UJMR, Vol. 8 No. 2, December, 2023, pp. 8 – 14

E-ISSN: 2814 – 1822; P-ISSN: 2616 – 0668

https://doi.org/10.47430/ujmr.2382.002

Received: 03 August 2023 **Accepted:** 10 September 2023

Prevalence and Risk Factors Associated With Malaria among Pregnant Women Attending Selected Public Health Facilities within Katsina Metropolis, Katsina State, Nigeria

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Abstract

Malaria remains a major threat and concern for public health, especially in developing countries. This study was aimed at determining the prevalence and risk factors associated with malaria among pregnant women within Katsina metropolis. The study was conducted among 400 antenatal attendees in selected public health facilities within Katsina metropolis from January, 2022 to June, 2022. Venous blood sample was collected from each consenting participant, immediately dispensed into EDTA containers and transported to the laboratory for further analysis. The samples were screened microscopically for Plasmodium parasites. Risk factors, socio-demographic information and other maternal characteristics of the participants were obtained using questionnaires. The BMI of the pregnant women was also calculated using the BMI calculator after measuring their weights and heights. The data were analyzed using descriptive statistics, Chi-square test, Fishers exact test and odd ratio analysis at p ≤ 0.05 level of significance. The overall prevalence of malaria was 24.25%. The major factors that are found to have significant association with malaria prevalence in the study area were level of education, occupation, BMI and spraying of insecticide before sleeping (P<0.05). Prior knowledge of malaria is not associated with its prevalence while prior knowledge of anaemia is extremely associated with its prevalence in the study area. The only risk factor for the co-existence of malaria and anaemia in the study area is parity status. Consequently, consistent environmental cleaning and raising awareness among expectant mothers will go a long way towards reducing, if not completely eliminating, malaria in the study area.

Keywords: Malaria, Pregnant, Women, Risk factors, Blood

INTRODUCTION

Malaria is one of the most widespread parasitic diseases worldwide. It is responsible for approximately two hundred and forty one million clinical cases each year (WHO, 2019). It is a potentially fatal parasitic illness brought on by parasites of the genus Plasmodium that are transmitted to the vertebrate host by the infected bite of the vector mosquito, a female Anopheles mosquito. There are five species of *Plasmodium* responsible for malaria in humans: *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae and Plasmodium knowlesi* (WHO, 2016). Although *P. vivax* predominates outside of Africa, *P. falciparum* is the parasite that causes the majority of fatalities worldwide and is the most common on the African continent (WHO, 2019). Each year, this illness kills several million people globally, the majority of whom live in sub-Saharan Africa (Schantz-Dunn and Nour, 2009). Recent data show that Nigeria accounted for twenty seven percent of malaria cases and twenty three percent of malaria deaths globally (WHO, 2020). Immune compromised people, pregnant women, and children under 5 years of age are the most vulnerable (Hartman *et al.*, 2010). In Africa, specifically the endemic areas, millions of pregnant women are at risk of malarial attack (WHO, 2016). This is due to poor sanitation habit and resistance of *Plasmodium* species to various drugs. Pregnant women have a high susceptibility to being infested with *P. falciparum*. These results in high frequency of malaria episodes with a high parasite density compared to non-pregnant women (Ugwu *et al.*, 2014).

In view of the consequences of malaria during pregnancy, it is important that pregnant women living in malaria endemic areas be on malaria prophylaxis (Hellgren and Rombo, 2010). In sub-Saharan Africa, WHO has recommended prevention strategies during pregnancy based on the administration of intermittent preventive treatment to all pregnant women during antenatal care visits

from the beginning of the second trimester and the use of insecticide-treated bed nets (Yaya *et al.*, 2018). The prevalence of malaria as a major cause of anemia in pregnant women in malaria endemic regions, needs to be fully elucidated in all localities.This will help policy makers to know if the control measures put in place are working to reduce their prevalence. Therefore, against this background, studies on the prevalence and associated-risk factors of malaria among pregnant women in the endemic regions are needed so as to help monitor the health of pregnant women, thus contributing to reduce maternal morbidity and mortality in particular, and infant mortality as well as fetal growth problems. This study aimed at determining the prevalence of malaria infection among pregnant women as well as the risk factors associated with the infection in the study area.

MATERIALS AND METHODS

Study area

This research is a hospital base cross sectional study conducted from January 2022 to June 2022 among pregnant women attending antenatal clinics of some selected public health facilities in Katsina metropolis, Katsina State. Katsina State is located in the North-western zone of Nigeria (Tukur *et al.*, 2013). The state spans between Latitude 10˚33′59′N to 13˚18′30′′N and Longitude 6˚59′32′E to 9˚00′0.1′′E. Katsina town is approximately located on Latitude 12˚59′N and Longitude 7˚36′E, at an elevation of 519 meters above sea level. Katsina local government was chosen as the study area for this research because documented studies on cases of Malaria in pregnancy in the area are very scanty (Tukur *et al.*, 2013).

A tropical wet and dry type (tropical continental climate) characterizes the weather of Katsina state. Rainfall peaks in August and normally occurs between May and September each year. A 700 mm of rain falls annually on average. Due to the region's very erratic rainfall patterns, there has been a severe and widespread drought that has the potential to have a negative social and economic impact. Between 29˚C and 31˚C is the average annual temperature range. Typically, the months of April and May have the greatest air temperatures and December through February see the lowest. In general, evapotranspiration is high year-round. The dry season is when there is the most evaporation. The Sudan savannah type, which combines the traits and species of both the Guinea and Sahel Savannahs, is the predominant vegetation in the region (Abaje *et al.*, 2012; Tukur *et al.*, 2013).

Inclusion and Exclusion Criteria

Woman of reproductive age attending the antenatal clinics during the study period who had previously completed a biological pregnancy test and/or obstetrical ultrasound and confirmed the pregnancy, who are not critically ill and who have voluntarily given written consent were included in the study. The exclusion factors for the study included non-pregnant women and those pregnant women who did not give consent to participate or sign the informed consent form.

Sample Size Estimation

Based on the calculated sample size using the Araoye (2004) method, 400 pregnant women were recruited using a straightforward random sampling technique.

$$N = \frac{Z^2 P(1-P)}{d^2}$$

Where “N” is the desired sample size, “Z” is the critical value and in a two-tailed test, Z=1.96, *P* is the estimated prevalence of 60.00% (Agomo *et al.*, 2009), *q* is the probability which is 1-*P*, while *d* is the absolute sampling error that can be tolerated. In this study, it will be 5.00% or 0.05. Thus,

$$N = \frac{(1.96)^2 \times 0.60 \times (1-0.60)}{(0.05)^2}$$

$$N = \frac{3.8416 \times 0.60 \times 0.4}{0.0025}$$

$N = \frac{0.921984}{0.0025}$ N = 369

Hence about 369 subjects were needed for the study. However there was a deliberate increase in sampling size to 400 to cater for possible drop-outs along the course of the research.

Sample Collection and Processing

Using sterile needle and syringe, about 5mL of venous blood was collected from each study subject with the assistance of medical laboratory technologists by vein puncture technique in the two selected public health facilities namely; Federal Medical Centre Katsina and Turai Umaru Yaradua Maternity and Children Hospital Katsina. Each blood sample collected was immediately dispensed into ethylene diamine-tetra-acetic acid (EDTA) anti-coagulated blood container, properly mixed and labeled appropriately (Ajzenberg *et al.*, 2016). The blood samples were then transported to the hematology laboratory of Federal Medical Center Katsina for parasites detection. For the BMI, The weight and height of each of the respondents were appropriately measured using weighing scale and stadiometer respectively and the calculations were made using BMI calculator. Data were also collected from the women using an administered questionnaire. The questionnaire contained information on malaria prevalence as well as the maternal and

socio demographic characteristics of the pregnant women.

Laboratory Analysis

Thick and thin blood films for all the subjects were prepared using WHO malaria blood film preparation template as a guide (WHO, 2015). With the aid of micro-pipette 6µL of each blood sample was placed 1cm away from the frosted end of a grease free glass slide and a thick film was made in a circular motion to cover 15mm in diameter, and 2µL was placed at the center of the same slide, with the aid of a spreader, a thin blood film was made by maintaining a contact between the glass slide and the spreader at an angle of 30°. The slides were allowed for overnight on a flat surface to air dry. The thin blood films were fixed with methanol and then allowed to air dry on a drying rack prior to staining. Both films were then placed on a staining rack and flooded with 10.00% Giemsa stain and allowed to stand for ten minutes before being rinsed with distilled water and placed on a drying rack to air dried. The slides were examined for the presence of malaria parasites using ×100 oil immersion microscopes. The thick films were used for parasites quantification by counting the asexual parasites against white blood cells. Parasite density per micro liter of blood was estimated by multiplying the number of parasites counted by 40, assuming a leucocyte count of 8000 cells per micro liter of blood (Umeh *et al.*, 2012). The degree of parasitaemia was graded thus: 1-999 μl^{-1}= mild or +, 1000-9999 μl^{-1} = moderate or ++ and ≥10000 μl^{-1} = severe or +++. A negative result was recorded if no parasite was found after thorough examination of 100 fields (Ugwu *et al.*, 2014).

Statistical Analysis

Statistical analysis was carried out using Graph Pad Statistical software version 3.01. The prevalence of malaria was determined using descriptive statistics. Chi square test and Fishers exact test were used to determine the association between malaria infection and some socio-demographic features and maternal characteristics of the respondents. The Odds Ratio (OR) analyses was used to measure the strength of association between malaria infection and exposure variables. A *P*-value of ≤ 0.05 was considered significant at 95% confidence level.

Ethical Clearance

The study was approved by the Medical Research Ethics Review committee of Katsina state Ministry of Health (MOH/ADM/SUB/1152/1/535), and also by the Medical Research Ethics Review of Federal Medical Center Katsina (FMCNHREC.REG.N003/082012). The study was carried out following the relevant ethical guidelines and regulations.

RESULTS

Majority of the women (62.50%) were within the age range of 26-35 years and most of them (35.00%) have secondary education. Similarly, data regarding main occupation, area of residence and BMI revealed that most of the women (59.00%, 81.25% and 76.50%) were housewives, live in urban areas and have BMI of normal values respectively as shown in Table 1.

Table 1: Sociodemographic characteristics of the respondents (n = 400)

Variables	Frequency	Percentage (%)
Age (Years)		
15-20	24	6.00
21-25	69	17.25
26-30	120	30.00
31-35	130	32.50
35 and above	57	14.25
Education Level		
None	64	16.00
Primary	73	18.25
Secondary	140	35.00
Tertiary	123	30.75
Main Occupation		
Housewife	236	59.00
Formal Worker	63	15.75
Student	101	25.25
Area of Residence		
Urban	325	81.25
Rural	75	18.75
BMI		
Underweight	30	7.50
Normal	306	76.50
Overweight	38	9.50
Obese	26	6.50

The overall prevalence of malaria in this study was 24.25% whereas 75.75% of the respondents are not infected with malaria. Furthermore, data on category of malaria severity revealed that 24.74% of the respondents were mildly infected whereas 75.75% were moderately infected. The data further revealed that no severe case of malaria infection was encountered among the study participants (Table 2).

Table 2: Prevalence and Severity of Malaria among the Pregnant Women (n=400)

Variables	Frequency	Percentage(%)
Malaria Status		
Infected	97	24.25
Non-infected	303	75.75
Total	400	100
Category of Malaria Severity		
Severe	0	0
Moderate	73	75.26
Mild	24	24.74
Total	97	100

The association between malaria prevalence and several predictor variables is shown on Table 3. According to the result, level of education, main occupation and BMI of the women were significantly associated with malaria prevalence ($p<0.05$). Other factors like age, area of residence and age of pregnancy were assessed but were not associated with malaria among the study subjects ($p>0.05$).

Table 3: Relationship between Prevalence of Malaria and certain Maternal/Socio-Demographic Characteristics of the Study Participants (n = 400)

Variables	No. Examined	Malaria Status		P-Value
		Infected (%)	Non-Infected (%)	
Age (Years)				
15-20	24(6.00)	6 (25.00)	18 (75.00)	0.6813
21-25	69(17.25)	20 (28.99)	49 (71.01)	
26-30	120(30.00)	30 (25.00)	90 (75.00)	
31-35	130(32.50)	26 (20.00)	104(80.00)	
≥36	57(14.25)	15 (26.32)	42 (73.68)	
Education Level				
None	64(16.00)	26 (40.63)	38 (59.37)	0.0025
Primary	73(18.25)	20 (27.39)	53 (72.62)	
Secondary	140(35.00)	31 (22.14)	109(77.86)	
Tertiary	123(30.75)	20 (16.26)	103(83.74)	
Occupation				
Housewife	236(59.00)	65 (27.54)	171(72.46)	0.0256
Formal Worker	63(15.75)	7 (11.11)	56 (88.89)	
Student	101(25.25)	25 (24.75)	76 (75.25)	
Area of Residence				
Urban	325(81.25)	72 (22.15)	253(77.85)	0.0616
Rural	75(18.75)	25 (25.77)	50 (66.67)	
BMI				
Underweight	30(7.50)	2 (6.67)	28 (93.33)	0.0006
Normal	306(76.50)	73 (23.86)	233(76.14)	
Overweight	38(9.50)	18 (47.37)	20 (52.63)	
Obese	26(6.50)	4 (15.38)	22 (84.62)	
Parity Status				
Primipare	154(38.50)	39 (25.32)	115(74.68)	0.7199
Multipare	246(61.50)	58 (23.58)	188(76.42)	
Inter Pregnancy Interval				
1year	134(54.47)	36 (26.87)	98 (73.13)	0.7249
2years	86(34.96)	15 (17.44)	71 (82.56)	
3years	21(8.54)	4 (19.05)	17 (80.95)	
4years&above	5(2.03)	3 (60.00)	2 (40.00)	
Age of Pregnancy				
1st Trimester	22(5.50)	2 (9.09)	20 (90.91)	0.1733
2nd Trimester	107(26.75)	24 (22.43)	83 (77.57)	
3rd Trimester	271(67.75)	71 (26.19)	200(73.81)	

The association of malaria prevalence with some attitudes of the study participants is shown on Table 4. Several attitudes of the study participants were assessed but only spraying insecticide before sleeping was found to have significant association with malaria prevalence in the study area ($p<0.05$).

Table 4: Association of Malaria Prevalence with some Attitudes of the Study Participants in the Study Area (n = 400)

Variables	Number Examined (%)	Number Infected with Malaria (%)	Number Normal(%)	P-value
Sleeping under mosquito net				
Yes	146(36.50)	31(21.23)	115(78.77)	0.3327
No	254(63.50)	66(25.98)	188(74.02)	
Spraying insecticide before sleeping				
Yes	138(34.50)	24(17.39)	114(82.61)	0.0202
No	262(65.50)	73(27.86)	189(72.14)	
Fever in the past few weeks/months				
Yes	136(34.00)	40(29.41)	96(70.59)	0.1421
No	264(66.00)	59(22.35)	205(77.65)	
Presence of stagnant water				
Yes	165(41.25)	39(23.64)	126(76.36)	0.9057
No	235(58.75)	58(24.68)	177(75.32)	
Presence of haemorrhagic disease				
Yes	40(10.00)	11(27.50)	29(72.50)	0.6973
No	360(90.00)	86(23.89)	274(76.11)	
Taking iron supplements				
Yes	143(35.75)	36(25.17)	107(74.83)	0.8078
No	257(64.25)	61(23.74)	196(76.26)	
Presence of nausea and vomiting				
Yes	151(37.75)	38(25.17)	113(74.83)	0.8099
No	249(62.25)	59(23.69)	190(76.31)	

Table 5: Analysis of Risk Factors Associated with Malaria Prevalence in the Study Area

Variable	Odds Ratio	95% C.I.	P-value
Educational Level	2.55	1.34-2.76	0.0014
Main Occupation	1.57	0.97-2.05	0.0753
BMI	0.55	0.31-0.98	0.0550
Spraying Insecticide before Sleeping	0.55	0.33-0.91	0.0202

DISCUSSION

Based on the result from this study, the overall prevalence of malaria in the study area was found to be 24.25% which is similar to 22.10% prevalence reported by Kagu *et al.*, (2007) among pregnant women in Maiduguri, Nigeria. The prevalence in this study is also lower than 40.67% and 72.00% prevalence among pregnant women reported by Abubakar *et al.*, (2021) in Katsina State, Nigeria and Abdullahi *et al.*, (2020) also in Katsina State, Nigeria, respectively. The lower prevalence from this finding might be for the reason that this study was conducted during the dry season. The prevalence of malaria infection is higher in the wet season than the dry season Ayanda (2009). According to Minakaw *et al.* (2002), the increase in larval homes and increased humidity during the rainy season create favorable environmental circumstances that promote mosquito multiplication and survival. Regarding malaria severity, data from this study revealed that 75.26% of the infected pregnant women were moderately infected whereas 24.74% were mildly infected. No severe cases of malaria was recorded among the study participants. This is in line with the findings of Nwonwo *et al.*, (2009) who reported mild, moderate and severe malaria prevalence among pregnant women in rural communities of Southeastern Nigeria of 94.20%, 5.80% and 0.00% respectively.

In our study, it was observed that level of education, main occupation, BMI and spraying insecticide before sleeping were significantly associated with malaria infection. It was observed that pregnant women with tertiary level of education had the lowest percentage of infection.

This emphasizes the impact that education may have on the overall effectiveness of malaria control initiatives in the area. In order to lessen the burden of the disease on the nation, particularly among the most susceptible population, government measures should be focused on raising citizens' educational statuses. It could also be explained by the fact that pregnant women with higher levels of education had more money and could therefore afford to take the required precautions against infections. Agomo *et al*. (2013) found that education was not substantially related to malaria infection among pregnant women in a prior study they carried out in Lagos, Nigeria. Similarly, the occupation of the study participants was found to have significant association with malaria prevalence with a P-value of 0.0256. It was observed that housewives had the highest rate of infection while formal workers had the least. This might be for a reason that pregnant women that have financial support in one way or the other are more likely to have access to the preventive measures of malaria infections than their counter parts. This agrees with the findings of Suliman *et al*., (2021) in Al-Jabalian Locality, White Nile State, Sudan which revealed that housewives had the highest rate of malaria infection than their counterparts. BMI was also found to have a significant association with malaria prevalence in the study area. Based on the findings of this study, overweight pregnant women have the highest percentage of malaria infection than their counterparts. The National Heart, Lung, and Blood Institute (NHLBI, 2017) states that a person's risk of contracting certain diseases and infections increases with increasing BMI. This finding is similar to that of Nacher *et al*., (2001) who reported that BMI was significantly associated with malaria prevalence in Thailand. Lastly, spraying insecticide before sleeping was also significantly associated with malaria prevalence in the study area. Pregnant women who do not spray insecticide before sleeping were more affected by malaria as compared to those who did. This is in agreement with the study of Chimere and Wellington (2013) in Lagos, Nigeria which was the first study to report the effect of the use of personal/household insecticide spray on malaria in pregnancy in Nigeria.

CONCLUSION

The greatest threat variables for developing malaria infection were lack of education, occupation, BMI, and insecticide use before bed. It is important to assess the local control methods and emphasize the proper application of pesticides. Similar to that, young women who are not yet married should be made aware of malaria prevention techniques, ideally in public settings.

REFERENCES

Abaje I.B, Ati O.F. and Iguisi E.O. (2012).Recent Trends and Fluctuations of Annual Rainfall in the Sudano-Sahelian ecological zone of Nigeria: Risks and opportunities. *Journal of Sustainable Society* 1 (2): 44-51.

Abdullahi M.S., Abdlazeez M.A., Mudassir L.and Aminu A. (2020).Prevalence of Malaria amongst Pregnant Women Attending Comprehensive Health Centre Dutsin-Ma Local Government Area, Katsina State, Nigeria. *International Journal of Research and Reports in Hematology*. 3(2): 53-59.

Abubakar S.A., Hadiza A. and Khalifa J.S. (2021).'Incidence of Malaria Parasites among Pregnant Women Attending Antenatal in Dutsin-Ma General Hospital, Katsina State, Nigeria'.*International Journal of Advanced Multidisciplinary Research and Studies*. 1(3):45-50.

Agomo C.O., Oyibo W.A., Anorlu R.I. and Agomo P.U. (2013). Prevalence of Malaria in Pregnant Women in Lagos South-west Nigeria.*Korean Journal of Parasitology*. 47:179-83. **[Crossref]**

Agomo, C.O., Oyibo, W.A., Anorlu, R.I., and Agomo, P.U. (2009). Prevalence of malaria in pregnant women in Lagos, South-West Nigeria. The Korean journal of parasitology, 47(2), 179. **[Crossref]**

Ajzenberg, D., Lamaury, I., Demar, M., Vautrin, C., Cabié, A., Simon, S., ... & Boncoeur, M. P. (2016). Performance testing of PCR assay in blood samples for the diagnosis of toxoplasmic encephalitis in AIDS patients from the French Departments of America and genetic diversity of Toxoplasma gondii: a prospective and multicentric study. PLoS Neglected Tropical Diseases, 10(6), e0004790. **[Crossref]**

Araoye, M.O. (2004) *Sample Size Determination in Research Methodology with Statistics for Health and Social Sciences*. Nathadex Publishers, Ilorin, 115-121.

Ayanda, O. (2009). Relative abundance of adult female anophelines mosquitoes in Ugah, Nasarawa State, Nigeria.*Journal of Parasitology and Vector Biology*, Vol. 1 (1) pp. 005-008.

Chimere O. Agomo, and Wellington A. Oyibo (2013). 'Factors associated with risk of malaria infection among pregnant

women in Lagos, Nigeria. *Journal of infectious diseases of poverty* 2;19. [Crossref]

Hartman, T. K., Rogerson, S. J., and Fischer, P. R. (2010). The impact of maternal malaria on newborns. *Annals of tropical paediatrics*, 30(4), 271-282. [Crossref]

Hellgren, U., and Rombo, L. (2010). Alternatives for malaria prophylaxis during the first trimester of pregnancy: our personal view. *Journal of travel medicine*, 17(2), 130-132. [Crossref]

Kagu M. B., Kawuwa M. B. and Gadzama G. B. (2007).Anaemia in Pregnancy: A cross-sectional study of pregnant women in a Sahelian tertiary hospital in Northeastern Nigeria. *Journal of Obstetrical Gynaecology*.;27:676-9. [Crossref]

Minakaw, N., Sonye, G., Mogi, M., Githeko, A., and Yan, G. (2002).The effects of climate factors on the distribution and abundance of malaria vectors in Kenya.*Journal of Medical Entomology*. 39: 833-841. [Crossref]

Nacher, M., Singhasivanon, P., Vannaphan, S., Treeprasertsuk, S., Phanumaphorn, M., Traore, B., ...and Gay, F. (2001). Socio-economic and environmental protective/risk factors for severe malaria in Thailand. *ActaTropica*, 78(2), 139-146. [Crossref]

National Heart, Lung, and Blood Institute(2017) .Screening and Prevention – National Heart Lung and Blood Institude, NIH. [online] Available at: <https://www.nhlbi.nih.gov/health/health-topics/topics/obe/prevention.

Nwonwu, E.U., Ibekwe, P.C., Ugwu, J.I., Obarezi, H.C., and Nwagbara, O. C. (2009). Prevalence of malaria parasitaemia and malaria related anaemia among pregnant women in Abakaliki, South East Nigeria. *Nigerian journal of clinical practice*, 12(2).

Schantz-Dunn, J., andNour, N. M. (2009). Malaria and pregnancy: a global health perspective. *Reviews in obstetrics and gynecology*, 2(3), 186.

Suliman, M. A., Tamomh, A. G., Younis, O. Y., Magboul, A. M., Mohammed, H. Y., Hassan, I. M.,and Musa, N. M. (2021). Malaria infection and associated risk factors in pregnant women attending antenatal care clinics in Al Jabalian Locality, White Nile state, Sudan. *Annals of Parasitology*, 67(3), 499-504.

Tukur J., I. K., Auwal M. Aminu, A. T. Atanda and F. Sarkinfada (2013) 'Prevalence and risk factors of high risk human papilloma virus infections among women attending gynaecology clinics in Kano, Northern Nigeria'. *Bayero Journal of pure and applied sciences* 6 (1): 67-7. [Crossref]

Ugwu, E. O., Dim, C. C., Uzochukwu, B. S., Iloghalu, E. I., and Ugwu, 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. [Crossref]

Ugwu, E. O., Obi, S. N., Iferikigwe, E. S., Dim, C. C., andEzugwu, F. O. (2014). Membrane stripping to prevent post-term pregnancy in Enugu, Nigeria: a randomized controlled trial. *Archives of gynecology and obstetrics*, 289, 29-34. [Crossref]

Umeh, U. A., Obi, S. N., Onah, H. E., Ugwu, E. O. V., Ajah, L. O., Umeh, C. R., and Okafor, I. I. (2012). The impact of intermittent preventive treatment with sulfadoxine-pyrimethamine on the prevalence of malaria parasitaemia in pregnancy. *Tropical Doctor*, 42(3), 133-135. [Crossref]

World Health Organisation (2015).'*The Special Programme for Research and Training in Tropical Diseases*'.(PDF).UNICEFISBN.Avenue Appia1211 Geneva 27Switzerland.

World Health Organization (2016) "Achieving the malaria MDG target: reversing the incidence of malaria 2000-2015."(PDF).UNICEFISBN9789241509442.

World Health Organization. (2019). Compendium of WHO malaria guidance: prevention, diagnosis, treatment, surveillance and elimination (No. WHO/CDS/GMP/2019.03). World Health Organization.

World Health Organization. (2020). *World Malarias Report 2020*. WHO Global Malarial Programme. Geneva, Switzerland,pp264.

World Health Organization.(2021). "Malaria Fact shee tN°94".https://www.who.int/news-room/fact-sheets/detail/malaria*Retrieved 28 August2023*.

Yaya, S., Uthman, O. A., Amouzou, A., & Bishwajit, G. (2018). Use of intermittent preventive treatment among pregnant women in sub-Saharan Africa: evidence from malaria indicator surveys. *Tropical medicine and infectious disease*, 3(1), 18. PMID: 30274416; PMCID: PMC6136633. [Crossref]