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Prevalence of Uncomplicated and Severe Malaria in Outpatients of a Tertiary Hospital in Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author MNW designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author FON managed the analyses of the study. Author KTW managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Malaria is a public health burden in Nigeria, causing high levels of morbidity and mortality. A cross-sectional survey was conducted to investigate the prevalence of malaria amongst 1000 consenting outpatients of University of Port Harcourt Teaching Hospital, Rivers State. Intravenous blood and demographic information were collected from each study participant. Blood samples were analyzed for the presence of malaria parasites with thick and thin blood films using Giemsa microscopy. Data obtained were analyzed statistically with Chi square test and a p-value less than 0.05 was considered significant. The only malaria parasite diagnosed in the study was *Plasmodium falciparum*. A total of 431 (43.1%) study participants were infected with *P. falciparum* with females and males having infection values of 202 (39.4%) and 229 (47.0%) respectively (P<0.05). Age groups 0 – 10 years and 31 – 40 years had the highest and least prevalence of 49.5% and 36.3% respectively (P<0.05). Overall malaria intensity levels (≥1000

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parasites/µL) in this study was 190 (19.0%), with males and females having intensity prevalence of 18.1% and 19.9% respectively (P>0.05). Malaria intensity prevalence in relation to age showed a decrease in prevalence as the age of the study participants increased with age group 0 – 10 years having the highest prevalence of 37.8% and >40 years having the least prevalence of 13.9% (P<0.05). The study showed that malaria is still a health concern and also provided current data on malaria prevalence which is vital for planning and implementing successful malaria control strategies.

Keywords: Malaria; prevalence; intensity; Nigeria.

1. INTRODUCTION

Malaria has plagued man since early times and it is a parasitic disease caused by *Plasmodium* species mainly via the blood feeding of infected female *Anopheles* species [1]. Other forms of transmission include sharing contaminated needles/sharp objects, congenitally – acquired malaria (mother to foetus), transfusion of infected blood and organ transplantation [2,3]. Malaria infection is a global health problem with an estimated 429,000 deaths in 2015; about 95% of these deaths occurred in Africa and 86% of the victims were children below 5 years [4]. Nigeria and Democratic Republic of Congo jointly account for 44% of the total malaria cases in Africa [4]. Malaria has a constant transmission rate (holo – endemic) during all seasons (dry and wet) in most parts of Nigeria and this accounts for the significant malaria prevalence values reported [5]. Malaria infection can be prevented and treated but if diagnosed and treated early, the duration of the infection can be considerably shortened which in turn reduces the risk of complications and death [6]. The incidence of malaria continues to rise in most parts of Nigeria due to ecological changes which affects the species composition and population densities of *Anopheles* vectors. Such ecological changes usually result from water development projects including dam construction, expanded irrigation, changing crop practices, deforestation, human population migration, urbanization, mining and industrialization. These cause massive environmental changes which increase the breeding of *Anopheles* vector population and transmission of *Plasmodium* species [7]. More knowledge is needed on the current prevalence of malaria to aid in accurate control and management in Nigeria. This study was conducted to investigate the current malaria parasitaemia among randomly selected consenting study participants in a tertiary healthcare facility in Rivers State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The research was conducted in the University of Port Harcourt Teaching Hospital (Latitude 4°53'58"N and Longitude 6°55'43"E) in Obio – Akpor L.G.A., Rivers State, Nigeria. Heavy rainfalls occur during greater periods of the year in Rivers State (the predominant vegetation in this region is the rain forest) and this causes flooding and sanitation challenges due to blocked drainage/sewage systems. This in turn, favours the breeding and survival of *Anopheles* vectors.

2.2 Study Population and Design

The research was a cross – sectional study and enrolled 1000 consenting study participants (487 males and 513 females) seeking medical attention in the University of Port Harcourt Teaching Hospital (UPTH) from January 2014 to December 2015. Study participants were randomly chosen without prior knowledge of their medical history using computer generated random sequence by Statistical Analysis System (SAS) software and minimum sample size determination was done using Leslie – Kish formula [8]. The main occupations among the study participants were farming, hunting, fishing and civil service. The inclusion criteria for this study was that study participants attended the selected healthcare centres, had suspected body temperatures ≥38℃ for less than 10 days, were examined by a physician and gave their oral or written consent to be part of the research. Exclusion criteria included individuals undergoing malarial treatment (or took antimalarial drugs within two weeks before the research), diagnosed with mental illness, measles, chickenpox, infected wounds, pneumonia and those with suspected body temperatures ≥38℃ but did not give their consent to be part of the study.

2.3 Ethical Clearance

Ethical clearance from the Rivers State Ministry of Health and University of Port Harcourt Teaching Hospital Ethics Committee were obtained before the commencement of the research.

2.4 Data Collection

The consent (oral or written) of all study participants (consent was obtained from guardians or parents of participants below 18 years) was obtained before collecting demographic (age and sex) information and blood samples. Venous blood samples were collected using standard laboratory procedures and stored in EDTA tubes to avoid coagulation. Blood samples were analyzed using Giemsa microscopy and viewed under a light microscope using oil immersion (x100) objective lens [9]. Slides were read by two separate microscopists to ensure efficiency and quality control. Thin blood films were used for parasite species confirmation as well as polymerase chain reaction (PCR) technique. Parasite intensity per microliter (µL) was obtained by counting the number of parasites per 200 leucocytes on a thick blood film assuming a total standard white blood cell (WBC) count of 8000/µL. The degree of intensity was graded as low (1 – 999 parasites/µL) and high (≥1000 parasites/µL) [10].

Parasites/µL = (Number of asexual stages x 8000 leucocytes) / 200 leucocytes.

2.5 Data Analysis

Data obtained in this study were compared with Chi square (χ^2) test (McNemar chi-square for paired and Pearson independence chi-square for unpaired comparisons) using statistical package for social sciences (SPSS) version 17. The data were presented in frequencies, percentages and means while a p-value less than 0.05 was considered significant.

3. RESULTS

Plasmodium falciparum was the only parasite observed in this study. The overall prevalence of malaria was 431 (43.1%) among the study participants (Table 1), with males and females having prevalence of 229 (47.0%) and 202 (39.4%) respectively (P<0.05) (Table 1). According to age, study participants between 0 – 10 years had the highest prevalence of 49.5% while those between 31 – 40 years had the least prevalence of 36.3% (P<0.05) (Table 2). Overall malaria intensity levels of ≥1000 parasites/µL in the study was 190 (19.0%) with males and females having intensity prevalence of 88 (18.1%) and 102 (19.9%) respectively (P>0.05) (Table 3). Malaria intensity prevalence in relation to age showed a decrease in prevalence as the age group of the study participants increased with age group 0 – 10 years having the highest prevalence of 37.8% and >40 years having the least prevalence of 13.9% (P<0.05) (Table 4).

Table 1. Malaria prevalence in relation to sex

Sex	Number examined	Number infected (%)
Males	487	229 (47.0)
Females	513	202 (39.4)
Total	**1000**	**431 (43.1)**

χ^2 = 5.956, Df = 1, P – value = 0.015 (P<0.05)

Table 2. Malaria prevalence in relation to age

Age (Years)	Number examined	Number infected (%)
0 – 10	111	55 (49.5)
11 – 20	245	106 (43.3)
21 – 30	249	121 (48.6)
31 – 40	201	73 (36.3)
>40	194	76 (39.2)
Total	**1000**	**431 (43.1)**

χ^2 = 9.938, Df = 4, P – value = 0.041 (P<0.05)

Table 3. Malaria intensity levels ≥1000 parasites/µL in relation to sex

Sex	Number examined	Number infected (%)
Males	487	88 (18.1)
Females	513	102 (19.9)
Total	**1000**	**190 (19.0)**

χ^2 = 0.538, Df = 1, P – value = 0.465 (P>0.05)

Table 4. Malaria intensity levels ≥1000 parasites/µL in relation to age

Age (years)	Number examined	Number infected (%)
0 – 10	111	42 (37.8)
11 – 20	245	52 (21.2)
21 – 30	249	40 (16.1)
31 – 40	201	29 (14.4)
>40	194	27 (13.9)
Total	**1000**	**190 (19.0)**

χ^2 = 9.938, Df = 4, P – value = 0.041 (P<0.05)

4. DISCUSSION

P. falciparum was the only malaria parasite identified in this study and this observation agreed with some similar studies conducted [11,12]. The overall malaria prevalence in this study was 43.1% and it is comparable to 40.5% reported in South – eastern Nigeria [13], 40.8% in Rivers State [14], 45.0% in Northwest Ethiopia [15] and 46.6% in Zamfara State [16]. The lower malaria prevalence reported in this study when compared to higher prevalence of previous similar studies in Rivers State could be attributed to the recent efforts of the Rivers State Ministry of Health in applying bio – larvicides (to kill *Anopheles* species larvae) in most parts of the State as well as mass distribution of free insecticide treated nets and antimalarials to laboratory confirmed malaria – infected individuals in several communities [14]. There was significant difference in malaria prevalence between males and females, the higher prevalence in males could be attributed to spending more periods outside in the evenings especially during hot periods (usually not fully clothed) and staying at nights in forests or bushes for hunting expeditions. Some similar studies also reported higher malaria prevalence in males than females [17,18,19]. Malaria parasitaemia severity levels ≥1000 parasites/µL in relation to sex was not statistically significant. The study opines that males and females had equal exposure risk of contracting and developing severe malaria especially in malaria endemic regions. Malaria parasitaemia in this study was highest in age group 0 – 10 years because individuals (children) in this group have not built up acquired immunity due to low exposure to malaria previously and their developing immune systems. Individuals in age group 21 – 30 years had the second highest malaria prevalence and are mainly energetic youths whose youthful exuberance and daily outdoor activities could greatly predispose them to regular contact with *Anopheles* species. Malaria parasitaemia severity levels ≥1000 parasites/µL in relation to age reduced significantly as the age of the study participants increased with age group 0 – 10 years and >40 years having the highest and least prevalence respectively ($P<0.05$). According to the WHO report [20], individuals in malaria endemic regions develop increased levels of immunity to *Plasmodium* species as they get older due to previous malaria bouts and younger individuals are more susceptible to contracting malaria infection than older individuals.

5. CONCLUSION

Malaria is still a public health concern but prompt diagnosis and early treatment will significantly reduce the duration of the infection and prevent health complications as well as death. The study provided current data on malaria prevalence which is vital for planning and implementation of successful malaria control strategies in Rivers State.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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