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Prevalence of Malaria in Pregnant Women Attending Antenatal Clinic in a Rural and an Urban Hospital in Port Harcourt, Nigeria

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Authors' contributions

This work was carried out in collaboration between the two authors. Author ASE designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author NWG managed the analyses of the study and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

A total of 400 pregnant women, 200 from Braithwaite Memorial Specialist Hospital (BMSH), 200 from Bori General Hospital (BGH) and 100 non- pregnant women used as control were examined for malaria parasitemia by staining their blood films with Giemsa stain. The prevalence of malaria among the pregnant women from BMSH and BGH are 55(27.50%) and 70(35%) respectively, and the prevalence among the non pregnant women was 15%. Prevalence of malaria by age groups showed that the most predisposed age groups in BMSH are 26-30 yrs (13.0%) and BGH 21-25 yrs (19.0%) respectively. There was high prevalence of malaria among pregnant women in the first trimester from both hospitals, BMSH (21.5%) and BGH 60(30.0%) respectively. Statistically, using Chi-square $p>0.05$ there was no significant difference in the prevalence of malaria among the pregnant women attending antenatal clinic in BMSH and BGH. The prevalence of malaria by haemoglobin (Hb), pregnant women with Hb less 11 g/dL in BMSH had malaria prevalence of 34.5% and those attending BGH had 35.3% .Those with Hb more than 11 g/dL from BMSH had

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42.1% and BGH,34.5%; using Chi-square p>0.05 there was no significant difference between both groups in both hospitals. The parasite density results were, 20.0% and 22.5% had low parasite density, 6.5% and 10.0% had moderate parasite density, while1.0% and 2.5% had high parasite density among pregnant women from BMSH and BGH respectively. Malaria, particularly in pregnancy is still a health problem to overcome in malaria endemic region such as the Sub Saharan Africa.

Keywords: Prevalence; malaria; pregnant women; rural; urban.

1. INTRODUCTION

The disease malaria is caused by the parasite *Plasmodium*, transmitted to man by female infected *Anopheles* mosquitoe. There are five species of *Plasmodium* known to cause malaria in man, *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi.* Mixed infections with two or more of the *Plasmodia* species are common. Clinical presentation of infection with the four species of *Plasmodia* may include; periodic paraoxysm, chills, rigors, sweating, body aches, headaches, nausea, general weakness and prostration. Severe life threatening complications may be associated with cerebral malaria, severe anaemia, acidosis, acute respiratory distress syndrome, which are mostly associated with *P. falciparum* infection. Malaria, a life threatening parasitic disease with high morbidity, mortality and high economic impact [1,2]. The effect of malaria infection in pregnancy is of serious public health concern in tropical and sub-tropical regions throughout the globe [3,4]. In hyper-endemic area like Nigeria, it is a common cause of anaemia in pregnancy and is aggravated by poor socio-economic circumstances [5]. Malaria is a serious health burden to developing countries, including Nigeria [6]. Malaria is simple to diagnostic and treat, yet it claims more lives than any other infectious disease today [7]. The burdens of malaria on sub-Saharan African accounts for as much as 40% of public health expenditure, 30 – 50% of inpatient admissions and up to 50% of out-patients visits [7,8].

Malaria situation in sub-Saharan Africa is a grim and the disease now constitutes a leading cause of poverty in the entire region [9,10,11]. In pregnancy, malaria can cause abortion, miscarriage, stillbirth, premature birth, intrauterine growth retardation and neonatal death [12,13]. Malaria affects more than 3,000 pregnant women each year in developing countries and is commonly associated with poor birth outcomes, maternal anaemia and death [14,15]. During pregnancy, malaria increases anaemia by increasing red blood cells destruction and decreasing erythropoesis [16]. Malaria accounts for 10–20% of low birth weights [17,18]. The prevalence of malaria among pregnant women in Sokoto, Nigeria was 52.2%, infection was significantly higher among pregnant women in the second trimester (61.2%), the first and third trimesters are 5.5% and 33.3% and *P. falciperum* was responsible for all infections [19,5]. In a similar work in North Western Nigeria, the prevalence of malaria in the second trimester was 50.9%, 6.2% and 42.9% in the first and third trimester respectively [5]. In Calabar south south Nigeria, a prevalence of 70.1% was reported [20] 92.0% in Gombe state, 56.9% in Abeokuta, 66.6% in Enugu all in Nigeria [21,22,17]. In Benin City, the prevalence of malaria among pregnant women attending traditional delivery home was 72.5% [23]. Reports of studies carried out in Sub-Sahara Africa between 200 and 2003 showed the prevalence of malaria in pregnant women attending antenatal clinics were 29.5% in East and Southern Africa, and 35.1% in West and Central Africa [24,25]. Review in East and South Africa showed that the prevalence of malaria in women attending antenatal clinics was 32% for peripheral blood and 38% for placental malaria [26]. In high transmission area like the Sub- Saharan Africa, one in every four pregnant women has evidence of peripheral or placenta malaria [27]. Pregnant women are more susceptible to malaria with significantly lower mean heamoglobin and younger women are more predisposed to malaria. Anaemia was significantly lower in none malaria parasite infected pregnant women [28]. Maternal anaemia (Hb< 11g/dL)^2 was 51.7% among pregnant women in a cross sectional study in Southern Laos [29]. In high transmission setting with high level of acquired immunity, *P. falciparum* may be asymptomatic in pregnancy; the parasite may be present in placenta contributing to maternal anaemia even in absence of documented peripheral parasitemia [30]. Malaria is still a burden to be lifted from the Sub Sahara African countries.

2. MATERIALS AND METHODS

2.1 Study Area

This study was conducted among pregnant women attending antenatal clinic in Braithwaite Memorial Specialist Hospital (BMSH), Port Harcourt and Bori General Hospital (BGH), both in Rivers State, Nigeria. Bori, the headquarter of Khana Local Government Area, a rural community mainly of the Ogoni tribe, the people are predominantly farmers. Port Harcourt is a cosmopolitan city, the capital of Rivers State, Nigeria. The dwellers reflect the entire Nigerian ethnic groups because of the presence of oil and gas industries.

2.2 The Subjects

A total of 500 subjects comprising 200 pregnant women from BMSH, 200 pregnant women from BGH and 100 non-pregnant women which serve as control were examined for malaria in this study. The pregnant women from both hospitals were from age 21 – 40 years.

2.3 Ethical Consent

Ethical consent was obtained from the Ethical Committees of BMSH and BGS respectively. The participants were briefed of the purpose of the study and their confidentiality assured. An informed consent was obtained from each participant. The investigations were conducted at no cost.

2.4 Collection of Samples

About 2 mL of venous blood samples were collected by phlebotomy from the upper arm of the pregnant women. Ethanol (70%) soaked in cotton wool was used first to sterilize the site of collection, allowed to dry and blood collected with hypodermic syringe. It was dispensed directly into EDTA bottle. They were mixed properly to avoid coagulation.

2.4.1 Preparation of blood film for malaria parasite

Thick and thin blood smears were prepared accordingly to [31].

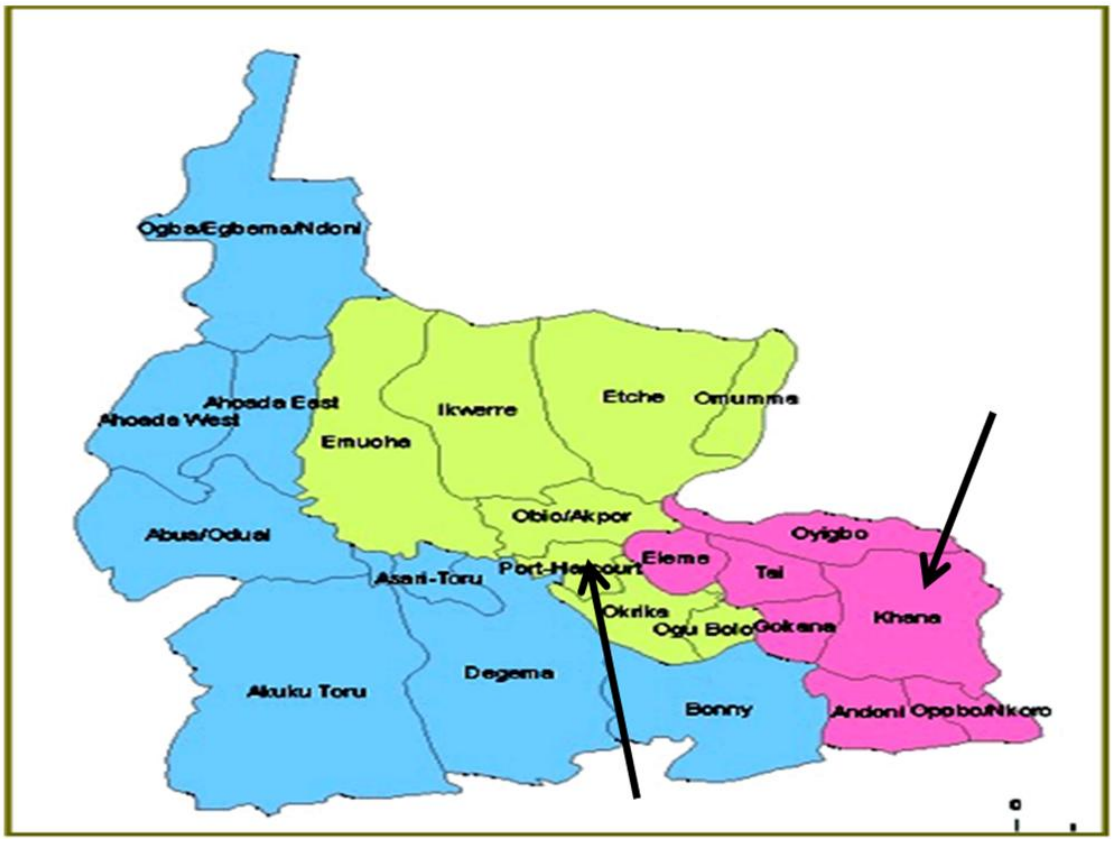

Fig 1. The map of Rivers State

2.4.2 Thick smears

The thick and thin films are made on the same slide, thick films were prepared by pippeting 0.2 ul of well mixed anticoagulated blood onto a clean grease free glass slide, spread with smooth edged slide and allowed to air dry for 30 minutes. Giemsa working solution was used, 10% solution was prepared by adding 5 mL of Giemsa stain to 45 mL of buffered distilled water P^H 7.1-7.2 in 50 ml cylinder. With the aid of disposable pipette, the prepared Giemsa stain was flooded on the smears for 8–10 minutes. The stained smears were allowed to dry, the under were cleaned with cotton wool and examined using x40 to check the staining morphology and distribution of cells and (x100) oil immersion objective (immersion oil applied) under the microscope to determine parasite density [31].

2.4.3 Thin smear

The thin films were allowed to dry for 10 minutes and fixed by dipping the thin smear carefully in methanol for 5 seconds and avoid methanol interfering with the thick smear. The preparation was allowed to dry and stained as above. They were rinsed with distilled water and allowed to dry, and also examined with x 100 objective. Thin film was used to differentiate the species of *Plasmodium.*

2.4.4 Microscopic examination

The back of stained air dried blood smears were carefully cleaned with cotton wool and examined with x10 and x40 objectives at first for cell morphology and x100 for detection of malaria schizonts, trophozoites, gametocytes and *Plasmodium species*.

2.4.5 Blood group determination

The blood groups of the subjects were determined by rapid tile cell grouping technique. A test tube of 0.5 ml of EDTA blood was added to 5 ml of physiological saline and centrifuge at 1,200 rpm for 5 minutes. This process was carried out thrice, discarding the supernatant. A drop of 5% red blood cells suspensions were added into 3 tubes labeled A, B and AB and antisera A, B and AB were added correspondingly. They were incubated at 25ºC for 5 minutes and centrifuged. These were read by observing for agglutination macroscopically and microscopically respectively.

2.4.6 Haemoglobin determination

Haemoglobin (Hb) estimation was done by dispensing 5 ml of Drabins solution into test tubes, 0.20 mL of blood were added, mixed and allowed to stand for 10 minutes at room temperature for complete conversion to cyanomethaemoglobin. The absorbance of the solutions was read at 540 nm using Drabkins solution as blank. The value of haemoglobin were extrapolated from a calibrated curve already prepared [31].

2.4.7 Determination of parasite density

This was determined by viewing the thick blood as above, low parasite density which is one plus (+) represents 1 to 10 parasites per 100 thick film fields. Moderate is two plus (++), which is 10 to 100 parasites per 100 thick film fields and high which is (+++), is I to 10 parasites per a thick film field.

3. RESULTS

The prevalence of malaria among pregnant women attending antenatal clinic in BMSH and BGH are 55(27.50%) and 70(35%) respectively. The prevalence of malaria among 100 non-pregnant women used as control was 15%. The overall prevalence of malaria for both hospitals was 31.3%. The prevalence of malaria among pregnant women attending antenatal in BGH was higher by 7.5% as shown on Table 1.

Table 1. Prevalence of malaria among pregnant women in BMSH and GBH

Hospital	Number examined	Number positive
BMSH	200	55(27.5)
BGH	200	70(35.0)
Non pregnant women	100	15(15.0)
Total	**400**	**125(31.3)**

Numbers in parenthesis= Percentages

In BMSH, the prevalence of malaria among pregnant women within the age group 21-25yrs 22, 8(4.0%) , 26- 30yrs 72, 26(13%), 31 – 35 yrs, 80, 18(9.0%) and 36-40yrs 26, 6(3.0%) respectively. In BGH, the prevalence among the age groups were 21 – 25 yrs 86, 38(19.0%), 26-30yrs 74, 17(8.5%), 31-35yrs 28, 10(5.0%) and 36-40yrs 12, 5(2.5%) respectively. In BMSH, the most predisposed age groups was 26-30yrs (13.0%), while in BGH the most predisposed age group was 21-25yrs (19.0%) respectively. The

lowest prevalence of malaria in both hospitals was among pregnant women within age group 36 – 40 yrs BMSH 6(3.0%) and BGH 5(2.5%) respectively.

The percentage of pregnant women that registered in the first trimester to antenatal clinics was 98(49.0%) for BMSH and 132(66.0) for BGH respectively. The prevalence of malaria by trimester among pregnant women was high among pregnant women in the first trimester from both hospitals BMSH 43(21.5%) and BGH 60(30.0%) respectively. The results of the prevalence of malaria in the second and third trimesters were BMSH 48, 10(5.0); 2(1.0) and BGH 42, 7(3.5%); 3(1.5%) respectively.

The prevalence of malaria among pregnant women by haemoglobin level from BGH, Hb 8.0 - 10.9 g/dL were 116, 41(35.3%), whereas those having Hb 11- 13 g/dL were 84, 29(34.5%) were infected respectively. The pregnant women from

Table 2. Prevalence of malaria by age groups among pregnant women

Age group (yrs)	BMSH		BGH	
	Number examined	Number positive	Number examined	Number positive
21 – 25	22	8(4.0)	86	38(19.0)
26 -30	72	26(13.0)	74	17(8.5)
31 – 35	80	18(9.0)	28	10(5.0)
36 – 40	26	6(3.0)	12	5(2.5)
Total	**200**	**55(27.5)**	**200**	**70(35.0)**

Numbers in parenthesis=percentages

Table 3. Prevalence of malaria by trimester among pregnant women

Trimester	BMSH		BGH	
	Number examined	Number positive	Number examined	Number positive
First	98	43(21.5)	132	60(30.0)
Second	48	10(5.0)	42	7(3.5)
Third	54	2(1.0)	28	3(1.5)
Total	**200**	**55(27.5)**	**200**	**70(35.0)**

Numbers in parenthesis=percentages

Table 4. The prevalence of malaria by haemoglobin concentration (Hb/dL)

Hb(g/dL) Ranges	BGH		BSMH	
	Number examined	Number positive	Number examined	Number positive
8.0 – 9.9	19	5(2.5)	2	1(0.5)
9.0 – 9.9	48	15(7.5)	23	6(3.0)
10.0 – 10.9	49	21(10.5)	62	23(11.5)
11.0 – 11.9	58	22(11.0)	79	16(8.0)
12.0 – 12.9	16	7(3.5)	28	9(4.5)
13.0and above	10	0(0.00)	7	0(0.00)
Total	**200**	**70(35.0)**	**200**	**55(27.5)**

Numbers in parenthesis=percentages.

Table 5. Showing Parasite density among pregnant women and control group

		Results		
Density	**Degree**	**BMSH**	**BGHI**	**Control**
Low	+	40(20.0)	45(22.5)	13(13.0)
Moderate	++	13(6.5)	20(10.0)	2(2.00)
High	+++	2(1.0)	3(2.5)	0(0.00)
Total		55(27.5)	70(35.0)	15(15.0)

BMSH, having Hb 8.0–10.9 g/dL were 87, 30(34.5%) had malaria, while those who had Hb 11 – 13 g/dL were 114, 48(42.1%) were infected with malaria parasite.

The results of the parasite density showed that 20% and 22.5% of the pregnant women from BMSH and BGH had low parasite density, 6.5%, 10.0% had moderate parasite density, whereas 1.0% and 2.5% had high parasite density in BMSH and BGH respectively.

4. DISCUSSION

The prevalence of malaria among pregnant women attending antenatal in BMSH was 27.5%, while the prevalence of malaria among pregnant women attending antenatal in BGH was 35% respectively. The overall prevalence in both hospitals was 31.3%. Statistically, using chi-square $p>0.05$, there was no significant difference in the prevalence of malaria among pregnant in both health facilities. The prevalence of malaria among the non pregnant women used as control was 15%. The difference in prevalence among pregnant women from the health facilities was 7.5%. Exposure of pregnant women in the rural communities to mosquito bites due to the presence of surrounding bushes, plantain plantations within and around residential houses, mosquito breeding sites in surrounding environment and inadequate knowledge of the measures to control mosquito may have accounted for the difference in prevalence rate. In Sokoto Northern Nigeria, [9] malaria prevalence of 52.2% among pregnant women attending clinics was recorded, while a prevalence of 70.1% was reported among pregnant women attending antenatal in Calabar, South Eastern Nigeria whereas, [32] a prevalence of 68.9% was observed in Cameroon. The above results are not in line with our findings but similar to that of [33] they had prevalence of 36.5% among the pregnant women in Kastina, Nigeria. Our results are similar to that of [34] who had prevalence of 32.9% in South South Nigeria, [35] in Port Harcourt had a prevalence of 26% and a similar study in EAS and South Africa, [36] had prevalence of 32% from peripheral blood among pregnant women attending antenatal clinic. In this work, only *Plasmodium falciperium* was diagnosed as the species of malaria parasite associated with malaria, this was in agreement with the results obtained by [33] identified only *P. falciperium* among pregnant women in Kastina, Nigeria. In some regions of Saharan Africa such as Port Harcourt, Nigeria; mosquitoes are both nocturnal and diurnal in nature, because the young pregnant women are more involved in most daily activities such as domestic and agricultural works; they remain more vulnerable to mosquito bites and concomitantly malaria.

From the results of age prevalence of malaria among pregnant women, 75% of pregnant women attending antenatal in BMSH were between ages 26-35 yrs, whereas in BGH 80% are between ages 21-30 yrs. This may suggest that those in rural setting are exposed to early sex and marriage compared to their counterparts in BMSH (urban). The prevalence of malaria was high 26(13.0%) among pregnant women from ages 26-30 yrs in BMSH and 38(19.0%) among pregnant women from ages 21-25 yrs in BGH. The prevalence of malaria in this study was found to be high among the young women in both health facilities, this was attributed to the existence of low natural immunity [26] and activities exposing to mosquitoes bites and inadequate knowledge of control measures [37]. Statistically, using Chi-square $p<0.05$; there was no significant difference in prevalence of malaria among pregnant women in BMSH and BGH hospitals by age groups but there was significant difference among age groups in each of the hospitals.

The trimester prevalence of malaria was high among pregnant women in the first trimester from both health facilities (BMSH 21.5% and BGH 30.0%). This result was not in agreement with findings of [20,5] both had the highest prevalence in the second trimester; but our results agrees with that of [33,17] they recorded a prevalence of 43.5% and 71% respectively in the first trimester of pregnancy. Malaria parasites may taken advantage of the lowered immunity that results from sudden onset of pregnancy, despite the baseline immunity the pregnant women may acquires in malaria endemic areas.

From the results of haemoglobin estimation, 58% of pregnant women from BMSH and 43.5% in BGH had anaemia. Anaemia is a serious problem in pregnancy because of increased demand of growing fetus. Pregnant women with Hb from 11 g/dL and above had malaria prevalence of 42.1% in BMSH and 34.3% BGH, this shows that normal hemoglobin may not provide protection against malaria pasitemia. In malaria endemic areas such as Nigeria, malaria is a major cause of anaemia in pregnancy [38]. Malaria associated anaemia will pose serious clinical risk to mother and fetus. Immunity of pregnant women is lowered because of

conditions associated with pregnancy such as lowered immunity and haemodilution [39] etc., therefore pregnant women bear more burdens of malaria compared to others in the same geographical area [20]. Amaemia is defined [23] as haemoglobin concentration <11g/dL. The prevalence of severe anaemia among pregnant women in Calaber, Nigeria was 6.1% [32], while in this study, the prevalence of malaria associated anaemia was 10% in Bori (rural community) and 3.5% in Port Harcourt (urban). This may be due to reasons given above for higher prevalence of malaria in rural communities. It is evident that the burden of malaria on the haemoglobin of pregnant women, that is, the ability of malaria parasites to destroy RBCs had accounted for low haemoglobin concentration observed in pregnancy, aside haemodilution. This was made clear by the percentage of pregnant women (5.0%) from both hospitals that were not infected with malaria parasites; they had haemoglobin concentration of 13.0 g/dL and above. Anaemia in pregnancy was more in the rural setting (BGH) as compared to (BMSH) urban setting. Statistically, using Chi-square p>005 there was no significant difference in the prevalence of anaemia among pregnant women in both hospitals. The pregnant women with Hb 11 and above may not be exposed to early sign and symptoms of malaria like the anaemic ones but the impact of malaria in pregnant women in Sub –Saharan Africa is diverse including: anaemia, placental malaria which increases the risk of low birth weight and neonatal mortality; and malaria induced low birth weight is estimated to be responsible for 3-17 deaths per 1000 live births [40]. Greater percentage of pregnant women had low parasite density, this may be due to underlying natural immunity prevalent in malaria endemic areas, use of preventive nets, indoor spraying and health education on mosquito preventive measures.

5. CONCLUSION

The prevalence of malaria in Port Harcourt and Bori indicates that malaria in pregnancy is still a health problem to overcome, considering the burden malaria places on pregnant women in malaria endemic areas.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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