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Prevalence and Management of Falciparum Malaria among Febrile Patients in South-western Nigeria

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Abstract
The World Health Organization reported 241 million cases and 627,000 deaths from malaria worldwide in 2020, out of which Nigeria accounted for 27%. Effective tools are continually developed through global efforts to have a malaria-free world. The study was aimed at assessing the prevalence and management of falciparum malaria among febrile patients in south-western Nigeria. It was a cross-sectional descriptive study conducted on febrile patients undergoing treatment at the outpatient units of selected hospitals in Ekiti and Ondo States, Nigeria between August 2019 and January 2021. A total of 399 participants were enlisted in the study following informed consent. Blood was taken from the participants for microscopy and a rapid diagnostic test for malaria. A structured questionnaire was used to collect sociodemographic data and information about the participant's management of malaria. Two hundred and ninety-five (73.9%) of the subjects were females, and 104 (26.1%) were males, with a modal age of 21–28 years. There were 171 (42.9%) and 228 (57.1%) participants from Ekiti and Ondo States, respectively. Subjects from Ondo State reported a significantly higher occurrence of malaria than their counterparts from Ekiti State ($p = 0.005$). Individual perceptions of malaria treatment approaches ($p = 0.002$) and the use of local herbs ($p = 0.002$). Artemisinin-based combination therapies (ACTs) were the drugs of choice (76.3%) by the respondents; other drugs commonly used were Sulphadoxine-pyrimethamine (13.3%) and chloroquine/quinine (10.4%). The use of insecticide-treated nets (26.6%), insecticide spray (25.3%), as well as nets on windows and doors (15.8%) were reported as the major ways of controlling mosquito bites at home. The management of malaria among respondents is commendable. Notwithstanding, healthcare professionals will need a combination of new approaches and tools for effective management of malaria.
Keywords: Febrile Patients, Malaria, Plasmodium falciparum.
Keywords: *Oreochromis niloticus, dams, parasites, prevalence, intensity.*

INTRODUCTION

The protozoan *Plasmodium* is the causative agent of malaria, an acute fever sickness that infects people bitten by female *Anopheles* mosquitoes. Four species have long been known to cause malaria in humans: *Plasmodium falciparum*, *P. vivax, P. ovale*, and *P. malariae*. Falciparum malaria is potentially life-threatening. Individuals who are affected may experience liver and kidney failure, convulsions, and coma. Although occasionally severe, infections with *P. vivax* and *P. ovale* generally cause less serious illness, but the parasites can remain dormant in the liver for many months, causing a reappearance of symptoms months or even years later (World Health Organization, 2021).

In 2019, global malaria was estimated at 215 million cases, with WHO's African Region accounting for over 94 percent of the cases. While Nigeria alone was responsible for 27% of all malaria deaths in 2020, there were 241 million cases and 627,000 fatalities reported globally (World Health Organization, 2021). In reality, between 2000 and 2019, malaria fatality rates decreased globally by 29% as a result of sustained efforts and improved understanding of malaria control and prevention strategies. While Sub-Saharan Africa is still plagued by a serious problem with malaria, the incidence of malaria decreased from 363 to 225 cases per 1000 people at risk during this time period. This decrease highlights the difficulty in interpreting changing disease transmission in a rapidly expanding population in the region (World Health Organization, 2020).

In the absence of effective and practicable preventive interventions, the only current approaches to lowering malaria morbidity and death, particularly in Africa, are chemoprophylaxis and chemotherapy. As a result, the rising incidence of *P. falciparum* variants resistant to therapies poses a significant problem for treating and controlling malaria. This study was conducted to determine the prevalence and management of falciparum malaria in Ekiti and Ondo States, South-Western Nigeria.

METHOD AND MATERIALS

Study Area: The states of Ondo and Ekiti were the locations of the study. The state of Ondo was founded on February 3rd, 1976. It was composed of 18 local government areas in Nigeria's South Western Zone.

The State is located between longitudes 5"45" and 8"15" North of the Equator and between longitudes 4"30" and 6" East of the Greenwich Meridian. It follows that the state is totally tropical. It is surrounded by the states of Ekiti and Kogi in the north; Edo in the east; Oyo and Ogun in the west; and the Atlantic Ocean in the south. As of 2006, there were 3,460,877 people, 1,745.057 of them men and 1,715,820 of them women. By 2026, there will be 4,883,792 people, 2,462,525 men and 2,421,267 women (by the State Bureau of Statistics). Ekiti State's population was 2,384,212 according to the National Population Commission's 2006 census.

Ekiti State is bordered by Ondo State in the east and south; Kwara and Kogi States to the south; and Osun States to the east. On October 1, 1996, a statehood declaration was made. Ekiti State has two fantastic seasons and tropical weather. These are the dry season (November–March) and the rainy season (April–October).

Study population and sample size: A cross-sectional hospital-based study was conducted at the Ekiti State Teaching Hospital Ado-Ekiti, Federal Teaching Hospital Ido-Ekiti, Ondo State Specialist Hospital Akure, and Federal Medical Centre, Owo, Nigeria between August 2019 and January 2021. 399 willing participants in total were recruited for this study. This equation was used to determine the sample size:

$n = t^2 \times p\,(1-p)/\ m^2$ (Awosolu and Ugboaja, 2021)

Where n = the required sample size, t = confidence level at 95% (standard value of 1.96),

p = estimated prevalence of the infection in the project area which is 71% [3]

m = margin of error at 5% (standard value of 0.05).

$$n = 1.9622 \times 0.71\,(1-0.71)/\ (0.05)^2$$
$$= 3.924 \times 0.2059/0.0025$$
$$= 323.180.$$

Ethics Approval: Before the study began, approval was received from selected government hospitals: the Federal Teaching Hospital in Ido-Ekiti (ERC/2018/08/02/131B), the Ondo State Ministry of Health (OSHREC/24/07/19/154), and the Ekiti State Teaching Hospital in Ado-Ekiti (EKSUTH/A76/2019/04/009). Each adult participant, as well as each child parent or guardian being examined, gave their written informed consent.

Data Collection: The participants were given a well-designed and organized questionnaire to complete in order to gather data regarding their gender, age, occupation, level of education, and response to, and treatment of, malaria. Prior to distribution, the questionnaire underwent validation, pretesting, and reliability testing. (Awosolu and Ugboaja , 2021; Roopa and Rani, 2012).

Sample Collection and Examination: A 2mL of blood was aseptically drawn from the patients' veins using a sterile syringe into EDTA bottles with the help of a skilled medical laboratory technician in order to diagnose malaria by microscopy and rapid test kits. Giemsa stain was applied after preparing thin and thick smears of the samples on sterile slides. The light microscope's x100 objective lens was used to examine the smears in order to look for the malaria parasite. (Atroosh *et al*., 2015; Roopa and Rani, 2012).

Statistical Analysis: In order to ascertain the differences in malaria prevalence by age, sex, occupation, education, frequency, response, and malaria management, the data was analyzed using IBM Statistical Product and Service Solutions (SPSS) version 23. The data was presented as the mean minus the standard error of the mean (SEM). The one-way analysis of variance (ANOVA) was used to assess the association of malaria with determinant variables. Values of $p \leq 0.05$ were considered statistically significant.

RESULTS

Socio- demographic characteristics of the malaria patients

This study was carried out on three hundred and ninety-nine febrile patients, with 171(42.9%) participants from Ekiti and 228 (57.1%) from Ondo State. Two hundred and ninety-five (73.9%) of the subjects were females, and 104 (26.1%) were males, with both the median and modal age group being 21–28 years (39.0%). The people were highly educated, with 68.5% of them having tertiary education and the majority residing in urban settlements. Subjects from Ondo State reported a significantly higher frequency of malaria than their counterparts from Ekiti State ($\chi^2 = 12.884$, $p = 0.005$).

A strong association was obtained between the prevalence of malaria and age ($\chi^2 = 15.995$, $p = 0.047$), and ditto for malaria occurrence and occupation of the participants ($\chi^2 = 47.067$, $p = 0.001$). However, no significant relationship was found between the occurrence of malaria on one hand and gender ($p = 0.266$), education ($p = 0.480$) and residency (0.839) of the subjects on the other (Table 1).

Table 1: Socio-demographic characteristics of malaria occurrence among subjects

		Frequency of malaria						
Characteristics	**Once a year**	**Twice a year**	**Once in 3 months**	**Once a month**	**Total (%)**	**χ2**	**p value**	
Age (years)	≤12	6	4	3	1	14 (3.5)	15.995	0.047*
	13-20	11	21	22	12	69 (16.71)		
	21-28	29	55	33	37	153 (38.99)		
	29-36	15	31	21	39	107(26.84)		
	37-44	5	10	15	9	40 (9.91)		
	≥45	3	2	7	4	16 (4.05)		
Gender	Male	15	34	22	33	104 (26.1)	3.957	0.266
	Female	54	90	81	70	295 (73.9)		
Education	No-formal	6	5	6	3	23 (5.8)	8.553	0.480
	Primary	4	8	6	11	28 (7.0)		
	Secondary	19	21	20	16	75 (18.7)		
	Tertiary	39	87	69	71	273 (68.5)		
Residential	Town	44	87	70	67	272 (68.2)	2.758	0.839
	City	17	24	20	26	87 (21.8)		
	Village	8	12	12	8	40 (10.0)		
Occupation	Teaching	4	6	5	13	28 (7.0)	47.067	0.001*
	Trading	6	12	7	11	38 (9.5)		
	Student	43	55	46	23	170(42.6)		
	Artisan	6	16	9	16	46 (11.5)		
	Housewife	0	3	5	1	12 (3.0)		
	Farming	2	2	3	6	13 (3.3)		
	Civil servant	6	26	24	29	84 (21.1)		
	Others	1	1	1	3	8 (2.0)		
State	Ekiti	41	49	48	33	171 (42.9)	12.884	0.005*
	Ondo	29	74	55	70	228 (57.1)		

*Significant

Association between the presence of malaria and its treatment.

The response of participants to the frequency of malaria showed that 29.7% had malaria every 3 months, 26.6% had malaria twice in a year, and 16.8% had malaria every month, while 26.6% responded that they had malaria once in a year, as shown in Table 2. A total of 295 (73.9%) of the respondents sought advice from medical professionals for malaria management, and 299 (74.9%) agreed to the use of a full regimen of prescribed drugs. The decision to stop treating for malaria was found to be highly impacted by elements like aversion to medications, concern regarding drug overdose, and people's sense of being treated. Use of native herbs and individual assessment of the strategy to treat malaria were found to be substantially correlated with the frequency of malaria attacks (χ^2=38.326, p = 0.001). Use of native herbs was found to be strongly correlated with the frequency of malaria attacks (χ^2 = 14.841, p = 0.002) and considering each person's impression of the malaria treatment strategy (χ^2 = 25.825, p = 0.002) as shown in Table 2.

Also, 71.4% of the respondents believed using doctors prescribed drugs was the most effective approach to curing malaria, 14.3% believed in traditional healers, 12.1% believed in the use of local herbs, and 1.3% was not in support of any of these but in their faith that they would be cured without taking any drug. There was no significant association with having a medical laboratory diagnosis before treatment (χ^2 = 10.916, p =0.091) and use of prophylaxis by the respondents, χ^2 = 4.698, p =0.196) (Table 2).

Table 2: Association between the presence of

malaria and its treatment

Characteristics		Frequency of malaria						
		Once a year	Twice a year	Once in 3 months	Once a month	Total (%)	χ^2	P value
Frequent use of ACT drugs	Yes	44	85	68	67	264(66.2)	0.553	0.907
	No	25	39	34	37	135(33.8)		
Sought Medical advice from health care professionals	Yes	56	93	73	77	299(74.9)	2.235	0.525
	No	14	30	29	27	100(25.1)		
Use of drugs on Doctor's prescription	Yes	59	91	70	77	297(74.4)	7.371	0.061
	No	10	32	33	27	102(25.6)		
Use of full regime of prescribed drugs	Yes	53	94	76	76	299(74.9)	2.228	0.973
	No	10	32	33	25	100(25.1)		
When medication is stopped	When I feel okay	20	29	25	20	94(23.6)	16.468	0.058
	When I complete the dosage	33	81	52	68	234(58.6)		
	Anytime	4	6	10	7	27(6.8)		
	When I finished what money can buy	12	7	17	8	44(11.0)		
Consideration for stoppage of antimalarial treatment	Price of drugs	20	19	26	12	77(19.3)	38.326	0.001*
	Dislike for drugs	9	22	15	16	62(15.5)		
	Fear of overdose when the fever is down	8	4	15	14	41(10.3)		
laboratory diagnosis before drug administration	Yes	25	53	26	33	137(34.3)	10.916	0.091
	No	33	45	55	49	182(45.6)		
	Sometimes	9	25	21	19	74(18.5)		
Prophylactic use of antimalarial drugs	Yes	41	55	48	56	200(50.1)	4.693	0.196
	No	28	69	55	47	199(49.9)		
Use of local herbs in Malaria treatment	Yes	35	85	56	75	251(62.9)	14.841	0.002*
	No	34	38	48	28	148(37.1)		
Perceived effectiveness of Antimalarial drugs commonly used	Not effective	11	7	15	5	38(9.5)	25.825	0.002*
	Effective	23	67	50	60	200(50.1)		
	Highly effective	16	29	23	28	96(24.1)		
	Extremely effective	19	20	14	9	62(15.5)		
Most effective approach to cure malaria	Use of local herbs	10	11	15	12	48(12.0)	12.696	0.177
	Doctors' prescription	44	95	65	81	285(71.4)		
	Traditional healers	13	16	20	8	57(14.3)		
	Faith healing	2	1	1	1	5(1.3)		

Health professionals visited for medical advice.

Figure 1 displays the health professionals that research participants saw for medical guidance. Only 38.1% saw doctors, 20.1% saw nurses, 15.3% saw pharmacists, 14.5 % bought pharmaceuticals from chemists, and 9.5 % self-medicate. Other visitation showed a combination of Doctors and Pharmacists (0.3%), Doctors and Chemists (0.3%), Doctors and personal treatment (0.5%), Nurses and Pharmacists (0.3%), while those that visited Pharmacists and practiced self medication were 0.3%, whereas 0.5% visited Doctors, Nurses and Pharmacists concurrently and others that visited Doctors, Nurses, Pharmacist and also practiced self medication are 0.3% (Figure 1).

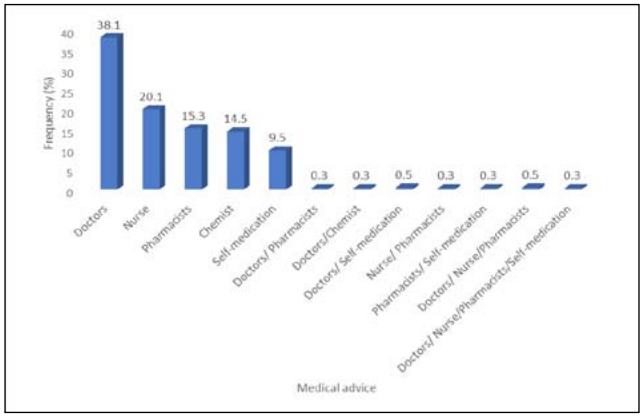

Figure 1: Health professionals visited for medical advice

Antimalaria drugs frequently used by malaria patients

Figure 2 describes the different antimalaria drugs taken by respondents in the study. The usage of Artemisinin-based combination therapies (ACTs), chloroquine/ quinine and Sulphadoxine-pyrimethamine (Fansidar, Maloxine and Amalar) for malaria treatment were 76.3, 10.4, and 13.3 % respectively.

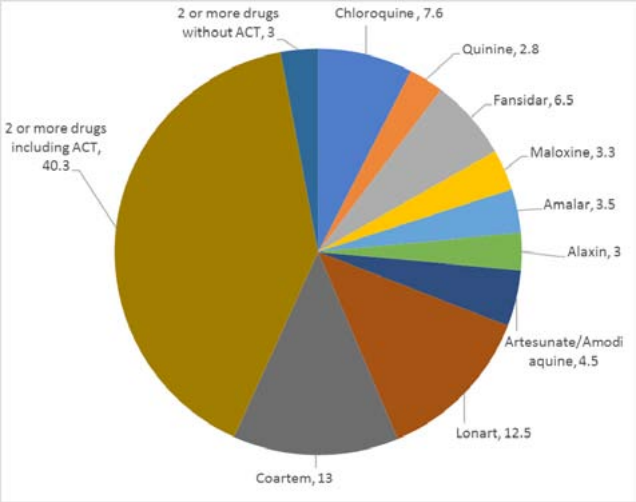

Figure 2: Antimalaria drugs frequently used by malaria patients

Antibiotics frequently used with antimalaria

In this study, antibiotics were being taken alongside antimalaria drugs, and it showed that 61.2% of the respondents were taking Amoxicillin while others were taking other antibiotics such as Ampicillin, Tetracycline, Ofloxacin, Amoxicillin-Clavulanic acid, Metronidazole, Cefuroxime and Ciprofloxacin.

Methods of controlling mosquito bites by subjects

Various methods of controlling mosquito bites in this study showed that only 26.6% were using insecticide treated nets (ITNs), 25.3% were using insecticide spray, 15.8% believed in windows and doors' nets in controlling malaria vectors, while 13% were using mosquito coils. Moreover, 12.8% of the participants were using combined methods of prevention and control.

DISCUSSION

All of the 399 respondents to this study were highly knowledgeable about the signs and symptoms of malaria, which could be attributed to the fact that the vast majority of them (94.2%) have a formal education and reside in cities and towns. The prevalence of malaria in the present study was found to increase from childhood to adulthood, a pattern that had earlier been reported by Ogah *et al.* (2013) and Noland *et al.* (2014). Malaria control programmes often target infants and pregnant women, who are always provided with materials for malaria prevention (Ogah *et al.,* 2013). In a survey carried out in Kenya, malaria was found to affect more women than males, which was attributed to pregnancy and the higher prevalence of HIV in women than in men. (Jenkins *et al.,* 2015). In the present study, a higher prevalence was recorded in female respondents than in males, because females are health-conscious and they visit hospitals more often than males.

The frequent use of artemisinin combination therapy by participants was noticed in this study. This may be because of the awareness created by healthcare sectors recommending ACTs as the malaria first-line treatment, and this, in a way, has a great impact on drug resistance by the malaria parasite. It may surprise all, as the antimalaria drugs that have been abandoned are now more effective than these new generation drugs. Chloroquine and quinine are drugs in this category but still work for most people. Additionally, most participants were using artemether/lumefantrine as prophylaxis. This is an artemisinin-based combination therapy that's mild with no or minimal side effects; this can be associated with why they made it their drug of choice.

With 62.9% of the respondents agreed to the use of herbal remedy when feverish at one time or the other, shows they believe in effectiveness of medicinal plants. The development of resistance among microbial agents against conventional or standard antimicrobial drugs has given rise to the need for alternative approaches to therapeutic measures. Medicinal plants are rich sources of antimicrobial agents; due to the metabolites they constitute (Okiki *et al*., 2022)

Due in great part to the highly adaptive nature of the associated parasites and vector, malaria is a challenging illness to control. While efficient malaria-fighting measures have been produced and will continue to be developed, it is inevitable that mosquitoes and parasites will eventually find ways to get around those tools if they are employed ineffectively or alone (National Institute of Allergy and Infectious Diseases, 2016). Healthcare workers will need a combination of innovative techniques and equipment to successfully manage malaria, and research will be a key factor in the creation of these cutting-edge tactics.

Currently, insecticide-treated nets and indoor residual spraying remain the mainstays of malaria control. Both are efficient in preventing malaria morbidity and mortality as vector control strategies in a variety of epidemiological contexts. The majority of the

participants in this study were using the various preventative measures that were advised. Insecticide-treated mosquito nets, insecticide sprays, mosquito coils, and other uncommon techniques were the main approaches employed in this study.

Conclusion

Although falciparum malaria is common in the study area, the approach to control of malaria by the respondents is admirable. Because the malaria parasite and the mosquito vector involved are so adaptive, malaria cannot be easily eradicated. Healthcare professionals will need a combination of new approaches and tools, and research will play a crucial role in the development of those next-generation strategies.

Conflicts of Interest

We declare there are no conflicts of interest in this study.

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REFERENCES

Abossie, A., Bekele, A., Yohanes, T. and Abera, A. (2017). Prevalence of asymptomatic *Plasmodium falciparum* and *Plasmodium vivax* malaria carriage among school children of malaria endemic areas of Mirab Abaya district, Southern Ethiopia. *Journal of Parasitology and Vector Biology*, 9(1): 1 – 7.

Atroosh, W. M., AL-Mekhlafi, H. M., Aljasari, A., Sady, H., AL-Delaimy, A. K., Nasr, N. A., Dawaki, S., Abdulsalam, A. M., Ithoi, I., Lau, Y. L. and Fong, M. Y. (2015). Genetic variation of pfhrp2 in *Plasmodium falciparum* isolates from Yemen and the performance of HRP2-based malaria rapid diagnostic test. *Parasites and Vectors*, 8(1): 388.

Awosolu, O.B. and Ugboaja, C.K. (2021). Pattern of malaria parasitemia in a high transmission setting of Oba – Ile, Akure North, South Western, Nigeria. *Animal Research International*, 18(1) 3947 – 3954.

Egbewale, B. E., Akindele, A. A., Adedokun, S. A. and Oyekale, O. A. (2018). Prevalence of asymptomatic malaria and anaemia among elderly population in Osun State Southwestern, Nigeria. *International Journal of Community Medicine and Public Health*, 5(7): 2650 – 2656.

Ezeudu, CE., Ebenebe, JC., Ugochukwu, EF., Chukwuka, JO., Amilo, GI., Okorie, OI. (2015) Performance of a Histidine rich protein-2 rapid diagnostic test (RDT) against the standard microscopy in the diagnosis of malaria parasitemia among febrile under-five children at Nnewi. *Nigeria Journal of Paediatrics*, 42:59-63

Jenkins, R., Omollo, R., Ongecha, M., Sifuna, P., Othieno, C., Ongeri, L., Kingora, J., and Ogutu, Bernherds (2015). Prevalence of Malaria Parasites in Adults and its Determinants in Malaria Endemic Area in Kisumu County, Kenya. *Malaria Journal*, 14: 263.

National Institute of Allergy and Infectious Diseases (2016) *https://www.niaid.nih.gov/diseases-conditions/malaria*. Accessed 21st of July, 2022

Noland, G.S., Graves, P.M., Adamu, S., Abel, E., Emmanuel, E., Patterson, A.E., Okorofor, I., Oji, O.U., Umar, M., Alphonsus, K., Damen, J., Ngondi, J., Ozaki, M., Cromwell, E., Obiezu, J., Eneiramo, S., Okoro, C., McClintic-Doyle, R., Oresanya, O., Miri, E., Emerson, P.M. and Richards, F.O. (2014) Malaria prevalence, anaemia and baseline intervention coverage prior to mass net distributions in Abia and Plateau States, Nigeria. *Biomedical Journal of Infectious Disease*. 14:168.

Ogah, A.O., Ezeonwumelu, J.O., Okoruwa, A.G., Adiukwu, C.P., Ajayi, AM. and Akib, S. (2013). Manifestations of severe malaria among the under-five children attending Kampala International University Teaching Hospital Bushenyi Western Uganda: pilot study. *British Journal of Pharmacology and Toxicology*. 4:128-135.

Okiki, P.A., Egbebi, A., Akharaiyi, F.C., Adewole, E. and S.O Asoso, S.O (2022) Drug properties and antimicrobial evaluations of extracts from *Phyllanthus amarus*. *Journal of Microbiology & Experimentation,* 10(1):10-16. DOI: 10.15406/jmen.2022.10.00346

Roopa, S. and Rani, M. S. (2012). Questionnaire designing for a survey. *Journal of Indian Orthodontic Society*, 46: 273 – 277.

World Health Organization (2020). World malaria report; 20years of global progress and challenges. https://www.who.int/publications/i/item/9789240015791 Accessed August 25, 2021.

World Health Organization (2021). Malaria https://www.who.int/news-room/fact-sheets/detail/malaria. Accessed August 25, 2021.