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REVIEW ARTICLE

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Prevalence and Intensity of Malaria among Pregnant Women in North Eastern Part of Ebonyi State, Nigeria

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ABSTRACT

The study was undertaken to determinene the prevalence and intensity of malaria among pregnant women in Ebonyi State, Nigeria. Cross-sectional study on malaria infection among pregnant women in Ebonyi State, Nigeria was carried out from April 2011 to March 2012 from two purposively selected hospitals. Venous blood samples were collected for thick and thin films blood smears for microscopy. Geimsa stained thin blood films were used to identify malaria parasites. The intensity was graded 1 to 10 parasites per 100 thick film fields (+) as mild, 11 to 100 parasites per thick film fields (++) as moderate and above 100 parasites per 100 thick film fields (+++) as severe. Chi-square ($\chi 2$) was used to analyse the data generated at $P<0.05$ significance level. Result showed that out of 360 pregnant women sampled, 150 (41.7%) was infected. The rate of infection in rainy season was significantly higher than dry season. No significant association was observed in the prevalence of malaria and months except in June and August. Trimester and age group showed no significant association while gravidity showed with primigravidae having the highest prevalence of 54 (53.5%). The degree of intensities varied considerably with light parasitaemia having the highest 128 (85.3%) among the infected pregnant women. There was a high prevalence of malaria infection with light parasitaemia being most predominant.

Keywords: Prevalence of malaria, intensity, pregnant women, Ebonyi State and Nigeria.

INTRODUCTION

Malaria may be broadly defined as intermittent febrile infection caused by protozoan parasite of the genus *Plasmodium* that is transmitted by female *Anopheles* mosquitoes (WHO, 2014). Malaria is probably the most important tropical disease in terms of morbidity and mortality. Malaria associated with pregnancy remains a major source of poor-mother child health in endemic area. Most cases of malaria in pregnancy in areas of stable transmission are asymptomatic (Nwonwu *et al.* 2009; Nwogha *et al.* 2009; Aliyu *et al.* 2011). This is attributed to anti-disease immunity acquired during previous exposures which protects against clinical malaria (Staalsoe *et al.* 2005, Ogbodo *et al.* 2009). Unfortunately, this sub-clinical infection still poses great danger to both the mother and the foetus. The principal impact of malaria infection is due to the presence of parasite in the placenta causing maternal anaemia and low birth weight (LBW) (Newman *et al.* 2003; Rogerson and Boeuf, 2007; Aribodor *et al*. 2009; Nwonwu *et al.* 2009; Mbanefo *et al.* 2009; Agomo *et al*. 2009; Akanbi *et al*. 2010).

In Nigeria, malaria contributes greatly to the increase in hospital attendance across the geo-political zone. Malaria infections during pregnancy have adverse effects on both mother and their foetus, which could include maternal anaemia, premature delivery and low birth weight (Feiko, 2005). Recent World Malaria Report indicated that Nigeria accounts for 39 % of all malaria cases in the 45 malaria-endemic countries in Africa, showing clearly the challenge of malaria in Nigeria (Ivoke *et al.* 2013; WHO, 2014; Afolabi *et al.* 2015). This may be due to the large population, approximately 140 million inhabitants (National Bureau of Statistics, 2006) living in area of stable malaria transmission. In Nigeria, 11% maternal deaths are attributed to malaria (Federal Ministry of Health, 2010; Okoye and Isara, 2011; WHO, 2014). Many researchers have reported high prevalence rates of malaria in pregnancy in different parts of Nigeria, ranging from 19.7% to 72.0 % (Kagu *et al*. 2007; Adefioye *et al*. 2007; Aribodor *et al*. 2007; Uneke, 2008; Agomo *et al.* 2009., Gajida et *al.* 2010 and Iwuezu *et al.*2014). Thus, pregnant women are known to be one of the groups at high risk of the effects of malaria, need special protective measures to ensure their survival and improve birth outcome. Therefore the study was carried out to estimate the prevalence and intensity of malaria among pregnant women attending antenatal clinic in Ebonyi State, Nigeria.

MATERIALS AND METHODS

Study Area

The study area, Ebonyi State is one of thirty-six states of Nigeria. It is in the South-Eastern part of the country. Ebonyi State is made up of thirteen local government areas which include Abakaliki, Ebonyi, Izzi, Ishielu, Ezza North, Ezza South, Ikwo, Ohaukwu, Onicha, Ohaozara, Ivo, Afikpo North and Afikpo South Local Government Areas. Ebonyi State has a projected population of about 2.3 million and a total land area of about 5935km^2 which gives a population density of over 300 persons per square kilometre (National Population Commission, 2007; National Bureau of Statistics, 2006). The State is located between latitudes $5^0 30^1$ North and $6^0 46^1$ North and longitudes $7^0 30^1$ East and $8^0 30^1$ East. Like most parts of Nigeria, it has two main seasons; rainy and dry seasons. The rainy season which is the main farming season commences around late April and could last up to October (Ministry of Environment, Abakaliki 2011).

Ebonyi State is located within the rainforest and Guinea savannah zones of Nigeria characterized by high rainfall intensity with high run-off volumes and high relative humidity. The annual rainfall is over 1600 mm while the daily rainfall is over 150 mm. The daily maximum and minimum temperatures are 32^0C and 25^0C respectively. The dry season commences around November and last up to early April. However, there could be occasional rains in January, February and March. The dry season is punctuated by a brief period of dry and chilly, wind and dust haze, known as the harmattan period. This usually occurs around late December through January although in recent times it seems to have extended up to February. The climate of Ebonyi State is temperate in nature.The temperature of Ebonyi ranges from 8 - 40^0 C. The humidity of Ebonyi State ranges from 22-80% (Ministry of Environment, Abakaliki 2011).

Study Design and Population: The study was a cross-sectional, hospital-based study to investigate malaria parasite among pregnant woman attending antenatal clinic in Ebonyi State. The hospitals that were selected include Mile Four Hospital and Federal Medical Centre Abakaliki. These were located in Abakaliki and Ebonyi Local Government Area. The study lasted for twelve months, from April 2011 to March 2012. The study employed such tools as informed conversation to raise awareness on the study, administration of questionnaire, parasitological examination of the parasite. Pregnant women attending antenatal clinics in their different trimesters were population selected for the research. Three hundred (360) pregnant women were selected from two hospitals.

Ethical Approvals: Ethical review and clearance was obtained from the Ministry of Health, Ebonyi State and University of Nigeria Nsukka Ethical Research Committee. Ethical consideration was also obtained from the two hospitals selected for the study from antenatal division and research department. The permission to use hospital facilities was also obtained from management. Informed consent was also obtained from the pregnant women before collection of the sample. The approval was on the agreement that patient anonymity must be maintained, good laboratory practice and that findings would be treated with utmost confidentiality and for the purpose of this research only. All work was performed according to the international guideline for human experimentation clinical research (WMA, 2005).

Sampling Method: The hospitals used were purposively selected for the study based on the availability of active antenatal clinic. Random sampling through balloting was employed for the selection of pregnant women for the study. Pieces of papers written either yes or no were picked by the pregnant women attending antenatal clinics. Those that picked yes were chosen for the study. One hundred and eighty (180) pregnant women were numbers chosen for each hospital.

Administration of Questionnaire: A structured pretested questionnaire was administered to the randomly selected pregnant women through participatory approach. By this the researchers discussed each question and their options with the pregnant women in a manner that facilitates effective recall of experiences. The questionnaire sought information on age, gravidity, trimesters and among others.

Collection of blood sample: Five ml venepuncture sample was taken from the arm of each pregnant woman using syringe. After cleaning the volar surface of the arm with cotton wool moistened with methylated spirit, peripheral blood samples were collected into sterile EDTA (ethylenediamine tetra acetic acid) containers. The blood sample was immediately transported to laboratory for analysis. The blood sample collected for malaria parasite and haematological profile determinations were done by trained Nurses and laboratory scientist in the hospitals.

Blood smear staining and microscopy procedure: Thin and thick blood films were prepared immediately upon blood collection on different slides. For thick films, 12µl of blood was spread in a diameter of 15 mm, while 2µl of blood was used for thin films as described by Cheebrough, (2005). The films were allowed to dry for at least 45 minutes (thin) and 12 hours (thick) (Ukaga, *et al*. 2002; Cheebrough, 2009). The thin films were fixed in absolute methanol for 2 seconds and air dried. The blood films were stained with 3% Giemsa stain solution. Each slide was examined under the x 100 objective oil immersion for the presence of characteristic stages of *Plasmodium*. Identification of species was done using the thin blood smear. The parasite density was estimated on the thick smear under oil immersion and viewed using x100 objective lens.

Malaria parasite intensity determination: The thick film was use for detection and counting of malaria parasite density. The degree of parasitaemia was graded thus: 1 to 10 parasites per 100 thick film fields (+) as mild, 11 to 100 parasites per thick film fields (++) as moderate and above 100 parasites per 100 thick film fields (+++) as severe. A negative result was recorded after thorough examination of 100 fields without any parasite (WHO, 2008).

Analysis: Results were analyzed using SPSS version 20.0. Preliminary information showing demographic profile of pregnant women was calculated as simple frequencies. Chi-square test was used to determine significant differences. Intensity of malaria parasite was categorized into light, moderate and severe. Significant difference in the prevalence of this categorized intensity in relation

to the above stated variable was also checked using chi-square test. Statistical significance was set at P<0.05.

RESULTS

Characteristics of Studied Population: Three hundred and sixty pregnant women were sampled during the study with average age of 26.54 ± 4.61. Two hundred and four (204) pregnant women representing 56.7%, 138(38.9) and 18(5.0%) were in their 3rd, 2nd, and 1st, trimesters, respectively. Primigravid, secundigravid and multigravid comprised 101(28.1%), 85(23.6%) and 174(48.3%) respectively. Fourty one (41) pregnant women representing 11.4%, 125(34.7%), 142(39.4%), 38(10.6%) and 14(3.9%) were in their 15 - 20, 21 – 25, 26 – 30, 31 – 35,and ≥ 36 age groups respectively. The seasonal prevalence of malaria among pregnant women indicated that the rainy season had higher malaria prevalence 86 (47.8%) than the dry season 64(35.6). Rainy season was significantly associated (χ^2 = 5.53, p = 0.03) with prevalence of malaria but was not associated (χ^2 = 5.54, P = 0.19) with dry season. In the monthly prevalence, disease cases occurred all through the study months with June 16(53.3%) and August 16(53.3%) with same the highest prevalence. This was followed by July 15(50.0%) and September 15(50.0%) with same prevalence while the least prevalence was observed by January and March with prevalent of 8(26.7%) and 9(30.0%) respectively. No significant association was observed in the prevalence of malaria and months except in June and August with (χ^2 = 3.14, P = 0.04) respectively.

Table 1. Seasonal and monthly prevalence of malaria in pregnant women in Ebonyi State, Nigeria.

Variables	Number Examined	Number infected	χ^2	P value
Seasons				
Rainy	180	86 (47.8)	5.53	0.03*
Dry	180	64 (35.6)	5.54	0.19
Total	360	150(41.7)		
Months– April	30	14 (46.7)	2.14	0.16
May	30	10 (33.3)	3.53	0.46
June	30	16 (53.3)	3.14	0.04*
July	30	15 (50.0)	2.75	0.07
August	30	16 (53.3)	3.14	0.04*
September	30	15 (50.0)	2.75	0.07
October	30	14 (46.7)	2.41	0.11
November	30	12 (40.0)	1.83	0.28
December	30	11 (36.7)	4.67	0.20
January	30	8 (26.7)	5.12	0.58
February	30	10 (33.3)	3.53	0.46
March	30	9 (30.0)	12.21	0.35

Figures in parentheses = %.

The prevalence of malaria in relation to trimester, gravidity and age of pregnant women from Ebonyi State, Nigeria indicated that the 1st trimester 9 (50.0 %) had the highest prevalence, followed by third trimester 87(42.6%) while the 2nd trimester 54 (39.1 %) had the least prevalence. No significant association was observed (χ^2 = 0.37, 0.21, 0.96). In gravidity, primigravidae had the highest prevalence of 54(53.5%), followed by multigravidae 69 (39.7 %) while the least prevalence was observed among secundigravidae 27 (31.8 %). There was high significant association between malaria and gravidity (χ^2 = 10.12, 8.65, 9.50, P = 0.004, 0.006, 0.009). In relation age, the age groups 15 - 20 had the highest prevalence 21 (51.2 %). This was followed by age groups 36 and

above 8 (42.9 %), while the least was observed among age groups 26-30, 54 (38.0 %). There was no significant association observed in the prevalence of malaria in relation to age.

Table 2. Prevalence of malaria in relation to trimester, gravidity and age group among pregnant woman in Ebonyi State, Nigeria.

Variables	Number examined N=360	Number infected (%)	χ^2	P value
Trimesters				
1st trimester	18	9 (50.0)	0.37	0.55
2nd trimester	138	54 (39.1)	0.21	0.52
3rd trimester	204	87 (42.6)	0.96	0.62
Gravidity				
Primigravidae	101	54 (53.5)	10.12	0.004*
Secungrividae	85	27(31.8)	8.65	0.006*
Multigravidae	174	69 (39.7)	9.50	0.009*
Age groups (yr)				
15-20	41	21 (51.2)	3.50	0.49
21-25	125	53 (42.4)	1.86	0.69
26-30	142	54(38.0)	2.01	0.43
31-35	38	16 (42.1)	2.16	0.51
36 and above	14	8 (42.9)	2.35	0.67

Figures in parentheses = %.

Table 3. Intensity of malaria in relation to seasons, trimesters, gravidity and age groups among pregnant women in Ebonyi State, Nigeria.

Variables	Category	Number examined	Number positive	Light (+)	Moderate (+)	Severe (+++)	P value
Seasons	Rainy	180	86	74 (86.0)	8 (9.3)	4 (4.7)	0.33
	Dry	180	64	54 (84.4)	9(14.1)	1(1.6)	0.78
Trimesters	1st trimester	18	9	9 (100)	0 (0)	0 (0)	0.51
	2nd trimester	138	54	46 (85.2)	5(9.3)	3(5.6)	0.99
	Third trimester	204	87	73 (83.9)	12(13.8)	2(2.3)	0.84
Gravidity	Primigravidae	101	54	46(85.2)	7(13.0)	1(1.9)	0.60
	Secundgrividae	85	27	24(88.9)	3(11.1)	0(0)	0.86
	Multigravidae	174	69	58 (84.1)	7(10.1)	4(5.8)	0.55
Age groups	15-20	41	21	17(81.0)	4(19.0)	0(0)	0.73
	21-25	125	53	44(83.0)	7(13.2)	2(3.8)	0.99
	26-30	142	54	47(87.0)	4(7.4)	3(5.6)	0.99
	31-35	38	16	14(87.5)	2(12.5)	0(0)	0.99
	Total	360	150	128 (85.3)	17(11.3)	5(3.3)	0.02*

Figures in parentheses = %.

The degree of intensities varied considerably with light parasitaemia having the highest 128 (85.3 %) among the infected pregnant women, followed by the moderate 17 (11.3 %) and severe 5 (3.3 %) intensity respectively. There was significant association between light, moderate and severe intensity. In relation to seasons, highest light intensity was observed in all seasons while in moderate intensity was higher in dry season and severe intensity in rainy season. There was no significant

difference in the seasonal intensities. In trimester, light intensity had the highest in all trimesters. In moderate intensity it was high in 3rd trimester, while in severe intensity it was high in 2nd trimester. There was no moderate and severe intensity recorded in 1st trimester. No significant difference was recorded in the trimesters intensities. In gravidity, light high intensities were observed in all gravidities. Moderate and severe were high in secundigravidae. There was no significant difference in intensities among gravidity. In age, light high intensities were observed in all age groups. In moderate and severe intensities, it was 15-20 and 26-30 age groups. No significant difference was recorded in the age intensities (Table 3).

DISCUSSION AND CONCLUSION

The prevalence of *Plasmodium falciparum* (41.7 %) recorded in this study was an indication that malaria in pregnancy is still a serious problem in Ebonyi State. Pregnancy has been identified to increase the risk and vulnerability to malaria. The prevalence of malaria among pregnant women recorded in this study was high, but comparable to 42% reported in Ghana (Mockenhaupt *et al*. 2000); 41% reported in Uyo Nigeria (Opara *et al*. 2004); 58 % reported in Abakaliki (Nwagha *et al*. 2009); 39.07% reported in Awka (Mbanefo *et al.* 2009) 39 % reported in Kano, Nigeria (Gajida *et al*. 2010) and 58% in Awka Nigeria (Iwueze *et al.* 2014); 42.o % in Abakaliki (Odikamnoro *et al.* 2014) and 44.0% Abakaliki (Alo *et a.l* 2014). However it is higher than 29% reported in Abakaliki, Nigeria (Nwonwu *et al*. 2009); 29% reported in Kano, Nigeria (Aliyu *et al.* 2011); 23% reported in Mozambique (Saute *et al*. 2002) and 26.75% reported in Malawi (Rogerson *et al*. 2003). This rate was however much lower than 72 % reported in Oshigbo Nigeria (Adefioye *et al*. 2007); 72 % in reported Ebonyi, Nigeria (Ngele, 2008); 59.9 % reported in rural community in Ebonyi, Nigeria (Ogbodo *et al*. 2009) and 80.9 % reported in Imo State, Nigeria (Ohalete *et al.* 2011); 65.6 % in Ebonyi State, Nigeria (Ivoke *et al.* 2013). This report may suggest that those efforts to control malaria by government and other agencies like Roll Back Malaria Programme, WHO, UNICEF and many other non governmental agencies may not have been effectively implemented in Ebonyi State, Nigeria.

Moreso, the high rate of prevalence observed could be due to the environmental condition inherent in Ebonyi State which favours *P. falciparum* transmission. It has been recognized that a temperature range of 16^0C - 38^0C and relative humidity of 60% were suitable for malaria parasite transmission (WHO, 2008). The attitude of the woman not starting pre-natal care early in pregnancy may also have contributed to the high prevalence. Some of the woman began pre-natal care either at the end of 1st Trimester or mid second trimester.

Malaria transmission occurs year round in Ebonyi State, with significant seasonal prevalence, with higher rate during the rainy season than the dry season. This agreed with Rogerson *et al*. (2003) in Malawi but contrasted with Ainong *et al*. (2002) where dry season recorded higher prevalence than rainy season. In this study, the highest malaria prevalence was observed in pregnant women in their first trimester. This is in line with studies done by Ainong *et al*. 2002); Anosike *et al*. (2004); Sheick *et al*. (2007); Ogbodo *et al*. (2009); Akinboro *et al.* 2010; Iwueze *et al.* (2014) and Odikamnoro *et al.* (2014) but contrast the studies of Aliyu *et al.* (2011); Ohalete *et al.* (2011); Ivoke *et al.* (2013) where highest rate of prevalence was recorded in the second trimester. However, no significant difference was observed between malaria and trimester in this study. This implied that pregnant women were at equal risk of malaria infection.

With regards to number of pregnancies (gravidae), pregnant women at primigravidae were more infected than women of other gravidities; secundigravidae and multigravidae. Primigravidae have been reported to be at the greatest risk of malaria because they lack the specific immunity to placental malaria parasite which they acquire from exposure to malaria parasite during pregnancy (Staalsoe, *et al*. 2005; Elliot *et al*. 2005; Ivoke *et al.* (2013); Iwueze *et al.* (2014). The relatively low infection observed among women at secundigravidae and multigravidae suggested the significance in the level of specific immunity of placenta to malaria of these gravidities during pregnancy. These however agreed with Chimere *et al*. (2009) who conducted a similar study among pregnant women in Lagos, South-west Nigeria, but disagreed with Saute *et al*. (2002) in Mozambique that observed no

significance in prevalence due to gravidity. Rick *et al*. (2000) and Okoko *et al*. (2003) had suggested that the early onset of efficient antibody response in multigravidae and the delayed production of antibodies in primigravidae appeared to account for the gravidity dependent and differential of *Plasmodium* malaria in pregnant women.

In this study, the highest malaria prevalence was observed in pregnant women of the age group 15 - 20 years this was, however consistent with the report of Ohalete *et al.* (2011); Iwueze *et al.* (2014); Odikamnoro *et al.* (2014) and Alo *et al.* (2014). In this study age was not statistically significant. This implied that any age groups could be prone to the infection. This result agreed with the work of Lander *et al*. (2002) who reported no significant association between malaria infection and maternal age. Similar reports include Arpita (2011) and Ogbodo *et al* (2009). This result contrasted with the work done by Mendez *et al*. (2000) in Malawi. The high rate of infection observed in these age groups could be due to the lack of awareness and malaria prevention during pregnancy. The prevalence of malaria parasitaemia among pregnant women in study was high. There is need for control measure to avert the deadly menace among pregnant mothers and their foetus.

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