Prevalence and associated risk factors of malaria infection among pregnant women attending antenatal clinic in Yola North, Adamawa State, Nigeria

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Abstract

This study determined the prevalence and associated risk factors of malaria infection among pregnant women attending antenatal clinic in Yola North, Adamawa State, Nigeria, between December 2017 and April 2018. Both direct microscopy and rapid diagnostic test were employed in this study to establish infection. Structured questionnaires were used to collect information from the participants. The study showed that 63 pregnant women were positive for malaria infection out of the 270 sampled. Overall malaria prevalence of 23.3% was recorded during this study. There was no significant association between malaria infection and the clinics sampled (p>0.05). Results have shown that the prevalence was relatively low, and this could be attributed to low transmission rate of malaria during dry season in Adamawa State. In relation to parity, prevalence of malaria were; primigravidae (21.6%), secundravidae (20.0%) and multigravidae (26.7%). Similarly, in relation to gestational age prevalence was first trimester (27.9%), second trimester (25.0%) and third trimester (20.0%). There were no significant associations between malaria infection, parity and gestational age (p>0.05). The age-group 38 ≥ years had highest prevalence while 15-23 years had least. There was no significant association between malaria infection, educational level and occupation (p>0.05). Relating to the participants occupation, prevalence of malaria was reported as 30.0, 22.9 and 23.5% for civil servants, unemployed and business respectively. It is therefore recommended that early attendance and utilization of focused antenatal care services by all pregnant women will reduce the risk of malaria in pregnancy.

Keywords: Risk factors; malaria; pregnant women; antenatal; Yola North.

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Introduction

Malaria is a life threatening parasitic disease of man caused by a parasite of genus *Plasmodium*, which is transmitted from person to person through the bite of infected female *Anopheles* mosquito. It is a killer and debilitating disease, formidable health and socio-economic problem in the world (Word Health Organization, 2014). Malaria is an entirely preventable and treatable mosquito-borne illness. In 2015, 95 countries and territories had ongoing malaria transmission and an estimated 3.2 billion people nearly half the world's population, were at risk of malaria (World Health Organization, 2016). There were an estimated 214 million cases of malaria worldwide, and an estimated 438,000 deaths. Approximately 90% of all malaria deaths occur in Africa. In 2015, an estimated 292 000 African children died before their fifth birthday due to malaria. Globally, the disease caused an estimated 306 000 under-five deaths in 2015 (WHO, 2016). Between 2000 and 2015, an expansion of malaria interventions helped to reduce malaria incidence by 37% globally, and by 42% in Africa. During the same period, malaria mortality rates decreased by an estimated 60% worldwide and by 66% in Africa. In the under-five age-group, mortality rates have declined by 65% globally, and by 71% in Africa (WHO, 2016). In addition, pregnant women are at immense risk of malaria due to natural immune depression in pregnancy (Fievet *et al* 2007). About 25% of all estimated malaria cases in the World Health Organization African Region occur in Nigeria (WHO, 2010).

Malaria infection during pregnancy is a major public health problem in tropical and subtropical regions throughout the world (WHO, 2010). The burden of malaria infection during pregnancy is caused mainly by *Plasmodium falciparum*, the most common malaria species in Africa (WHO, 2010). Each year at least 3 million pregnancies occur among women in endemic areas of Africa, most of who reside in areas of relatively stable malaria transmission (Brabin, 2000). The symptoms and complications of malaria during pregnancy differ with the intensity of malaria transmission and thus with the level of immunity the pregnant woman has acquired (Perlmann and Troye-Blomberg, 2000). Pregnant women and the

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unborn children are particularly vulnerable to malaria, which is a major cause of prenatal mortality, low birth weight, and maternal anaemia (Greenwood *et al* 2007).

Beyond the impact of malaria on children and pregnan women, it affects the general population; 100% of the tota population of Nigeria is at risk of malaria and at least 50% of the total population suffers from at least one episode of malaria each year (WHO, 2010). In Nigeria, 11% o maternal deaths are attributed to malaria (Federal Ministry of Health, 2000). However, malaria prevention measures have received great attention in the last six years as increased funding has resulted in the scale-up of malaria control efforts. The reports on the prevalence of malaria in pregnancy in different regions of Nigeria ranged from 19.7% to 72% (Kagu *et al* 2007; Tayo *et al* 2009) Nevertheless, the method employed in any diagnosis is an important criterion in reporting valid results. The accuracy of a malaria microscopy result is influenced by factors such as training and retraining, experience, motivation and laboratory facilities (Ohrt *et al* 2007).

Aim of the study

The aim of this study was to determine the prevalence and associated risk factors of malaria among pregnant women attending antenatal clinic in Yola North, Adamawa State.

Materials and methods

Study area and design

The study was conducted in Yola North Local Government Area which has a population of 336,648 (NPC, 2006) and located in central zone of Adamawa State. It lies between Latitudes 9º, 11 ′ N to 9ºN and Longitudes 12º 20 ′ N to 12º 39 ′ N covering a tropical climate marked by dry and rainy season. The rainy season usually commences around May and ends in the middle or late October. The rainfall is characterized by a maximum mean total rainfall of 1113.3 mm. August and September are the wettest months with about 25% of the total annual rainfall. The dry season starts in late October and ends in late April (Adebayo, 1999). Maximum temperature in Yola North can reach 40ºC around April and minimum temperature could be as low as18.3ºC between December and early January. Relative humidity in the areas is about 26% in the month of January while February is the lowest, with high relative humidity valves of 58, 69, 79, 79, 77, and 66 respectively could be recorded during the month of May to October, particularly during the month of July and August as the peak with about 80% relative humidity.

Three (3) Primary Health Care Centres were selected namely: Alkalawa Primary Health Care Center, Doubelli Primary Health Care Center and Jambutu Primary Health Care Centre out of a total of 11 primary health care centers in Yola North Local Government Area, Adamawa State. 270 pregnant women were selected randomly without the prior knowledge of their family history. The women were of varying age ranging from 20-40 years and also of different status. Peripheral blood samples were collected from the pregnant women in each of the primary health centers once a week, during the antenatal visits. The study was conducted between December 2017 and April 2018.

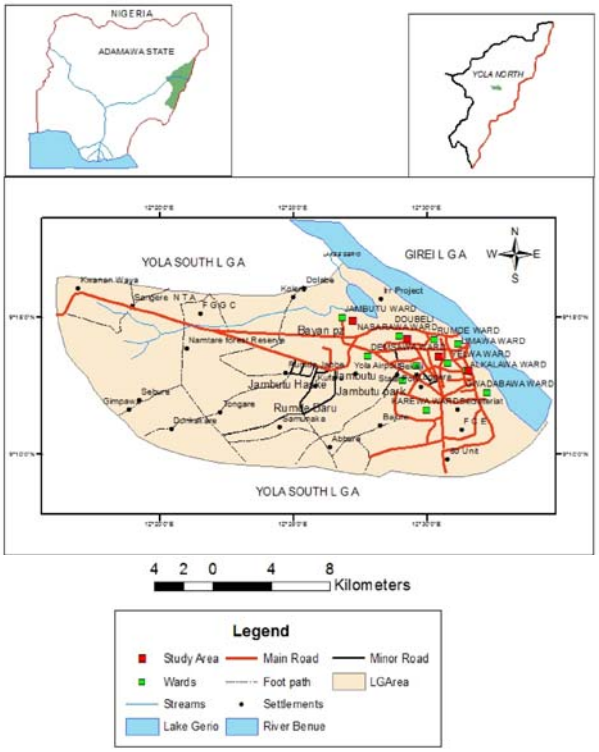

Figure 1. Map of Yola North showing the study-area.

Source: GIS Laboratory, Department of Geography, MAUTECH, Yola, 2018.

Ethical clearance

Prior to the commencement of the study, ethical clearance was obtained from the State Ministry of Health, Yola. Permission were also obtained from the authorities of Yola North Local Government Area. The informed consent of the pregnant women who were recruited for the study were sought and obtained.

Sample size determination

The 270 sample size was determined using the formula for cross-sectional studies as described by Araoye (2003):

$$N = \frac{Z^2PQ}{D^2}$$

Where N = Desired sample size.
Z = Standard normal deviation at 95% confidence level usually set at 1.96.
p = prevalence rate.

D is the allowable error which is taken as 5%, Q =1 – *p*.

Questionnaire administration and blood sample collection

Structured questionnaires were administered to all participants to collect information on age, parity,

gestational age, use of insecticide treated nets (ITNs), level of education and occupation. Those who were literate filled the questionnaires by themselves while those who could not read and write were assisted by trained interviewers. The questionnaires were retrieved instantly.

For each pregnant woman, the finger to be pricked was cleaned with 70% ethyl alcohol, and allowed to air dry, and then the side of the fingertip was pricked with a sterile blood lancet. A drop or two of blood were collected from each selected person and were dropped on a clean grease-free slide. It was then spread to make a thick smear using a spreader. The thick films were air-dried.

Thick film staining and observation

Giemsa stain (3%) of pH7.0 was poured on each thick blood smear and allowed to stand for 30-40 minutes on a staining rack (Cheesbrough, 2006). The stained films were then washed using buffered distilled water. The slides were drained on a filter paper and air-dried. The stained slides were examined microscopically for malaria parasites using oil immersion (x100) objective as described by Cheesbrough (1998). The number of asexual malaria parasite found on the slide were counted per 200 leucocytes (Agomo *et al* 2001) and recorded. The parasite density was calculated by dividing the number of parasite by the number of leukocytes and multiplied by 8000, assuming each woman has 8000 leucocytes/ml.

$$\text{Parasite D ml} = \frac{\text{number of observed parasites x 8000D ml}}{200}$$

The parasites density was calculated for each pregnant woman that was found to be malaria positive.

Data analysis

The data generated on prevalence was analyzed using statistical package for Social Sciences (SPSS) version 22.0 Window versions. The statistical significance of variables was estimated using *chi*-square test. Pearson correlation analysis was used to establish possible correlation of prevalence with parity, age, and trimester. *p*-values ≥ 0.05 were considered as measures of significance.

Results

The result in Table 1 shows that 63 (23.3%) pregnant women were positive for malaria parasite out of the 270 sampled. There was no significant association between malaria infection and the clinics sampled ($p>0.05$). Table 2 presents the prevalence of malaria with regard to parity among pregnant women in the study area. Primigravidae had 21.6%, secungravidae had 20.0% and multigravidae had 26.7%. Highest percentage prevalence was found among multigravidae. However, there was no significant association between parity and malaria infection among the subject group ($p>0.05$). The prevalence of malaria infection among the pregnant women according to gestational age is also shown in Table 2. First trimester had 27.9%, second trimester had 25.0% and third trimester had 20.0%. No significant association was found between malaria and gestational age ($p>0.05$). Table 3 presents prevalence of malaria according to age in the order; 22.4, 21.2, 27.8 and 40.0% for 15-23, 24-30, 31-37 and 38years and above respectively. Age range 38 ≥ years had highest prevalence while 24-30 had lowest. At *p*-value 0.05, there was no significant association between malaria infection and age. Similarly, prevalence of malaria according the use of ITNs as presented in Table 3 shows that those using ITNs always had prevalence of 25.8% while 14% was recorded for those who seldom use ITNs. This work reports no significant association between malaria and the use of ITNs ($p>0.05$). Table 4 presents the prevalence of malaria according to educational level among the pregnant women. Those who had tertiary, secondary, primary and no formal education had malaria prevalence of 21.4, 21.9, 21.6 and 27.9% respectively. Highest prevalence was observed among those with non-formal education. The association between malaria infection and educational level was not significant ($p>0.05$). Table 4 also presents the prevalence of malaria infection among the subject group according to occupation. Civil servants had 30%, unemployed had 22.9% and business women had 23.5%. Farmers were not recruited in the study. The association between malaria infection and occupation was not significant ($p>0.05$).

Table 1: Prevalence of malaria among pregnant women according to health centres in Yola North, Adamawa State.

Health Centre	No. examined	No. positive (%)
Alkalawa PHC	70	12(17.1)
Doubelli PHC	80	18(22.5)
Jambutu PHC	120	33(27.5)
Total	**270**	**63(23.3)**

x^2 =2.22, *df* = 2, *p*-value = 5.99.
PHC – Primary Health Centre.

Table 2: Prevalence of malaria among pregnant women according to parity and gestational age in Yola North, Adamawa State.

Variables		No. examined	No. positive (%)
Parity	Primigravidae	74	16 (21.6)
	Secundigravidae	80	16 (20.0)
	Multigravidae	116	31 (26.7)
Gestational Age	First trimester	43	12 (27.9)
	Second trimester	108	27 (25.0)
	Third trimester	119	24 (20.2)
Total		**270**	**63 (23.3)**

Parity: x^2 =2.22, *df* = 2, *p*-value = 5.99.
Gestational Age: x^2 =1.66, *df* = 2, *p*-value = 5.99.

Table 3: Prevalence of malaria among pregnant women according to age and use of Insecticides Treated Nets in Yola North, Adamawa State.

Variables		No. examined	No. positive (%)
Age (years)	15-23	111	26 (22.4)
	24-30	118	25 (21.2)
	31-37	36	10 (27.8)
	38 ≥	5	2 (40)
Use of ITNs	Always	213	55 (25.8)
	Seldom	57	8 (14)
Total		**270**	**63 (23.3)**

Age: x^2 =1.12, *df* = 3, *p*-value = 7.82.
Use of ITNs: x^2 = 3.49, *df* = 1, *p*-value = 3.84.
ITNs – Insecticide Treated Nets.

Table 4: Prevalence of malaria among pregnant women according to educational level and occupation in Yola North, Adamawa State.

Variables		No. examined	No. positive (%)
Educational Level	Tertiary	14	3 (21.4)
	Secondary	114	25 (21.9)
	Primary	74	16 (21.6)
	Non formal	68	19 (27.9)
Occupation	Civil servant	10	3 (30)
	Farming	0	0 (0.0)
	Unemployed	175	40 (22.9)
	Business	85	20 (23.5)
Total		**270**	**63 (23.3)**

Educational Level: x^2 = 1.04, *df* = 3, *p*–value = 7.82.
Occupation: x^2 = 0.29, *df* = 2, *p*-value = 5.99.

Discussion

Malaria is dangerous especially an infection with *P. falciparum* during pregnancy. Pregnancy appears to interfere with the immune processes in malaria a disease which itself alters immune reactivity. In highly endemic malarious area where semi-immune adults usually have substantially acquired resistance to local strains of plasmodia, the prevalence of clinical malaria is higher and its severity greater in pregnant women than non-pregnant women (Uko *et al* 1998). The prevalence level recorded in this study is lower than in Otukpo, Benue State, where a prevalence of 42.3% was recorded (Jombo *et al* 2010), and a prevalence of 41.6% in Argungu, north-western Nigeria (Sani *et al* 2015). However, the findings in this work corroborated the result in Maiduguri where a prevalence of 22.1% was recorded among pregnant women (Kagu *et al* 2007). It also agrees with the result reported by Agomo *et al* (2009) among pregnant women attending antenatal clinic in Lagos where a prevalence of 7.7% was recorded. The relatively low prevalence of malaria recorded in this research could be due to the fact that data was collected during the dry season as climate and environmental conditions have been shown to greatly affect the transmission of malaria (Ayanda, 2009). Another contributing factor for the low prevalence of malaria among pregnant women in this study could also be as a result of adherence to recommendation by WHO that every pregnant woman attending antenatal clinic should receive intermittent prevention treatment with the inclusion of salfadoxine-pyrimethaine (IPTP) as part of antenatal care (Diala *et al* 2013).

Previous studies have consistently demonstrated that malaria infection rates are higher in pregnant woman in their first and second pregnancy with lower rate in later pregnancies (Brabin *et al* 1991). This is understandable as pregnancy is naturally accompanied by general immune suppression that may cause loss of acquired immunity to placental malaria especially among primigravidae. This is because they lack the specific immunity to placental malaria that is acquired from exposure to malaria parasite during pregnancy (Staalsoe *et al* 2004). This immunity accumulates with successive pregnancies provided there is exposure to malaria infection (Beeson *et al* 2005). However, the outcome of this study revealed that there is no significant association between parity and malaria which agrees with another study carried out in Mozambique (Sauté *et al* 2002) that observed no significance in prevalence level of malaria with parity. It was also observed in a population-based study elsewhere in Asia (Rijken *et al* 2012) that primigravidae and secungravidae were not likely to be parasitaemic than multigravidae. Moreover, other workers also reported no association between parity and malaria infection (Rogerson *et al* 2000; Adam *et al* 2005; Campos *et al* 2012). These suggest that effort to reduce burden of malaria in pregnancy should target all gravidae rather than restricting to a particular stage of pregnancy. However, the findings from this study contrasts other reports from Malawi (Rogerson *et al* 2003) and India (Hamer *et al* 2009) which showed that primigravidae and secungravidae were pregnancy stages at higher risk of malaria infection.

The focus of malaria prevention during pregnancy has been the use of antimalaria chemorophyloxine and the use of ITNs. Pregnant women on antimalaria chemorophylaxine are at reduced risk of the harmful effect of malaria (Kalanda *et al* 2006). Thought there is an increase in awareness among pregnant women on the importance of attending antenatal clinics by primary care health workers in the communities, most of the women book for their first visit for ANC in their second trimester. This could probably be some of the reason why this study recorded higher prevalence of malaria among pregnant women in second trimester as they might have been exposed to malaria parasite without taking any antimalaria drugs. The high prevalence rate obtained in the first trimester and second trimester agrees with those of other studies which observed peak prevalence in weeks 10-20 of pregnancy (Zhou *et al* 2002; Anosike *et al* 2004). This might be attributed to the expression of adherence proteins on the surface of the infected red blood cells (IRBCs) enabling the IRBCs to adhere to micro-vascular capillaries of vital

organs causing severe pathological condition (Miller *et al* 2002).

In this study, older women appeared to be susceptible to malaria as prevalence was highest among age group 38≥(40%). This agreed with the findings of Adefioye *et al* 2007 that found 36-39 year old group to be more susceptible, but contradicted with the findings of Dicko *et al* (2003) who opined that adolescents and young adult pregnant women were more susceptible to malaria than older pregnant women, because of continuous development of malaria immunity in older women. This work as well as in that of Adam *et al* (2002) also reported no significant association between malaria infection and maternal age (Kalanda *et al* 2006).

The association between use of ITNs and malaria in this study contradicts with results showed by other workers who reported that use of ITNs decrease both the number of malaria cases and malaria deaths in pregnant woman (WHO, 1993). Jombo *et al* (2010) also reported that the rate of malaria increases with a proportionate decrease in the use of ITNs. This observed lack of association could probably be attributed to an inconsistent or inappropriate use of the nets or perhaps the pregnant women were exposed during the day or evening to mosquito bite when the nets were not in use.

A previous study conducted by Agomo *et al* (2013) indicated that education was not significantly associated with malaria infection among pregnant women. This study also made a similar observation where no association between education level and malaria parasite among pregnant women was found. However, the educational levels of pregnant women have been shown to be an important risk factor of malaria (Snyman *et al* 2015). The continuous increase of awareness among pregnant women during ANC visit, high literacy rate and the widespread use of ITNs among the subject group could have probably led to the low prevalence of malaria in this study. However, other workers reported high prevalence of malaria infection among pregnant women in rural areas which contrasts with the findings of this study. This is probably because pregnant women in rural areas are more exposed to malaria parasite due to bad environmental condition and their life styles (Mogaji *et al* 2013).

Employment status of the respondents was also being observed to be one among the possible risk factor that were associated with the prevalence of malaria among pregnant women during the survey. This concurred with Hemeidin *et al* (2007) who reported that the burden of malaria is greatest among poor people, imposing significant direct and indirect costs on individuals and households and pushing households into in a vicious circle of disease and poverty. Individuals who are unemployed usually have low socio-economic status and have been found to be at greater risk of malaria diseases (Mogaji *et al* 2013). It is likely that the least prevalence among the civil servants as recorded in this study was due to their higher socio-economic status and that they can go for other alternative ways of preventing malaria other than the use of ITNs.

Conclusion

Malaria is still a major public health problem among pregnant women in Yola North, Adamawa State, Nigeria. Lack of education and non-usage of ITNs were the major factors associated with an increased risk of malaria infection. The control measures available in the area should be reviewed and emphasis should be placed on adequate sensitization on usage of ITNs. Early attendance and participation in focused ante-natal care services should be encouraged among all pregnant women especially the primigravidae, in order to reduce the risk of malaria infection in pregnancy. Again, adequate supply of antimalarial drugs should be included in free antenatal drugs in order to ensure prophylaxis care to the pregnant women. Also, Public health education campaign for pregnant women to create awareness that may lead to reduction of vectors of malaria especially among vulnerable groups.

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