Introduction

Malaria poses enormous public health burden worldwide [1]. Pregnant women and children under the age of 5 years are at risk of severe disease and mortality. The burden of malaria in pregnancy in sub-Saharan Africa is caused mainly by *Plasmodium falciparum* [1]. In malaria holo-endemic areas, malaria in pregnancy may remain asymptomatic despite sequestration of parasitized red blood cells in the placental micro-circulation with antecedent complications [2]. These complications include chronic anaemia, post-partum haemorrhage and death. The impact on the foetus is usually from maternal infection of the placenta and maternal anaemia resulting in low birth weight, prematurity, still birth, abortions, intra-uterine growth restriction, as well as congenital malaria [1, 2].

Prevalence rates for malaria parasitaemia in pregnancy (using microscopy) in hospital-based surveys in different parts of Nigeria included 3.1% in Sokoto in the north-west [3], 9.0% in Jos in the north-central [4] 27.4% in Lagos in the south-west [5] and 39.1% in Awka in the south-east [6].

Most of the available data were from urban areas, whereas most of Nigeria is rural [7]. This anomaly partly derives from the difficulty in conducting microscopy in rural areas because microscopists are few and power supply is erratic. However, Rapid Diagnostic Test (RDT), now recommended by the World Health Organization (WHO) for diagnostic purposes where microscopy is unavailable [8, 9] is not yet widely used in surveys in Nigeria.
of the PHC. The written informed consent was read, interpreted and explained in the local dialect by trained research assistance to the participants; following which each participant then gave a verbal consent before being recruited in the study.

Recruitment of subjects was during the campaign for malaria control at the PHC, Odo-Aiye. Participants for this study included all pregnant women who were in attendance during the malaria campaign program. Pregnant women who though were present during the program but had already booked at the PHC or in any other organized health facility were excluded from this study. Pregnant women who had fever or who received antimalaria drugs in the preceding two weeks to the study and those who were on intermittent preventive treatment (IPT) were also excluded from the final analysis of the study. Fever was defined as axillary body temperature $\geq 37.5^\circ C$ or history of fever in preceding 7 days to this study. Participants for the study included all pregnant women who were in attendance during the malaria campaign program. Pregnant women who had fever or who received antimalaria drugs in the preceding two weeks to the study and those who were on intermittent preventive treatment (IPT) were also excluded from the final analysis of the study. Fever was defined as axillary body temperature $\geq 37.5^\circ C$ or history of fever in preceding 7 days to this study [1].

A total of 116 pregnant women attended the campaign program. In line with aforementioned criteria, 31 were excluded from the study because they had booked in the PHC; of whom 4 had received IPT for malaria and another 4 had fever during the period of recruitment for this study.

A validated questionnaire was administered to the participants by one of the authors and assisted by a trained research assistant who verbally translated the required information in the questionnaire to respondents where necessary. The questionnaire contained questions about the participants’ demography, whether or not she had long lasting insecticide-treated net (LLIN), and whether she slept under the net. Family social class was obtained by the method proposed by Olusanya, Okpere and Ezi-mokhai [10], using level of education of the participant and the occupation of her husband. In this method of classification of social class, specific scores (0, 1, and 2 for the woman’s level of education; and 1, 2 and 3 for her husband’s occupation) was allotted to each participant and the sum of these scores was used to describe social class as I, II, III, IV, and V. Participants with scores I and II were classified as upper class, III-middle class; IV and V as lower class. The gestational age of the participants was calculated from the first day of the last menstrual period (LMP).

Each subject was then tested for malaria using the RDT kit for malaria parasite- *Plasmodium falciparum* (pf). The RDT was a one step invitro diagnostic test for qualitative detection of pf antigen known as the histidine-rich protein II (HRP-II) in capillary blood [11]. The RDT kit for malaria parasite received the recommended anti-malarials in line with the national guideline for treatment of malaria in pregnancy.

**Data analysis**

The data obtained for this research was entered into the Statistical Package for Social Sciences (SPSS) version 16.0 (SPSS Inc Chicago, Illinois, USA) spread sheet where analysis was also done. The major outcome variable was the presence of malaria parasitemia. Associations with this variable were tested using chi-square and student t tests as appropriate. The level of significance of each test was set at $p < 0.05$.

| Demographic data n = 85 (%) |
|---------------------------|
| **Age**                  |
| 18-24 years              | 50 (55.3) |
| 25-31 years              | 46 (51.4) |
| 32-38 years              | 8 (9.4)   |
| 39-45 years              | 1 (1.2)   |
| **Educational status**   |
| No formal education      | 7 (8.2)   |
| Primary                  | 22 (25.9) |
| Secondary                | 54 (63.5) |
| Tertiary                 | 2 (2.4)   |
| **Social class**         |
| Upper                    | 1 (1.2)   |
| Middle                   | 9 (10.6)  |
| Lower                    | 75 (88.2) |

**Tab. I.** Demographic data of the subjects.
Results

Mean (± SD) age of the 85 pregnant women recruited for this study was 26.1 ± 4.7 years (age range 18-40 years); mean gestational age was 27.1 ± 8.1 weeks (range 6-40 weeks). Forty-five (52.9%) were in the third trimester, 35 (41.2%) were in second trimester and 5 (5.9%) were in the first trimester. Forty-eight (56.5%) were multipara, 20 (23.5%) were primigravidae and 17 (20.0%) were grand multiparous women. Fifty-four (63.5%) of the women had secondary education, 22 (25.9%) had primary, 2 (2.4%) had tertiary education and 7 (8.2%) had no formal education. Table I shows the age group and social class of the respondents. Majority (88.2%) of the women were from the lower social class and most were 31 years and below.

The prevalence of malaria parasitaemia in this study was 22 (25.9%). There was no significant difference in mean age of infected (26.5 ± 5.1 years) and non-infected subjects (25.9 ± 4.6 years); (t = 0.46, p = 0.65, 95%CI = -1.78, 2.85).

Only 3 (3.5%) out of the 85 women owned LLIN; and only one of the three slept under a LLIN. Reason given by the other two who did not sleep under the net was that the net was difficult to mount. Malaria parasitaemia was not significantly associated with age, parity, gestational age and social class (Tab. II).

Discussion

The high prevalence of asymptomatic malaria in pregnancy in this study supports similar findings in other stable malarial transmission areas [1, 3-6]. Susceptibility to Plasmodium parasitaemia has been linked to the level of antibodies to placental sequestrated parasites [2]. The most preferentially adherence is to the chondroitin sulphate-A (CSA) receptors expressed by the syncytiotrophoblasts in the placenta [12]. This adherence is common in primigravidae and women in second pregnancy as the anti-adhesion antibodies against CSA binding parasites usually develop in women after successive pregnancies [2]. The consequence of untreated asymptomatic malaria parasitaemia in pregnancy is enormous [3-6], therefore adequate and prompt implementation of malaria control policy for pregnant women should be intensified to protect these women and their un-born babies from the antecedent complications of malaria disease.

In most African countries, pregnant women usually book for antenatal care by the 2nd trimester [13], there is the need for malaria parasite screening as a routine test at booking to identify and treat asymptomatic malaria parasitaemia with the recommended anti-malarial drug before the commencement of IPT. Some authors have also suggested that in areas with high prevalence of asymptomatic malaria in pregnancy, it may be more appropriate to institute intermittent screening for malaria parasite using simple tools such as the RDT as well as treat the individual with presence of asymptomatic malaria parasitaemia as alternative to IPT especially in areas where sulphadoxine-pyrimethamine (SP) resistance is very high [14].

Malaria detection using RDT is a major break-through in malaria control [8]. Though this study did not compare the prevalence of malaria parasitaemia by RDT and microscopy, the prevalence found (25.9%) was comparable to 27.4% observed in a study among pregnant women using microscopy in Lagos, in the same south-west Nigeria [5]. Malaria screening and diagnosis in pregnancy using RDT especially at booking may also be a cost effective malaria control strategy in pregnancy and should be an integral component of malaria control in pregnancy in holo-endemic regions.

Only 3.5% of the pregnant women had the LLIN. The use of the LLIN is now one of the most important preventive tools against malaria. LLIN has been shown to reduce the number of infective mosquito bites by 70.0 – 90.0% in a variety of ecologic settings as well as reduce the prevalence of malaria in children and adults [15, 16]. Unfortunately, most women of reproductive age group in Nigeria do not possess the LLIN and the few who had the LLIN barely sleep under the net [15].

Limitations of the study

The observations were not sufficient to permit statistical significance in the observed differences. In addition, microscopy on the specimens could have offered an opportunity to assess the validity of the RDT results in the community.
Conclusions

This study showed that one-quarter of the pregnant women had asymptomatic malaria parasitaemia and that RDT can be an invaluable instrument for malaria diagnosis in rural areas. The authors therefore recommended routine malaria parasite screening for all pregnant women at booking as well as scaling-up the availability of LLIN for vector control and the RDT kits for malaria diagnosis in rural areas. Health education on the use of LLIN as important tool for control of malaria should be intensified in malaria control National Advocacy, Communication, and Social Mobilization Strategic Framework and Implementation Plan in Nigeria.

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