Prevalence of Malaria and Anaemia among Pregnant Women Attending the Ante Natal Clinic in a Tertiary Institution in South-West Nigeria

***Okangba, C. C.,[1] Nwadike, V. U.,[1, 3] Oluwole, T. O.,[1,2] Okunbor H.N.,[1] Solanke, O. A.,[2] Okangba, U.G.,[1] Pius, E. I.,[1] Agada, D.,[1] Amapu, D. A.,[1] Bayo-Shidipo, A. T.,[1] Faleye, A.,[1] Olokodana, A.,[1] Okorie, S. I.[1]**

[1]Department of Medical Microbiology and Parasitology Benjamin Carson (Snr) School of Medicine, Babcock University. Illisan –Remo, Ogun State, Nigeria.

[2]Babcock University Teaching Hospital. Ilisan – Remo, Ogun State, Nigeria

[3]Department of Medical Microbiology, Federal Medical Centre Abeokuta, Ogun State, Nigeria

***Corresponding Author**

DOI: https://dx.doi.org/10.47772/IJRISS.2023.701165

Received: 08 September 2023; Revised: 28 September 2023; Accepted: 04 October 2023; Published: 22 November 2023

INTRODUCTION

Malaria is a major public health infection in tropical and subtropical regions within the world. Africa has the most malaria-endemic areas (Amadi and Nwankwo, 2012). Malaria is a serious infectious disease that mostly affects children under the age of five and pregnant women (Amadi and Nwankwo, 2012). Malaria raises the potential risk of low birth weight and child mortality in the first year of life, causing intrauterine retardation, premature birth, and anemia in infants (Aribodor *et al.*, 2007). Past research has discovered a linkage among malaria and anemia, particularly in pregnant mothers and children. The component is known to be hemolysis of the erythrocytes because of Plasmodium infection, along with the resultant folate deficiency and hypersplenism (Ugwu *et al.*, 2014).

Plasmodium falciparum, Plasmodium vivax, Plasmodium knowlesi, Plasmodium ovale, and *Plasmodium malariae* are the species that cause malaria. *Plasmodium falciparum* is the most widespread and virulent parasite, and it is found throughout Africa, accounting for more than 95 percent of cases in Nigeria *Plasmodium falciparum* is the species that has given rise to the formidable drug-resistant strain in Asia (Amali *et al.*, 2011). Malaria infection is most frequent in primigravidae than in multigravidae, but multigravidae are also susceptible because of a higher rate of malaria during pregnancy than previously or after pregnancy. The height of prevalence of *Plasmodium falciparum* is somewhere in the range of week 9 to 16 of gestation and reduces towards childbirth (Amadi and Nwankwo, 2012).

In Nigeria 11% of maternal deaths are attributed to malaria (FMOH, 2000). The prevalence of malaria in pregnancy in different areas of Nigeria has been reported to range from 19.7% to 72% (Okwa, 2003; Kagu *et al.*, 2007; Adefioye *et al.*, 2007; Uneke 2008, Tayo *et al.*, 2009). These reports indicate the huge burden of malaria in pregnancy in Nigeria, and the need for special measures to prevent malaria infection during pregnancy.

Anaemia in pregnancy is common in developing countries and is associated with adverse consequences both for the mother and the foetus. Anaemia in pregnancy can lead to poor intrauterine growth and increased risk of preterm births and low birth weights and in severe cases can lead to the death of the mother (Kalaivani,

2009).

Anemia is a significant complication of malaria in pregnancy and a major cause of concern in this endemic area. In Nigeria, prevalence rates ranging from 40.2 to 70.2 percent have been reported (Ugwu *et al.*, 2014). Due to their susceptibility to malaria, hunger, grandmultiparity, HIV infection, and hookworm infestation, developing countries have a higher prevalence of anemia. Various methods are used in pregnant women's antenatal treatment to reduce the incidence of malaria and anemia (Ugwu *et al.*,2014).

Anemia during pregnancy is a known danger factor for maternal mortality, stillbirths, low birth weight, and fetal impedances (Uneke, 2007). It is accounts for 3.7 % of maternal mortality in pregnancy and childbirth in Africa (Erhabor *et al.*, 2019). Its management and control in pregnancy are aided by the availability of local prevalence statistics, which are currently understudied in Nigeria (Idowu *et al.*, 2005). In order to manage malaria infection effectively during pregnancy, an accurate and timely diagnosis is required (Oshikoya, 2007).

An iron-sufficient, disease free woman with relative anemia during pregnancy will have a hemoglobin level above 11g/dl and a Packed Cell Volume of above 35%. The average hemoglobin levels during pregnancy are between 11.5 and 12.5g/dl as opposed to 13 – 15g/dl found in non-pregnant state due to the 20% increase in plasma volume causing hemodilution in pregnant women. (Perry *et al.*, 2004). Iron therapy is recommended to maintain the hemoglobin levels and hematocrit nearer to that of non pregnant women.

Malaria and anemia are associated due to the fact malaria results in the lack of non-parasitized red blood cells, immune destruction of damaged erythrocytes, and reduced erythropioesis because of bone marrow dysfunction. Malaria and anemia's poor results at the mother and infant exhibit the need for more attention to greater competitive and long-term preventive and therapeutic approaches (Fondjo et al., 2020).

OBJECTIVES

General Objective;

The goal of this research is to determine the prevalence of malaria and anemia among pregnant women attending ante-natal clinic in Babcock University Teaching Hospital (BUTH)

Specific Objectives are to;

1. Determine the prevalence of malaria infection among pregnant women attending antenatal clinic in BUTH.
2. Evaluate the Packed Cell Volume (PCV) and Hemoglobin Concentration among pregnant women attending antenatal clinic in BUTH.
3. Investigate the effect of gravidae on the prevalence of Malaria and Anemia among pregnant women attending antenatal clinic in BUTH.
4. Ascertain the effect of age on the prevalence of Malaria and Anemia among pregnant women attending antenatal clinic in BUTH.
5. Evaluate the effect of level of education on the prevalence of Malaria and Anemia in pregnant women attending antenatal clinic in BUTH.

Significance of Study

The goal of this research is to establish a safe preventive measures that can be used in preventing malaria during the course of pregnancy because pregnant women are a part of the risk group for Malaria Infection. The preventive measures that can be employed includes the use of mosquito nets, insecticides, mosquito repellents, hygiene practices such as cleaning gutters and clearing up bushes which serve as a good habitat

for malaria parasite.

Statement of Problem

Malaria and pregnancy are both infuriating conditions. Pregnancy's physiological changes, combined with malaria's pathological changes, can result in extreme complications that makes life difficult for both mother and child. This project topic was thus validated in order to ascertain the prevalence of malaria and anemia in pregnant women attending antenatal clinic in BUTH.

Rationale for the study

The paucity of Nigerian studies investigating the factors associated with increased risk of malaria infection during pregnancy as well as prevalence of anaemia in pregnancy necessitated this study to provide local data on malaria and anaemia in pregnancy in order to improve the health of pregnant women. Also, considering the wide variation in reports of prevalence of malaria in pregnancy, it became imperative for a closer assessment of the malaria prevalence among pregnant women in Lagos, south-west Nigeria.

Antenatal clinics were chosen for this study based on the report that ANC attendance is high in most countries with upto four ANC visits per woman recorded (Marchesini and Crawley, 2004). Since adequate malaria control strategies are expected to be initiated after booking at antenatal clinics, the women were recruited on the first day of registration for antenatal care

MATERIAL AND METHODOLOGY

Study Area

The research was a cross sectional study conducted in Babcock University, situated in Ilishan-Remo, Ogun State in Southwestern which is located along the Sagamu-Lagos expressway, Ikenne Local Government Area, Ogun State, Nigeria. Its headquarters are in the town of Ikenne at 6°52′ N 3°43′ E. It has an area of 144 km² and a population of 118,735 at the 2006 census. The postal code of the area is 121. Laboratory studies were conducted in Research Laboratory in the Department of Medical Microbiology and Parasitology, Benjamin S. Carson (Snr) School of Medicine.

Study Design

The study was a cross-sectional study, which was conducted over a period of three months. The prevalence of malaria and anemia in pregnant women attending antenatal clinics at BUTH was assessed.

Criteria for Selection and Study Population

The study site was selecting factoring in the proximity of the researchers to the area. Consequently, individuals will include pregnant women attending antenatal clinics at BUTH.

Inclusion Criteria

- No intake of anti-malaria medications in the last 2 weeks as pregnant women usually take antimalarials as prophylaxis
- Patients that consented to participating in this study.

Exclusion Criteria

- Patients with Sickle cell anaemia and other medical conditions

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

- Patient who refused to give consent to participate in this study.
- Recent intake of anti-malaria medications in the last 2 weeks

Sample Size

A minimum sample size was calculated using a standard formula:

$N= (Z^1\text{-}a)^2 (p) (1\text{-}p) / d^2$

With prevalence (P) of 8.4%, the maximum difference between the true population and sample incidence (d) of 5% is (Z1 –a) = 1.64 (Mohammed *et al.*, 2017).

$N=1.64^2 \times 0.084 (1 – 0.084)/0.05^2 = 118$

The minimum sample size for this study is calculated to be 118.

Ethnical Approval

Babcock University's Health and Research Ethics Committee (BUHREC) gave permission to perform this research. Participant's consent was sought during the process of this study in order to conduct the required clinical treatment on them. The entire study was conducted in accordance with Good Clinical and Laboratory Practices.

Laboratory Procedure

A study team trained in the collection of blood samples was assigned to this study. Standardized structured and pretested questionnaire coupled with an informed consent form was given to individuals within the eligibility criteria for the research.

Blood samples were collected from the individuals after the questionnaire form has been filled and consent acquired for the performance of microscopy, RDT (HRP-2 and pLDH) and PCV. Laboratory data was recorded on a spreadsheet.

Collection of blood sample

Patients who m. Blood will be drawn from the preferred arm via venipuncture. At least 5ml of blood was collected, of which 3ml was placed in an EDTA bottle and the remaining 2ml will be placed in a plain bottle. The EDTA bottle was mixed by gentle inversion. The EDTA bottle was mixed by gentle inversion. Each tube was labeled with the patient's hospital number. The blood was used to prepare smears, and carry out Rapid Diagnostic Test after collection of sample.

Blood films Preparation for parasite diagnosis

Thin Smear preparation

2µl of blood was positioned on the end of a grease-free slide using an automated micropipette. A sterile spreader slide was drawn into the 2µl of blood at a 45-degree angle. The blood was allowed to spread over the entire width of the spreader slide. The spreader slide was easily and smoothly transferred to the opposite end of the slide at the same angle. For a few minutes, the thin film was allowed to dry at room temperature. After being fixed in methanol for 15-30 seconds, the thin film was stained with 10 percent Giemsa stain. The smear had eathered tip that was used to inspect the stained smear under a microscope. (Tankeshwar,

2017).

Thick Smear Preparation

Before the desired density was achieved, a loss of blood with a diameter of about 12mm was spread in a circular motion in the corner of a clean slip. The smear was able to dry for 8-12 hours at room temperature. Each patient was given two smears, one on each slide. Both smears was numbered on the slides with the patient's hospital number. The air was kept clean of mosquitoes, pollen, and excessive weather. For 45 minutes, the film was stained with 10 percent Giemsa stain. Immersion oil was added to the smear, and the blood smear was tested under a microscope at a magnification of x100 for malaria parasites.

Determining parasitema

Tally counter was used to count white blood cells. Slides were read within 24 hours. Every parasite's density was determined by counting the number of asexual parasites in a positive thick film against 200-500 leukocytes, and parasite counts were computed and documented in parasites/L blood using the standard 8,000 leukocytes (Olasehinde *et al.*, 2015). (WHO 2010).

Packed cell volume (PCV) determination

Blood was drawn from a finger prick into a capillary tube to assess the PCV. The blood samples was put in microhematocrit tubes and spun at 12,000-15,000 rpm for 5 minutes in a hematocrit centrifuge before being read using a hematocrit reader. Anemia in pregnancy is described as a PCV of less than 30% or a hemoglobin level of less than 10%. The severity of anaemia was classified as follows: mild (PCV: 27 – 29%), moderate (PCV: 19 – 26 %) and severe (below 19%) (Abudu, 2001).

Rapid Diagnostic Test Procedure

The expiration date of the test packet was determined. When opening the test kit and extracting the test pad, capillary hose, and desiccant sachets, gloves was worn. Using the capillary channel, a drop of blood from the EDTA bottle was deposited in the square opening. The capillary tube was disposed of in a sharps container. The test result was registered in the registry by the researcher. To guarantee the validity of the test, the researcher ensured the existence of a control line (CDC, 2018). The RDT result was read as follows:

0 – No band indicating negative result

1+ – Faint band, but clearly visible indicating positive result

2+ – Medium intensity band stronger than 1+ but equal than control band 3+ – Stronger intensity than the

control band indicating positive result

HRP-2 is used to detect the presence of Plasmodium falciparum specie alone and PLDH is used to determine all types of malaria species.

Data Analysis

Data generated from this trial will be entered into EPI-INFO version 7.2.2.6 *(Olufemi, et al., 2015).* Microsoft excel software will be used to pilot simple illustrative graphs. Various aspects of the data will be subsequently analyzed using SPSS statistical package version II. Descriptive statistics will be compared using "X" or student t –test or analysis of variance (ANOVA) as appropriate. Pearson's correlation test will be used to examine the relationship between selected variables.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

RESULTS

The respondents of this study were pregnant women attending antenatal clinic at BUTH.

Of the 118 structured questionnaires given out to 118 pregnant women, All the questionnaires were returned and appropriately filled. Of the 118 questionnaires filled, not all the respondents filled all the questions, as some left some portions blank, and thus, most of the results did not add up to 100%.

The statistics were analysed using a Statistical Package for Social Sciences (SPSS) version 21.0 and also via the non-parametric Karl Pearson's chi-square (x2) test.

The results are presented in the form of tables showing the variables, number of respondents and the corresponding percentage of respondents in separate columns.

Table 1: Socio-Demographic Data

CHARACTERISTICS		**N=118 (%)**
1. Age	<18	1 (0.8)
	18-29	57 (48.3)
	30-39	57 (48.3)
	40-49	3 (2.5)
	≥50	0 (0.0)
		N=118 (%)
2. Ethnic group	Yoruba	55 (46.6)
	Igbo	30 (25.4)
	Hausa	2 (1.7)
	Calabar	1 (0.8)
	Delta	1 (0.8)
	Edo	6 (5.1)
	Efik	1 (0.8)
	Ibibio	3 (2.5)
	Idoma	1 (0.8)
	Ijaw	2 (1.7)
	Ikwerre	1 (0.8)
	Itsekiri	1 (0.8)
	Liberian	1 (0.8)
	Tiv	1 (0.8)
	Urhobo	1 (0.8)
	Nil	11 (9.3)
		N=118 (%)

3. Educational level	Primary education Secondary education Tertiary education Nil	3 (2.5) 35 (29.7) 78 (66.1) 2 (1.7)
4. Religion	Christianity Islam Traditional	106 (89.8) 10 (8.5) 2 (1.7) **N=118 (%)**
5. Marital status	Single Married Divorced Separated Widowed	11 (9.3) 101 (85.6) 2 (1.7) 3 (2.5) 1 (0.8) **N=118 (%)**
6. Number of children	<5 ≥5	117 (99.2) 1 (0.8) **N=118 (%)**
7. Occupation	Skilled Unskilled Nil	85 (72.0) 24 (20.3) 9 (7.7) **N=118 (%)**
8. Have you heard of malaria parasite before	Yes No I don't know	108 (91.5) 8 (6.8) 2 (1.7) N=118 (%)
9. Have you fallen sick during the course of this pregnancy?	Yes No	55 (46.6) 63 (53.4) N=55 (%)

10. If yes, how many times have you fallen sick during the course of this pregnancy?	Once Twice Thrice	41 (74.5) 8 (14.5) 6 (10.9) **N=55 (%)**
11. If yes, what do you think was the reason you became ill?	Due to malaria or its complications Due to non-malaria related causes Due to unknown causes	40 (72.7) 14 (25.5) 15 (27.3) **N=55 (%)**
12. Did you visit any health care facility?	Yes No	55 (100.0) 0 (0.0) **N=55 (%)**
13. Did you take any antimalarial drug?	Yes No	49 (89.1) 6 (10.9) **N=55 (%)**
14. If yes, name the drugs	Amalar Amartem and Amalar Artesunate Coartem Lonart DS Nil	10 (18.2) 6 (10.9) 3 (5.5) 3 (5.5) 27 (49.1) 6 (10.9) **N=55 (%)**

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue X October 2023

15. Did you get better after the treatment?	Yes No	55 (100.0) 0 (0.0) **N=118 (%)**
16. Did you have malaria in previous pregnancies?	Yes No	18 (15.3) 100 (84.7) **N=18 (%)**
17. Any associated complications?	Yes No	0 (0.0) 18 (100.0) **N=18 (%)**
18. Did you visit any health care facility?	Yes No	18 (100.0) 0 (0.0) **N=18 (%)**
19. Did you take any antimalarial drug?	Yes No	18 (100.0) 0 (0.0) **N=18 (%)**
20. If yes, name the drugs	ACT Amalar Amartem	3 (16.7) 6 (33.3) 9 (50.0) **N=18 (%)**
21. Did you get better after the treatment?	Yes No	18 (100.0) 0 (0.0) **N=118 (%)**
22. Do you clean your environment regularly?	Yes No	116 (98.3) 2 (1.7)
23. Do you live near swampy areas or stagnant water?	Yes No	20 (16.9) 98 (83.1) **N=118 (%)**
24. Do you make use of mosquito bed nets?	Yes No	62 (52.5) 56 (47.5) **N=62**

25. If yes, is the mosquito net treated?	Yes No I don't know	52 (83.9) 20 (16.1) 0 (0.0) **N=62**
26. Is the bed net a long-lasting insecticide net (LLINs)	Yes No I don't know	35 (56.5) 27 (43.5) 0 (0.0) **N=118 (%)**
27. Do you make use of any mosquito preventive measures?	Yes No	115 (97.5) 3 (2.5) **N=115 (%)**
28. If yes, which do you use?	Insecticides Mosquito repellant Mosquito coil	101 (87.8) 57 (49.6) 23 (20.0) **N=115 (%)**
29. RDT (HRP-2 SD Bioline)	Positive Negative	2 (1.7) 116 (98.3) **N=115 (%)**
30. RDT (HRP-2 Core start)	Positive Negative	3 (2.5) 115 (97.5) **N=115 (%)**
31. RDT (PLDH Core start)	Positive Negative	2 (1.7) 116 (98.3)

Table 1 shows the sociodemographic characteristics and responses to the research questions.

The mean age was 29.25±5.20 with age groups 18-29 and 30-39 being the most represented (48.3% each). The Yorubas predominated the study population (46.6%), followed by the Igbos (25.4%). Majority of the participants had tertiary education (66.1%) and were Christians (89.8%). 85.6% were married and 99.2% had less than 5 children. Most of the respondents were skilled (72.0%).

Almost all the participants (91.5%) had heard of malaria parasite in the past. Furthermore, 53.4% had fallen sick in their current pregnancy, and all (100.0%) visited a health care facility. 89.1% of them received antimalarial medications, with Lonart DS being the most prescribed (49.1%). They all got better after

treatment (100.0%). Only 15.3% of the respondents had malaria in previous pregnancies with no associated complications. They all took antimalarials from a healthcare facility (100.0%), with Amartem being the most prescribed (50.0%). All got better following treatment (100.0%). Majority of the respondents (98.3%) clean their environments regularly and 16.9% live near swampy regions. 52.5% make use of mosquito beds, 83.9% of which are treated and 56.5% specifically being long-lasting insecticide nets. Almost all the respondents (97.5%) make use of some mosquito preventive measures with insecticides topping the list (87.8%) and mosquito coil being the least utilized method (20.0%).

Rapid Diagnostic Test kits (RDTs) were used to test for malaria among the respondents. Only 1.7% tested positive for malaria using the HRP-2 SD Bioline and PLDH Core start test kits, while 2.5% using the HRP-2 Core start test kit.

Prevalence of malaria infection **(using microscopy which is the gold standard)** among pregnant women attending antenatal clinic in BUTH: 0.8%

Mean PCV among pregnant women attending antenatal clinic in BUTH: 34.05±3.78

Prevalence of anemia among pregnant women attending antenatal clinic in BUTH **(PCV cutoff for anemia in pregnancy: <33%):** 43.2%

Table 2: Chi-Square Statistics

SN	VARIABLES	CHI-SQUARE	*p-value*
1.	Age and microscopy result (prevalence of malaria)	1.079	0.782
2.	Age and anemia status (PCV)	5.475	0.140
3.	Level of education and microscopy result (prevalence of malaria)	0.517	0.915
4.	Level of education and anemia status (PCV)	2.756	0.431
5.	Microscopy result (prevalence of malaria) and anemia status (PCV)	0.768	0.381

Table 2 shows the chi-square statistics assessing the effect of age and level of education on the prevalence of malaria and anemia among women attending antenatal clinic in BUTH. There was no statistical significance (*p-value* >0.05). Furthermore, it also delineates the relationship between prevalence of malaria and anemia in the study population; there was however no statistically significant association (*p-value >0.05*).

DISCUSSION

The goal of this study is to determine the prevalence of malaria and anemia in the pregnant women attending antenatal clinics in BUTH (Babcock University Teaching Hospital, Ogun State. From the result, most of the mothers attending the clinic were either between 18-29(48.3%) or 30-39(48.3%). The majority of the participants of the experiment were Yoruba (46.6%) which is consistent with the fact that Ogun state is Yoruba predominant state, being in the South-West region of Nigeria.

A large percentage of the population of the population of the respondents were of tertiary education (66.1%) with most of them being skilled workers (72%).

From the chi-square test, there is no significant relationship between the age or the level of occupation of the respondents and the presence of malaria and anemia in pregnant women attending the antenatal clinic in the BUTH.

The respondents of the study showed adequate knowledge of the existence of malaria parasite (91.5%). This is due to a large portion of the study population being well educated. A large percentage of the study

population were Christians (89.8%). This can be attributed to the fact that BUTH is in a Christian faith-based institution.

46.6% of the respondents had fallen sick of during the course of the pregnancy and most of those who fell sick did so only once (74.5%). A majority of those who fell sick attributed the cause of the sickness to malaria or its complications. (72.7%) which was dissimilar to the study carried out by Enato, E. O., et al., in 2007 which had only 30% of it's study population attribute their sickness to malaria. Although, it was similar by the fact that almost all participants reported that the drugs taken were efficacious (98%).

The most used antimalarial drug used by the respondents were Lonart DS (49.1%). This is expected as Lonart DS (Atermether- Lumenfantrine) is the most commonly prescribed drug in uncomplicated malaria in Nigeria (Ezenduka, *et al*., 2014.)

CONCLUSION

This study has revealed that majority of the pregnant women attending the antenatal clinic at BUTH have been a proper awareness of Malaria Infection, its complication and preventive measures. 98.3% of these women cleaned their environment regularly, 83.1% do not live near swampy areas or stagnant water, 62% use mosquito bed nets, 87.8% use insecticides, 49.6% use mosquito and 23% use mosquito coil. This indicates that the antenatal clinic health education and awareness programs taking place every Monday and Wednesday is effective. It was also discovered that the clinics gives antimalarial prophylaxis drugs; Amalar, which has a sulfadoxine and pyrimethamine combination which acts via sequential blockade of folate synthesis in the malaria parasite. This drug is effective against strains of Plasmodium falciparum that are resistant to Chloroquine.

It is therefore safe to conclude that the effectiveness of the antenatal clinic at BUTH can be attributed to the low prevalence of malaria and anemia in their pregnant patients.

Conflict of interest: None declared

REFERENCES

1. Abudu, O. O. (2001). Textbook of obstetrics and gynaecology for medical students. (Vol. 11).
2. Achidi, E., Kuoh, A., Minang, J., Ngum, B., Achimbom, B., Motaze, S., Troye-Blomberg, M. (2005). Malaria infection in pregnancy and its effects on haemoglobin levels in women from a malaria endemic area of Fako Division, South West Province, Cameroon. Journal of Obstetrics and Gynaecology, 25(3), 235–240. https://doi.org/10.1080/01443610500060628
3. Agomo, C. O., Oyibo, W. A., Anorlu, R. I., & Agomo, P. U. (2009). Prevalence of Malaria in Pregnant Women in Lagos, South-West Nigeria. The Korean Journal of Parasitology, 47(2), 179–183. https://doi.org/10.3347/kjp.2009.47.2.179
4. Amadi, A., and (2012). All rights reserved. J. Appl. Sci. Environ. Manage. Dec, 16(4), 367–370. Retrieved from https://www.ajol.info/index.php/jasem/article/download/90990/80405
5. Anemia – Symptoms and Causes. (2019, August 16). Retrieved from Mayo Clinic website: https://www.mayoclinic.org/diseases-conditions/anemia/symptoms-causes/syc-20351360#:~:text=Anemia%20is%20a%20condition%20in
6. Anemia in Pregnancy: Causes, Symptoms, and Treatment. (2020). Retrieved March 15, 2021, from WebMD website: https://www.webmd.com/baby/guide/anemia-in-pregnancy#2-4
7. Aribodor, D. N., Nwaorgu, O. C., Eneanya, C. I., andAribodor, O. B. (2007). Malaria among primigravid women attending antenatal clinics in Awka, Anambra STATE; BUTH (Babcock University Teaching Hospital), FMC (Federal Medical Centre) Abeokuta and OOSUTH (Olabisi Onabanjo University Teaching Hospital), south-east Nigeria. Nigerian Journal of Parasitology, 28(1). https://doi.org/10.4314/njpar.v28i1.37854

8. Aso Joseph, O., Aso Oluwaseun O, O., Toluwalase J, I., Olayinka W, A., Tuesday, O., Adekunle O, A., andShesha, A. (2017). Malaria in Pregnancy: A Demographic and Clinical Surveillance at Mother and Child Hospital Ondo, South Western, Nigeria. Journal of Prevention and Infection Control, 03(01). https://doi.org/10.21767/2471-9668.100026
9. Bloland, P. B., Williams, H. A., and National Research Council (US) Committee on Population. (2015). Epidemiology of Malaria. Retrieved from Nih.gov website: https://www.ncbi.nlm.nih.gov/books/NBK221152/
10. Campbell, H., Byass, P., andGreenwood, B. M. (1987). BED-NETS AND MALARIA SUPPRESSION. The Lancet, 329(8537), 859–860. https://doi.org/10.1016/s0140-6736(87)91633-3
11. Centers for disease control and prevention (CDC). (n.d.). Malaria diagnosis (US)- Rapid diagnostic test. Retrieved 2018, from 1600 Clifton road atlanta, GA 30329-4027 USA 800-CDC- INFO
12. Centre for Disease Control and Prevention (CDC). (2019). Insecticide-treated bed nets. Retrieved from https://www.cdc.gov/malaria/malaria_worldwide/reduction/itn.html
13. Erhabor, O., Abdulrahaman, A., andErhabor, T. (2019). Effects of malaria parasitaemia on some haemostatic parameters among pregnant women of African descent in Specialist Hospital Sokoto, Nigeria. Human Antibodies, 1–8. https://doi.org/10.3233/hab-190389
14. Federal Ministry of Health. (2014). Nigeria National Malaria Control Strategic Plan. Retrieved from https://scholar.google.com/scholar_lookup?title=Nigeria+National+Malaria+Control+Strategic+Plan&publication_year=2014&
15. Federal Ministry of Health. Malaria situation analysis document. Nigeria: Federal Ministry of Health. p. 14. (2000). Retrieved from https://scholar.google.com/scholar_lookup?title=Malaria+situation+analysis+document&publication_year=2000&
16. Fondjo, L. A., Addai-Mensah, O., Annani-Akollor, M. E., Quarshie, J. T., Boateng, A. A., Assafuah, S. E., and Owiredu, E.-W. (2020). A multicenter study of the prevalence and risk factors of malaria and anemia among pregnant women at first antenatal care visit in Ghana. PLOS ONE, 15(8), e0238077. https://doi.org/10.1371/journal.pone.0238077
17. Kakkilaya. (2015, February 27). Malaria and Pregnancy. Retrieved January 11, 2020, from Malaria Site website: https://www.malariasite.com/pregnancy/
18. Kakkilaya. (2018). Malaria and pregnancy. Retrieved from https://www.malariasite.com/pregnancy/
19. NHS. (2018, August 24). Malaria – Complications. Retrieved from https://www.nhs.uk/conditions/malaria/complications/
20. NHS. (2018, August 24). Malaria – Complications. Retrieved March 9, 2021, from nhs.uk website: http://www.nhs.uk/conditions/malaria/complications/
21. Obi, Okangba, Nwanebu, Ndubuisi, and (2010). Premunition in Plasmodiumfalciparum malaria. African Journal of Biotechnology, 9(10), 1397–1401. https://doi.org/10.5897/ajbx09.034
22. Okwa, O. O. (2003). The Status of Malaria among Pregnant Women: A Study in Lagos, Nigeria. African Journal of Reproductive Health, 7(3), 77. https://doi.org/10.2307/3583292
23. Okwelogu, et al. (2012). Evaluation of knowledge, attitude and practices of pregnant women on malaria, intermittent preventive treatment and long lasting Insecticidal nets in Ihiala local government area of Anambra STATE; BUTH (Babcock University Teaching Hospital), FMC (Federal Medical Centre) Abeokuta and OOSUTH (Olabisi Onabanjo University Teaching Hospital), Nigeria | Nigerian Journal of parasitology. Retrieved from https://www.ajol.info/index.php/njpar/article/view/99503
24. Oladeinde, B. H., Omoregie, R., Odia, I., and Oladeinde, O. B. (2012). Prevalence of Malaria and Anemia among Pregnant Women Attending a Traditional Birth Home in Benin City, Nigeria. Oman Medical Journal, 27(3), 232–236. https://doi.org/10.5001/omj.2012.52
25. Omo-Aghoja, L., Aghoja, C., and Oghagbon, K. (2008). Prevention and treatment of malaria in pregnancy in Nigeria: obstetrician's knowledge of guidelines and policy changes-a call for action. Journal of Chinese Clinical Medicine, 3(2), 114-120.
26. Onoriode, et al. (2015). Determinants of use of insecticide-treated nets among pregnant women in Nigeria. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4492654/
27. Oyetunde, O., Akinwale, F., and (2015). Comparative assessment of microscopy and rapid diagnostic tools. Research journal of parasitology 10: 120-126.

28. Perry, K., andMorrison, J. (2004). Volume 3, Chapter 16. Anemia Associated with Pregnancy. Retrieved March 17, 2021, from glowm.com website: https://glowm.com/resources/glowm/cd/pages/v3/v3c016.html
29. Sotimehin, S. A., Runsewe-Abiodun, T. I., Oladapo, O. T., Njokanma, O. F., and Olanrewaju, D. M. (2008). Possible Risk Factors for Congenital Malaria at a Tertiary Care Hospital in Sagamu, Ogun STATE; BUTH (Babcock University Teaching Hospital), FMC (Federal Medical Centre) Abeokuta and OOSUTH (Olabisi Onabanjo University Teaching Hospital), South-West Nigeria. Journal of Tropical Pediatrics, 54(5), 313–320. https://doi.org/10.1093/tropej/fmn016
30. Tankeshwar, A. (2017, November 12). Thick and Thin Blood Smear for Malaria diagnosis – Microbeonline. Retrieved from Microbeonline website: https://microbeonline.com/microscopic-diagnosis-of-malaria/
31. TER KUILE, et al. (2003). Reduction of malaria during pregnancy by permethrin-treated bed nets in an area of intense perennial malaria transmission in western Kenya. The American Journal of Tropical Medicine and Hygiene, 68(4_suppl), 50-60. doi:10.4269/ajtmh.2003.68.50
32. Ugwu, E. O., Dim, C. C., Uzochukwu, B. S., Iloghalu, E. I., andUgwu, A. O. (2014). Malaria and anaemia in pregnancy: a cross-sectional study of pregnant women in rural communities of Southeastern Nigeria. International Health, 6(2), 130–137. https://doi.org/10.1093/inthealth/ihu009
33. Uneke, C. J. (2007). Congenital Plasmodiumfalciparum malaria in sub-Saharan Africa: a rarity or frequent occurrence? Parasitology Research, 101(4), 835–842. https://doi.org/10.1007/s00436-007-0577-9
34. Uneke, C. J., Iyare, F. E., Oke, P., & Duhlinska, D. D. (2008). Assessment of malaria in pregnancy using rapid diagnostic tests and its association with HIV infection and hematologic parameters in South-Eastern Nigeria. Haematologica, 93(1), 143–144. https://doi.org/10.3324/haematol.11695
35. WHO. (2020, November 30). Malaria. Retrieved from Who.int website: https://www.who.int/news-room/fact-sheets/detail/malaria
36. World Health Organisation. (2010). World Malaria Report 2010. Retrieved from malariaepidemiology.com
37. World malaria report 2012. (2013). In WHO. Retrieved