The prevalence of *Plasmodium falciparum* among three stages of pregnancy
in Dogon Dawa, Nigeria

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Abstract

A study of the efficacy of ITNs and chemoprophylaxis (SP) in preventing malaria in pregnant women was carried out at Dogon Dawa District. Birnin Gwari Local Government Area, Kaduna State. The Inclusion criteria for women in the survey were that: The woman is aged 15-49, pregnancy is confirmed by a health care provider on site, she is attending the antenatal clinic for the first time, the woman accepts malaria testing, have no chronic illness or severe form of malaria, not sick at the time of recruitment, none of the women that participated in this study -were sleeping under bednet as at the time of the study. Out of a total of 500 pregnant women attending Dogon Dawa primary health center, 150 were enrolled for the study. Thirty (20.2%) of Antenatal clinic attendees were primigravidia while 108 (73.0%) were multigravidia and 10 (6.7%) did not respond to whether it was their first pregnancy. Among the study population, 20 (13.5%) were in their first trimester. 58(39.2%), in the second trimester and 54(36.5%) in their third trimester. The subjects were divided into groups. Group 1 had fansidar only (SP), Group 2 had untreated net only, Group 3 had insecticide treated net (ITNs) and Group 4 had insecticide treated net (ITNs) and fansidar and Group 5 had no fansidar and no insecticide treated net. Prevalence of *Plasmodium falciparum* showed higher infection rate with group 5 using no fansidar and no treated net with \( p < 0.01 \). The Drugs used for fever by pregnant women were chloroquine, fansidar and herbal tea; herbal tea had highest prevalence, Among the drugs used by pregnant women against malaria, Herbal tea and Fansidar showed high significant difference.

From the findings in this study, it was could be concluded that house wives, women with no formal education and pregnant women within the age of (16-25 yrs) had the highest prevalence of the parasite. The findings also revealed that the use insecticide treated net and fansidar are effective in the control of the transmission of the parasite. It has been showed, that the highest prevalence could be attributed to exposure to the vector and ignorance about malaria transmission and its treatment.

Keywords: malaria; insecticide treated nets; pregnancy

Introduction

Malaria is a very old disease and prehistoric man is thought to have suffered from it (WHO, 2011). Malaria is the 5th cause of death from infectious diseases worldwide (after respiratory infections, HIV/AIDS, diarrheal diseases, and tuberculosis and in Africa (CDC, 2012). The first recorded incidence of the disease dated back to the Roman era. Worldwide, about 3.3 billion people live in 109 countries and territories with high risk of malaria transmission. Thirty five countries (30 in Sub-
Saharan Africa and 5 in Asia) account for 98% of global malaria burden and deaths. The World Health Organization estimates that in 2008 alone, malaria caused an estimated 190-311 million clinical episodes and 708,000-1,003,000 deaths. Eighty nine percent (89%) of the deaths caused by malaria worldwide occur in Africa. The World Health Organization records that in 2010, there were 216 million documented cases of malaria in Africa. Around 655,000 people died from the disease, many of whom were children under the age of five. The actual number of deaths may be significantly higher, as precise statistics are unavailable in many rural areas and many cases remain undocumented. The burden of malaria results in gross economic, social and psychological losses (WHO, 2011). Recent World Malaria Report indicated that Nigeria accounts for a 25% of all malaria cases in the 45 malaria endemic countries in Africa, showing clearly the challenge of malaria in Nigeria (WHO, 2011). This may be due to the large population of approximately 160 million inhabitants (National Bureau of Statistics, 2012) living in areas of stable malaria transmission. The risk of malaria exists throughout the country, but is greater in the rural areas. It reduces economic productivity due to absenteeism from schools and places of work during severe attacks of malaria.

Five species of *Plasmodium* parasite have long been known to infect humans: *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae, Plasmodium knowlesi*. *Plasmodium falciparum* causes malaria that mostly results in severe infections which, if not promptly treated may lead to death. In as much as malaria can be a deadly disease, illness and death resulting from malaria can be prevented (CDC, 2012). Each year, approximately 50 million women living in malaria-endemic countries throughout the world become pregnant, out of which over half live in tropical areas of Africa with intense transmission of *Plasmodium falciparum* (Anorl et al., 2001). An estimated 10,000 of these women and 200,000 of their infants die as a result of malaria infection during pregnancy, and severe malarial anaemia contributes to more than half of these deaths. Most cases of MIP in areas of stable transmission are asymptomatic (Anorl et al., 2001). This is attributed to anti-disease immunity acquired during previous exposures which protects against clinical malaria (Staalsoe et al., 2004). Unfortunately, this subclinical infection still poses great danger to both the mother and the fetus. The principal impact of MIP is due to the presence of parasites in the placenta thereby causing maternal anaemia and low birth weight (Newman et al., 2003). In pregnant women, infection may cause harmful effect for the mother and child. Placental parasitemia retards the growth of the fetus and can cause abortion, pre-term delivery or still birth. Malaria in pregnancy cause women to give birth to babies that are often grossly under weight, weighing less than 2,500 g (Goodman et al., 2002) and these babies are more likely to die in the neonatal period.

Materials and Methods

Study area

The study was conducted in Birin Gwari Local Government Area at Dogon Dawa district which is located on latitude 12°20′ N and longitude 9°10′ E, lies in the western part of Kaduna State and has population of 222,367 (NBS, 2012).
Study population

The populations of pregnant women attending antenatal clinics in the Primary Health Care Centers at Dogon Dawa sampled was 500 out of which 150 were selected for the study using eligibility criteria of age (age range 15-49 yrs).

Eligibility criteria

For this study, inclusion criteria for women in the survey were: the woman is aged between 15-49 yrs, the pregnancy is confirmed by a health care provider on site, the woman is attending the antenatal clinic for the first time, the woman accepts malaria testing, have no chronic illness or severe form of malaria, not sick at the time of recruitment and those attending antenatal at the time of this study (at least three months pregnant).

Study site selection

A site refers to a public health facility providing antenatal care for pregnant women, which in this case is a primary health care facility. In order to ensure a continuous monitoring, all the surveyed sites were visited weekly. Sites were also allowed to recruit collaborating households within the same catchments area for the purpose of achieving the required sample size. Selection of sites was based on the following criteria: Willingness to participate in the survey, availability of staff, facilities and procedure for collecting blood from antenatal clinic attendees on their first visit of the current pregnancy, provision of services to a relatively large number of pregnant women per week to meet the minimum sample size in 12 weeks, availability of qualified personnel and willingness of on-site staff to cooperate. Prior to the start of the survey, each site was evaluated to determine whether there were appropriate personnel, supplies and training to function as an antenatal site. Sufficient ITNs was received from the Federal Ministry of Health and distributed free to the recruits.

Sample design and size

The appropriate sample size for a population-based survey is determined largely by three factors: (i) the estimated prevalence of the variable of interest-malaria in this instance, (ii) the desired level of confidence and (iii) the acceptable margin of error. The following steps were taken (NBS, 2012).

Step 1: Base sample size determination
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\[ n = \frac{t^2 \times p(1-p)}{m^2} \]

Where, \( n \) = required sample size; \( t \) = confidence level at 95% (standard value of 1.96); \( p \) = estimated prevalence of malaria in pregnant women in the project area (NBS, 2012).

\( m \) = margin of error at 5% (standard value of 0.05)

\[ n = \frac{(1.96)^2 \times 0.95 \times 0.05}{(0.05)^2} = \frac{3.8416 \times 0.95 \times 0.05}{0.0025} = 72.9 \]

\[ \approx 73 \text{ People} \]

Step 2: Design effect

The survey designed as a random sample was taken from a clustered health facility (a representative selection of Dogon Dawa village). To correct for the difference in design, the sample size is multiplied by the design effect (\( D \)). The design effect was generally assumed to be 2 for maternal surveys using cluster-sampling methodology.

Therefore, \( n \times D = 73 \times 2 = 146 \)

Step 3: Contingency

The sample was further increased by 5% to account for contingencies such as non-response or recording error.

\[ n + 5\% = 146 + 7.3 = 153.3 \approx 153 \]

Step 4: Distribution of observations

Finally, the calculation result was rounded up to the closest number that matches well with the number of clusters to be surveyed, in this case, two health facilities to allow for the maximum number of women to be sampled. To obtain accurate result, 75 samples were selected randomly from each of the two cluster health facilities.

Final sample size: \( n = 150 \) pregnant women

The study sample of 75 was each divided into five groups, with each group consisting of 15 samples. The sample was randomly selected from two clustered health facilities in Dogon Dawa, each having 75 pregnant women. Each of the 75 is further divided into 5 groups of 15 persons each. Only the Pregnant women using neither ITNs nor SP were randomly selected at household level, but other groups were randomly selected at the health facilities. A survey period of 12 weeks was performed. Use of ITNs was determined from history, hospital records and physical verifications through home visits. Additional ITNs were distributed to newer pregnant women who enrolled at the health facility and all were observed over a four week period when they were due for the second dose of SP. Pregnant women in the same catchment community but not attending ANC or using ITNs and SP were also sampled and these served as the control group. Women attending the clinic for the first time were given SP at first attendance, followed up for 4 weeks up to 8 weeks when they received complete dose of SP. Blood samples were then taken complete dose when they were due for the second dose of SP. Blood samples were then taken complete dose for drop-out samples to be replaced within this period (Table 1).

Ethical clearance

Approval for the study was sought for from the Primary Health Care Committee on Research and Ethics, Kaduna State Ministry of Health. The essence of the study was discussed with the women and a consent form was given to each interested woman for completion. Those who were not literate were communicated to in their local language. Only verbal consent from these women was needed at this time. Women were informed of the results of their malaria test and treatment offered.
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Table 1. Prevalence of *Plasmodium falciparum* among the Three Stages of Pregnancy

<table>
<thead>
<tr>
<th>Groups</th>
<th>Total Number examined</th>
<th>1st Trimester</th>
<th>2nd Trimester</th>
<th>3rd Trimester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number examined</td>
<td>Number positive (%)</td>
<td>Number examined</td>
<td>Number positive (%)</td>
</tr>
<tr>
<td>Fancider</td>
<td>30</td>
<td>12</td>
<td>6 (50.00)</td>
<td>10</td>
</tr>
<tr>
<td>UTN Only</td>
<td>30</td>
<td>15</td>
<td>3 (20.00)</td>
<td>13</td>
</tr>
<tr>
<td>ITN Only</td>
<td>30</td>
<td>2</td>
<td>0 (0.00)</td>
<td>14</td>
</tr>
<tr>
<td>ITN+F</td>
<td>30</td>
<td>14</td>
<td>4 (28.57)</td>
<td>7</td>
</tr>
<tr>
<td>Control</td>
<td>30</td>
<td>13</td>
<td>8 (61.54)</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>56</td>
<td>21 (37.5)</td>
<td>52</td>
</tr>
<tr>
<td>ANOVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trimester</td>
<td>0.109 ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groups</td>
<td>0.746 ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trimester x Groups</td>
<td>Not defined</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ns – non-significant at $p > 0.05$

by the consulting health staff. The survey protocol ensured that the unlinked anonymous testing procedure for malaria was maintained. It was also ensured that the flow of samples and data was unidirectional (i.e.) from site to health facility.

**Results**

The demographic characteristics of pregnant women considered age, educational status, occupation and state of pregnancy. Pregnant women at the age range 16-25 yrs had the highest prevalence of of malaria parasites 50% while at the age of 15 had the lowest of 23.33%. Pregnant women with no formal education had the highest prevalence of 43.31% while those with secondary education had the lowest of 16.67%. House wives had the highest prevalence of 56.67% while the civil servants were devoid of the malaria parasite. The prevalence was high among 2nd trimester while the 3rd trimester had the lowest. The prevalence of *P. falciparum* among the three categories of pregnant women showed no significant association ($p > 0.05$). The prevalence was high among the 2nd trimester of 78.57% while the 3rd trimester had the lowest of 19.08%.

**Discussion**

In this study, 150 pregnant women at different trimesters and both primigravidae and multigravidae were recruited for the study. The demographic characteristics of the pregnant women considered age, education status, occupation and state of pregnancy. Pregnant women at the age range 16-25 had the highest prevalence of 50% while at the age of 15 had the lowest prevalence of 23.33%. The highest prevalence could be attributed to exposure to the vector which could have transmitted the parasite to the women. Similar observation was made by Goodman et al. (2002). Pregnant women with no formal education had the highest prevalence of 43.31% while those with secondary education had the lowest of 16.67%. House wives had the highest prevalence of 56.67% while the civil servants were devoid of the malaria parasite. The prevalence was high among 2nd trimester while the 3rd trimester had the
lowest. The prevalence of the *Plasmodium falciparum* among the three stages of pregnant women showed no significant association ($p>0.05$) considering the fact that 2nd trimester had the highest while the 3rd trimester had the lowest. The high prevalence recorded by the 2nd trimesters could be attributed to the fact that the infection is successfully established in the placenta which is the main and most dangerous site of infection for pregnant women as reported by Goodman et al. (2002).

**Conclusion**

From the findings in this study, it could be concluded that house wives, women with no formal education and pregnant women within the age 16-25 had the highest prevalence of the parasite. The finding has also revealed that 2nd trimesters had the high prevalence of malaria which could be attributed to the fact that the infection is to exposure to the vector and ignorant about malaria transmission and its treatment.

**Acknowledgement**

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**References**


CDC (2012). Centre for Disease Control and Prevention


