



Assessment of Prevalence and Intensity of Malaria Infection among IPT and ITN Users in Imo State.

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ABSTRACT

Malaria infection is a tropical parasitic disease of man that causes severe morbidity and mortality in sub-Saharan Africa. The aim of this study was to assess the Prevalence and Intensity of Malaria Infection among IPT and ITN Users in three geopolitical zones of Imo State. A total of 960 pregnant women were recruited for the study. Their socio-economic characteristics, Prevalence and intensity of malaria; Usage and Effectiveness of IPTp and ITNs were obtained using pre-tested structured questionnaire. Results obtained showed that majority of the participants were within the age range of 21-30 years 553(57.6%). In Owerri Zone, ITNs 135(37.50%) usage was found highest, IPTp usage had 113(31.38%) while usage of both 72(20.00%) recorded least. In Orlu and Okigwe Zones, IPTp usage 160(44.44%) and 156(43.33%) recorded highest, followed by usage of both 88(24.44%) and 90(25.00%), respectively while ITN usage recorded least usage with 78(21.66) and 64(17.77%), respectively. 429(44.68%) use IPTp only, 287(29.89%) use ITNs only while 244(25.41%) combine both. In their age relation, age groups 15-30 years 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. Results of overall prevalence recorded 117(36.56%) in Owerri Zone, 116(36.25%) in Orlu Zone and 112 (35.00%) in Okigwe Zone respectively. Percentage revealed that age group 31-40 years had the highest prevalence of (46.33%), followed by 15-20years (35.44%), 21-30years (32.34%) and >40years had (24.63%) as the least prevalence. With respect to intensity according to trimester shows, results revealed that 266(27.71%) had light (+) malaria, 79(8.23%) had moderate (++) a total of 690(71.88%) pregnant women had full knowledge of ITN, 270(28.12%) had partial knowledge of ITN.

Keywords: Prevalence, Intensity, Malaria, IPT, ITN, Imo State.

Introduction

Insecticide-treated mosquito nets (ITNs) used for protection against mosquito bites have proven to be a practical, highly effective, and cost-effective intervention against malaria [1]. The evidence of the public health impact of ITNs, supporting their wide-scale use in Africa, is drawn from areas of stable malaria transmission where *Plasmodium falciparum* infection prevalence in the community is often over 40% [1, 2]. Malaria poses a severe health threat in sub-Saharan Africa, particularly for pregnant women. The World Health Organization reports that in 2018, approximately 228 million new malaria cases were reported worldwide, with most of them in Africa. Nigeria was responsible for nearly 24% of all global malaria-related deaths in 2018.

Pregnant women in Nigeria are particularly vulnerable to malaria infection due to various factors such as poor access to quality healthcare services, poverty, and demographic characteristics. The burden of malaria is highest in rural areas, where access to health services is limited. The poverty rates in these areas make it challenging for pregnant women to access healthcare services and afford preventive measures such as insecticide-treated bed nets and antimalarial drugs [3]. This lack of access to quality healthcare services also means that many cases of malaria go undiagnosed and untreated, leading to severe complications for pregnant women and their fetuses.

Malaria is a mosquito-borne infectious disease of humans and other animals caused by eukaryotic protists of the genus *Plasmodium*. This genus *Plasmodium* infects mammals, birds, and lizards and is transmitted through the bites of female mosquitoes (*Anopheles* species in mammals or *Culex* species in birds and lizards) [4]. The signs and symptoms of malaria typically begin 8–25 days following infection. However, symptoms of malaria may occur later in those who have taken antimalarial medications as prevention [5]. Initial manifestations of malaria are similar to flu-like symptoms [6] and can resemble other conditions such as sepsis, gastroenteritis, and viral diseases [7]. The presentation may include headache, fever, shivering, joint pain, vomiting, haemolytic anaemia, jaundice, haemoglobin in the urine, retinal damage, and convulsions [8].

The current Prevalence and Intensity of Malaria Infection among IPT and ITN is still scanty. The results of this study will contribute to developing an evidence-based protocol for malaria during pregnancy in clinical setting and similar settings in Nigeria, sub-Saharan Africa and beyond.

MATERIALS AND METHODS

Study Area

The study was conducted in six Local Government Areas (Owerri Municipal, Mbaitoli, Orsu, Njaba, Isiala-Mbano and Onuimo) of Imo State randomly selected between July and October, 2021. 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' and 6°15' North, longitude 6°38' and 7°18' East. It comprises of three geo-graphical zones: Orlu, Owerri and Okigwe. The population is mostly engaged in agriculture; yams, taro, corn (maize), rice, and cassava (manioc) are the staple crops, and [oil palm](#) is the main cash crop.

Ethical Clearance & Consent

Ethical clearance for this study was obtained from the Imo State University Ethics Committee while informed consent was obtained from the participants during advocacy visits.

Sample size & Sampling Technique

Well-structured questionnaire were issued to the study population to obtain demographic data, choice 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. A total of 960 consenting participants were selected for the study.

Study/Sample Population

The sample population was determined randomly 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. This method was drawn from [1]. The choice of these Local Government Areas was 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 Criteria

- i. Consenting pregnant women between 15years and above attending antenatal at the time of this study
- ii. Pregnant women sleeping under insecticide treated bed nets and utilizing intermittent preventive therapy as a malaria control measure.
- iii. Pregnant women using both the above named malaria control strategies for over a period of one year.

Exclusion Criteria

- i. Non-consenting pregnant women
- ii. Pregnant women who are not using either insecticide treated net or intermittent preventive therapy as a malaria control strategy.
- iii. Pregnant women utilizing the two malaria control measures less than the stipulated time interval.

Study Design

Cross-sectional study design was adopted for the study.

Data Analysis

All the data collected were analyzed using descriptive and inferential statistics (percentages (%), chi square (χ^2) and z-test)

Results and discussion

The demographic characteristics of pregnant women under study are shown in table 1. A total number of 960 pregnant women were recruited for the study; results of the ages of pregnant women revealed that 21-30years 553(57.6%) recorded the highest participation followed by 31-40years with 259(26.9%), 15-20years had 79(8.2%) participation, >40years had 69(7.2%) while no pregnant woman was found below<15years. In their educational levels, those with tertiary education 622(64.8%) participated more in the study, followed by those with secondary education 319(33.2%) while those with primary education 19(1.95) recorded the least participation.

It was observed that most of these pregnant women 510(53.1%) were students/unemployed, 206(21.5%) were civil servants, 147(15.3%) were house wives/farmers while 97(10.1%) were traders. Also, the gravidity of these pregnant women examined, showed that 527(54.9%) were multiplegravid, 311(32.4%) were secundigravid and 122(12.7%) were primigravid. On the number of antenatal visit, 533(55.5%) of the subjects had 3 or more antenatal visit, 356(37.1%) had visited twice, while 156(16.3%) had visited once. More so, it was observed among the subjects that 546(56.9%) are in their 3rd trimester, 356(37.1%) are in their 2nd trimester while only 58(6.0%) are in their 1st trimester.

Table1:Demographic Characteristics of the Pregnant Women under Study

Variables	Frequency	Percentage
Age in years		
15-20	79	8.2
21-30	553	57.6
31-40	259	26.9
>40	69	7.2
Educational Level		
Primary	19	1.9
Secondary	319	33.2

Tertiary	622	64.8
Occupation		
Students/unemployed	510	53.1
Trader	97	10.1
Civil Servant	206	21.5
House wife/farmer	147	15.3
Gravidity		
Primigravid	122	12.7
Secundigravid	311	32.4
Multiplegravid	527	54.9
Number of Antinatal Visit		
1 st Visit	156	16.3
2 nd Visit	271	28.2
3 rd or more visit	533	55.5
Trimester		
1 st Trimester	58	6.0
2 nd Trimester	356	37.1
3 rd Trimester	546	56.9

The frequencies of usage of IPTp and ITNs among pregnant women according to hospital are shown in table 2. The study sampled 4 hospitals each from the 3 zone in Imo State. IPTp usage was found highest (43.75% vs 56.25% vs 51.25%) among subjects in Nwaorubi general hospital, Ogechi Hospital and Maternity, Obeakpu Njaba and Umuna Health Center, Okigwe, respectively; ITN usage was also highest (50.00%) among subjects in Holy Family and Maternity, Ikenegbu and St. David's Hospital, Mbari, (25.00%) among subjects in Amaruru Community Health Center, Orsu, Ignatius and Veronica hospital and maternity, Ihitenansa Orsu and Ogechi Hospital and Maternity, Obeakpu Njaba, respectively.

Similarly, In Owerri Zone, ITNs 135(37.50%) usage was found highest, IPTp usage had 113(31.38%) while usage of both 72(20.00%) recorded least. In Orlu and Okigwe Zones, IPTp usage 160(44.44%) and 156(43.33%) recorded highest, followed by usage of both 88(24.44%) and 90(25.00%), respectively while ITN usage recorded least usage with 78(21.66) and 64(17.77%), respectively.

There was a significant difference ($P < 0.05$) in the frequency of usage of IPTp, ITNs or both in pregnant women attending clinic at the four hospitals in Owerri when compared with one another. There was a significant difference ($P < 0.05$) in the frequency of usage of IPTp, ITNs or both in pregnant women attending clinics at Ignatius and Veronica Hospital Orlu, Ogechi Hospital and maternity Orlu and Umuaka community hospital Orlu when compared with one another. Similarly, there was a significant difference ($P < 0.05$) in the frequency of usage of IPTp, ITNs or both in pregnant women attending clinics at Hope Alive Hospital and maternity Okigwe, T. Emmanuel Hospital and maternity Okigwe and Umuna Health Center Okigwe when compared with one another

Table 2: Assessment of Usage of IPTp and ITNs among Pregnant Women according to hospitals

Hospitals	No. Exam.	IPTp (%)	ITNs (%)	Both (%)
Owerri Zone				
Holy Family and Maternity, Ikenegbu	80	28.75±2.50 ^a	50.00±0.00 ^b	21.25±1.25 ^c
St. David's Hospital, Mbari	80	31.25±3.75 ^a	50.00±0.00 ^b	18.75±2.50 ^c
Rimah hospital and Maternity, Umudagu Mbieri	80	37.50±2.50 ^a	43.75±1.25 ^b	18.75±2.50 ^c
Nwaorubi general hospital	80	43.75±5.00 ^a	25.00±0.00 ^b	31.25±1.25 ^c
Total	320	35.31±3.44	42.19±0.31	22.50±0.63
Orlu Zone				
Amaruru Community Health Center, Orsu	80	50.00±0.00 ^a	25.00±0.00 ^b	25.00±0.00 ^b
Ignatius and Veronica hospital and maternity, Ihitenansa Orsu	80	43.75±3.75 ^a	25.00±0.00 ^b	31.25±1.25 ^c
Ogechi Hospital and Maternity, Obeakpu Njaba	80	56.25±6.75 ^a	25.00±0.00 ^b	18.75±1.25 ^c
Umuaka community hospital Njaba	80	50.00±0.00 ^a	22.50±1.25 ^b	27.50±1.25 ^c
Total	320	50.00±2.50	24.38±0.32	25.63±0.32
Okigwe Zone				
Hope Alive hospital and maternity, Amaraku	80	43.75±2.50 ^a	31.25±1.25 ^b	25.00±0.00 ^c

T. Emmanuel hospital and maternity Amaraku	80	50.00±0.00 ^a	18.75±1.25 ^b	31.25±2.50 ^c
Umuna Health Center, Okigwe	80	51.25±5.00 ^a	17.50±1.25 ^b	31.25±2.50 ^c
Okwelle general Hospital	80	50.00±0.00 ^a	25.00±0.00 ^b	25.00±0.00 ^b
Total	320	48.75±1.88	23.13±0.32	28.13±1.25

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

Assessment of the usage and effectiveness of IPTp and ITNs in relation to age groups, educational levels, occupation, gravidity and trimesters among the subjects were shown in Table 3. 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. 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%. 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. 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 both by 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.

Table3: Assessment of the Usage and Effectiveness of IPTp and ITNs among Pregnant Women under Study

Variables	No. Exam. N = 960	IPTp Usage (%)	ITN Usage (%)	Combined (%)
Age in years				
15-20	79	44.30±2.53 ^a	31.64±1.27 ^b	24.05±1.27 ^c
21-30	553	50.63±1.09 ^a	31.64±0.73 ^b	17.72±0.36 ^c
31-40	259	36.29±1.16 ^a	30.50±1.16 ^b	33.20±0.39 ^c
>40	69	28.98±2.89 ^a	11.59±1.45 ^b	59.42±2.90 ^c
Educational Level				
Primary	19	36.84±5.26 ^a	42.10±5.27 ^a	21.05±0.00 ^b
Secondary	319	40.75±1.26 ^a	31.34±0.94 ^b	27.98±0.63 ^c
Tertiary	622	46.94±0.65 ^a	28.77±0.32 ^b	24.27±0.16 ^c
Occupation				
Students/unemployed	510	40.98±0.59 ^a	23.13±0.39 ^b	35.88±0.59 ^c
Traders	97	38.14±2.07 ^a	29.89±1.03 ^b	31.95±2.07 ^c
Civil Servant	206	49.02±1.46 ^a	39.32±0.49 ^b	11.65±0.49 ^c
House wife/farmer	147	55.78±1.36 ^a	40.13±2.05 ^b	4.08±0.00 ^c
Gravidity				
Primigravid	122	55.73±2.43 ^a	26.22±1.62 ^b	19.67±0.81 ^c
Secundigravid	311	54.01±0.65 ^a	28.61±0.33 ^b	17.36±0.65 ^c
Multiplegravid	527	36.62±1.14 ^a	31.87±0.58 ^b	31.87±0.38 ^b
Trimester				
1 st Trimester	58	50.00±3.45 ^a	22.41±1.73 ^b	27.58±3.45 ^c
2 nd Trimester	356	51.96±1.12 ^a	28.08±0.84 ^b	19.94±0.57 ^c
3 rd Trimester	546	39.37±0.92 ^a	31.86±0.37 ^b	28.75±0.55 ^c

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

Overall prevalence of malaria according to zones among pregnant women under study was shown in Table 4. Results showed overall prevalence of 117(36.56%) in Owerri Zone, 116(36.25%) in Orlu Zone and 112(35.00%) in Okigwe Zone.

In relation to hospitals, prevalence was highest in Rimah hospital and Maternity, Umudagu Mbieri and St. David's Hospital, Mbari (38.75% vs 37.50%) in Owerri Zone, respectively. In Orlu Zone, prevalence of malaria among pregnant women were highest in Amaruru Community Health Center, Orsu and Ignatius and Veronica hospital and maternity, Ihitenansa Orsu with (37.50% vs 37.50%), respectively, while in Okigwe Zone, prevalence were found

highest in Umuna Health Center, Okigwe (36.25%), Hope Alive hospital and maternity, Amaraku and T. Emmanuel hospital and maternity Amaraku with (35.00%), respectively.

There was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women attending clinics at Holy Family Hospital Owerri, Nwaorubi Hospital Owerri, Ogechi Hospital Orlu, Hope Alive Hospital Okigwe, T. Emmanuel Hospital Okigwe and Okwelle Hospital Okigwe when compared with Rimah Hospital Owerri. Also, there was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women attending clinics at St Davids Hospital Owerri, Amaruru Health Center Orlu and Ignatius and Veronica Hospital Orlu when compared with Ogechi Hospital Owerri. Similarly, there was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women attending clinics at St Davids Hospital Owerri, Amaruru Health Center Orlu and Ignatius and Veronica Hospital Orlu when compared with Okwelle Hospital Okigwe.

Table 4: Overall Prevalence of malaria among pregnant women

S/N	Hospitals	No. Exam.	No. Infected (%)
Owerri Zone			
1.	Holy Family and Maternity, Ikenegbu	80	35.00±2.50 ^a
2.	St. David's Hospital, Mbari	80	37.50±3.75 ^b
3.	Rimah hospital and Maternity, Umudagu Mbieri	80	38.75±2.50 ^b
4.	Nwaorubi general hospital	80	35.00±1.25 ^a
	Total	320	36.56±2.50
Orlu Zone			
5.	Amaruru Community Health Center, Orsu	80	37.50±2.50 ^b
6.	Ignatius and Veronica hospital and maternity, Ihitenansa Orsu	80	37.50±1.25 ^b
7.	Ogechi Hospital and Maternity, Obeakpu Njaba	80	33.75±1.25 ^a
8.	Umuaka Community hospital, Njaba	80	36.25±2.50
	Total	320	36.25±1.88
Okigwe Zone			
9.	Hope Alive hospital and maternity, Amaraku	80	35.00±2.50 ^a
10.	T. Emmanuel hospital and maternity Amaraku	80	35.00±0.00 ^a
11.	Umuna Health Center, Okigwe	80	36.25±2.50
12.	Okwelle general Hospital	80	33.75±2.50 ^a
	Total	320	35.00±1.88

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 age was shown in table 5. Result of percentage prevalence revealed that age group 31-40years had the highest prevalence of (46.33%), followed by 15-20years (35.44%), 21-30years (32.34%) and >40years had (24.63%) as the least prevalence. Also, result of the percentage prevalence of malaria in relation to educational levels revealed that those with primary education (57.89%) had the highest prevalence, followed by those with secondary education (43.88%) and tertiary education (31.18%). The result shows that educational levels of subjects influenced the prevalence of malaria among pregnant women. More so, result of the percentage prevalence of malaria in relation to occupation revealed that house wives/farmers had the highest prevalence of (44.21%), followed Civil Servant (41.26%), Students/unemployed (32.35%) and Trader (30.92%).

Furthermore, result of the percentage prevalence of malaria in relation to gravidity show that primigravid (47.54%) had the highest prevalence, followed by Multiplegravid (35.10%) and Secundigravid (32.79%). It was shown that the result of the percentage prevalence of malaria in relation to trimester revealed highest among 3rd and 1st trimesters with (36.63%) and (36.20%), respectively, while 2nd trimester recorded prevalence of (34.83%). Prevalence of malaria among pregnant women in relation to IPT and ITN Usage revealed highest prevalence among IPT users (46.38%), followed by ITN users (33.79%) and combined users (20.08%) as the least.

There was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women from all age brackets when compared with one another. There was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women at all educational level when compared with one another. Also, there was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women that are students/unemployed and traders when compared with those that civil servants and house wife/farmers. There was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women at secundigravid and multiplegravid when compared with those at primigravid. There was a significant difference ($P<0.05$) in the prevalence of malaria in pregnant women that use IPTp and ITNs separately when compared with those that combine them. There was no significant difference ($P<0.05$) in the prevalence of malaria in pregnant women at the three trimesters when compared with one another.

Table 5: Prevalence of Malaria among pregnant women in relation to age, Educational Level, Occupation, Gravidity, Trimester, IPT and ITN Usage

Variables	No. Exam.	No. Infected (%)
Age in years		
15-20	79	35.44±2.53 ^a

21-30	553	32.34±1.09 ^b
31-40	259	46.33±1.54 ^c
>40	69	24.63±1.45 ^d
Educational Level		
Primary	19	57.89±5.27 ^a
Secondary	319	43.88±0.94 ^b
Tertiary	622	31.18±0.65 ^c
Occupation		
Students/unemployed	510	32.35±0.59 ^a
Trader	97	30.92±2.07 ^a
Civil Servant	206	41.26±0.97 ^b
House wife/farmer	147	44.21±1.37 ^b
Gravidity		
Primigravid	122	47.54±1.64 ^a
Secundigravid	311	32.79±0.97 ^b
Multiplegravid	527	35.10±0.76 ^b
Trimester		
1 st Trimester	58	36.20±0.00
2 nd Trimester	356	34.83±0.85
3 rd Trimester	546	36.63±0.19
IPT and ITN Usage		
IPTp	429	46.38±0.70 ^a
ITNs	287	33.79±0.70 ^b
Combined	244	20.08±0.00 ^c

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 6. Results of intensity according to trimester shows that 266(27.71%) had light (+) malaria, 79(8.23%) had moderate (++) . There was no severe malaria infection. 3rd trimester (28.93%) recorded highest in Light (+) malaria infection, while 1st trimester (13.79%) was found be highest in moderate (++) malaria infection. According to gravidity, 309(32.19%) had light (+) infection and only 36(3.75%) had moderate (++) infection. Primigravid (40.16%) and (7.37%) recorded highest in Light (+) and moderate (++) malaria infections, respectively.

According to age (in years), Light (+) malaria infection was found to be highest with 259(26.98%) while only 86(8.96%) had moderate (++) infection. It was observed that age group 31-40years recorded highest in both Light (+) and moderate (++) malaria infections with (34.36%) and (11.96%), respectively.

There was a significant difference (P<0.05) in the intensity of malaria (light, moderate and severe) in pregnant women at the three respective trimester stages, gravidity levels and different age brackets when compared with one another.

Table 6: Intensity of malaria in relation to trimester, gravidity and age groups among pregnant women in the study areas

Variables	No. Exam.	No. positive (+)	Light (+)	Moderate (++)	Severe (+++)
1 st Trimester	58	36.20±00	22.41±0.00a	13.79±0.00b	0.00±0.00c
2 nd Trimester	356	34.83±0.85	26.68±0.57a	8.14±0.00b	0.00±0.00c
3 rd Trimester	546	36.63±0.74	28.93±0.55a	7.69±0.00b	0.00±0.00c
Total	960	35.93±0.32	27.71±0.52a	8.23±0.00b	0.00±0.00c
Gravidity					
Primigravid	122	47.54±1.64	40.16±0.82a	7.37±0.00b	0.00±0.00c
Secundigravid	311	32.79±0.97	29.58±0.64a	13.21±0.00b	0.00±0.00c
Multiplegravid	527	35.10±0.95	31.87±0.77a	3.22±0.20b	0.00±0.00c
Total	960	35.93±0.32	32.19±0.74a	3.75±0.11b	0.00±0.00c
Age in years					
15-20	79	35.44±1.20	27.84±0.00a	7.59±0.00b	0.00±0.00c
21-30	553	32.34±0.55	24.41±0.18a	8.13±0.00b	0.00±0.00c
31-40	259	46.33±0.77	34.36±0.77a	11.96±0.00b	0.00±0.00c
>40	69	24.63±2.90	18.84±1.45a	5.79±0.00b	0.00±0.00c
Total	960	35.93±0.32	26.98±0.42a	8.96±0.00b	0.00±0.00c

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

The KAP on ITN compliance and malaria status of pregnant women in the study areas was shown in Table 7 below. Results revealed that a total of 690(71.88%) pregnant women had full knowledge of ITN, 270(28.12%) had partial knowledge of ITN. Out of the participants with full knowledge of ITN, only 247(35.79%) had +ve malaria status while majority 443(64.20%) were negative. On the other hand, those with partial knowledge recorded 98(36.29%) +ve malaria status and 172(63.70%) –ve. Also, a total of 760(79.19%) of the participants owned ITN while 200(20.83%) do not own ITN. Out of 760 participants with ITN, 268(35.26%) were +ve while 492(64.74%) were –ve; while those without ITN, 77(38.50%) were +ve and 123(61.50%) were –ve.

On the ITN usage, Number of pregnant women that use ITN was 287(37.76%), of which 82(28.57%) were +ve and 205(71.93%) were –ve while those participants that don't use ITN recorded higher percentage malaria status (as shown in table 7). Result on the hanging position revealed that only 66(22.99%) hang ITN on windows and doors, 221(77.00%) hang over the bed. From the results, participants that hang on windows and doors recorded higher 51(77.27%) +ve malaria status; same was applicable to the frequency of ITN use, where higher prevalence of (88.09%) +ve malaria status were recorded among those who use ITN sometimes. Those whose nets rolled down were found to have 27(72.97%) +ve malaria status against those whose nets were tucked into bed. There was a significant difference ($P<0.05$) in all the KAP parameters analyzed when compared with one another.

Table 7: KAP on ITN compliance and malaria status of pregnant women in the study areas

Variables	No. Examined	Malaria Status (%)		Total (%)
		+ve	–ve	
Level of knowledge				
Full	690	35.79±0.44 ^a	64.20±0.58 ^a	71.88±0.00 ^a
Partial	270	36.29±0.76 ^a	63.70±1.11 ^a	28.12±0.00 ^b
None	0	0.00±0.00 ^b	0.00±0.00 ^b	0.00±0.00 ^c
Total	960	35.94±0.52 ^a	64.06±0.32 ^a	100.0±0.00 ^d
Ownership				
No. with ITN	760	35.26±0.53 ^a	64.74±0.27 ^a	79.19±0.00 ^a
No. without ITN	200	38.50±1.00 ^b	61.50±1.50 ^b	20.83±0.00 ^b
Total	960	35.94±0.40 ^a	64.06±0.32 ^a	100.0±0.00 ^c
ITN Usage				
No. that use ITN	287	28.57±0.70 ^a	71.93±1.08 ^a	37.76±0.00 ^a
No. that don't use ITN	473	55.60±0.64 ^b	44.39±1.06 ^b	62.23±0.00 ^b
Total	760	45.39±0.66 ^c	54.61±0.66 ^c	100.0±0.00 ^c
Hanging position				
Windows or doors	66	77.27±4.55 ^a	22.73±0.00 ^a	22.99±0.00 ^a
Over the bed	221	15.38±0.00 ^b	84.62±1.36 ^b	77.00±0.00 ^b
Total	287	29.62±0.70 ^c	73.38±2.23 ^c	100.0±0.00 ^c
Frequency of use				
Always	245	15.10±0.82 ^a	84.89±1.63 ^a	85.36±0.00 ^a
Sometimes	42	88.09±7.14 ^b	11.90±0.00 ^b	14.63±0.00 ^b
Total	287	25.78±0.70 ^c	74.21±1.05 ^c	100.0±0.00 ^c
Follow instruction				
Net rolled down	37	72.97±0.00 ^a	27.02±0.00 ^a	12.89±0.00 ^a
Net tucked into bed	227	16.29±0.44 ^b	83.70±1.76 ^b	79.09±0.00 ^b
Can't tell	23	47.82±0.00 ^c	52.17±0.00 ^c	8.01±0.00 ^c
Total	287	26.13±0.70 ^d	73.87±1.39 ^d	100.0±0.00 ^d

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.

Relationship between malaria status and IPTp compliance rate as shown in table 8 revealed that all the participants were knowledgeable of IPTp of which 345(35.93%) were +ve and 615(64.06%) showed negative result. Out of 429 IPTp users, 129(30.06%) were found to be positive. This was noticeable in the recommended drugs (fansider) and in the number of tablets (3). Out of 229 IPTp users who took it every month, only 9(14.29%) were found positive, 39(61.90%) were found positive among those who took IPTp once in 2-3 months, while 15(23.81%) found positive among those who took it once in 4-6 months.

Table 8: KAP on IPTp compliance and malaria status of pregnant women in the study areas

Variables	Category		No Examined	Malaria status %		Total
	Yes	No		+ve	–ve	
Knowledge of IPTp	960	0	960	345(35.93)	615(64.06)	960(100.0)
Users of IPTp	429	531	960	129(30.06)	300(69.93)	429(100.0)
Recommended drugs			429			
Malarich	0	429		0(0.00)	0(0.00)	0(0.00)

Almalar	0	429		0(0.00)	0(0.00)	0(0.00)
Phensic	0	429		0(0.00)	0(0.00)	0(0.00)
Fansider	429	0		129(30.06)	300(69.93)	429(100.0)
No. of tablets						
3	960	0	960	129(30.06)	300(69.93)	429(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 = 429						
Every month	229	200		9(14.29)	220(60.11)	229(53.38)
Once in 2-3 months	175	254		39(61.90)	136(37.16)	175(40.79)
Once in 4-6 months	25	404		15(23.81)	10(2.73)	25(5.83)
Once in 7-9 months	0	429		0(0.00)	0(0.00)	0(0.00)
Total				63(14.69)	366(85.31)	429(100.0)

Discussion

The greater percentage of women within 21-30 years (57.6%) and 31-40 years (26.9%) and that there were mostly in the tertiary institutions (64.8%) was not surprising because this represent the age bracket within which women enroll in the university. Education is highly prioritized in the eastern states of Nigeria and parents always preferred to send their children (male and female) to tertiary institutions before giving them out to marriage unlike their counterparts from the northern part of Nigeria. Globally, any marriage or pregnancy earlier than 18 years is termed abuse and violation of human right [9]. This is contrary to the provisions in Sharia law practiced in the northern part where maturity in women is a function of development of puberty and secondary characteristics [10]. Obviously, women in their third trimester are expectant mothers and should take precautionary measures to protect their babies and one of such measures is attending ante natal regularly and adhering to the physician's advice.

The higher percentage of women using Insecticide Treated Nets (ITNs) in Owerri zone (42.19±0.31 %) than other zones is not surprising considering that Owerri zone is the capital of Imo state, hence hospitals and health centers within should have easy access to mosquito nets provided by the government. Correspondingly, the higher percentage of women using Intermittent Preventive Therapies (IPTs) in Orlu (50.00±2.50 %) and Okigwe (48.75±1.88 %) zones can be attributed to the rural nature of the areas and difficulty (poor road network and lack of poor communication channels) in accessing the state government headquarters from their location. Also, women in these regions may not be as enlightened as their counterpart in the state capital city and may have some cultural belief that will make them prefer IPTs to the widely accepted ITNs. This may likely be the reason for the higher percentage of pregnant women attending hospitals and health centers from Orlu and Okigwe zones preferring IPTp to ITNs while the reverse was the case in Holy Family Ikenegbu, St David's hospital, Mbari and Rimah hospital and maternity Umudagu Mbieri from Owerri zone.

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 (Table 3). 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 4). This implies that there was a marked variation in malaria prevalence in a highly endemic area during the season of high prevalence rate [11-14].

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 5) was lower than the 78.4% malaria prevalence recorded among the pregnant women in the study carried out by [15] as well as the 52.7% malaria prevalence reported by [16]. 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 [17]. It was also lower than the 89 % affected in Ibadan [15] 78.9% reported by [18] and 72% documented by [19] 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 [2] 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.

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 (Table 5). 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 [20] 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 (Table 7). 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 [5]. 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% [21] and Rwanda where increase in ITN distribution brought down malaria sharply in the affected community [22-25]. Effective prevention against malaria reduces intensity of malaria infection [9]. In all, there was no difference in the rate of compliance to IPTp and ITN by the pregnant women.

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