (88.3% of the participants) had IPTpSP; 16.1% had only one dose, 50.7% had two doses and 21.5% had at least, three doses. None of the unbooked parturients (11.7% of the participants) had IPTpSP or any other form of malaria chemoprophylaxis. The parturients who booked late in the third trimester (from 32 weeks of gestation and beyond) contributed to the number of women that had just one

or two doses of IPTpSP, the remainder booked early but were not compliant with the prescription.

b) **Insecticide-treated net (ITN) use:** About half (50.2%) of the respondents slept under ITNs but only 30.7% did so consistently.

c) **Other measures:** Other forms of vector control/malaria preventive measures used by respondents were indoor residual spraying with insecticides (72.7%) and use of mosquito coils (22%). Majority (98.5%) of the respondents had door and window nets at home.

d) **Malaria case treatment:** Fifty nine (28.8%) respondents were treated for symptomatic malaria during pregnancy. Artemether-Lumefantrine combination was the most common antimalarial used by 27.8% of the respondents while the remaining 1% took quinine.

**Table 3:** Malaria control measures

	<b>Frequency</b>	<b>Percentage</b>
<b>IPTpSP</b>		
No use	24	11.7
1 dose	33	16.1
2 doses	104	50.7
3 or more doses	44	21.5
<b>Insecticide Treated Net</b>		
No use	102	49.8
Occasional use	40	19.5
Consistent use	63	30.7
<b>Insecticide spray</b>		
Does not use	56	27.3
Uses less than once a week	58	28.3
Uses once a week	32	15.6
Uses twice a week or more	59	28.8
<b>Mosquito coils</b>		
Does not use	160	78.0
Uses less than once a week	18	8.8
Uses once a week	8	3.9
Uses twice a week or more	19	9.3
<b>Door and window netting</b>		
Absent	11	5.4
Present	194	94.6
<b>Malaria drug treatment</b>		
None	146	71.2
Quinine	2	1.0
Artemether/Lumefantrine	57	27.8

### **Prevalence and pattern of placental malaria parasitaemia**

Two hundred and five placental blood films were analysed. Malaria parasite was detected in 28(13.7%) placental blood films and all had mild (+) parasitaemia. Plasmodium falciparum was the only malaria species detected in all the placental blood films.

### Risk factors for placental malaria parasitaemia

As depicted in table 4, maternal age of less than 25 years; primary or no education; nulliparity and primiparity; unbooked status and non-use of intermittent preventive treatment with sulphadoxine-pyrimethamine (IPTpSP) were shown to have a significant association with the detection of malaria parasite in the placental blood sample.

Other risk factors that were assessed and found not to be significantly associated with placental blood parasitaemia were marital status, maternal employment status, husband's educational status, husband's employment status, malaria case treatment in pregnancy, insecticide-treated net (ITN) use, presence of nets on doors and windows at home, use of insecticide sprays and use of mosquito coils.

After multivariate logistic regression analysis, the variables statistically and independently significant were maternal age of less than 25 years [odds ratio = 4.19(1.56-11.22)]; low parity including nulliparity [odds ratio = 2.7(0.84-8.77)] and primiparity [odds ratio = 2.05(0.62-6.75)]; and non-use of intermittent preventive treatment with sulphadoxine-pyrimethamine [odds ratio = 3.43(1.07-11.00)].

**Table 4:** Risk factor analysis

	MP +ve N(%)	MP-ve N(%)	Total N	OR(95% CI)	X <sup>2</sup>	df	P- value
<i>Age group</i>					15.81	1	0.00*
<25 years	13(33.3)	26(66.7)	39	5.03(2.15-11.79)			
≥25 years	15(9.0)	151(91.0)	166				
<i>Educational status</i>					5.02	1	0.03*
Primary or less	6(30.0)	14(70.0)	20				
At least secondary	22(11.9)	163(88.1)	185	0.32(0.11-0.91)			
<i>Marital status</i>					0.35	1	0.69
Single	2(15.4)	11(84.6)	13	0.86(0.18-4.12)			
Married	26(13.5)	166(86.5)	192				
<i>Employment status</i>					0.53	1	0.39
Unemployed	6(10.3)	52(89.7)	58				
Employed	22(15.0)	125(85.0)	147	0.66(0.39-1.17)			
<i>Husband's educ. Stat.</i>					0.38	1	0.54
Primary or less	2(20.0)	8(80.0)	10	1.65(0.33-8.22)			
At least secondary	24(13.2)	158(86.8)	182				
<i>Husband's empl. Stat.</i>					0.32	1	0.57
Unemployed	0(0.0)	2(100.0)	2				
Employed	26(13.7)	164(86.3)	190				

<i>Parity</i>					6.89	2	0.03*
Nulliparous	10(17.5)	47(82.5)	57	2.98(1.02-8.70)			
Primiparous	12(20.7)	46(79.3)	58	3.65(1.28-10.37)			
Multiparous	6(6.7)	84(93.3)	90				
<i>Booking status</i>					18.08	1	0.00*
Unbooked	10(41.7)	14(58.3)	24	6.47(2.51-16.66)			
Booked	18(9.9)	163(90.1)	181				
<i>IPTpSP use</i>					18.08	1	0.00*
No	10(41.7)	14(58.3)	24	6.47(2.51-16.66)			
Yes	18(9.9)	163(90.1)	181				
<i>IPTpSP dose</i>					10.62	2	0.01*
One	8(24.2)	25(75.8)	33	13.76(1.63-116.54)			
Two	9(8.7)	95(91.3)	104	4.07(0.50-33.17)			
Three and above	1(2.3)	43(97.7)	44				
<i>ITN use</i>					0.71	1	0.40
No	16(15.7)	86(84.3)	102	1.41(0.63-3.15)			
Yes	12(11.7)	91(88.3)	103				
<i>Insecticide spray</i>					0.38	1	0.54
No	9(16.1)	47(83.9)	56	1.31(0.55-3.10)			
Yes	19(12.8)	130(87.2)	149				
<i>Mosquito coil use</i>					1.95	1	0.16
No	24(15.6)	130(84.4)	154	2.17(0.72-6.58)			
Yes	4(7.8)	47(92.2)	51				
<i>Door/ window netting</i>					2.30	1	0.13
No	0(0.0)	11(100.0)	11	2.52(0.74-8.54)			
Yes	28(14.4)	166(85.6)	194				
<i>Malaria drug treat.</i>					0.86	1	0.36
No	22(15.1)	124(84.9)	146	1.57(0.60-4.09)			
Yes	6(10.2)	53(89.8)	59				

MP =Placental malaria parasitaemia; OR = Odds Ratio; CI = confidence interval;  $\chi^2$  = Chi square value

df = Degree of freedom; \* = significant association (P<0.05); empl. Stat.= employment status; educ. Stat. = educational status; IPTpSP = intermittent preventive treatment with sulphadoxine-pyrimethamine;

ITN = Insecticide-Treated Net; treat = treatment

## Discussion

The socio-demographic profile of the participants showed patronage from the more educated and affluent women. It is likely that, because of the higher hospital charges in tertiary hospitals, a good number of the less educated and poorer women patronize the primary and secondary health care centres with lower hospital charges. The predominant tribe and religion in the

area of study were Ijaw and Christianity respectively; this was reflected in the preponderance of Ijaw and Christian women in the study. The older maternal age predominance may have also accounted for the preponderance of parturients that were multiparous.

Concerning the utilization of malaria preventive measures among the parturients, the contributory factors to the non-use of malaria chemoprophylaxis with sulphadoxine-pyrimethamine as well as use of less than three doses in the course of pregnancy include unbooked status, late booking and non-adherence to prescription. While it is possible to have women book early for antenatal care by ensuring female education and empowerment, administration of sulphadoxine-pyrimethamine as directly observed therapy (DOTS) during antenatal visits would prevent non-compliance to the medication. Because pregnant women in malaria endemic areas are among the most vulnerable to the infection, the World Health Organization has recommended that all pregnant women should consistently sleep under insecticide treated bed nets.(Olumese, 2014) According to the Nigerian Demographic Survey of 2013, only 18% of pregnant women slept under insecticide treated bed net the night before the survey (an index for its consistent use).(National Population Commission [Nigeria] and ICF International, 2013) Although the result from this study (30% rate of consistent use) is an improvement from the 2013 findings, it is still below the recommendation of consistent use among all (100%) pregnant women in malaria endemic regions.

The prevalence of placental malaria parasitaemia of 13.7% found in this study is similar to the prevalence of 14% reported by Mokuolu et al in a study from four geopolitical zones in Nigeria(Mokuolu et al., 2009) and that (13.0%) reported by Falade et al in south western Nigeria(Falade et al., 2010) but much lower than the 65.2% prevalence reported in Portharcourt (Bassey et al., 2015) within the same geographical zone with Bayelsa where this study was conducted. The lower prevalence in this study may be due to the high level of education among the parturients which may have contributed to their health awareness with a positive impact on their health and the effective malaria preventive measures utilized by the parturients including IPTpSP (88.3%) and ITN (50.2%); other factors may include a high level of community acquired immunity and the quality of antenatal care.(Bassey et al., 2015)

The finding that *Plasmodium falciparum* was the only parasite species detected in all the placental blood films in this study confirms previous reports that placental malaria is an exclusive feature of *plasmodium falciparum* infection in pregnancy(Srivastava et al., 2010) and that *Plasmodium falciparum* is the most prevalent species in Nigeria accounting for about 98% of malaria cases in the country(Federal Ministry of Health [Nigeria], 2010)

This study identified maternal age less than 25 years, less than secondary level of education, low parity (nulliparity and primiparity), unbooked status and non-use of malaria chemoprophylaxis (sulphadoxine-pyrimethamine) as risk factors for placental malaria parasitaemia. Parturients younger than 25 years of age were 5 times more likely to have placental malaria parasitaemia than those 25 years and older. This supports the findings of previous studies stating young maternal age as a risk factor for placental malaria (Idowu & Babalola, 2015; Mokuolu et al., 2009; Okolie et al., 2014) which could be attributed to lower levels of acquired immunity as well as the lack of pregnancy associated immunity against the placental-binding parasites. (Idowu & Babalola, 2015)

As observed in the study and although not an independent risk factor, parturients who had none or primary level of education were 3 times more likely to have placental malaria compared to parturients with at least secondary level of education. High educational standards usually affect health awareness and therefore has a positive impact on health. (Ogbu et al., 2015) The reverse may be the case in those with lower standards of education as they may not appreciate the burden of malaria in pregnancy and the importance of adherence to stipulated malaria preventive measures because of their limited understanding and knowledge.

Multiparous women in malaria-endemic regions are believed to form blocking antibodies that bind to placental chondroitin sulphate A during their subsequent pregnancies and prevent placental sequestration of Plasmodium falciparum. (Maestre & Carmona-Fonseca, 2014) This explains why the burden of malaria in pregnancy is higher among women of low parity (nulliparity and primiparity) and is supported by findings from this study that demonstrated low parity as an independent risk factor for placental malaria parasitaemia. The result suggested that nulliparous and primiparous women individually had a three-fold risk for placental malaria compared to multiparous women. Similar findings have been reported by researchers in Portharcourt, Nnewi and Ile Ife in Nigeria. (Bassey et al., 2015; Fehintola et al., 2016; Okolie et al., 2014)

As a component of the malaria preventive measures during pregnancy, the Nigerian Federal Ministry of Health has recommended the use of at least three doses of sulphadoxine-pyrimethamine combination with each dose given not less than 4 weeks apart in the second and third trimesters of pregnancy. (Federal Ministry of Health [Nigeria], 2014) Not receiving intermittent preventive treatment in pregnancy, identified as an independent risk factor in this study increased the risk of placental malaria parasitaemia by six times compared to those that received. Several studies have reported similar findings. (Bassey et al., 2015; Fehintola et al., 2016; Idowu & Babalola, 2015) Also, among the parturients who had malaria chemoprophylaxis with at

least a dose of sulphadoxine-pyrimethamine combination during pregnancy, receiving at least three doses was more protective than receiving 2 doses (Odds Ratio of 0.25) or one dose (Odds Ratio of 0.07). The contributory factors for receiving less than the recommended doses include unbooked status, late booking, non-compliance with prescription and possibly, unavailability of the medication at the time of desired purchase from pharmacy stores (as at the time of this study, the drug was not being administered as directly observed therapy in the study location). Provision of the medication at the antenatal clinic and administration as directly observed therapy (DOT) coupled with adequate female education and empowerment would likely eliminate the above stated factors.

While several studies have demonstrated the non-use of insecticide treated bed nets by pregnant women as a risk factor for placental malaria parasitaemia, (Ezebialu et al., 2012; Idowu & Babalola, 2015) this study did not. A common habit in the study area of sitting out till late at night before retiring to sleep in a bid to ‘get fresh air’ and avoid the heat inside the houses especially during the protracted periods of interrupted power supply that prevents the use of fans or air conditioners, is likely to expose individuals to mosquito bites and undermine the effectiveness of sleeping under insecticide treated bed nets. This may explain the contrary finding in this study.

Malaria in pregnancy is still a public health problem. The level of utilization of the preventive measures is still far from what is desired. The results of this study, adds justification for advocacy from all stakeholders to promote the utilization of malaria preventive measures during pregnancy in order to achieve a reduction in the burden of the disease.

## **Conclusion**

Malaria during pregnancy is still an important public health problem in our obstetric population with a high prevalence of placental malaria parasitaemia and the significant contributors include low maternal age, low educational status, low parity, unbooked status and non-use of intermittent preventive treatment in pregnancy. Women should be educated and empowered financially and encouraged to register for antenatal care during pregnancy. There should be a prompt switch to the recent WHO recommendation regarding malaria prophylaxis in pregnancy and the medication should be given as Directly Observed Therapy.

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