Prevalence of *Plasmodium falciparum* Infection Among Pregnant Women Visiting Community Hospitals in Aguata L.G.A., Anambra State, Nigeria

Rose Lotachukwu Nwangwu, Chukwudi Michael Egbuche[*], James Ikechukwu Mbanugo, Vivian Ifediba Onwuzulike

Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka, Nigeria

Email address:
cm.egbuche@unizik.edu.ng (C. M. Egbuche)
[*]Corresponding author

Abstract: A Study on the prevalence of *Plasmodium falciparum* infection among pregnant women visiting community hospitals in Aguata LGA of Anambra State, Nigeria was carried out between October, 2014 and March 2015. Six hundred and five (605) pregnant women from 5 communities, who attended antenatal clinic during the research period, were involved in the study. Venous blood samples were collected and *Plasmodium* infection determined using microscopy of Giemsa stained thick and thin blood films. Of the 605 pregnant women sampled, 263 (43.5%) were infected. The prevalence by community was highest (67.4%) in Uga and least (29.9%) in Achina (P<0.05). Prevalence by age was highest (46.9%) in the age group (21–25) years and least (39.5%) in the age group (31-35) years (P>0.05). Highest prevalence (43.7%) was recorded among women that attained secondary school while women that attained tertiary education recorded the least (42.5%) prevalence (P>0.05). Farmers had the highest (81.8%) prevalence and the least (40.5%) was among traders (P<0.05). The highest prevalence (52.0%) was recorded among those in their second trimester and lowest (33.7%) among those in their third trimester (P<0.05). Women who started ANC in their third trimester had highest prevalence (56.5%) whereas those that started ANC in second trimester had least (37.6%) prevalence (P<0.05). With the high prevalence of *Plasmodium* infection in the study area, there is need for continual community enlightenment programs to reduce the burden of *Plasmodium* infection especially during pregnancy.

Keywords: *Plasmodium falciparum* Infection, Pregnant Women, Aguata, Anambra State, Nigeria

1. Introduction

Malaria is number one out of the seven initially earmarked diseases for global control and eradication by Tropical Disease Research (TDR) of the World Health Organization (WHO). This is because of its morbidity, mortality, problem of diagnosis, lack of ideal drugs and effective vaccines as well as behaviors of the vector [1]. Among the high risk groups for malaria are pregnant women. The prevalence of malaria in pregnancy is reported to be highest towards the end of the first trimester and throughout the second trimester [2, 3]. This is due to the breakdown of acquired immunity during pregnancy, especially in primigravidae [4]. More so, Merozoite Surface Protein 2 (MSP 2) allelic families and

Sulfadoxine-Pyrimethamine (SP) resistance molecular markers of *P. falciparum* have been reported among pregnant women [5]. Malaria during pregnancy has serious consequences to the mother, her foetus and the neonate; and it is an important health challenge [6]. Pregnant women in endemic areas are vulnerable to malaria than non-pregnant women, with increased risk of severe anaemia and death [7]. Anaemia and altered placental integrity caused by malaria can lead to low birth weight (LBW), abortion, stillbirth, premature birth and high infant mortality/morbidity [8]. This is a common problem for women in their first and second pregnancies and for women who are HIV positive [9]. The increased susceptibility can be explained by the immunological changes induced by pregnancy [10]. The

most common symptoms observed in clinical profiles of pregnant women include: Anaemia, enlargement of spleen, fever, nausea, vomiting, diarrhoea and convulsion in complicated cases [11]. The symptoms and complications of malaria during pregnancy have economic implications [12]. The World Health Organisation therefore recommends a package of interventions for controlling malaria during pregnancy in areas with stable transmission of *P. falciparum*. It includes the use of insecticide treated nets (ITN), the administration of at least two (2) doses of intermittent preventive treatment with Sulfadoxine-pyrimethamine (SP) based drugs after quickening and effective case management of malaria. With these control efforts in place, this research will enable us know the extent to which malaria is still a public health problem. It will equally highlight those factors responsible for continued and high prevalence of malaria in the study area. Therefore, the aim of this study was to determine the prevalence of Malaria parasite infection among pregnant women in Aguata, in relation to location, age, educational status, occupation, gestational age and time of first antenatal care (ANC) visit.

2. Materials and Methods

2.1. The Study Area

The study was carried out in five (5) randomly selected communities namely: Ezinifite, Igboukwu, Achina, Ekwulobia and Uga, in Aguata Local Government Area of Anambra State, Nigeria. Aguata L.G.A is one of the oldest and largest Local Government Area in the State. It is located at latitude $5°55.2^1$N to $6°4.8^1$N and longitude $6°5.9^1$E to $7°9.6^1$E. The local government headquaters is located at Aguata, and is composed of fourteen autonomous communities: Akpo, Agulu-Ezechukwu, Amesi, Achina, Ekwulobia, Ezinifite, Igboukwu, Ikenga, Isuofia, Nkpologwu, Oraeri, Uga, Umuchu and Umuona. The LGA landmass covers an area of $19,906.25km^2$. It is bounded on the East by Orumba South LGA, on the North by Orumba North LGA, on the west by Anaocha LGA and on the South by Nnewi South LGA. The estimated population of the area is 434,124, with females having a population of 220,535, according to National population Commission data for 2006. The study area is marked by two seasons: the rainly season, which starts from March to October with annual rainfal of about 180mm to 270mm. While dry season covers the period of November to April with very high tempreture. The inhabitants of the study area are mostly farmers. Their crops are planted close to human habitation; bushes are also left for grazing animals, predisposing them to mosquito bites. Erosion is a serious natural disaster in the study area.

2.2. Study Design

The research was a quantitative cross-sectional study of pregnant women who attended antenatal clinic during the study period.

2.3. Study Population and Sampling Method

The study population consists of all the pregnant women who attended antenatal clinic in the five communities (Achina, Ezinifite, Ekwulobia, Igboukwu and Uga) between October 2014 and March 2015. These communities were selected out of the fourteen communities that make up Aguata L.G.A. through simple random sampling method. In each of the selected communities, one hospital was selected using judgmental (purposive) sampling method which involves researchers' informed judgment about the sampling unit and size based on his knowledge and experience about the population as well as the purpose of the study [13]. The selected hospitals were: Kandudi specialist hospital Achina, Apex specialist hospital Uga, General hospital Ekwulobia, Apex specialist hospital Igboukwu, and University teaching hospital/Comprehensive health centre Ezinifite. Six hundred and five (605) consented pregnant women who came for antenatal clinic during the research period (October, 2014 to March, 2015) were involved in the study.

2.4. Ethical Considerations

An introductory letter obtained from the Head of Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka was used to identify the researchers in this study. The research proposal was then submitted to the Ethical Committee of Anambra State University Teaching Hospital, Amaku Awka Nigeria, and their approval was obtained (COOUTH/AA/VOL.1.023). The introductory letter was also used to obtain permission from the management of the health facilities, the health workers in charge of antenatal clinics as well as the laboratory unit used in the study. The informed consents of the pregnant women was equally sought for and was obtained verbally.

2.5. Collection of Blood Samples

With the assitance of laboratory technicians, blood samples were collected employing the venipuncture technique. The punctured sites were cleaned with cotton wool dipped in methylated spirit (methanol) and the blood specimens were obtained using 2ml syringes. Each blood specimen collected was transfered into a sterile EDTA container. Each sample was labeled correctly with the patient's data, avoiding any mix up.

2.6. Determination of Plasmodium Infection

Both thick and thin blood films were prepared using 10% v/v Giemsa stain. Thick blood films were used to detect the presence of malaria parasite, while thin blood films were examined for the identification of *Plasmodium* species present.

Both blood films were examined microscopically using $100\times$ oil immersion objectives lens. For each participant, 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 according to [14].

3. Results

The overall prevalence of *Plasmodium* infection among pregnant women in Aguata L.G.A was 43.5% ($\frac{264}{605}$) and *P. falciparum* was the only malaria parasite species identified in the study. The prevalence by communities was 67.4% ($\frac{62}{92}$), 59.0% ($\frac{56}{95}$), 48.0% ($\frac{48}{100}$), 31.1% ($\frac{51}{164}$) and 29.9% ($\frac{46}{154}$) for Uga, Igboukwu, Ezinifite, Ekwulobia and Achina respectively (Table 1). The difference in the prevalence of *Plasmodium falciparum* infection by community was statistically significant (P<0.05).

Table 1. *Prevalence of Plasmodium falciparum infection among pregnant women according to community in Aguata L.G.A.*

Community	Number examined	Number infected (%)
Achina	154 (25.5)	46 (29.9)
Ekwulobia	164 (27.1)	51 (31.1)
Ezinifite	100 (16.5)	48 (48.0)
Igboukwu	95 (15.7)	56 (59.0)
Uga	92 (15.2)	62 (67.4)
Total	605	263 (43.5)

The result also showed that the age group 21-25years had the highest prevalence of 46.9% ($\frac{69}{147}$), followed by 44.6% ($\frac{25}{56}$), 44.0% ($\frac{84}{191}$), 41.4% ($\frac{36}{87}$), and 39.5% ($\frac{49}{124}$), for age groups>35years, 26-30years, ≤20years and age group 31-35years respectively, as shown in Table 2. The difference in the prevalence of *Plasmodium falciparum* infection by age was not statistically significant (P>0.05).

Table 2. *Prevalence of Plasmodium falciparum infection among pregnant women by age in Aguata L.G.A.*

Age (years)	Number examined	Number infected (%)
≤20	87	36 (41.4)
21-25	147	69 (46.9)
26-30	191	84 (44.0)
31-35	124	49 (39.5)
>35	56	25 (44.6)
Total	605	263 (43.5)

The prevalence of *Plasmodium falciparum* infection by educational status was 43.7% ($\frac{192}{439}$), 43.3% ($\frac{26}{60}$), and 42.5% ($\frac{45}{106}$), for secondary, primary and tertiary educational status respectively (Table 3). The difference in the prevalence of *Plasmodium* infection by educational status was statistically not significant (P>0.05).

Table 3. *Prevalence of Plasmodium falciparum infection among pregnant women according to Educational status in Aguata L.G.A.*

Educational status	Number examined	Number infected (%)
Primary	60	26 (43.3)
Secondary	439	l92 (43.7)
Tertiary	106	45 (42.5)
Total	605	263

The result equally showed that farmers had the highest

prevalence of 81.8% ($\frac{9}{11}$), followed by 52.9% ($\frac{36}{68}$), 48.9% ($\frac{44}{90}$), 43.8% ($\frac{14}{32}$) and 40.5% ($\frac{160}{395}$) prevalence for those who did not specify their occupation, civil servants, students and traders respectively (Table 4). The prevalence of *Plasmodium falciparum* infection by occupation was statistically significant (P<0.05).

Table 4. *Prevalence of Plasmodium falciparum infection among pregnant women by occupation in Aguata L.G.A.*

Occupation	Number examined	Number infected (%)
Trader	395	160 (40.5)
Civil servant	90	44 (48.9)
Student	32	14 (43.8)
Public servant	9	0 (0.0)
Farmer	11	9 (81.8)
Others	68	36 (52.9)
Total	605	263 (43.5)

The prevalence by time of first antenatal clinic visit was 56.5% ($\frac{35}{62}$), 45.8% ($\frac{132}{288}$), and 37.7% ($\frac{96}{255}$) for women who visited first in their third, first, and second trimester respectively (Table 5). The prevalence of *Plasmodium falciparum* infection by time of first antenatal visit was statistically significant (P<0.05).

Table 5. *Prevalence of Plasmodium falciparum infection among pregnant women by time of first Antenatal visit in Aguata L.G A.*

Trimester	Number examined	Number infected (%)
First	288	132 (45.8)
Second	255	96 (37.6)
Third	62	35 (56.5)
Total	605	263 (43.5)

The prevalence by trimester was 52.0% ($\frac{150}{289}$), 33.7% ($\frac{64}{190}$), and 31.0% ($\frac{49}{126}$), for those in their second, third and first trimester respectively (Table 6). The prevalence of *Plasmodium falciparum* infection by trimester was statistically significant (P<0.05).

Table 6. *Prevalence of Plasmodium falciparum infection among pregnant women by trimester in Aguata L.G.A.*

Trimester	Number examined	Number infected (%)
First	126	49 (38.9)
Second	289	150 (52.0)
Third	190	64 (33.7)
Total	605	263 (43.5)

4. Discussion

The overall prevalence of *Plasmodium*, infection among pregnant women visiting community hospitals in Aguata L.G.A from this research was 43.5%. This finding is lower than the result of [15] which recorded a slightly higher prevalence of 52% on the prevalence of malaria infection in pregnant women living in surburb of Lagos State Nigeria., and 58.0% prevalence record among pregnant women attending antenatal clinics in Onitsha North L.G.A., Anambra

State [12]. A comparatively lower prevalence obtained in this study may be as a result of the period of the research, given that IPTp – SP is now well integrated in antenatal clinics. Despite that, 43.5% malaria parasite prevalence among pregnant women in the study area is still of great public health concern. Even though the research was carried out in the dry season (October to March), the pregnant women could have acquired the infection during the period of rain when *Anopheles* mosquito breeding habitats abound and their population tends to increase. This is evident in the statement [16, 17], that malaria transmission is affected by season as malaria vector population abounds in the rainy season than in the dry season, and vice versa. In addition, the pregnant women in the study area may not have been sleeping under Long Lasting Insecticide – treated Nets (LLINs) which are meant to offer protection against mosquito bites, thereby preventing malaria parasite infection [18]. Interestingly, this study confirms the dominance of *P. falciparum* infection in Anambra state as earlier reported [18, 19]. Thus the high prevalence recorded may also be attributed to resistance of *P. falciparum* to SP drugs used for IPTp during the ANC period [5].

The difference in the prevalence of malaria parasite among the pregnant women based on community was statistically significant. A factor which may have contributed to high prevalence in some areas is the behavioral attitudes of the inhabitants. Utilization of control tools seemed unequal as it was observed during visits to the selected communities that pregnant women in the affected areas focused more on their daily business, thereby not valuing Antenatal Care (ANC). In a situation whereby ANC day is on a market day, they do not visit clinics or the turnout is very poor. Also, the environmental conditions of the various communities may have contributed unequally to *Anopheles* mosquito breeding habitats as well as unequal exposure to their bites.

In this study, pregnant women of all ages were at equal risk of malaria parasite infection [20], even though the highest prevalence of malaria parasite infection was among the age group 21- 25. The observed high prevalence among them may be that most of the women in that range are primigravidae who are thought to have more reduced immunity. This was in contrast with the work of [21] in Oshogbo, Southwest Nigeria, where the highest prevalence was among the age group 36-39years.

The prevalence of *Plasmodium falciparum* infection among the pregnant women was not significantly related to their educational qualification. This finding is in line with the work of [22] in metropolitan Lagos, where prevalence was not determined by educational status. It shows that pregnant women of varying educational qualifications may have shown similar level of compliance to WHO malaria control interventions; the use of LLINs and the administration of intermittent preventive therapy (IPT) during pregnancy,

Prevalence of malaria parasite infection was significantly higher with pregnant women who are farmers, compared to other women. This result is in agreement with the findings of [23], who reported higher prevalence of malaria parasitaemia among farmers in Okigwe and Owerri area of Imo State. Their farming activities especially around their houses create suitable breeding habitats for *Anopheles* mosquitoes, thereby exposing them to more bites.

The highest prevalence of malaria parasite infection occurred among pregnant women who started antenatal care in their third trimester, followed by those who started in their first trimester. Women who started clinic in their second trimester were the least infected. From the statistical analysis, there is significant difference between prevalence and time of first ANC visit. The high prevalence among those who started ANC in their third trimester can be attributed to the fact that these women might not have received any dose of intermittent preventive therapy (IPT) prior to the research period. It then shows that early registration and compliance to ANC can reduce the prevalence of malaria parasite infection among pregnant women.

With regards to trimester/gestational age, pregnant women in their second trimester recorded significantly the highest prevalence of malaria parasite infection. This is in line with the report of [24] in South Eastern Nigeria; [15] in Surburb of Lagos reported highest in second trimester. However, it contradicts the finding of [3] in Western Kenya who reported highest prevalence among those in their first trimester. It shows that these women in their second trimester may have low level of compliance to intermittent preventive treatment of malaria with Sulphadoxine – Pyrimethamine (IPTp – SP), even though they might have started ANC early in their first trimester. Moreso, it could be a problem of drug resistance since Sulfadoxine-Pyrimethamine (SP) resistance molecular markers of *P. falciparum* have been reported among pregnant women [5].

5. Conclusion

In conclusion, malaria is still a public health problem among pregnant women in Aguata LGA of Anambra State Nigeria. Pregnant women irrespective of their age and highest educational qualifications are affected. However, the risk of infection is increased by occupation of the pregnant women and their time of first ANC visit. Thus there is need for the pregnant women to be constantly educated or reminded of the importance of sleeping under LLINs and early ANC visit.

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