Effectiveness and compliance to the use of sulphadoxine-pyrimethamine as a prophylaxis for malaria among pregnant women in Port Harcourt, Rivers State, Nigeria

Helen Onoja, Florence O Nduka, Austin E Abah

Department of Animal and Environmental Biology, Faculty of Science, University of Port Harcourt. Rivers State, Nigeria.

Abstract

Background: Malaria during pregnancy escalates the damaging consequence to the mother and neonate. The usage of intermittent preventive treatment of malaria (IPTp) with sulfadoxine-pyrimethamine (SP) is recommended for averting the deleterious consequences of malaria in pregnancy. This study evaluated the effectiveness of, and compliance with the use of SP for malaria among pregnant women in Port Harcourt Rivers State, Nigeria.

Method: A total of 300 samples of maternal peripheral blood (MPB), 84 neonatal cord blood (NCB) and 84 placental blood (PLB) were collected from consenting mothers. Malaria parasitaemia were analysed using standard parasitological methods, and bio-data of consenting mothers were collected through questionnaires and from ANC records.

Results: Out of the samples examined for MPB, 59(19.7%) tested positive to malaria. Those with only primary education (57.1%) and women of age ≤ 20yrs (25%) had higher prevalence. Women who took SP had significantly lower prevalence (17.6%) than those that took other drugs (36.4%) (p < 0.05). Malaria prevalence was highest among women who had 3 months interval between each dose (39.1%), followed by those of 2months (23.7%) and those of 1 month (7.0%) (p < 0.05). The primigravidaes (22.8%) had an insignificantly higher prevalence than secundigravidae (19.4%) and multigravidae (15.9%). Also, 30.5% of women who registered in their third trimester of pregnancy had a significantly higher malaria parasitaemia than those who registered during their first 8.10%, or second trimesters, 19.4%. Of the 84 MPB-NCB-PLB paired samples examined, 16.7%, 8.3% and 25% respectively were infected with malaria parasitaemia. On frequency of compliance, mothers who took SP once (37.5%) had a significantly higher MPB parasitaemia than those who took it twice (7.84%) and those of thrice (6.25%). Neonatal cord blood parasitaemia prevalence revealed that those that took SP once, that is, 25%, had a higher prevalence than others like those of twice (5.88%) and thrice (0%) respectively.

Conclusion: The use and compliance of SP reduced the prevalence of malaria among pregnant women and their new-borns.

Keywords: Compliance; Sulphadoxine-Pyrimethamine; Pregnant women; Malaria Parasitaemia.

DOI: https://dx.doi.org/10.4314/ahs.v22i2.22

Cite as: Onoja H, Nduka FO, Abah AE. Effectiveness and compliance to the use of sulphadoxine-pyrimethamine as a prophylaxis for malaria among pregnant women in Port Harcourt, Rivers State, Nigeria. Afri Health Sci. 2022;22(2): 187-193. https://dx.doi.org/10.4314/ahs.v22i2.22

Introduction

About 32 million pregnancies occur annually in Africa’s malarious regions1, and 74 % of this population live in areas that are highly endemic for malaria2. Malaria during pregnancy is of great public health importance much as it is associated with serious adverse consequences such as maternal deaths, abortion, premature labour, maternal anaemia and low birth weight resulting in maternal and fetal morbidity and mortality. Coupled with the foregoing is that annual average of 200,000 infant deaths has also been associated with malaria in pregnancy3. These unfavorable pregnancy outcomes are connected with sequestration of malaria parasites in the placental intervillous spaces attached to chondroitin-sulphate-A4,5. When Pro-inflammatory cells and cytokines also invade the placental bed, the net result is impairment of foetal blood and nutrient supply, which in turn results in low birth weight (LBW), and most times this proves the greatest risk factor for neonatal mortality as a major contributor to infant mortality5. The pregnant woman runs a higher risk of contracting malaria than her non-pregnant counterpart6,7. A short/occasional drop or reduction in the
maternal immunity due to pregnancy is one of the reasons adduced for the increased susceptibility of the pregnant woman to malaria. Although malaria in pregnancy is often asymptomatic, it is however the cause of a number of unfavorable pregnancy outcomes both in the mother and in her baby.6,8. The African Summit on Roll Back Malaria in April 2000 adopted the Abuja Declaration in which regional leaders committed themselves to ensuring that 60% of pregnant women in malaria-endemic communities accessed effective prevention and treatment of malaria by 2005.9. Also, 80% scale-up was also initiated by the federal government to ensure that at least 80% of pregnant women in the country participate in IPTp-SP10.

Over the years, malaria prophylaxis with pyrimethamine or chloroquine was broadly adopted in many African countries11. However, poor compliance and emergence of drug resistant strains of Plasmodium falciparum compromised the efficacy of these drugs12. In order to reduce the possibility of Plasmodium falciparum infection in pregnancy and its subsequent adverse effects, the World Health Organization (WHO) recommends intermittent preventive treatment in pregnancy using sulphadoxine-pyrimethamine (IPTp-SP) with at least 2 doses of SP one month at intervals after quickening13. IPTp-SP is provided as part of a comprehensive antenatal package to control maternal anaemia, and it has proved to be safe, inexpensive and effective14; and it has resulted in increase of both maternal haemoglobin levels and the infant’s birth weight15,16. Although majority of the pregnant women attend antenatal clinic at least once during pregnancy, extant indication shows that IPTp-SP uptake as well as ITN coverage among pregnant women is unacceptably low in most countries17, and lowest in areas with highest transmission of malaria18.

While most pregnant women in Nigeria receive IPTp-SP, at least once during pregnancy about 5% of them take it up to three times19. This study is intended to aid relevant programmes and policies needed to ensure a universal and an optimal coverage of IPTp-SP. The study ultimately aimed at evaluating the effectiveness of, the use of SP as a preventive treatment in a Tertiary Hospital in Port Harcourt.

Methods

Study Area

This was a cross-sectional descriptive study carried out between February and June, 2018 among pregnant women who registered for antenatal at Rivers State University Teaching Hospital (RSUTH), and those who had their babies in their labour ward. Port Harcourt is the capital of Rivers State which is one of the largest cities in the Niger Delta region of Nigeria. The temperature all through the year varies between 25°C to 32°C.

Inclusion and Exclusion Criteria

Healthy Women who attended ANC in RSUTH Labour ward and who consented to be studied with their Neonates enrolled for the study. This study excluded mothers who are suffering from Sickle Cells Disease (SCD), Human Immunodeficiency Virus (HIV) and Diabetics. Healthy mothers who refused to consent to be studied were excluded from the samples, and as such were completely excluded in the overall research study.

Ethical Clearance

Permission was obtained from Rivers State Ministry of Health, Rivers State Hospital Management Board, the Chief Medical Director of the Rivers State Teaching Hospital and University of Port Harcourt Ethical Committee. Each mother’s consent was also obtained.

Administration of Questionnaire

A designed proforma containing obstetrics and demographic questions relating to age, education, parity, types of preventive drug taken during the pregnancy and other personal efforts to prevent malaria was administered to the women. This study proforma was quickly done during the first stage of labour. Other useful information was gotten from their ANC records.

Sample Collections

Maternal Peripheral Blood (MPB) samples were collected from 300 consenting mothers, while only 84 women consented to the collection of Neonatal Cord Blood (NCB) and Placental Blood (PLB). All samples were collected into Ethylene Diamine Tetra Acetic Acid (EDTA) bottles to prevent clotting. Samples were then transported to the Parasitology Research Laboratory of the Department of Animal and Environmental Biology for analysis. The mothers’ 5mls pre-delivery peripheral blood was taken on admission into the labour ward. The cord blood of the neonates and Placental blood of consenting mothers were collected immediately after the delivery into heparinized tubes respectively.
Laboratory Analysis
Thick and thin blood films for each sample were prepared on a clean grease-free microscope glass slide. The smears were air-dried. The thin films were fixed in absolute methanol and they were both stained in 1:10 dilution of Giemsa stain. They were air-dried and examined under x100 objective lens of the binocular light Microscope²⁰.

Data Analysis
Data obtained from the study were presented for analysis using SPSS version 22. Chi-square trend (χ²) with Yate's correction was used to investigate the effects of quantitative and qualitative variables respectively. A p-value <0.05 was considered significant.

Results
Of the 300 women examined, 59(19.66%) tested positive to malaria with those that had primary education (57.1%) having a significantly higher prevalence of infection than those of secondary (29%) and those of tertiary (16.5%) counterparts (χ²=8.101, df=2, p=0.017) as shown in Table 1.

| Characteristic       | No. Examined | No Infected | χ²   | p-value |
|----------------------|--------------|-------------|------|---------|
| Educational Status   |              |             |      |         |
| Primary              | 7            | 4(57.1)     |      |         |
| Secondary            | 105          | 24(22.9)    |      |         |
| Tertiary             | 188          | 31(16.5)    | 8.101| 0.017   |
| Total                | 300          | 59(19.66)   |      |         |
| Ages (Yrs)           |              |             |      |         |
| ≤20                  | 12           | 3(25)       |      |         |
| 21-30                | 109          | 23(21.10)   |      |         |
| 31-40                | 161          | 30(18.63)   |      |         |
| ≥41                  | 18           | 3(16.66)    | 0.569| 0.903   |
| Parity               |              |             |      |         |
| Primigravidae        | 114          | 26(22.80)   |      |         |
| Secundigravidae      | 98           | 19(19.38)   |      |         |
| Multigravidae        | 88           | 14(15.9)    | 1.503| 0.472   |

Those aged ≤20 yrs (25%) had the highest prevalence followed by those of 21-30yrs (21.10%) while those of >40yrs (16.66%) had the least. And although there was a difference in prevalence across the various age groups, it was not significant (χ²=0.569, df=3, p=0.903).

Parity of the participants showed that the primigravidae (22.80%) had an insignificantly higher prevalence than secundigravidae (19.38%) and multigravidae (15.9%) (χ²=2.728, df=2, p=0.472) (Table 1). Women (30.49%) who registered in their third trimester of pregnancy had a significantly higher malaria parasitaemia than those who registered during either their first 8.10%, or second trimesters, 19.44%, (χ²=12.340, df=2, p=0.002). Preventive drugs taken during the pregnancies showed that 17.60% of women who took SP had a significantly lower prevalence compared to women who took other drugs, i.e.36.36% (χ²=6.543, df=1, p=0.011) (Table 2). The trimester in which the usage of SP started revealed that 14.86% of the pregnant women who started treatment in their second trimesters had an insignificantly lower infection than 25% who started in their third trimester (χ²=3.719, df=1, p=0.054).
Table 2: Relationship between parasitaemia and IPTP-SP compliance among pregnant women in Port Harcourt

| Time of registration | ANC No. Examined | No Infected | χ² | p-value |
|----------------------|-----------------|-------------|-----|---------|
| First                | 74(24.7)        | 6(8.10)     |     |         |
| Second               | 144(48)         | 28(19.44)   |     |         |
| Third                | 82(27.3)        | 25(30.49)   | 12.340 | 0.002  |

Preventive Drugs

| SP                | Preventive Drug Complied: 267(89) | Infected: 47(17.60) | χ² | p-value |
|-------------------|-----------------------------------|----------------------|-----|---------|
| Others            | 33(11)                            | 12(36.36)            | 6.543 | 0.011   |

Trimester SP intake started

| Time of registration | ANC No. Examined | No Infected | χ² | p-value |
|----------------------|-----------------|-------------|-----|---------|
| Second               | 195(73)         | 29(14.86)   |     |         |
| Third                | 72(27)          | 18(25)      | 3.719 | 0.054   |

Number of times SP was taken

| Time of registration | ANC No. Examined | No Infected | χ² | p-value |
|----------------------|-----------------|-------------|-----|---------|
| Once                 | 40(14.9)        | 11(27.5)    |     |         |
| Twice                | 204(76.4)       | 34(16.7)    |     |         |
| Thrice               | 23(8.6)         | 2(8.69)     | 4.083 | 0.130   |

Interval between intake of doses of SP

| Time of registration | ANC No. Examined | No Infected | χ² | p-value |
|----------------------|-----------------|-------------|-----|---------|
| 1 month apart        | 128 (56.39)     | 9(7.03)     |     |         |
| 2 months apart       | 76 (33.48)      | 18(23.68)   |     |         |
| 3 months apart       | 23 (10.1)       | 9(39.13)    | 20.297 | 0.000   |

Malaria parasitaemia, in relation to the number of times SP was taken, indicated that pregnant women who took SP once had a prevalence of 27.5%, while those that took it twice and thrice had prevalence of 16.7% and 8.69% respectively. In this connection, the difference was insignificant (χ²=3.897, df= 2, p=0.143).

Malaria infection with respect to the interval between intake of SP revealed that prevalence was highest among those who had 3 months interval between each dose (39.13%), followed by those of 2months (23.68%); while those that took at 1 month interval had the lowest (7.0%), and the difference between them was significant (χ²=13.047, df=2, p= 0.000) (Table 2).

Eighty-four (84) women consented to the collection of their three blood samples (MPB, NCB and PLB) out of which 75 were on SP and 9 were not. The result revealed that 33.33% of those not on SP had an insignificantly higher prevalence of maternal peripheral blood (MPB) parasitaemia than those on SP which constituted (14.66) (χ²=2.016, df=1, p=0.156). Neonatal cord blood examination also showed that those not on SP, the 22.22% had a higher prevalence of infection than those on SP (6.66%), but the difference was insignificant (χ²=2.545, df=1, p=0.111). Malaria prevalence in the placental blood revealed that those not on SP made up of 66.66% had a significantly higher prevalence than their SP counterparts totalling 20%, (χ²=9.333, df=, p=0.002). (Table 3)

Based on frequency of compliance, mothers who took SP once (37.5%) had a significantly higher MPB parasitaemia than those who took it twice (7.84%) and those of thrice (6.25%) (χ²=6.799, df=2, p=0.033). Neonatal cord blood parasitaemia prevalence revealed that those that took SP once, had a higher prevalence (25%) than those that took twice (5.88%) and thrice (0%) respectively; but the difference was insignificant χ²=5.515, df=2, p=0.063, while parasitaemia prevalence in PLB showed a significant difference between those whose frequencies were once 50%, twice 19.61% and thrice 6.25% (χ²=6.396, df=2, p=0.041) as shown in Table 3.
Table 3: Malaria parasitaemia based on compliance to SP among pregnant women in Port Harcourt

| SP compliance | No. Examined | No. Infected | MPB(%) | NCB(%) | PLB(%) |
|---------------|-------------|-------------|--------|--------|--------|
| Compliant     | 75          | 11(14.66)   | 5(6.66)| 15(20) |
| Non-compliant | 9           | 3(33.33)    | 2(22.22)| 6(66.66)|
| Total         | 84          | 14(16.66)   | 7(8.33)| 21(25) |
| $\chi^2$      |             | 2.016       | 2.545  | 9.333  |
| p-value       |             | 0.156       | 0.111  | 0.002  |

SP-complaints usage frequency

| Frequency  | No.  | MPB (%) | NCB (%) | PLB (%) |
|------------|------|---------|---------|---------|
| Once       | 8    | 3(37.5)| 2(25)  | 4(50)   |
| Twice      | 51   | 4(7.84)| 3(5.88)| 10(19.61)|
| Three      | 16   | 1(6.25)| 0(0)   | 1(6.25) |
| Total      | 75   | 8(10.66)| 5(6.66)| 15(20)  |
| $\chi^2$   |      | 6.799   | 5.515  | 6.396   |
| p-value    |      | 0.033   | 0.063  | 0.041   |

* Only 84 participants gave consents for the collection of the three samples (MPB-Maternal Peripheral Blood, NCB-Neonatal Cord Blood and PLB-Placenta Blood.

Discussion
The results of this study indicated that SP use during pregnancy is effective in reducing malaria prevalence both in the maternal peripheral blood (MPB) and Neonatal cord blood as mothers who took SP only once (37.5%) had a significantly higher MPB parasitaemia than those who took it twice (7.84%) and those of thrice (6.25%). Also, neonatal cord blood parasitaemia prevalence revealed that those that took SP once, had a higher prevalence (25%) than those that took twice (5.88%) and thrice (0%) respectively. This finding agrees with the findings in Kenya and Nigeria17,21.

In an evaluation of the effectiveness of SP in preventing maternal malaria, it was observed that women who took SP had a significantly lower prevalence compared to women who took other drugs. A prevalence of 17.6% was recorded in this study among SP users which agrees with a prevalence of less than 20% reported22. This shows the protective effects of SP, as the non SP compliant had a significantly higher prevalence value.

The use of SP as an approved preventive drug was high since 89% of the women were SP-complaints. This value agrees with the findings of Bassey who reported 85.7% in the same region23. This value however varies with the 33% reported in the eastern part of Nigeria21. The higher compliant level in this study area could be attributable to a number of factors such as the availability of the drug, the type of health facility, the social economy class of the women in the study area, the health information and education of the women on malaria prevention in pregnancy. These results also indicated that the national 80% scale-up target of IPTp-SP in the study area had been met. The 89% recorded in the current study could be as a result of progress made by the federal government in developing policy thrust, partnership and funding necessary for the effective malaria control in pregnancy. The recommended doses of IPTp in Nigeria are three doses. However, less than half took the complete three doses, probably due to late registration for antenatal care at the third trimester (48%), skipping of ANC appointment and because they do not enforce the Directly Observed Therapy (DOT), or due to failure of some of the women to take their drugs.

Approximately, 15% of the women took SP once during pregnancy while 76.4% took it twice and 9% took it thrice. These findings are similar to the report of Doku and Mpungu who discovered that less than half pregnant women took the recommended doses in Ghana and Uganda respectively24,25. The interval between successive doses of SP indicated that 63% of the women took the
doses one month interval. This relatively high level of adherence could be attributed to the numerous efforts made by the government and Hospital management to ensuring compliance to WHO recommendations pertaining SP usage. The significant decrease in maternal parasitaemia between those that took their doses one month apart and others could be due to the possibility of higher concentration of SP circulating in their peripheral blood. The non-total compliant attitude of women towards taking complete SP dosages may be the reason why this study recorded 19.7% malaria parasitaemia despite that we recorded 89% compliance to SP.

Out of the 300 women that were recruited into this study, only 84 women gave their consent for the collection of their NCB and PLB. Of the 84 MPB-NCB-PLB paired samples examined, 16.66%, 8.33% and 25% respectively were infected with malaria parasitaemia. There was no significant associations of parasitaemia between SP-compliers (14.66%) and non-compliers (33.33%) in MPB (p>0.05), and SP-compliers (6.66%) and non-compliers (22.22%) in NCB (p>0.05) but a significant association existed between them in PLB (p<0.05). The result showed that it was not in all cases of Placental Parasitaemia that Neonatal Parasitaemia was discovered and this resulted to a lower prevalence of 22% and 6.7% for those on SP and those not on SP respectively. This may be because of the Foetus IgG antibodies which help to fight against diseases and only densely positive cases of Placental parasitaemia can transfer to the foetus\textsuperscript{23}.

The women who used SP as preventive drug in pregnancy recorded a significantly lower malaria prevalence than those that took other drugs. Likewise women that complied strictly with the rules of SP recorded 0% parasitaemia in the Neonatal Cord Blood films. This again buttresses the fact that SP is very effective in malaria prevention.

**Conclusion**

SP-compliant women recorded significantly lower maternal and Neonatal malaria infections and also lower malaria-related adverse pregnancy effects. Intermittent preventive treatment in pregnancy using Sulphadoxine-pyrimethamine (IPTp-SP) is an effective agent against malaria in pregnancy. There is also increased response to the use of SP as an ant-malarial agent in pregnancy. This means that the federal government campaign and funding of the programme is yielding positive results in the study area. However to ensure total compliance, the campaign on early registration for ANC should be intensified as some women deliberately choose to register late. The health education on the importance of not postponing ANC appointment should be intensified and the Pharmacist or Midwife should ensure that the Directly Observed Therapy rule is adhered to strictly.

**Conflict of interest**

The authors do not have any conflict of interest in the Publication of this Article.

**Acknowledgement**

We sincerely thank the women who gave their consent especially those that gave consent for the collection of the three samples (MPB, NCB and PLB). We also thank Mrs Dambo Helen, Mrs Nangi Blessing, Mrs Ojido Susan and Mr Jack Barido for their assistance during this work.

**References**

1. Dellicour S., Tatem A.J., Guerra C.A., Snow R.W. and TerKuile, F.O. (2010). Quantifying the number of pregnancies at risk of malaria in 2007: a demographic study. *PLoS Medicine*, 7:e1000221.
2. WHO Regional WHO (2006). Regional Office for Africa. The health of the people: the African regional health report. Geneva:
3. WHO (2017). Malaria in pregnancy (2017). Available from: http://www.who.int/malaria/areas/high_risk_groups/pregnancy/en/ Accessed on 2 October, 2017
4. Williams, N. (1996): Malaria hideout found in new mothers. *Science*, 272:1416-1417.
5. Van Geertruyden, J.P., Thomas, F., Erhart, A., D'Alessandro, U. (2004): The contribution of malaria in pregnancy to perinatal mortality. *American Journal of Tropical Medicine and Hygiene*.
6. Brabin, B.J. (1983): An analysis of malaria in pregnancy in Africa. *Bull World Health Organization*, 61:1005-1016. 71(2):35-40
7. Akanbi, O.M., Odaibo, A.B., Afolabi, K.A., Ademowo, O.G. (2005). Effect of self-medication with antimalarial drugs on malaria infection in pregnant women in South-Western Nigeria. *Med Princ Pract*, 14:6-9.
8. Kassam, S.N., Nesbitt, S., Hunt, L.P., Oster, N., Soothill, P., Sergi, C. (2006). Pregnancy outcomes in women with or without malaria. *International Journal Obstetrics and Gynaecology*, 93:225-23.
9. Roll Back Malaria/WHO (2000). The Abuja declara-
tion and the plan of action. An extract from the African Summit on Roll Back Malaria, Abuja. Geneva: WHO.

10. Federal Ministry of Health.(2009). National framework for monitoring and evaluation of malaria control in Nigeria. FMI, Nigeria, pp. 1–39.

11. WHO (1986). WHO Expert committee on malaria. Eighteenth report. Geneva. World Health Organization, WHO technical report series.

12. Sirima S.B., Sawadogo, R., Moran, A.C., Konate, A., Diarra, A., Yameogo, M., Parise, M.E., Newman, R.D. (2003): Failure of a chloroquine chemoprophylaxis program to adequately prevent malaria during pregnancy in Koupela District, Burkina Faso. *Clinic of Infectious Diseases*, 36:1374-1382.

13. World Health Organization (2004). A strategic framework for malaria prevention and control during pregnancy in the African region. AFR/MAL/04/01. Brazzaville: WHO Regional Office for Africa, 2004.

14. Verhoeff, F.H., Brabin, B.J., Hart, C.A., Chimsuku, L., Kazembe, P. and Broadhead, R.L. (1999). Increased prevalence of malaria in HIV-infected pregnant women and its implications for malaria.

15. Rogerson, S.J., Chaluluka, E., Kanjala M., Mkundika, P., Mhango, C., Molyneux, M.E. (2000). Intermittent sulphadoxine-pyrimethamine in pregnancy: effectiveness against malaria morbidity in Blantyre, Malawi, in 1997–99. *Transatlantic Royal Society of Tropical Medicine and Hygiene*, 94:549–53.

16. Shulman CE, Marshall T, Dormon EK, Bulmer JN, Cutts F, Peshu N, Marsh K (2001). Malaria in pregnancy: adverse effects on haemoglobin levels and birth weight in primigravidae and multigravidae. *Tropical Medicine and International Health*, 6:770–8.

17. Malaria protection in pregnancy (2013): A lifesaving intervention for preventing; 2013. www.pmi.gov/technical/pregnant/docs/mip_brief.pdf. 2013

18. Van Eijk, A.M., Hill J, Alegana, V.A., Kirui, V., Gething, P.W., TerKuile, F.O., Snow RW (2011): Coverage of malaria protection in pregnant women in sub-Saharan Africa: a synthesis and analysis of national survey data. *Lancet Infectious Diseases*, 11:190–207.

19. Chukwurah J.N., Emmanuel TI., Adeniyi K.A., Oluwagbemiga, O.A., Philip U.A., Adetoro, O.O. (2016). Knowledge, attitude and practice on malaria prevention and sulfadoxine-pyrimethamine utilization among pregnant women in Badagry, Lagos State, Nigeria. *Malaria World Journal*, 7(3):1-6

20. Arora, D. R. and Arora B.B. (2010): Medical Parasitology third edition, CBS publishers and distributors PVT LTD, New Delhi, Bangalore, 240-241.

21. Nduka F.O, Nwosu E and Oguariri R. M. (2011). Evaluation of the effectiveness and compliance of intermittent preventive treatment (IPT) in the control of malaria in pregnant women in south eastern Nigeria. *Annals of Tropical Medicine and Parasitology*, 105(8): 599–605.

22. Falade C.O., Olukemi O.T., Oluwatoyin O.O., Adebola E. O. (2010). Effects of malaria in pregnancy on newbornanthropometry. *Journal of Infections in Developing Countries*, 4(7):448-453

23. Bassey G., Nyengidiki T.K. and John C.T. (2015): Prevalence of placental Plasmodium parasitaemia and pregnancy outcome in asymptomatic patient at delivery in a University Teaching Hospital in Nigeria. *Nigeria Journal of Clinical Practice* 18:27-32

24. Doku D.T., Mumuni M.Z. and Addae B.A. (2016): Factors influencing dropout rate of IPTp of Malaria in Pregnancy, *BMC Research Notes* 9:460.

25. Mpungu S.K. and Mufubenga P. (2008): Use of antenatal care maternity services, intermittent Presumptive treatment and insecticides treated bed nets by pregnant women in Luwero district, Uganda. *Malaria Journal* 7:44