



Prevalence and Density of Malaria Parasites in Asymptomatic Students of the Federal University of Technology, Akure, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author IASO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors IASO and DOK managed the analyses of the study. Author DOK managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: Malaria is a complex disease that varies widely in epidemiology and clinical manifestation in different parts of the world. The research was carried out to evaluate the prevalence and intensity of malaria parasitaemia in asymptomatic students of the Federal university of Technology, Akure, Nigeria.

Place and Duration of Study: Post Graduate Research Laboratory, Department of Biology, Federal University of Technology, Akure, Nigeria, between February and August, 2018.

Methodology: A cross-sectional study was carried out in which blood samples were collected from students who volunteered. Relevant information such as sex and age was obtained through a well-designed questionnaire. Thick and thin blood smears were prepared and microscopy was used to establish malaria infection, parasite identification and intensity.

Results: A total of 200 students were examined, out of which 153 (76.5%) were positive for malaria infection. Female had higher prevalence of 80.9% while male had lower prevalence 73.3%. The age

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group 21 to 25 years had the highest prevalence of 80.8% while age group <16 years had the lowest prevalence of 62.5%. The genotype HbAA had the highest prevalence and intensity of malaria (63.0%) while genotype HbAS had the lowest malaria intensity of 33.0%. HbSS recorded 0% of malaria parasites. Blood group AB had the highest prevalence and intensity of 86.7% while type O had the lowest parasitaemia of 54.5%. Students who live on campus had higher prevalence of 80.8% while those who live off campus had the least of 75.0%. Students who sleep under ITNs recorded higher prevalence of 87.5% while those who did not sleep under ITNs had 73.0%.

Conclusion: These findings further confirm the endemicity of malaria infection in the student population. Measures to control the transmission should be taken into consideration.

Keywords: Malaria; parasitaemia; genotype; blood Group; asymptomatic; akure; student.

1. INTRODUCTION

Malaria has a worldwide distribution, affecting people of all ages, with an enormous burden amounting to 300-500 million clinical cases per year. Globally ten new cases of malaria occur every second, which is a major public health problem in the tropics where about 40% of the world population lives [1]. Since 2000, significant progress has been made in the control of malaria, with a reduction in reported cases. Between 2000 and 2013, the global malaria mortality rate dropped by 47%. In 2013, malaria killed an estimated 584 000 people with over 2 million cases, Nigeria is reported to have the unenviable record of contributing about 25% of the world malaria burden [2]. According to the World Health Organization (WHO), between 2000 and 2015 malaria case incidence was reduced by 41% and malaria mortality rates by 62% [3].

Despite this improvement, more than 3 billion people, almost half of the world population, are still at risk for infection and such cases occur due to a lack access to prevention, diagnosis and treatment, especially in low income countries [4]. Nigeria accounts for 56% of malaria cases in the West African sub-region. Microscopy detected malaria prevalence in Nigeria dropped from 42% in 2010 to 27.4% in 2015. However, great variations still exist among regions within the country [5]. In Nigeria, *Plasmodium falciparum* is the most endemic species and most fatal in pregnant women, children and immune-compromised people [6]. Malaria is a complex disease that varies widely in epidemiology and clinical manifestation in different parts of the world.

Asymptomatic parasitaemia which is the presence of malaria parasite in the blood in the absence of symptoms is prevalent in highly

endemic areas of Africa, reaching over 90% in children [7], with only a small percentage of individuals ever exhibiting clinical symptoms. Asymptomatic parasitaemia provides a reservoir for transmission and may be a precursor in the progression to symptomatic disease. Most of these asymptomatic stages if not treated can lead to severe cases of malaria since there are no symptoms giving the parasite enough time to develop and go through its life cycle until it gets to the erythrocytic stage which might at this point become critical [6].

In asymptomatic parasitemia the person carries malaria parasites in his bloodstream, but due to partial immunity the parasites are incapable of inducing symptoms to the affected individual [8]. In areas where the transmission of malaria is seasonal due to the presence of wet and dry seasons and their effect to the incidence of *Anopheles* mosquitoes, this makes it possible for malaria parasites to survive through the dry season in the bloodstream of the asymptomatic persons. This leads to high prevalence malaria infection within the population during the wet season [9]. This study is to evaluate the prevalence and intensity of malaria parasite and associated parameters in asymptomatic students.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted at the Federal University of Technology, Akure (FUTA) Ondo State. Akure is the capital and the largest city in Ondo state which covers a land area of 14,793 square kilometres within South-west of Nigeria. It lies between latitude 7°15'0"N and longitude 5°11'42"E and has a population of about 484,798. Akure has an average temperature of 25.6°C and relative humidity of 85% [10].

2.2 Study Population and Design

This study was conducted from February to August, 2018 at Federal University of Technology, Akure. A total of 200 samples were collected from student volunteers and questionnaires were given in order to collect information such as age, sex, usage of Insecticide Treated Net (ITNs) e.t.c.

2.3 Collection of Blood Samples and Preparation of Blood Films

Syringe was used to collect 2 mL of venous blood into an EDTA bottle through the assistance of a laboratory technician after which thin and thick blood films were prepared for the detection of malaria parasite.

2.4 Staining and Microscopic Examination of Blood Films

After fixing thin blood films with absolute methanol, both thick and thin blood films were stained with 10% Giemsa for 20 minutes and examined under the X 100 (oil immersion) objectives of a light microscope, for the detection and identification of malaria parasites respectively. For positive slides, parasite species and stages were assessed and parasitaemia (parasite density) was determined by counting only the asexual stages against 200 white blood cells (WBC) and then multiplying by 40, assuming the mean total WBC count of individuals is 8000 cells per μl of blood. The level of parasitaemia was recorded as low (<1000 parasites/ μl of blood), moderate (1000–9999 parasites/ μl of blood) and severe ($\geq 10,000$ parasites/ μl of blood). Also (+) was used to indicate 1-10 parasite in x100 oil immersion field (low), (++) to indicate 11-100 parasite in 100 oil immersion field (moderate) and (+++) to indicate 1-10 parasites in a field (heavy or severe) [11].

2.5 Data Analysis

The data generated were analyzed using the Statistical Package for the Social Sciences (SPSS) version 20. The statistical parameter that was used for the analysis of the data was the Pearson's Chi-Square Test, the level of significance at 95%. P value less than 0.05 was considered statistically significant.

3. RESULTS

A total of 200 asymptomatic students were examined. 153 (76.5%) students were positive

with malaria parasite and 47 (23.5%) were negative. Table 1 shows the prevalence of the parasite in respect to gender, age, location and the use of Insecticide Treated Net (ITN). Females were more infected with malaria parasite 68 (80.95%) than Males 85 (73.3%). However, there was no significant difference. In relation to age, age group <16 recorded the lowest prevalence of 25 (62.5%) while the highest prevalence of 59 (80.82%) was recorded in the age group 21-25. In the age groups, there is a significant difference in relation to malaria infection. According to locations, 148 (74%) live off-campus while 52 (26%) stays on-campus. Those staying on campus recorded higher prevalence of 42 (80.8%), however, there is no significant difference between locations. Students who do not sleep under insecticide treated net (ITN) recorded a prevalence of 111 (73.0%) and those who sleep under Insecticide Treated Net recorded a prevalence of 42 (87.5%), there is no significant difference statistically.

Table 2 showed the intensity of malaria parasites. Age group 21-25 had the highest parasite intensity of 27.4% while <16 years had the lowest of 5.0%. In relation to gender, male recorded higher intensity of 18.1% compared to the females with 17.9%, however there was no significant difference. The students who stay off campus had higher parasitaemia 16.1% while those who stay on campus had 15.9%. With the usage of insecticide treated nets (ITNs), the students who did not use ITNs recorded higher intensity of 17.8% than those who use ITNs 10.4%. Blood group AB recorded the highest intensity of 46.7% while type O had the least intensity of 8.2%.

4. DISCUSSION

This study showed that *Plasmodium falciparum* is the only species of *Plasmodium* encountered which is in agreement with previous studies in Nigeria [12,13]. It has been reported that *P. falciparum* is the major cause of malaria in Africa [14]. The asymptomatic students harboured malaria parasites as previously observed by Otajevwo [15] and Samuel et al. [6] in Akure and Nassarawa-Eggon, Nigeria. A prevalence of 76.5% of malaria infection was recorded in this study, this is lower than the result obtained from similar study conducted by Salwa et al. [12] among students of the Federal University of Technology Akure and [16] among first year students of Nnamdi Azikiwe University, Akwa,

South eastern Nigeria where a prevalence of 80.3% and 80.0% were recorded respectively. These findings further confirm the presence of malaria infection among the student population. It is not well known why some people tolerate malaria infection with few or no symptoms whereas others are severely affected [17]. The high prevalence of malaria infection in the study area could be attributed to some factors such as indiscriminate disposal of waste, poor water drainage system, abandoned wells, and vegetation which harbour and serve as breeding sites for female *Anopheles* mosquito [11].

The females recorded higher prevalence and intensity than the males. Previous studies have revealed that females are expected to have better immunity against malaria and a variety of other parasitic diseases, and this has been attributed to genetic and hormonal factors. Also, it was attributed to stronger immune system against malaria infection due to proper nutritional standard and immediate treatment than in males

[18,13]. This study is similar to the report of Obimakinde and Simon [16] who recorded a higher prevalence among female students (56.9%) than male students (42.9%) in Abakiliki, Nigeria but in contrast to the report of Simon-Oke et al. [13] in Akure where prevalence of malaria parasite among the males was higher than that of females. Age group 21-25 recorded the highest prevalence of (53.4%). The high prevalence recorded among the age could be as a result their different habits, level of exposure to mosquito bites and immunity developed against the parasite [14]. This study is in agreement with the study of Awosolu et al. [14] who recorded higher prevalence among age group and a lower prevalence among age 11-20. Students with genotype AA had the highest prevalence of malaria parasite. This conforms with antecedent studies of Eduardo et al. [19] and Awosolu et al. [14]. However, it is dissimilar to the work of Akhigbe et al. [20] who reported that Hb SS and Hb SC were most susceptible to malaria. In this study, participants of blood group O were more

Table 1. Prevalence of malaria parasite in relation to parameters

		No. examined	Positive (%)	Negative (%)	X ²	P-value
Sex	Male	116	85.0(73.30)	31.0 (26.72)	1.88	0.69
	Female	84	68.0 (80.95)	16.0 (19.04)		
Age	<16	40	25.0 (62.50)	15.0 (37.50)	15.7	0.02
	16-20	87	69.0 (79.31)	18.0 (20.67)		
	21-25	73	59.0 (80.82)	14.0 (19.18)		
Location	Off Campus	148	111 (75)	37 (25)	2.8	0.42
	On Campus	52	42 (80.8)	10 (19.2)		
Sleep Under ITN	Yes	48	42 (87.5)	6 (12.5)	2.66	0.45
	No	152	111 (73.0)	41 (27.0)		

Table 2. The density of malaria parasite in relation to parameters

	No examined	Parasitemia				df	X ²	P-value
		+	++	+++	None			
Age								
<16	40	2.0(5.0)	7.0 (17.5)	2.0 (5.0)	29.0 (72.5)	2	15.70	0.015
16 – 20	87	6.0 (6.9)	22.0(25.3)	10.0(11.5)	49.0(56.3)			
21 – 25	73	7.0 (9.6)	12.0(16.4)	20.0 (27.4)	34.0 (46.6)			
Sex								
Male	84	10.0 (8.6)	21.0 (18.1)	17.0 (18.1)	68.0 (58.62)	1	1.88	0.596
Female	116	5.0 (5.9)	20.0 (23.8)	15.0 (17.9)	44.0 (52.4)			
Blood Group								
A	48	8 (16.7)	10 (20.8)	12 (25.0)	18 (37.5)	3	40.78	0.017
B	27	7 (25.9)	6 (22.2)	10 (37.0)	4 (14.8)			
AB	15	3 (20.0)	3 (20.0)	7 (46.7)	2 (13.3)			
O	110	9 (8.2)	23 (20.9)	38 (34.4)	40 (36.4)			
Genotype								
AA	128	16 (12.5)	43 (33.6)	67 (52.3)	2 (1.6)	2	0.113	
AS	68	15 (22.1)	31 (45.6)	20 (29.4)	2 (2.9)			
SS	04	0(0)	0(0)	0(0)	4(100)			

populated, followed closely by blood group B, blood group A and the least was group AB which is similar to the reports of Awosolu et al. [14], who reported that the ratio of blood group O to other blood groups is higher in geographic region where malaria is endemic. Blood group A was more infected than other blood groups, followed by group AB, B and the least infected was blood group O. However, this work disagrees with the study of Yahaya et al. [21] in Kogi State where blood group O had the highest prevalence (40.2%) and the least is AB (36.4%). This result might be due to the strong rosette formation with groups A RBCs which form rosette more than group O cells.

5. CONCLUSION

This study revealed that malaria is still endemic in the study area. *Plasmodium falciparum* was the only malaria parasite species encountered. The results of this study suggest that clinical symptom(s) is not always indicative of the presence of malaria in an individual. People with malaria parasite could be asymptomatic thereby, making such individual a reservoir of the infection and also capable of transmitting the disease through mosquito bite. The high prevalence of malaria parasite in asymptomatic subject is considered a major hurdle for malaria control and elimination. Therefore there is a need to pay attention to malaria infection in the study area in order to reduce the rate of transmission.

CONSENT AND ETHICAL APPROVAL

Prior the commencement of the research work, approval was given by the Health Research Ethics Committee (HREC) of the University, the Chief Medical Director of the health Centre and from the students for collection of blood who were clearly informed on the aims and objectives of the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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