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Asymptomatic Malaria Parasitaemia Among Students of the University of Port Harcourt, Nigeria: A Cross-Sectional Study

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ABSTRACT

Asymptomatic malaria parasitaemia represents a significant reservoir for malaria transmission in endemic areas. Understanding its prevalence is crucial for malaria control and elimination strategies. This study determined the prevalence of asymptomatic malaria parasitaemia among students of the University of Port Harcourt. A cross-sectional study was conducted among asymptomatic students. Blood samples were collected using a finger prick and examined using thick and thin blood smears stained with Field's and Giemsa stains. Structured questionnaires were used to collect data on demographics, housing conditions, and prevention practices. Statistical analysis was performed using SPSS with chi-square tests for associations. The overall prevalence of asymptomatic malaria parasitaemia was 78.3%. Males had a higher infection rate (82.0%) compared to females (75.7%), though this difference was not statistically significant ($p>0.05$). Significant protective factors included sleeping under mosquito nets vs not (26.7% vs 85.7% infection rate, $p<0.05$), regular insecticide use vs not (30.8% vs 91.5%, $p<0.05$), and living in clean environments vs not (58.8% vs 86.1%, $p<0.05$). Blood group O+ individuals had the highest infection rate (75.6%). Recent malaria treatment showed a protective effect, with infection rates of 42.8% among those treated within two weeks compared to 91.3% among those who had not received treatment for extended periods ($p < 0.05$). The high prevalence of asymptomatic malaria among university students highlights the need for targeted interventions, including active case detection, improved vector control measures, and health education programs in academic institutions to support malaria elimination efforts.

Keywords: Asymptomatic malaria, parasitaemia, university students, Nigeria, Plasmodium falciparum, vector control

INTRODUCTION

Malaria remains a significant global health challenge, with an estimated 247 million cases and 619,000 deaths reported worldwide in 2021 [1]. Sub-Saharan Africa bears the heaviest burden, accounting for approximately 95% of global malaria cases and 96% of deaths [2]. In Nigeria, malaria is endemic, with approximately 97% of the population at risk of infection, contributing to an estimated 51 million cases and 207,000 deaths annually [3].

Asymptomatic malaria parasitaemia, defined as the presence of malaria parasites in the blood without clinical symptoms, represents a critical yet often overlooked component of malaria epidemiology [4]. Unlike symptomatic cases that seek treatment, asymptomatic carriers remain undetected and untreated, serving as reservoirs for continued transmission [5]. The prevalence of asymptomatic infections varies with transmission intensity, age, and acquired immunity levels within populations [6].

University students represent a unique demographic group that may harbour significant levels of asymptomatic malaria. This population typically comprises young adults from diverse geographical backgrounds living closely, often under suboptimal housing conditions that may facilitate vector breeding and transmission [7]. Despite their potential epidemiological importance, university students have received limited attention in malaria surveillance and control programs.

Understanding the prevalence and determinants of asymptomatic malaria among university students is crucial for several reasons. First, it provides insights into the neglected burden of malaria in educated populations. Second, it helps to identify risk factors specific to academic environments. Finally, it informs targeted intervention strategies that could contribute to broader malaria control and elimination efforts [8].

This study aimed to determine the prevalence of asymptomatic malaria parasitaemia among University of Port Harcourt students and identify associated demographic, environmental, and behavioural risk factors. The findings will contribute to evidence-based malaria control strategies in academic settings and support Nigeria's malaria elimination goals.

Methods

Study Design and Setting

This study employed a cross-sectional study design and was conducted at the University of Port Harcourt, Rivers State, Nigeria, in 2016. The University of Port Harcourt is a federal university located in the Niger Delta region of southern Nigeria, characterised by a tropical climate conducive to year-round malaria transmission.

Study Population and Sampling

The study population comprised undergraduate students aged 15-30 years who were asymptomatic for malaria at the time of sampling. Students were considered asymptomatic if they had no fever, chills, headache, or other clinical symptoms suggestive of malaria within the preceding 72 hours. A convenience sampling method was used to recruit students (males and females) from both on-campus hostels and off-campus accommodations.

Data Collection

Questionnaire Administration

A structured questionnaire was administered to collect information on: Demographic characteristics (age, sex, residence type), malaria prevention practices (bed net ownership and use, insecticide use), housing conditions (door/window screens, environmental cleanliness), medical history (recent malaria treatment, blood group, genotype), and recent travel history

Blood Sample Collection and Examination

Blood samples were collected via finger prick using sterile lancets following standard protocols: **Sample Collection:** The Finger (thumb) was cleaned with cotton wool and methylated spirit. A sterile lancet was used to prick the finger, and a blood drop was collected on clean glass slides. **Thick Blood Smear Preparation:** A Blood drop is placed on the centre of a clean slide, spread in circular motion using another slide, and air-dried and stained with Field's stain A (5 seconds), followed by Field's stain B. **Thin Blood Smear Preparation:** Blood drop spread at a 45° angle to create a feathered edge, air-dried and fixed with methanol (2 minutes), stained with Giemsa stain.

Microscopic Examination

Stained slides were examined under oil immersion microscopy (×1000 magnification). Malaria parasites were identified based on morphological characteristics: **Trophozoites:** Ring-shaped with a chromatin dot, golden-brown to dark-brown pigment, **Schizonts:** Single dark chromatin mass with 12-30 merozoites, and **Gametocytes:** Round or banana-shaped with a single chromatin dot. Parasite density was recorded as low, moderate, or high based on parasite count per field.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 20.0. Descriptive statistics were calculated for all variables. Categorical variables were compared using chi-square tests. Statistical significance was set at $p<0.05$.

Ethical Considerations

Ethical approval was obtained from the University of Port Harcourt Research Ethics Committee. Written informed consent was obtained from all participants after explaining the study objectives, procedures, risks, and benefits.

Results

Participant Characteristic

The majority of the respondents (82.5%) were aged 21-26 years, while 17.5% were aged 15-20 years. 64% of the respondents live in off-campus accommodations, while 35.8% (43/120) live in university hostels.

Overall Prevalence of Asymptomatic Malaria: The overall prevalence of asymptomatic malaria parasitaemia was 78.3% (95% CI: 70.1-85.2%). All detected infections were *Plasmodium falciparum*. The majority of infections (68.1%) were characterised as low-density parasitaemia.

Prevalence by Demographic Characteristics

Sex Distribution: Male students had a higher infection rate (82.0%) compared to females (75.7%), but this difference was not statistically significant ($\chi^2 = 0.679$, $p = 0.410$).

Age Distribution: Students aged 21-26 years showed higher prevalence (80.8%) compared to those aged 15-20 years (66.7%), though the difference was not statistically significant ($\chi^2 = 2.041$, $p = 0.153$).

Residence Type: Hostel residents had a slightly higher infection rate (86.0%) compared to off-campus residents (74.0%), but this difference was not statistically significant ($\chi^2 = 2.349$, $p = 0.125$).

Vector Control Measures and Infection Rates

Bed Net Ownership: Students who owned bed nets had lower infection rates (62.9%) compared to non-owners (82.8%), but this difference was not statistically significant ($\chi^2 = 4.849$, $p = 0.028$).

Sleeping Under Mosquito Nets: A significant protective effect was observed among students who regularly slept under mosquito nets (26.7%) compared to those who did not (85.7%) ($\chi^2 = 26.963$, $p < 0.001$).

Insecticide Use: Regular insecticide use showed a strong protective effect, with infection rates of 30.8% among users compared to 91.5% among non-users ($\chi^2 = 33.176$, $p < 0.001$).

Door and Window Screens: Students living in accommodations with screened doors and windows had similar infection rates (76.1%) to those without screens (81.6%) ($\chi^2 = 0.531$, $p = 0.466$).

Environmental Factors

Environmental Cleanliness: Students living in clean environments had significantly lower infection rates (58.8%) compared to those in dirty environments (86.0%) ($\chi^2 = 10.640$, $p = 0.001$).

Host Genetic Factors

Genotype: Students with genotype AS had slightly higher infection rates (82.1%) compared to those with genotype AA (77.2%), and was not statistically significant ($\chi^2 = 0.312$, $p = 0.576$).

Blood Group: Blood group O+ individuals had the highest infection rate (75.6%), followed by A+ (75.0%), B+ (87.5%), while all AB and O- individuals recruited were infected. However, the overall difference was not statistically significant due to small sample sizes in some groups.

Previous Malaria Treatment History

A significant association was found between recent malaria treatment and current infection status ($\chi^2 = 16.976$, $p = 0.002$). Students who had received treatment within the previous two weeks had the lowest infection rate (42.8%), while those who had not been treated for extended periods had the highest infection rate (91.3%).

Discussion

In recent years, asymptomatic malaria has remained a target to shoot at if symptomatic malaria must be controlled, as it serves as a reservoir for malaria transmission and prevalence. It is increasingly associated with the risk of anaemia. [18-19]

This study revealed a high prevalence (78.3%) of asymptomatic malaria parasitaemia among university students in Port Harcourt, Nigeria. The finding underscores the significant hidden burden of malaria in educated populations and highlights the potential role of asymptomatic carriers in sustaining transmission in endemic areas.

The observed prevalence is considerably higher than the rates reported in similar studies from other Nigerian institutions. Adesina (2013) reported a 17.4% prevalence among University of Maiduguri students, while other studies in different populations have shown varying rates [9,10]. The high prevalence in our study may reflect several factors, including the high endemic nature of malaria transmission in the Niger Delta region, suboptimal housing conditions, and limited vector control measures.

The predominance of *Plasmodium falciparum* infections aligns with the known species distribution in Nigeria, where P. falciparum accounts for over 95% of malaria cases [11]. The majority of infections being low-density parasitaemia are consistent with asymptomatic infections, where parasite loads remain below the fever threshold due to partial immunity [12].

The slightly higher infection rate among males (82.0% vs 75.7%) contradicts some previous studies that reported higher rates in females [13,14]. This gender difference may reflect behavioural patterns, environmental factors, or differences in health-seeking behaviour between male and female students. However, the lack of statistical significance suggests that sex may not be a major determinant of asymptomatic infection in this population. The higher prevalence among older students (21-26 years) compared to younger ones (15-20 years) can be associated with longer residence time and cumulative exposure of older students in the malaria-endemic environment.

The study demonstrated clear evidence of the protective effectiveness of personal protection measures. Students who regularly slept under mosquito nets had lower infection rates (26.7% vs 85.7%), providing strong support for the continued promotion of insecticide-treated nets (ITNs). Similarly, regular insecticide use showed remarkable protective effects (30.8% vs 91.5% infection rate).

Interestingly, bed net ownership alone did not provide significant protection unless accompanied by consistent use, emphasising the importance of behavioural change alongside intervention provision. This finding highlights the need for comprehensive education programs that address not only bed net distribution but also proper usage and maintenance. The lack of protection from door and window nets likely reflects poor maintenance, with many being torn or dust-covered, rendering them ineffective against mosquito entry.

The strong association between environmental cleanliness and infection rates (58.8% vs 86.0%) underscores the importance of sanitation in malaria control. Dirty environments provide ideal breeding sites for *Anopheles* mosquitoes in the form of stagnant water, blocked drains, and organic debris. This finding suggests that environmental management should be a key component of malaria control strategies in academic institutions.

The similar infection rates between genotype AA and AS individuals contrast with some studies that reported lower infection rates among sickle cell trait carriers [15]. However, our sample size for AS individuals was relatively small (n=28), which may have limited the power to detect significant differences. The relationship between ABO blood groups and malaria susceptibility remains

complex, with our finding of high infection rates among blood group O+ individuals consistent with a previous study [16].

Asymptomatic malaria is on the increase and needs to be curbed, especially in children. The high proportions of asymptomatic malaria contribute to negative implications for malaria control interventions, as they serve as a reservoir that encourages and sustains transmission [19]. Findings from [18] highlight the need for malaria interventions with a focus on asymptomatic infections, which are an important risk factor for anaemia and also a source of continued transmission of symptomatic malaria. High parasite densities in asymptomatic parasitemia were reported to increase the odds of developing symptomatic malaria; this emphasises the importance of the treatment and control of asymptomatic cases.

Public Health Implications

The high prevalence of asymptomatic malaria among university students has several important implications. Asymptomatic individuals serve as silent reservoirs, potentially maintaining transmission even when symptomatic cases decline. Even asymptomatic infections can cause subtle health effects, including anaemia, cognitive impairment, and reduced academic performance [17]. Traditional passive case detection will miss these infections, supporting the need for active screening programs in high-risk populations. Achieving malaria elimination will require addressing asymptomatic reservoirs alongside symptomatic cases.

Study Limitations

The convenience sampling method may introduce selection bias, potentially limiting generalizability. Microscopy, while specific, has limited sensitivity for low-density infections, possibly leading to underestimation of prevalence.

CONCLUSION

This study reveals a high prevalence of asymptomatic malaria parasitaemia among university students in Port Harcourt, Nigeria, highlighting a significant hidden reservoir of infection. The strong protective effects of mosquito nets, insecticide use, and environmental cleanliness provide

clear evidence for the effectiveness of integrated vector management approaches. These findings support the need for targeted malaria control interventions, including active case detection, enhanced vector control measures, and comprehensive health education programs. Addressing asymptomatic malaria in university populations represents an important component of broader malaria elimination strategies in Nigeria.

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