Plasmodium Parasitaemia Among Pregnant Women Attending Antenatal Clinic in Sokoto, North Western Nigeria


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Abstract
Background: Malaria infection during pregnancy is a significant public health problem and a major contributor to adverse maternal and perinatal outcome. In hyper endemic area like Nigeria, it is a common cause of anaemia in pregnancy and is aggravated by poor socioeconomic circumstances. The aim of this study is to investigate plasmodium infection rate and parasite density among pregnant women attending antenatal clinic in Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto. Method: Two hundred and ten (210) consecutively recruited pregnant women, aged between 18-45 years constituted the subjects for this descriptive study. The study was conducted in the month of June, when malaria infection is usually high. Blood samples were collected and examined for malaria parasite. Both thick and thin films were made and stained using parasitological standard procedures. Malaria density was computed using the WHO formulae. Results: The result indicated a malaria prevalence of 52.2%. Malaria infection was significantly higher among pregnant women in the second trimester (50.9%), followed by third trimester (42.9%) and then first trimester (6.2%) (p=0.01). Level of parasitaemia among the subjects indicated that 25(21.6%) had severe malaria infection while 55(47.4%) had moderate case of malaria parasitaemia and 36(31.0%) had mild malaria density. The prevalence of malaria infection was significantly higher among pregnant women in the 18 – 25 years age group (54.3%), followed by third trimester (42.9%) and then first trimester (6.2%) (p=0.01). Level of parasitaemia among the subjects indicated that 25(21.6%) had severe malaria infection while 55(47.4%) had moderate case of malaria parasitaemia and 36(31.0%) had mild malaria density. The prevalence of malaria infection was significantly higher among pregnant women in the 18 – 25 years age group (54.3%) followed by those by the 26 – 35 with (43.1%) and 36 – 45 age range (2.6%) (p=0.01). Severe parasitaemia was more prevalent among primigravids women, followed by secondigravids women and the least severity was recorded among multigravids women (12(10.3%), 8(6.9%) and 5(4.3%) respectively). Plasmodium falciparum was responsible for all the cases of malaria. Conclusion: This present study indicates a high prevalence of Plasmodium falciparum malaria among pregnant women in Sokoto, Nigeria. There is need for the implementation of preventive measures including the provision of regular malaria prophylaxis and provision of insecticide-treated mosquito nets to reduce the substantial risks to the pregnant woman and her foetus.
1. Introduction

Malaria is a life threatening parasitic disease transmitted by female anopheles mosquitoes. It is the most prevalent tropical disease, with high morbidity and mortality and high economic and social impact. Malaria remains a major public health problem worldwide, causing about 216 million infections and approximately 655,000 deaths in the year 2010. Each year, 80% to 90% of the World’s malaria cases occur in sub-Saharan Africa and approximately 19 to 24 million women are at risk of malaria and its adverse consequences. In areas with stable malaria transmission like Nigeria, the vast majority of infections with *P. falciparum* in pregnancy remain asymptomatic, undetected and untreated.

Malaria infection caused by *Plasmodium falciparum* is a major cause of fever and anaemia in pregnant women resident in hyper endemic areas of Africa. Basically, this is as a result of reduced immunity to malaria during pregnancy, making the pregnant women prone to severe malaria attack and subsequently anaemia. Severe anaemia has been found to be more than twice as common in women with peripheral parasitaemia as in those without parasitaemia. Indeed, malaria can cause severe perinatal and maternal complications including abortion, stillbirth, low birth weight and even death. Incidentally malaria infection is more rampant among the primigravidae and secundigravidae than the multigravidae. The preferential susceptibility of of pregnant women may be related to some evidence that immuno-suppression associated with pregnancy, occurs more in the first than subsequent pregnancies. Previously, the depression of cell-mediated immune response to *Plasmodium falciparum* antigens has been implicated in this phenomenon. Epidemiological studies have shown that malaria in pregnancy is more prevalent in younger than older age groups. Currently, susceptibility to *Plasmodium* parasitaemia has been linked to the level of antibodies to placental sequestrated parasites. There is paucity of data on the prevalence of malaria among pregnant women in Sokoto, North Western Nigeria. The aim of this study was to investigate the prevalence of malaria and it associated socio and obstetrics factors among pregnant women attending antenatal clinic in Usmanu Danfodiyo University Teaching Hospital (UDUTH).

2. Materials and Methods

2.1. Study Subjects

The study subjects consisted of 210 consecutively-recruited pregnant women attending ante-natal clinic visit in Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto.

2.2. Study Area

The study was carried out in Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto State, Nigeria. The hospital is a tertiary health facility offering quality obstetrics care to pregnant women in Sokoto State and surrounding states (Kebbi, Zamfara) and neighboring Niger Republic. The health institution is aimed at the provision of effective and efficient tertiary care services which are affordable, accessible and equitable to the general public as well as training in medical education and conducting of relevant researches. Sokoto State comprises of 23 local governments. The population of the state as at the March 2006 census was 3.70 million.

2.3. Data Collection and Statistical Analysis

The socio-demographic data and other relevant information of each participant were obtained using a structured self-administered questionnaire. Statistical data was analyzed using SPSS computer software program version 18.0. A p-value of ≤ 0.05 was considered significant in all statistical comparisms.

2.3.1. Ethical Consent

The ethical clearance was obtained from the ethical committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto. All pregnant subjects were offered pre and post test counseling. Verbal informed consent was obtained from all study subjects.

2.3.2. Eligibility Criteria

(i) Inclusion Criteria

Inclusion criteria included age ≥ 18 years, confirmation of pregnancy by a consultant obstetrician and willingness to offer a verbal informed consent to participate in the study.

(ii) Exclusion Criteria

Non pregnant women, pregnant women < 18 years and non-consenting pregnant women were excluded from the study.

2.4. Method

Five milliliter (5ml) of blood was collected by venepuncture using aseptic technique from each participant into Ethylene Diamine Tetracetic Acid (EDTA) anticoagulated tube for the determination of parasite load and malaria testing using the OnSite Malaria P/Pv Ab Combo Rapid Test (CTK Biotech, U.S.A). The test is a lateral flow chromatographic immunoassay for the simultaneous detection and differentiation of antibodies including IgG, IgM and IgA to *Plasmodium falciparum* (Pf) and *Plasmodium vivax* (Pv) in human serum, plasma or whole blood. Screening of malaria parasites was carried out strictly following the manufacturer’s instructions.

2.5. Malaria Parasite Density Estimation

White blood cells count (WBCs) is the bedrock in the estimation of malaria parasite density in malaria field trials, interventions and patient management. White cells are indirectly and relatively used in microscopy to estimate the density of malaria parasite infections, due to frequent lack of
facilities in some malaria-endemic countries. In order to quantify WBCs of patients, the World Health Organization recommend a WBCs of $8.0 \times 10^7/L$ to help in estimating malaria parasite densities. Parasite density was determined by counting the number of asexual parasites relative to at least 200 leukocytes in each thick film and assuming a mean leukocytes count of 8000 per micro litre of blood (as recommended by WHO). Parasitaemia was graded as low or mild (parasite <1000/ul), moderate (parasite >1000 - 9,999/ul) and high or severe (parasite >10000/ul). The thick films were used to determine the parasite densities while thin films were used to identify the parasite species and infective stages.

### 3. Results

The result indicated that 116 out of the 210 (52.2%) were positive for malaria. Malaria infection was more prevalent among pregnant women in the second trimester (50.9%), followed by third trimester (42.9%) and then first trimester (6.2%). Table 1 shows the prevalence of malaria infection in various trimesters. Malaria prevalence followed the trend 2nd trimester (50.9%) > 3rd trimester (42.9%) > 1st trimester (6.2%) (p=0.01). Malaria parasitaemia was more severe among pregnant women in the second trimesters, 25(21.6%) followed by third trimester 9(7.8%) and first trimester 4(3.4%). Table 2 show the prevalence of malaria parasitaemia based on trimester. The prevalence of malaria infection was significantly higher among pregnant women in the 18 – 25 years age group (54.3%), followed by those in the 26 – 35 years age group (43.1%) and lowest among subjects in the 36 – 45 years age group (2.6%) (p=0.01). Table 4 shows the degree of malaria parasite density in relation to parity.

#### Table 1. Prevalence of Malaria Parasites by Trimester

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Not Infected</th>
<th>Infected</th>
<th>$X^2$</th>
<th>df</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>First trimester</td>
<td>5(2.4%)</td>
<td>8(3.8%)</td>
<td>3.45</td>
<td>2</td>
<td>13(6.2%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Second trimester</td>
<td>45(21.4%)</td>
<td>62(29.5%)</td>
<td></td>
<td></td>
<td>107(50.9%)</td>
<td></td>
</tr>
<tr>
<td>Third trimester</td>
<td>44(21.0%)</td>
<td>46(21.9%)</td>
<td></td>
<td></td>
<td>90(42.9%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>94(44.8%)</td>
<td>116(55.2%)</td>
<td></td>
<td></td>
<td>210(100%)</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 2. The level of malaria parasitaemia according to trimesters.

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Mild (parasite &lt;1000/ul)</th>
<th>Moderate (parasite &gt;1000 - 9,999/ul)</th>
<th>Severe (parasite &gt;10000/ul)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Trimester</td>
<td>3(2.6%)</td>
<td>1(0.9%)</td>
<td>4(3.4%)</td>
<td>8(6.9%)</td>
</tr>
<tr>
<td>2nd Trimester</td>
<td>17(14.6%)</td>
<td>33(28.4%)</td>
<td>12(10.3%)</td>
<td>62(53.4%)</td>
</tr>
<tr>
<td>3rd Trimester</td>
<td>16(13.8%)</td>
<td>21(18.1%)</td>
<td>9(7.8%)</td>
<td>46(39.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>36(31.0%)</td>
<td>55(47.4%)</td>
<td>25(21.6%)</td>
<td>116(100%)</td>
</tr>
</tbody>
</table>

#### Table 3. Prevalence of plasmodium parasitaemia among age groups

<table>
<thead>
<tr>
<th>Age group (Years)</th>
<th>Positive</th>
<th>Negative</th>
<th>$X^2$</th>
<th>df</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-25</td>
<td>63(30.0%)</td>
<td>49(23.3%)</td>
<td>4.28</td>
<td>2</td>
<td>112(53.3%)</td>
<td>0.01</td>
</tr>
<tr>
<td>26-35</td>
<td>50(23.8%)</td>
<td>43(20.5%)</td>
<td></td>
<td></td>
<td>93(44.3%)</td>
<td></td>
</tr>
<tr>
<td>36-45</td>
<td>3(1.4%)</td>
<td>2(1.0%)</td>
<td></td>
<td></td>
<td>5(2.4%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>116(55.2%)</td>
<td>94(44.8%)</td>
<td></td>
<td></td>
<td>210(100%)</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 4. Distribution of Malaria Parasite density according to parity

<table>
<thead>
<tr>
<th>Gravidae</th>
<th>Severe (parasite &gt;10000/ul)</th>
<th>Moderate (parasite &gt;1000 - 9,999/ul)</th>
<th>Mild (parasite &lt;1000/ul)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primigravidae</td>
<td>12(10.3%)</td>
<td>17(14.7%)</td>
<td>23(19.8%)</td>
<td>52(44.9%)</td>
</tr>
<tr>
<td>Secundigravidae</td>
<td>8(6.9%)</td>
<td>11(9.5%)</td>
<td>17(14.7%)</td>
<td>36(31.0%)</td>
</tr>
<tr>
<td>Multigravidae</td>
<td>5(4.3%)</td>
<td>8(6.9%)</td>
<td>15(12.9%)</td>
<td>28(24.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>25(21.6%)</td>
<td>36(31.0%)</td>
<td>55(47.4%)</td>
<td>116(100%)</td>
</tr>
</tbody>
</table>

### 4. Discussion

In this study we observed the prevalence of malaria infection to be 55.2% among pregnant women in Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto. Our observed prevalence is higher than that reported in some previous studies in Nigeria. Our finding is also however consistent with previous report in Libreville, Gabon which indicated a 57% prevalence. Our observed prevalence is also significantly higher than prevalence observed in a previous study in Calabar and Lagos as well as in India. This high prevalence observed in this study may be due to the fact that the present study was carried out during the raining season. The rainy season starts late in June and ends early in September but may sometimes extend into October. The average annual rainfall is 550 mm with peak in the month August. The raining season provides available surface water and pools which facilitates the breeding of the
disease vector and subsequently the spread of the disease. The high prevalence of malaria observed in this study has negative implication on the pregnant woman and her developing foetus. *Plasmodium falciparum* infection during pregnancy increases the likelihood of maternal anaemia, abortion, still birth, prematurity, intrauterine growth retardation and low birth weight\textsuperscript{22}. Infection with *Plasmodium falciparum* is more hazardous during pregnancy. Pregnancy appears to interfere with the immune processes in malaria disease which itself alters immune reactivity. In highly endemic malarious area where semi – immune adults usually have substantially acquired resistance to local strains of plasmodium, the prevalence of clinical malaria is higher and its severity is greater in pregnancy\textsuperscript{18}.

In this present study, we observed that the prevalence of malaria was significantly higher among pregnant women in 15-25 years age groups to those in the 26 - 35 and > 36 years age group. This observation is consistent with finding from previous reports in Ibadan, Nigeria \textsuperscript{22} and Gabon \textsuperscript{23} which indicated that younger women were more susceptible to malaria infection. The reason for the high prevalence among younger women may be due to the existence of low natural immunity to infectious disease including malaria at that age\textsuperscript{25,20,13}. However, some studies have reported that age did not show any relationship with the prevalence of malaria\textsuperscript{26,27}.

We observed in this study that malaria parasitaemia was higher in the primigravidae than the secundigravidae and multigravidae women. Earlier workers observed that primigravidae and secondegravidae demonstrate more vulnerability to malaria parasitaemia and consequently develop more malaria- related complications in pregnancy\textsuperscript{28,29,30,31}. Other similar studies\textsuperscript{2,25,32-35} had established a significant difference between malaria parasitaemia and parity. The reason for the increased predisposition of primigravidae women may be due to a lack of specific immunity to malaria. It seems that as parity increases, the predisposition to malaria infection decreases. Several reports have shown that malaria in pregnancy has deleterious effects on the growth and subsequent survival of the foetus and that this effect is even more pronounced in those who are not immuned or have partial immunity\textsuperscript{2,36,37,38,39,40,41}. Epidemiological evidence from cross-sectional surveys also indicates that parity influences susceptibility to malaria to an important degree\textsuperscript{33,42}.

In this study we observed that severe malaria was higher in the second trimester of pregnancy. Our finding is consistent with report by some researchers which indicates that susceptibility is more marked in the second trimester than during the third trimester\textsuperscript{7,10}. Our finding is however at variance with a previous report which indicated that there was no relationship between malaria severity and gestational age\textsuperscript{35}.

We observed that *P. falciparum* was the predominant species among the pregnant subjects studied. Previous reports\textsuperscript{41,42} indicates that *Plasmodium falciparum* malaria is more prevalent in sub Saharan Africa and that it may be associated with a potentially fatal outcome, particularly if there are delays in recognition and treatment\textsuperscript{43}.

5. Conclusion

This present study indicates a high prevalence of *Plasmodium falciparum* malaria among pregnant women in Sokoto, Nigeria. There is need for the implementation of preventive measures including the provision of regular malaria prophylaxis and provision of insecticide-treated mosquito nets to reduce the substantial risks to the pregnant woman and her foetus.

Authors Contribution

Erhabor O and Udomah FP designed the study, Nwobodo D and John RT recruited the subjects and Isaac IZ carried out the laboratory testing. Erhabor O and Isaac were involved in the statistical analysis and writing up the manuscript. All authors approved of the final content.

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References


