



## **Malaria in Pregnancy in Ethiope East Local Government Area of Delta State, Nigeria**

**E. J. Onochie<sup>1\*</sup> and A. O. Egwunyenga<sup>1</sup>**

<sup>1</sup>*Department of Animal and Environmental Biology, Delta State University, Abraka, Nigeria.*

### **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

The study was carried out to determine the prevalence of malaria in pregnant women in Ethiope East Local Government Area of Delta State, Nigeria during the period of March to August, 2014. A total of two hundred and seven pregnant women were examined, 60% were infected with malaria parasite. With respect to age, pregnant women within the age of 18-25 years had the higher prevalence rate of 67.8%. Prevalence rate of 63.5% were observed within pregnant women in their first trimester. Pregnant women who are farmers tend to have the highest prevalence rate of 71.4% while those who lived in rural areas showed prevalence rate of 69.1%. Primigravidae showed the higher prevalence rate of 68.9%. Of the two locations sampled Abraka had the highest overall prevalence in terms of malaria infection with 64% while Eku showed a prevalence rate of 56%. Based on the findings, there is clear evidence of high level of malaria in pregnant women in the study area, hence the need to reduce the morbidity of malaria in pregnancy in Delta State. Efforts should be made to scale-up intermittent preventive treatment of pregnant women (IPTp) for malaria with Sulfadoxine Pyrimethamine (SP), and ensure increased access to IPTp with SP in all areas in Delta State. Free bed nets should also be provided to pregnant women on their first antenatal visit.

\*Corresponding author: E-mail: [onochieekenejames@gmail.com](mailto:onochieekenejames@gmail.com);

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## 1. INTRODUCTION

Malaria is an important parasitic disease estimated to affect 212 million people globally. The mortality in Africa alone is less than 600,000 people per annum [1]. It is dangerous to both the mother and the foetus. The pregnant women are at greater risk of malaria infection and of symptomatic malaria disease than non-pregnant adults [2]. Human malaria is caused by *Plasmodium vivax*, *P. ovale*, *P. malariae*, *P. falciparum* and *P. knowlesi*. Of these, the latter is the most frequent cause of severe malaria, including cerebral malaria. Malaria is currently regarded as the most common and potentially the most serious infection occurring in pregnancy in many Sub-Saharan African countries [3]. The majority of malarial infections that occur in pregnancy are due to *P. falciparum*, and less commonly to other *Plasmodium* species. The parasite is transmitted by an infected female anopheline mosquito, which finds a natural habitat in the hot and humid climate of many African countries. It is well-known that pregnant women constitute an important risk group for malaria infection particularly in hyper and holoendemic situations. The well-known effects include the effectiveness of placental barrier, parasite sequestration in placenta, suboptimal nutrition of the fetus, congenital malaria, intrauterine growth retardation, low birth weight, premature interruption of pregnancy, infant mortality and maternal death [4,5].

An estimated 30 million women living in malarial endemic areas of Africa become pregnant each year. Pregnant women are particularly vulnerable to malaria because pregnancy reduces immunity to malaria; increases susceptibility to malaria infection, the risk of illness, severe anaemia, acute pulmonary edema, renal failure, puerperal sepsis, postpartum hemorrhage, and increases the risk of death [6]. Malaria in pregnancy results in adverse pregnancy outcomes, such as spontaneous abortion, neonatal death, and low birth weight. Chronic anemia, due to malaria may also affect a child's growth and intellectual development [7]. Malaria is preventable, yet a major cause of maternal and newborn illness and death in Africa, resulting in about 10,000 maternal deaths and between 75,000 and 200,000 infant deaths each year [8].

Pregnant women are three times more likely to suffer from severe disease as a result of malarial

infection compared with their nonpregnant counterparts, and have a mortality rate from severe disease that approaches 50%. [9] in areas endemic for malaria, it is estimated that at least 25% of pregnant women are infected with malaria, with the highest risk for infection and morbidity in primigravidas, adolescents, and those coinfecting with HIV [10]. The second trimester appears to bring the highest rate of infection, supporting the need for antepartum care as part of malarial prevention and treatment efforts. It is hypothesized the majority of sequelae in pregnancy results from two main factors: the immunocompromised state of pregnancy and placental sequestration of infected erythrocytes.

The study aimed to investigate the determinants of malaria prevalence among pregnant women in Ethiope East Local Government Area, Delta State, so as to generate information that will help in malaria prevention and control particularly among pregnant women. The objective of this study was to estimate the prevalence of malaria among pregnant women, identify socio-demographic factors that influence malaria prevalence among pregnant women and investigate malaria prevention practices of pregnant women in Ethiope East Local Government Area, Delta State.

## 2. METHODOLOGY

### 2.1 Description of Study Area

Ethiope East is a Local Government Area of Delta State, Nigeria. It lies between longitudes 5° 38' 0" N, and latitude 6° 2' 0" E Its headquarters are in the town of Isiokolo. It has a population of 200, 792 and the 2006 census. It was created out of the defunct Ethiope East Local Government Area and occupies a land area of about 220 square kilometers, with over ninety percent of the people being Urhobos. It is made up of two clans; Agbon and Abraka each headed by a traditional ruler. The main towns are Isiokolo, Kokori Inland, Orhoakpo, Inland, Ovu Inland, Okpara Waterside, Eku and Abraka. The two main study areas are Abraka and Eku, these areas have tropical wet and dry climate, with lengthy wet season and relatively constant temperatures throughout the courses of the year. Abraka and Eku's, wet season runs from March through October, though August sees somewhat

of a lull nearly divides the wet season into two different wet seasons. The remaining months forms the city's dry season. Like a good portion of West Africa. Abraka an Eku Experiences the harmattan between the months of November and February. Health facilities (health centers, personnel, and medical equipments) are inadequate in Ethiopie East Local Government Area though Eku Baptist hospital was recently equipped with state of the heart facilities by the Delta Sate Government.

## 2.2 Data Collection

A total of 207 pregnant women from two different hospitals in the Local Government Area form Eku Government Baptist Hospital, Eku and Government Hospital, Abraka. The study spans through a period of six months from March to August 2014. Questionnaires were administered requesting information on age, occupation, residence, parity, gestational period, body temperature, blood group, chemoprophylaxis, bednets use, White Blood Cell (WBC) count, PCV and Haemoglobin (HB) Concentration. Another 43 healthy non pregnant women of the same age bracket mainly students and female workers of Delsu, Abraka was used as controls. Pregnant women who could not read or write was assisted in filling their questionnaires.

## 2.3 Laboratory Analysis

The volar surface of the arm was cleaned with cotton wool moistened with methylated spirit, peripheral blood samples was collected in sterile containers. Thin and thick blood smears was made from each of these samples, stained with Geimsa and then examined under the microscopic using x 100 objective lens in each case. Identification of species was done using the thin blood smear. The parasite density were estimated on the thick smear under oil immersion and viewed using x 100 objectives lens. The determination was done by counting the number of asexual forms of *Plasmodium falciparum* parasites against at least 100 leucocytes and 200 leucocytes for definitive count. The numbers of asexual parasites were calculated using this formula.

If >10 parasites are counted, then the following formulae can be applied:

$$\frac{(\text{No. of Parasites}/\text{No. of WBCs counted}) \times 8000}{\text{No. of parasites}/\text{ul}}$$

Quality control was ensured using freshly reconstituted and filtered Giemsa stains. The microscopist is very experienced and he spent and average of 10 minutes on each thick and thin film respectively. Comparison was made with both known positive and negative thin films. Samples were estimated for PVC using the microhaematocrit centrifugation while hemoglobin concentration will be estimated spectrophotometrically using the cyamethaemoglobin method [11]. All laboratory analysis was done on the day of sample collection except microscopy. All the patients with malaria parasites and anaemia were adequately treated.

## 2.4 Ethical Clearance

Informed consent was obtained from all subjects and health officers. Ethical clearance was sought from the State Ministry of Health and the Ethiopie East Local Government Ministry of Health, Delta State.

## 2.5 Data Analysis

This was done using SPSS version 11 computer software. Results were presented as simple percentages. Test for significance was done using Chi square and ANOVA where applicable.  $P < 0.05$  were considered significant.

## 3. RESULTS

Of the 207 pregnant women whose peripheral blood samples were examined for infection with malaria parasites, 60% were positive. It was observed that of the 207 pregnant women observed in the two health care centres Government Hospital Abraka 64% were infected, 36% were not infected while in Eku Baptist Hospital 56% were infected while 44% were not infected. The result also showed that according to age, pregnant women aged 18-25 years had highest infection rate of 67.8%, others were 57.1% for age group 26-35 years, and age group 36-45 show no infection of malaria. The differences were statistically significant ( $P < 0.05$ ).

Highest prevalence of 63.5% was observed among women in the first trimester of pregnancy, followed by 54.7% in the second trimester, with the least seen in the third trimester with 41.2%. Gestation periods was statistically significant ( $P < 0.05$ ). The result also showed that according to occupation, pregnant women who are farmers

had the highest infection rate of 71.4%, student 64.5%, traders 62.3%, civil servant 52.5% and housewives 40%. The differences were statistically significant ( $P < 0.05$ ). The result also showed that according to residence, pregnant women who live in rural areas show 69.1% while those at the urban areas while 49.5% for rural areas. The differences were statistically significant ( $P < 0.05$ ).

According to parity, primigravidae had the highest infection rate with 68.9% being infected while multigravidae shows prevalence of 51%. The differences were statistically significant ( $P < 0.05$ ). According to chemoprophylaxis use, those that didn't use chemoprophylaxis has the highest infection rate of 88% while those that used chemoprophylaxis shows prevalence of 23.1%. The differences were statistically significant ( $P < 0.05$ ).

According to bed net use, those that didn't use bed nets has the highest prevalence rate of 86.2% while those that used bed net shows prevalence rate of 30.6%. The differences were statistically significant ( $P < 0.05$ ).

#### 4. DISCUSSION

This research work shows that malaria is a serious problem seen in pregnant women sampled in Ethiopia East Local Government Area of Delta State. However, the prevalence rate of 60% observed in this research is comparable to previous work done in other areas; 72% recorded in pregnant women in Osogbo, Southwest Nigeria [1], 60% observed in pregnant women in Anambra [12], 59.9% in a rural community in Eastern Nigeria [13], 57% in Libreville, Gabon [14], 63.5 in Awka, Nigeria [15], 58.4% in Enugu [16] 52% in suburb of Lagos [17]. This was not

**Table 1. Prevalence of Malaria and socio-demographic factors**

<b>Hospitals</b>	<b>No. infected (%)</b>	<b>No. not infected (%)</b>	<b>No. examined</b>
Government Hospital Abraka	64 (64%)	36 (36%)	100
Eku Baptist Hospital Eku	60 (56%)	47 (44%)	107
Total	124 (60%)	83 (40%)	207
<b>Age (Years)</b>	<b>No. Infected (%)</b>	<b>No. Not Infected (%)</b>	<b>No. Examined</b>
18-25	80 (67.8%)	38 (32.2%)	118
26-35	44 (57.1%)	33 (42.9%)	77
36-45	0 (0%)	12 (100%)	12
Total	124 (59.9%)	83 (40.1%)	207
<b>Gestation periods</b>	<b>No. Infected (%)</b>	<b>No. Not Infected (%)</b>	<b>No. Examined</b>
First trimester	73 (63.5%)	42 (36.5%)	115
Second trimester	41 (54.7%)	34 (45.3%)	75
Third trimester	7 (41.2%)	10 (58.8%)	17
Total	124 (59.9%)	83 (40.1%)	207
<b>Occupation</b>	<b>No. Infected (%)</b>	<b>No. Not Infected (%)</b>	<b>No. Examined</b>
Farmers	30 (71.4%)	12 (28.6%)	42
Housewives	10 (40%)	15 (60%)	25
Civil Servant	21 (52.5%)	19 (47.5%)	40
Traders	43 (62.3%)	26 (37.7%)	69
Student	20 (64.5%)	11 (35.5%)	31
Total	124 (59.9%)	83 (40.1%)	207
<b>Residence</b>	<b>No. Infected (%)</b>	<b>No. Not Infected (%)</b>	<b>No. Examined</b>
Urban	48 (49.5%)	49 (50.5%)	97
Rural	76 (69.1%)	34 (30.9%)	110
Total	124 (59.9%)	83 (40.1%)	207
<b>Parity</b>	<b>No. Infected (%)</b>	<b>No. Not Infected (%)</b>	<b>No. Examined</b>
Primigravidae	71 (68.9%)	32 (31.1%)	103
Multigravidae	53 (51%)	51 (49%)	104
Total	124 (59.9%)	83 (40.1%)	207
<b>Bed net use</b>	<b>No. Infected (%)</b>	<b>No. Not Infected (%)</b>	<b>No. Examined</b>
Yes	30 (30.6%)	68 (69.4%)	98
No	94 (86.2%)	15 (13.8%)	109
Total	124 (59.9%)	83 (40.1%)	207

correlated with report of [4] who recorded a low prevalence of 10.71% in Ethiopia East. This may be due to the fact that the study was carried out during rainy season March to August, this may also be due to the sanitation problems (no proper drainage/sewage disposal systems) and flooding (stagnant water bodies are suitable breeding habitats for malaria vectors) therefore exposure rate to infective female anopheles mosquito bites of the inhabitants in the study area.

For several decades, malaria has been recognized in Africa, especially in children. Conversely, less attention has been given to the severe problems posed by malaria occurring in pregnant women. In many African countries where malaria is holo-endemic, non-pregnant female adults eventually achieve a significant level of immunity against malaria. It is interesting to note that during pregnancy, these women experience considerable decline in their levels of immunity to malaria infection [18,19,20,21]. Thus, as compared to non-pregnant women, pregnant women of the same age and parity have lower levels of both cell-mediated and humoral immunity to malaria [3]. Consequently, pregnant women tend to have more episodes of malaria fever. Moreso, malaria has substantial devastating effects on the developing foetus and makes substantial contributions to the large burden of perinatal and neonatal morbidity and mortality in holo-endemic areas. This therefore could explain why more pregnant women than non-pregnant women had infections in this research work.

Pregnant women 25 years of age and below have higher prevalence rate of 67.8% and most primigravidae belong to this group. While pregnant women in the age 26-35 years have lower rate of infection and those of the group 36-45 years have the least prevalence rate. Normally, primigravidae have a higher prevalence rate of parasitaemia [22] since their immune system is still building up as compared to the multigravidae. A partial explanation to this observation in this study could be that apart from immunological status, resistance to malaria may also be influenced by other factors such as haemoglobin type, erythrocyte, glucose -6-phosphate dehydrogenase activity and well-balanced nutritional status [9].

The high prevalence rate obtained within the first and second trimesters in this study, agreed with those of other studies which observed peak prevalence in week 10-20 of pregnancy [23]. This

may be attributed to the expression of adherent proteins on the surface of infected red blood cells (IRBCs), enabling the IRBCs to adhere to micro-vascular capillaries of vital organs causing severe pathological condition [24].

The finding that farmers had the highest infection of 71.4% may be implicative especially as other studies from Nigeria [25,26] have reported high prevalence of malaria parasitemia among farmers than the general population.

From the study it was discovered that most of the pregnant women do not use chemoprophylaxis with a prevalence rate of 88.8%. By contrast, chemoprophylaxis is currently thought to be the most effective method for preventing the maternal and fetal effects associated with malaria in pregnancy. The world Health Organization has recommended the routine administration of anti-malaria drugs to all pregnant women in holo-endemic areas as an important strategy to prevent malaria and that such drugs be given in pregnancy as early as possible. Indeed, the routine administration of anti-malaria drugs is one of the six elements in the current roll back malaria initiative being propagated by the World Health Organization and has been endorsed by several countries across Africa, including Nigeria.

To date, there is still no agreement on the best drug combinations to use for the prevention of malaria in pregnancy. Initially, oral pyrimethamine and chloroquine administered weekly were used in various parts of Africa as chemoprophylactic agents. However, recent reports indicate that these are no longer effective in reducing parasitaemia in pregnancy as a result of the high incidence of chloroquine resistance [36]. Other agents that have been used for chemoprophylaxis in pregnant women include proquanil, deoxycycline, primaquine, deoxycycline, mefloquine, halofantrine, sulfadoxine/pyrimethamine, artesunate and quinine but none has proven to be completely effective [37].

There is no doubt that ITN has a capacity to reduce mosquito bites and malaria prevalence [38] showed a non-significant increase in prevalence of malaria after 6 months use in a rural agrarian Nigerian community. The reasons are most likely related to sustained exposure to mosquito bites partly due to occupation and other poverty/environmental related factors. These factors include poor housing and overcrowding

which make the use of nets very uncomfortable. This increases the average night time spent outside the ITNs, thus increasing exposure to mosquito bites. In the presence of poorly ventilated houses and very poor electricity supply in the study community the time spent under the ITNS is most likely reduced [39]. This may be associated with the lack of use of bed nets by the pregnant women in Ethiopia East this may be the reason why this study shows high prevalence of 86.2% of those that did not use the bed nets.

Malaria prevalence of 69.1% was observed in rural areas in Ethiopia East Local Government Area of Delta State this may be due to majority of the houses surrounded by farmlands with thick bushes and poor waste management. These factors will inadvertently contribute additional breeding sites for mosquitoes which transmit the malaria parasite. Furthermore it has been reported that environmental modification measures are difficult to implement in rural community [40].

## 5. CONCLUSION

In conclusion, the study had provided data on the prevalence of malaria in pregnancy in Ethiopia East Local Government Area of Delta State. The prevalence of malaria among pregnant women showed that malaria is a serious public health problem. Therefore, efforts aimed at controlling and preventing malaria in pregnancy should include; avoidance of mosquito bites, preventing the breeding of mosquito larvae, destroying adult mosquitoes by regular spraying of all houses with residual insecticides as well as planned health talks on the disease transmission to pregnant women. These would be very useful as a preventive rather than curative approach. The rural areas will benefit from efforts at larva control and reduction of breeding sites like bushes near living homes. Concerted efforts to reduce poverty, improve nutrition, housing and electricity in the rural areas of Nigeria will invariably reduce the malaria burden. This will go a long way in reducing maternal and perinatal morbidity and mortality.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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