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Prevalence of Malaria Parasite Infection among Pregnant Women Attending Antenatal Clinics in Port Harcourt, Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author MNW designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author FON managed the analyses of the study. Author MDW managed the literature searches. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: To evaluate the prevalence of malaria parasites among some pregnant women attending antenatal clinics in Rivers State, Nigeria.

Study Design: Cross-sectional study.

Place and Duration of Study: Five healthcare centres in Rivers State, Nigeria, between April and September 2011.

Methodology: Peripheral blood samples were collected using venous procedure and the presence of malaria parasites was observed microscopically on thick and thin blood smears prepared from each sample. Personal data were collected through questionnaires and the general results gotten during this study were analyzed statistically using two-way Analysis of Variance (ANOVA).

Results: The only species of malaria parasite identified in this study was *Plasmodium falciparum*. A total of 104 (26%) pregnant women were infected with *P. falciparum* in this

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study. Pregnant women in their first, second and third trimesters had prevalence rates of 27%, 27.3% and 21.8% respectively ($P<0.05$). Prevalence rates for primigravidae, secundigravidae and multiparous women were 26.1%, 31.5% and 20% respectively ($P<0.05$). Prevalence rates of 26.9%, 27.8% and 21.5% were observed in pregnant women between the ages of 11-20, 21-30 and 31-40 respectively ($P<0.05$).

Conclusion: Malaria still needs to be given more attention due to its negative impact on pregnant women and their unborn children.

Keywords: Prevalence; malaria; pregnancy; women; Plasmodium; gestation period; parity; age.

1. INTRODUCTION

Malaria is a life-threatening parasitic disease transmitted mostly by female Anopheles mosquitoes and caused by different species of *Plasmodium* parasites. An increased risk of malaria during pregnancy was observed over 60 years ago by Wickramasariya [1]. The protection of pregnant women living in malaria-endemic countries has been of particular interest to many National Malaria Control Programmes because of their reduced immunity. The recent World Malaria report, which indicated that Nigeria accounts for a quarter of all malaria cases in the 45 malaria-endemic countries in Africa, clearly showed the challenge of malaria in Nigeria [2]. The principal impact of malaria infection is due to the presence of parasites in the placenta causing maternal anaemia (potentially responsible for maternal death when severe) and low birth weight (LBW) [3,4]. Despite considerable efforts to control malaria, it is still the most prevalent and devastating disease in tropical Africa (with pregnant women and children below five years the highest risk groups). With the government of Nigeria interested in various malaria control strategies, this study was undertaken to provide part of the much needed baseline data to effectively plan and control malaria especially among the population at risk, the pregnant women.

2. MATERIALS AND METHODS

2.1 Study Site, Study Subjects and Criteria for Eligibility

Port Harcourt (capital of Rivers State) is located at latitude 4.75°N and longitude 7.00°E and lies along Bonny River in the Niger Delta. Population of the area is about 1,620,214 [5]. The city of Port Harcourt is an urban area. The geography and infrastructure of Port Harcourt is highly congested because building codes and zoning regulations are not properly enforced. This adds to flooding and sanitation problems of the area, since there is no proper drainage or sewage disposal system, and most parts of the city get flooded during very heavy rains that fall for half of the year [5]. The ecology of Port Harcourt provides suitable breeding habitats for biological multiplication, development and high survival rate of female anopheles mosquito vectors for the transmission of malaria parasite to the human population.

In this cross-sectional study, source population consisted of pregnant women attending public and private antenatal clinics between April and September, 2011 (Wet/Rainy season). Two public and three private healthcare centres were used in this study (all healthcare centres are situated in Port Harcourt). The pregnant women were selected randomly (systematic random sampling) without prior knowledge of their clinical and family health

history. Pregnant women were used in this study because children (between 0-5years) and pregnant women are the groups with the highest risk of contracting malaria.

2.2 Data Collection

The oral consent of each pregnant woman was gotten before commencing this study. Questionnaires to determine age, parity and gestation period, were distributed to and completed by the pregnant women. Pregnant women who could not read or write were assisted in filling their questionnaires. Peripheral blood samples were collected using venous procedure. Standard and careful laboratory procedures were adopted in collecting blood samples from the pregnant women. Thick and thin blood films were made on clean slides and labeled accordingly as recommended by WHO [6].

2.3 Microscopic Examination

Thick blood films were stained using Field's staining method while thin blood films were stained using Leishman staining method. Stained slides were examined under the light microscope using x100 objective lens (immersion oil) [7]. Thick blood films were used to determine the parasite densities while thin blood films were used to identify the parasite species and infective stages. Slides were read by two trained microscopists using standard and quality-controlled procedures. Slides with malaria parasite <3 in a high power field was scored scanty; 3-10 as (+); 10-19 as (++); >20 as (+++) or more according to the degree of infection (parasitemia).

2.4 Statistical Analysis

The data collected from this study were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) for windows (version 17.0). Comparisons were made using two-way Analysis of Variance (ANOVA). Differences were shown to be statistically significant where $P < 0.05$.

3. RESULTS

3.1 Overall Malaria Prevalence

Plasmodium falciparum was the only malaria parasite observed in the blood samples of the pregnant women examined in this study. Out of the 400 pregnant women examined for malaria parasites, 104 (26%) were positive for malaria infection while 296 (74%) were negative for malaria infection ($P < 0.05$). Malaria prevalence rates according to healthcare centres are shown in Table 1.

Table 1. Prevalence of malaria parasite among pregnant women

Healthcare facilities	NI (%)	NNI (%)	NE (%)
University of Port Harcourt Teaching Hospital	42 (28%)	108 (72%)	150
Aluu Health Center	23 (23%)	77 (77%)	100
Golden Hands Hospital	16 (32%)	34 (68%)	50
Zeta Hospital	13 (26%)	37 (74%)	50
Ebony Hospital	10 (20%)	40 (80%)	50
TOTAL	104 (26%)	296 (74%)	400

NI=Number Infected; NNI=Number Not Infected; NE=Number Examined

3.2 Effect of Gestation and Parity on Malaria Prevalence

Highest prevalence of 30% was observed among women in the first trimester of pregnancy, followed by 24% in the second trimester, with the least seen in the third trimester with 20% ($P<0.05$) (Table 2). Parity was statistically significant ($P<0.05$) as primigravidae (29%) and secundigravidae (23%) were more infected than multiparous women (third or more pregnancies) with 22% infection (Table 2).

Table 2. Effect of gestation and parity on malaria prevalence

Gestation period	NI (%)	NNI (%)	NE
First trimester	56 (30%)	131 (70%)	187
Second trimester	28 (24%)	87 (76%)	115
Third trimester	20 (20%)	78 (80%)	98
Parity	NI (%)	NNI (%)	NE
Primigravidae	64 (29%)	158 (71%)	222
Secundigravidae	25 (23%)	86 (77%)	111
Multiparous	15 (22%)	52 (78%)	67

NI=Number Infected; NNI=Number Not Infected; NE=Number Examined

3.3 Effect of Age on Malaria Prevalence

Malaria parasitemia was more prevalent in those between 11-20 years (32%) and 21-30 years (23%) but was least in older females between 31-40 years (20%) (Table 3). Age was statistically significant ($P<0.05$).

Table 3. Effect of Age on malaria prevalence

Age (Years)	NI	NNI	NE
11-20	52 (32%)	110 (68%)	162
21-30	33 (23%)	112 (77%)	145
30-40	19 (20%)	74 (80%)	93

NI=Number Infected; NNI=Number Not Infected; NE=Number Examined

4. DISCUSSION

The overall prevalence of *Plasmodium falciparum* infection in this study was 26%. This rate is higher than 7.3% reported in Port Harcourt [8] and 6.8% reported in Calabar [9]; comparable to 23% reported in Mozambique [10], 26.75% reported in Malawi [11] and 29% reported in Abakaliki [12] but much lower than 42% reported in Ghana [13], 57.5% reported in Gabon [14], 54% reported in South East Nigeria [15] and 41% observed in Uyo [16]. The malaria prevalence rate observed in this study may be due to the sanitation problems (no proper drainage/sewage disposal systems) and flooding (stagnant water bodies are suitable breeding habitats for malaria vectors) of the study area. The high prevalence rate obtained within the first and second trimesters in this study, agreed with those of other studies which observed peak prevalence in weeks 10-20 of pregnancy [17,18]. This may be attributed to the expression of adherent proteins on the surface of infected red blood cells (IRBCs), enabling the IRBCs to adhere to micro-vascular capillaries of vital organs causing severe pathological condition [19]. Also, parity played a role in the prevalence rates. Paucigravidae (primigravidae and secundigravidae) had a higher infection rate than the multiparous

pregnant women. The malaria prevalence rate observed among primigravidae in this study (29%) is lower than the 64% reported among primigravidae in Malawi [11] but disagrees with another research carried out in Mozambique [10] that observed no significance in prevalence levels with parity. Malaria parasitaemia in relation to age showed that older pregnant women had reduced malaria prevalence rates. This finding is similar to that reported by other research carried out in Nigeria [15,20]. The different malaria prevalence rates observed among these age groups could be attributed to the level of acquired immunity that increases with age, which may also be associated with protection from malaria infection.

5. CONCLUSION

The main epidemiological factor to *P. falciparum* infection in pregnancy should be considered in relation to the endemic malaria conditions under which women are living. Pregnancy is one of the factors affecting the rate of malaria parasite infection in women living in malaria-endemic communities. Proactive steps such as cleaning of waterways, maintaining a healthy environment condition (which discourages the breeding of mosquitoes) and other effective malaria control strategies would all have a synergistic effect in controlling malaria infection among pregnant women.

CONSENT

All authors have declared that written informed consent was obtained from the patients for publication of this case report and accompanying images.

ETHICAL APPROVAL

Ethical approval was gotten from the ethical committee of the Rivers State Ministry of Health before the commencement of this research.

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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