



Prevalence of Malaria Among Pregnant Women Attending Antenatal Care at Faith Alive Foundation, Jos, Plateau State, Nigeria

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Abstract: Malaria remains the most devastating infectious parasitic disease responsible for maternal and childhood deaths, particularly in most African countries. This study was carried out to determine the prevalence of malaria parasite among pregnant women attending antenatal care at Faith Alive Foundation, Jos North Local Government Area Plateau State Nigeria. One hundred and thirty (130) pregnant women were examined for malaria infection using Rapid Diagnostic Kits and thick/thin blood smear. The overall prevalence of 59 (45.38 %) was recorded in this study. Age group 21–25 years had the highest prevalence of 23(54.76%) thick/thin and 11(26.19%) for RDT, while the lowest prevalence of 33.33% occurred in age group 31-35 and above 40 years. However, there was no significant difference ($p > 0.05$) in infection rate between the different age groups. Prevalence according to the genotype shows that women with genotype AS had the highest infection of 25(58.14 %) for microscopy and 9(29.03 %) using RDT. In relation to the trimester, women in the second trimester had the highest infection rate of 58.06 %. With parity; multigravidae mothers (fourth gravid above) had the highest infection (80.0 %). Based on the use of Long – lasting Insecticides Nets(LLINs)/ Insecticides treated Nets(INTs), women that did not use nets recorded significantly ($p < 0.05$) highest infection of 55.26 %. The morbidity and mortality of malaria infection among pregnant women could be reduced through regular prophylaxis, proper sanitation, and regular use of Long – Lasting Insecticides Treated Nets (ITNS).

Keywords: Malaria, Pregnancy, Microscopy, Rapid Diagnostic Test.

1. Introduction

Malaria is a life - threatening disease, despite considerable research and control effort devoted since from time immemorial, the disease remains the most prevalent from a public health stand point ;the most common devastating parasitic disease in the tropical and sub-tropical regions [1]; [2] Malaria is a serious fatal parasitic disease characterize by paroxysm include fever with temperature of up to 40-41% at regular intervals every 48 or 72 hours (tertian or quartan) alternating with good periods of no fever, chills and anemia and have a fatal consequence leading to death and is caused by a *Plasmodium* species[3].

The parasites are transmitted from the blood of an infected host to the blood of an uninfected person through bite (inoculative method) by female *Anopheles* mosquito. There are five species of *Plasmodium* that can infect human there are; *Plasmodium malariae*, *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium knowlesi* [4]; [5]. In a research conducted to determine the spatial variability in the complexity of the vector situation, [6] reported that in Africa *An. gambiae*, *An. arabiensis* and *An. funestus* are primary dominant vector species, while *An. moucheti*, *An. nili*, *An. melas* are secondary dominant across much of the continent, where as in Asian-Pacific region there is a highly complex situation with multi-species co-existence and variable species dominance.

The risk of death from malaria is considerably higher in Africa than other parts of the world. It remains a major impediment to health in Africa, South of the Sahara. Each year there are more than 247 million cases of malaria killing between one and three million people, majority of who are young children in sub-Saharan Africa [7]. Nigeria contributes a quarter of malaria burden in Africa where over 90 % of the population of are at risk. 50 % of the population would have at least one attack per year. It is responsible for about 67 % of all clinic attendance and is the commonest cause of absenteeism from

offices, farms, markets, schools etc. Malaria accounts for 30 % childhood mortality, 11 % maternal mortality and reduces by 1 % Nigeria's GDP annually [8].

The burden of malaria infection during pregnancy is caused mainly by *Plasmodium falciparum* the most common species in Africa [9]. Malaria infection in pregnancy is a health problem requiring multidisciplinary and multidimensional solution. Pregnant women constitute the main adult risk group of malaria and 80% of death due to malaria in Africa occurs in pregnant women and children below 5 years [10]. Abe and Olusi [11] pointed out that the effect of malaria in pregnancy include; morbidity, anemia, fever illness, hypoglycemia, puerperal sepsis, more severe infection such as cerebral malaria and hemorrhage. The problems in the new born include low birth weight, premature birth, congenital malaria and mortality [12]. The pathological effect of malaria in pregnancy is greatly due to altered immunity. The non-immune, primigravidae are usually the most affected than the multigravidae [13].

2. Materials and Methods

2.1. Study Area

The study was conducted at the Faith Alive Foundation Jos, Plateau State, Nigeria. Jos the Capital of Plateau State, Nigeria being the study area is located between latitude $9^{\circ} 50'$ and $10^{\circ} 05'$ N and longitude $8^{\circ} 45'$ and $9^{\circ} 01'$ E. Plateau State shares borders with Bauchi State to the northeast, Kaduna State to the northwest, Nasarawa State to the southwest and Taraba State to the southeast, and encloses the Jos Plateau (after which it is named) within its boundaries [14]. It is situated in the central part of Nigeria commonly referred to as the middle belt. The state is bounded on the North and West by Kaduna plains and on the south by the Benue plains. The land surface of Jos Plateau consists of plains, hills, depression and rock of various forms, shapes and sizes. At an altitude of 1,217m (3,993ft) above sea level, Jos enjoys a more temperate climate than much of the rest of Nigeria. The Average monthly temperature range from $21 - 25^{\circ}\text{C}$ ($70 - 77^{\circ}\text{F}$) and from mid-November to late January, night - time temperature drop as low as 11°C (52°F). Hail sometimes falls during the rainy season because of the cooler temperature drops at high altitudes. Jos receives about 1,400 millimeters of rainfall annually. Mining activities in Jos is also pronounced, this is because of the availability of tin and columbite in large deposits.

2.2. Study Population

One hundred and thirty (130) pregnant women who attended their antenatal routine check up at the Faith Alive Foundation were enrolled for the study.

2.3. Exclusion Criteria

The non-pregnant women and those that did not consent for the study or not willing to participate were excluded.

2.4. Ethical Consideration

Ethical clearance was obtained from the Faith Alive Foundation. The approval was granted on the understanding that all information about each patient will be treated with utmost confidentiality.

2.5. Collection of Samples

This was carried out according to the method adopted by [15]. Before commencement of sample collections from the individual patient, the patient were enlighten on malaria transmission, prevention and control and the effects of malaria on both the mother and the fetus. Afterwards, oral informed consents were obtained from individual patient after a clear explanation of the objectives, potentials benefit of the study and information such as age, occupation, genotype, trimester, use of insecticide treated nets (ITNs) / long lasting insecticide nets (LLINs) were obtained from each patient using pre - tested questionnaire. The sample collection was twice a week and carried out between the periods of February - April 2017 during the antenatal visits. 2mls of the blood samples of each patient was collected intravenously/ vein puncture using sterile 5ml syringe after carefully swabbing the surface with cotton wool soaked/ dipped in methylated spirit. The blood was transferred into a sterile EDTA tubes. This anticoagulant (EDTA) is used for haematological test. The chemical therein, prevent blood from clotting by removing calcium [16]. Each container has a number corresponding to that written on the questionnaire given to each individual to

avoid mixing of results. After each day's collection, the blood samples were taken to the Faith Alive Foundation laboratory for examination.

2.6. Procedure for Rapid Diagnostic Test

Malaria rapid diagnostic test (RDTs) detects specific antigens (protein) produced by malaria parasites that are present in blood of infected or recently infected individuals. Some RDTs can detect only one species (*Plasmodium falciparum*), some also detect other species of the parasite (*Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*). The RDTs were used in the study according to the manufacturer's instruction. RDTs are lateral flow immune-chromatographic antigen detection tests, which rely on the capture of dye-labeled antibodies to produce a visible band on a stripe of nitro cellulose. With malaria RDTs, the dye- labeled antibody first bind to a parasite antigen, and the resultant complex is captured on the strip by a band of bound antibody forming a visible line (tests line). A control line gives information on the integrity of the antibody-dye conjugate, but does not confine the ability to detect parasite antigen. The test is limited to detection of antigens to malaria *P. falciparum* though the test is very accurate in detecting histidine rich protein (HRP2).

The blood was transferred from the EDTA bottle to the sample window on the test kit and then two drops of buffer was then added to the buffer well window on the cartridge. Each test kit was read between 15-30 minutes. Malaria was detected by the present of two colour bands T test line and C control line within the result window. The control band became visible as sufficient label antibody accumulates on the line.

2.7. Micorscopy

Giemsa stain was used to stain both thick and thin film in this study.

2.8. Procedure for Thick Film

This method was carried out as described by [16]. Thick smear consists of a thick layer of dehemoglobinized (lysed) red blood cells (RBCs). The elements (including parasites, if any) are more concentrated (approximately 30 times) than is an equal area of thin smear. Thus, thick smears allow a more efficient detection of parasites (increased sensitivity). Thick smears are often not adequate for species identification of malaria parasites. In this study, the thin film/smear was used for species identification. A drop of blood was placed in the middle of a clean, grease free glass slide. Using an applicator stick, the drop of blood was spread in a circular pattern until it was the size of a dime (1.5cm²). The slide was placed on a dry rage which was protected from dust and it was allowed to a dry. The smear was flooded with 10% dilution of giemsa stain; it was then allowed to stand for about 45minutes. The slides were then washed using clean water and the back of the slides were wiped with cotton wool and placed vertically in a draining rack to air dry. Before it was ready for view, a drop of immersion oil was added on the film.

2.9. Procedure for Thin Smear

This method was carried out as described by [16]. The thin smear consists of a blood spread in a layer such that the thickness decreases progressively towards the featured edge. A well mixed anti-coagulated blood was placed on a clean greased free slide. Another slide was placed at 45⁰ angle to the top, allowing the drop to spread along the contact line of the two slides. A smear must have a head, body and tail. The upper (spreader) slides were then quickly pushed towards the unfrosted end of the lower slide. The smear was fixed with methanol and allowed to air dry. The smear was the flooded with giemsa stain and allowed to stand for 45 minutes. The slides were then washed using clean water and the back of the slides were wiped with cotton wool and placed vertically in a draining rack to air dry. These were examined under the microscope at x100 objectives with immersion oil.

2.10. Statistical Analysis

Chi-square was used to analyze the data using software package for social sciences (SPSS) version 21. Values at $p < 0.05$ were considered significant.

3. Results

The overall prevalence of malaria among the pregnant women is shown in Table 1. Out of the one hundred and thirty (130) pregnant women examined, the Rapid Diagnostic Test Kit had a lower sensitivity

with an overall prevalence of 23.85 % while the microscopy showed a higher sensitivity with overall prevalence of 45.38 %.

The age prevalence of malaria among pregnant women is shown in [table 2](#). Age group 21-25 had the highest prevalence 53.76 %, followed by age group 36-40 (50 %), 26-30 (44.19 %), 15-20 (38.89 %) while age group 31-35 and 41 and above had the least infection of 33.33 %. However, there is no significance ($P>0.05$) difference between the prevalence of malaria among the different age groups.

Prevalence of malaria in relation to the genotype of the pregnant women showed that 85 Out of the 130 pregnant women examined, belong to the genotype AA ([Table 3](#)). The result of microscopy indicates that 38.82 % of pregnant women within this group had malaria while the RDT kits recorded 24.71 % infection. 43 out of the total pregnant women examined had genotype AS. 58.14 % of these pregnant women tested positive for malaria in the microscopy while the RDT kits showed that 20.93 % of the pregnant women were infected. Two of the 130 pregnant women examined belonged to genotype SS with 50 % prevalence of malaria each in the RDT and microscopy. There is no significance ($P>0.05$) difference between the prevalence of malaria in relation to the genotype of the pregnant women.

In relation to the gestation period of the pregnancy, out of the 79 pregnant women examined within their first trimester, the RDT kits recorded 17.72% infection while the microscopic test showed that 40.51 % of the pregnant women were infected ([Table 4](#)). 31 pregnant women examined were in their second trimester and the RDT kits showed 29.03 % infection while microscopy had 58.06 % infection. The RDT kits recorded 40 % infection out of the 20 pregnant women in their third trimester while microscopy showed 45 % infection. However, analysis showed that there is no significance ($P>0.05$) difference between the prevalence of malaria in relation to the trimester of the pregnant women.

[Table 5](#) shows the prevalence of malaria in relation to the gravid status of the pregnant women examined. It was observed that pregnant women in their fourth and fifth gravid had high prevalence 80 % and 50 % infection respectively accompanied by primigravidae (48.51 %) and tertigravidae (45.45 %). Secundigravidae recorded the least infection (28.13 %). Analysis showed that there is no significance ($P>0.05$) difference between the prevalence of malaria among the different number of Gravid of the pregnant women.

Malaria infection was found to be higher (55.26 %) among pregnant women who did not use long-lasting insecticide nets or insecticide treated nets followed by those who always used it (45.45 %) and unexpectedly least among those who sometimes used it (31.25 %) ([Table 6](#)). However, there is significance ($P<0.05$) difference in the prevalence of malaria between those who used and those who do not make use of Long – Lasting Insecticide Nets(LLINs)/ Insecticides Treated Net(ITNs).

4. Discussion

The overall prevalence of malaria (45.38 %) among pregnant women recorded in this study is consistent with [Mockenhaupt, et al. \[17\]](#) who reported the prevalence of 42.0 % among pregnant women in Ghana, [Ejike, et al. \[18\]](#) who reported a prevalence of 40.1 % among pregnant women in Abia South LGA, Abia State and [Maina, et al. \[19\]](#) who reported 39. 7 % among patients in Kaduna Metropolis, Nigeria. This is higher than 27.0 % reported in Rivers State [\[20\]](#) but lower than 60.5 % among pregnant women in Dutsin Ma, Katsina State, Nigeria [\[21\]](#) and 69.5 % among patients from some selected LGAs of Kaduna State, Nigeria [\[22\]](#). This could be attributed to differences in the use of insecticide treated nets (ITNS) by the women and the seasons which the studies were conducted. According to [Ayanda \[23\]](#) the prevalence of *P.falciparum* infection is higher in the wet season than the dry season. [Minakaw, et al. \[24\]](#) opined that the rainy season presents favorable environmental conditions that enhance mosquito breeding and survival, through the proliferation of larval habitats and improved humidity respectively.

Younger women appeared to be susceptible to malaria in this study as prevalence was highest (54.76%) among age group 21 – 25 years. The average prevalence (50. 0 %) among age group 36-40 could be attributed to low number of pregnant women examined. This varies with the findings of [Adefioye, et al. \[25\]](#) who reported the prevalence of 88.2 % in age group 36 – 39 years. However this agrees with the findings of [Dicko, et al. \[26\]](#) who opined that adolescents and young adult pregnant women were susceptible to malaria than older pregnant women because of continuous development of immunity to malaria in older women.

Findings from this study does not support the fact that sickle cell trait carriers are more protected against death from severe malaria compare with haemoglobin genotype AA individuals since they had highest infection. This was probably due to the small number of pregnant women among this category. With an increase in the number of pregnant women with SS or AS, there is the possibility that there could be changes from the present results. Genotype AA can survive till the end of the developmental cycle

(erythrocytic cycle) of *Plasmodium* and the body identifies the haemoglobin genotype AA as normal red blood cell in nature which will not be destroyed by the spleen, thereby enabling the parasite to gain ground to multiply and thrive in the infected individuals. Unlike the haemoglobin genotype AS (abnormal sickle) red blood cell do not survive till the end of the erythrocytic cycle because the body identify the sickle shaped cell as abnormal and are destroyed by the spleen [Abe and Olusi \[11\]](#). The relationship between malaria and the genotype of mothers showed no significant difference and this indicates that genotype has no influence on the epidemiology of malaria among the pregnant women in this study. The higher prevalence of malaria amongst pregnant women with sickle cell traits agrees with [Pati, et al. \[27\]](#) who reported that symptomatic *P. falciparum* individuals from eastern India with sickle cell traits were as vulnerable to severe, even fatal forms of malaria as those who had normal haemoglobin. This report is at variance with [Amoo, et al. \[28\]](#) who reported more parasitaemia among individual with genotype AA than those with AS.

The higher prevalence of malaria among pregnant women in their second trimester 58.06 % recorded in this study is in consonance with [Ivoke, et al. \[29\]](#) who reported highest prevalence among pregnant women in their second trimester in southwestern Ebonyi State, [Ahmed, et al. \[30\]](#) in Indonesia and [Eberemu and Magaji \[21\]](#) in Dutsin Ma. This result varies with [Dicko, et al. \[26\]](#) in Bandiagara, [Iwueze, et al. \[31\]](#) in Onitsha, Anambra State, Nigeria who separately reported higher prevalence among pregnant women in their first trimester while in Eastern Sudan the risk of malaria infection was significantly associated with the third trimester [Adam, et al. \[32\]](#).

The gravidity status of the pregnant women in this study shows that women from their fourth gravidae had the highest prevalence than those within the first to third gravidae. This agrees with the findings of [Odikamnor, et al. \[33\]](#) who reported a higher prevalence among the multigravidae than primigravidae. However, this is at variance with [Eberemu and Magaji \[21\]](#) who reported highest risk in primigravidae due to lack of immunity to pregnancy- specific variants of *P. falciparum* that selectively accumulates in the placental intervillous space leading to placental malaria and occult placental malaria. The differences could probably be due to small sample size of women examined with gravidae from third and above or individual responses to xenobiotics and environmental factors which may in turn affect the development of immunity in infected persons.

The result showed that pregnant women who used Long – Lasting Nets (LLINs) or Insecticide Treated Nets (ITNs) had low level of malaria infection compared with those that do not use the net due to personal reasons. This agrees with [Odoemene et al. \(2017\)](#) who reported that the majority of respondents having malaria infection in five major communities in Ikenne LGA, Ogun State, Nigeria were not sleeping under LLINs

5. Conclusion

The high prevalence (45.38 %) of malaria in pregnant women reported in this study is the probable cause of continuous maternal and childhood deaths in Jos metropolis and elsewhere. This calls for more attention to save the life of mothers and the future generations. The study shows that Microscopy still remains the best methods of diagnosis of malaria than Rapid Diagnostic Test (RDT) due to factors including the host and the sensitivity of some RTDs kits. Early antenatal booking for effective monitoring and prompt treatment of malaria in pregnancy will contribute significantly in reducing maternal morbidity and mortality and its prenatal mortality, and it is of necessity that routine intermittent preventive treatment of malaria is recommended for pregnant women in this area. Proper and regular environmental sanitation to dislodge mosquitoes from their breeding places will go a long way to reduce prevalence of malaria.

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Table 1. Overall Prevalence of Malaria in Pregnant Women attending Faith Alive Foundation Jos, Plateau State, Nigeria.

Method	Number examined	Number Infected (%)
RDT	130	31(23.85)
Microscopy	130	59(45.85)

Source: Author

Table 2. Prevalence of Malaria In relation to the age of the Pregnant Women

Age Group	Number examined	Number infected using RDT(%)	Number infected in Microscopy(thick/thin)
15-20	18	3(16.67)	7(38.89)
21-25	42	11(26.19)	23(54.76)
26-30	43	11(25.58)	19(44.19)
31-35	18	3(16.67)	6(33.33)
36-40	6	2(33.33)	3(50.0)
41and above	3	1(33.33)	1(33.33)
Total	130	31(23.85)	59(45.38)

Source: Author

Table 3. Prevalence Of Malaria relation to The Genotype of the Pregnant Women

Genotype	Number examined	Number infected using RDT(%)	Number infected in microscopy(thick/thin)
AA	85	21(24.71)	33(38.82)
AS	43	9(20.93)	25(58.14)
SS	2	1(50.0)	1(50.0)
Total	130	31(23.85)	59(45.38)

Source: Author

Table 4. Prevalence of Malaria in Relation to the Gestation Period of Pregnancy.

Trimester	No. examined	Number Infected Using RDT(%)	Number Infected in Microscopy(thick/thin)
First	79	14 (17.72)	32 (40.51)
Second	31	9 (29.03)	18 (58.06)
Third	20	8 (40.0)	9 (45.0)
Total	130	31(23.85)	59(45.38)

Source: Author

Table 5. Prevalence of Malaria in Relation to the Parity of the Pregnant Women

No. Gravid	No. examined	Number Infected Using RDT(%)	Number Infected In Microscopy(thick/thin)
prime	58	13 (22.41)	28(48.27)
2	32	5 (15.63)	9(28.13)
3	22	7 (31.82)	10(45.45)
4	10	2(20.0)	8(80.0)
5 & above	8	4(50.0)	4 (50.0)
Total	130	31(23.85)	59(45.38)

Source: Author

Table 6. Prevalence of Malaria in Relation to the use of Long – Lasting Insecticide Nets or Insecticides Treated Nets

Use of LLINs/ITNs	Number Examined	Number Infected Using RDT(%)	Number Infected in Microscopy(thick/thin)
Always	22	10(45.45)	7(31.82)
Sometimes used	32	9(28.13)	10(31.25)
Not available/ Not used	76	12(15.79)	42(55.26)
Total	130	31(23.85)	59(45.38)

Source: Author