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Original Article

Prevalence And Risk Factors for Malaria Parasitaemia in Pregnant Women Attending Antenatal Clinic in Primary Health Centres in Keffi, Nigeria.

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Abstract

Background: Malaria is a disease of public health importance especially in the Tropical and the subtropical parts of the world. Though malaria in pregnancy is a preventable and treatable disease, the largest burden of malaria in pregnancy is found in sub-Saharan Africa with the women in pregnancy having greater severe malaria infection as well as associated feto-maternal morbidity and mortality. Early detection of malaria infection in pregnant through microscopy and prompt treatment is thus necessary to avert the detrimental results. **Objectives**: To determine the prevalence and risk factors of malaria parasitaemia among pregnant women attending booking clinic in Primary Health Care Centres in Keffi, Nigeria. **Methodology**: The study was a descriptive cross-sectional design carried out between March 1st, 2022, and May 31st, 2022, in Keffi Local Government Area of Nasarawa State, Nigeria. Data was collected using a structured interviewer administered questionnaire, blood sample was taken for blood film microscopy, and these were entered into the statistical package for social sciences (IBM SPSS) version 26 and analyzed. **Results:** Four hundred and thirty-six pregnant women (436) had complete data of which 333 of them (76.38%) tested positive for malaria parasitaemia. The mean malaria density was 681parasites/uL (2+ of parasite) with the age group 25-29yrs and second trimester having the highest malaria parasitaemia. Those who had no formal education had the lowest malaria parasitaemia. There was no statistical significance between age, gravidity, gestational age at booking, educational level, income, and use of ITNs. **Conclusion:** Malaria in pregnancy is hyperendemic in Keffi, North Central Nigeria. Due to the severe nature of Malaria in pregnancy and the on towards effect to the mother, fetus and the neonate, there is the need for early booking of pregnant women to identify women who have the parasite, treat accordingly, and prevent malaria as the pregnancy advances. Also, continuous Health Education for women of childbearing age is needed.

Keywords: Malaria Parasitaemia, Pregnancy, Prevalence, Keffi, Nigeria.

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Introduction

Tropical and also the subtropical parts of the world have malaria in pregnancy as a serious public health concern.[1] Though malaria is a preventable and treatable disease, the largest burden of malaria in pregnancy is found in sub-Saharan Africa with their women in pregnancy having greater severe malaria infection in comparison to those women who are not pregnant and a mortality rate ranging from 1%-50 %.[2,3,4]

In 2021, approximately 40 million pregnancies occurred across 38 malaria endemic African countries and 13.3million (32%) were exposed to malaria infection during pregnancy. [5] Malaria in pregnancy is recognized as an infection that jeopardizes outcome of pregnancy leading to unfavourable results in and outside pregnancy in the mother, her foetus and the newborn. [6] This includes anaemia in pregnancy, acute pulmonary oedema, renal failure, puerperal sepsis, post-partum haemorrhage, intrauterine fetal growth retardation, preterm delivery, still birth, spontaneous abortion, and low birth weight.[7]

Female anopheles mosquitoes are ubiquitous in sub-Saharan Africa and transmit plasmodium species which cause malaria. There are 4 major Plasmodium types that cause malaria in man. In Nigeria, 98% of cases of malaria are caused by Plasmodium Falciparum with severe morbidity and mortality.[8] pregnant women are prone to reduced immunity to malaria in pregnancy which increases their susceptibility to malaria infection. Early detection of malaria infection in pregnant through microscopy and prompt treatment is thus necessary to avert the detrimental results. Testing women at Antenatal booking will help identify those with the malaria parasite and with their prompt treatment, avert adverse maternal and fetal outcomes. Also, determination of risk factors for malaria in pregnancy could help prevention of malaria early in pregnancy thereby reducing both the adverse outcomes and the malaria burden. This study aimed to determine the percentage of clinically diagnosed pregnant women with malaria at booking, using microscopy and also determined risk factors in same women.

Materials and Methods

This was a descriptive cross-sectional study among pregnant women booking for antenatal clinic in randomly selected Primary health care centres in Keffi local government area of Nasarawa state, Nigeria from 1st March, 2022 to 31st May 2022. Women that gave consent and met the inclusion criteria were consecutively selected. The exclusion criteria were women who took anti-malarias two weeks before booking and women who are HIV Positive. The sample size was calculated using the Fisher's formula [9] and a previous study by Fana et al[10] that showed the proportion of women with malaria parasitaemia to be 41.5%. An attrition level of 20% was added. Four hundred and fifty pregnant (450) women were consecutively recruited from the booking antenatal clinic of 6 randomly selected Primary Health centres using the multistage sampling techniques. There are 10 wards and 19 PHC's in Keffi LGA of Nasarawa state. Using the Simple Random Sampling technique 6 wards were chosen from the 10 wards. A PHC was chosen using the simple random sampling from each ward.

Consecutive Sampling technique was used in each of the PHC's to select the pregnant women. An interviewer administered questionnaire was used to collect information from the pregnant women following a written consent and subsequently blood samples were taken for malaria parasites. The questionnaire contained information on the women's socio-demographic and obstetrics status.

The data generated was entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 26. Frequency tables and charts were generated for univariate analysis. Pearson Chi –Square test was used to determine the association between qualitative variables and a P-value of < 0.05 was considered statistically significant.

Ethical clearance was obtained from the ethical committee of the Bingham University Karu and the Keffi Local Government authorities.

Results

450 pregnant women were select for this study out of which 436 women had complete questionnaires and laboratory results. Only 333 women (76.38%) were positive for malaria parasite.

The mean ages fell between 25–29 years. The predominant tribe was Hausa/ Fulani (55.5%) while 58.3 % were housewives. Less than half of the women (43.8%) had secondary level of education while 11.9% of the pregnant women had no formal education. Most of the women test earned less than #2,000 (57.1%). (Table 1)

About one third of the women (31.7%) were in their third and fourth pregnancy. More than 80% of the women booked in their second and third trimester of pregnancy (Table 2).

Malaria parasitaemia prevalence was 76.38% (n-333) with the age group 25 – 29 years having the highest prevalence of malaria parasitaemia. Those with secondary level of education and income less than# 2,000 had the highest prevalence of malaria

Table 1: Sociodemographic characteristics of respondents

	Malaria Parasitaemia					
	Negative	Positive	Total	Mean density	χ^2	p value
Age range					10.011	0.055
<20	5 (4.9%)	29 (8.7%)	34 (7.8%)	604		
20-24	24(23.3%)	85 (25.4%)	109 (25%)	777		
25-29	30(29.1%)	102 (30.6%)	132 (30.3%)	622		
30-34	21 (20.4%)	81 (24.3%)	102 (23.4%)	838		
35-39	15(14.6%)	27 (8.1%)	42 (9.6%)	513		
>39	8 (7.8%)	9 (2.7%)	17 (3.9%)	216		
Total	103(100%)	333 (100%)	436 (100%)	681		
Tribe					4.131	0.531
Hausa/Fulani	62 (60.2%)	180 (54.1%)	242 (55.5%)	662		
Igbo	3 (2.9%)	21 (6.3%)	24 (5.5%)	1060		
Yoruba	1 (1.0%)	11 (3.3%)	12 (2.8%)	761		
Eggon	8 (7.8%)	27 (8.1%)	35 (8.0%)	653		
Mada	3 (2.9%)	14 (4.2%)	17 (3.9%)	996		
Others*	26 (25.2%)	80 (24.0%)	106 (24.3%)	589		
Total	103(100%)	333 (100%)	436 (100%)	681		
Occupation					1.333	0.932
Housewife	61 (59.2%)	193 (58.0%)	254 (58.3%)	626		
Trader	23 (22.3%)	78 (23.4%)	101 (23.2%)	880		
Farmer	1 (1.0%)	7 (2.1%)	8 (1.8%)	812		
Civil servant	8 (7.8%)	19 (5.7%)	27 (6.2%)	609		
Private worker	5 (4.9%)	16 (4.8%)	21 (4.8%)	678		
Others**	5 (4.9%)	20 (6.0%)	25 (5.7%)	480		
Total	103 (100)	333 (100)	436 (100%)	681		
Educational level					5.663	0.129
Primary	20 (19.4%)	78 (23.4%)	98 (22.5%)	882		
Secondary	42 (40.8%)	149 (44.7%)	191 (43.8%)	583		
Tertiary	22 (21.4%)	73 (21.9%)	95 (21.8%)	691		
No formal Education	19 (18.4%)	33 (9.9%)	52 (11.9%)	642		
Total	103(100%)	333 (100%)	436 (100%)	681		
Income					6.007	0.306
<#2,000	55 (53.4%)	194 (58.3%)	249 (57.1%)	697		
#2,000-#4999	11 (10.7%)	46 (13.8%)	57 (13.1%)	882		
#5,000-#9,999	13 (12.6%)	34 (10.2%)	47 (10.8%)	645		
#10,000 - #14,999	9 (8.7%)	15 (4.5%)	24 (5.5%)	446		
#15,000 - #19,999	1 (1.0%)	10 (3.0%)	11 (2.5%)	319		
>#20,000	14 (13.6%)	34 (10.2%)	48 (11.0%)	594		
Total	103(100%)	333 (100%)	436 (100%)	681		

Note: X^2 is chi square, while p value < 0.005 was considered statistically significant.

Table 2: Obstetric characteristics of the respondents.

	Malaria parasitaemia					
	Negative	Positive	Total	Mean density	χ^2	p value
Parity					2.014	0.57
Primi	16(15.5%)	59 (17.7%)	75 (17.2%)	442		
1-2	28(27.2%)	107 (32.1%)	135 (31.0%)	725		
3-4	38(36.9%)	100 (30.0%)	138 (31.7%)	728		
>4	21(20.8%)	67 (20.1%)	88 (20.2%)	744		
Total	103(100%)	333 (100%)	436 (100%)	681		
Trimester					1.176	0.555
<14	22 (21.4%)	61 (18.3%)	83 (19.0%)	571		
14-26	51 (49.5%)	185 (55.6%)	236 (54.1%)	759		
>26	30 (29.1%)	87 (26.1%)	117 (26.8%)	603		
Total	103(100%)	333 (100%)	436 (100%)	681		

parasitaemia (Table 1). Gravida one and two and second trimester of pregnancy had the highest prevalence of malaria parasite (Table 3).

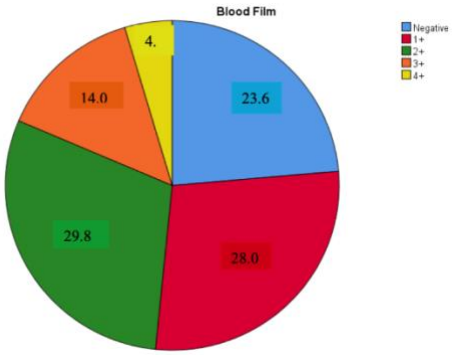

Figure 1: Blood film grading of malaria parasitaemia among respondents in percentage

Note: All respondents with positive malaria parasitaemia had Plasmodium falciparum.

Table 3: ITNs possession/use among the pregnant women and malaria parasitaemia.

	Blood film positivity				
	Negative	Positive	Total	χ^2	p value
ITNs possession				1.227	0.268
Yes	72 (69.6%)	251(75.4%)	323 (74.1%)		
No	31 (30.1%)	82(24.6%)	113 (25.9%)		
Total	103 (100%)	333(100%)	436 (100%)		
ITNs use				0.389	0.533
Yes	70 (68.0%)	237(71.2%)	307 (70.4%)		
Everyday	55 (78.6%)	201(84.8%)	256 (83.4%)		
Often	5 (7.1%)	15 (6.3%)	20 (6.5%)		
Occasionally	10 (14.3%)	20 (8.4%)	30 (9.8%)		
Others	0 (0.0%)	1 (0.4%)	1 (0.3%)		
No	33 (32.0%)	96(28.8%)	129 (29.6%)		
Total	103 (100%)	333(100%)	436 (100%)		

There was no statistical significance between the age, the parity (gravidity), level of education, income (Table 1) and use of ITN among respondents and malaria parasitaemia (Table 3).

Only Plasmodium falciparum (100%) was isolated from the women. 29.8% of the respondents had 2 + of malaria parasite. The Mean Parasite Density among the women was 681 parasites /uL of blood which is about 2 + of parasites (Fig 1).

Discussion

A high malaria parasitaemia prevalence of 76.38% was found among the Pregnant women in this study signifying a strong evidence of malaria parasitaemia as highly prevalent and hyperendemic in the rural communities of Keffi, North Central Nigeria. This high prevalence rate findings is higher than reports of studies in some North central states of Nigeria [11,12], north western states [10,13-15] ,Southern part [16,17] and also in some African Countries.[18-24] It contrasts sharply with a study done in Lagos among pregnant women booking in the antenatal clinic.[25] It however was consistent with study findings in Sokoto [26], Gombe [27], Osogbo [28], and Enugu.[29,30]

The high prevalence might be due to the high temperature in Keffi and thus high breeding of mosquitoes. This study was also community based in a Public Health centre where many rural dwellers attended. Rural settings from studies have been shown to often favour high rates of parasite multiplication and transmission.[31]

The age group 25-29yrs had a high malaria parasitaemia rate which was in contrast with most studies that had findings of a younger age group.[10,12,14,25,32]This age group had the highest number of booking women and this may have affected prevalence rate. Age was however not statistically significant and not associated with the malaria parasitaemia prevalence.

Second trimester of pregnancy had a high prevalence rate in keeping with some studies.[10,14,33,34] The mean parasite density was highest in the second trimester although majority of the pregnant women in this study booked in the second trimester. This is a common practice in Nigeria and Africa at large.[35,36] The gestational age at booking was however not significantly associated with the malaria parasitaemia. (x^2=2 1.176 P=0.555,), although some studies on malaria burden in pregnancy have reported high prevalence in the first and second trimester.[32]

Contrary to studies which found higher malaria parasitaemia among primigravidae compared to the multigravida this study found higher parasitaemia among the multigravida and higher mean parasite density with increase gravidity. This could be due to the hyperendemic nature of malaria parasite in this environment and the fact that the primigravidae may have used antimalarials before booking .[13]However gravidity was not statistically associated with malaria parasitaemia. (x^2=2.014 , P=0.57)

Pregnant women with secondary level of education had a high malaria parasitaemia followed by those with primary level of education. This contradicts studies which showed no formal education or low level of education having the highest prevalence rate [30,37]but agrees with the study in Lagos[14] and Abuja [12]. There was no statistical significance between educational level and malaria parasitaemia as found in the Lagos.[14] The respondents with primary education had a mean parasite density of 882 parasite/uL compared with women with no formal education who had a mean malaria density of 642 parasites/uL. Those with secondary education however had the lowest mean density of parasites of 583 parasites/uL. The low mean density might be due to the use of anti-malaria drugs before booking. Good knowledge and correct application of knowledge by the women with no formal education might be responsible for the low malaria parasitaemia in pregnancy. Studies have shown that people can acquire good knowledge of malaria irrespective of educational status.[38]

This study also showed *Plasmodium falciparum* to be the only malaria specie responsible for malaria in pregnancy. This is consistent with many of the findings in studies in Nigeria [14,17,28,34,39-44]and also confirms *P. falciparum* as the predominant Plasmodium specie in sub-Saharan African.[45]The mean parasite density in this study was 681 parasite/uL of blood. It shows the hyperendemicity of malaria in this environment and the high risk for malaria infestation.

Women who earned less than #2,000 had malaria parasitaemia prevalence of 57.1%, the highest among the income group which agrees with study findings by Abdalla [46] which found that malaria prevalence was higher among those with lower income compared with those with higher income. It could be due to better education and thus more resources at hand to buy antimalarial drugs and prevent malaria infection. A study conducted in Southwestern Region of Cameroon [47], found income level to be directly proportional to mean parasite density of malaria. The study attributed the high malaria parasite density and prevalence among the low-income earners in Brazil to poverty level and low socio-economic states of individuals and felt the poor often have little or no access to health services especially in the rural areas. [48] The income of the women was however not associated with the prevalence of malaria which contradicts the study by Nyasa.[47]

Conclusion

Malaria is hyperendemic in Keffi, North Central Nigeria and found not to be statistically associated with socio-demographic factors like age, gravidity, age at booking, educational level, income, and the use of ITN. Due to complications of malaria in pregnancy on mother and fetus, early booking of mothers is advocated for and continuous health education on the environmental control, proper and adequate use of ITNs and

intermittent preventive therapy in pregnancy with Sulphadoxine-Pyrimethamine (IPT_p-SP).

Conflict of interests

There was no conflict of interest.

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References

1. Okogun G.R.A, Ugwuoke Hilary and ChidiIbhafidon Esther. Burden of malaria parasitaemia among pregnant women in Iruaa Specialist teaching hospital, Irrua, Edo State, Nigeria. Der Pharmacia letter, 2015;7 (10): 30-38
2. Omokanye LO, Saidu R, Jimoh A.A.G, Salaudeen A, Lawal S.I, Raji HO etal. The relationship between socio-demographic characteristics and malaria parasite density among pregnant women in Ilorin, Nigeria. Int J. Trop med 2012; 7(2): 64-68.
3. Schantz- Dunn J, Noor NM. Malaria and Pregnancy. A Global Health Perspective- Rev. ObstetGynecol 2009; 2 (3):189-192.
4. World Health Organization. Guidelines for the treatment of malaria. Geneva= world Health Organization, 2006
5. W.H.O. World Malaria Report 2022. Geneva: World Health Organization; 2022.Licence:CCBY-NC-SA 3.0 IGO.
6. MockenhauptF.P,UlmenU,VonGaertnerC,etal. Diagnosis of Placental Malaria. J.Clin microbial 2002; 40 (1): 306-308
7. Desai M, TerKuile FO, Nosten F, et al Epidemiology and burden of malaria in pregnancy. Lancet Infect Dis 2007; 7 (2): 93-104
8. Federal Ministry of Health. National malaria control program in Nigeria. Roll back malaria Annual Report. Abuja: malaria control program, Federal Ministry of Health, 2005: 8-9
9. Bartlett J et al.(2000).Organizational Research: Determining Appropriate Sample Size in Survey Research. Retrieved April 28,2021 from: htttp://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1486.8295&rep=rep1&type=pdf.
10. Fana SA, Bunza MDA, Anka SA, Imam AU, Nataala SU. Prevalence and risk Factors associated with malaria infection among pregnant women in a semi-urban community of North-Western Nigeria. Infectious Diseases of Proverty. 2015;4:24. DOI 10. 1186/s40249-015-0054-0
11. Isah AY, Amanabo MA, Ekele BA. Prevalence of malaria parasitaemia amongst asymptomatic pregnant women attending a Nigerian teaching Hospital. Ann Afri Med. 2011; 10:171-4
12. Ogbu G I, Aimakhu C.O, Ajen A.S, Ngwan S, and Ogbu D.A. Prevalence of malaria parasitaemia among asymptomatic women at booking visit in a tertiary hospital, North central Nigeria. J. ReprodBiol Health. 2015; 3:1. http://dx.doi.org/10.7243/2054-0841-3-1
13. GajidaAU,Iliyasu Z, Zoakah A I. Malaria among antenatal clients attending primary health care facilities in Kano state, Nigeria. Annals of African Medicine. 2010;9(3):188-93. DOI:10.4103/1596-3519.68352.
14. Udomah F.P, Isaac I.Z, Iukman I, Nwobodo d, Erhabor O, etal. Plasmodium parasitaemia among pregnant women attending Antenatal Clinic in Sokoto, North Western Nigeria. Journal of Nursing Science. 2015; 1(1):9-14.
15. Umaru ML, Uyaiabasi GN. Prevalence of malaria in patients attending the general hospital Makarfi, Makarfi, Kaduna State; North- Western Nigeria, American Journal of Infectious Disease and Micro-biology 2015; 3(1): 1-5
16. Agan, T. U., Ekabua, J. E., Udoh, A. E., Ekanem, E. I., Efiok, E. E., &Mgbekem, M. A.. Prevalence of anemia in women with asymptomatic malaria parasitaemia at first antenatal care visit at the University of Calabar Teaching Hospital, Calabar, Nigeria. *Int J Women's Health* (2010); *2:* 229-33.
17. Usip LPE, Okonkwo I.G, Ubulom P.E, Bassey E.B, Adam E.G, Okoro M.F. Knowledge, risk factors and prevalence of malaria in pregnancy among women attending antenatal clinics in Uyo metropolis, AkwaIbom State, Nigeria. Int J of Pregnancy and Childbirth (IJPC). 2021;2(1) : 008-016.
18. Accrombessi M, Fievet N, Yovo E, Cottrell G, Agbota G, et al. Prevalence and Associated Risk factors of malaria in the first trimester of pregnancy: A Preconceptional Cohort study in Benin. JID 2018:217:1309-17 DOI:10.1093/infdis/jiy009
19. Fondjo LA, Addai-Mensah O, Annani- Akollor ME, Quarshie JT, Boateng AA, et al. A Multicenter study of the prevalence and risk factors of malaria and anaemia among pregnant women at first antenatal care visit in Ghana. PLUS ONE 2020;15(8): e 0238077. https://doi.org/10.1371 journal.pone.0238077.
20. Gontie GB, Wolde HF, Baraki A G. Prevalence and associated factors of malaria among pregnant women in Sherkole district, BenishangulGumez regional State, West Ethiopia. BMC Infectious Diseases.2020; 20:573 https://doi.org/10.1186/s12879-020-05289-9.
21. Mosha JF, Lukole E, Charlwood JD, Wright A, Rowland M, et al. Risk factors for malaria infection, prevalence and household vector density between mass distribution campaigns of long-lasting insecticidal nets in North-Western Tanzania. Malar J .2020; 19: 297. https://doi.org/10.1186/s12936-020-03369-4.
22. Nyamu GW, Kihara JH, Oyugi EO, Omballa V, EL-Busaidy H, Jeza VT. Prevalence and risk factors associated with asymptomatic Plasmodium falciparum infection and anemia among pregnant women at the first antenatal care visit: A hospital based cross-sectional study in Kwale Country, Kenya. PLOS ONE 2020; 15 (10): e0239578 https://doi.org/10.1371/journal. pone 0239578
23. Toure AA, Doumbouya A, Diallo A, loua G, Cisse A, et al. Malaria-Associated factors among pregnant women in Guinea. Hindawi Journal of Tropical Medicine. Volume 2019, Article ID 3925094, 9pages. https://doi.org/10/1155/2019/3925094
24. Yaro J.B, Ouedraogo A, Diarra A, Sombie S, Ovedraogo A, et al. Risk factors for Plasmodium falciparum infection in pregnant women in Burkina Faso: a community-based cross-sectional survey. Malar J. 2021; 20:362. https://doi.org/10.1186/s12936-021-03896-8
25. Agomo CO and Oyibo WA. Factors associated with risk of malaria infection Among Pregnant Women in Lagos, Nigeria. Infectious Diseases of poverty. 2013;2:19. http://www.idpjournal .com/content 2/1/19.
26. Faruku N, Magaji UF, Bunza NM, Bello M. Parity and malaria parasitaemia among pregnant women attending

ANC, UDUTH Sokoto. International Journal of Medical and Health Research 2016;2(9):61-64
27. Sarki A, Pukuma M.S, Yoriyo K.P, Kunihya I.Z, Hafizu M.S et al. Study on malaria infection in pregnant women attending Primary Health care centres in Gombe Metropolis, Gombe State, North-East, Nigeria .FUDMA Journal of sciences. 2019; 3(4): 90-97.
28. Adefioye OA, Adeyeba O.A, Hassan W.O and Oyeniran O.A. Prevalence of malaria parasite infection among pregnant women in Osogbo, South West, Nigeria. Am-Euras J. Sci Res. 2007; 2(1): 43-45
29. Gunn J.K.L, Ehiri J.E, Jacobs E.T, Ernst K.C, Pettygrove S et al. Population-based prevalence of malaria among pregnant women in Enugu State, Nigeria: the Healthy Beginning Initiative. Malar J. 2015;14:438 DOI 10.1186/s12936-015-0975-x
30. Ugwu O.E, Dim C.C, Uzochukwu BS, IIoghalu IE, Ugwu A.O. Malaria and anaemia in pregnancy: a cross-sectional study of pregnant women in rural communities of southeastern Nigeria. Int Health 2014 doi:10.1093/inthealth/ihu009
31. Nwagha VI, Ugwu VO, Nwagha TU et al. Asymtomatic Plasmodium parastaemia in pregnant Nigerian woman: almost a decade after roll back malaria. Trans R SOC Trop Med Hyg. 2009; 103: 16-20.
32. Takem EN, D'Alessandro U. Malaria in Pregnancy. Mediterr J Hemato/Infect Dis. 2013;5(1)
33. Bello FA, Agende AI. Prevalence of malaria parasitaemia and the use of malaria prevention measures in pregnant women in Ibadan, Nigeria. Annals of Ibadan Postgraduate Medicine. 2019;17(2):124-129.
34. Tayo A O, Akinola O.I, Shittu LAJ, Ohun T.A, Bankole M.A, Akinola R.A, ShittuR.K ,Okunribido A.I. Prevalence of malaria parasitaemia in the booking antenatal (ANC) patients at the Lagos State University teaching Hospital. African journal of Biotechnology 2009;8(15): 3628-3631.
35. Elom MO, Nworie A, Ozougw JC, Ibiam GA, Usanga VU et al. Differences in malaria parasitaemia among pregnant women visiting Antenatal clinics of a Tertiary Health facility in South Eastern Nigeria. Influence of some pregnancy related factors. World Journal of Medical Sciences 2017; 14(1):08-12. DOI:10.5829/idosi.wjm.2017.08.12.
36. Nwonwu EU, Ibekwe PC, Ugwu JI, Obarezi HC, Nwagba OC. Prevalence of malaria parasitaemia and malaria related anaemia among pregnant women in Abakaliki, South East Nigeria. Nigeria Journal of Clinical Practice 2009; 12(2):182-186.
37. Osaro E, Abdullahi A, Tosan E; Charles A.T. Risk factors associated with malaria infection among pregnant women of African Descent in Specialist Hospital Sokoto, Nigeria. ObstetGynecolInt J. 2019: 10(4): 274-280. DOI: 10.15406/ogij. 2019.10.00454.
38. Awosolu, O.B., Yahaya, Z.S., Haziqah, M.T.F., Simon-Oke, I.O.,&Fakunle, C. A cross-sectional study of the prevalence, density, and risk factors associated with malaria transmission in urban communities of Ibadan, Southwestern Nigeria. Heliyon 7, e05975.https://doi.org/10.1016/j.heliyon.2021.e05975
39. Awolola T.S, Oyewole I.O, Koekemoer LL, Coetzee M. Identification of three members of the Anopheles funestus (Diptera: Culicidae) group and their role in malaria transmission in two ecological zones in Nigeria. Trans R Soc Trop Med Hyg. 2005; 99:525-531.
40. Bassey G, NyengidikiT.K , John C.T. Prevalence of placenta Plasmodium parasitaemia and pregnancy outcome in Asymptomatic Patients at Delivery in a University Teaching Hospital in Nigeria. Niger J. ClinPract. 2015;18:27-32.
41. Falade C.O, Olayemi O, Dada-Adegbola HO, Aimakhu CO, Ademowo OG and Salako LA. Prevalence of malaria at booking among antenatal clinics in a Secondary health Care facility in Ibadan, Nigeria. Africa Journal of Reproductive Health. 2008; 12(2): 141-151.
42. Idowu OA, Sokunbi OA, Babalola AS. Prevalence of Malaria at Booking among Antenatal Clinics in a Secondary Health care facility in Abeokuta, Nigeria. Clinics Mother Child Health. 2015;12:2 .http://dx.doi.org/10.4172/2090-7214,1000177.
43. Onyabe DS, Conn JE. The distribution of two major malaria vectors Anopheles gambiae and Anopheles arabiensis in Nigeria. Med Inst.Oswaldo. Cruz. Rio de Jainero. 2001;96:1081 - 1084.
44. Wogu M.D and Diofelo E.E. Some socio-demographics and malaria parasitaemia among pregnant women at their first antenatal care visit in Warri, Nigeria. Journal of Basic and Applied Sciences .2016;2(1): 62-74.
45. Iwueze MO. Okwusogu MI, Onyido AE, Okafor FC, NwaorguO.C ,Ukibe S.N. Prevalence, Intensity and Clinical profile of malaria among pregnant women attending Antenatal clinics in Onitsha North Local Government Area, Anambra State, Southern Nigeria. The Bioscientis.2014;2(1):17-9.
46. Abdalla, E.A.M., Abdalla, L.A.M.&Eltayeb, W.A.H.. Prevalence and possible risk factors of malaria among pregnant women attending to Antenatal care at Umttalha Health centre in Gezira State-Sudan. *Journal of Pharmacy and Biological Sciences*. (2017); *12*(3): 67-72. https://doi.org/ 10.9790/3008-1203056772.
47. Nyasa, R.B., Fotabe, E.L.,&Ndip, R.N. (2021).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, 16(5): 0251380.https://doi.org/10.1371/journal, pone 0251360
48. Donald, S. Economic and Social of malaria in new colonization projects in Brazil. Social Science & Medicine. (1993); 37(9): 1131-6.