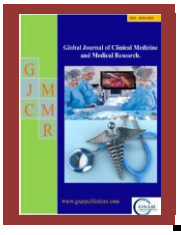

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Impact of Intermittent Preventive Therapy and Insecticide Treated Net in Malaria Control Among Pregnant Women in Imo State Nigeria

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Abstract

The study was conducted to ascertain the impact of Intermittent Preventive Therapy and Insecticide Treated Net in Malaria Control Among Pregnant Women in Imo State Nigeria. A total of 960 pregnant women were recruited for the study and examined using standard analytical protocols. Twelve hospitals were purposely selected for the study. The result revealed an overall malaria prevalence of 35.9% in the study areas. However, the prevalence of malaria based on the zone was not significantly significant (F stat = 1.2057; P = 0.3436). The profile of intensity based on gravidity presented 32.2% (+) light infection, 3.8% (++) moderate infection with no record of severe (+++) infection. Primigravids recorded most light (40.2%) and moderate (7.4%) infections; while Secundigravids had the least light infection (29.6%) and least moderate infection (3.2%) with Multiplegravids. The occurrence of light and moderate infections was not dependent on level of gravidity (X^2 = 1.95; P = 3.76). Overall result revealed that 44.69% of the respondents used IPTp, 28.85% used ITNs while 244(25.41%) used both mathods. The usage of the methods of malaria control and prevention was significantly different (P<0.05) which is replicated in the zones (X^2 = 42.1299; P = <0.0001). Result recorded that 250 pregnant women had full knowledge of ITN, while 70 pregnant women had partial knowledge. Out of the participants with full knowledge of ITN, only 79(31.60%) had +ve malaria status while majority 171(68.40%) had –ve malaria status. On the other hand, those with partial knowledge recorded 30(42.86%) +ve malaria status and 40(57.14%) –ve malaria status.This study has been able to establish the fact that some pregnant women do not protect themselves from malaria parasite infection with protective measures such as ITNs and IPTp, in spite of the popularity given to the use of these protective measures.

Keywords: *Intermittent, Therapy, Prevalence, Intensity, Malaria, IPT, ITN, Imo State*

Introduction

Malaria in pregnancy is an immense public health problem with at least 50 million pregnant women living in malaria endemic areas. To prevent malaria and its complications in pregnancy the World Health Organization recommends the use of intermittent preventive treatments sulfadoxine–pyrimethamine (IPTp-SP), the use of insecticide-treated nets (ITNs), and effective case management [1]. In most malaria endemic countries in Africa, 40% of pregnant women sleep under ITNs. As a result of these interventions provided, malaria transmission has fallen in some parts of Africa, leading to localized reductions in the malaria [2]. However, the incidence remains high in many other areas. Following the 2011 mass-campaign of free distribution of ITNs coupled with routine Antenatal Care (ANC) distribution of ITN and adoption of IPTp, studies were carried out to assess the effectiveness of both interventions and efficient results has also been achieved [3]. Although the compliance gap was low, IPTp-SP users had significantly better pregnancy and foetal outcomes compared with non-users.

Malaria places huge economic burden on infected people including pregnant women in endemic regions. The burden include the direct cost (medical consultion, laboration diagnosis, drugs and hospitalization) and indirect cost due to

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work days lost for both malaria cases and those taking care of them [4]. Although the exact economic burden that falls on households in Nigeria (like other countries) is not known, it is likely to vary from region to region.

Globally, an estimated 214 million clinical cases of malaria (range 149 – 303 million) occurred in 2015 [5]. Records available have shown that there are 100 million malaria cases per years in Nigeria [6]. Every year approximately 50% of Nigeria Adults including pregnant women suffer at least one episode of malaria [7] while children <5years of age have an average of 2-4 hours of malaria ([1]. Malaria accounts for 30% of childhood mortality and 11% of maternal death alone in Nigeria [8].

Pregnant women are at high risk of malaria infection. This is because malaria infection is associated with adverse birth outcomes that affect the mother and foetus [9]. Since pregnant women are most vulnerable to malaria, implementation of the appropriate prevention and control measures among this group is very important. Global malaria control strategies have changed over time. In the 1950s the focus of the World Health Organization (WHO) was on eradication of malaria, although formal campaigns never included Africa. Intermittent Preventive Treatment or Therapy (IPT) is one approach to reduce parasite carriage and disease burden amongst the most vulnerable individuals. The Federal Government of Nigeria in 2004 adopted prevention measures in the control of malaria and current recommended approaches are intermittent preventive treatment of malaria using an effective antimalarial drug to address the heavy burden of asymptomatic infections, the use of Insecticide Treated Nets (ITNs) and effective case management of malaria illness and aneamia [10].

Insecticide Treated Nets (ITNs) and Intermittent Preventive Therapy (IPT) has remained the mainstay of malaria prevention in endemic areas and widespread implementation has significantly reduced malaria-related morbidity and mortality [11]. Insecticide-treated bed nets have been shown to significantly reduce the burden of childhood mortality secondary to malaria and to reduce the incidence of anaemia and malaria in pregnancy. Insecticide treated nets takes advantage of the indoor feeding (endophagic) and indoor resting (endophilic) behaviours of some *Anopheles* mosquitoes and work by repelling and killing or decreasing the life span of mosquitoes as well as providing a physical barrier between mosquitoes and user [12].

Studies on ITNs combined with IPT-SP are limited with different focus/objective and hardly account for coverage rate and compliance. [13] have revealed the factors associated to the use of ITNs and IPT-SP in Cameroon. [14] on the use of INT and IPT-SP in Kenya centred only on randomly selected pregnant women from four districts. Similarly, [11] in Malawi focused on household survey using urban and rural communities. Clearly, there is need to assess the impact of ITNs and IPT-SP in the Southern part of Nigeria where so far very little or no work has been done. This study therefore seeks to assess the impacts of these intervention measures in malaria control on pregnant women in Imo State, Nigeria.

Study Area

The study was conducted in twelve hospitals/clinics purposively selected from six Local Government Areas of Imo State between November 2020 and May, 2023. Imo State is bordered by the states of Anambra to the North, Abia to the East, and Rivers to the south and west. The State lies between latitudes $5°30^{1}$-$6°15^{1}$ North and longitude $6°38^{1}$-$7°18^{1}$ East. It comprises of three geo-graphical zones: Orlu, Owerri and Okigwe (Figure 1). The population is mostly engaged in agriculture; yams, corn (maize), rice, and cassava (manioc) are the staple crops, and oil palm is the main cash crop.

Fig. 1: Map of Imo State showing the local government areas under study (arrow indicated) (Source: Imo State Ministry of Lands Owerri)

Ethical Consideration

Ethical approval for the study was gotten from the Post Graduate Board of the Department of Animal and Environmental Biology, Imo State University Owerri ethical committee. Written/oral Consent was sought and obtained from the health officers in the different health facilities as well as the study participants. Prior to commencement of study, the researcher also obtain ethical clearance from the state ministry of health and the local government health authorities under study.

Preliminary visit and selection of study

This aspect of study was done immediately after the consent was obtained from the randomly selected twelve (12) hospitals from the six (6) Local Government Areas under study. The researcher and her team visited the heads of the selected hospitals. The aim was to create a forum for interaction, familiarization with them, explain the study objectives and obtain their consent. After this, the research team had an interactive session with the pregnant women where they were acquainted with the purpose of the study and its benefits to them.

The heads of the hospitals and some nurses were educated intensely to assist the researcher's team in further explaining to the pregnant women the purpose of the study, specimen collection procedures and administration of the intervention measures (IPTp and ITNs).

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Study/Sample Population

The sample population was drawn from six (6) Local Government Areas (Owerri Municipal, Mbaitoli, Isiala Mbano, Onuimo, Orsu and Njaba) to cover the Three (3) Geopolitical Zones of the Study Area with sample size of 960 participants. This method was drawn from [15]. The choices of these Local Government Areas were to ensure good geographical spread. The subjects were selected on the basis of obtaining an informed consent. The study population cut across pregnant women of all age groups between 15years and above and their societal class, immune-compromised.

Inclusion and Exclusion Criteria

Inclusion Criteria

i. Consenting pregnant women attending antenatal at the time of this study
ii. Pregnant women between age 15 and above
iii. Those who had no underlying chronic diseases

Exclusion Criteria

i. Non-consenting pregnant women
ii. Those who had an underlying chronic disease

Study Design

The study was a cross-sectional survey for the assessment of the impact of intermittent preventive therapy and insecticide treated nets and their association in malaria control and elimination among pregnant women. Three medical personnels (Nurse, Medical Laboratory Scientist and another health worker) were recruited prior to the study in October, 2021. To ensure quality data control, one day training was organized for them on the study; how to administer and fill questionnaires, collection, handling and storage of samples. All the enrolled population 960 was used for the survey method. Three hospitals/clinics were given interventions of either ITN, IPT or both on the bases of malaria status results.

Questionnaire distribution and administration

Well-structured questionnaires were issued to the study population to obtain demographic data, awareness and usage of malaria control strategy and personal health information. After proper explanation of the study objectives and consent sought from subjects, the questionnaires were administered alongside with instruction on how to fill it properly. Completed questionnaires were submitted to the field assistant on the spot.

Data Analysis

Data were entered into Excel version 2013, cleaned, and imported to Stata version 13 for analysis. Data obtained from the study was analyzed using the statistical package for Social sciences (SPSS) software (version 20.0, SPSSInc, Chicago, IL, USA).

Results

Overall prevalence of malaria among pregnant women was shown in Table 1. The result revealed an overall malaria prevalence of 35.9% in the study areas. However, the prevalence of malaria based on the zone was not significantly significant (F stat = 1.2057; P = 0.3436). The hospital based prevalence in the zones revealed significant difference (P<0.05). In Owerri Zone, Holy Family and Nwaorubi recorded 35.0% prevalence of malaria, while St. David's Hospital and Rimah hospital and Maternity Umudagu Mbieri recorded (37.5%) and (38.8%), which is significantly higher. In Orlu Zone, Ogechi Hospital Orlu (33.8%) recorded significantly lower malaria prevalence than the 37.5% recorded in Amaruru Community Health Centre and Ignatus and Veronica Hospital and Maternity; and 36.3% recorded in Umuaka Community Hospital (P<0.05).

In Okigwe Zone, the prevalence of malaria infection was significantly higher in Umuna Health Centre. Hope Alive Hospital and Maternity and T. Emmanuel Hospital and Maternity had similar prevalence of (35.0%) as against 33.8% recorded in Okwelle General Hospital. However, the difference was not significantly different.

Table 1: Overall Prevalence of malaria among pregnant women

Hospitals	No. Exam.	No. (%) Infected	$\bar{X} \pm SD$
Owerri Zone			
Holy Family and Maternity, Ikenegbu	80	28(35.0)	35.0±2.50[a]
St. David's Hospital, Mbari	80	30(37.5)	37.5±3.75[b]
Rimah hospital and Maternity, Umudagu Mbieri	80	31(38.8)	38.8±2.50[b]
Nwaorubi general hospital	80	28(35.0)	35.0±1.25[a]
Sub Total	**320**	**117(36.6)**	**36.6±2.50**
Orlu Zone			
Amaruru Community Health Center, Orsu	80	30(37.5)	37.5±2.50[b]
Ignatius and Veronica hospital and maternity, Ihitenansa Orsu	80	30(37.5)	37.5±1.25[b]
Ogechi	80	27(33.8)	33.8±1.25[a]

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Hospital and Maternity, Obeakpu Njaba			
Umuaka Community hospital, Njaba	80	29(36.3)	36.3±2.50[b]
Sub Total	**320**	**116(36.3)**	**36.3±1.88**
Okigwe Zone			
Hope Alive hospital and maternity, Amaraku	80	28(35.0)	35.0±2.50[a]
T. Emmanuel hospital and maternity Amaraku	80	28(35.0)	35.0±0.00[a]
Umuna Health Center, Okigwe	80	29(36.3)	36.3±2.50[a]
Okwelle general Hospital	80	27(33.8)	33.8±2.50[a]
Sub Total	**320**	**112(35.0)**	**35.0±1.88**
Total	**960**	**345(35.9)**	**35.9±1.92**

Values are mean±S.D of triplicate determinations (n=3). Values bearing different superscript alphabets "a,b,c" down the column show significant difference (P<0.05) when compared with one another.

Prevalence of malaria among pregnant women in relation to demographic characteristics is shown in table 2. Result of percentage prevalence revealed that age group 31-40years had the highest prevalence of 46.3%, followed by 15-20years (35.4%), 21-30years (32.3%) and >40years had 24.6% as the least prevalence. The age related prevalence is significantly different (P<0.05).

The result of the percentage prevalence of malaria in relation to educational levels revealed that those with primary education (57.9%) had the highest prevalence, followed by those with secondary education (43.9%) and tertiary education (31.2%). The result shows that educational levels of subjects influenced the prevalence of malaria among pregnant women (P<0.05).

The result of the percentage prevalence of malaria in relation to occupation revealed that house wives/farmers had the highest prevalence of 44.2%, followed by Civil Servant (41.3%), Students/unemployed (32.4%) and Trader (30.9%). Statiscal analysis revealed that the occupation related prevalence is significantly different.

The prevalence of malaria based on gravidity showed that primigravid (47.5%) had significantly higher prevalence (P<0.05), followed by Multiplegravid (35.1%) and the Secundigravid (32.8%), which were however statistically similar (P>0.05). The result of the percentage prevalence of malaria in relation to trimester revealed highest among 3rd and 1st trimesters with 36.63% and 36.2% malaria occurrence rate, respectively, while 2nd trimester recorded prevalence of 34.8%. However, the difference is not statistically significant.

Table 2: Prevalence of Malaria among pregnant women in relation to Demographic Characteristics

Variables	No. Exam.	No. (%) Infected	$X \pm \overline{SD}$
Age (years)			
15-20	79	28(35.4)	35.4±2.53[a]
21-30	553	180(32.3)	32.3±1.09[b]
31-40	259	120(46.3)	46.3±1.54[c]
>40	69	17(24.6)	24.6±1.45[d]
Educational Level			
Primary	19	11(57.9)	57.9±5.27[a]
Secondary	319	140(43.9)	43.9±0.94[b]
Tertiary	622	194(31.2)	31.2±0.65[c]
Occupation			
Students/unemployed	510	165(32.4)	32.4±0.59[a]
Trader	97	30(30.9)	30.9±2.07[a]
Civil Servant	206	85(41.3)	41.3±0.97[b]
House wife/farmer	147	65(44.2)	44.2±1.37[b]
Gravidity			
Primigravid	122	58(47.5)	47.5±1.64[a]
Secundigravid	311	102(32.8)	32.8±0.97[b]
Multiplegravi	527	185(35.1)	35.1±0.76

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d			b
Trimester			
1st Trimester	58	21(36.2)	36.2±0.00 a
2nd Trimester	356	124(34.8)	34.8±0.85 a
3rd Trimester	546	200(36.6)	36.6±0.19 a

Values are mean±S.D of triplicate determinations (n=3). Values bearing different superscript alphabets "a,b,c,d" down the column show significant difference (P<0.05) when compared with one another.

The intensity of malaria in relation to trimester, gravidity and age groups among pregnant women in the study areas was shown in Table 4. Results of intensity according to trimester shows that 266(27.7%) had light (+) malaria, 79(8.2%) had moderate (++). There was no severe malaria infection. 3rd trimester (28.93%) recorded the most Light (+) malaria infection and least moderate intensity, while 1st trimester (13.79%) recorded the most moderate (++) malaria infection (13.8%). Chi Square analysis showed that the observed level of intensity was not dependent on stage of the trimester (P>0.05; X^2 = 3.172, P = 2.47).

The profile of intensity based on gravidity presented 32.2% (+) light infection, 3.8% (++) moderate infection with no record of severe (+++) infection. Primigravids recorded most light (40.2%) and moderate (7.4%) infections; while Secundigravids had the least light infection (29.6%) and least moderate infection (3.2%) with Multiplegravids. The occurrence of light and moderate infections was not dependent on level of gravidity (X^2 = 1.95; P = 3.76).

Likewise the assessment of intensity based on age showed 26.9% (+) light and 8.9% (++) moderate infections. The age related intensity did not present any obvious trend, however, respondents of 31-40 years has most light (34.4%) and moderate (11.96%) infections.

Table 3: Intensity of malaria in relation to trimester, gravidity and age groups among pregnant women in the study areas

Variables	No. Exam.	No. % positive (+)	Intensities (%)		
			Light (+)	Moderate (++)	Severe (+++)
1st Trimester	58	21(36.2)	13(22.4)	8(13.8)	0(0.0)
2nd Trimester	356	124(34.8)	95(26.7)	29(8.1)	0(0.0)
3rd Trimester	546	200(36.6)	158(28.9)	42(7.7)	0(0.0)
Total	**960**	**345(35.9)**	**266(27.7)**	**79(8.2)**	**0(0.0)**
Gravidity					
Primigravid	122	58(47.5)	49(40.2)	9(7.4)	0(0.0)
Secundigravid	311	102(32.8)	92(29.6)	10(3.2)	0(0.0)
Multiplegravid	527	185(35.1)	168(31.9)	17(3.2)	0(0.0)
Total	**960**	**345(35.9)**	**309(32.2)**	**36(3.8)**	**0(0.0)**
Age in years					
15-20	79	28(35.4)	22(27.8)	6(7.6)	0(0.0)
21-30	553	180(32.3)	135(24.4)	45(8.1)	0(0.0)
31-40	259	120(46.3)	89(34.4)	31(11.9)	0(0.0)
>40	69	17(24.6)	13(18.8)	4(5.8)	0(0.0)
Total	**960**	**345(35.9)**	**259(26.9)**	**86(8.9)**	**0(0.0)**

Assessment of awareness and usage of intervention measures in relation to age groups, educational levels, occupation, gravidity and trimesters among the subjects were shown in Table 6. The table shows that 429(44.68%) use IPTp only, 287(29.89%) use ITNs only while 244(25.41%) combine both. In their age relation, age groups 15-30years had the highest percentage 31.64% of ITN usage, 21-30years recorded highest 50.63% of IPTp usage while >40years recorded highest 59.42% combination. The use of the different intervention methods in relation to age was statistically significant (P<0.05; X^2 = 73.7413, P =<0.0001).

It was also observed that subjects with primary education had the highest percentage 42.10% of ITN usage while IPTp usage was found to be highest among secondary 40.75% and tertiary 46.94%. The use of different intervention method was not

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dependent on the level of education of the respondents ($P<0.05$; $X^2 = 4.7433$, $P =<0.314$).

In relation to their occupation, the result shows that ITN and IPTp usages 40.13% vs 55.78% were found to be highest among house wives/farmers, and 39.32% vs 49.02% among civil servants, while combined were found to be highest between students/unemployed and traders (35.88% vs 31.95%) respectively. The occupation based used of the different intervention methods was significantly different ($P<0.05$; $X^2 = 91.78$, $P =<0.0001$).

In their gravidity, ITN usage and combined were found highest among multiplegravid (31.87% vs 31.87%); IPTp usage was found highest among primigravid (55.73%). More so, ITN and Combined were found to be highest among 3rd Trimester (31.86% vs 28.75%) while IPTp usage was highest among 2nd Trimester (51.96%). There was a significant difference ($P<0.05$) in the frequency of usage of IPTp, ITNs or both in pregnant women from all the age brackets when compared with one another. There was a significant difference ($P<0.05$) in pregnant women in the primary school using IPTp and ITNs when compared with those that use both. There was a significant difference ($P<0.05$) in pregnant women at tertiary education level using IPTp, ITNs or both when compared with one another. There was a significant difference ($P<0.05$) in usage of IPTp, ITNs or bothby pregnant women from the respective occupations when compared with one another. Similarly, there was a significant difference ($P<0.05$) in usage of IPTp, ITNs or both by pregnant women at the respective gravidity levels when compared with one another. Also, there was a significant difference ($P<0.05$) in usage of IPTp, ITNs or both by pregnant women at the three trimester levels when compared with one another.

Table 5: Assessment of awareness and Usage of intervention measures in relation to Demographic Characteristics

Variables	Frequency N = 960	IPTp Usage (%)	ITN Usage (%)	Combined (%)
Age in years				
15-20	79	35(44.30)	25(31.64)	19(24.05)
21-30	553	280(50.63)	175(31.64)	98(17.72)
31-40	259	94(36.29)	79(30.50)	86(33.20)
>40	69	20(28.98)	8(11.59)	41(59.42)
Educational Level				
Primary	19	7(36.84)	8(42.10)	4(21.05)
Secondary	319	130(40.75)	100(31.34)	89(27.98)
Tertiary	622	292(46.94)	179(28.77)	151(24.27)
Occupation				
Students/unemployed	510	209(40.98)	118(23.13)	183(35.88)
Trader	97	37(38.14)	29(29.89)	31(31.95)
Civil Servant	206	101(49.02)	81(39.32)	24(11.65)
House wife/farmer	147	82(55.78)	59(40.13)	6(4.08)
Gravidity				
Primigravid	122	68(55.73)	32(26.22)	24(19.67)
Secundigravid	311	168(54.01)	89(28.61)	54(17.36)
Multiplegravid	527	193(36.62)	168(31.87)	168(31.87)
Trimester				
1st Trimester	58	29(50.00)	13(22.41)	16(27.58)
2nd Trimester	356	185(51.96)	100(28.08)	71(19.94)
3rd Trimester	546	215(39.37)	174(31.86)	157(28.75)

Table 6 shows the summary of compliance rate and malaria status. From the result, the compliance rate and malaria status of ITN, IPT and ITN+IPT usage revealed malaria infection rate of 51.25% versus 41.25% versus 15.31% in relation to age, 55.31% versus 37.81%

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versus 14.69% in relation to educational level, 48.44% versus 42.29% versus 17.19% in relation to occupation, 51.25% versus 41.25% versus 15.31% gravidity and (42.50% versus 45.94% versus 19.38%) trimester.

Table 6: Summary of Compliance rate and malaria status

Variables	ITN		IPT		Combined	
	No. Exam	No. (%) infected	No. Exam	No. (%) infected	No. Exam	No. (%) infected
Age (years)	320	164(51.25)	320	132(41.25)	320	49(15.31)
Educational Level	320	177(55.31)	320	121(37.81)	320	47(14.69)
Occupation	320	155(48.44)	320	135(42.29)	320	55(17.19)
Gravidity	320	164(51.25)	320	132(41.25)	320	49(15.31)
Trimester	320	136(42.50)	320	147(45.94)	320	62(19.38)

IPTp compliance rate and malaria status of pregnant women in the study areas is shown in table 8a. It was revealed that all the participants were knowledgeable of IPTp of which 145(35.31%) were +ve and 175(54.69%) showed negative malaria result. Out of 320 IPTp users, 75(23.44%) were found to be positive and 245(76.56%) status were found to be negative. This was noticeable in the recommended drugs (fansider) and in the number of tablets (3). The result of IPTp usage during pregnancy revealed that women that adhered to the recommendaed intake of drugs once every month had significantly reduced malaria prevalence 5(2.44%) as against those that took the drugs once in 2-3 months 29(34.12%) and once in 4-6 month 23(76.67%).

Table 7: IPTp compliance rate and malaria status of pregnant women in the study areas

Variables	Category		No Examined	Malaria status %		Total
	Yes	No		+ve	–ve	
Knowledge of IPTp	320	0	320	145(35.31)	175(54.69)	320(100.0)
Users of IPTp	320	0	320	75(23.44)	245(76.56)	320(100.0)
Recommended drugs			**320**			
Malarich	0	0		0(0.00)	0(0.00)	0(0.00)
Almalar	0	0		0(0.00)	0(0.00)	0(0.00)
Phensic	0	0		0(0.00)	0(0.00)	0(0.00)
Fansider	320	0		123(38.44)	197(61.56)	320(100.0)
No. of tablets						
3	320	0	320	123(38.44)	197(61.56)	320(100.0)
2	0	0	0	0(0.00)	0(0.00)	0(0.00)
5	0	0	0	0(0.00)	0(0.00)	0(0.00)
IPTp use during pregnancy = 320						
Every month	205	115		5(2.44)	200(97.56)	205(100.0)
Once in 2-3 months	85	235		29(34.12)	56(65.88)	85(100.0)
Once in 4-6 months	30	290		23(76.67)	7(23.33)	30(100.0)
Once in 7-9 months	0	320		0(0.00)	0(0.00)	0(0.00)

ITN compliance rate and malaria status of pregnant women in the study areas is shown in Table 9. Result recorded that 250 pregnant women had full knowledge of ITN, while 70 pregnant women had partial knowledge. Out of the participants with full knowledge of ITN, only 79(31.60%) had +ve malaria status while majority 171(68.40%) had –ve malaria status. On the other hand, those with partial knowledge recorded 30(42.86%) +ve malaria status and 40(57.14%) –ve malaria status. Also, a total of 290 pregnant women owned ITN, while 30 pregnant women do not own ITN. Out of 290 with ITN, 98(33.79%) were +ve while 192(66.21%) were –ve; while those without ITN, 12(40.00%) were +ve and 18(60.00%) were –ve.

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On the ITN usage, number of pregnant women that use ITN was 169 of which 41(24.30%) were +ve malaria percentage and 128(75.70%) were –ve while those that don't use ITN recorded higher percentage malaria status (as shown in table 9). Result on the hanging position revealed that only 46 hang ITN on windows and doors, 141 hang over the bed. From the results, participants that hang on windows and doors recorded higher (71.73%) +ve malaria status, while those that hang ITN over the bed recorded a higher reduction of malaria status (70.92%). Those who use ITN always recorded 118(76.62%) –ve malaria status, while those that use ITN sometimes were seen to have higher (64.29%) +ve malaria status. Those whose nets rolled down were found to have 17(62.96%) +ve malaria status against those whose nets were tucked into bed.

Table 8: ITN compliance rate and malaria status of pregnant women in the study areas

Variables	No. Examined	Malaria Status (%)	
		+ve	–ve
Level of knowledge			
Full	250	79(31.60)	171(68.40)
Partial	70	30(42.86)	40(57.14)
Total	**320**	**109(34.06)**	**211(65.94)**
Ownership			
No. with ITN	290	98(33.79)	192(66.21)
No. without ITN	30	12(40.00)	18(60.00)
Total	**320**	**110(34.38)**	**210(65.63)**
ITN Usage			
No. that use ITN	169	41(24.30)	128(75.70)
No. that don't use ITN	121	66(54.54)	55(45.45)
Total	**290**	**107(36.90)**	**183(63.10)**
Hanging position (N = 187)			
Windows or doors	46	33(71.73)	13(28.26)
Over the bed	141	41(29.08)	100(70.92)
Total	**187**	**74(39.57)**	**113(60.43)**
Frequency of use (N = 187)			
Always	145	27(17.53)	118(76.62)
Sometimes	42	27(64.29)	15(35.71)
Total	**187**	**54(28.88)**	**133(71.12)**
Follow instruction (N = 141)			
Net rolled down	27	17(62.96)	10(37.04)
Net tucked into bed	101	37(36.63)	64(63.37)
Can't tell	13	8(61.54)	5(38.46)
Total	**187**	**54(28.88)**	**133(71.12)**

Table 9 illustrated the ITN and IPT-SP compliance rate and malaria status of pregnant. The result showed a compliance rate of 827(86.15%) on ITN and IPT-SP with only 169(20.44%) been positive. On the frequency of usage, a compliance rate of 655(68.23%) was recorded among those who adhered to recommendation with only 15(2.9%) being positive. Five hundred and forty (56.25%) compliance was recorded among pregnant women that take IPT but hardly sleep on ITN with 242(44.81%) being positive, 727(75.73%) compliance was them that take IPT and sleep on ITN with none positive, 287(29.90%) compliance was recorded among them that sleep with ITN but don't take IPT and it was revealed that 127(44.25%) were positive.

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Table 10: ITN and IPT-SP compliance rate and malaria status of pregnant

Variables	No. Exam.	No. (%) Infected	Malaria Status		% Total N = 960
			+ve	–ve	
Usage of ITN and IPT-SP					
Yes	827	169(20.44)	169(20.44)	658(79.56)	827(86.15)
No	133	73(54.89)	73(54.89)	60(45.11)	133(13.85)
Frequency of usage					
As recommended	655	15(2.29)	15(2.29)	640(97.71)	655(68.23)
Not as recommended	305	266(87.21)	266(87.21)	39(12.79)	305(31.77)
Take IPT but hardly sleep on ITN	540	242(44.81)	242(44.81)	298(55.29)	540(56.25)
Take IPT and sleep with ITN when remembered	727	0(0.00)	0(0.00)	727(100.00)	727(75.73)
Sleep with ITN but don't take IPT	287	127(44.25)	127(44.25)	160(55.75)	287(29.90)

Table 11 shows the pre and intervention results of malaria prevalence among pregnant women. The result revealed preprevalence infection of 44(37.6%) among the group that used only ITNs; preprevalence of 27(23.3%) among those that used IPTp-SP and a preprevalence of 4(3.6%) among subjects that used both intervention measures (ITN+IPTp-SP). There was a significant difference in the preprevalence infection and intervention measures among pregnant women.

Table 11: Antenatal care (ANC) attendance, ITN use, IPTp-SP uptake and malaria infection during pregnancy by subjects

Characteristics	Frequency	Percentage (%)
Gestation age at first ANC N = 960		
1st trimester	242	25.2
2nd trimester	582	60.6
3rd trimester	136	14.2
No of ANC visit N = 960		
1-4	158	16.5
5-7	465	48.4
8 visits and above	337	35.1
Dosage of IPTp-SP received N = 320		
<3	0	0.00
3	320	100.0
>3	0	0.00
Gestational age at first dose of SP (weeks) N = 320		
16	64	20.0
17-24	99	30.9
25-36	157	49.1
SP taken under Direct Observation Therapy (DOT) N = 320		
Always	280	87.5
Often	40	12.5
Usage of ITN N = 290		
Number that used ITN	169	58.8
Number that did not use ITN	121	41.7

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Malaria infection N = 960		
Number infected	545	56.8
Number that were not infected	415	43.2

Relationship between ANC visits, sociodemographic characteristics, IPTp-SP uptake and malaria infection among pregnant women is illustrated in table 13. The result revealed that the gestational age at which the first dose of SP was received, the total number of ANC visits that were made and the gestational age at which the first ANC visit was made were found to be significantly associated with the total number of doses of SP received before delivery (p <0.001). Similarly, the educational level of these women was also found to be associated with uptake of SP ($\chi 2$ = 12.4; p = 0.021), however, the remaining factors such as marital status, age, number of children and malaria infection status were not associated with SP uptake (p > 0.05).

Discussion

Assessment of the usage and effectiveness of IPTp and ITNs among pregnant women according to their socio-demographic characteristics revealed that pregnant women from the respective age brackets, different occupations, gravidity and various trimester preferred IPTp to ITNs. This reflected the greater population of pregnant women from Orlu and Okigwe zones combined together who preferred IPTp to ITNs.

Generally, there was a significant difference (P<0.05) in the prevalence of malaria among pregnant women attending clinic from the various hospitals and health centers in the respective zones when compared with one another (Table 2). This implies that there was a marked variation in malaria prevalence in a highly endemic area during the season of high prevalence rate [16].

The overall prevalence of malaria among pregnant women attending clinic from the respective zones recorded in this study (Table 4) and pregnant women of various age bracket (Table 3) was lower than the 78.4% malaria prevalence recorded among the pregnant women in the study carried out by [17] as well as the 52.7% malaria prevalence reported by [12] in Abia. The difference could be attributed to the poor attitude of the pregnant women towards seeking ante natal care. Similarly, the malaria prevalence was lower than 99% prevalence reported in Enugu [18]. It was also lower than the 89 % affected in Ibadan 78.9% reported by [19] in Benin and 72% documented by [20] in the South West. However the malaria prevalence obtained in this study could still be considered high especially in pregnant women with primary basic qualification (57.89), pregnant women from primigravid (47.54%) and pregnant women between 31-40 years (46.33%) knowing that malaria prevalence is higher in the southern part of the country than their northern counterparts [20] and all the prevalence used in the comparison above are from the southern region. The high malaria prevalence could be attributed to the environmental conditions (especially during the rainy season which corresponded to the period the study was carried out) inherent in the study area creating conducive atmosphere for the breeding of Mosquito vector [22].

Expectedly, the prevalence of malaria varied significantly (P<0.05) among pregnant women from the different age bracket, educational levels, type of occupation and gravidity, however, there was no significant difference (P<0.05) in the prevalence of malaria among pregnant in their first, second and third trimesters Result on the lower prevalence of malaria among pregnant women using ITN (33.79%) from those using IPT (46.38%) in this study (Table 5) was in agreement with the study by [22] on the Impact of Insecticide Treated Nets and Intermittent Preventive Treatment in Reducing Malaria Morbidity among Pregnant Women in Gombe, Nigeria. Their findings showed a significant difference among pregnant women utilizing ITN from those who do not as it was recorded that pregnant women using ITN recorded lower malaria prevalence (74.4%) as against those that do not use ITN (83.6%).

It is expected that ITN usage will significantly affect malaria infection; hence it is not surprising that in this study net usage by pregnant women greatly influence malaria infection. This finding corroborate with that of a study in Cote d' Ivoire where no difference was found between user and non-user group of mosquito net with regard to parasitaemia [21]. Similarly, the finding was in disagreement with the results of a study carried out in East Africa where net usage did not appear to reduce malaria prevalence [23]. Furthermore, this finding contrast sharply with that of Tanzania [3] where effective utilization of ITN was accompanied by 100% reduction in malaria cases, but in accordance with studies in Gambia where ITN utilization was common among houses with low malaria incidence of less than 40% [6] and Rwanda where increase in ITN distribution brought down malaria sharply in the affected community [2]. Effective prevention against malaria reduces intensity of malaria infection [4]. In all, there was no difference in the rate of compliance to IPTp and ITN by the pregnant women.

In Table 10, most of the pregnant women were experiencing their first pregnancy for their first child. Although they were well-versed on the transmission of malaria during pregnancy. Their clinical characteristics regarding IPTp-SP uptake showed that all pregnant women took a maximum of three doses of IPTp-SP, regardless of whether they were pregnant for the first time or not, had one child, two children, or more than three children, or knew how to prevent malaria or not. Pregnant women who were unaware of the risks of malaria during pregnancy, however, took more than four doses. Anything more than the recommended two to three doses of Fansidar (sulfadoxine) may result in problems and side effects [24] This decrease over the years may be attributable to the routinely free provision of bed nets and IPT-SP to expectant mothers. Also, in the nation where it has been demonstrated that at least 90% of pregnant women receive the first dosage, IPTp-SP coverage is increasing [9] which can reduce malaria-related anaemia.

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More pregnant women took SP under DOT each time and their dosage of administration was mostly not more than 3. Despite the fact that there were many healthcare providers at the facility centers, accessibility via distance and transportation were significant barriers. However, some expectant women bemoaned the fact that they did not receive medical attention when they went to health facility centers, which caused them to take more than four doses of IPTp-SP. Pregnant women typically reported that they could not get medications at the health facility centers, leaving them no choice but to purchase them elsewhere, frequently without a prescription. They had to take more than 4 doses of IPTp-SP as a result of this serious issue. This dosage effect conclusion was different from that of Fokam *et al* (2016), who discovered a systematic decline in malaria prevalence with higher doses of SP molecule.

Similar to this, more women who were 37 weeks pregnant took 3 doses or less of IPTp-SP (Table 11). Due to the medical help these expectant mothers received, the majority of the babies they delivered were alive and were only given three doses of IPTp-SP; however, some others were stillborn. IPTp-SP was administered in excess doses (more than 4) to mothers of babies born as stillbirth, which may have contributed to the difficulties. The majority of the infants delivered were between the ranges of 2.2 and 3.4 kg at birth, 45.5 to 52.5 cm long, and with a head circumference of 30 to 34 cm. These anthropometric traits mirror those of a young child in good health.

Conclusion

This study has been able to establish the fact that some pregnant women do not protect themselves from malaria parasite infection with protective measures such as ITNs and IPTp, in spite of the popularity given to the use of these protective measures, particularly the ITNs which in most centers are distributed free of charge to these pregnant women. Despite the widespread acceptance of the use of these intervention measures, particularly the ITNs, which in most centers are provided free of charge to these pregnant women, this study has been able to demonstrate that some pregnant women do not protect themselves from malaria parasite infection with protective measures such as ITNs and IPTp. The study's findings revealed important information about the clinical traits and degree of IPTp-SP uptake among pregnant women, which supported the most effective malaria management and prevention throughout pregnancy. The study's findings revealed important information about the malaria status, pregnancy outcome in regard to the degree of IPTp-SP uptake among pregnant women, which supported WHO recommendation of IPTp-SP use of the most effective malaria management and prevention throughout pregnancy.

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