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Plasmodium falciparum Malaria among Pregnant Women Attending Ante - Natal Clinic, Federal Medical Center, Birnin Kudu, Jigawa State, Nigeria

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Abstract

Malaria in pregnancy is a major public health problem in endemic areas of sub-Saharan Africa and has significant consequences on birth outcome. This research work was carried out between May and August, 2017 in Ante- Natal clinic, Federal Medical Center, Birnin Kudu, Jigawa State, Nigeria. A total of 406 blood samples were collected from the pregnant women. Malaria parasites were examined microscopically on thick and thin blood smear stained with Giemsa stain, personal data were collected orally and from file records and were analyzed using Chi-square test. The results showed that of 406 pregnant women sampled, 219 (53.9%) were positive for *Plasmodium falciparum*. The highest prevalence of *P. falciparum* (79.8%) was observed in ages 15-20 pregnant women while the lowest prevalence of (21.6%) was found in ages 41-45. Statistical analysis showed a significant difference in between the various age groups (P<0.05). Multigravidae pregnant women recorded higher prevalence of (54.7%) while (52.5%) prevalence was observed in primigravidae. Women in the second trimester were more infected with *P. falciparum* (43.8%) than those in first trimester (26.5%) and third trimester (29.7%) and this was not significant (P>0.05). Malaria infection showed a high level of endemicity in the study area, hence, there is need for prompt treatment offered to pregnant women, encourage the use of insecticide -treated bed nets and to incorporate the laboratory components into the RBM strategy by enhancing parasite diagnosis at all levels of health care.

Keywords: *Birnin Kudu; Gravidity; Pregnant women; Prevalence; Plasmodium falciparum*

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Introduction

Malaria is a preventable and treatable infectious disease, which is transmitted through the bites of infected female anopheles mosquitoes. Malaria is caused by a protozoan parasite of the genus Plasmodium, four species namely; *Plasmodium vivax, P. ovale, P. malariae* and *P. falciparum* are responsible for human malaria [1]. *P. falciparum* accounts for about 80% morbidity and 90% mortality in humans [2], its common symptoms include headache, weakness, fever, pains, high body temperature (chills and rigors), bitterness of mouth and loss of appetite [3]. In children, additional symptoms include more than sleeping, nausea and vomiting.

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Malaria kills more than one million people every year, most of them in Sub Saharan Africa, where malaria is a leading cause of death for children under five years and pregnant women [4]. However, the current status as reported by WHO [5] was 219 million cases in 2010. That year between 660,000 and 1.2 million people died from the disease (roughly 2000-3000 per day [6]. In Sub Saharan Africa, malaria in pregnancy is predominantly asymptomatic and yet a major cause of severe maternal anaemia and low birth weight babies strongly associated with marked increase in infant mortality [7].

Malaria is endemic in Nigeria and its existence is well recognized and surveys reporting the prevalence in various communities in Nigeria [8-10]. Available records show that at least 50 percent of the population of Nigeria suffers from at least one episode of malaria each year [11]. High level of malaria endemicity, parasite resistance to affordable drugs and inadequate access to treatment facilities has contributed to making the disease the leading killer of children, accounting for an estimated 300,000 deaths each year. Many researchers have reported high prevalence rates of malaria in pregnancy in different parts of the country, ranging from 19.7% to 72.0% [12], with anaemia, pregnancy miscarriages and low birth weight of babies identified as the most debilitating effects of the disease which accounts for 11% of maternal deaths in the country [13]. Pregnant women are 3 times more likely to suffer from severe disease as a result of malarial infection compared with their non-pregnant counterparts, and have a mortality rate from severe disease that approaches 50% [14,15]. In endemic areas, acquired immunity, though established is liable to break down the conditions of stress, in pregnant women. During pregnancy, there are usually high protein requirement and if dietary intake is insufficient, metabolic channels may be altered to withdraw protein from the immune system, hence the low the immunity in pregnant women [16]. Fetal and prenatal mortality, which sometimes lead to premature and false labour, occur in malarious mothers, although the incidence of preterm delivery is significantly increased only in non-immune mothers or those with low level of acquired immunity. Different studies have shown that malaria infection is more prevalent in primigravidae than in multigravidae [17,18].

Transmission of malaria is intense and stable in Nigeria because the intensity of attack remains constant throughout the year or from year to year. The degree of endemicity of malaria measured is based on the spleen rate in children aged 2-9 years as published by World Health Organization (WHO) in order of severity. Hypoendemic malaria occurs when spleen rate in children is less than 10%, Mesoendemic occurs when the spleen rate is 11-50% in children, Hyperendemic occurs when spleen rate is 75% in children and greater than 25% in adults while Holoendemic occurs when spleen rate is greater than 75% in children but very low in adults. Malaria is holoendemic in Nigeria, with *Plasmodium falciparum* accounting for ninety five percent of all infections in the country [12]. Due to the terminal form of the malaria infection in the country, we studied the prevalence of the disease in pregnant women in ante- natal clinic of Federal Medical Center, Birnin Kudu, Jigawa State, Nigeria.

Materials and Methods

The Study Area and Population

Birnin Kudu is a small town and a Local Government Area in the south of Jigawa State, Nigeria (Figure 1). The Local Government Area is located 41Km from the state capital and some 120Km south-east of Kano [19]. It is situated at 11.45° North latitude, 9.5° East longitude and 474m elevation above the sea level [20]; and has an estimated population of 313,373 [21]. The climate is semi-arid, characterized by long dry season and short wet season. The climatic factors vary considerably over the year and are sharply inconsistent. The temperature out regime is warm to hot. The mean annual temperature is about 25°C but the mean monthly values range between 21°C in the coolest month and 31°C in the hottest month. Wet season is roughly four months (June to September) and dry season is seven to eight months (October to May). The rainy season may commence in May, but early rains in April are most common. The bulk of the rainfall comes in June through September. Violent dust storms are usually accompanied by tornadoes and lightening, which usually precede the onset of the rains in May/June and their retreat in September or earlier than that [22]. Most of the state falls within the in Sudan Savannah vegetation belt, but traces of Guinea savannah vegetation are found in parts of the southern districts. Extensive open grasslands, with few scattered stunted trees, are characteristics of the vegetation. The ecology of Birnin Kudu provides suitable breeding sites for biological multiplication, development and high survival rate of female Anopheles mosquito vectors for the transmission of malaria parasite to the populace. The major occupation of the inhabitants is farming, Cattle rearing and fishing

Ethical Consideration

Prior to data collection, ethical clearance was taken from the State Ministry of Health and from the Chief Medical Director of Federal Medical Center Birnin Kudu, Jigawa State, Nigeria. The oral consent of each pregnant women sampled was also sought before commencing this study. Four Hundred and Six pregnant women who visited the ante-natal clinic of Federal Medical Center, Birnin Kudu were involved. Structured Questionnaire were distributed to and completed by the pregnant women to obtain information such as age, stage of pregnancy, gravidity and bio-data. Pregnant women who could not read or write where assisted in filling their questionnaires.

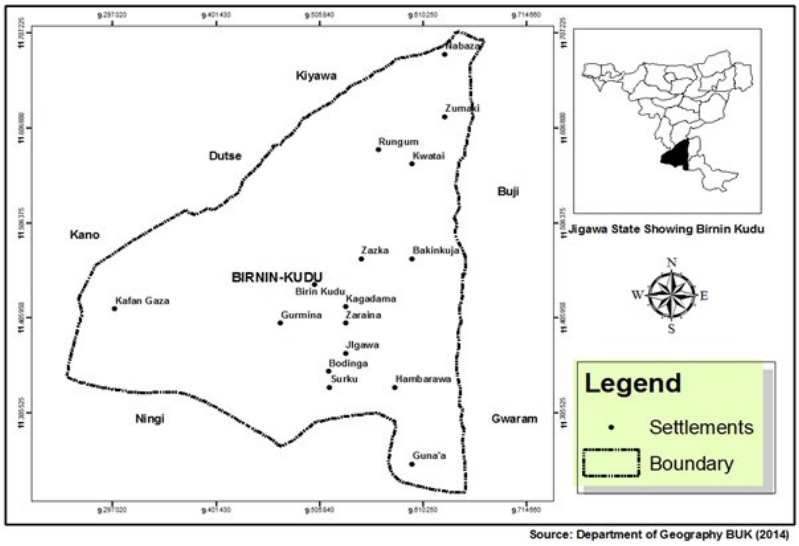

Figure 1: *The Study Area.*

Sample collection and Examination

Sample collection was done between May and August, 2017. Samples were collected under the supervision of a trained laboratory technician. 2ml venous blood was collected from both groups using tourniquet tied to the upper arm after cleaning of the spot, blood samples were collected and emptied into anticoagulant specimen bottles. Both thin and thick blood films were stained with 0.5ml of Leishman's solution for 30 minutes as recommended by WHO and examined for malaria parasites by standard method. Venous blood samples were collected using a tubing tourniquet tied to the upper arm of each of the children with care and adequate safety precautions to ensure test result are reliable, contamination of the samples was avoided and infection from blood transmissible pathogens was also prevented. Protective gloves were worn when collecting and handling blood samples. The blood samples were collected into EDTA bottle/container which was labelled with information such as name of the child, sex and age; and mixed gently. This anticoagulant (EDTA) is commonly used for haematological test. The chemicals therein, prevent blood from clotting by removing calcium [23].

Thin/Thick Blood Film preparation and parasitological examination

The laboratory method employed for staining and identification of malaria parasites in collected blood samples was as described by Cheese rough [23]. Both thick and thin films were prepared. A small drop of blood was placed on a clean microscopic slide near the end of a slide, a spreader was used to smear a blood steadily across the slide in a steady even movement at an angle of 45° and the slide was allowed to dry and labeled appropriately. One [1] volume of Giemsa stain was flooded on the slide for few minutes, two [2] volumes of buffered distil water of PH 6.8 was added and left for further 10 minutes, the slide was washed thoroughly under tap water to differentiate (the colour should be salmon pink), the slide was left to dry and back of the slide was clean with cotton wool soaked in alcohol. A drop of oil immersion was placed on a stained slide to cover about 10mm in diameter in the areas of the film and viewed with the (X100) objective of compound microscope in order to identify the plasmodium parasites [23]. Positive or negative results were recorded accordingly.

Statistical Analysis

The prevalence of parasites was presented as descriptive statistics while the relationship between several variables and the presence of parasites was determined using Chi square test Chi-square at 5% level of significance (P□0.05 was considered significant). The data analysis was performed using statistical programme for social sciences (SPSS) version.

Results

Out of the 406 samples collected from the pregnant women, 219 (53.9%) were infected with P. falciparum (tables 1, 2 and 3). From the age groups of the pregnant women sampled, it was observed that the age group between 15-20 years had the highest prevalence of *P. falciparum* infection 71 (79.8%) while least prevalence was observed in age group between 41-45 years with 11(21.6%). Chi-square analysis revealed that there is a significant difference ($p<0.05$) in the prevalence of *P. falciparum* infection among the age group (Table 1).

Age Group (Years)	No. Examined	No (%) Infected
15-20	89	71 (79.8)
21-25	79	53 (67.1)
26-30	67	38 (56.7)
31-35	62	28 (48.2)
36-40	58	18 (31.0)
41-45	51	11 (21.6)
Total	406	219 (53.9)

Table 1: *Prevalence of Plasmodium falciparum according to age of pregnant women in the study area.*

Of the 141 primigravidae sampled, 74 (52.5%) were infected with malaria parasite while the highest prevalence of 145 (54.7%) was recorded from 265 multigravidae sampled (Table 2). However, statistical analysis showed that there was no significant difference ($p>0.05$) in the prevalence of malaria parasites according to parity.

Pregnancy Gravidity	No. Examined	No (%) Infected
Primigravidae	141	74 (52.5)
Multigravidae	265	145 (54.7)
Total	406	219 (53.9)

Table 2: *Prevalence of Plasmodium falciparum according to pregnancy gravidity of women in the study area.*

As for the gestational periods (Table 3), the highest prevalence of 96 (43.8%) of P. falciparum infection was recorded among women in second trimesters; followed by those in third and first trimesters with prevalence of (29.7%) and (26.5%), respectively. Chi-square analysis revealed a significant difference in the trimesters ($p<0.05$).

Discussion

This study revealed that malaria parasite was prevalent in Federal Medical Center, Birnin Kudu. *P. falciparum* was the only species observed; which also had been confirmed earlier as the predominant species in Sub Saharan Africa by WHO [5]. The present study revealed that the prevalence of *P. falciparum* malaria varied considerably between ages, gravidity, trimester of the pregnant women

screened. The prevalence of 53.9% of P. falciparum observed in the blood sample of pregnant women in this study is slightly higher than those of Egwunyenga., *et al*. [24] who recorded 36.2% in studies carried out in Jos, Bauchi and Eku regions of Nigeria and almost closer to the findings of Boyou., *et al*. [25], Okwa., et al. [12], Nduka., *et al*. [26] Iwueze., *et al*. [22] which recorded 57.5%, 60.0%, 54.0% and 58.0% in Gabon, Lagos State, Nigeria, South East Nigeria and Anambra State, Nigeria, respectively; as well a much higher prevalence of 72% reported by Singh., *et al*. [27] in India and Akinboye., *et al*. [28] in Oyo State, Nigeria.

Trimester	No. Examined	No (%) Infected
First	67	58 (26.5)
Second	209	96 (43.8)
Third	130	65 (29.7)
Total	406	219 (53.9)

Table 3: *Prevalence of Plasmodium falciparum according to trimester among women in the study area.*

The relatively higher prevalence of malaria infection in this study may be attributed to the high level of illiteracy, traditional believes, lack of personal engagement of the population to fight malaria, the climate which influence the development of mosquito larvae, human behaviour and the presence Anopheles gambien and Anopheles funestus which are anthropophilic and consequently, are said to be the most efficient in the world [29]. All these factors promote the spread of malaria infection. The presence of *P. falciparum* infection in this study is not surprising as it was reported that falciparum malaria infection mostly occur in the Sub-Saharan Africa and also has been shown to be more common in pregnant women than non- pregnant women [30]. The results of this study has further confirmed to the fact that the epidemiology of malaria parasite is dependent on seasons of the year. This observation is in accordance with the work of Emerton [31], Amadi and Abenezer [32], Yahaya., *et al*. [33] and Yakudima., *et al*. [34] who reported that the highest infection rate of the disease occurred during the peak of rainy season when there were abundance of Anopheles mosquito vectors in the transmission of the parasite.

It was observed from the results that pregnant women of all age group were infected with P. falciparum malaria. However, the significantly higher infection rate of malaria recorded in the age group between 15-20 years compared to other age group could be due to the fact that the younger age groups have less contact with the mosquito vector than the other age groups and therefore, their immunity is not as well developed as others. This also confirmed that as women get older, their resistance to malaria becomes higher due to improvement in host immunity. This result is closely similar to that of McGregor., *et al*. [35] in Gambia, West Africa who reported a decline in prevalence of malaria infection as age increase and that with improved host immunity, thus reducing susceptibility in later years; as well as the reports of Desai., *et al*. [36] in Sub-Saharan Africa; Kolawole., *et al*. [37] in Ilorin, Kwara State, Nigeria; Falade., *et al*. [38] in Ibadan, South Western Nigeria; Banao., *et al*. [39] in Maradi, Niger Republic and Iwueze., *et al*. [22] in Anambra State, Nigeria who recorded higher infection rate in age group <21, but disagrees with the works of Adefioye., *et al*. [40] in Oshogbo, Nigeria who found higher prevalence of malaria in between age group of 36-39.

The higher prevalence of P. falciparum infection in multigravidae than in primigravidae recorded in this study may be as a result of lack of specific immunity to malaria infection and the immunological changes in host during pregnancy or due to low level of Antibodies against Variant Surface Antigen (VSA). This result corroborates the works of Campos., *et al*. [41] in Luanda, Angola and Isa., *et al*. [42] in Maiduguri, Borno State, Nigeria where the multigravidae had the highest prevalence of malaria infection. However, this result disagrees with the findings of McGregor., *et al*. [35]; Sketelie., *et al*. [43]; Anorlu., *et al*. [44]; Opare-Ado and Odoi [45]; Zhou., *et al*. [46]; Desai., *et al*. [36]; Schanz- Dunn and Nour [47]; Akanbi., *et al*. [17]; Amali., *et al*. [48]; Wogu., *et al*. [49]; Ibecheozor and Peletri [50]; Bedu-Ado., *et al*. [18] and Ebenezer., *et al*. [51].

The significantly higher prevalence of falciparum malaria parasite recorded among pregnant women in their second trimester than other trimesters in this study is in agreement with the works of Schanz- Dunn and Nour [47]; Amali., *et al*. [48] in Makurdi, Benue State, Nigeria and Isa., *et al*. [42] in Maiduguri, Borno State, Nigeria and Inah., *et al*. [52] in Abi Local Government Area, Cross River State, Nigeria, but disagree with the reports of Brabin [16] in Western Kenya, Desai., *et al*. [36] in Sub- Saharan Africa and Houmsou., *et al*. [20] in Nigeria, who reported that pregnant women in their first trimester had higher prevalence of malaria infection as well as the reports of Alnonghol., *et al*. [53] and Ebenezer., *et al*. [51] who indicated high prevalence in third trimester. Chi-square analysis revealed that there is a significant difference between the first, second and third trimesters.

Conclusion

The result of this study indicated that there is active transmission of malaria which indeed constitutes a public health problem in the study area. The high prevalence observed, might be attributed to the period of study (May-August) which is within the period of maximum rainfall in Nigeria. Therefore, Relevant government agencies should ensure that Insecticide-Treated Bed Nets (ITNs) are made available free to every pregnant woman. Appropriate antimalarial drugs for treatment should be given free to all malaria positive pregnant women. Community participation and health education strategies, promoting awareness of malaria and the importance of control measures aimed at reducing the incidence of malaria in our environment should be encouraged through media advocacy and during ante- natal care hours. Proactive steps such as cleaning of waterways, avoiding stagnant pools, maintaining a healthy environment condition (which discourages the breeding of mosquitoes) and other effective malaria control strategies would all have a synergistic effect in controlling malaria infection among pregnant women.

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