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Prevalence of Malaria Infection among Pregnant Women Attending Specialist Hospital Yola, Adamawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author KHK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AIA and TA managed the analyses of the study. Authors KHK, AIA and TA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Malaria in pregnancy is a public health problem with serious negative impact on the mother and the foetus. There were 228 million cases of malaria and 405,000 deaths worldwide according to the World Health Organization (WHO) world malaria report for 2018. It is caused by a parasite of genus *Plasmodium*, transmitted to humans by a bite of an infected female *Anopheles* mosquito. Thus, the present study aims at determining the prevalence of malaria infection among pregnant women attending Specialist Hospital Yola, Adamawa State, Nigeria. A study was conducted through random anonymous testing of volunteers from the month of July to September 2019, at antenatal care unit, Specialist Hospital Yola after ethical clearance was obtained. Three hundred and thirteen participants were examined for the presence of malaria parasite using standard method, microscopy (Giemsa stained) thick and thin blood smears. Structured questionnaires were also administered to the women from whom blood samples were collected. Prevalence was characterized based on age group, educational level, occupation and gestational age of the participants. Overall prevalence showed that 36.74% of the pregnant women were infected with malaria. Participants between age groups; 26-35 years old had the highest prevalence of 58.26%**.** There was a statistically significant difference ($P < 0.05$) between the prevalence of malaria and age group of the participants. In relation to/As regards the Educational level, participants with secondary education had the highest

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prevalence of malaria infection with 56.52%**.** There was a statistically significant difference (P < 0.05) between the prevalence of malaria and educational level of the participants. Regards occupation of the participants, women who were Unemployed recorded the highest prevalence of malaria (27.83%). There was a statistically significant difference (P < 0.05) between the prevalence of malaria and occupation of the participants. Based on gestational age of the participants, subjects that were in their second trimester recorded the highest prevalence of malaria with 55.65%. There was a statistically significant difference (P< 0.05) between the prevalence of malaria and gestational age of the participants examined. This study has revealed the prevalence of malaria infection among pregnant women; hence the need for health education in malaria control and prevention especially during pregnancy.

Keywords: Malaria infection; Giemsa stain; pregnant women; prevalence; gestational age; Nigeria.

1. INTRODUCTION

Malaria infection is a fatal disease caused by parasites of the genus *Plasmodium* which has a□ected an estimated 219 million people causing 435,000 deaths globally [1]. Malaria is caused by some plasmodial parasites namely *Plasmodium vivax, Plasmodium falciparum, and Plasmodium malariae* which are the most common etiologic agents of human malaria [2]. Among these species, infection with *P. falciparum* is the most fatal and common in Africa [3] which differs from other human malarial parasites. This is because infected red blood cells (IRBC) do not remain in circulation for the entire life cycle of the erythrocytic phase [4].

Malaria infection remain widespread despites strategies used to control it for centuries. It became more challenging through the coming up of antimalarial drug resistance [5]. Malaria in pregnancy is a major public health concern in endemic areas and has important consequences on birth outcome [6].

Previous study has explored the occurrences of malaria transmission to be high and perennial, approximately 25 million pregnant women are at risk of *Plasmodium falciparum* infection every year in Sub-saharan Africa [5]. [3] observed that malaria has frighten the lives of about 40% of the world's population worldwide, the majority of whom are young children (under 5 years of age) and pregnant women. Malaria is a febrile illness and clinical features of uncomplicated malaria/infection include sensation of cold and shivering, headaches, tiredness, abdominal discomfort, fever, muscle aches, malaise, sweats, nausea and vomiting [5]

In Nigeria, malaria is highly endemic and remains one of the most leading causes of morbidity and mortality which poses a major challenge to socio-economic development. Approximately 51 million cases and 207,000 deaths reported annually (Federal Ministry of Health) [7]. Statistics has shown that 300,000 lives especially those of children and pregnant women are lost annually due to malaria in Nigeria [8].

Pregnancy and malaria are known to be mutually bothersome in endemic areas, especially among primigravidae including in those who were previously immune [9]. Though previous studies have emphasized that the greatest burden of malaria in pregnancy in terms of incidence and outcome is among the paucigravida, it has been increasingly recognized that women of higher gravidities, especially in areas of low transmission, are also at risk [10].

Pregnancy reduces immunity against many infectious diseases, women who have developed protective immunity against *P. falciparum* tend to lose this protection when they become pregnant, especially during their first and second pregnancies. Malaria during pregnancy has substantial risk, not only to the mothers but also to the unborn children. The latter are at greater risk of being delivered prematurely or with low birth weight, with consequently decreased chances of survival in their early life [11]. When the transmission of malaria is high, maternal anemia is common, and it is one of the fundamental contributors to preterm delivery, low birth weight, intrauterine growth retardation (IUGR), miscarriage, intrauterine death, poor neurodevelopment and immunosuppression in infants [3,12].

Protection of pregnant women living in malaria endemic countries has been of particular interest to many malaria control programmes because of this group's higher vulnerability and reduced immunity to infection [13]. Use of Insecticide-treated nets (ITNs) is one of the basic

components of malaria prevention and control as recommended by the World Health organization (WHO) [14]. The nets reduce human contact with mosquitoes, thus leading to a significant reduction in the incidence of malaria associated morbidity and mortality [13]. However, it is important to stress that human behavior, often dictated by social and economic reasons, can also influence the risk of contracting malaria for individuals and communities. For instance: Poor rural populations in malaria-endemic areas often cannot afford good housing and bed nets that would protect them from exposure to mosquitoes, cultural beliefs resulting in use of traditional herbs, ineffective methods of treatment, human activities can create breeding sites for larvae, agricultural activities such as harvesting (also influenced by climate) may force increased nighttime exposure to mosquito bites [11].

Previous report has shown that there is a correlation between low birth weight and neonatal deaths, with malaria responsible for more than 10% of this burden [15]. Malaria in pregnancy is thus a public health problem, which has to be handled with all solemnity, if we are to achieve the sustainable development goal (SDG) targets [15].

Although a lot of work has been done on the prevalence of malaria in most part of Nigeria, little information is available about the prevalence of this disease in pregnant women of major cities where transmission is unstable but high as a result of topography, poor drainage system and high human-vector contact due to poor environmental condition etc.

Therefore, in view of the background information, this study was undertaken to assess the prevalence of malaria infection among pregnant women in Yola North Local Government Area, Adamawa State, North-East, Nigeria. This study would therefore add value to the existing body of knowledge and provide information towards achieving effective public health strategies for malaria control and prevention.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Yola-North Local Government area of Adamawa state Nigeria which has population of 336,648 [16] and it is located in central zone of Adamawa state which lies between latitudes $9^{0,}$ 11^{0}N to 9^{0}N and longitude 12^{0} 20^{0}N to 12^{0} 39^{0}N covering a tropical climate marked by dry and rainy season. Yola has an annual rainfall which usually commences around April and ends in October, and a dry season from the month of November to March. Temperature drops in the rainy season especially in the month of June to October. Yola North is both an administrative Centre and agrarian community. The major occupations of resident are civil servants, Artisans, traders and farmers.

2.2 Sample Collection Site

Five milliliter (5ml) of blood sample was obtained by venipuncture from the participants attending antenatal care unit of Specialist Hospital Yola, located at hospital road, Yola-North Local Government Area. The samples were collected between the months of July to September 2019 from three hundred and thirteen (313) pregnant women who consented to participate in the study.

2.3 Malaria Diagnostic Procedure

Safety measures were adopted in the collection of samples using standard procedure [17]. Both thick and thin blood films were made on the same slide and labeled accordingly for the detection of malaria parasite and identification of the Plasmodium species present respectively. About 10% Giemsa stain was used to stain the blood films. Prior to that, the thin blood film were fixed using methanol for 2 minutes. The diluted stain was then placed on the slides until it covered the thick and the thin blood films. This was allowed to stand for 30 minutes and then washed off. The back of each slide was cleaned and placed in a draining rack for the preparation to dry. Both blood films were examined microscopically using 100x oil immersion objective lens. The thick blood film was examined first in order to detect the presence of malaria parasite. This was followed by the examination of the thin blood film for identification of the Plasmodium species present using standard procedure [17].

2.4 Statistical Analysis

Results obtained were subjected to statistical analysis using statistical package for social sciences (SPSS) version 23. Comparism of the proportion was carried out using chi-square test. P-values less than 0.05 were considered to be significant.

3. RESULTS

Three hundred and thirteen (313) blood samples of consenting pregnant women were tested for malaria during this study. Of the 313 pregnant women whose blood samples were examined, 115 (36.74%) were positive for malaria parasites while 198 (63.25%) were negative. About 49.84% of the study participants were within the age range 26-35 years, and majority of the subjects had secondary education (53.99%), and most of the participants were employed (Govt./private) (32.27%). Most of the women were in their second trimester (49.20%) (Table 1).

Table 2 shows the prevalence of malaria infection with respect to age of the pregnant women in the study area; the results shows that malaria infection was highest in the age group of 26-35 years with a prevalence of 67 (58.26%) and the least was obtained in the age bracket 16-25 years 21 (18.26%). The distribution of the infection was statistically significant **(**P< 0.05) to the age of the participants. Table 3 shows the prevalence of malaria infection in relation to educational level of the study participants; the results shows that malaria infection was highest in those with secondary education with a prevalence of 65 (56.52%) and least was recorded in those with Non-Formal education with a prevalence of 2 (1.74%). The distribution of the infection was statistically significant **(**P< 0.05) to the educational level of the participants. Table 4 shows the prevalence of malaria infection based on occupation of the study participants; the results shows that malaria infection was highest in those that were unemployed 32 (27.83%) and least was recorded in student 12 (10.43%). The study found a significant association between malaria **(**P< 0.05) and the occupation of the participants.

Table 5 shows the prevalence of malaria infection in relation to gestational age of the study participants; the results shows that malaria infection was highest among participants that were in their second trimester 64 (55.65%) and least was found in women that were in their third trimester 24 (20.87%). The distribution of the infection was statistically significant **(**P< 0.05) to the gestational age of the participants.

4. DISCUSSION

The prevalence obtained for malaria infection among the study participants in the study area disagree with previous findings, as it is lower than the findings recorded among pregnant women in Anambra State, South-east Nigeria [18], data obtained among pregnant women in Port Harcourt, Rivers State [19] and the result reported among pregnant women in Lagos, Nigeria [8,20]. On the other hand, the

Table 1. Sociodemographic data of study participants in specialist hospital Yola, Nigeria

Variables	Frequency	Percentage
Age group (years)		
16-25	59	18.85
26-35	156	49.84
36-45	98	31.31
Educational level		
Primary	42	13.42
Secondary	169	53.99
Tertiary	98	31.31
Non-Formal	4	1.28
Occupation		
Employed	101	32.27
Business	84	26.84
Student	20	6.39
Farming	43	13.74
Unemployed	65	20.77
Gestational Age		
First trimester	61	19.49
Second trimester	15498	49.20
Third trimester		31.31

Table 2. Prevalence of malaria infection in relation to age of the participants in the study area

Age Group (years)	No. Examined	No. Infected (%)	No. Uninfected (%)	X^2 - value	P-value
16-25	59	21(18.26)	38(19.19)	7.392	0.025
26-35	156	67(58.26)	89(44.95)		
36-45	98	27(23.48)	71(35.86)		
Total	313	115	198		

Table 3. Prevalence of malaria infection in relation to educational level of the study participants

Educational Level	No. Examined	No. Infected (%)	No. Uninfected (%)	X^2 – value	P-value
Primary	42	21(18.26)	21(10.61)	20.781	0.0001
Secondary	169	65(56.52)	104(52.53)		
Tertiary	98	27(23.47)	71(35.86)		
Non-Formal	4	2(1.74)	2(1.01)		
Total	313	115	198		

Table 4. Prevalence of malaria infection based on occupation of the study participants

Occupation	No. Examined	No. Infected (%)	No. Uninfected (%)	X^2 - value	P-value
Employed	101	16(13.91)	85(42.93)	43.659	0.0001
Business	84	27(23.47)	57(28.79)		
Student	20	12(10.43)	8(4.04)		
Farming	43	28(24.35)	15(7.57)		
Unemployed	65	32(27.83)	33(16.67)		
Total	313	115	198		

Table 5. Prevalence of Malaria Infection in relation to Gestational age of the study participants

Gestational age	No. Examined	No. Infected (%)	No. Uninfected (%)	X^2 – value	P-value
First trimester	61	27(23.48)	34(17.17)	16.998	0.0001
Second trimester	154	64(55.65)	90 (45.45)		
Third trimester	98	24(20.87)	74(37.37)		
Total	313	115	198		

Prevalence recorded in this study is comparable with the reports among pregnant women in Argungu, North-western Nigeria [13], and data obtained among pregnant women in Abia State [21], and higher than the result reported among pregnant women in Northern Ghana [22].

The differences in the reported prevalence rates of malaria infection may be attributed to the skills and experiences of the laboratory personnels involved in malaria diagnosis. The variation in prevalence of malaria may also be attributed to the fact that transmission of malaria is affected by environmental factors such as level of sanitation, season, water supply and nature of housing which provide adequate breeding sites for mosquitoes [12]. The level of environmental sanitation as well as the state of infrastructural development may vary between the different study locations thus causing differences in the level of malaria infection and transmission [12]. Other factors could be attributed to individual's habit which include non-compliance with using Insecticides Treated Nets (ITNs) [11].

Consequences of malaria for a pregnant mother include anemia while stillbirth, premature delivery and foetal growth restriction affect the developing foetus [23]. Other complications include; high rate of miscarriage, intrauterine demise, low-birth-weight neonates and neonatal death [12]. Therefore, pregnant women infected with malaria are likely to experience these complications due to the effects of parasite in the blood. With respect to the age groups, the data obtained from current study is similar to the results obtained by other researchers where the highest prevalence of malaria was recorded among pregnant women within age group 25-29 years [24,20,8] and in younger age groups 15-20 years [21], 15-19 years [25], 17-22 years [18]. Younger women were more at risk (had the highest risk). This could be attributed to the fact that the women in this age brackets are more involved in active reproduction than women of other age groups. This is in conformity to [26] who stated that women within the age bracket 25-34 years are the most sexually active and fertile group**.** Malaria prevalence in relation to age showed that older pregnant women had reduced malaria prevalence rates. This finding is similar to the result reported by [18]. The different malaria prevalence rates observed among these age-groups could be attributed to the level of acquired immunity that increases with age, which may also be associated with protection from malaria infection [27].

With respect to the educational level, higher occurrence were recorded against women with secondary education, these result disagrees with the data reported by other researchers where the highest prevalence of malaria fever was found among subjects with Non-formal education [18,22] and in those with tertiary education [20]. This could be due to the fact that these groups of women visit ante-natal clinic more than the women with other level of education who were very few in number in the study area. Regards occupation of the participants, the highest prevalence of malaria was recorded among the unemployed. This result disagrees with the findings of [18] where the highest prevalence of malaria was recorded among students, and [21] reported highest prevalence of malaria among traders who were involved in one form of business or the other. This current result could be due to poverty, poor environmental condition and inability to access good health care services. The unemployed respondents may also be exposed to malaria parasites due to bad environmental condition and their life styles.

Based on their gestational age, the result of this study agrees with the reports of [25] where the highest prevalence of malaria was recorded in pregnant women that were in their second trimester, but contradicts the reports of [8] [21] and [22] where/in which the highest prevalence of malaria was obtained among pregnant women in their first and third trimester respectively. This may be associated with the time most pregnant women register for antenatal services. Previous study has shown that large proportion of pregnant women turn out for antenatal care in their second trimester, which is common among African women [22]. Increased prevalence in the second trimester of pregnancy when compared to other gestational ages agrees with previous reports [28,29]. The increased prevalence is believed to result from reduction of acquired immunity to malaria at this stage. This situation seems to reverse during the third trimester when malaria prevalence was lowest. Previous studies suggest that acquired immunity to malaria is highest during the third trimester and susceptibility to infection is significantly reduced [18].

5. CONCLUSION

This study has provided information on the prevalence of malaria infection in Yola North, Adamawa state, Nigeria. Pregnant women should be seriously taken care of to avoid being

infected and also be educated on the importance of sleeping under Insecticide Treated Bed Nets (ITBNs) to avoid mosquitoes' bite; hence reduce malaria transmission. Free Intermittent prevention and treatment of malaria should be incorporated in the antenatal and postnatal programmes in hospitals to prevent infection of the infants by their infected mothers. It is also recommended that infected pregnant women should be well diagnosed and properly managed to avoid future burden of the disease.

CONSENT AND ETHICAL APPROVAL

Introductory letter was obtained from the department of Zoology, Mautech Yola. The letter was taken to the hospital management to seek for permission before the commencement of the study. Informed consent was obtained from each study participant after an explanation of the purpose and benefits of the study. Ethical Approval for the study was obtained from the hospital management, the approval was on the agreement that every participant's finding would be treated with utmost confidentiality and for the purpose of the research only.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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