Research Article ISSN 2833-034X

Women's Health Care and Issues

Comparative Study of Placental Malaria in HIV-positive and HIV- Negative Pregnant Women in Enugu, South-Eastern Nigeria

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Received: 09 Apr 2024; **Accepted:** 13 May 2024; **Published:** 20 May 2024

Citation: Nweze SO, Ezenwaeze MN, Ortuanya KE. Comparative Study of Placental Malaria in HIV-positive and HIV- Negative Pregnant Women in Enugu, South-Eastern Nigeria. Womens Health Care Issues. 2024; 3(1): 1-8.

ABSTRACT

Background: *Malaria and HIV/AIDS are two of the most devastating global health problems of our time. Available evidences have shown that HIV/AIDS increases the risk of clinical malaria, which in turn leads to low birth weight, anaemia and other morbidities in pregnancy.*

Aim of the Study: *The aim of this study was to determine if HIV infection increases placental malaria in HIV positive pregnant women compared with HIV negative pregnant women attending antenatal clinics in Poly General Hospital, South-eastern Nigeria.*

Material and Method: *A cross-sectional descriptive study, carried out on 200 HIV positive and 200 HIV negative pregnant women attending antenatal clinics in Poly General Hospital, Enugu State. Poly General Hospital was selected using simple random sampling technique. Placenta blood samples were collected and thick blood films were examined for malaria parasite using Giemsa expert microscopy. A structured self-administered questionnaire was used for data collection. All data was collected from women who were recruited during antenatal period, entered into record form designed for this study and analysed using SPSS version 23.*

Results: *About 164 HIV positive women had cases of malaria unlike in HIV negative women where only 151 women had cases of malaria. This brings the prevalence of malaria in HIV positive and negative pregnant women to be 82% and 75.5% respectively ($P < 0.001$). The HIV positive and HIV negative participants were between 16-45 years of age with majority in the age range of 31-35 years. Mean gestational age of HIV positive and HIV negative participants were 24.3±1.1 and 24.4±1.3 weeks respectively. Amongst the HIV positives, mild malaria cases were recorded in 73(36.5%) women, moderate cases in 91(45.5%) women and high cases of malaria in 3(1.5%) cases. As against 49(24.5%), 68(34%) and 82(41%) in HIV negative women with mild, moderate and high cases of malaria. The above findings show that the prevalence of mild, moderate and severe cases of malaria were higher in HIV positive than the negative pregnant women($(P<0.001)$)*

Conclusion: *Malaria prevalence and cases of mild, moderate and high malaria parasitemia were higher amongst the HIV positive pregnant women when compared with their negative counterparts. Sequel to that, malaria preventive strategies, including drugs should be reviewed and up scaled in pregnancy to avert the rising complication of malaria in pregnancy*

Keywords

Malaria in pregnancy, HIV positive, HIV negative, Prevalence.

Introduction

Malaria in HIV pregnant clients is a major public health challenge in tropical and subtropical regions of the world [1]. About 70% of the world's HIV-infected population lives in sub-Saharan Africa, where 350 million people are at risk of malaria infection [2]. Malaria and Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) are two most devastating global health problems of our time. Both disproportionately affect poor people in developing countries and have been called "Diseases of Poverty".

It causes significant morbidity and mortality in affected women.

malaria and HIV cause more than 4 million deaths yearly [3,4]. Sub-Saharan Africa is also the region most affected by the HIV pandemic and the disease is still responsible for a significant morbidity and mortality especially in under 5 children [5-7].

Coinfection with malaria and HIV is thought to have a synergistic effect, with studies reporting that repeated infection with malaria leads to a more rapid decline in CD4+ T cells overtime, meanwhile malaria coinfection with HIV results in more episodes of symptomatic malaria [8], and more episodes of severe or complicated malaria including death in both children and adults [9].

Malaria is a blood-borne disease caused by *Plasmodium* species, with *Plasmodium falciparum* (*P. falciparum*) being the deadliest species [10]. Pregnant women, especially Primigravidas are at high risk of severe malaria due to *Plasmodium falciparum* erythrocyte membrane protein-1 (PfEMP1), a major variant surface antigen displayed on the surface of. *falciparum*-infected erythrocytes (IEs) that serves as an adhesion [11]. As a result, infected erythrocytes (IEs) accumulate within the placenta, triggering an inflammation in the placental intervillous spaces; the infected and inflamed placenta is commonly regarded as placental malaria (PM).

There are five species of Plasmodium which cause disease in humans namely; Plasmodium ovale, *Plasmodium* vivax, *Plasmodium* malariae, *Plasmodium* knowlesi and *Plasmodium* falciparum, with the latter being the most virulent accounting for the majority of cases and deaths attributed to malaria. As in most parts of Sub-Saharan Africa, *Plasmodium* falciparum is the predominant Plasmodium specie in Cameroon, accounting for almost 100 % of all malaria-related cases [12].

Risk factors of malaria during pregnancy will include not owning and inappropriate use of Long lasting insecticide treated nets and drug shortages at health institutions [13,14]. Malaria in pregnancy causes several effects on the mother and fetus, including parasite sequestration in the placental vascular space [15]. Abortion and stillbirth [16], preterm birth, low birth-weight, mother-to-child transmission (MTCT) of parasites and maternal anaemia [17]. Anaemia due to malaria causes up to 10,000 maternal deaths each year [18]. In areas of stable malaria transmission in sub-Saharan Africa, it is recommended that all pregnant women should receive intermittent preventive treatment with sulfadoxine-pyrimethamine (SP) at each scheduled antenatal-care visit (at least one month apart), until delivery [19,20]. Several studies have shown that HIV during pregnancy amplifies the effects of malaria [21], which is why administering Cotrimozaxole alongside antiretroviral therapy (ART) to pregnant women is essential during every antenatal-care visit [21]. Therefore, this study was designed to showcase the overlapping effect of malaria and HIV infections among pregnant women to enable the formulation of program (s) for optimal control and improving the clinical management of women during antenatal-care visits.

Justification of the Study

Since the diagnosis of HIV in the United States of America in 1981 there has been special concern on the management and the pregnancy outcome of HIV-positive pregnant women. In the sub-Saharan Africa, HIV and malaria are among the leading causes of morbidity during pregnancy. Nigeria with a population of 140 million people has birth rate per annum of 42/1000, birth per annum of 5,900,000, and 65,000 to 117,500 HIV-infected infants per year of which 260,000 infants are infected through MTCT [22]. Today, approximately 50% of the world's population, about 3.3 billion people, are at varying degree of risk of malaria [23]. Each year, roughly 300 million people become acutely ill with malaria of which about one million people die from malaria annually [23].

Aim of the Study

To determine whether HIV increases placental malaria parasitaemia in HIV-positive pregnant women compared with HIV-negative pregnant women.

Specific Objectives

1. To determine the prevalence of placental malaria parasite among HIV-positive pregnant women.
2. To determine the prevalence of placental malaria parasite among HIV-negative pregnant women.
3. To compare the prevalence of placental malarial parasitaemia among HIV-positive and HIV-negative mothers.
4. To make deductions and recommendation based on the results.

Hypothesis: - There is no difference between prevalence of placental malaria parasitaemia among HIV-positive women and HIV-negative women.

Alternative Hypothesis – HIV-positive women have more placental malaria parasitaemia than HIV-negative women.

Outcome Measures

The main outcome measure was the prevalence of malaria parasite in HIV-positive and HIV-negative women.

Methodology

Study Centre

This study was carried out in Prevention of Mother-to-Child Transmission (PMTCT) of Human Immunodeficiency virus unit of Poly General Hospital, Enugu, South East Nigeria. Poly General Hospital is within Enugu metropolis, it offers comprehensive Anti-retroviral services, including the PMTCT and Voluntary Confidential Counselling and Testing (VCCT).Poly General Hospital, Enugu is one of the centres in the South-Eastern region of Nigeria designated by the National Action Committee on AIDS (NACA)/Federal government for the effective management of People Living with HIV/AIDS (PLWHA) by offering adult anti-retroviral and PMTCT clinics with free HAART to pregnant women.

Pre-test counselling is offered to every patient and is subsequently sent for HIV testing. When the result of the retroviral test is obtained, a post-test counselling is offered to every patient whether the test is positive or negative. The HIV-positive women are then referred to PMTCT and their husbands' HIV status is also determined and voluntary counselling and testing (VCT) is given to the husbands

before and after HIV testing. If positive the husbands are then referred to adult ARV clinic. Counselling on safer sex practices is done and condoms are given to all the husbands of the HIV-positive women irrespective of the husbands' HIV status.

Study Area

Enugu is the capital of the former South-Eastern region of Nigeria and is the capital of Enugu state which was created from the old Anambra state on 27th August, 1991. It has a land area of 8727.1 kilometers with a population of about 3.26million (2006 population census) [24]. It Lies partly within the semitropical rain forest belt of the South with annual rainfall of between 1520mm and 2030 mm. Malaria transmission is holoendemic in the area and is higher in the raining (wet) season of April to November, than in the dry season of December to March. It is surrounded by states of the South-Eastern, North-Eastern and North-Western regions of Nigeria. By the South border is Abia State, by North East is Benue, by North West is Kogi state, by the East is Ebonyi state and by the West in Anambra State. There are 17 Local government Areas (LGAs) in the State, most of which are rural.

The major occupation of the state includes subsistence farming, animal husbandry, civil service and trading. There are other health facilities in the state such as University Teaching Hospital Ituku/Ozala, Enugu State University of Science and Technology, Teaching Hospital, Park lane, Enugu and other specialist mission and private Hospitals and clinics as well as other district and General Hospitals. In each seventeen Local Government Areas and thirty-nine development centres in the state, there is at least one health centre and/or cottage Hospital.

The state prevalence varies from one area to another, 12.7% for Achi area and 2.5% for Nsukka area. Since the natural survey involved only the women using the public Health institutions, these figures may not be true picture of HIV.AIDS epidemics in the state.

The 2007 prevalence rate of Enugu state in the sentinel survey report showed that the HIV prevalence in Enugu state is higher in the rural areas [24]. The majority of the population lives in rural areas.

Study Design and Study Population

The patients for the study were selected from women attending antenatal and PMTCT clinics for HIV-negative (Group A) and HIV-positive (Group B) pregnant women respectively, between May to December 2023. Every consecutive delivery that fulfils the inclusion criteria was enrolled. A sample size of 394 was calculated using the prevalence rate documented in a different study. Provision was made for 5% attrition, bringing the sample size to 400.

Inclusion Criteria

Group A:

1. Willingness to participate in the study
2. Residing within the study area for at least two years
3. Pregnant women who are sleeping in ITNS and receiving IPT
4. Pregnant women who are HIV positive

Group B:

1. Willingness to participate in the study
2. Residing within the study area for at least two years
3. Pregnant women who slept under ITNS and receiving IPT
4. Pregnant women who were HIV negative

Exclusion Criteria for Groups A and B

1. Patients who fail to give consent
2. Patients who have obvious malaria fever
3. Sickle cell disease patients
4. Twin pregnancy
5. Significant antepartum haemorrhage
6. Miscarriage (less than 28 weeks' gestation)
7. Patients who had delivered before the study

Materials and Methods

Quality Assurance

A mandatory training was carried out for quality control and universal precautions. Slides were coded and read by a trained microscopist and reviewed by a second microscopist. Refresher courses and quality control assurance training toke place mid-way after starting the study.

All HIV positive and negative pregnant women that met the inclusion criteria and attended antenatal clinic were recruited. Samples were collected from the placentae of those recruited HIV positive and negative pregnant women after delivery. During recruitment the researcher or trained study staff took the obstetric history and reviewed Antenatal cards to obtain the bio-data, gestational age, gravidity, ART, IPT, CD4 count at booking, date of diagnosis of HIV, husband's status and patient's genotype.

Laboratory Procedures

After delivery of both the baby and the placenta, the maternal surface of the placenta was washed with normal saline and then incised with a scalpel and placental blood collected with a syringe into EDTA bottle within 1 h of delivery. The specimens were coded to correspond with the codes on the questionnaires for easy identification. These samples were then sent to the hematology laboratory for processing. Within four hours of collection, thin and thick films were prepared and air dried and stained using 10% freshly prepared Giemsa stain and pH of 7.2 maintained. The blood smears were fixed with 100% methanol prior to staining. The films were viewed under a light microscope at 100 magnifications [25].

The diagnosis of placental malaria parasitaemia was based on the identification of asexual stages of plasmodium on the tick films while the thin films were for identification of the species of the plasmodium. Plasmodium parasite density was determined by counting the number of asexual parasites against 200 white blood cells on the thick blood film and converted to parasites per µL using an assumed total white blood cell count of 800 per µL or parasite density ≥ one parasite per µL [25]. A blood film was declared

negative if no parasite was seen after viewing five hundred white blood cells by two different blinded microscopists.

Preparation of Thin and Think Films

Materials

Clean grease-free slides, Sterile needle, Absorbent cotton wool, Slide boxes, and Filter paper.

Preparation of thin film

A small drop of blood was placed at the proximal end of the slide. Using a second slide as a "Spreader" with the tip resting on the flat surface of the drop of blood few seconds was allowed for the blood to run along its edge. The spreader was firmly but gently pushed forward, keeping the spreader at an angle of 45 degrees such that the film forms "a base" and "a tail".

Preparation of thick film

Using the syringe, a drop of blood was placed at the centre of the clean slide. The drop of blood was spread using the corner of the spreader to make an even, circular, thick film of about one centimetre in diameter to enable reading of printed letters placed under the slide. The film was allowed to air dry.

Staining the blood film

Materials

The materials for staining blood film includes: Stock Giemsa satin, Methanol, Absorbent cotton wool, staining rack, Phosphate buffer, pH 7.2, Measuring cylinders 10-25ml and 100-500ml, Beakers, Timing clock, and a Slide-drying rack.

Procedure

To fix the films, each film was dipped into a container of methanol for a few seconds and placed on a staining rack, making sure that they do not touch each other. 10% solution of Giemsa stain was prepared by adding 3ml of Giemsa stock solution to 97ml of buffer. The stain was gently poured on the slide until the slides were totally covered. The stain was left on the slides for 45 minutes. The stained slides were rinsed using clear water for a few seconds. The slides were removed and placed on the drying rack to air dry.

Examining the stained thin blood film

This was used to differentiate the specie of the parasite.

Each slide was placed on the mechanical stage of the microscope which was positioned at 100 magnifications. A drop of Immersion oil was placed on the edge of the middle of the film. The objective lens of the microscope was lowered such that it touched the immersion oil and the film was examined by moving along the edge of the thin film, then inside the slide and back to the edge until the whole length of the film was examined.

Examination of stained thick film

Using the 40 magnification objective, the film was scanned to select the part of the film that was well stained, free of staining debris, and well populated with white blood cells. The immersion oil was placed on the thick film, the 100 magnification oil immersion object swiveled over the selected portion of the film and Lowered so that it touches the immersion oil. The film was on oil immersion field each time, following the pattern as described in the examination of the thin film, using the fine adjustment for focusing. A hand tally counter was used to count the Fields as they are being examined.

A slide was pronounced negative only after no parasites have been found in 100 fields of the blood film.

Establishing a parasite count: parasites per 200 WBCs

Counting of both the leukocytes as well as the parasites, using a tally counter was done.

If after 200 leukocytes have been counted, 10 or more parasites have been identified and counted, the results will be recorded on the record form in terms of the number of parasites per 200 leukocytes.

Data Analysis

Data was recorded in case record forms specially designed for the study and cross-checked. Data entry and analysis was done using version 23 software (SPSS 23) of Statistical Packages for Social Sciences of Chicago in the United States of America that has been programmed to check for errors. Demographic and birth outcome data of HIV-positive pregnant women and HIV-negative pregnant women was compared using Chi-Square Test, relative risk and percentages. Significance level was placed at a P-value of less than 0.05.

The study results were presented using simple percentages, tables and charts as appropriate.

Result

Table 1: Shows the socio-demographic characteristics of the research participants.

Variables	Categories	HIV Positive group N %		HIV negative group N %	
Age (years)	16-20	6	3	4	2
	21-25	28	14	24	12
	26-30	53	26.5	57	28.5
	31-35	81	40.5	83	41.5
	36-40	21	10.5	24	12
	41-45	11	5.5	8	4
Marital status	Single	3	1.5	1	0.5
	Married	190	95	196	98
	Widowed	4	2	2	1
	Divorced	3	1.5	1	0.5
Level of education	Primary	20	10	18	9
	Secondary	99	49.5	104	52
	Tertiary	66	33	60	30
	Postgraduate	15	7.5	18	9
Occupation	Traders	87	43.5	84	42
	Civil servants	58	29	61	30.5
	Teachers	19	9.5	18	9
	Health workers	14	7	16	8
	Others	22	11	21	10.5
Gravidity	Primigravida	46	23	40	20
	Multigravida	154	77	160	80

Table 2: Shows malaria Parasitaemia among HIV Positive and HIV Negative participants.

Malaria Parasite (MP)	HIV Positive		HIV Negative		p-value
	N	%	N	%	
No MP	33	16.5	49	24.5	0.001
Mild MP (1-999)	73	36.5	68	34	
Moderate MP (1000-9999)	91	45.5	82	41	
High MP	3	1.5	1	0.5	

Table 3: Correlating factors and prevalence of malaria among HIV positive respondents.

Category	Variables	No Examined	No Malaria Seen	Mild Infection N	Moderate Infection	High infection	Total Malaria Prevalence %	p-value
Age grp(years)	**16-20**	**6**	**3**	**2**	**1**	**0**	**3(50)**	0.05
	21-25	**29**	**7**	**6**	**14**	**0**	**20(69)**	
	26-30	**53**	**6**	**21**	**25**	**1**	**47(85)**	
	31-35	**81**	**11**	**35**	**34**	**1**	**70(86)**	
	36-40	**21**	**1**	**11**	**9**	**0**	**20(95)**	
	41-45	**11**	**3**	**5**	**3**	**0**	**7(63)**	
Trimester	1ST	**49**	**6**	**21**	**20**	**2**	**43(88)**	0.001
	2ND	**72**	**12**	**32**	**27**	**1**	**60(83)**	
	3RD	**79**	**15**	**24**	**40**	**0**	**64(81)**	
Gravidity	Primigravida	**46**	**6**	**22**	**17**	**1**	**40(86)**	0.001
	Multigravida	**154**	**27**	**60**	**65**	**2**	**127(82)**	
Level of Education	Primary	**20**	**5**	**7**	**8**	**0**	**15(75)**	
	Secondary	**99**	**8**	**39**	**50**	**2**	**91(92)**	
	Tertiary	**66**	**15**	**22**	**28**	**1**	**51(77)**	
	Postgraduate	**15**	**5**	**6**	**4**	**0**	**10(67)**	
CD4 Count	≤500 Cells/mm3	**54**	**7**	**19**	**28**	**0**	**47(87)**	
	>500 cells/mm3	**146**	**26**	**54**	**66**	**0**	**120(82)**	

Table 4: Correlating factors and prevalence of malaria among HIV negative respondents.

Category	Variables	No Examined	No Malaria Seen	Mild Infection N	Moderate Infection	High infection	Total Malaria Prevalence	p-value
Age grp(years)	**16-20**	**4**	**3**	**1**	**0**	**0**	**1(25)**	0.05
	21-25	**24**	**14**	**3**	**7**	**O**	**10(42)**	
	26-30	**57**	**14**	**20**	**23**	**0**	**43(75)**	
	31-35	**83**	**12**	**32**	**38**	**1**	**71(85)**	
	36-40	**24**	**2**	**10**	**12**	**0**	**22(91)**	
	41-45	**8**	**4**	**2**	**2**	**0**	**4(50)**	
Trimester	1ST	**46**	**26**	**10**	**10**	**0**	**20(43)**	0.001
	2ND	**69**	**10**	**26**	**32**	**1**	**59(86)**	
	3RD	**85**	**13**	**32**	**40**	**0**	**72(85)**	
Gravidity	Primigravida	**40**	**14**	**10**	**15**	**1**	**26(65)**	
	Multigravida	**160**	**35**	**40**	**50**	**0**	**125(78)**	
Level of Education	Primary	**18**	**8**	**6**	**4**	**0**	**10(56)**	0.01
	Secondary	**104**	**14**	**39**	**50**	**1**	**90(86)**	
	Tertiary	**60**	**16**	**20**	**24**	**0**	**44(73)**	
	Postgraduate	**18**	**11**	**3**	**4**	**0**	**7(39)**	
CD4 Count	≤500 Cells/mm^3	**58**	**14**	**20**	**24**	**0**	**44(76)**	0.01
	>500 cells/mm^3	**142**	**35**	**49**	**58**	**0**	**107(75)**	

Socio-demographic characteristics of the research participants

Table 1 shows the socio-demographic characteristics of the research participants. Their age group ranged between 16 -45years with majority within the age bracket of 31-35 (40.5% and 41.5%) in both HIV positive and negative respectively. Also most of the HIV positive and negative participants were married, 95% and 98% respectively. While 1.5% of the HIV positive were single, less number (0.5%) of the HIV negative were single. Similarly, 1.5% of the positive participants were divorced while 0.5% of the negative were divorced.

As it concerns level of education, majority of the HIV positive and negative participants had secondary level of education, 49.5% and 52% respectively. While 10% of the positive women had primary education, it was 9% in HIV negative women. About 33% of the positive women had tertiary education, while it was 30% in negative women. Least level of education, 7.3% was found amongst the HIV positive who had tertiary level of education. Even though level of education was higher in HIV p Trading is the major occupation of both HIV positive (43.5%) and negative participants (42%). Amongst the HIV positive participants, 29%

were civil servants, 9.5% were Teachers, 7% health workers, while 11% were involved in other works. Amongst the HIV negatives, 30.5% were Civil servants, 9% Teachers, 8% Health workers, while 10.5% carry out other works. Most of the women were multigravida when compared with those that were Primigravida in both HIV positive and negative women. Amongst the HIV positive, 23% were Primigravida, while 77% were multigravida. Amongst the HIV negative, 20% were Primigravida while 80% were multigravida.

Malaria parasitaemia amongst HIV positive and negative women

About 164 HIV positive women had cases of malaria unlike in HIV negative women where only 151 women had cases of malaria. This makes the prevalence of malaria in HIV positive and negative women to be 82% and 75.5% respectively. Amongst the HIV positives, 33 (16.5%) had no case of malaria, mild malaria cases were recorded in 73 (36.5%) women, moderate cases in 91 (45.5%) women and high cases of malaria in 3 (1.5%) participants. Amongst the HIV negative women, 49 (24.5%) had no case of malaria, mild malaria cases were recorded in 68 (34%) women, moderate cases in 82 (41%) women and high case of malaria in 1 (0.5%). The above finding shows that the prevalence of malaria was higher in the HIV positive than the HIV negative women, just like all cases of malaria parasitaemia was equally higher in HIV positive participants.

Correlating factors to the prevalence of malaria parasitaemia in HIV positive and negative pregnant women

Table 2 and 3 show that HIV positive women had the highest level of malaria prevalence at all age groups, 50% in 16-20 years age group as against 25% in HIV negative of the same age group, 75% in 21-25 years age group as against 42% in HIV negative of the same age group, 85% in 26-30 years age group as against 75% in HIV negative of the same age group, 86% in 31-35years age group as against 85% in HIV negative of the same age group, 95% in 36-40 years age group as against 91% in HIV negative of the same age group, 63% in 41-45 years age group as against 50% in HIV negative of the same age group. The higher difference in malaria prevalence in all age bracket of the positive women when compared with the negative women was statistically significant ($p<0.05$). Higher prevalence of malaria was also noted in the first trimester of those that were HIV positive (88%) when compared with the HIV negative (43%) and the difference was statistically significant (0.001). Prevalence of malaria was also higher in HIV positive primigraviads (86%) when compared with the HIV negative primips which was also significant ($P < 0.05$).

Discussion

About 164 HIV positive women had cases of malaria unlike in HIV negative women where only 151 women had cases of malaria. This makes the prevalence of malaria in HIV positive and negative pregnant women to be 82% and 75.5% respectively. This finding was statistically significant and also aligns with a similar malaria prevalence of 81% and 75% in HIV positive and negatives pregnant women respectively from previous research work done in Enugu [26] just like similar malaria prevalence of 86.5% found in another study conducted in Cameron [27]. Higher malaria prevalence (96.92%) was observed in another study [28]. Amongst the HIV positives, 33 (16.5%) had no case of malaria, mild malaria cases were recorded in 73 (36.5%) women, moderate cases in 91 (45.5%) women and high cases of malaria in 3 (1.5%) cases. Amongst the HIV negative women, 49 (24.5%) had no case of malaria, mild malaria cases were recorded in 68 (34%) women, moderate cases in 82 (41%) women and high case of malaria in 1 (0.5%). The above findings show that the prevalence of mild, moderate and severe cases of malaria were higher in HIV positive than the negative pregnant women. This finding agrees with another study done in South East Nigeria. The Correlating factors to the prevalence of malaria parasitaemia in HIV positive and negative pregnant women.

Table 3 and 4 shows that HIV positive women had the highest level of malaria prevalence at all age groups, 50% in 16-20 years age group as against 25% in HIV negative of the same age group, 75% in 21-25 years age group as against 42% in HIV negative of the same age group, 85% in 26-30 years age group as against 75% in HIV negative of the same age group, 86% in 31-35years age group as against 85% in HIV negative of the same age group,95% in 36-40years age group as against 91% in HIV negative of the same age group, 63% in 41-45 years age group as against 50% in HIV negative of the same age group. The higher difference in malaria prevalence in all age bracket of the positive women when compared with the negative women was statistically significant ($^{<}0.05$). Higher prevalence of malaria was also noted in the first trimester of those that were HIV positive (88%) when compared with the HIV negative (43%) and the difference was statistically significant (0.001). Prevalence of malaria was also higher in HIV positive primigraviads (86%) when compared with the HIV negative primips which was also significant ($P < 0.05$). The above findings were similar to that found in previous studies [25,26], Majority of the research participants were within the age bracket of 31-35 (40.5% and 41.5%) in both HIV positive and negative respectively. Also most of the HIV positive and negative participants were married 95% and 98% respectively. While 1.5% of the HIV positive were single, less number (0.5%) of the HIV negative were single. Similarly, 1.5% of the positive participants were divorced while 0.5% of the negative were divorced. However, the difference in the above socio-demographic variables were not significant.

As it concerns level of education, majority of the HIV positive and negative participants had secondary level of education, 49.5% and 52% respectively. While 10% of the positive women had primary education, it was 9% in HIV negative women. About 33% of the positive women had tertiary education, while it was 30% in negative women. Least level of education, 7.3% was found amongst the HIV positive who had tertiary level of education. Trading is the major occupation of both HIV positive (43.5%) and negative participants (42%). Amongst the HIV positive participants, 29% were civil servants, 9.5% were Teachers, 7% health workers, while 11% were involved in other works. Amongst

the HIV negatives, 30.5% were Civil servants, 9% Teachers, 8% Health workers, while 10.5% carry out other works. Most of the women were multigravida when compared with those that were Primigravida in both HIV positive and negative women. Amongst the HIV positive, 23% were Primigravida, while 77% were multigravida. Amongst the HIV negative, 20% were Primigravida while 80% were multigravida**.** The observed socio-demographic features of the two groups as above did not vary significantly.

Conclusion

Malaria prevalence and cases of mild, moderate and high malaria parasitaemia were higher amongst the HIV positive pregnant women when compared with their negative counterparts. Sequel to that, malaria preventive strategies, including drugs should be reviewed and up scaled in pregnancy to avert the rising complication of malaria in pregnancy.

Ethical approval

Approval for the study was obtained from the management of Poly General Hospital Enugu and written consent obtained from the research participants.

Acknowledgement

The authors are grateful to the research participants and to the various staff of Poly General Hospital who played roles in the study.

References

1. Kwenti TE. Malaria and HIV coinfection in sub-Saharan Africa: Prevalence, impact, and treatment strategies. Res Rep Trop Med. 2018; 9: 123-136.
2. Joint United Nations Programme on HIV and AIDS. Fact sheet: WorldAIDS Day 2017. 2017. http://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf.
3. Malaria and HIV/AIDs Interactions and Implications: Conclusions of a Technical consultation convened by WHO, 23-25 June 2004. WHO. 2017.
4. Kakklilaya BS. Pregnancy and Malaria. Malaria site. 2006.
5. Murillo D, Roudenko S, Tameru AM, et al. A mathematical model of HIV and malaria co-infection in sub-Saharan Africa. J AIDS Clin Res. 2012; 3: 1000173.
6. Jamison DT, Richard GF, Malegapuru WM, et al. Disease and mortality in Sub-Saharan Africa. World Bank. 2006.
7. Anna Longdoh Njunda, Charles Njumkeng, Shey Dickson Nsagha, et al. The prevalence of malaria in people living with HIV in Yaoundé, Cameroon. BMC Public Health. 2016; 16: 964.
8. Kamya MR, Gasasira AF, Yeka A, et al. Effect of HIV-1 infection on antimalarial treatment outcomes in Uganda: a population-based study. J Infect Dis. 2006; 193: 9-15.
9. Nkuo-Akenji T, Tevoufouet EM, Nzang F, et al. High prevalence of HIV and malaria co-infection in urban Douala, Cameroon. Afr J AIDS Res. 2008; 7: 229-235.
10. World Health Organization. WHO. 2020.
11. Lennartz F, Smith C, Craig AG, et al. Structural insights into diverse modes of ICAM-1 binding by Plasmodium falciparum-infected erythrocytes. Proc Natl Acad Sci. 2019; 116: 20124-20134.
12. Cameroon: epidemiological profile World malaria report. WHO. 2010.
13. Nyasa RB, Fotabe EL, Ndip RN. Trends in malaria prevalence and risk factors associated with the disease in Nkongho-mbeng; a typical rural setting in the equatorial rainforest of the South West Region of Cameroon. PLoS ONE. 2021; 16: e0251380.
14. Touré M, Keita M, Kané F, et al. Trends in malaria epidemiological factors following the implementation of current control strategies in Dangassa, Mali. Malar J. 2022; 21: 65.
15. Fried M, Duffy PE. Malaria during Pregnancy. Cold Spring Harb Perspect Med. 2017; 7: a025551.
16. Taylor SM, ter Kuile FO. Stillbirths: The hidden burden of malaria in pregnancy. Lancet Glob Health. 2017; 5: e1052-e1053.
17. Walther B, Miles DJ, Crozier S, et al. Placental Malaria is associated with reduced early life weight development of affected children independent of low birth weight. Malar J. 2010; 9: 16.
18. Prevention and control of malaria in pregnancy. A workshop for health care providers on Maternal and neonatal health. JHPIEGO. 2008.
19. Azizi SC, Chongwe G, Chipukuma H, et al. Uptake of intermittent preventive treatment for malaria during pregnancy with Sulphadoxine-Pyrimethamine (IPTp-SP) among postpartum women in Zomba District, Malawi: A cross-sectional study. BMC Pregnancy Childbirth. 2018; 18: 108.
20. Preparing for Certification of Malaria Elimination. World Health Organization: Geneva, Switzerland. 2020.
21. Wumba RD, Zanga J, Aloni MN, et al. Interactions between malaria and HIV infections in pregnant women: A first report of the magnitude, clinical and laboratory features, and predictive factors in Kinshasa, the Democratic Republic of Congo. Malar J. 2015; 14: 82.
22. National Guidelines: implementation of Prevention of Mother-to-Child Transmission (PMTCT) of HIV programme in Nigeria. FMOH. 2007.
23. Gil Z, Ndiaye C. The Link between Malaria and HIV/AIDS. World Vision/Roll Back Malaria. 2010; 1-2.
24. Enugu State of Nigeria. www.ebeano2007.org/enugustate.html.
25. Mokuolu OA, Falade CO, Orogade AA, et al. Malaria at Parturition in Nigeria: Current Status and Delivery Outcome. Infect Dis Obstet Gynaecol. 2009; 2009: 473971.

26. Ezeoke U, Ndu A, Omotowo B, et al. Prevalence of malaria in HIV positive and HIV negative pregnant women attending antenatal clinics in south eastern Nigeria. Malawi Med J. 2018; 30: 256-261.

27. A Strategic Framework for malaria Prevention and control during pregnancy in the Africa Region. WHO. 2004.

28. Olusi TA, Abe AF. Co-infection of HIV and malaria parasites in pregnant women attending major ante-natal health facilities in Akure, Ondo State, Nigeria. J Parasitol Vector Biol. 2014; 6: 124-130.