Prevalence of malaria parasitemia in pregnant women attending antenatal and delivering at some selected hospitals of Katsina metropolis, Nigeria.

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ABSTRACT

Malaria during pregnancy remain one of serious public health problems especially in sub-Saharan Africa, accounting for an estimation of about 10,000 maternal deaths and 200,000 infant mortality annually. Hence, the need to conducts numerous studies worldwide to forge ways by which prevalence of malaria could be assessed for proper diagnosis, evaluation, prevention and eradication. For this study 300 pregnant women with mean age of 27 years were enrolled, of which 222 (74%) were positive for peripheral malaria infection and 180 (60%) shows a positive placental malaria infection by thick film microscopy.

INTRODUCTION

Malaria is known to be cause by a one-celled obligate intra-erythrocytic protozoan of the genus Plasmodium (Antinori *et. al* 2012). Six species of Plasmodium are responsible for human malaria infections. *P. falciparum, P. vivax, P. malariae, and P. ovale curtisi, P. ovale wallikeri* and *P. knowlesi. Plasmodium falciparum* is the most prevalent malaria parasite in sub-Saharan Africa (Autino *et.al* 2012), accounting for 99% of estimated malaria cases in 2016 (WHO, 2016). Outside of Africa, *P. vivax* is the predominant parasite in the WHO Region of the Americas representing 64% of malaria cases (Howes *et.al* 2016), while in the South-East Asia the proportion of malaria cases is about 30% and 40% in the Eastern Mediterranean regions (WHO, 2017). Malaria in pregnancy from different literatures is known to be an obstetric, social and medical problem (Lasisi *et al.* 2018) requiring multi-displinary and multi-dimensional solution (Sabin *et al.* 2018). According to a report by the World Health Organization in sub-Saharan Africa each year, more than 50 million pregnant women are reportedly exposed to the risk of malaria (WHO, 2017).

MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Katsina metropolis of Katsina State. Katsina State is located in the North- Western part of Nigeria, bordering Niger republic to the North, Zamfara state to the South, Kano state to the East and Jigawa state to the West (El-Ladan *et al.* 2014). The state covers a total area of 24, 192 km^2 spanning between longitude 10°33′59″ to 13°18′30″N and latitude 6°59′32″ to 9°00′0.1″E with an estimated population of 6.5 million people (National census projection, 2015). The mean annual temperature ranges from 29°C – 31°C, the highest air temperature normally occurs in April/May and the lowest occur in December through February. Annual rainfall in Katsina state normally falls between July and October with a range of 500mm – 920mm (Ogungbenro and Morakinyo, 2014). Malaria transmission is endemic in Katsina state with all year-round transmission at levels below National average, with a seasonal peak (60% of annual malaria cases) coinciding with the raining season (Stranchan *et.al* 2016).

2.2 Study Population

The population (subjects) involved in this study was drawn from pregnant women (primigravidae and multigravidae) with a gestation period of between 36 to 40 weeks attending antenatal care and delivering at the maternity units of General Hospital Katsina, Federal medical Center Katsina and Turai Yaradua maternal Hospital Katsina, were a total of 300 study participants were recruited. Using the yearly average of deliveries conducted from each of the 3 hospitals, (246 deliveries from Federal Medical Center Katsina, 314 deliveries from Turai maternal hospital and 346 from General Hospital Katsina), 83 participants were recruited from Federal Medical center Katsina, 102 participants from Turai maternal hospital Katsina and 115 participants from General hospital Katsina.

2.3 Ethical Consideration

Ethical clearance certificate with reference number (MOH/ADM/SUB/1152/1/194) was obtain from the State Ministry of Health with which permission was obtain from the management of the three selected hospitals. Both written and oral informed consent was obtained from the

participants prior to collection of samples, in the event where the pregnant women are indisposed any close relative of the participant were allowed to fill in the consent form and the semi structured questionnaire.

2.4 Sample Collection

Before delivery, either at the inception of the programme or during labor, 2mls of peripheral blood samples was aseptically collected by vein puncture from the antecubital vein of the forearm of each subject with a sterile syringe by a certified nurse (Adikwu *et al.* 2017). Using the biopsy pool method as described by Conroy *et al.* (2012), immediately after delivery, an incision was made at the maternal surface of the placenta approximately a third of the distance from the umbilical cord and at the edge of the placental disc. At the incision site 2mls of the heparinized blood was aseptically collected using a sterile syringe. Immediately after collection, the blood samples were stored and labeled accordingly in screw cap bottles already treated with ethylene diamine tetra-acetic acid (EDTA) and gently mixed to prevent clotting.

2.5 Blood staining and Microscopy

All the blood samples collected were transported in ice filled coolers to Sahel diagnostic center Katsina where thick and thin smears were prepared and Gemsa stained by well-trained microscopist, for parasite identification and quantification as described by the WHO, 2010. Parasite density was determined by counting the number of asexual parasites relative to at least 200 leucocytes in each thick blood film and assuming a mean leucocyte count of 800 (WHO,2010). Parasitemia was graded as low (Parasite < 1000), moderate (Parasite > 1000 – 9,999) and severe (Parasite > 10,000).

2.6 Statistical Analysis

Statistical package for Social Sciences (SPSS) software (IBM SPSS Statistics v.23.0) was used for the analysis. From the values obtained after malaria microscopy of both peripheral and placental blood samples collected, Descriptive statistic of frequency was use to present the level of malaria parasitemia,

RESULTS

Out of the 300 pregnant women involved in this research 115 (38.3) were screened at G.H.K, 102 (34.0) at T.M.H while the remaining 83 (27.7) at F.M.C of which majority of them are multigravid 177 (59.0) followed by primigravids 72 (24.0) and secundgravids 51 (17.0). As shown on **table 1** below majority of the participants are within the age group 14-25 years and most had secondary education 116 (38.7) followed by those with none formal education 106 (35.3), primary education 62 (20.7) then those with tertiary education 19 (6.3). Majority of the participants resides outside the vicinity 173 (57.7).

Table 2 shows the prevalence and intensity of malaria infection present in both peripheral and placental blood samples examined. From the table 222 (74.0) participant shows positive for malaria parasite in their peripheral blood smear while 78 (26.0) were negative, for the placental blood smear majority shows a positive result 180 (60.0) while the remaining 120 (40.0%) appears negative. The severity of malaria parasitemia is found to more in the peripheral blood (Mild + = 39.35%, Moderate ++ = 20.7%, Severe +++ = 14.0%) as compared with that of placental blood smears (Mild + = 29.7%, Moderate ++ = 18.0%, Severe +++ = 12.3%)

Table 1: Socio-demographic characteristics of the participants.

Variables	Frequency (%) N = 300
Age groups	
14 – 25	137 (45.7)
26 – 35	104 (34.7)
36 – 47	59 (19.7)
Gravid	
Primigravid	72 (24.0)
Secundgravid	51 (17.0)
Multigravid	177 (59.0)
Level of Education	
No formal education	106 (35.3)
Primary	62 (20.7)
Secondary	116 (38.7)
Tertiary	
Residential Area	127 (42.3)
Urban	173 (57.7)
Rural	
Hospital involved	115 (38.3)
G.H.K	102 (34.0)
T.M.H.K	83 (27.7)
F.M.C.K	

*G.H.K = General Hospital Katsina, T.M.H.K = Turai Maternal Hospital Katsina,

F.M.C.K = Federal Medical Center Katsina

Table 2: Occurrence of P.falciparum malaria in both peripheral and placental blood samples by Intensity of infection.

Intensity of Infection	Peripheral Samples	Placental Samples
Negative	78 (26.0)	120 (40.0)
Mild	118 (39.3)	89 (29.7)
Moderate	62 (20.7)	54 (18.0)
Severe	42 (14.0)	37 (12.3)
Total Positive	222 (74.0)	180 (60.0)

When ascertaining the prevalence of malaria in pregnancy in association with gravidity, from **table 3** it is notice that the intensity of malaria parasite increases as per gravidity in both peripheral blood and placental blood smear. Such that parasitemia is more virulent among primigravids 89 (95.8%) and 72 (100%), followed by secungravids 37 (72.5%) and 41 (80.4%), while multigravids recorded the least number of infections 34 (66.7%) and 71 (40.1%) respectively. However, when comparing the level of malaria parasitemia and its severity in both the 2-blood sample it is observed from **table 3** that among primigravid and secungravid malaria parasite is found to be more severe in the placental blood smear as compared with the peripheral blood, while in the case of multigravids the reverse is the case.

Table 3: Prevalence of Malaria parasitemia in Relation to Gravid

Gravid	Sample Size	Intensity of Infection N (%)	
		Peripheral blood Samples	Placental blood Samples
Primigravid	72	Negative 3 (4.2) Mild 26 (36.1) Moderate 25 (34.7) Severe 18 (25.0) Total positive 89 (95.8)	Negative 0 (0.0) Mild 12 (16.7) Moderate 28 (38.9) Severe 32 (44.4) Total positive 72 (100)
Secungravid	51	Negative 14 (27.5) Mild 12 (23.5) Moderate 11 (21.6) Severe 14 (27.5) Total positive 37 (72.5)	Negative 10 (19.6) Mild 26 (51) Moderate 9 (17.6) Severe 6 (11.8) Total positive 41 (80.4)
Multigravid	177	Negative 70 (39.5) Mild 65 (36.2) Moderate 25 (14.1) Severe 18 (10.2) Total positive 34 (66.7)	Negative 106 (59.9) Mild 51 (28.8) Moderate 17 (9.6) Severe 3 (1.7) Total positive 71 (40.1)

From **table 4** out of the 222 and 180 pregnant women positive for malaria parasite in both peripheral and placental blood respectively (as shown in **Table 1**). The age range of 14 - 25 years were more infected with malaria parasite 133 (96.4%) and 121 (87.7%), followed by 26 – 35 years age range 62 (60.1) and 64 (62.1), while pregnant women within the age range of 36 - 47 years were the least infected with malaria parasite 27 (45.8%) and 36 (61%) respectively. The level of education of the pregnant women with respect to intensity of malaria parasite infection showed that pregnant women with no formal education were most infected with malaria parasite75 (70.8%) , followed by secondary education 71 (55.9%), primary education 32 (62.7%) , while those with tertiary education showed the lowest rate of malaria infection 2(10.5%) as shown in **Table 5**. With respect to residential area, **table 6** shows that the pregnant women that reside in the rural areas are more infected with severe malaria infection 104 (60.1%), than their counterparts living within the state metropolis 76 (59.8).

Table 4: Prevalence of Malaria parasitemia in pregnancy in Relation to Age group

Age group	Sample Size	Intensity of Infection N (%)	
		Peripheral blood Samples	Placental blood Samples
14 – 25	138	Negative 5 (3.6) Mild 95 (68.8) Moderate 14 (10.1) Severe 24 (17.4) Total positive 133 (96.4)	Negative 17 (12.3) Mild 31 (22.5) Moderate 48 (34.7) Severe 42 (30.4) Total positive 121 (87.7)
26 – 35	103	Negative 41 (39.8) Mild 15 (14.6) Moderate 31 (30.1) Severe 16 (15.5) Total positive 62 (60.1)	Negative 39 (37.9) Mild 12 (11.7) Moderate 27 (26.2) Severe 25 (24.3) Total positive 64 (62.1)
36 – 47	59	Negative 32 (54.2) Mild 8 (13.6) Moderate 17 (28.8) Severe 2 (3.4) Total positive 27 (45.8)	Negative 23 (39.0) Mild 11 (18.6) Moderate 15 (25.4) Severe 10 (16.9) Total positive 36 (61.0)

Table 5: Prevalence of Malaria parasite in pregnancy with respect to level of education

Level of education	No. examined	No. +ve in peripheral blood	No. +ve in placental blood
None	106 (35.3)	89 (83.9)	75 (70.8)
Primary	51 (17.0)	45 (88.2)	32 (62.7)
Secondary	127 (42.3)	81 (63.8)	71 (55.9)
Tertiary	19 (6.3)	7 (36.8)	2 (10.5)

Table 6: Prevalence of Malaria parasite in pregnancy with respect to the participants residential area

Residential Area	No. examined	No. +ve in peripheral blood	No. +ve in placental blood
Urban	127 (42.3)	91 (71.7)	76 (59.8)
Rural	173 (57.7)	131 (75.7)	104 (60.1)

DICUSSIONS

Malaria during pregnancy remain one of serious public health problems especially in sub Saharan Africa, accounting for an estimation of about 10,000 maternal deaths and 200,000 infant mortality annually (Omer *et al.*2017). Hence, the need to conducts numerous studies worldwide to forge ways by which prevalence of malaria could be assessed for proper diagnosis, evaluation, prevention and eradication. For this study 300 pregnant women with mean age of 27 years were enrolled, of which 222 (74%) were positive for peripheral malaria infection and 180 (60%) shows a positive placental malaria infection by thick film microscopy as shown in table 2. The result shows a higher prevalence rate than what was observed in Sudanese women as reported by Omer *et al.* 2017 where malaria parasites was confirmed in 37.8% of the peripheral blood films and 59.3% of the placental films. From the study based on the thin film conducted on both the peripheral and placental blood samples, *P.falciparum* happens to be the dominant species observed, which coincides with a report by Nicaise *et al.* 2018 and the common knowledge that *P. falciparum* is the predominant plasmodium specie in sub Saharan regions where malaria transmission is high (Irene *et al.* 2016).

When clinically observing pregnant women, primigravidae, secundgravidae and multigravidae are the three major classifications of pregnant women. From the results obtained in table 3 from both the peripheral and placental blood smear, malaria parasitemia is more virulent among primigravidae 89 (95.8%) and 72 (100%), followed by secundgravidae 37 (72.5%) and 41 (80.4%), while multigravidae recorded the least number of infections 34 (66.7%) and 71 (40.1%) respectively. The result obtained seems to be in tandem with the works of Aliyu *et al.* 2017. However, when comparing the level of malaria parasitemia and its severity in both the 2 blood samples it is observed from **table 3** that among the pregnant women primigravidae and secundgravidae were found to harbor severe malaria infection in the placental blood smear as compared with the peripheral blood, while in the case of multigravids the reverse is the case. The

reason for the upsurge of malaria parasitemia in the placental blood of the primigravids and secundgravids might be that the physiological changes caused by pregnancy and the pathological alterations caused by malaria have a synergistic effect on the course of each other. Thus, making the disease more virulent especially among primigravidae and secundgravidae (Cisse *et al.* 2014), whose immunity is low (Steketee *et al.* 2014) resulting in higher density infections (Soma-Pillay and Macdonald, 2012). Also, in such endemic regions pregnant women are often reported with high placental parasitemia but with minimal peripheral parasitemia (Ouédraogo *et al.* 2011; Ezebialu *et al.* 2012; Bassey *et al.* 2015; Omer *et al.* 2017).

From the result of table 4, the thick smear from both the peripheral and placental blood samples collected, pregnant women within the age range of 14 - 25 years were more infected with malaria parasite 133 (96.4%) and 121 (87.7%), followed by 26 – 35 years' age range 62 (60.1%) and 64 (62.1%). While pregnant women within the age range of 36 - 47 years were the least infected with malaria parasite 27 (45.8%) and 36 (61%) respectively. The results obtained are in line with the work conducted in different studies the likes of (Saute *et al.* 2002, Dicko *et al.* 2003, Rogerson *et al.* 2007) whose works further explains that complexity of malaria infection showed an increase in young pregnant women.

Well- known risk factors that further aggravate the spread and persistence of malaria infection especially among pregnant women are educational status and residential area. From this study the level of malaria parasitemia was recorded higher in women with no formal education 75 (70.8%), followed by those with secondary education 71 (55.9%), primary education 32 (62.7%), while those with tertiary education showed the lowest rate of malaria infection 2(10.5%) as shown in **Table 5**. As supported by the findings of Alaku *et al. (*2012) and Fana *et al.* (2015), low level of education and awareness of the dangers posed by malaria during pregnancy especially to the neonates and the new mother are some of key factors that aggravate the level of malaria caused maternal and neonatal morbidity and mortality. With respect to the prevalence of malaria infection among the pregnant women in respect to their residential areas, results from **table 6** shows that the pregnant women that reside in the rural areas are more infected with severe malaria infection 104 (60.1%), than their counterparts living within the state metropolis 76 (59.8).

CONCLUSION

The present study showed higher prevalence of placental malaria as compared to other studies especially among primigravideas and secundigravideas, also the study shows significant association of prevalence of placental malaria and with pregnant women of younger age group. The overall results obtained indicates a need for pregnant women especially those coming from the rural areas with no or little formal education to be sensitized about the dangers posed by placental malaria to both the mother and the unborn child. Also, special care needs to be given to pregnant mothers of younger age generation especially primigravidaes on how best they could prevent malaria infection.

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