*Journal of Advances in Medicine and Medical Research*

***29(4): 1-8, 2019; Article no.JAMMR.47884***
***ISSN: 2456-8899***
*(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)*

# Low Prevalence of Asymptomatic Malaria in Pregnancy among Subjects Attending Antenatal Clinic at a Tertiary Hospital in Bauchi, Nigeria: A Preliminary Report

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Authors ASK, KOO and STB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MAB, LMD and AS administered the questionnaire and reviewed the subjects. Author KOO managed the analyses of the study. Authors MA, YBJ and CC managed the literature searches. All authors read and approved the final manuscript.*

***Article Information***

DOI: 10.9734/JAMMR/2019/v29i430077
Editor(s):
(1) Dr. Sevgul Donmez, Faculty of Health Sciences, Gaziantep University, Turkey.
Reviewers:
(1) Tebit Kwenti Emmanuel, University of Buea, Cameroon.
(2) James Prah, University of Cape Coast, Ghana.
(3) Martin E. Ohanu, University of Nigeria, Nigeria.
(4) Kamgain Mawabo Lugarde, District Hospital of Deido, Cameroon.
(5) Boniphace Sylvester, Hubert Kairuki Memorial University, Tanzania.
Complete Peer review History: http://www.sdiarticle3.com/review-history/47884

***Original Research Article***

***Received 02 January 2019***
***Accepted 18 March 2019***
***Published 01 April 2019***

## ABSTRACT

**Background:** Asymptomatic malaria in pregnancy still posed clinical challenge and diagnostic problem. The preventive measures are often advocated during antenatal visits. This study assessed the prevalence of asymptomatic malaria in pregnancy among subjects attending ante-natal clinics.

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**Methodology:** The cross-sectional study was conducted among 140 volunteer asymptomatic pregnant women attending antenatal clinics at Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH) between July and September 2017. A structured questionnaire was used to obtain data on sociodemography, obstetric history and malaria control practices from the subjects following an informed consent. They were subjected to malaria screening by rapid diagnostic test (RDT) and Giemsa-stained blood smears were prepared for RDT-positive subjects. The malaria positive subjects were treated according to national treatment guidelines on malaria in pregnancy.
**Results:** The overall mean (standard deviation) age of the 140 subjects was 24.2 (±10.3) years with majority within the age group of 27-32 years (41.4%, 58/140; $p<0.05$). Only three of the 140 subjects had malaria parasitaemia giving a prevalence of 2.1% (3/140). Among all the variables analyzed, malaria in pregnancy was associated with only older age ($p<0.05$) in the present study.
**Conclusion:** The study revealed low prevalence of asymptomatic malaria among pregnant women attending ATBUTH, Nigeria and could be attributed to the satisfactory ante-natal and malaria prevention practices. However, elaborate epidemiological studies are required to ascertain the finding.

*Keywords: Asymptomatic malaria; pregnant women; antenatal practices; Bauchi.*

## 1. INTRODUCTION

Malaria infection caused by protozoan parasite, *Plasmodium spp*. and transmitted by vector Anopheles mosquitoes remain a major public health problem, particularly in endemic regions of sub-Saharan Africa and Asia, with attendant consequence of high morbidity and mortality [1]. The burden of malaria infection is much felt among pregnant women and children aged less than 5 years,indicative of susceptibility of these population due to the level of immunity [2,3,4]. Over 90% of global population are at the risk of malaria, and 50% experience one malaria episode annually [5]. Thirty million pregnant women are at the risk of the infection, with 10,000 maternal mortalities and 20,000 neonatal deaths annually [5].

Nigeria accounts for 25% of malaria cases recorded in sub-Saharan Africa [6] and the predisposition of pregnant women to malaria and the attendant clinical outcomes continued to attract public health attention especially in Nigeria. Varying prevalence of malaria in pregnancy have been reported across various geographical location, however, most of these reports agreed that it is dependent on factors such as age, parity, gestational age and diagnostic method employed [7]. In most cases malaria in pregnancy often presents as asymptomatic form, but progress to symptomatic depending on the intensity of infection resulting in serious clinical outcomes like anaemia, low birth weight and mortality [8-10]. Asymptomatic presentation is as a result of hormonal changes induced by pregnancy that causes the attraction of pregnant women to mosquitoes [11], sequestration of infected erythrocytes in the placenta [12] and expression of parasite antigen on infected erythrocyte [13].

The increasing parasite resistance limits effective treatment and control of malaria, thus prompt diagnosis and effective control measures become imperative especially among people at high risk of the infection such as pregnant women. Some of the WHO recommended measures include use of insecticide-treated net (ITN), proper drainage system, and malaria screening during ante-natal clinics. During these visits, they undergo several physical and laboratory investigations including malaria test. Asymptomatic pregnant women with malaria parasitaemia could be incidentally detected and promptly treated. Intermittent Preventive Treatment (IPT) with Sulfadoxine-Pyrimethamine is prescribed or administered at least twice during antenatal clinics [14]. In addition, health talks on malaria control measures are often presented during the visits as these could improve pregnancy outcomes. Light microscopy remains a gold standard for malaria diagnosis, however, it is time-consuming and requires experienced microscopists [15]. Thus, faster techniques like Rapid Diagnostic Tests (RDT) which detect histidine-rich protein 2 (HRP-2), aldolase or plasmodium lactate dehydrogenase (pLDH) are often employed during antenatal visit [16].

A meta-analysis of malaria in pregnancy studies conducted in sub-Saharan Africa between 2000 and 2011 revealed a prevalence of 35.1% in West and Central region [17]. Studies conducted in Nigeria had reported varied malaria

prevalence, for instances, 2.0% in Lagos [18], 11% in Sokoto [19], 61.8% in Bauchi [20] and 99% in the Southeastern Nigeria [21]. Thus, it is difficult to extrapolate or estimate the burden of malaria in pregnancy in a region from data reported from other regions especially when the climatic factors and malaria control practices are not similar. To this background, the present study was designed to assess prevalence of malaria in pregnancy among pregnant women attending antenatal clinics in Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH), Bauchi and to evaluate malaria control practices among the subjects.

## 2. METHODOLOGY

The descriptive cross-sectional study was carried among volunteer pregnant women attending antenatal clinic at ATBUTH Bauchi between July and September 2017. ATBUTH is a 750-bed capacity hospital that provides multi-specialty cares in northeastern zone. Geographically, Bauchi State, Nigeria is located at latitude 10° 17N and longitude 09° 49I E with mean daily maximum temperature ranges from 27.0°C to 29.0°C between July and August and 37.6°C in March and April, mean daily minimum ranges from 22.0°C in December and January to about 24.7°C in April and May. The humidity ranges from 12% to 68%. The rainy season is between May to September and dry season is between October to April. The vegetation is within Sudan Savanna [22] with stable malaria transmission. The study protocol was approved by ATBUTH Institutional Review Board. Criteria for inclusion were asymptomatic pregnant women, with no obvious conditions (e.g. septicemia) capable of elevating body temperature and attending ante-natal clinics at ATBUTH during the study period. The sample size was estimated as described by Qiu et al. [23] and the estimated number of subjects who met the criteria were randomly recruited following an informed consent. A structured questionnaire was used to obtain required data including sociodemographic variables, gestational age, and malaria preventive practices such as use of IPT and ITN.

Malaria diagnosis was conducted using RDT kit, Care Start™ Combo Pf/PAN (Access Bio, Inc., NJ, USA) according to manufacturer instruction; this method is routinely used during antenatal clinics at ATBUTH. The kit is designed for diagnosis of the four human *Plasmodium species* via detection of both HRP-2 for *P. falciparum* and pLDH for *P. vivax, P. malariae, P. ovale* and *P. falciparum.* The diagnostic performance of the kit has been previously reported [24]. In addition, Giemsa-stained blood smears were prepared for RDT-positive subjects. Briefly, the preferred finger of the pregnant women was sterilized with 70% alcohol, allowed to dry and pricked with lancet by an experienced Medical Laboratory Scientist. The first blood drop was wipe off, and subsequent blood dropped on the sample well of the RDT kit cassette, and 60µl of assay buffer placed into the 'A' well. The test result was read after 20 minutes. Positive result was indicated with two colour band (C and T), and negative result with only one line (C). Subjects who were positive to the malaria tests were treated according to WHO malaria treatment guidelines adopted in Nigeria [25].

Data were analyzed using the SPSS version 20.1. Sociodemographic variables and parasitological data were expressed in mean values and percentage, while the Chi square test was used to compare the variables. Statistical significance difference was inferred at $p<0.05$.

## 3. RESULTS

A total of 140 pregnant women at different gestational stages, were enrolled in the study, with mean age of 24.2±10.2 years. Sociodemographic variables (Table 1) showed that a high number of the pregnant women were within the age-group of 27-32years (41.4; 58/140; $p<0.05$). Majority resides in urban setting (92.1%; 152/140; $p<0.05$), married (96.4%; 135/140; $p<0.05$), into a monogamous relationship (75.7%; 106/140; $p<0.05$) with tertiary education (49.3%; 69/140; $p<0.05$). In addition, significantly higher proportion of the subjects were at second trimester (51.4%; 72/140; $p<0.05$), with parity of 1-3 (45.7%; 64/140; $p<0.05$), had IPT (54.3%; 76/140; $p<0.05$), used ITN (57.1%; 80/140; $p<0.05$) and received haematenic medication (68.6%; 96/140; $p<0.05$).

Overall, malaria was detected in 3 of the 140 enrolled subjects giving malaria in pregnancy prevalence of 2.1% (3/140). Assessment of antenatal practice on malaria prevalence as presented in Table 2, indicates statistical significance difference between the age-group and malaria prevalence, with the 3 cases recorded within age-group of 33-38years and >39years ($p<0.05$). In addition, the 3 women with

malaria are residing in urban area, and have secondary and tertiary educational background. For the gestational age the 3 cases were recorded within 2 and 3 trimester stages, who were nulliparous and multiparous women. On preventive measures, the 3 cases were recorded among pregnant women sleeping under ITN and those using insecticide sprays, while one each with those who had IPT treatment and haematenics.

## 4. DISCUSSION

In the present study, the prevalence of malaria in pregnancy of 2.1% (3/140) is low and is similar to previous studies reported within and outside Nigeria. For instances, prevalence of 2.0% and 7.7% reported in Lagos [18,26], 11% in Sokoto [19], 7.3% in Port Harcourt, [3], 2.3% in Chittagny, Bangladesh [27] and 4.7% in Colombia [16]. In contrast, the prevalence recorded in the present study is significantly lower than 13% reported in Dekina, Northcentral Nigeria [28], 36.8% in Southwest Nigeria [4] and 41% in Southeastern Nigeria [29]. These studies employed light microscopy and RDT kits with similar sensitivity, thus, the disparity could be attributed to factors such as malaria transmission intensity and control measures among other factors. The low prevalence of malaria in pregnancy observed in the present study may be partly attributed to several factors such as low parasite density [16], altered parasite antigen [30] and the presence of antimalarial antibodies (anti-HRP-2) elicited during exposure [31]. These factors are known to affect sensitivity of RDT and could have affected our finding. However, the fact that none of the RDT-negative was symptomatic could be an indication that they were truly malaria-free. Despite that none of the malaria control measures (IPT, ITN and drainage system) recorded 100% compliance, all the subjects used at least two malaria control measures and this could have contributed to the low prevalence observed in the present study.

Maternal age, parity and gestational stages are known risk factors of malaria in pregnancy and prevalence [4,18,19,20,29]. In stable malaria transmission region as in the study area, high prevalence is often recorded with young age, second trimester and primigravidae and secondi gravidae due to low pregnancy-specific immunity [2,3]. Though the number of malaria cases detected was low nevertheless statistical significance association was observed between the age-group and malaria prevalence ($p<0.05$), while the expected pattern was in contrast, as the 3 cases were recorded among pregnant women within second and third trimester and nulliparous and multiparous women. It is expected that previous exposure to malaria infection by multiparous women must have mounted pregnancy specific immunity capable of lowering the risk of infection. This observed pattern raises possibility of obvious exposure of the subjects to mosquito bites either through environmental or occupational activities in the community.

The adherence and application of malaria infection preventive measures with the subjects depends primarily on adequate public health education, knowledge and awareness, which depends on the level of formal education [32,33]. Several studies have collaborated this observation with high malaria infection prevalence among pregnant women with non-informal education compared to those with formal educational background [30,32]. In this study, the 3 malaria cases were seen in subjects with at least secondary education, similar to the finding of study conducted among pregnant women in Katsina, Northwest Nigeria [34]. This raises the need for further advocacy on public health education awareness in the community. Appropriate usage and ownership of ITN, regular antimalarial prophylaxis and clean environment without stagnant water to encourage mosquito breeding are some of the WHO recommendations. Response from the participant (Table 1) showed that 56% sleep under ITN which is lower than 68% in similar study in Kano [35], but higher than 45% in a study that reported 41% malaria prevalence in southern Nigeria [30]. The impact of ITN in lowering the risk of malaria depends on effective usage and ownership of the ITN [33]. While the ITN has impacted positively in lowering the risk of malaria infection, some limitations have been identified, such as improper usage, quality of ITN and cost implication might have limited the success.

Despite, the positive perceptive of the study, there are limitations. The low malaria prevalence limits the assessment impact of antenatal practice on malaria infection. The sample size, number of malaria cases detected, and period of the study cannot serve as a good epidemiological representation of infection rate.

**Table 1. Demographic variables of the pregnant women**

| Variables | Frequency (%) |
|---|---|
| **Age-group** | |
| ≤20years | 12 (8.6) |
| 21-26 | 32 (22.9) |
| 27-32 | 58 (41.4) |
| 33-38 | 35 (25.0) |
| ≥39 | 3 (2.1) |
| **Residence** | |
| Urban | 129 (92.1) |
| Semi urban | 9 (6.4) |
| Rural | 2 (1.4) |
| **Occupation** | |
| Student | 29 (20.7) |
| Civil servant | 40 (28.6) |
| Applicant | 21 (15.0) |
| Business | 34 (24.3) |
| Trader | 16 (11.4) |
| **Marital status** | |
| Married | 135 (96.4) |
| Non-married | 5 (3.6) |
| **Type of relationship** | |
| Polygamous | 34 (24.3) |
| Monogamous | 106 (75.7) |
| **Educational background** | |
| Islamic | 8 (5.7) |
| Primary | 11 (7.9) |
| Secondary | 52 (37.1) |
| Tertiary | 69 (49.3) |
| **Gestational stage** | |
| First | 13 (9.3) |
| Second | 72 (51.4) |
| Third | 55 (39.3) |
| **Intermittent Preventive therapy during index Pregnancy** | |
| Yes | 64 (45.7) |
| No | 76 (54.3) |
| **Preventive measure** | |
| Insecticide-treated net | 80 (57.1) |
| Mosquito coil | 25 (17.9) |
| Insecticide spray | 35 (25) |
| **Heamatenic intake** | |
| Yes | 96 (68.6) |
| No | 44 (31.4) |
| **Drainage system** | |
| Stagnant water | 25 (17.9) |
| Open space | 40 (28.6) |
| Drainage provided | 75 (53.6) |
| **Parity** | |
| 0 | 37 (26.4) |
| 1-3 | 64 (45.7) |
| >3 | 39 (27.9) |
| **Source of water** | |
| Well water | 36 (25.7) |
| Tap water | 104 (74.3) |

**Table 2. Malaria Prevalence versus demographic variables of pregnant women**

| Variables | Frequency (% ) | p-value |
|---|---|---|
| **Age-group** | | |
| ≤20years | 0 (0.0) | 0.001 |
| 21-26 | 0 (0.0) | |
| 27-32 | 0 (0.0) | |
| 33-38 | 2 (5.7) | |
| ≥39 | 1 (33.3) | |
| **Residence** | | |
| Urban | 3 (2.4) | 0.877 |
| Semi urban | 0 (0.0) | |
| Rural | 0 (0.0) | |
| **Occupation** | | |
| Student | 0 (0.0) | 0.443 |
| Civil servant | 1 (2.5) | |
| Applicant | 0 (0.0) | |
| Business | 2 (5.9) | |
| Trader | 0 (0.0) | |
| Housewife | 0 (0.0) | |
| **Type of relationship** | | |
| Polygamous | 1 (2.9) | 0.569 |
| Monogamous | 2 (1.9) | |
| **Educational background** | | |
| Islamic | 0 (0.0) | 0.731 |
| Primary | 0 (0.0) | |
| Secondary | 2 (3.8) | |
| Tertiary | 1 (1.4) | |
| **Gestational stage** | | |
| First | 0 (0.0) | 0.589 |
| Second | 1 (1.4) | |
| Third | 2 (3.6) | |
| Control | | |
| **Intermittent Preventive therapy during index Pregnancy** | | |
| Yes | 1 (1.6) | 0.582 |
| No | 2 (2.6) | |
| Preventive measure | | |
| Insecticide-treated net | 2 (2.5) | 0.930 |
| Mosquito coil | 0 (0.0) | |
| Insecticide spray | 1 (2.9) | |
| **Haemtenics intake** | | |
| Yes | 1 (1.0) | 0.226 |
| No | 2 (4.5) | |
| Drainage system | | |
| Stagnant water | 1 (4.2) | 0.249 |
| Open space | 1 (2.4) | |
| Drainage provided | 1 (1.3) | |
| **Parity** | | |
| 0 | 1 (2.5) | 0.379 |
| 1-3 | 0 (0.0) | |
| >3 | 2 (2.8) | |
| **Source of water** | | |
| Well water | 2 (4.2) | 0.265 |
| Tap water | 1 (1.1) | |

## 5. CONCLUSION

In conclusion, there is no absolute compliance with malaria control measures by the subjects attending antenatal clinics at ATBUTH, however, the prevalence of malaria in pregnancy is low among these subjects. These findings unraveled the deficit in malaria control practices and provide scientific evidence for the need to raise awareness on compliance with malaria control measures in the region.

## CONSENT

A structured questionnaire was used to obtain data on sociodemography, obstetric history and malaria control practices from the subjects following an informed consent.

## ETHICAL APPROVAL

The study protocol was approved by ATBUTH Institutional Review Board.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. World Malaria Report. Available:011.http://www.who.int/malaria/world_malaria_report_2011/9789241564403_eng.pdf.
2. Desai M, ter Kuile FO, Nosten F, McCready R, Asamoa K, Brabin B. Epidemiology and burden of malaria in pregnancy. Lancet Infect Dis. 2007;7:93–104.
3. Ibeziako PA, Okerengwo AA, William AIO. Malaria immunity in Pregnant Nigerian Women and their babies. J Gynaecol Obstet. 1980;18:147–149.
4. Oyeyemi OT, Sode OJ, Adebayo OD, Mensah-Agyei GO. Reliability of rapid diagnostic tests in diagnosing pregnancy and infant-associated malaria in Nigeria. Journal of Infection and Public health. 2016;9:471-477.
5. World Malaria Report (Malaria in Pregnancy). WHO Global Malaria Programme, Geneva, Switzerland. World Health Organization; 2008.
6. Federal Ministry of Health. Malaria Desk Situation Analysis. Abuja, Nigeria; 2005.
7. Ebako NT, D'Alessandro U. Malaria in Pregnancy. Mediterr J Hematol Infect Dis. 2013;5.
8. Uko EK, Emeribe AO, Ejezie GC. Malaria infection of the placenta and Neonatal Low Birth Weight in Calabar. J Med Lab Sci. 1998;7:7–20.
9. Kalilani L, Mofolo I, Chaponda M, Rogerson SJ, Meshnick SR. The effect of timing and frequency of Plasmodium falciparum infection during pregnancy on the risk of low birth weight and maternal anemia. Trans R Soc Trop Med Hyg. 2010; 104(6):416-420.
10. Huynh BT, Fievet N, Gbaguidi G, Dechavanne S, Borgella S, Guezo-Mevo B, Massougbodji A, Ndam NT, Deloron P, Cot M. Influence of the timing of malaria infection during pregnancy on birth weight and on maternal anemia in Benin. Am J Trop Med Hyg. 2011;85(2):214-220.
11. Lindsay S, Ansell J, Selman C, Cox V, Hamilton K, Walraven G. Effect of pregnancy on exposure to malaria mosquitoes. Lancet. 2000;355(9219):1972.
12. Cserti CM, Dzik WH. The ABO blood group system and Plasmodium falciparum malaria. Blood. 2007;110(7):2250-2258.
13. Staalsoe T, Shulman CE, Bulmer JN, Kawuondo K, Marsh K, Hviid L. Variant surface antigen-specific IgG and protection against clinical consequences of pregnancy-associated *Plasmodium falciparum* malaria. Lancet. 2004;363 (9405):283-289.
14. Rogerson SJ, Boeuf P. New approaches to malaria in pregnancy. Parasitology. 2007; 134:1883-1893.
15. World Malaria Report. World Health Organization, Geneva; 2017.
16. VaÂsquez AM, Medina AC, ToboÂn-Castaño A, Posada M, VeÂlez GJ, Campillo A. Performance of a highly sensitive rapid diagnostic test (HS-RDT) for detecting malaria in peripheral and placental blood samples from pregnant women in Colombia. PLoS ONE. 2018; 13(8):e0201769.
17. Chico RM, Mayaud P, Ariti C, Mabey D, Ronsmans C, Chandramohan D, Prevalence of malaria and sexually transmitted and reproductive tract infections in pregnancy in sub-Saharan Africa. A systematic review. JAMA. 2012; 307(19):2079-2086.
18. Oluwagbemiga A, Bamidele A, Babatunde A, Agomo C, Sulyman M, Rahman O. Prevalence of Malaria in Pregnant Women Attending Antenatal Clinic in Primary Health Centres in Lagos,South West,

Nigeria. Journal of Advances in Medicine and Medical Research. 2018;25(12):1-9.
19. Buhari HA, Erhabor O, Momodu I. *Plasmodium falciparum* Malaria among Pregnant Women attending Ante-Natal Clinic in Sokoto, North Western, Nigeria. Sokoto. Journal of Medical Laboratory Science. 2016;1(1):187-193.
20. Samalia AB, Uchendu, SC, Yarma AA. Prevalence of *Plasmodium falciparum* Malaria in Pregnant women and non-pregnant women attending Specialist Hospital Bauchi, Bauchi State, Nigeria. Palgo J Med Medical Sci. 2017;4(1):139-144.
21. Gunn JKL, Ehiri JE, Jacobs ET, Ernst KC, Pettygrove S, Kohler LN et al. Population‐based prevalence of malaria among pregnant women in Enugu State, Nigeria. The Healthy Beginning Initiative. Malar J. 2015;14:438.
22. Local weather: Maiduguri. My Weather. Available:www.myweather2.com/city-Town/Nigeria/Maiduguri/climate-profile.aspx?month=6.
[Accessed on 6th March, 2019]
23. Qiu SF, Poon WY, Tang ML. Sample size termination for disease prevalence studies with partially validated data. Stat Methods Med Res. 2016;25(1):37-63.
24. Xiaodong S, Tambo E, Chun W, Zhibin C, Yan D, Jian W, Jiazhi W, Xiaonong Z. Diagnostic performance of CareStart™ malaria HRP2/pLDH (Pf/pan) combo test versus standard microscopy on falciparum and vivax malaria between China-Myanmar endemic borders. Malar J. 2013; 12:6.
25. Guidelines for the Treatment of Malaria (3rd ed.). World Health Organization, Geneva; 2015.
26. Agomo CO, Oyibo WA, Anorlu RI, Agomo PU. Prevalence of Malaria in Pregnant Women in Lagos South-west Nigeria. Kor J Parasitol. 2009;47:179–183.
27. Wasif AK, Sean R, Chai P, Jacob K, Sabeena A, Malathi R, Myaing MN. Asymptomatic *Plasmodium falciparum* malaria in pregnant women in the Chittagong Hill District of Bangladesh. Plos ONE. 2013;11:45-50.
28. Yaro CA, Iyaji FO, Tope MO. Rapid Diagnostic Test Kits Detection of Malaria Parasites among Pregnant Women Attending Antenatal in Selected Hospitals in Anyigba, Kogi State, Nigeria. Advances in Bioscience and Biotechnology. 2017; 8:249-258.
29. Georgian I, Matthew O, Nte NI. Prevalence and effect of malaria in pregnancy among antenatal women in Ebonyi State, Nigeria. International Research Journal of Public and Environmental Health. 2017;4(8):177-183.
30. Wellems TE, Walker-Jonah A, Panton LJ. Genetic mapping of the chloroquine-resistance locus on *Plasmodium falciparum* chromosome 7. Proc Nat Acad Sci USA. 1991;88:3382-3386.
31. Biswas S, Tomar D, Rao DN. Investigation of the kinetics of histidine-rich protein 2 and of the antibody responses to this antigen, in a group of malaria patients from India. Ann Trop Med Parasitol. 2005;99: 553-562.
32. Agomo CO, Oyibo WA. Factors associated with risk of malaria infection among pregnant women in Lagos Nigeria. Infect Dis Poverty. 2013;2:19.
33. Report of the meeting on the development of guidelines for testing and evaluation of long-lasting insecticidal mosquito nets. WHO-Pesticide Evaluation Scheme (WHOPES), WHO/HQ, Geneva; 2005.
34. Eberemu NC, Magaji H. The use of microscopy and rapid diagnostic test in diagnosing the prevalence of malaria among women attending antenatal clinic in Dutsin Ma, Katsina State Nigeria Nigerian. J Parasitol. 2017;38:92-96.
35. Dawaki S, Al‐Mekhlafi HM, Ithoi I, Ibrahim J, Atroosh WM et al. Is Nigeria winning the battle against malaria? Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. Malar J. 2016;15:351.



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*The peer review history for this paper can be accessed here:*
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