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Prevalence of Malaria Parasite among Students of Federal College of Veterinary and Medical Laboratory Technology, Vom, Plateau State, Nigeria

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ABSTRACT

Background: Malaria, an acute febrile illness caused by *Plasmodium* parasites and transmitted through infected *Anopheles* mosquitoes, remains a significant public health challenge. Nigeria has a high malaria burden, particularly among vulnerable populations. We aimed to determine the prevalence of malaria among students at Federal College of Veterinary and Medical Laboratory Technology (FCVMLT) in Vom, Plateau State, Nigeria, and assess their knowledge and prevention practices.

Materials: The study involved 134 students from three academic departments at FCVMLT between Apr and Jun 2022. Venous blood samples were collected, and malaria infection was assessed using microscopy with Giemsa-stained thick and thin blood films. A questionnaire was also administered to gather information on malaria awareness and preventive behaviors.

Results: The overall malaria prevalence among students was 35.07%, with a higher infection rate observed among females (42.35%) compared to males (22.45%), a difference that was statistically significant (χ^2 = 47.38, P<0.001). Malaria prevalence varied slightly across departments, with the Medical Laboratory Science department recording the highest prevalence at 39.13%, followed by Environmental Science and Management (25.00%) and Environmental Health Technology (26.92%), though this variation was not statistically significant (χ^2 =2.14, P=0.344). Students residing off-campus had a slightly higher prevalence (35.78%) than those living on-campus (32.94%), with no statistically significant difference (χ^2 = 0.24, P=0.622).

Conclusion: The high prevalence of malaria among students, despite good awareness, highlights the need for improved malaria control measures within educational settings. Asymptomatic infections among students could contribute to sustained malaria transmission within the community. Implementing regular malaria screenings, distributing insecticide-treated bed nets, and conducting educational campaigns on effective preventive practices are recommended.

Keywords: Malaria; Mosquito coil; *Anopheles*; Vom; Nigeria

Introduction

Malaria is an acute febrile illness caused by *Plasmodium* parasites, which are spread to people through the bites of infected female *Anopheles* mosquitoes (1). Clinical symptoms of malaria are fever, head ache, chills, fatigue, nausea, chest and abdominal pains. It can also lead to enlargement of spleen, kidneys, and liver in malignant malaria (2).

In 2020, there were an estimated 241 million cases of malaria worldwide. The estimated number of malaria deaths stood at 627,000 in 2020. *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 socio-economic attitudes (3). The 2023 WHO global reports showed that there were an estimated 263 million malaria cases and 597,000 malaria deaths in 83 countries. In 2023, The WHO African region was home to 94% of malaria cases (246 million) and 95% (569,000) of malaria deaths. Children under 5 accounted for about 76% of all malaria deaths in the region (4). 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. malaria* and *P. knowlesi* (5). Of these five different species pathogenic to man, *P. falciparum* infection is the commonest and the deadliest among children in endemic areas and it often complicates itself into cerebral malaria (6). Infection with *P. falciparum* has a wide spectrum of manifestations 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 harbor parasites without presenting signs of clinical malaria and are considered asymptomatic cases (7). Asymptomatic carriers do not usually seek treatment for their infection and therefore constitute a reservoir of parasites available for transmission by *Anopheles* mosquitoes (8,9). Nearly half of the Nigerian population suffers from malaria and majority of outpatients attendance to health facilities can be attributed to this disease as identified by the National Malaria programme. The Federal Ministry of Health in Nigeria revealed that about 132 billion naira is lost to the treatment and prevention of malaria (10).

Stagnant water is a factor identified to be contributing to malaria transmission. Nigeria is endemic due to noncompliance on the part of Nigerians to malaria preventive measures such as sleeping under Insecticide Treated Nets (ITNs), using Artemisinin-based Combination Therapy (ACTs) correctly and consistently, using intermittent preventive treatment of malaria in pregnancy and proper environmental sanitation. Factors militating against significant success in the fight against malaria include insufficient funding, poor utilization of available health care services, weak supply chain system, inadequate strategic information network, and various infrastructural challenges.

Human factors pose significant challenge to the prevention and control of malaria scourge (10,11). This challenges often relates to behavioral factors, such as socio-cultural practices that promote mosquito breeding and access to people, as well as the failure of the vulnerable population to use proven and effective methods of malaria control promptly and appropriately (11). There is need to identify these knowledge gaps and factors, for appropriate awareness campaign to be channelled to the appropriate quarters. Moreover, to achieve reduced morbidity and mortality resulting from malaria, the infection must be recognized quickly so that infected individuals are treated promptly. Malaria morbidity results in absenteeism in class, resulting to poor academic performance among students, thus we sought to examine the prevalence of malaria infection among students of Federal College of Veterinary and Medical Laboratory Technology, Vom, Plateau state, Nigeria.

Material and methods

Study Area

This study was conducted in Federal college of Veterinary and Medical Laboratory Technology, Vom, Jos South Local Government area of Plateau state, Nigeria. The college is a post-secondary institution in North central Nigeria for training middle level laboratory workers.

Vom is a quiet rocky settlement situated 1,285 m above sea level with the nearest towns being Bukuru and Jos, 12.8 km and 24 km to the northeast respectively. The college was established in 1956. At the time of this study, the school had three academic departments, namely medical laboratory science (MLS), Environmental Health Technology (EHT), and Environmental Science and Management (ESM).

Study Population and Design

The study population was made up of 134 registered students of the three academic departments of FCVMLT, Vom; that is Medical Laboratory Science, Environmental Health, and Environmental Science and Management departments. The study was a descriptive cross-sectional study among the three departments, between Apr and Jun, 2022.

Eligibility criteria

All registered students of the three departments who consented to participate in the study were included in the study. While all registered students who agreed to participate but failed to fill and or return the questionnaires were excluded from the study.

Ethical Considerations

Approval for the study was sought for from the Head of the institution. A formal letter seeking for permission to conduct the laboratory analysis at the Parasitology laboratory of FCVMLT, Vom was also written to the school head for this purpose. His permission was obtained. Informed consent of the individual students who participated were also sought and obtained by verbal persuasion.

Questionnaire Administration

One hundred and thirty-four questionnaires were administered to each respondent (student of FCVMLT, Vom) from whom the samples were collected. The questionnaires contained demographic data, treatment of malaria, modes of transmission and control measures of mosquitoes and malaria.

Sample Collection and Processing

Blood collection was as described by Cheesbrough (12). Two milliliters of blood were collected from each student and dispensed into ethylene diamine tetra acetic acid (EDTA) bottle and mixed gently. Thin and thick blood films were made from each of the student's blood samples and air dried. The thin blood films were fixed by treating with methanol for one minute. The slides were stained with 3% Giemsa stain for 30 min, rinsed with tap water and allowed to dry. The slides were examined for malaria parasites by microscope with an oil immersion objective lens.

Data Analysis

Data obtained was analyzed using Chi square and statistical significance was set at $P \leq 0.05$. All analysis was done in Statistical Package for the Social Sciences (SPSS) version 21 (IBM SPSS Inc., Chicago, Illinois, USA).

Results

The overall prevalence of malaria among the 134 students sampled was 35.07%. A higher prevalence was observed among females, with 36 out of 85 (42.35%) testing positive, compared to 11 out of 49 males (22.45%). This difference was statistically significant (χ^2=47.38, P<0.001). Age-wise, the highest malaria prevalence was found in students aged 24-25 yr (45.45%) and those above 25 yr (50.00%). However, the association between age group and malaria prevalence was not statistically significant (χ^2=2.55, P=0.635). Christian students recorded a malaria prevalence of 35.11%, while the Muslims a higher rate at 50.0%. This difference was not statistically significant (χ^2=0.74, P=0.692). Prevalence varied slightly across departments, with the highest rate in the Medical Laboratory Science (MLS) department at 39.13%,

followed by Environmental Science and Management (ESM) at 25.0%, and Environmental Health Technology (EHT) at 26.92%. This distribution was not statistically significant (χ^2=2.14, *P*=0.344). Students residing off-campus had a slightly higher malaria prevalence (35.78%) than those living on-campus (32.94%), though this difference was also not statistically significant (χ^2=0.24, *P*=0.622) (Table 1).

Students aware of mosquito bites as the cause of malaria had a prevalence of 36.00%, while those who attributed it to other causes, such as poor nutrition or stress, showed a higher rate of infection (50.00%). The association between cause attribution and malaria prevalence was not statistically significant (χ^2=3.14, 1p=0.791). Regarding malaria control practices, students who used mosquito coils had the highest prevalence (42.10%), followed by those who used door and window nets (40.0%), and insecticide-treated nets (36.06%). The difference among control practices was not statistically significant (χ^2=1.50, *P*=0.913). Nearly all students (98.51%) recognized mosquito bites as the transmission route for malaria, with a prevalence rate of 35.60% among this group. Students' understanding of the best malaria treatment showed no statistical difference in infection rates, with 35.07% among those who preferred pharmaceutical drugs. In relation to malaria incidence, students who reported having malaria twice in the past year had the highest prevalence at 44.68%. Those who experienced malaria more than three times in the past year had the lowest prevalence (8.33%), though the difference was not statistically significant (χ^2=6.44, *P*=0.169). Knowledge of malaria signs and symptoms was uniformly high, with the highest prevalence among those identifying abdominal pain (39.13%) and the lowest among those with muscle pain (20.0%). This association was not statistically significant (χ^2=1.416, *P*=0.923) (Table 2).

Table 1: Prevalence of Malaria in Relation to Demographic Characteristics of students of FCVMLT, Vom

Demographic Characteristics	***Number of subjects (Frequency)***	***Number positive (%)***	***Chi-square (χ^2)***	***P-value (<0.05)***	***Df***
Gender					
Male	49	11(22.45)	47.38	< 0.001	1
Female	85	36(42.35)			
Age (years)					
15-17	2	0(0.0)	2.55	0.635	4
18-20	49	18(36.73)			
21-23	66	21(31.82)			
24-25	11	5(45.45)			
Above 25	6	3(50.00)			
Religion					
Christianity	131	46(35.11)	0.74	0.692	2
Islam	2	1(50.0)			
African Tradi. Religion.	1	0(0.00)			
Department					
MLS	92	36(39.13)	2.14	0.344	2
ESM	16	4(25.00)			
EHT	26	7(26.92)			
Campus Location					
Off campus	49	19(35.78)	0.24	0.622	1
On Campus	85	28(32.94)			
TOTAL	134	47(35.07)			

Table 2: Prevalence of malaria in relation to Knowledge and Practice about malaria prevention and control among students of FCVMLT, Vom

Knowledge and Practice of malaria	*Number of subjects (Frequency)*	*Number positive (%)*	*Chi-square (χ^2)*	*P-value (P<0.05)*	*Df*
Cause of malaria			3.14	0.791	6
Mosquito bite	125	45(36.00)			
Poor Nutrition	2	1(50.00)			
Stress	2	1(50.00)			
Spirits/Charm	1	0(0.00)			
Don't know	1	0(0.00)			
Unhygienic condition	2	0(0.00)			
Bad water	1	0(0.00)			
Mosquito control strategy			1.50	0.913	5
Insecticide spray	30	8(26.67)			
Clear all stagnant water	13	5(38.46)			
Use mosquito coils	19	8(42.10)			
Wear protective clothing	6	2(33.33)			
Use of Insecticide Treated Net	61	22(36.06)			
Window and Door Net	5	2(40.0)			
Transmission knowledge			0.09	0.764	1
Mosquito bite	132	47(35.60)			
Don't know	2	0(0.00)			
Best malaria treatment			1.66	0.437	2
Drugs	131	47(35.88)			
Traditional Healers	1	0(0.00)			
Prayers	2	0(0.00)			
Malaria Incidence in Past Year			6.44	0.169	4
One time	40	15(37.5)			
Two times	47	21(44.68)			
Three times	10	3(30.00)			
More than three times	12	1(8.33)			
Not even once	25	7(28.00)			
Malaria Signs and Symptoms			1.416	0.923	5
Chills	7	2(28.57)			
Vomiting	9	2(22.22)			
Fatigues/tiredness	16	7(43.75)			
Headache	28	8(28.57)			
Muscle pain	5	1(20.00)			
Abdominal pain	69	27(39.13)			

Discussion

This study highlights the ongoing high prevalence of malaria (35.07%) among students at the Federal College of Veterinary and Medical Laboratory Technology, Vom, Nigeria. The persistence of malaria in an educational setting, despite high levels of awareness, points to several underlying challenges in malaria control, including behavioral, environmental, and systemic factors. This prevalence is comparable to findings in other endemic regions, where asymptomatic infections have been reported to play a significant role in malaria transmission within communities and institutions (13,14). High infection rates in asymptomatic individuals, such as those found in this study, are particularly concerning as these individuals can serve as reservoirs for the parasite, facilitating

transmission through local Anopheles mosquito populations (15).

Female students exhibited a significantly higher prevalence of malaria (42.35%) than their male counterparts (22.45%). This finding aligns with similar studies that suggest females in certain cultural contexts may experience greater exposure to mosquitoes due to outdoor activities, caregiving responsibilities, or dress practices that may limit protective clothing (16,17). Conversely, other studies have shown higher malaria prevalence in males, attributing this to outdoor occupational exposure (18). Gendered behavioral patterns, specific to each population, must be considered in developing targeted malaria prevention strategies.

Although the study found no statistically significant difference across age groups, the data suggest a trend toward higher prevalence among older students (45.45% in the 24-25 age group and 50% in students over 25). A similar trend noted, attributing it to behavioral factors, as older students may engage in more nighttime activities, reside off-campus, or have fewer protective measures in place (19). Younger students often benefit from parental guidance on health practices, while older students may face increased exposure due to academic or social activities. This trend underscores the need for awareness programs that specifically target at-risk age groups, particularly those with heightened exposure risk.

The study revealed slight variations in malaria prevalence across different academic departments, though these differences were not statistically significant. MLS students had the highest prevalence, potentially due to increased exposure from practical laboratory activities involving biological samples or working in settings where infection risks are inherently higher. However, all departments had significant contact with one another, which could explain the lack of statistical significance. Additionally, the finding that students living off-campus had marginally higher prevalence rates than on-campus students is consistent with literature linking higher malaria prevalence to less-regulated living environments (20). Off-campus students may encounter less favorable housing conditions, with inadequate screening or proximity to mosquito-breeding sites (21).

Although most students identified mosquito bites as the main mode of malaria transmission (consistent with global malaria awareness efforts), their prevention practices varied considerably. The majority of students reported using insecticide-treated nets (ITNs), which are a proven malaria prevention tool endorsed by the WHO (22,25). However, some students relied on less effective strategies, such as mosquito coils or room sprays, which have shown limited efficacy due to the emergence of insecticide-resistant mosquito strains (23). These findings suggest the importance of updating malaria education programs within institutions to reflect emerging knowledge on insecticide resistance and encourage effective practices.

This study emphasizes the role of asymptomatic malaria carriers in transmission dynamics. Research by Ibekwe et al. and a WHO report highlights those asymptomatic infections represent a hidden reservoir, particularly in high-density settings like educational institutions (23,24). Asymptomatic students, unaware of their infection status, may contribute to sustained transmission cycles if effective vector control measures are not implemented. In this study, asymptomatic students with high malaria prevalence despite good awareness of malaria symptoms illustrate a critical gap in the detection and management of malaria in endemic settings.

The study's findings underscore the need for more comprehensive, institution-wide malaria control programs. While malaria control in educational settings remains underexplored, recent studies emphasize the effectiveness of integrated

interventions; combining routine ITN distribution, environmental hygiene initiatives, and targeted awareness campaigns as critical to reducing malaria burden in such settings (25, 26). The college environment offers a unique opportunity to implement robust preventive measures, such as campus-wide mosquito control campaigns, increased access to ITNs, and prompt malaria testing during peak transmission seasons.

To effectively control malaria in educational institutions within endemic regions, regular screening for asymptomatic malaria carriers should be implemented to identify hidden reservoirs of infection. Strengthened malaria prevention education programs are essential, focusing on the consistent use of ITNs and dispelling reliance on less effective methods such as mosquito coils, particularly in light of growing insecticide resistance. Additionally, institutions should facilitate the distribution of ITNs and repellents, prioritizing off-campus students who may face greater exposure risks, while also collaborating with environmental health authorities to reduce mosquito breeding sites through regular campus clean-up and improved drainage systems. Establishing a malaria prevention task force within institutions can further coordinate these efforts, while partnerships with public health agencies for seasonal indoor residual spraying (IRS) and access to rapid diagnostic tests (RDTs) can provide critical support during peak transmission seasons. Integrating malaria education into the academic curriculum could foster preventive practices among students, and further research on local mosquito populations and insecticide resistance will optimize malaria control strategies. Adopting these actions could significantly reduce malaria prevalence in student populations, contributing to a healthier campus environment and advancing public health goals in malaria-endemic areas.

Conclusion

This study's findings highlight the multifaceted nature of malaria control within an educational setting, where individual and collective behavioral factors intersect with environmental conditions and knowledge gaps. Effective malaria control in such settings requires tailored interventions that address specific risk factors associated with age, gender, and living environment while fostering accurate knowledge of prevention and transmission dynamics. Such comprehensive approaches have the potential to significantly reduce malaria prevalence and contribute to long-term malaria control goals.

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Conflict of interest

We declare that we have no conflict of interest.

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