Prevalence of malaria and risk factors associated with symptomatic malaria pregnant women attending antenatal care in South-South, Nigeria

Running title: Risk factors associated with symptomatic malaria pregnant women

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Abstract

Background: An evaluation of prevalence of malaria and the risk factors in pregnancy across various transmission contexts is necessary.

Methods: This is a cross-sectional study conducted in a health facility in April and May, 2024. The convenient sampling technique was used to enroll 120 pregnant women attending antenatal in Health center, south-south, Nigeria. A questionnaire was used, to gather clinical and sociodemographic data. Blood smears were done using a standard technique. The factors associated with malaria were evaluated using Pearson Chi-square and p- value of less than 0.05 was considered statistically significant.

Result: Among symptomatic pregnant women, the prevalence of malaria was 83.3% (100/120). The following factors were significantly associated with the prevalence of malaria in pregnant women with malaria symptoms: not being on antimalarial treatment for 1-5 months ($p<0.001$), being higher degree ($p<0.018$), being primigravidae ($p<0.001$), being in the first trimester ($p= 0.081$), and those pregnant women between 26 and 30 years old ($p= 0.001$).

Conclusion: Malaria remains the main public health concern among pregnant women, even though, there is an increased rate of intervention on antimalarial drugs in this region. Pregnant women who are at risk for these conditions should therefore receive extra care.

Keywords: Prevalence; Malaria; Risk Factors; Pregnancy; Symptomatic

Introduction

Malaria is by far not a common global health concern. Over 200 million infections occur yearly, and 400,000 deaths are predicted (1). Over 90% of cases and fatalities worldwide are found in Sub-Saharan Africa, which bears a disproportionate amount of the burden.

Plasmodium falciparum (*P. falciparum*), the parasite responsible for the deadliest form of malaria, poses a significant threat to pregnant women, particularly in sub-Saharan Africa (2). During pregnancy, women are more susceptible to *P. falciparum* infection due to the changes in their immune system, which can lead to severe consequences for both the mother and the fetus (3). The transmission of *P. falciparum* in pregnancy occurs through the bite of an infected female Anopheles mosquito (2). Once infected, the parasite can infect the placenta, leading to placental malaria, which can cause inflammation and damage to the placenta, affecting fetal growth and development (3).

About 50 million pregnant women live in malaria endemic areas, making pregnancy-related malaria a serious public health concern (4).

The *P. falciparum* parasite is more common in peripheral and placental blood under high transmission settings, and it is more common in first-time pregnancies than in subsequent ones. *P. falciparum* has a long-established epidemiological pattern, with a higher incidence in the early stages of pregnancy that rises if treatment is not received and subsequently falls as gestation goes on (5). If left untreated, nearly all primigravidae in stable high transmission areas are likely to get infected during the early stages of pregnancy; of these, about half would still be infected at delivery. The development of parity-specific immunity in multigravidae, particularly at higher parities, significantly lowers prevalence (6).

Control of malaria is still a problem in Africa, where the disease is endemic in 45 countries, including Nigeria, and 588 million people are at risk (7). Many National Malaria Control Programmes (NMCP) have shown particular interest in protecting pregnant women living in malaria-endemic areas due to their weakened immunity. In regions where malaria transmission is stable, the majority of pregnant cases of malaria are asymptomatic (8). Such NMCP include; insecticide-treated bed nets (ITNs), intermittent preventive treatment (IPT), and case management, are crucial to reducing the transmission of *P. falciparum* in pregnancy (9).

This can be explained by anti-disease immunity that was developed from prior exposures and guards against clinical malaria. Regretfully, there is still a significant risk of infection from this subclinical condition for both the mother and the fetus. The primary effects of malaria infection are caused by parasites in the placenta that result in low birth weight and maternal anemia, which can be fatal in severe cases (10).

The most prevalent malarial species in Africa, *P. falciparum*, is the primary cause of malaria during pregnancy. Regular exposure causes the development of a potent anti-disease immunity that inhibits the pro-inflammatory responses that cause disease and prevents potentially fatal parasite burdens (11). Thus, the purpose of this study was to evaluate the characteristics that are associated with the prevalence of malaria among pregnant women who have symptoms and are receiving antenatal care at health care in the South-South of Nigeria.

Methods

Study design

A hospital based cross-sectional study was conducted at Faith Mediplex Hospital, Benin City in South-South, Nigeria from April to May, 2024.

Dependent and independent variables

The dependent variable was malaria infection status. The independent variables were age, residence, educational status, occupation, gestational age, gravidity, distance from health centers.

Operational definitions

Symptomatic: Women who had at least one sign or symptom of malaria, such as chills, joint pain, fever (axillary temperature ≥37.5°C), vomiting, or malaise.

Pregnant: Women of confirmed urine Human Chorionic Gonadotropin (HCG) hormone positive in laboratory.

Data collection and processing

Clinical and socio-demographic data collection Women confirmed of being pregnant by using Human Chorionic Gonadotropin hormone test from urine sample in laboratory attend their follow up. So, pregnant women exhibiting signs and/or symptoms of malaria during their visit were asked for willingness to participate in the study. From volunteered pregnant women, clinical and socio-demographic data were collected through face-to-face interview by the midwives using a structured questionnaire.

Blood sample collection for detection and identification of *Plasmodium* species, capillary blood was collected by trained and experienced medical laboratory Scientist from each health center and the principal investigator. Pregnant women's finger was cleaned with 70% ethyl alcohol and the side of fingertip was pricked with a sterile lancet. The first drop of blood which contains tissue fluids was wiped away. One µl and 2 µl of blood were used for preparation of thin and thick blood films, respectively. The prepared blood films were air dried and thin films were fixed with absolute methanol. The smears were then stained by 10% Giemsa stain and examined under light microscope following standard operating procedures. A negative result was reported after checking at least 100 oil immersion fields. Thick blood films were used for parasite detection and thin blood films were used for species identification.

Data quality control

Before starting data collection, training was given to data collectors (Midwives and Medical Laboratory Scientists) by principal investigator on how to collect socio-demographic and clinical data and process laboratory data. To ensure the quality of Giemsa stain, a quality Giemsa stock solution prepared in Amhara public health institute (APHI) was used for preparation of 10% Giemsa (working solution) and prepared every 8 hours. Buffered water with PH- value of 7.2 was used for preparation of Giemsa stain working solution and filtered before use. At the end of data collection, all the slides were re-examined by experienced malaria microscopists in Faith Mediplex Hospital who have not been engaged during data collection. This review (re-examination) was taken as final.

Data analysis

Questionnaire containing socio-demographic characteristics, clinical data and associated factors was checked for completeness. The data were coded, entered, cleaned and analyzed using Statistical Package for Social Sciences version 27 (SPSS 27).

Descriptive statistics (frequencies, mean and percentage) was used to explain the study participants in relation to the variables. Chi-square was used to determine factors associated with malaria and P- value < 0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from Faith Mediplex Hospital Ethical Committee (FMH/REC/VOL12024/16). Written informed consent was obtained from study participants after explaining the purpose of the study by data collectors. Study participants with positive results were treated according to the national malaria treatment guideline.

Result

All 120 pregnant women with symptoms of fever cases included in the study were subjected to blood smear examination and the results were compared; 100 (83.3%) fever patients tested positive for malaria by blood smear examination whereas 20 (16.7%) tested negative by blood smear examination.

In terms of gravida status, the prevalence of malaria density was least among pregnant women in their primigravida (38.0%), and higher among those in their multigravida (62.0%) and the association was statistically significant (P<0.05). The prevalence of malaria parasite density among the pregnant women who were taken antimalarial therapy accounted for higher exposure during the period of 1-5 months (60%), followed by < 1 month (28%) and the least was recorded at 6 months (12%) and association was statistically significant (Figure 1). The study's findings, demonstrated the pregnant women aged 26–30 had the highest occurrence of malaria parasite infection, accounting for (43%) malaria-infected women. The age group 31–35 followed closely behind with (22 %) malaria-infected women, and aged between 20-25 years and 36-40 years had (15%) respectively, whereas the lowest prevalence was observed among women aged 41–45, with (6%) malaria-infected women. Nevertheless, the observed difference in the rate of malaria infection in relation to age was statistically significant (Figure 2). In terms of gestation age, malaria was higher among women in their first (39%), second (35.0 %), trimester (26.0 %) and the association were not statistically significant (P<.05) (Figure 3). The study showed the malaria parasite density with respect to education level of pregnant women, Secondary level accounted of 41% while Tertiary level had 51% and association was statistically significant (p value = 0.081).

Discussion

Understanding the factors contributing to malaria prevalence in pregnant women provides an opportunity to implement effective preventive measures and interventions particularly in the context of Benin City. The prevalence of malaria density was least among pregnant women in their primigravida 28 (28.0%), and higher among those in their multigravida 62 (62.0 %) and the association was statistically significant (P<0.05). Analyzing the result of this research, it can be observed that pregnant women who have been pregnant multiple times (multigravida) had a higher infection rate compared to women who were pregnant for the first time (primigravidae). This finding contradicts the findings of Yimam *et al*., (11), Mlugu *et al*., (12), and Olukosi *et al*., (13), who reported that primigravidae were more prone to contracting malaria infection during pregnancy than multigravida. This is because primigravidae lack immunity to fight against malaria infection during pregnancy, while multigravida have acquired immunity against malaria during pregnancy (14). Nevertheless, the outcome of this study was consistent with the research conducted by Suliman *et al*. (15), and Kiemde *et al*. (16), indicating that women with multiple pregnancies are the most vulnerable group and that the number of previous pregnancies does not influence protective immunity during pregnancy. The findings might be explained by the fact that women do not typically encounter regions with a high prevalence of the disease during their first pregnancy but are more common during subsequent pregnancies (17).

It was observed that the prevalence of malaria parasite among the pregnant women who were taking antimalarial therapy was higher in those who had not treated during the period of 1-5 months

60 (60%), followed by < 1 month 28 (28%) and the least was recorded at 6 months 12 (12%). This is in agreement with findings of Umar *et al*. (17).

The study's findings, as demonstrated indicated that pregnant women 26–30 had the highest occurrence of malaria parasite infection, accounting for 43 (43%) malaria-infected women. The age group 31–35 followed closely behind with 22 (22 %) malaria-infected women, and aged between 20-25 years and 36-40 years had 15 (15%) respectively, whereas the lowest prevalence was observed among women aged 41–45, with 6 (6%) malaria-infected women. Nevertheless, the observed difference in the rate of malaria infection in relation to age was statistically significant. This study concurred with the findings of Okoroiwu (14); Umar *et al*. (17), and Bolaji *et al*. (18), who concluded that the occurrence of malaria is not influenced by age. This study demonstrates a contrast to the research conducted by Mangusho *et al*. (19) and Yusuf *et al*. (20). They discovered that pregnant teenagers and young adult women had a higher vulnerability to malaria infection than older expectant mothers. It is further explained that older women acquire immunity to malaria over time due to frequent infections, leading to lower levels of malaria parasites in adult women (19; 21).

There are two possible explanations for the increased occurrence of malaria infection in the 26–30 age bracket: first, a smaller proportion of pregnant women examined in comparison to other age groups, and second, the direct impact of previous pregnancies, as a considerable proportion of the study subjects may be old and experienced mothers rather than younger, first-time mothers (18; 22; 23).

It was observed that malaria was higher among women in their first (39%), second (35.0 %), trimester (26.0 %) and the association were not statistically significant ($P<.05$). this is because most times, women in first trimester may have not tested for pregnancy, malaria, and have not registered for clinic where they would be tested, treated and monitored.

Conclusion

Overall, the findings underscored complex dynamics of malaria infection in pregnant women, influenced by age, gravidity, treatment timing, and gestational stage, contributing to the understanding of malaria management in maternal health. Therefore, special attention should be given to pregnant women prone to these factors.

Acknowledgement

Text

Funding Sources

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Ethical Statement

Text

Conflicts of Interest

Text

Author Contributions

Text

Data Availability Statement

Text

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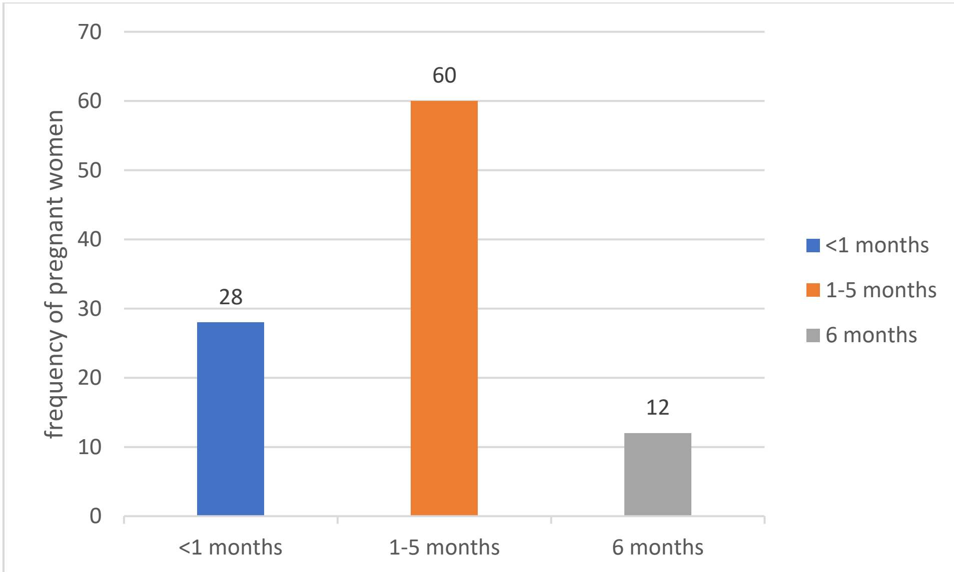

Figure 1. Distribution of malaria parasite density with respect to the duration of antimalarial therapy (P-value = 0.001)

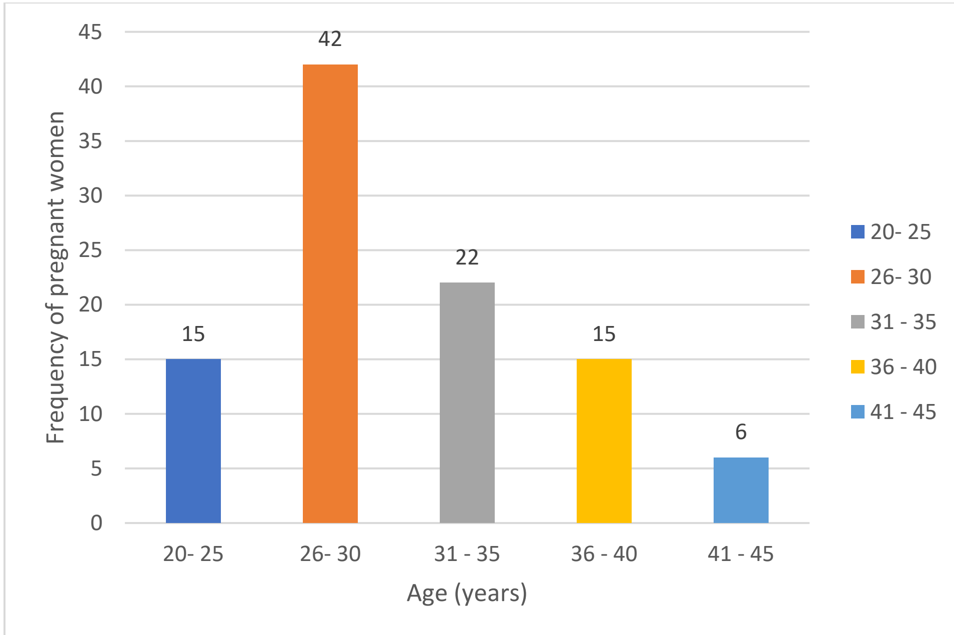

Figure 2. Distribution of parasites density according to age (P-value = 0.001)

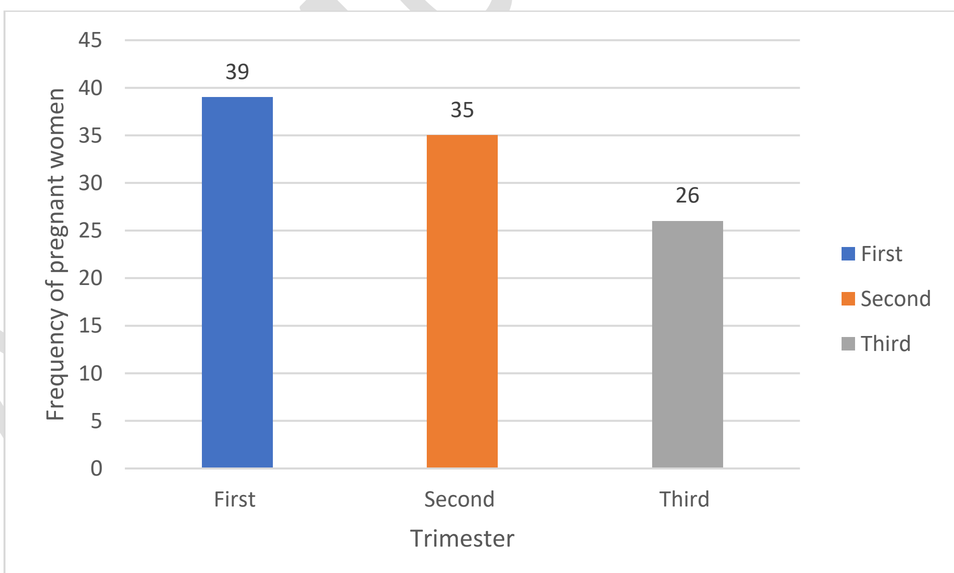

Figure 3. Distribution of parasites density with respect to trimesters (P-value = 0.081)