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Malaria Infection Among Psychiatric Patients Attending Federal Neuropsychiatric Hospital, Edo State

Omoruyi, Z.* and Oni, O.L.
Department of Medical Laboratory Science, School of Basic Medical Sciences, University of Benin, Benin City, Edo State, Nigeria.

Author for Correspondence*: *zainab.omoruyi@uniben.edu/* +234-803-700-2791/Orcid Number: 0009-0008-4635-1363. DOI: 10.4314/sokjmls.v9i1.22

Abstract
Malaria is a dangerous and sometimes fatal disease caused by the Plasmodium parasite. It is spread to humans via the bite of an infected female Anopheles mosquito. It negatively affects populations with improper prevention measures like psychiatric patients. The aim of this study was to determine the prevalence of malaria parasite infection among psychiatric patients in Federal Neuropsychiatric Hospital, Benin City, Edo state, Nigeria. Ethical approval and informed consent was sorted prior to collection of samples. A total of 122 males and 98 females within the age of 21-70 years were examined. Information bordering on gender, age, and marital status, use of drugs and level of education were obtained from the patients. Blood samples were collected aseptically through venipuncture and thick blood films were prepared for the examination of malaria parasites. An overall prevalence rate of 52.7% malaria parasite infection was recorded. The prevalence was higher in males (60.3%) when compared to females (39.7%) although it was not statistically significant (OR-1.522, 95%CI-0.714-3.242, p=0.276). Age group 21-30 years had the highest prevalence (65.5%) of malarial infection. Stagnant water and usage of drugs had a significant relationship with prevalence of malaria parasite infection ($p<0.05$). Marital status and level of education had no statistically significant association with the infection ($p>0.05$). Furthermore, there was a significant association between anaemia and malaria among the participants. In conclusion, this study sheds light on the significance of malaria infection among psychiatric patients in the study area. There is a need for targeted interventions and improved healthcare access for these patients.

Keywords: Age, Anaemia, Malaria infection, Gender, Socio-economic factors

Introduction

Malaria is a mosquito-borne infection of human and animals caused by genus *Plasmodium*. Over 2 million febrile episodes and one million deaths are caused by malaria in sub-Saharan Africa (Adepeju, 2017). Five species of *Plasmodium* can infect and transmit malaria to humans and majority of death are caused by *P. falciparum, P vivax, P. ovale, P. malariae* and *P. knowlesi* (Coluzzi, 2013). Among them, *Plasmodium falciparum* and *Plasmodium vivax* are the most prevalent (WHO, 2021). The fifth species, *Plasmodium knowlesi*, which causes malaria in macaque monkeys, was reported to infect humans in Southeast Asia (Collins, 2012). *Plasmodium* infection remains an important cause of mortality and morbidity in many parts of the world and it could have adverse effect on the population both on health and socioeconomic activities (Zoghi *et al*., 2012).

Approximately 50% of the Nigerian population experience at least one episode per year. However, official estimate suggests as much as four episodes per year on the average (WHO, 2013). In Nigeria, malaria is the number one public health problem (Onwujekwe *et al*., 2000) and has been responsible for about 300,000 deaths every year. Malaria accounted for 40% public health expenditure and the cost of malaria treatment and prevention in Nigeria was

estimated to be over $1 billion per annum (Coker *et al*., 2001).

Infection with *Plasmodium falciparum* has a wide spectrum of manifestation that are roughly classified into three clinical groups: asymptomatic infection, mild malaria and severe malaria. In malaria endemic areas, a large proportion of the populace harbour parasites without presenting signs of clinical malaria and are considered asymptomatic cases (Mombo *et al*., 2003). Asymptomatic carriers do not usually seek treatment for their infection and therefore constitute a reservoir of parasites available for transmission by Anopheles mosquitoes (Kimbi *et al*., 2012).

Psychiatric patients are often patients living with some sort of mental illness that is a major public health problem in developed and developing countries. The impact of mental illness on the patient, family and community is significant (Shrestha and Pradhan, 2011). The onset of mental illnesses typically occurs in adolescents and young adults, primarily in males (Shrestha and Pradhan, 2011). Individuals with psychiatric illnesses may be at higher risk of developing malaria than the general population. This risk appears to be particularly elevated for individuals with severe mental illness, such as schizophrenia or bipolar disorder (Oreh, 2007). Individuals with psychiatric illnesses may be more likely to live in poverty or in areas with poor sanitation and limited access to healthcare, which can increase their exposure to malaria (Phillip-Howard *et al*., 2003). Therefore, there is necessity to establish the prevalence of malaria infection among psychiatric patients and to understand how the risk factors of malaria can predispose them to contacting the disease.

Materials and Methods

Study Area

The study was conducted in Federal Neuropsychiatric Hospital, Uselu axis, Egor local government area, Benin City, Edo state. Egor LGA has an area of 93 km2 and lies between longitude 5^0 34E and latitude 6^0 23N, with a population of 339,899 (Ministry of Land and Survey, 2008) and a population density of 70 people/km2 with headquarters in Uselu town. It shares borders with Ovia Northeast in Oredo, Ovia Southwest, and Ikpoba-Okha LGAs. Federal Neuropsychiatric Hospital serves as one of the main federal institutions for psychiatric patients in Benin City, Edo State.

Study Population

A hospital-based cross-sectional study was conducted from August to September 2023 among selected psychiatric patients attending Federal neuropsychiatric hospital. A total of 220 participants comprised of 122 males and 98 females were recruited for this study. The age ranged from 21 to 70 years. The protocol for this study was approved by the Ethics and Research Committee of the Federal Neuro-psychiatric Hospital, Benin City, Edo State (Reference Number PH/A.864/VOI.XXII/23). Prior to this research, Informed consent was sought and obtained from the participants and structured questionnaires were administered to the participants to obtain their socio-demographic data.

Sample collection.

About 10 ml of blood samples were collected from each participant by venipuncture and dispensed into ethylene diamine tetra acetic acid (EDTA) container and mixed. The samples were transported to microbiology laboratory of University of Benin Teaching Hospital for processing.

Specimen processing

A drop of the blood sample on a clean grease free glass slide was prepared to form thick and thin blood films that were used to screen for malaria. Both films were prepared, allowed to air dry and stained in 1:10 dilution Giemsa stain solution for 30 minutes and Wright stain respectively (Raghuveer and Mangala, 2012). The stained thick films were examined for the presence of malaria parasites density while the thin blood films were used for speciation by light microscopy. A total of 200 fields per blood film were examined (Cheesbrough, 2009).

Haemoglobin was analysed using the automated three parts ERMA Haematology Auto analyser PCE-210N (Diamond Diagnostic; Holliston, USA). The classification of anaemia, mild anaemia, and non-anaemia was determined based on reference ranges for haemoglobin (Hb)

levels. Non-anaemia was defined as Hb levels above 13.0 g/dL for adult males and above 12.0 g/dL for adult females. Mild anaemia was characterized by Hb levels between 11.0-12.9 g/dL for males and between 10.0-11.9 g/dL for females. Anaemia was defined when Hb levels fell below 11.0 g/dL for males and below 10.0 g/dL for females.

Statistical Analysis

The data obtained were analyzed using SPSS version 17 software (Ogbeibu, 2005), while odd ratios (OR) with 95% confidence intervals (Cl) were calculated on each potential risk factor. Chi-square test was carried out and differences were considered significant at p-values < 0.05.

Results

The results showed that out of 220 participants screened for malaria parasite, 116 (52.7%) were positive for malaria parasite infection among psychiatric patients attending Federal Neuropsychiatric Hospital, Edo state (Figure 1). The prevalence of malaria infection was higher in males (60.3%) when compared to females (39.7%) although it was not statistically significant (OR=1.522, 95%CI=0.714-3.242, p=0.276). The highest prevalence of malaria parasite infection was found in the age group 21-30 years (65.5%) while age group 61-70 had no positive case of malaria parasite infection. The prevalence in relation to the age group was statistically significant (p=0.034) (Table 1).

Socio-demographic characteristics of the patients observed revealed that single patient had higher prevalence (70.7%) of malaria parasite infection when compared to their married counterparts (29.3%%) although marital status was not statistically significant (OR-0.933, 95%CI-0.412-2.111, p=0.868). Educational level did not strongly affect the malaria parasite infection among the patients (P>0.05). The proximity of participants hostels to stagnant water had a statistically significant relationship to malaria parasite infection (p=0.041) as it was observed that those closer to stagnant water had a higher prevalence (65.5%) than those that were not (34.5%). There was statistically significant association between patients using antimalarial drugs (6.9%) and those that were not (93.1%) with malaria infection (p=0.034). In relation to educational status, there was no statistically significant relationship with malaria infection (p=0.086) (Table 2). There was a significant relationship between anaemia and prevalence of malaria (p<0.005). Among the participants examined, 76 (34.5%) were diagnosed with anaemia, of which 56 (48.3%) were also found to be infected with malaria. Thirty-two (32) participants had mild anaemia, with 20 (17.2%) of them testing positive for malaria. Among participants without anaemia (non-anaemia), 112 (50.9%) were observed, and 40 (34.5%) of them were infected with malaria (Table 3).

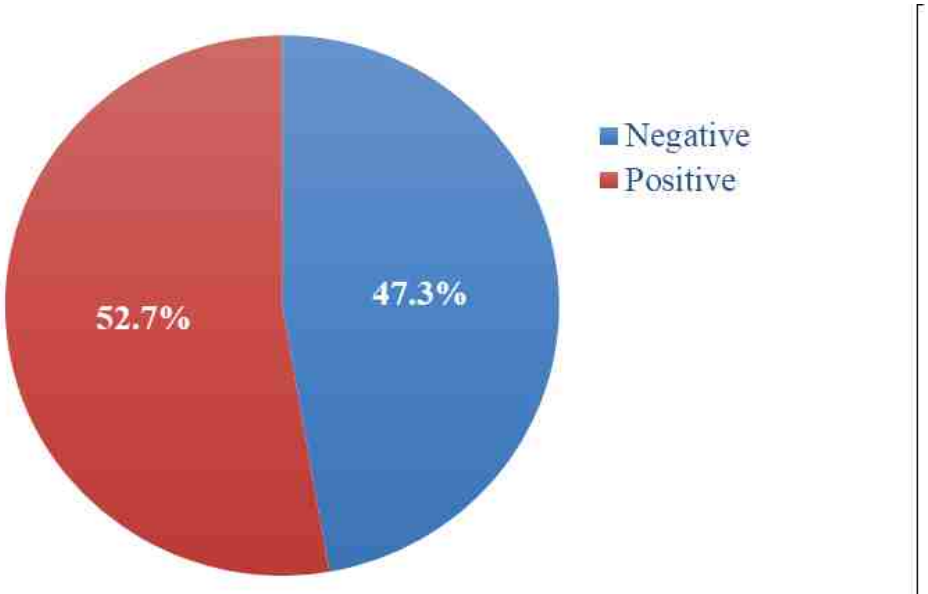

Figure 1. Prevalence of malaria infection among Psychiatric patients in the study area

Table 1: Prevalence of Malaria parasite infection by sex and Age group of Study subject

Variable	No. Examined	No. Infected (%)	OR	95%CI	P - value
Gender					
Males	122	70 (60.3)	1.522	0.714-3.242	0.276
Females	98	46 (39.7)			
Age Group					
21-30	114	76 (65.5)			0.034
31-40	52	20 (17.2)			
41-50	30	12 (10.3)			
51-60	20	8 (6.9)			
61-70	4	0 (0)			

Table 2: Socio-demographic characteristics associated with malaria parasite Infection among the Patients

Variable	No Examined	No Infected (%)	OR	95%CI	p value
Marital status					
Married	66	34 (29.3)	0.933	0.412-2.111	0.868
Single	154	82 (70.7)			
Educational level					
No formal Education	82	34 (29.3)			0.086
Primary	70	38 (32.8)			
Secondary	30	24 (20.7)			
Tertiary	38	20 (17.2)			
Close proximity to Stagnant water					
Yes	124	76 (65.5)	2.217	1.028-4.780	0.041
No	96	40 (34.5)			
Use of Drugs					
Yes	38	8 (6.9)	0.183	0.056-0.594	0.002
No	182	108 (93.1)			

Table 3. Relationship Between Prevalence of Malaria and Anaemia among Participants

Status	No. Examined (%)	No. Infected (%)	p value
Anaemia	76 (34.5)	56 (48.3)	0.001
Mild Anaemia	32 (14.5)	20 (17.2)	
Non-Anaemia	112 (50.9)	40 (34.5)	
Total	220 (100)	116 (100)	

Discussion

Out of 220 psychiatric patients examined for malaria parasites, 116 (52.7%) prevalence rates were recorded. The prevalence of malaria observed in this study was higher when compared to a study carried out by Akinbo *et al*. (2018) who reported a prevalence of 20%. Another study carried out in Akure reported a higher prevalence of 80.33% (Adepeju, 2017). This disparity in prevalence rates may be due to the different seasons of both studies. Malaria transmission often fluctuates with seasonal changes and studies conducted during different times of the year among similar populations may report varying prevalence rates based on the peak transmission seasons (Endy *et al*., 2011).

Malaria prevalence was higher among males. This agrees with the research carried out in Bayelsa by Abah (2015) and Akure by Adepeju (2017) which indicated that there were no gender differences in the prevalence of malaria. Our finding, however, disagrees with that of Odikamnoro (2018) who reported a higher prevalence in females (58%) when compared to males (50%). The reason for this higher prevalence in males might be because males might engage in outdoor activities that expose them to mosquito bites more frequently than females. This increased outdoor exposure can lead to a higher risk of being bitten by infected mosquitoes. Also, hormones, such as estrogen and testosterone, can affect immune responses and susceptibility to infections. Hormonal differences between males and females could contribute to variations in malaria susceptibility (Adepeju, 2017).

In relation to age, the highest prevalence (65.5%) was observed from age group 21-30. Abah and Temple (2015) also reported a higher prevalence of malaria parasites among the younger population (41.1%) when compared to the older ones (26.6%). However, this study is not consistent with a study carried out in Ebonyi state by Odikamnoro (2018). This might be due to the fact that older individuals often acquire partial immunity to malaria over time through repeated exposure to the parasite. This means that they might experience fewer clinical symptoms or milder infections, leading to lower reported prevalence. Also, people in the 21-30 age groups might be more exposed to mosquito bites due to their behaviors and activities. This age group is often more active and might socially engaged in outdoor activities leading to the increase in risk of exposure to infected mosquitoes.

The single patients had a higher prevalence (70.7%) than the married patients (29.3%) amongst the psychiatric patients. This finding agree with the study carried out in Ghana (Tetteh *et al*.,2023) who reported a higher prevalence of malaria among singles as compared to married couples. The reason for this may be because single individuals might engage in riskier behaviours or have different activity patterns that expose them to a higher risk of mosquito bites. We observed that educational level has no statistically significant effect on malaria prevalence ($p = 0.086$). Our finding is consistent with the report of Agomo *et al.* (2009) that observed that educational level did not strongly affect the prevalence of malaria.

The proximity of the hostels of psychiatric patients to stagnant water greatly influenced the prevalence of malaria parasite infection ($p<0.05$). This is consistent with previous reports (Madukaku *et al*.,2012; Belete *et al*., 2016 and Abossie *et al*., 2020), which indicated a significant relationship between close proximity to stagnant water and prevalence of malaria infection. This could be attributed to the fact that

stagnant water is a prime breeding site for Anopheles mosquitoes, the primary vectors of the malaria parasite (Abossie *et al*., 2020). These mosquitoes lay their eggs in standing water, and the larvae develop in these water bodies. Areas with stagnant water provide a conducive environment for the mosquitoes to reproduce and thrive.

Subsequently, patients who were not on any form of antimalarial drug or who hadn't been on one in the past 3 months had a significantly higher prevalence (93.1%). This could be due to the fact that antimalarial drugs are intended to eradicate or stop the development of malaria parasite in the body. Antimalarial drug users are more likely to have their existing illnesses treated and cleared, which results in fewer parasites in their circulation (WHO, 2015).

The living quarters/hostels of participants in this study were subjected to regular and general usage of insecticides. Mosquito nets were not allowed as a preventive measure due to the safety of the psychiatric patients as these nets can be employed as a measure for committing suicide by these mentally ill patients (Smith, 2014).

The study revealed a significant association between anaemia and malaria among the participants. Anaemia emerged as a prevalent complication, affecting 34.5% of the participants. Alarmingly, nearly half (48.3%) of those diagnosed with anaemia were concurrently infected with malaria. This result is consistent with the findings of Akinbo *et al*. (2018) who observed an association between asymptomatic malaria and anaemia. These findings prove the well-established notion that anaemia is a major complication of malaria infection. Anaemia, characterized by a reduction in haemoglobin levels, is a common consequence of malaria infection (Ghosh and Ghosh, 2007). Malaria parasites invade red blood cells, leading to their destruction and subsequent haemolysis. Additionally, the inflammatory response triggered by malaria further exacerbates red blood cell destruction, contributing to the development of anaemia (Weatherall et al., 2002).

Conclusion

In this study, the overall prevalence recorded among psychiatric patients was 52.7%. The age group 21-30 years was found to have the highest prevalent in the area. Similarly, marital status and educational level did not strongly influence malarial infection among the participants in this study. Also, there was an association between malaria and anaemia. These findings underline the need for focused interventions and better healthcare access as well as the sensitivity of this particular demographic to malaria. The increased prevalence highlights the necessity of including thorough malaria control measures within mental health care settings. To combat this double burden of illness, the public and mental health sectors must work together to improve understanding, diagnosis and care for both disorders.

Recommendations

Integrated Healthcare Services: Create integrated healthcare models that smoothly integrate mental health services with the detection, diagnosis, and treatment of malaria. This strategy guarantees that patients in psychiatric facilities receive thorough care that meets both their mental health requirements and the danger of malaria.

Regular Screening and Monitoring: All mental patients should undergo regular, organized screening for malaria, especially in locations where the disease is endemic. Early detection, prompt treatment, and better management of both illnesses will be made possible by regular monitoring of infection rates.

Education and Awareness: There is a need to launch focused education programs to inform medical professionals and patients in psychiatric facilities about the elevated risk of malaria in this population. Inform patients on ways to avoid getting bitten by mosquitoes and wearing appropriate clothing.

Conflict of Interest

There is no conflict of interest.

Declaration

Each author confirms neither this manuscript nor

one with substantially similar content under our authorship has been published or is being considered for publication elsewhere.

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