Malaria and Associated Risk Factors among Pregnant Women attending Antenatal care in Awka, Anambra State, Nigeria

Abstract

Malaria in pregnancy is a major public health problem in endemic areas of sub-Saharan Africa. It is a major contributor to adverse maternal and perinatal outcome. This work was carried out to determine the prevalenceand associated risk factors of malaria among pregnant women attending antenatal clinics in Awka. Microscopy was used to determine the prevalence of malaria among the pregnant women, while structure questionnaire was used to determine the knowledge and use of IPTp and LLINs among thepregnant women. Out of the 300 pregnant women screened for malaria, 184 (61.3%) were positive for malaria parasite.of 184 positive for malaria, 130(47.1%) had mild malaria, 49(27.0%) moderate infection, while 5(2.7%) had severe malaria. Of the 184 pregnant women positive for malaria parasite, those less than 20 years (70.0%) were more infected with malaria parasite, followed by 21-30 years (65.4%), while 41 years and above (20.0%) years were the least infected. Those in their first trimester had the highest prevalence of malaria (76.2%). Primigravidae (64.5%) were more infected than multigravidae (56.1%) Pregnant women with non formal education were most infected (95.0%), followed by primary education (27.3%), while secondary education showed the lowest rate of malaria in pregnancy (92.9%). Farmers reported the highest cases(86.3%) of malaria in pregnancy, while civil servants reported the least (27.3%). Married women showed the highest cases of malaria in pregnancy (65.1%), while single reported the least (51.0%).the knowledge and compliance of IPTp among the pregnant women studied were 84.7% and 52.7% respectively, while knowledge of LLINs was 51.7%. intensified health education is needed to reducethe burden of malaria among pregnant womenin Awka.

Keywords: Malaria, infectious disease, protozoan parasites, public health

Introduction

Malaria is an infectious disease caused by the protozoan parasites of the genus *Plasmodium*, transmitted by a vector, an infected female *Anopheles*-mosquito. *Plasmodium vivax, P. ovale, P. malariae, P. falciparum* and *P. knowlesi* are the five *Plasmodium* species capable of infecting humans, *P. falciparum* being the deadliest of the four (WHO, 2015). Malaria is among the five top killer diseases worldwide, being the second in Africa, after HIV/AIDS. The global health burden of malaria is enormous. In 2014 an estimated 3.3 billion people are at risk of malaria of which 1.2 billion are at high risk. In high-risk areas, more than one malaria case occurs per 1000 population. In 2013 an estimated 437 000 African children died before their fifth birthday (WHO, 2015). There were an estimated 198 million cases of malaria worldwide (range 124-283 million) in 2013, and an estimated 548 000 deaths (range 367 000- 755 000). Ninety percent of all malaria deaths occur in Africa (WHO, 2015).

Malaria in pregnancy is an enormous public health problem in the whole of sub-Saharan Africa. It has severe consequences for a pregnant woman and her unborn infant. An infant born to a mother with malaria is more likely to have low birth weight (LBW), which is the single greatest risk factor for death during the first months of life. The risk of maternal death also increases considerably as a pregnant woman suffering from malaria is likely to develop severe maternal anaemia (Dellicour *et al.*, 2010; WHO, 2004).

Malaria in pregnancy is a major contributor to adverse maternal and perinatal outcome. In hyper endemic areas, malaria is a common cause of anaemia in pregnancy in both immune and non-immune individuals and is aggravated by poor socio-economic circumstances (Ogbodo *et al.*, 2009). Malaria in non-immune pregnant women can be devastating and lead to maternal death, abortion, low birth weight, still birth, premature birth, morbidity and mortality.

Malaria and pregnancy usually affect the course of each other adversely. The physiological changes of pregnancy and pathological changes due to malaria have a deleterious effect on the course of each other. In endemic areas, clinical episodes of malaria are more frequent and more severe during pregnancy and mortality rate is higher among them as compared to nonpregnant (Ruchi *et al*., 2013). Many studies from areas with different malaria transmission patterns have investigated the consequences of malaria in pregnancy on both maternal health and birth outcomes (DeBeaudrap *et al*., 2013). Malaria in pregnancy has been associated with significant degree of intrauterine growth restriction, 36% of preterm deliveries, 30% of preventable low birth *weight* deliveries, 14% of low birth weight deliveries and 15% of maternal anaemia (Steketee *et al*., 2001). While the consequences of MIP on maternal health are dominated by anaemia, data on malaria-related maternal mortality are sparse (Desai *et al*., 2007).

The World Health Organization recommends the use of Intermittent Presumptive Treatment with sulphadoxine pyrimethamine (IPTsp), household use of Insecticide Treated Nets (ITNs) and effective and prompt case management as malaria control strategies in pregnancy (WHO, 2012). In areas of stable malaria transmission in sub-Saharan Africa, ITNs are highly effective in reducing childhood mortality and morbidity from malaria (Lengeler, 2004). Although ITNs are being promoted as a major tool in the fight against malaria in pregnancy, the available evidence about their effect in pregnancy appears inconsistent (Gamble *et al*., 2009).

Other malaria control measures recommended include personal protection measures against vectors such as use of residual sprays, window screening and mosquito repellent creams. In Nigeria, traditional remedies against malaria have always been employed, though with unproven efficacy, while chemoprophylaxis with weekly pyrimethamine and chloroquine which were widely utilized in several African countries are no longer efficacious because of emergence of resistance (WHO, 2013; Nahlen *et al*., 2012; Sirima *et al*., 2003). Despite numerous studies conducted over the last decades, Malaria in Pregnancy (MIP) remains an important public health problem that has proved difficult to tackle (DeBeaudrap *et al*., 2013). The relationship between malaria in pregnancy and its outcome on birth in endemic areas such as Nigeria continues to be a subject of research. Hence this present work is carried out to ascertain the prevalence, risk factors and control tools of pregnant women infected with malaria parasites in Awka, Anambra State.

STUDY AREA

The study was carried out in four randomly selected health facilities in Awka South Local Government Area (fig 1). Awka South LGA is made up of nine communities, namely: Ezinato, Isiagu, Umuawulu, Mbaukwu, Nibo, Nise, Amawbia, Awka, and Okpuno. These communities are within the capital territory of Anambra State. Awka south is situated between Longitude $7^0$04'East and Latitude $6^0$10' North of the Equator (Microsoft Encarta, 2009). Awka is in the tropical rainforest zone of Nigeria and experiences two distinct seasons brought about by the two predominant winds: the southwestern monsoon winds from the Atlantic Ocean and the northeastern dry winds from across the Sahara desert. The monsoon winds creates eight months of heavy tropical rains, which occur between April and October and are followed by four months of dryness (November - March). There is also harmattan, dry and dusty wind that enters Nigeria in late December or in the early part of January and is characterized by a grey haze limiting visibility and blocking the sun's rays. The temperature in Awka is generally 27-30˚C between April and October but rises to 32-34˚C between November and March, with the last few months of the dry season marked by intense heat.

Fig 1: Map of Anambra State Showing Awka South Local Government Area

3.1 Source: GIS and Cartography Lab, Department of Geography and Meteorology, NAU, Awka.

3.2 . SAMPLE POPULATION AND SAMPLE SIZE

The sample population comprised pregnant women attending antenatal clinics in

3.3 . COLLECTION OF BLOOD SAMPLES

Peripheral blood sample were collected using syringe. Peripheral blood was used because the malaria parasite resides at the periphery of the red blood cells. This was transferred immediately to a properly labeled slide

3.4 . DETERMINATION OF PARASITE

Malaria parasites were determined using microscopy. The field staining technique for identification of malaria parasites was used. A thin film was prepared to determine the intensity of parasitaemia. The thin films are similar to usual blood films and allow species identification because the parasite's appearance is best preserved in this preparation. With the pros and cons of thin smears taken into consideration, it is imperative to utilize the thin smears while attempting to make a definitive diagnosis (Cheesebrough, 2005).

3.4.1 PREPARATION OF THIN FILMS

A completely clean, grease free and scratch free slide was placed on a template and a drop of peripheral and venous blood were dropped and spread using a spreader slide. This was aimed at getting a region called the monolayer where the cells are spaced far enough apart to be counted and differentiated. The slide was left to air dry, after which the blood was fixed using absolute methanol briefly for 30 seconds. The remaining alcohol was tipped off and the film was allowed to air dry. The fixative is essential for good staining and presentation of cellular detail. The fixed slide was then stained with 6% Giemsa solution for 45 minutes and the stained slide was washed off with tap water and allow to air dry. The stained slide was placed on stage and viewed with microscope using 40x for identification and 100x oil immersion objective lens to examine the characteristic morphology of the parasite.

3.5. DETERMINATION OF THE USE OF IPT AND LLIN

A total of 200 questionnaires which was pretested were distributed to the pregnant women who attended antenatal care. A closed ended type of questionnaire was used to collect data from pregnant women during their antenatal visit to the hospital which was aimed at determining their knowledge and use of IPT and LLIN. Respondents were only intended to answer YES or No to questions asked (Appendix 1).

3.6. ANALYSIS OF DATA

Data generated were subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS) version 21.0. Chi-square analysis was used to compare the association among the different group for significant difference.

RESULTS

4.1 Prevalence of malaria

4.1.1 Age –specific prevalence of malaria among pregnant women studied.

The prevalence of malaria among pregnant women in relation to age is shown in Table 1. The highest prevalence 14(70.0%) of malaria was observed among those less than twenty years old while the least prevalence 3(20.0%) was observed among those that were 41 years old and above. Those in the age groups 21-30 and 31-40 years of age had 65.4% and 60.7% respectively. Chi-square analysis showed that there was a significant difference in malaria prevalence in relation to age ($P<0.05$).

On the intensity of malaria, the highest prevalence of mild infection (84.1%) was obtained from those in the age group 31-40 years old. No case of mild infection was found among those that are 41 years old and above. However, the highest prevalence of moderate (66.7%) and severe (33.3%) infections were obtained from those that were 41 years and above. Chi-square analysis showed that there was a significant difference in malaria prevalence in relation to age ($P<0.05$).

Table 1: Prevalence and intensity of malaria in relation to the age.

Age group(years)	Number examined	Number positive (%)	Intensity of Infection		
			Mild(+)(%)	Moderate(++)(%)	Severe(+++)(%)
<20	20	14(70.0)	10(71.4)	3(21.4)	1(7.1)
21-30	130	85(65.4)	51(60.0)	32(37.6)	2(3.2)
31-40	135	82(60.7)	69(84.1)	12(14.6)	1(1.2)
41+	15	3(20.0)	0(0.0)	2(66.7)	1(33.3)
Total	300	184(61.3)	130(47.1)	49(27.9)	5(2.7)

($P>0.05$).

4.1.2 Prevalence and intensity of malaria in relation to trimester.

The prevalence of malaria in relation to trimester is as shown in Table 2. The highest prevalence 99(76.2%) was observed in women who were in their first trimester while the least prevalence 25(31.3%) was observed in women in their third trimester. There was no significant difference in prevalence of malaria in relation to trimester (P>0.05)

The highest prevalence of mild infection was found among those in the first trimester (84.8%) followed by those in their second trimester 16(64.0%), while the least was observed among those 30(50.0%)in the third trimester. For moderate infection, the highest prevalence was found among those in second trimester 28(46.7%), followed by those in their third trimester 9(36.0%) while those in their first trimester had the least prevalence 12(12.1%) of moderate infection. On severe infection, the highest prevalence was obtained from those in their second trimester (3.3%). No case of severe infection was found among those in their third trimester. The observed difference in the intensity of malaria in relation to trimester was significantly different (P<0.05).

Table 2: Prevalence and intensity of malaria in relation to the trimester of women studied

Trimester	Number examined	Number positive (%)	Intensity of Infection		
			Mild (+) (%)	Moderate (++)(%)	Severe (+++)(%)
1st	130	99(76.2)	84(84.8)	12(12.1)	3(3.0)
2nd	90	60(66.7)	30(50.0)	28(46.7)	2(3.3)
3rd	80	25(31.3)	16(64.0)	9(36.0)	0(0.0)
Total	300	184(61.3)	130(47.1)	49(27.9)	5(2.7)

(P<0.05, x^2=40.172, df =2).

The prevalence and intensity of malaria in relation to gravidity of women studied

Table 3 shows the prevalence and intensity of malaria in relation to gravidity. The highest prevalence of malaria 120(64.5%) was observed among the primigavidae while the least prevalence 64(56.1%) was found among the multigravidae. A total of 80(66.7%) had mild infection while 50(78.1%) had mild infection. For moderate infection, the highest prevalence 36(30.0%) was found among the primigravidae, while the least 13 (20.3%) was observed among the multigravidae. In the same vein, highest prevalence of severe infection 4(3.3%) was found among the primigravidae, while the least prevalence 1(1.6%) was obtained from the multigravidae. The observed difference in the intensity of malaria parasite in relation to parity was significantly different (P<0.05).

Table 3: Prevalence and intensity of malaria in relation to gravidity of women studied.

Parity	Number examined	Number positive (%)	Intensity of Infection		
			Mild (+)(%)	Moderate (++)(%)	Severe (+++)(%)
Primigravid	186	120(64.5)	80(66.7)	36(30.0)	4(3.3)
Multigravid	114	64(56.1)	50(78.1)	13(20.3)	1(1.6)
Total	300	184(61.3)	130(47.1)	49(27.9)	5(2.7)

(P<0.05, x^2=., df=3)

4.2 Prevalence of malaria in relation to risk factors of the studied subjects.

Table 4 showed the prevalence of malaria with respect to level of education, occupation and marital status of the pregnant women. The highest prevalence (95.0%) was found among pregnant women who had no formal education, while the least prevalence of (44.4%) was observed in pregnant women who had their education up to the tertiary level. Statistical analysis showed no significant difference in intensity in relation to level of education (P>0.05). The prevalence of mild infection was highest among those that had tertiary education (84.5%), However, the highest prevalence of moderate (63.2%) and severe malaria (15.8%) were observed among those that had non-formal education.

As also shown in Table 4, in relation to the pregnant women's occupation, the highest prevalence 88(86.3%) of malaria was found among women whose occupation is farming, while the civil servants had the least prevalence of 24(27.3%). The difference observed in the prevalence malaria in relation to the women's occupation was not statistically significant (P>0.05).

On the intensity of malaria, the highest prevalence of mild infection (72.7%) was obtained among pregnant women who are farmers. Surprisingly, the highest prevalence of moderate infection was observed among the civil servants. However, no case of severe malaria 0(0.0%) was found among the civil servants, while the highest infection rate of severe infection (3.4%) was observed among the farmers. Statistical analysis showed that there was a significant difference

From the prevalence and intensity of malaria infection by marital status**,** married pregnant women had the highest prevalence (65.1%) while pregnant women who are single had the least (51.0%). The widows had a prevalence of (54.1%). There was a significant difference in the prevalence and intensity of malaria infection in relation to caregivers marital status (P<0.05) (P<0.000).

Those who are single parents had the highest prevalence of mild (65.4%) and severe malaria (7.7%), while those who are married had the highest prevalence (46.4%) of moderate information.

Table 4: Prevalence and intensity of malaria among pregnant women studied in relation to other associated risk factors.

Status of	**Total**	**Total**	**Mild (+)**	**Moderate**	**Heavy**

pregnant woman	examined	infection		(++)	(+++)
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Educational level					
Primary	70 (23.3)	65(92.9)	53(81.5)	11(16.9)	1(1.5)
Secondary	102(34.0)	52(51.0)	32(61.5)	19(36.5)	1(1.9)
Tertiary	108(36.0)	48(44.4)	41(85.4)	7(14.6)	0(0.0)
Non formal	20(6.7)	19(95.0)	4(21.1)	12(63.2)	3(15.8)
Total	**300(100)**	**184(61.3)**	**130(47.1)**	**49(27.9)**	**5(2.7)**
Occupation					
Farmers	102 (34.0)	88(86.3)	64(72.7)	21(23.9)	3(3.4)
Traders	77(25.7)	57(74.0)	41(71.9)	15(26.3)	1(1.8)
Civil servants	88 (29.3)	24(27.3)	15(62.5)	9(37.5)	0(0.0)
Artisans	43 (14.3)	15(34.9)	10(66.7)	4(26.7)	1(6.7)
Total	**300(100.0)**	**184(61.3)**	**130(47.1)**	**49(27.9)**	**5(2.7)**
Marital status					
Married	212 (70.7)	138(65.1)	72(52.2)	64(46.4)	2(1.4)
Widowed	37(12.3)	20(54.1)	11(55.0)	8(40.0)	1(5.0)
Single-parent	51(17.0)	26(51.0)	17(65.4)	7(26.9)	2(7.7)
Total	**300(100)**	**184(61.3)**	**130(47.1)**	**49(27.9)**	**5(2.7)**

(P<0.000)

Knowledge of pregnant women on IPTp

The result on the knowledge and use of intermittent preventive treatment of malaria of malaria in pregnancy (IPTp) showed that 60.0% of pregnant women have heard of IPTp, 61.3% knew the meaning of IPTp and 69.3% knew that IPTp is used to control malaria in pregnancy. Again 65.3 % responded that 3 tablets make up IPTp, while % of pregnant women acknowledged that they have received IPTp. The result also showed that 90.7% agreed that IPTp is helpful during pregnancy as shown in Table 5.

Table 5: Knowledge of respondents on IPTp.

Variable	Frequency	% frequency
Heard of IPTp		
Yes	180	60.0
No	120	40.0
Meaning of IPTp		
Intervention Preventive Therapy in pregnancy	62	20.7
Intervention proper therapy in pregnancy	54	18.0
Intermittent Prevention treatment in pregnancy	184	61.3
Importance of IPTp		
Controls malaria	208	69.3
Controls measles	12	4.0
Controls polio	52	17.3
Controls covid-19	28	9.3

How many tablets make up IPTp?		
One	**16**	**5.3**
Two	**84**	**28.0**
Three	**196**	**65.3**
Four	**4**	**1.3**
Would you accept IPTp?		
Yes	**270**	**90.0**
No	**30**	**10.0**
Is IPTp helpful?		
Yes	**272**	**90.7**
No	**28**	**9.3**

Pregnant women in age group 31-40 years old had the highest percentage knowledge (90.3%), followed by those in the age group 21-30 (84.6%) (Table 6). The least was observed among those less than twenty years old where percentage knowledge of 60.0% was obtained. The highest percentage compliance (58.5%) was obtained from pregnant women in the age group 31-40 years old, while the least percentage compliance (30.0%) was found among those less than twenty years old.

On the level of knowledge and compliance of IPTp, it was observed that pregnant women in their second trimester had the highest knowledge of IPTp (93.3%) followed by third trimester (89.2%). The least was those in first trimester (87.5%). Pregnant women in their second trimester also had the highest level of compliance (53.3%) followed by those in their first trimester (52.3%).Again, primigravidae had the highest knowledge of IPTp (90.3%) as shown in Table6. On the level of compliance, multigravidae had the highest percentage (40.4%).

Table 6: Knowledge and compliance of the pregnant women in relation to IPTp in Awka.

Age (years)	**Number sampled**	**Knowledge (%)**	**Compliance (%)**
<20	20	12(60.0)	6(30.0)
21-30	130	110(84.6)	76(58.5)
31-40	135	122(90.3)	72(53.3)
41+	15	10(66.7)	4(26.7)
Total	300	254(84.7)	158(52.7)
Trimester			
First	130	116(89.2)	68(52.3)
Second	90	84(93.3)	48(53.3)
Third	80	70(87.5)	32(45.7)
Total	300	270(90.0)	148(49.3)

Gravidity			
Primigravidae	186	168(90.3)	62(33.3)
Multigravidae	114	102(89.5)	46(40.4)
Total	**300**	**270(90.0)**	**108(36.0)**

On the use LLINs, the highest percentage of usage (54.1%) was observed among those in the age group 31-40 years old. followed by those in age group 21-30 years old (51.5%) (Table 7). The least percentage of usage (40.0%) was found among those less than twenty years old.

In relation to trimester, the highest percentage (50.0%) of LLIN usage was found among those in their first trimester, followed by those in their third trimester (47.5%). Those in their second trimester had the least percentage of LLIN usage (46.7%).

On the use of LLINs, the multigravidae had the highest percentage usage (56.1%) of LLIN, than primigravidae as shown in Table 7.

Table 7: Use of LLINs among pregnant women in Awka.

Variable	**Number sampled**	**Usage**	**% usage**
Age (years)			
<20	20	8	40.0
21-30	130	67	51.5

31-40	135	73	54.1
41+	15	7	46.7
Total	300	155	51.7
Trimester			
First	130	65	50.0
Second	90	42	46.7
Third	80	48	460.0
Total	300	155	51.7
Gravidity			
Primigravidae	186	88	47.3
Multigravidae	114	67	58.8
Total	**300**	**155**	**51.7**

DISCUSSION AND CONCLUSION

The result of this study shows an overall malaria prevalence of 61.3% among pregnant women attending antenatal clinic in Awka Metropolis, Anambra State. The high prevalence of malaria among women in the study area may be attributed to the high level of exposure to the risk factors such as exposure to mosquito bites, sleeping without mosquito nets, keeping open water collection cans close to living rooms etc. The result of this study is lower than 79.92% and 73.9% prevalence recorded by Houmsou *et al.* (2007) in Gboko, North-Central Nigeria and Bassey *et al.* (2007) in rural community in Nigeria respectively, but higher than 55.8% recorded by Raimi and Kanu (2010) in Ojo Local Government Area of Lagos State, Nigeria. The difference is possibly due to differences in environmental conditions. However, some researchers in Nigeria have reported low figures. For example, 42.4% malaria prevalence was recorded in Otukpo, Benue State, by Jombo *et al.* (2010), 7.75% prevalence in Ogun State by Chimere *et al.* (2008) and 32.2% malaria prevalence in Ogoja, Cross River State by Etim *et al.* (2007). The low prevalence in these places could be due to a combination of factors like good environmental hygiene, literacy and/or urban control efforts.

The highest prevalence of malaria in this study in relation to age was seen among pregnant women less than twenty years old (70.0%). This result is consistent with earlier reports in Gabon by Bouyou-Akotet *et al.* (2003) where pregnant women less than 24 years were at high risk of malaria. The high prevalence of the infection seen in younger pregnant women could be due to poor information and awareness on malaria preventive measures during pregnancy as most of these young aged pregnant women may not have enough access to such information. The result showed that the prevalence of malaria decreased with increasing age, with the 41 years and above having a low prevalence of 20.0%. This study disagrees with the study in Gabon by Marielle *et al.* (2003) and Iwueze *et al.* (2014) in Onitsha who reported a high prevalence of malaria in pregnant women within a similar age group (46-49years). There is an observed significant difference ($P<0.05$) with respect to malaria prevalence in the various age groups. This could be due to the fact that these young pregnant women are still in the process of acquiring natural immunity to malaria as proposed by Chimere *et al.* (2008) which the older women with subsequent pregnancies have acquired.

The pregnant women who were in their first trimester showed a higher prevalence (76.2%) of malaria than those who are in their second (66.7%) and third trimester (31.3%). These variations maybe due to the fact that pregnant women attending antenatal care started receiving intermittent preventive treatment (IPT) at their second and third trimester which reduces the presence of the parasite. These findings correspond with studies in other malarious areas of sub-Saharan Africa (Nair and Nair, 1993), studies conducted in Bandiagara, Mali, where the level of malaria parasitaemia among pregnant women was significantly higher among individuals in their first trimester (Dicko *et al.*, 2003), but contrasted in a study in Eastern Sudan where the risk of malaria infection was significantly associated with the third trimester (Adam *et al.*, 2003). There is no statistical difference ($P>0.05$) between malaria prevalence in pregnant women and trimester from this study but the high prevalence in the first trimester might be due to an immuno-compromised state.

Malaria in relation to parity showed that the infection rate decreases as parity increases and the primigravida had the highest rate of malaria (64.5%) while multigravidae had a prevalence of 56.1%. The high prevalence of malaria among the primigravidae compared with multigravidae in the study area may be attributed to the fact that women at their first pregnancy (primigravid) are highly stressed resulting in decreased immunity compared to those with higher gravids who have experienced physiological changes caused by the pregnancy (Houmsou *et al.*,2009; Cottrell *et al.*, 2005). This result is similar to the findings reported by Chimere *et al.* (2008) and Houmsou *et al.* (2009) in which primigravida had the highest prevalence of 91.1% and 71.1% respectively. The statistical difference (P<0.05) observed from this study in relation to malaria and parity shows the effect of a compromised immune system as a result of stress of first pregnancy.

Pregnant women with non-formal education had the highest prevalence of 95.0%. This might be due to a poor knowledge of the cause, breeding sources, and mode of transmission, symptoms, consequences and prevention of malaria. Tyagi *et al.* (2005) rightly asserted that knowledge is one of the important elements in any effort targeted towards the reduction of disease burden such as malaria. The least prevalence of malaria among degree holders explains the fact that they are better equipped with both the knowledge of causes and methods of prophylaxis against malaria. According to Antwi, (2010), high level of formal education is known to increase the level of general knowledge and hence, may positively influence healthy behavior. However, there is no significant difference (P>0.05) in prevalence of malaria in relation to education suggesting that mosquito bites is not influenced by level of education neither is there any educational background susceptible to mosquito bites. This study agrees with most studies on malaria carried out in other parts of Africa by Mazigo *et al.* (2010) in northwest Tanzania, Akinleye and Ajayi, (2011) in southwest Nigeria and Akaba *et al.* (2013) in the federal capital territory Abuja respectively on the prevalence of malaria in relation to educational status.

Pregnant women who were farmers had a higher prevalence (86.3%) of malaria than pregnant women engaged in other occupation such as traders (74.0%) and civil servants (27.3%).The reason might be due to the fact that farmers are more exposed to mosquito bites because they spend most of their days in their open farmlands which might have some breeding sites of mosquitoes, thereby making them more vulnerable to bites by mosquitoes. This did not correlate with the work of Aiyelabegan, (2002) on the prevalence of malaria parasite in Sokoto Metropolis where students had the highest rate of malaria infections. There is no observed significant difference (P>0.05) in relation to occupation from this study, showing that exposure to mosquitoes and subsequently malaria is not limited to the occupation of the pregnant women.

From this study, it was observed that pregnant women that were 41 years old and above had the highest prevalence of moderate infection (66.7%) and heavy infection (33.3%) while pregnant women within the age group 31-40 years old had the least intensity of moderate infection (14.6%). Lander *et al.* (2002) also reported no significant association between intensity of malaria infection and maternal age. However, from this study there was no statistical difference in the intensity of malaria among the pregnant women in relation to age (P>0.05).

The intensity of malaria in relation to trimester showed that pregnant women in their second trimester had the highest intensity (3.3%) of severe malaria than pregnant women in their first (3.0%) and third trimester (0.0%). This may be due to the fact that pregnant women in their second and third trimesters have become limited to the day to day activities in the course of pregnancy. This is in agreement with reports from Dicko *et al.* (2003) who reported the first trimester as the main risk period during malaria episodes although several studies reported the second and early third trimesters as the time of peak intensity (Menendez, 1995; Rogerson *et al.*, 2000; Dicko *et al.*, 2003). There is however no significant difference (P>0.05) between malaria intensity and trimester as susceptibility to malaria is not influenced by trimester. However the observed increase in intensity in the first trimester could be attributed to an immune-comprised state.

In relation to parity, primigravidae had the highest prevalence of heavy infection (3.3%) of malaria. The study showed a significant association (P<0.05) between malaria intensity and parity, which is also reported from other areas and locations with intense malaria transmission (Rogerson *et al.*, 2000; Dicko *et al.*, 2003; Lander *et al.*, 2002).

Malaria preventive measures in pregnancy still remains priority intervention required to protect the mother and the foetus against the adverse effects of malaria. The knowledge and utilization of IPTp and LLINs which are among the tools used in prevention of malaria were evaluated among the pregnant women in Awka. There has been intensified effort by government and nob-governmental organizations (NGOs) to provide IPT and LLINs to the high risk group; pregnant women and children below five years old. This study showed that % of the pregnant women have heard of IPT and % were aware of its importance. Interestingly, up to % agreed to have used it. In a similar study Aribodor *et al.* (2015) reported a high usage of LLIN (81.7%) in Onitsha, Anambra State. This showed that there has been massive campaign on the danger of malaria and various approaches to prevent it.

References

Akaba, G. O., Otubu, J.A.M., Agida, E.T. and Onafowokan, O. (2013). Knowledge and utilization of malaria preventive measures among pregnant women at a tertiary hospital in Nigeria's federal capital territory. *Nigerian Journal of Clinical Practice.* **16(2)**:201-206.

Akinboro, R.A., Ojurongbe, O., Akindele, A.A., Adefioye, O.A., Bolaji, O.S., Olaniran, O. and Adeyeba, O.A. (2010). *Plasmodium falciparum* parasitaemia in pregnancy in relation to maternal anaemia. *African Journal of Clinical and Experimental Microbiology.* **11(3)**:164-169.

Antwi, G.D. (2010). Factors that influence the uptake of intermittent preventive treatment of malaria in pregnancy in the Bosomtwe district of Ghana. Accra: French Embassy Small Grants programme in the Humanities and Social Sciences. *African Journal of Clinical and Experimental Microbiology.* **21(2)**:160-166

Aribodor, D. N., Nwaorgu, O. C., Eneanya, C. I., Okoli, I. Pukkila Worley, R. and Etaga, O. H. (2015). Association of low birth weight and placental malaria infection in Nigeria. *The Journal of Infection in Developing Countries.* **3(8)**: 620-623.

Bouyou-Akotet, M.K., Ionete-Collard, D.E., Mabika-Manfoumbi, M., Kendjo, E., Matsiegui, P.B., Mavoungou, E.and Kombila, M. (2003). Prevalence of *Plasmodium falciparum* in pregnant women in Gabon. *Malaria Journal.* **2**:18-28.

Cheesbrough, M. (2005). Test for Malaria Parasites. *Laboratory Practices in Tropical Countries,* Second Edition, Part 1. Cambridge University Press UK. **191**:115-129.

Chimere, O.A., Wellington, A.O.and Agomo, P.U. (2008) Prevalence of malaria in pregnancy in Ogun State, Nigeria. *Korean Journal of Parasitology*. **47(4)**: 129-164.

Cottrell G, Mary JY, Barro D, and Cot, M. (2005). Is malarial placental infection related to peripheral infection at any time of pregnancy? *American Journal of Tropical Medicine and Hygiene*. **73**:1112–1118.

DeBeaudrap, P., Turyakira, E. White, L.J., Nabasumba, C. and Tumwebaze, B 2013. Impact of malaria during pregnancy on pregnancy outcomes in a Ugandan prospective cohort with intensive malaria screening and prompt treatment. *Malaria Journal.*, 12: 139- 139. DOI: 10.1186/1475-2875-12-13

Desai, M., ter Kuile, F.O. and Nosten, F. (2007). Epidemiology and burden of malaria in pregnancy. *Lancet Journal of Infectious Diseases*. **7(2)**:93-104.

Dicko, A., Mantel, C. and Aly Thera, M. (2003). Risk factors for malaria infection and anemia for pregnant women in the Sahel area of Bandiagara, Mali. *Acta Tropical Journal*. **89**:17–23.

Etim, P.A., Adie, A.A., Asor, J.E. and Odey, F. (2007). Malaria burden among pregnant women living in Ogoja , Cross River State, Nigeria. *American Journal of Tropical Medicine and Hygiene.* **77(6)**:56-60.

Gamble, C.L., J.P. Ekwaru and F.O. Kuile, (2009). Insecticide-Treated Nets for Preventing Malaria in Pregnancy (Review). 1st Edn., John Wiley and Sons, Ltd Publication, pp: 38.

Houmsou, R. S., Amuta, E. U.and Sar, T. T.(2007). Malarial infection in pregnant women attending antenatal clinics in Gboko, Benue State, Nigeria. *International Journal of Academic Research.* **2**:33-36.

Houmsou, R.S., Amuta, E.U., Sar, T.T. and Adie, A.A. (2009). Malaria infection in pregnant women attending antenatal clinics in Gboko, Benue state, Nigeria. *The Open Parasitology Journal*. **3(6)**:243-256.

Iwueze, M.O., Okwusogu, M.I., Onyido, A.E., Okafor, F.C., Nwaorgu, O.C. and Ukibe, S.N. (2014). Prevalence, Intensity and Clinical Profile of malaria among pregnant women attending antenatal clinics in Onitsha-North L.G.A., Anambra State, Southern Nigeria. *The Bioscientist*. **2(1)**:17-29.

Lander, J., Leroy, V., Simonon, A., Karita, E., Bogaerats, J., Clercq, A.D., Van de Perre, P. and Dabis, F. (2002). HIV infection, malaria, and pregnancy: a prospective cohort study in Kigali, Rwanda. *American Journal of Tropical Medicine and Hygeine*. **66**:56–60.

Lengeler, C. (2004). Insecticide-treated bed nets and curtains for preventing malaria. *Cochrane Database of Systematic Reviews.* **2**:363-379.

Marielle, K.B.A., Denisa, E.I.C., Modeste, M.M., Eric, K., Pierre, B.M., Elie, M.and Maryvome, K. (2003). Prevalence of *Plasmodium falciparum* Infection in pregnant women in Gabon. *Malaria Journal.* **2**:1–17.

Menendez, C. (1995). Malaria during pregnancy: A priority area of malaria research and control. *Parasitology Today*.**11**:178–183.

Mintaka, S.and Opoku-Okrah, C. (2013). “The prevalence of malaria parasitaemia and predisposition of ABO blood groups to Plasmodium falciparum malaria among blood donors at a Ghanaian Hospital, *AU Journal of Technology*, 16 (4):255–260.

Nahlen, B.L., Alakija,T., Ogunbode, O., Adetoro, O. and Akintunde, A. (2012). Lack of pyrimethamine prophylaxis in pregnant Nigerian women. *Lancet.* 8667: 830-834. DOI: 10.1016/S0140-6736(89)92998-X

Nair, L.S. and Nair, A.S. (1993). Effects of malaria infection on pregnancy. *India Journal of Malaria.* **30**:207- 214.

Ogbodo, S.O., Nwagha, U.I., Okaka, A.N.C.S.C., Ogenyi, R.O., Okoko, and Nwagha, T.U. (2009). Malaria parasitaemia among pregnant women in a rural community of eastern Nigeria: need for combined measures. *Nigerian Journal of Physiological Sciences.* **24(2)**:95-100.

Ruchi, K., Pradeep, B.and Varun, K. (2013). A study of erythron status in pregnant and non-pregnant age matched females of Jodhpur. *IOSR J. Pharmacy,* 3: 35-39.

Sirima, S.B., R. Sawadogo, A.C. Moran, A. Konate and A. Diarra ., (2003). Failure of a chloroquine chemoprophylaxis program to adequately prevent malaria during pregnancy in Koupela District, Burkina Faso. *Clin. Infect. Dis.*, 36: 1374-1382. DOI: 10.1086/375077

Steketee, R.W., Wirima, J.J., Bloland, P.B., Chelima, B., Mermin, J.H., Chitsulo, L. and Breman, J.G. (2001). Impairment of a pregnant woman's acquired ability to limit *plasmodium falciparum* by infection with HIV-1. *American Journal of Tropical Medicine and Hygiene*. **55(3)**:42-49.

Tyagi, P., Roy, A., and Malhotra, M.S. (2005). Knowledge, awareness and practices towards malaria in communities of Rural, semi-rural and bordering areas of east Delhi, India. *Journal of Vector Borne Disease*. **42**:30-35.

Ukpai, O. M. and Ajoku, E. I. (2001). The prevalence of malaria in Okigwe and Owerri Areas of Imo State. *Nigerian Journal of Parasitology.* **22**:43-48.

Umeaneto, P. U., Ekejindu, I. M. and Ifeanyichukwu, M. O. (2006). Prevalence and intensity of malaria in blood donors at Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, Anambra State, *Nigeria Journal of Parasitology.* **27**:11-15.

WHO (2004). A strategic framework for malaria prevention and control during pregnancy in the African region, World Health Organization, Geneva. **10**:18-27.

WHO (2015). Malaria fact sheet N°94.

WHO (2016). Authors. Guidelines for the Treatment of Malaria. Geneva: World Health Organization.

WHO (2017). *World Malaria Report*. Geneva. World Health Organization.