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Malaria Prevalence and Its Demographic Determinants in Oyigbo Local Governement Area, Rivers State, South-South, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To investigate the prevalence of malaria and how demographic factors influence malaria parasite transmission among persons attending primary health care facilities in Oyigbo LGA, Rivers State, South-South, Nigeria.
Methodology: Intra-venous blood samples were obtained from 190 participants who enrolled for the study. These blood samples were stored in ethylene diamine tetra acetate bottles (EDTA) and used to make thick and thin films for malaria parasite detection using standard parasitological techniques (Cheesbrough 1998). Questionnaires were administered to the participants to obtain their demographic data. Data were analysed using the Statistical Package for Social Sciences version 25 and presented using descriptive statistics. Chi-square was used to obtain level of significance ($p<0.05$).
Results: Of the 190 persons examined, 109 were positive, giving a prevalence of 57.4%. *Plasmodium falciparum* was the only malaria parasite observed. Females 67 (59.82%) were more affected than males 42 (53.84%) but this difference was not statistically significant ($p>0.05$). Age

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group 41-50 and those with Secondary education had higher prevalence. The difference observed in these groups was statistically significant ($p<0.05$). Artisans had the highest prevalence whereas the unemployed had the least prevalence. However, this difference was not statistically significant ($p>0.05$).

Conclusion: Demographic factors have been shown to influence malaria transmission. Therefore, malaria control efforts should be intensified, taking into cognizance, the role of demographic factors in transmission.

Keywords: Malaria; prevalence; demographic factors; Oyigbo.

1. INTRODUCTION

Malaria remains a major public health threat in tropical and subtropical regions across the world [1]. It is a parasitic disease caused by protozoan parasites of the genus *Plasmodium* [2]. *Plasmodium species* that naturally infect humans and cause malaria in large areas of the world are limited to five: *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* [2]. The first four are specific for humans, while *P. knowlesi* is naturally maintained in macaque monkeys and causes zoonotic malaria widely in South East Asia including Vietnam and Thailand [3], and *P. knowlesi* malaria is now recognised as the fifth human malaria [4]. *P. falciparum* is considered the most pathogenic and most prevalent in Africa [5]. *Plasmodium species* still ranks the number one disease-causing parasite that kills a child somewhere in the globe every 30 seconds [6] and are naturally transmitted to man through the bites of infected female mosquitoes of the genus *Anopheles* [7,8].

Malaria is endemic in 87 countries worldwide [9]. According to WHO [9], an estimated 229 million cases of malaria occurred worldwide in 2019 declining from 238 million in 2000 across 108 countries. The estimated number of deaths stood at 409,000 compared with 411,000 deaths in 2018. About 51% of all cases globally were accounted for by Nigeria (27%), the Democratic Republic of the Congo (12%), Uganda (5%), Mozambique (4%) and Niger (3%). About 95% of malaria deaths were in 32 countries. Nigeria (23%), the Democratic Republic of Congo (11%), the United Republic of Tanzania (5%), Burkina Faso (4%), Mozambique (4%) and Niger (4%) accounted for 51% of all malaria deaths globally in 2019.

There is high transmission of malaria in Nigeria with more than 76% of the population reporting more than 1 case per 1,000 population [10]. Prevalence surveys give insights into the transmission patterns in any given area and act as useful tools for control purposes. The ambitions are to build an evidence-based platform to make decisions on the effective, efficient and equitable distribution of interventions to control malaria. The is imperative because the future success of malaria control in Africa depends on the intelligent use of epidemiological evidence, moving away from the dogma that one size fits all [11]. In Rivers State, there have been a number of researches on malaria [12-16]. The indication is that malaria is still endemic. This study therefore investigates the prevalence of malaria and how demographic factors influence malaria parasite transmission among persons attending primary health care facilities in Oyigbo LGA, Rivers State, a state in the tropical rain forest zone of South-South, Nigeria.

2. METHODOLOGY

2.1 Study Area

The study. The cross-sectional study was conducted in four primary health care (PHC) facilities in Oyigbo local government areas (LGA) as presented in Fig. 1 namely Model PHC Obete, Model PHC Mirinwanyi, Model PHC Obeakpu and PHC Egberu.

2.2 Selection of Participants

A total of 190 participants were selected through stratified random sampling. Oral consents were obtained from the participants and care givers.

Inclusion and Exclusion Criteria: The inclusion criteria was informed consent to participating in the study while the exclusion criteria were patients undergoing malaria treatment and refusal to give informed consent.

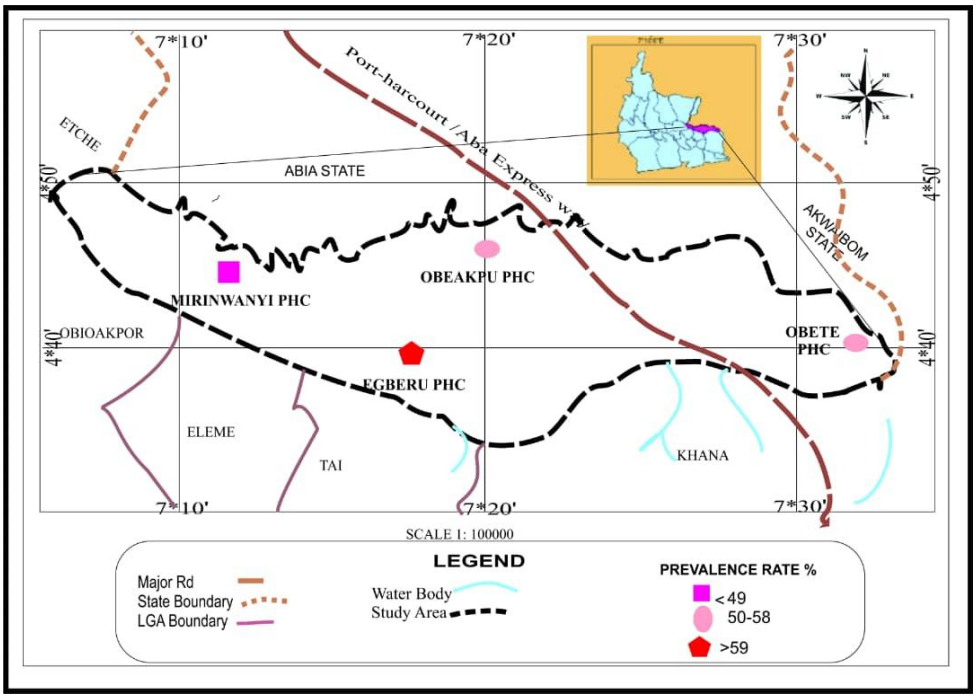

Fig. 1. Map of study area

Blood Sample Collection and Laboratory Analysis: Intra-venous blood samples were obtained from all enrolled study patients by trained laboratory scientists in the selected PHCs. These blood samples were stored in ethylene diamine tetra acetate bottles (EDTA) and used to make thick and thin films for malaria parasite detection using standard parasitological techniques [17]. Questionnaires were administered to the participants to obtain their demographic data, awareness, ownership and use of LLINs. The method of sample collection employed was venipuncture technique [18]. Soft tubing tourniquet was fastened to the upper arm of the subject to enable the index finger feel a suitable vein. The puncture site was then cleansed with methylated spirit and venipuncture made with the aid of a 21G needle attached to a 2ml syringe. Sufficient blood was collected, the tourniquet released and the needle removed immediately while the blood was transferred into an ethylene-diamine-tetra-acetic acid (EDTA) bottle [18]. Thick and thin blood films were prepared for malaria parasite detection using standard parasitological techniques [17]. The thin films were fixed in methanol for 30 seconds dabbing with a cotton wool pad. Care was taken not to allow contact between the thick film and the methanol. The slides were stained in 3% Giemsa stain for 45 minutes and dried. The stained slides were examined with 100× objective and the features in the thin film seen were used to identify *Plasmodium* species. Presence of ring forms and trophozoites of *Plasmodium* indicated positive results. Standardized questionnaires were used to obtain information such as age, sex, educational status and occupational status from respondents and caregivers.

2.3 Data Analysis

The prevalence and demographic data were analysed using the Statistical Package for Social Sciences version 25. The data generated from this study were presented using descriptive statistics. Chi-square was used to obtain level of significance ($p<0.05$).

3. RESULTS

Out of the 190 persons examined for malaria parasite, 109 were positive, thus giving a prevalence of 57.4%. *Plasmodium falciparum* was the only malaria parasite observed. Females 67 (59.82%) were more affected than males 42 (53.84%) as shown in Table 1. Malaria prevalence according to sexes was not significant ($P=0.413$, $p>0.05$).

The age-group 41-50 years had the highest malaria prevalence 16 (72.72%) while the age group 0-10 years had the least 6 (21.42%) as shown in Table 2. The results were statistically significant ($P=0.003$, $P<0.05$).

With respect to the educational status of the subjects, prevalence was highest among those with secondary education 55(64.70%) and was least among those without formal education 9(31.03%) as seen in Table 3. This difference was found to be statistically significant (P=0.015, P<0.05)

Prevalence was found to be higher among the artisans and least among the unemployed. However, this difference was not statistically significant (P=0.081, p>0.05).

4. DISCUSSION

This study showed that *P. falciparum* malaria is still significantly prevalent in Rivers State. The overall malaria prevalence of 57.4% found in the study area was found to be similar to another study done by Egbom and Nzeako [12] who recorded a prevalence of 52.5% in Rivers State. The result was higher than previous estimates reported in other parts of the state where a prevalence of 32% was reported by Wogu and Nduka [19] and prevalence of 43.1% reported by Wogu, Nduka and Wariso [13]. The observed prevalence was however lower than the prevalence reported by Wokem et al., [20] and Augustine- D'Israel and Abah [21] who recorded a prevalence of 87% and 78% respectively in the state.

Table 1. Prevalence of malaria parasitaemia by sex

Sex	No. Examined	No infected	Prevalence rate (%)
Males	78	42	53.8%
Females	112	67	59.8%
Total	190	109	57.4%

Table 2. Prevalence of malaria parasitaemia by age

Age groups	No. Examined	No infected	Prevalence (%)
0-10	28	6	21.4%
11-20	20	13	**65%**
21-30	49	28	57.1%
31-40	54	36	**66.7%**
41-50	22	16	72.7%
51-60	8	4	**50%**
>60	9	6	**66.6%**
Total	190	109	**57.4%**

Table 3. Prevalence of malaria parasitaemia by educational status

Educational status	No. Examined	No infected	Prevalence (%)
Tertiary	42	26	61.90
Secondary	85	55	64.70
Primary	34	19	55.55
None	29	9	31.03
Total	190	109	57.4

Table 4. Prevalence of malaria parasitaemia by Occupation

Occupation	No. examined	No. infected	Prevalence (%)
Formal employment	29	14	48.27
Trading	49	32	65.30
Artisan	19	15	78.94
Driving	24	15	62.5
Support from family	29	16	55.17
Unemployed	40	17	42.5
Total	190	109	57.4

The reported prevalence was lower than prevalence recorded in other parts of Nigeria where Egbuche et al., [22] recorded a prevalence of 67.0% in Aguleri, Anambra state; Obimakinde and Simon-Oke [23] recorded a prevalence of 82% in Akure; Nas et al*.,* [24] recorded a prevalence of 84% in Kano; Mohammad et al., [25] recorded a prevalence of 60.4% in Sokoto; Onyishi et al*.*, [26] recorded a prevalence of 72.8% in Nsukka and Ukwubile et al*.,* [27] recorded a prevalence of 64% in Taraba but was higher than that reported by Adedotun [28], Umaru and Uyaiabasi [29] and Ocheje and Dogara [30] who recorded a prevalence of 29.7%, 35.7% and 51% in Oyo, Kaduna and Jigawa states respectively. The observed differences could be attributed to the fact that prevailing environmental factors differ in different localities thereby affecting malaria transmission differently. It could also be attributed to the differences in the habits of people in the area which could make them vulnerable to mosquito bites thereby encouraging or mitigating disease transmission.

The only *Plasmodium* parasite identified in this study was *P. falciparum* which is consistent with the reports from Abah et al. [31], Wogu and Onosakponome [15] that observed only *P. falciparum* but in contrast with the findings of Nzeako et al*.* [32] who reported the occurrence of *P.vivax* along with *P. falciparum*. The presentation of *P. vivax* in the Niger Delta region could be due to the presence people of a non-African origin.

Malaria prevalence among the sexes was statistically significant (P<0.05). It was higher among the females than the males (Table 1). This is in line with the findings of Amadi et al. [33], Chijoke-Nwauche and Sam-Ozini [34], Egbom and Nzeako [12] and Okonko et al*.,* [16] but in contrast with the findings of Abah et al. [31] and Wokem et al. [14] who recorded a higher prevalence among the males. This could be attributed to greater exposure of women in their immediate environment due to their routine household activities at dusk and dawn, especially in the rural settings where they have to prepare meals and carry out their domestic chores outside their houses….Higher prevalence among the females in this study could be attributed to greater exposure of women in their immediate environment due to their routine household activities at dusk and dawn, especially in the rural settings where they have to prepare meals and carry out their domestic chores outside their houses It could also be attributed to immune suppression due to pregnancy [35].

Malaria prevalence was statistically significant in the various age groups (P<0.05). Differences in the prevalence could also be attributed to the differences in the habits in the different age groups. Age group 41-50 recorded a high prevalence of 72.7% and …..Age group 41-50 recorded a high prevalence of 72.7% which is in contrast with the findings of Aribodor et al., [35]; Kalu et al., [36]; Eze et al*.,* [37] and Mac et al*.,* [38] who recorded higher prevalence among age groups 10-19, 11-20, 21-30 and above 50 years respectively. The observed prevalence in this age group could be attributed to the fact that persons in this age group probably spend longer hours outside their homes and as such face higher risk of exposure to the disease vector. During the dry season especially when the weather is hot, adults tend to sleep outdoors thereby exposing themselves to mosquito bites. The low prevalence rate of 21.4% in age group 0-10 indicates that there could have been improvements in the uptake of primary interventions against malaria. The findings of this study.

Prevalence of malaria parasitaemia was statistically significant (P<0.05) among the different levels of education. Prevalence was highest among those with secondary education and least among those without formal education. However, the difference was not statistically significant. Amongst the different types of occupation, artisans had the highest prevalence whereas the unemployed had the least prevalence. This difference could be attributed to higher stress levels induced by the nature of their job. Stress weakens the ability of the immune system to fight, thereby making the system vulnerable……Prevalence of malaria parasitaemia was statistically significant (P<0.05) among the different levels of education. Prevalence was highest among those with secondary education and least among those without formal education. This is in contrast with the findings of Awosolu et al., [39] who recorded a higher prevalence among those with formal education. Amongst the different types of occupation, artisans had the highest prevalence whereas the unemployed had the least prevalence. This is in line with the findings of Awosolu et al., [39] but in contrast with findings of Kalu et al*.*, [36] who recorded a higher prevalence amongst farmers. This difference could be attributed to higher stress levels

induced by the nature of their job. Stress weakens the ability of the immune system to fight, thereby making the system vulnerable.

5. CONCLUSION AND RECOMMENDATION

This study provides information on the prevalence of malaria in Oyigbo L.G.A and shows that malaria remains a major public health problem despite pragmatic efforts made to control it. Demographic factors have been shown to influence malaria transmission. Therefore, malaria control efforts should be intensified, taking into cognizance, the role of demographic factors in transmission.

CONSENT

Consent was obtained from the participants and caregivers where applicable.

ETHICAL APPROVAL

Ethical approval for the study was given by the Ethical Committee of University of Port Harcourt and Rivers State Health Research Ethics Committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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