Malaria Parasitaemia and Uptake of Intermittent Preventive Treatment among Pregnant Nigerian Igbo Women

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ABSTRACT

Background: Pregnant women in sub-Saharan Africa are highly vulnerable to malaria during pregnancy and are usually targeted to receive special preventive care for malaria using intermittent preventive treatment (IPT). **Objectives:** To determine the prevalence of malaria parasitaemia and uptake of IPT among pregnant Nigerian Igbo women. **Materials and Methods:** This cross-sectional study recruited 330 pregnant women from two public and private health facilities. Microscopy was used to determine prevalence of malaria in pregnancy while structured pretested questionnaire was used to determine the level of knowledge, and use of IPT among them. Data obtained were analyzed using SPSS version 25 software. Chi-square test was used for comparison of variables at p <0.05% level of significance. **Results:** Malaria prevalence was 18.5% and was highest for women of 20-24 years age range (24.3%). Knowledge of IPT was 76.7% while uptake was 58.8%. IPT uptake was highest amongst pregnant women aged 20-24 years (70.3%) and lowest amongst those aged 35-39years (50.0%). Compliance-knowledge index to IPT was significantly higher among the pregnant women with complete data (0.77) compared to the no response group (0.57), p=0.012. Pregnant women with tertiary educational qualification had the highest level of compliance 60(61.2%) compared to secondary 120(58.5%) and primary 14(51.9%). **Conclusion:** Malaria parasitaemia occurred in 18.5% of the women. IPT knowledge and compliance were 76.7% and 57.7% respectively. Low Compliance-knowledge index amongst non-responders to question on IPT compliance suggest ineffective malaria prevention awareness creation. The need to review malaria prevention awareness-creation strategies and encourage early ANC booking is recommended to improve IPT uptake.

Keywords: Malaria parasitaemia; Uptake of intermittent preventive treatments (IPT); Pregnant Nigeria Igbo women.

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Specialty Section: *This article was submitted to Obstetrics and Gynecology, a section of TJMR.*

Received: *19 May, 2022*
Accepted: *8 June, 2022*
Published: *30 July, 2022*

Citation: *Adinma JIB, Ogamba SE, Edet MM, Aribodor DN. Malaria Parasitaemia and Uptake of Intermittent Preventive Treatment among Pregnant Nigerian Igbo Women. Trop J Med Res 2022;21(1):93-101. DOI: 10.5281/zenodo.6944416*

Access Code

http://tjmr.org.ng

INTRODUCTION

Malaria in pregnancy is an important public health problem in malaria endemic areas of the world. In 2019, estimate has it that malaria caused as high as 229 million clinical episodes, and 409,000 deaths. [1] Approximately 94% of these deaths occurred in the WHO African region. [2] The burden of malaria is highest in the sub Saharan African region, Nigeria inclusive, where over 90% of the world's malaria-related deaths occurs. [3]

The *Anopheles gambiae* complex, a very efficient group of mosquitoes, is responsible for transmission of malaria in Africa, and the predominant parasite species in Africa is *Plasmodium falciparum*. Children below 5 years and pregnant women are most at risk of malaria. [4] Protecting pregnant women is therefore crucial in the fight against malaria, as malaria in pregnancy contributes significantly to deaths of mother and young children, estimated to amount each year to 10,000 women and up to 200,000 infants under one year of age. [5] Malaria is still a major contributor to high rate of global infectious disease-related morbidity and mortality particularly in Africa, South-East Asia, Eastern Mediterranean Region and parts of South America. [6] *Plasmodium falciparum* is considered more dangerous than the other four species (*P. vivax, P. malariae, P. ovale and P. knowlesi*) of the human malaria. It is responsible for virtually all the severe malaria cases and deaths. [1] Sequestration of malaria parasites in the placenta of the pregnant women impairs foetal nutrition, thus adversely affecting the development of the foetus. Malaria is the major cause of morbidity and mortality among pregnant women. Each year, approximately 50 million African women become pregnant in malaria endemic areas. [7] In Nigeria, there are an estimated 100 million malaria cases with over 300,000 deaths per year. Out of this, there is estimated 11% maternal mortality. [8] In Anambra state of Nigeria, 73.1% of prevalence of malaria was reported among pregnant women. [9] Following massive deployment of malaria interventions in Nigeria, and as the country targets malaria elimination, it is important to update studies on malaria prevalence among pregnant women. Malaria and pregnancy are mutually aggravating conditions. Hence, the physiological and pathological changes in pregnancy due to malaria have synergistic effect on the course of each other. [10]

An important strategy in the control of malaria in pregnancy is the use of intermittent preventive treatment (IPT). WHO recommends and emphasized the need on the use of insecticide treated bed nets (ITN) and intermittent preventive treatment (IPT) for all pregnant women [4]. This is particularly important among pregnant women in areas where there is stable transmission of *P. falciparium* malaria. IPT is the administration at monthly intervals after the first trimester, of 3 tablets of anti-malarial sulphadoxine pyrimethamine (SP) drugs, to subjects at risk in endemic areas at specific times regardless of whether they are infected or not infected, up to the 40th week, or otherwise when the pregnant woman goes into labour. It has been shown that the consequences of malaria infection during pregnancy could be limited by the uptake of intermittent preventive therapy (IPT). This study has been undertaken among pregnant women attending antenatal clinic at an urban town of southeastern Nigeria to elicit the prevalence among them, of malaria parasitaemia, as well as their knowledge of, and compliance to Intermittent Preventive Therapy (IPT) during pregnancy. The findings may inform the revision of the current strategies in the prevention of malaria disease during pregnancy thereby further improving pregnancy, maternal and fetal outcomes.

MATERIALS AND METHODS

Study Area

Nnewi the location of the study is an urban town in Anambra state of southeastern Nigeria. The town has four quarters namely: Umudim, Otolo, Nnewi-Ichi and Uruagu which constitute Nnewi North local government area with an estimated population of 391,227 on the basis of the 2006 National population census. Nnewi is located between latitude 60^0 1' and 6.017^0 North and Longitude 6^0 55` and 6.917^0 East. [11] The area has an average temperature of 20.4^{0}C

and 33.8°C in rainy (April to October) and dry (November to March) seasons respectively. The area lies within the tropical rain forest with relative humidity range of 43% to 82%. The inhabitants of Nnewi are predominantly traders of Igbo-speaking ethnic group of Nigeria. The Igbos constitute one of the three major Nigerian ethnic groups, the others being the Hausas in the North and the Yorubas in the southwest.[12]

Study Population and Sample Size

This cross-sectional study recruited 330 pregnant women attending antenatal care , randomly selected from two public health facilities (Umuenem health center and Eme-court health center) and two private health facilities (Divine care hospital and Life specialist hospital), over a 6 months period April to October 2015. A sample size of 330 was arrived at using Taro Yamen's formula given as $n=N/1+N(e^2)$, [13] and applying the population of the pregnant women which is 5% of the women of the reproductive age (15-49 years) as calculated from the population of the female gender based on the 2014 estimated population.[14] The inclusion criteria for the study includes pregnant women aged 15-49 years; between their first and third trimester; and receiving IPT.

Ethical approval

Ethical approval for the study was obtained from the study health facilities (NAUTH/CS/66/Vol.8/117).

Informed consent

Recruitment of the subjects was made following due explanation of the study process and obtaining of appropriate informed consent from the participants.

Determination of malaria prevalence

Presence of malaria parasite was determined using microscopy as described by Cheesbrough, [15] two mls of blood samples were collected from the veins of the pregnant women using 2 milliliter disposable syringe and needle and transferred immediately into anti-coagulant tube (EDTA). Subsequently, thick and thin blood film were made to determine the presence or not of malaria parasite. Blood films were stained in 10% Giemsa for 15 min and viewed under X100 objective lens for malaria parasite using oil immersion. A thick film was considered as negative if 100 microscopic fields showed no parasite. Malaria was adjudged positive by the presence in blood of sexual blood stage of *Plasmodium* irrespective of the species, and the presence or not of symptoms. Quality control was assured by re-examining 10% of the negative samples and 20% of the positive samples.[14]

Determination of uptake of IPTs

Pre-tested structured questionnaires were administered to the pregnant women. The questionnaire schedule elicited information in respect of age of the respondents, together with their knowledge of and compliance to IPT use and the educational level of the respondents.

Data Analysis

Data obtained were coded and subjected to statistical analysis using Statistical Package for Social Science (SPSS) windows version 25.0. Chi-square (χ^2) analysis was used to compare the association among groups with $p<0.05$ at 95% confidence interval considered to be statistically significant. Compliance-Knowledge Index (CKI) derived from the ratio of the values of compliance to knowledge is applied as a measure of the effectiveness of awareness creation of malaria prevention in pregnancy from IPT.

RESULT

Overall, malaria parasitaemia occurred in 61(18.5%) of the 330 pregnant women. Table 1 shows the distribution by age for malaria parasitaemia (MP). MP was most prevalent among the women aged 20-24 years, 9(24.3%); followed by those aged 40-44 years 2(22.2%) while those aged 35-39 years had the least, 2 (4.2%). No significant difference occurred between the age groups (P>0.58).

The highest knowledge of IPT occurred among pregnant women aged 40 years and above 9(88.8%), while the lowest occurred amongst those aged 20-24 years and 35-39 years (72.9% apiece). The highest compliance to the use of IPT occurred amongst

pregnant women aged 20-24 years 26(70.3%); while the least occurred amongst those aged 35-39 years 24(50.0%) table 2.

The distribution by the age of pregnant women for compliance knowledge index (CKI) of the use of IPT is shown in table 3. CKI ranged from 0.74 to 0.96 across the various age ranges of women with complete data. There was no statistically significant difference (P= 0.320). CKI was however lowest amongst the no- response age group, 0.57, and this shows a statistical significant difference with that of pregnant women with complete data (p=0.012).

Pregnant women with tertiary educational qualification had the highest level of compliance 60(61.2%) followed by those with secondary educational qualification 120(58.5%) while the women with primary educational qualification had the least compliance 14(51.9%). There was however no statistically significant difference in these values (P-value=0.283) figure 1.

Table 1: Distribution by age for malaria parasitaemia

Age group (years)	No. Sampled	No. Positive	Percentage (%) Positive	P-value
15-19	6	0	0	
20-24	37	9	24.3	
25-29	137	3 0	21.9	0.58
30-34	92	18	19.6	
35-39	48	2	4.2	
40-Above	10	2	20.0	
Total	330	61	18.5	

Table 2: Distribution by age, knowledge and compliance to uptake of IPT

Age group (years)	Number sampled	Knowledge N(%)	Compliance N(%)
15-19	6	5 (83.3)	4 (66.7)
20-24	37	27 (72.9)	26 (70.3)
25-29	137	104 (75.9)	77 (56.4)
30-34	92	73 (79.3)	56 (62.0)
35-39	48	35 (72.9)	24 (50.0)
40 and above	10	9 (88.8)	7 (70.0)
Total	330	253 (76.7)	194 (58.8)

P value = 0.320

Table 3: Distribution by the age of pregnant women for compliance –knowledge index of the use of IPT

Age group (years)	Number sampled	CKI (compliance/knowledge)
15 -19	6	0.80
20 -24	37	0.96
25 -29	137	0.74
30 -34	92	0.77
35 -39	48	0.69
40 and above	10	0.78
Total	330	0.77

P value = 0.320

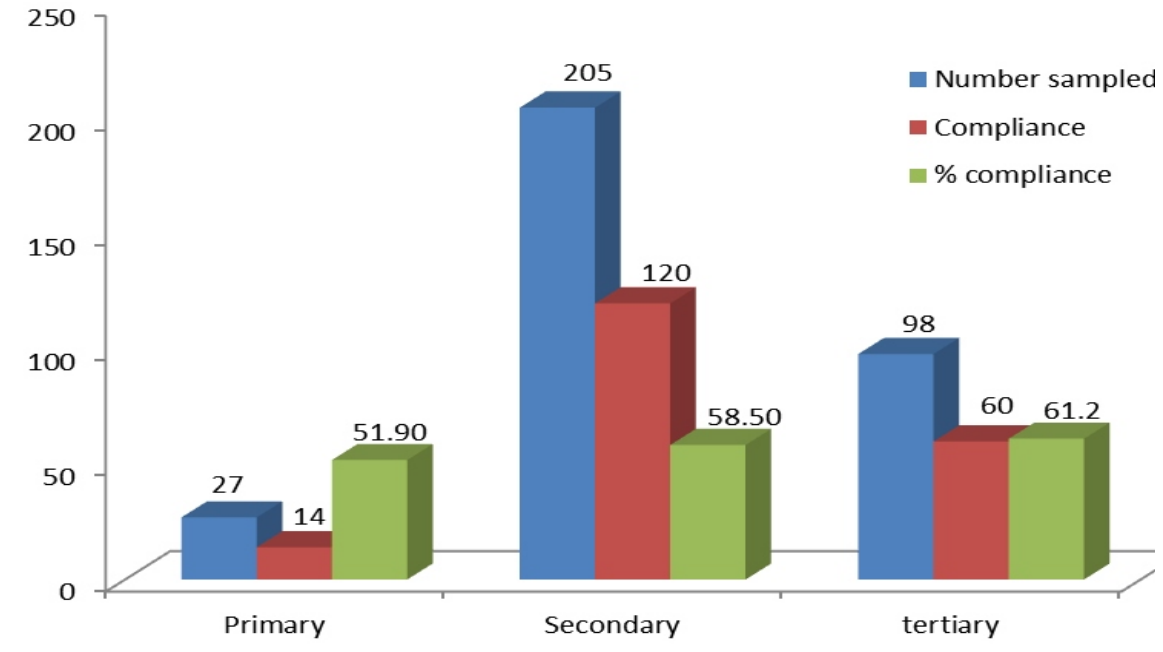

Figure 1: Distribution by the level of educational qualification of the pregnant women for their compliance to IPT (p-value=0.283)

DISCUSSION

The prevalence rate of malaria parasitaemia in this study is 18.5%. Nigeria is a malaria- endemic country. This rate surprisingly is relatively lower than reports from previous studies conducted in centers from the same area. Aribodo *et al*.[16] and Iwueze et al.[17] reported a prevalence rate of 65.0% and 67.2% respectively, of malaria in pregnancy amongst pregnant women from health facilities in Awka and Onitsha, Anambra state of south eastern, Nigeria. [16,17] Comparable prevalent rates to ours have been reported by Cisse *et al*.[18] in Burkina faso, 18.1% and Ouma *et al*.[14] in Kisumu, western Kenya, 18.0% while a lower rate of 10.9% was reported by Campos *et al*.[19] in Luanda, Angola. [14,18,19] Variations in prevalence rate of malaria parasitaemia in pregnancy, in malaria endemic regions may not be unrelated to differences in season, age of the pregnant women, their parity and social class as well as their compliance to malaria prevention measures. [2,20] A systematic review and meta-analysis of the prevalence of malaria parasitaemia in pregnant women and school-aged children in endemic settings of sub Saharan Africa was conducted by Makenga *et al*.[21] Poisson regression analysis in the review indicates that 1% increase in prevalence of malaria in pregnant women had significant association with 4% increase risk of malaria in school-aged children. [21] In this study, although there was no statistically significant difference in malaria prevalence rate for the various age groups, malaria parasitaemia was however highest amongst the relatively young reproductive age of 20-24 years, 24.3%. This observation is similar to that reported by Iwueze et al.[17] Lowest prevalent rate of malaria was observed amongst pregnant women aged 35-39 years, 4.2%. This disparity in MP prevalence rate between the younger age group and the higher age group may not be unrelated to the fact that the younger age group often times corresponds to lower gravidity usually characterized by relatively lower malaria immune status, and an increased likelihood of malaria parasitaemia in pregnancy. The role of intermittent preventive treatments of malaria using sulphadoxine pyrimethamine drugs as an effective means of preventing malaria in pregnancy and improving mother and child outcomes has been highlighted by world health organization [22]. Malaria prevention protocols have consequently been incorporated as a matter of policy into the antenatal care practices in malaria endemic countries like Nigeria and this has in no small measure complemented nutritional supplement in promoting pregnancy nutrition. [12,23,27] A recent study in rural northern Ghana to assess three dose policy IPT using sulfadoxine-pyrimethamine and pregnancy outcome showed that uptake of 3 or more doses of IPT was associated with term delivery and normal birth weight infants [20]. The study, like similar studies from other African countries- Cameroun, [28] Democratic republic of Congo [2931] South Africa further highlighted the place of antenatal care (ANC) and indeed early, antenatal booking in facilitating the recommended maximum uptake of IPT by pregnant women to achieve the optimum desired benefit. [20]

In this study, knowledge of IPT was relatively high (76.7%) amongst the pregnant women, irrespective of their age group, ranging from 72.9% to 88.8%. Overall, uptake of IPT however was 58.8% and ranged from 50% amongst the older women aged 35-39 years to 70.3% amongst the relatively younger women aged 20-24 years. Seemingly, malaria parasitaemia amongst the various age group, in relation to IPT uptake, present a paradoxical picture in this study whereby the younger women aged 20-24 years with the highest uptake of IPT also have the highest prevalent rate of MP (24.3%) in contradistinction to the relatively older women aged 35-39 years with the least uptake of IPT having the lowest prevalence rate of MP (4.2%). The reason for this paradox is not clear and may in fact not be unconnected to confounding variables which may include immunity, diet, parity, and knowledge and application of other malaria preventive and treatment measures.

In this study the compliance knowledge index (CKI) which is the measure of the effectiveness of awareness creation of malaria in pregnancy among

the pregnant women was relatively good amongst the women with complete response to the question on malaria knowledge and compliance with a range of 0.74-0.96. The CKI was however comparatively poor for the women of the no response group with a value of 0.57 which was significantly lower than the other age ranges. The implication of this is that there is a critical mass of pregnant women that are poorly informed on the knowledge of and by extension uptake of IPT as a very important component of effective antenatal care. It is possible that most of these women may have booked late in pregnancy as is commonly observed in reports from many African countries, [20,28,29,32,33] and consequently may not have been availed of the opportunity to receive the health talk on IPT and its benefit. It is also possible that some who have received such talks may not have clearly understood the information passed to them.

The role of education in antenatal care has been highlighted. [20,29]. In their study, Anto *et al*.[20] reported that high level of formal education is associated with better uptake of IPT. Education is considered to enhance the pregnant women's knowledge and understanding of the application and benefits of medical interventions in antenatal care, IPT-uptake inclusive. In this study, although the educational level of the pregnant women did not show any statistically significant difference with respect to their compliance to the use of IPT, women with tertiary education, however, more commonly complied with IPT uptake than those of secondary and primary educational qualifications.

This study shows that malaria parasitemia (MP) amongst pregnant women has a prevalent rate of 18.5% and that MP prevalence was highest amongst the younger age group of 20-24 years. Knowledge of intermittent preventive treatment for malaria was high at 76.7% while uptake of IPT was 58.8%. Paradoxically, IPT upkate was relatively higher amongst the younger age group who incidentally had a higher prevalence rate of malaria parasitemia, compared to the relatively lower IPT uptake amongst the older pregnant women with lower MP prevalence rate of only 4.2%. The compliance-knowledge index (CKI) which is a measure of the effectiveness of awareness creation to the use of IPT amongst the pregnant women was significantly higher amongst the women with complete information compared to those with no response, which suggests that a critical mass of the pregnant women studied had no or poor benefit of awareness creation effort at IPT uptake in pregnancy. The study also showed that more women with higher educational qualification complied to IPT uptake when compared to those with lower educational background - secondary and primary. The paradoxical relationship that exists in respect of IPT uptake and malaria parasitamia, between the younger and the older pregnant women is likely to be a consequence of confounding variables and therefore calls for further investigation. It is also recommended that strategies for malaria in pregnancy prevention awareness exercises be reviewed for greater effectiveness through, employing opportunities for the conduct of such exercises in the pre-pregnancy and early pregnancy stage. This further highlight the need also to encourage first trimestral booking of women for antenatal care, to ensure access of pregnant women to early knowledge and complete uptake of IPT and other malaria prevention measures according to recommended protocol.

Acknowledgement

The authors heartily appreciate all who contributed in one way or the other towards the success of the work.

Author contributions

JIBA and SEO conceptualized, designed and contributed to the implementation of the project. MME facilitated data recapturing and visualization, including revision of the manuscript, while DNA contributed to the revision of the manuscript. All authors were involved in the writing and revision of the manuscript. The authors read, approved the final manuscript and agree to be accountable for all aspects of the work.

Data availability

The data used to support the findings of this study are available from the site publicly.

Funding
No funding sources.

Conflict of interest
None declared.

Ethical approval
The study was approved by the Institutional Ethics Committee.

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