Prevalence, predictors, and perceived susceptibility to placental malaria parasitemia among pregnant women in a tertiary hospital in South-Western Nigeria.

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Abstract

Objective: Is to determine the prevalence and predictors of placental malaria among pregnant women.

Methodology: The study was cross-sectional in design. It was carried out over six months. We administered Pretested questionnaire to 300 eligible subjects. The researchers took maternal peripheral blood for malaria parasites while cord and placental blood sample at delivery for neonatal packed cell volume (PCV) and Malaria parasite. Data were analyzed using STATA 10.

Result: One hundred and forty-four (48%) participants had placental malaria parasitemia, while 173 (57.7%) had peripheral malaria parasitemia. Maternal age less than 20 years (P=0.008), low parity, and hemoglobin type AA (P=0.002) were significantly associated with a higher prevalence of placental parasitemia. Maternal secondary and tertiary education (P=0.013), perceived susceptibility to placental malaria and IPT use (p=0.014) were significantly associated with lower prevalence.

Conclusion: This study has shown that placental parasitemia is a significant problem in pregnancy as it is strongly associated with certain maternal factors. There is the need to intensify control efforts aimed at reducing malaria in pregnancy in Nigeria, and mothers with increased risk factors should receive more focused attention.

Keywords: Prevalence, risk factors, placental malaria, pregnancy

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Prévalence, Facteurs Prédictifs et Susceptibilité perçue à la Parasitémie du Paludisme Placentaire chez les Femmes Enceintes dans un Hôpital Tertiaire du Sud-Ouest du Nigéria.

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Résumé

Objectif de l'étude: Déterminer la prévalence et les facteurs prédictifs du paludisme placentaire chez les femmes enceintes.

Méthode de l'étude : La conception de l'étude était transversale. Elle s'est exécutée plus que six mois. Nous avons administré un questionnaire pré-test à 300 sujets éligibles. Les chercheurs ont prélevé du sang périphérique maternel pour les parasites du paludisme, ainsi qu'un échantillon de sang de cordon et de placenta lors de l'accouchement pour le volume néonatal des accumulateurs et le parasite paludisme. Les données ont été analysées avec STATA 10.

Résultat: 144 participants (48%) avaient une parasitémie du paludisme placentaire, tandis que 173 (57.7%) avaient une parasitémie périphérique du paludisme. L'âge maternel moins 20 ans ($p = 0.008$), la parité faible et l'hémoglobine de type AA ($p = 0.002$) étaient significativement associés à une prévalence plus élevée de la parasitémie placentaire. L'éducation maternelle secondaire et tertiaire ($p = 0.013$), la perception de la susceptibilité au paludisme du placenta et l'utilisation du TPI ($p = 0.014$) étaient significativement associés à une prévalence plus faible.

Conclusion: Cette étude a montré que la parasitémie placentaire est un problème important pendant la grossesse car elle est fortement associée à certains facteurs maternels. Il est nécessaire d'intensifier les efforts de contrôle visant à réduire le paludisme pendant la grossesse au Nigéria, et les mères présentant des facteurs de risque accrus devraient recevoir une attention plus ciblée.

Mots-clés: Prévalence, facteurs de risque, paludisme placentaire, grossesse

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INTRODUCTION

The female Anopheles mosquitoes transmit malaria parasites. Minute parasitic protozoa of the genus Plasmodium cause this infection. It probably originated in Africa and accompanied human migration to the Mediterranean, India, and Southeast Asia (1). Malaria causes significant morbidity and mortality in Nigeria. The disease is the most frequent cause of outpatient attendance across all age groups (2,3). An astounding 70 to 110 million clinical cases of malaria is estimated to occur per year in Nigeria. The disease accounts for 11% of maternal mortality, 25% of all infant-related death, and 30% of child-related mortality (4-7). It is also associated with maternal and childhood anemia as well as premature delivery, low birth weight babies, and fetal death.

Placental malaria is a common complication of this parasitic disease in pregnancy in areas of stable transmission. Consequently, serious health problems arise for the mother and especially her baby (8). These problems include preterm delivery, intrauterine growth restriction, low birth weight, fetal anemia, congenital malaria, and fetal mortality. In malaria-endemic countries like Nigeria, pregnant women, along with children under five years, represent the most vulnerable group to Plasmodium falciparum infection (9). Such infection often increases the risk of maternal and perinatal morbidity and mortality. Various authors have studies on placental malaria parasitemia and its effects on pregnancy and its outcomes in different parts of Nigeria (10-15). A similar survey conducted in Ile-Ife by Obiajunwa et al. in the pediatrics department of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Osun State in 2005 focused on the prevalence of congenital malaria (16). However, this study is broader and will surely go a long way to provide data for an evidence-based policy-making process in the malaria control program and better appraisal of the baseline characteristic of placental malaria.

MATERIALS AND METHODS

The study was cross-sectional in design. We conducted at the Obstetrics and Gynaecology departments of Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), Ile-Ife, Osun State, Nigeria between January and July 2017. The teaching hospital comprises of four units, namely Ife Hospital Unit Ile Ife, Wesley Guild Hospital, Ilesa, Urban Comprehensive Health center, Ile-Ife, and Rural Comprehensive Health Centre, Imesi Ile. The Ife Hospital Unit (IHU) and Wesley Guild Hospital (WGH) serve as tertiary referral centers, and the obstetric units in the two hospitals conduct an average of 2500 deliveries per year. The study populations were patients that presented for delivery at IHU and WGH. The recruitment was irrespective of the mode of delivery and booking status during the period of study. Both symptomatic and asymptomatic patients were enrolled. Researchers recruited both Mother and neonate for the survey. We excluded patients who refused to participate in the research and those who had anti-malaria treatment within the last two weeks before the onset of labor and delivery.

Consecutive sampling techniques were employed to recruits the study participants. The sample size was determined using Fisher's formula (17) with a total of 300 subjects.

The researchers used a structured interviewer-administered pre-tested questionnaire in data collection. The data obtained on basic demographics include; the age of the mother, parity, and her booking status. Other characteristics, including the educational condition of the parturient and the job description of the husband, were used for socio-economic stratification into class 1 to 5 (18). In this study, we regrouped class 1 and 2 as upper social status, class 3 as a middle social class while class 4 and 5 were grouped as the lower social status to aid data analysis. We used standardized proforma to obtain relevant obstetric data such as gestational age at the onset of labor, mode of delivery, and neonatal anthropometric measurements.

At delivery 5ml of peripheral venous blood was taken from the mother via veno-puncture for maternal packed cell volume, ABO blood group, and blood film for the malaria parasite. Estimation of baby's packed cell volume, followed by the film for malaria parasites using the 2mls of cord blood collected from the portion of the cord attached to the placenta.

We obtained placental aspirate from the incision through the cotyledons on the maternal surface of the placenta. The incision was made immediately after cleaning the placenta under running water. We prepared thick and thin blood smears from the mother, umbilical cord sample, and placental aspirates. Malaria diagnosis was based on the identification of asexual forms of malaria parasites in thick films while thin films were for species identification

Data Analysis

We carried out data entry and analysis using statistical package for social science (SPSS) version 20. Univariate analysis was carried out to determine the proportion of women with a primary and secondary outcome of interest. We carried out a bivariate analysis using ch_i-square and t-test.

This level of analysis determined the association between the primary outcome (presence of placenta malaria parasitemia) and selected independent variable such as educational status, age, social class, hemoglobin type, and IPT use (i.e., at least two doses) in pregnancy. For all statistical analysis, a P-value of less than 0.05 was considered significant.

Ethical Considerations: The ethics and research committee of the Obafemi Awolowo University Teaching Hospitals Complex gave clearance for the study. During data collection, the participants got adequate information about the objectives of the study, confidentiality, and the right not to participate or withdraw at any time in the study was assured. Laboratory investigations were done free of charge for the patient for this study.

RESULTS

Three hundred pregnant women were involved in the study. Of this 256 (85.33%) parturient was booked while the remaining were not. One hundred and twenty-one (40.3%) were primigravidae. One hundred and forty-one (47%) had tertiary education, while 33 (11%) had primary or no school. Seventy-eight (26.0%) belong to the upper social class, while 105 (35%) were of lower social status. Eleven percent had a preterm delivery, while the prevalence of low birth weight (LBW) babies was 19.7% [Table 1]

One hundred and seventy-three (57.7%) had positive peripheral smears with asexual forms of Plasmodium falciparum, 144(48%) had positive placenta parasitemia while 120 (40%) had positive cord parasitemia. Only 81(27%) of the respondents used ITN, while 41.7% used IPT (at least two doses). [Table 2]

Bivariate analysis revealed that maternal age, parity, booking status, education, and hemoglobin type were significantly associated with malaria placental parasitemia. The use of IPT during pregnancy was also associated considerably with placenta parasitemia. However, the number of the dose of IPT used, the use of Insecticide-treated nets (ITN) and maternal blood group were not significantly associated with placental parasitemia. There was a significant relationship between maternal age and placental parasitemia. Age <20years was associated with higher placental parasitemia rate of 88.9% compared to period>=20, which was 56.7 %(Fishers exact, P=0.0084) as shown in Table 3. There was a significant association between lower placental parasitemia and high social class (p=0.003) and higher educational status (p<0.001). The unbooked parturients had a higher prevalence of placental parasitemia, and this was statistically significant (P<0.001). Parity was also significantly associated with the prevalence of placental malaria parasitemia (p=0.02). There was a strong association between hemoglobin type and placental parasite (p=0.002) with hemoglobin type AA having the highest prevalence of 45.6%, while AS had a 25.6% prevalence of placental parasitemia. The use of intermittent preventive therapy (IPT) with sulphadoxine-pyrimethamine in pregnancy was strongly associated with a lower incidence of placental parasitemia ((p=0.014) as shown in table 3.

A logistic regression model of independent predictors for placental malaria parasitaemia showed that increasing maternal age (OR = 0.55; P= 0.03, CI=1.04 – 1.272), higher maternal education (secondary school and above) (OR = 0.1; Z= -2.50, P=0.010, CI=0.020 – 0.625), the use of IPT only (OR=0.11, P=0.01, CI=0.221-0.625), use of both IPT and ITN (OR=0.25, P=0.02, CI=0.21-0.68), and perceived susceptibility to placental malaria were predictors of lower prevalence of placental parasitaemia while primigravidity (OR = 3.000; P= 0.001; CI= 1.530 – 1.900), and heamoglobin type AA (OR = 2.98, P=0.015, CI =1.23 – 7.18) were predictors of higher placental parasitaemia as shown in table 4.

DISCUSSION

Studies from various areas of high transmission have reported placental malaria to be a cause of varying degree of fetal growth restriction (3,4,9). The prevalence of peripheral parasitemia in our study was 57.7%, while that of the placental parasitemia was 48%.

The peripheral parasitemia result was comparable to previous work done in other areas; Ogbodo et al (19). He found a peripheral parasitemia rate of 59.9% in the Igbo community of Ebonyi state. Obiajunwa et al (16) found a peripheral parasitemia rate of 54.2% in Ile Ife in 2005.

Placental malaria had a higher prevalence rate than values quoted from some

other studies in the Southwest; Falade et al (20) found a prevalence rate of 13.1% in Ibadan. The exact reason for the higher prevalence of malaria parasites in this study is not known. However, we collected most of the samples for this study during the raining season. Malaria infection is at its peak during this period. This result is comparable to that from a different area in Osun State, where a rate of 63.6% malaria parasitemia was quoted (21). "The average placental parasitemia prevalence rate quoted by a multicenter study in Nigeria was 21.5% with a range between 19 and 80% depending on the method of diagnosis "(5).

In this study, the predictors of positive placental parasitemia were low parity, younger maternal age, low maternal educational status, hemoglobin type AA, and thought of not being susceptible to placental malaria. This finding is similar to that of Shuaib et al. (22). In this study, those who had secondary and tertiary education were found to have a lower prevalence of placental malaria parasitemia compared to those without formal training. The finding could be a reflection of the effect of education on awareness, and utilization of malaria control measures and their level of knowledge about malaria infestation. The impact of maternal education seen in this study contradicts the much earlier work of Okonofua et al. (6). Parental educational status has no significant effect on the prevalence of placental parasitemia, according to Okonofua et al.

The use of IPT was significantly associated with a lower prevalence of placental parasitemia in this study. Previous studies confirm this finding. The study further found that unbooked parturients had a considerably higher prevalence of placental parasitemia than booked parturient. This finding may be because booked parturient is more likely to have received and used IPT during antenatal care than the unbooked parturient. This study showed a statistically significant reduction in the prevalence of placental malaria with the use of both ITN and IPT during pregnancy. This result is in keeping with findings of Ugboaja et al. (23).

"The tools for achieving effective malaria control are now available; these include the use of ITN, IPT, effective treatment, and environmental control of vectors" (24). The production of many treatment guidelines and policy documents facilitated the use of these tools (2,8,24). All stakeholders must combine efforts to ensure successful implementation in the deployment of these various tools to achieve a reduction in the burden of placental malaria (5). Worthy of note is the fact that parturients who believed that they are susceptible to placental malaria had lower parasitemia rate compared to those who did not. Perceived susceptibility to malaria parasitemia will make parturients seek protection from disease, thereby informing the use of IPT, ITN, and other malaria control measures. This finding was similar to that of a previous study on placental malaria parasitemia (23)

The limitation of this study is that we took all samples at delivery; hence, the presence or absence of placental parasite may not reflect past or chronic infection. Chronic infection usually has a profound effect on pregnancy and perinatal outcome.

Findings from this study have shown that placental parasitemia is a significant problem in pregnancy as it is significantly associated with certain maternal factors. There is the need to intensify control efforts aimed at reducing malaria in pregnancy in Nigeria, and mothers with increased risk factors should receive more focused attention.

Conflict of Interests: The authors declare that they have no competing interests. This manuscript has not been published before.

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Table 1: Socio-demographics and obstetric characteristics of respondents (N=300)

Variables	frequency	Percentage (%)
Booking status:		
Booked	256	85.3
Un-booked	44	14.7
Age (in years)		
Mean(±SD), Median	29.2(5.0), 29.5	
Marital status:		
Married	289	96.3
Single	11	3.7
Educational status:		
No formal	7	2.3
Primary	26	8.7
Secondary	126	42.0
Tertiary	141	47.0
Social class:		
Upper	78	26.0
Middle	117	39.0
Lower	105	35.0
Gestational age at booking(weeks) Mean(±SD), Median	38.7(2.1), 39	
Parity:		
Mean (±SD)	2.1(1.2)	
Retroviral status:		
Positive	12	4.0
Negative	288	96.0
Blood group:		
A	58	19.3
B	42	14.0
O	129	43.0
AB	14	4.7
Unknown	57	19.0
Genotype:		
AA	182	60.7
AS	47	15.6
Others	12	4.0
Unknown	59	19.7
Mode of delivery:		
C/S	121	40.3
Vaginal	179	59.7
Delivery outcome:		
Low birth weight(<2.5kg)	59	19.7
Preterm (<37weeks)	33	11.0

Table 2: Patterns of malarial parasitaemia and Malaria control measures used

Variables	Frequency	Percentage
Peripheral parasitaemia:		
Positive	173	57.7
Negative	127	42.3
Placental parasitaemia:		
Positive	144	48.0
Negative	156	52.0
Cord parasitaemia:		
Positive	120	40.0
Negative	180	60.0
IPT Use*		
Yes	125	41.7
No	175	58.3
Doses of IPT		
1	93	42.7
2	106	48.6
3	19	8.7
Mode of administration:		
Self	177	81.2
DOT	41	18.8
Use of ITN		
Yes	81	27.0
No	219	73.0

*IPT Use = Proportion of patients who took at least two doses of Sulphadoxine-Pyrimethamine for prevention of malaria in the index pregnancy.

Table 3: Association between placental malarial and selected maternal factor

Variable	Placental parasitaemia n= 300			Statistical remark
	Negative	Positive	Total	
	Freq. (%)	Freq. (%)	Freq. (%)	
Parity				
Primiparous	46 (38.0)	75 (62.0)	121 (100.0)	$X^2 = 15.5$, df = 1, p=0.02
Multiparous	81 (45.3)	98 (54.8)	179 (100.0)	
Age group				
< 20 yrs	1 (11.1)	8 (88.9)	9 (100.0)	Fisher's exact, p=0.008
>=20 yrs	126 (43.3)	165 (56.7)	291(100.0)	
Booking status				
Booked	120 (46.9)	136 (53.1)	256 (100.0)	$X^2 = 14.7$, df = 1, p<0.001
Un-booked	7 (15.9)	37 (84.1)	44 (100.0)	
Marital status				
Single	1 (9.1)	10 (90.9)	11 (100.0)	Fisher's
Married	126 (43.6)	163 (56.4)	289 (100.0)	exact, p =0.028
Educational status				
Noformal/Pry	8 (24.2)	25 (75.8)	33 (100.0)	$X^2 = 15.6$, df =2, p<0.001
Secondary	43 (34.1)	83 (65.9)	126 (100.0)	
Tertiary	76 (53.9)	65 (46.1)	141 (100.0)	
Social class				
Upper	41 (52.6)	37(47.4)	78 (100.0)	$X^2 = 11.4$, df =2, p=0.003
Middle	55 (47.0)	62 (53.0)	117 (100.0)	
Lower	31 (29.5)	74 (70.5)	105 (100.0)	
Use of ITN				
Yes	40(49.4)	41(50.6)	81(100.0)	$X^2 = 2.26$, df =1, p=0.133
No	87(39.7)	132(60.3)	219(100.0)	
Doses of IPT				
1	23(24.7)	70(75.3)	93(100.0)	$X^2 = 0.37$, df =2, p=0.829
2	69(65.1)	37(34.9)	106(100.0)	
3	14(73.7)	05(26.3)	19(100.0)	
Total	106(48.2)	112(51.8)	218(100.0)	
Genotype (n=241)				
AA	99(54.4)	83(45.6)	182(100.0)	$X^2 = 12.57$,
AS	35(74.5)	12(25.6)	47(100.0)	df =2, p=0.002
Others	2(16.7)	10(83.3)	12(100.0)	
Blood group (n=243)				
A	31(53.5)	27(46.6)	58(100.0)	$X^2 = 4.44$, df =3, p=0.218
B	23(54.8)	19(45.2)	42(100.0)	
O	53(41.1)	76(58.9)	129(100.0)	
AB	5(35.7)	9(64.3)	14(100.0)	
Use of ITN & IPT				
use both	34(58.6)	24(41.4)	58(100.0)	$X^2 = 11.9$, df = 2, p=0.003
Use neither	16(27.1)	43(72.9)	59(100.0)	

Table 4: Binary logistic regression model showing predictors of placental parasitaemia

Variable	Positive placenta parasitaemia			95% CI
	Odds ratio	**z-statistic**	**p-value**	
Age (years) (ref= < 20 years)				
>20 years	0.550	-2.920	0.007	1.048 - 1.270
Parity (ref = Multipara)				
Primigravida	3.000	1.920	0.001	1.530 – 1.900
Educational status (ref =no formal/primary)				
Secondary	0.233	-1.780	0.004	.047 - .150
Tertiary	0.110	-2.500	0.010	.020 – .6250
Social class (ref = upper)				
Middle	0.420	-1.780	0.000	.167 - 1.090
Lower	1.460	0.680	0.400	.486 - 4.400
Gestational age at booking (weeks)	1.020	0.910	0.360	.974 - 1.070
Gestational age at delivery (weeks)	0.950	-0.420	0.670	.794 - 1.160
Retroviral status (ref =positive)				
Negative	3.200	1.080	0.270	.383 - 27.810
Blood group (ref = A)				
B	.6200	-0.840	0.400	.204 - 1.880
O	1.450	0.910	0.360	.647 - 3.270
AB	2.280	0.910	0.360	.386 - 13.510
Genotype (ref = AA)				
AS	3.050	2.500	0.010	1.273 - 7.340
Others	3.990	1.280	0.200	0.480 - 33.200
Perceived Susceptibility to Placental malaria parasitemia (ref =Yes)				
No	2.270	1.730	0.080	1.898 - 2.770
Maternal PCV	0.840	-.3.640	0.000	0.772 - .9200
Used IPT (ref = No)				
Yes	0.110	-2.570	0.010	0.221-0.625
Used IPT/ITN (Ref = uses both)				
Use neither	0.250	-2.440	0.020	0.21-0.680