STATUS OF FALCIPARUM MALARIA AND ASSOCIATED KNOWLEDGE AMONGST FEBRILE PATIENTS ATTENDING COTTAGE HOSPITAL OGIDI-OLOJE, ILORIN, NORTH CENTRAL NIGERIA

[1]AMAECHI, Ebube Charles, [2]OKORE, Oghale O'woma, [2]UBIARU, Prince Chigozirim, [3]EJIKE, Blessing Uzoamaka, [3]IHEMANMA, Chioma Ada, [2]EGWU, Onyekachi, [4]IBRAHIM, Abdulhamid Burour, [1]BELLO, Bashirat Oniboki and [1]OYENIYI, Morufat Rike

[1]Department of Zoology, Faculty of Life Sciences, University of Ilorin, Ilorin, Kwara State, Nigeria.
[2]Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.
[3]Department of Biology/Microbiology, Abia State Polytechnic, Aba, Abia State, Nigeria.
[4]Department of Zoology, Faculty of Life Sciences, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

Corresponding Author: Amaechi, E. C. Department of Zoology, University of Ilorin, Ilorin, Kwara State, Nigeria. **Email**: ebubeamechi@yahoo.com **Phone**: +234 8039667283

Received: August 31, 2018 **Revised:** September 25, 2018 **Accepted**: October 04, 2018

ABSTRACT

Malaria is one of the major public health challenges in many tropical developing countries including Nigeria. Thus, comprehensive epidemiological information on transmission and distribution of the infection in different localities is a key factor to develop control strategies. The objective of this study was to determine the prevalence of malaria and assess biomedical knowledge and practice about malaria transmission, prevention and control measures among febrile patients attending Cottage Hospital Ogidi-Oloje, Ilorin between January and July, 2018. Structured and pre-tested questionnaires (n = 380) and blood films examinations were used for data collection. All the data were entered and analysed using SPSS 20.0. The overall falciparum malaria prevalence was 45.8 %. Malaria parasite infection resulted in signs and symptoms such as fever (33.7 %) headache (31.3 %), Shivering (14.2 %), body/joint pains (8.7 %) and others (0.3 %). On the average, 76.1 % of the subjects had knowledge and awareness about malaria parasite infections. The prevalence of malaria parasite infection were significantly associated ($p<0.05$) with health education, knowledge about malaria, educational status, and nature of house whereas sex, family size, distance from health facility, access to media were not. Proper health education is advocated with a special emphasis on the correct use of insecticide treated nets, adoption of integrated vector control and seeking early treatment.

Keywords: Falciparum malaria, Prevalence, Biomedical data, Associated knowledge, Ogidi-Oloje, Nigeria

INTRODUCTION

Malaria remains one of the most important and the greatest parasitic health challenge amongst populations residing in tropical and sub-tropical countries. The disease is caused by a single cell protozoan parasite that belongs to the genus *Plasmodium* and transmitted from man to man through the bite of an infected female *Anopheles* mosquito during blood meal. The disease imposes a huge burden upon the health and economic development of tropical nations where it impedes

sustainable development especially in sub-Saharan Africa where the disease accounts for 10 % of total disease burden (WHO, 2014). In 2016, an estimated 216 million people contracted malaria globally, resulting in an estimated 445,000 deaths, of which 91 % were in Africa (WHO, 2017). Malaria remains a serious health problem in Nigeria where 26 – 29 % of the global deaths and estimated 55 % of malaria cases occur (WHO, 2016). It accounts for 60 % of outpatient visits to hospitals, 30 % hospitalizations, 10 % of low birth weight, 11 % maternal mortality and 30 % child mortality especially among children younger than 5 years (NMEP *et al.,* 2016). In Nigeria, malaria is caused mainly by *Plasmodium falciparum* and the main vectors that are responsible for year round transmission are *Anopheles gambiae*, *Anopheles funestus*, *Anopheles arabiensis* and *Anopheles moucheti* (Dawaki *et al*., 2016). One of the core indicators to monitor the progress and evaluate the outcome and impact of Roll Back Malaria is to ascertain the number of malaria cases, determine uncomplicated and severe malaria cases among target group and determine clinic attendance rate (WHO, 2015). Despite prevention strategies especially the distribution of insecticide-treated nets (ITNs) and other vector control measures that are on-going in most parts of the country aimed at cutting down malaria transmission, the disease remains a health problem in most localities (Ejike *et al*., 2017; Oduola *et al*., 2018). There exist gaps between the hospital records and malaria programme implementation. It is based on this background that the present study was designed to determine the prevalence of malaria infection among febrile patients attending Cottage Hospital Ogidi-Oloje, Ilorin, Kwara State, north central Nigeria. It is expected that the result obtained from this study would assist organizations working in malaria control to undertake malaria control efforts within the area.

MATERIALS AND METHODS

Study Area: The study was carried out in Cottage Hospital Ogidi-Oloje, a peri urban community in Ilorin West Local Government Area (LGA) of Kwara State, north central Nigeria. According to 2006 national population census, there were 346,666 people living in Ilorin West LGA Located on latitude $8^0$30 N and longitude $4^0$35 E. The climate of Ogidi-Oloje is characterized by both wet and dry seasons. The temperature ranges from 33^0C to 34^0C from November to January while from February to April, the value ranges between 34^0C to 35^0C. The monthly temperatures are very high varying from 25^0C to 28.9^0C. The total annual rainfall is about 1200 mm (Adelowo, 2016). Relative humidity in the wet season is between 75 to 80 %, while in the dry season it is about 65 %. The derived savannah dominates the vegetation of the area with lateritic soil constituting the major soil type. The inhabitants are predominantly Yoruba ethnic group. Although other ethnic groups such as Nupe, Fulani, Ebira reside in the community with similar socio-economic characteristics. The main economic activity is weaving, while others engage in subsistence farming and petty trading. There are few health care centres in the area which makes Cottage hospital a major health centre where most residents visited whenever they had symptoms of malaria. The major sources of domestic water are dug-wells. Quite a number of stagnant water exists around homes in the community under study. The sanitary condition is poor with blocked drainages around human habitation. Most of the houses are mud walls with openings all around.

Study Design: The design of the study was a hospital-based survey that was carried out between January and July, 2018. The study consisted of questionnaire survey, collection of blood samples and parasitological examination protocols.

The content of the questionnaire include general characteristic of the respondents, issues related to biomedical knowledge, like awareness of malaria treatment seeking behaviour of the households and the practices of utilization of insecticide treated nets (ITNs). The questionnaires were administered to selected heads of the households in the study community who visited the hospital for treatment.

Ethics approval and Consent to Participate: Ethical approval was obtained from ethical committee, Kwara State Ministry of Health, Ilorin. Informed consent was sought and obtained from the patients before being listed for the study.

Data Collection: Data was collected by the following ways: using standardized questionnaire and from the results of screening blood samples for *Plasmodium falciparum* species. Data was collected using structured questionnaire with closed and open ended type of questions filled by heads of households for their biomedical knowledge, attitude and practice about malaria. The sample size of the study was estimated using 50 % prevalence as there was no reported study in the area. The sample size was determined by following the formula as outlined by Naing *et al*. (2007). A total of 375 subjects were obtained. Final sample size that was included in the study was 380 subjects comprising 157 males and 223 females. The finger- tips of the sample population were cleared with an alcohol-moistened swap, dried with a piece of dry cotton wool. Blood samples from sample population were collected by pricking their finger- tips with the help of laboratory scientist by using disposable blood lancet. Thin and thick films were made on the same slide side by side which was properly labelled and the thin blood smears were fixed with methanol at the laboratory. After being air dried in a horizontal position, the slides were stained with Giemsa solution for 30 minutes. Staining and blood smear examination were performed following the standard protocol of Garcia (2001).

Parasitological Examination: The presence of malaria parasites on thick blood smear was examined by using high power magnification objective (x 40) and the identification of *Plasmodium* species from the thin blood smear was done using WHO (2010) guidelines through oil immersed objective (x 100). Thick smear was used to determine the presence of malaria parasite and the thin smear was used to identify the type of *Plasmodium* species infection.

Data Analysis: Statistical analysis was carried out using SPSS version 20 software. Descriptive statistics were carried out to measure relative frequencies and percentages of the variables. Chi-squared test was used to determine the statistical significance of differences of the relative frequencies. Statistical significance was defined at P-values less than 0.05 ($p<0.05$).

RESULTS

Socio-Demographic Characteristics of Study Participants: A total of 380 respondents were included in this study. Female constitute 223(58.7 %), while males were 157(41.3 %). Majority of the respondents were rural residents. The average family size of the respondents was 5 persons. 166(43.7 %) of the respondents had no formal education, 134(35.3 %) had primary education, 50(13.2 %) had secondary education and 30(7.9 %) had tertiary education. Regarding occupation, most of the respondents; 137(36.1 %) were farmers, 27(7.1 %) were Government workers, 95(25 %) were students, 39(10.3 %) were private sector employee, 18(4.7 %) were housewife, 23(6.1 %) were artisans, while 41(10.8 %) had no job. Regarding the duration of stay in the area, the majority of the respondents 234(61.6 %) live in the area starting from their birth, 83(21.8 %) had stayed between 7 – 10 years, while the least 6(1.6 %) had stayed less than 3 years. Majority of the respondents 267(70.3 %) did not have access to any kind of mass media, whereas 113(29.7 %) of the respondents had some kind of access to mass

media like radio, television and newspapers. A majority of the respondents 214(56.3 %) were living less than 60 minutes distance walking to any of the health institution within the study area while 166(43.7 %) were living further than 60 minutes distance walking to any health institution. The housing condition of most of the respondents had iron sheet roof although the walls were made of mud, while 52(13. %) lived in thatch roof houses (Table 1).

Prevalence of Falciparum Malaria Infections by Age and Sex of Patients Attending Cottage Hospital Ogidi-Oloje, Ilorin, Kwara State Between January and July 2018: More males (47.1 %) were infected when compared to females (44.8 %). The age group less than five had the highest infection rate (49.4 %) (Table 2).

Manifested Sign and Symptoms Versus Malaria Parasite Infection: Majority of the respondents identified fever (33.7 %), headache (31.3 %), shivering (14.2 %), body pains (8.7 %) as main symptoms both in adult and children. Almost all the studied subjects had knowledge of at least one of the classical symptoms (Table 3).

Patients' Level of Knowledge and Awareness about Malaria: The results indicated that 96.8 % of the respondents believed that malaria could be transmitted from infected person to healthy person and also 2.1 % of the respondents believed that malaria cannot be transmitted from person to person, while 1.1 % had no idea. The study area indicated that 76.1 % of the respondents knew that mosquito bites are responsible for malaria transmission. There were however some misconceptions of results by respondents. Body contact (0.3 %), drinking contaminated water (6.3 %), malnutrition (6.3 %), excessive rainfall/sunlight (7.1 %) while 3.9 % had no idea (Table 4).

Association of Falciparum Malaria Parasite Infection with Socio-Demographic Characteristic and Level of Knowledge about Malaria Amongst Studied Subject: The result showed that respondents level of knowledge about malaria was significantly associated with prevalence of malaria ($p<0.05$) (Table 5).

DISCUSSION

Our hospital-based assessment showed that malaria is a problem in tropical countries like Nigeria where the prevalence rate is high. These findings are a particularly important public health issue, considering the cost of treatment of patients, loss of lives, and the negative economic and social impact of the disease. The result of this study showed that the overall prevalence of *falciparum* malaria parasite was 45.8 % (n = 380). This indicated that malaria is endemic in the study area as in other part of the country. The present result agreed with the findings of Amadi *et al*. (2017) who reported a 45 % prevalence rate in Umudike area of Abia State. Although our result is much lower than the findings of Shittu *et al*. (2018) who reported 63.86 % prevalence in Ile-Apa, a peri-urban community in Ilorin East LGA, Kwara State. Also a higher value of 60.6 % was reported by Dawaki *et al*. (2016) in Kano State, Nigeria. The reduction in prevalence rate may be linked to an improved awareness by the people of the area on better ways of preventing and controlling the malaria vector. The present result was in agreement with assertion of Ukpai and Ajoku (2001) that malaria infection is holo-endemic in Nigeria and widespread in tropical and subtropical region of Africa, Asia and America. These high rates can be one of the reasons for high mortality in these areas especially in children and pregnant women. Infection is acquired where there are human hosts carrying the parasites and sufficient female *Anopheles* mosquitoes, together with condition of temperature and humidity that favour the development of parasites in the mosquito.

Table 1: Socio-demographic characteristic of studied participants in Ogidi-Oloje (n=380)

Variable	Categories	Number	Percent (%)
Sex	Male	157	41.3
	Female	223	58.7
Residence	Rural	299	78.7
	Urban	81	21.3
Family size (no of person)	1-4	65	17.1
	5-8	104	27.4
	>8	211	55.5
Educational level	Illiterate	166	43.7
	Primary	134	35.3
	Secondary	50	13.2
	Tertiary	30	7.9
Occupation	Farmer	137	36.1
	Govt. employee	27	7.1
	Students	95	25
	Private sector	39	10.3
	House wife	18	4.7
	Artisans	23	6.1
	No job	41	10.8
Duration of stay in the area	<3 years	6	1.6
	4-6 years	45	11.8
	7-10 years	83	21.8
	>11 years	12	3.2
	Since birth	234	61.6
Access to mass media	Yes	113	26.7
	No	267	70.3
Distance from health facility	≥60 minutes	166	43.7
	<60 minutes	214	56.3
Type and quality of home	Thatch roof	52	13.7
	corrugated iron sheet	328	86.3

Table 2: Prevalence of falciparum malaria infections by age and sex of patients attending Cottage Hospital, Ogidi-Oloje between January and July 2018

Age Group (years)	Male		Female		Both sexes		X^2	P-value
	Number examined	Number positive	Number examined	Number positive	Number examined	Number positive		
< 5	48	34(70.8)	63	52(82.5)	111	86(49.4)		
5-10	24	12(50.0)	47	22(46.8)	71	34(19.5)		
11-20	29	11(37.9)	41	11(26.8)	70	22(12.6)		
21-30	23	5(21.7)	39	7(17.9)	62	12(6.9)		
31-40	18	3(16.7)	17	3(17.6)	35	6(3.6)		
41-50	3	0(0.0)	10	1(10.0)	13	1(0.6)		
51-60	12	9(75.0)	6	4(66.7)	18	13(7.5)		
Total	157	74(272.1)	223	100(268.3)	380	174(100.1)	38.5	0.001

Table 3: Manifested sign and symptom versus malaria parasite infection among patients attending Cottage Hospital, Ogidi-Oloje between January and July 2018

Variable sign and symptom	Frequency (%)	Malaria parasite infection	X^2	P-value
Fever	128(33.7)	56(14.7)		
Headache	119(31.3)	44(11.6)		
Shivering	54(14.2)	19(5.0)		
Vomiting	21(5.5)	15(3.9)		
Body/Joint pains	33(8.7)	22(5.8)		
Reduced appetite	20(5.3)	11(2.9)		
Excessive sweating	4(1.1)	7(1.8)		
Others	1(0.3)	0(0.0)		
Total	380	174(45.8)	18.72	0.117

Table 4: People level of knowledge and awareness about malaria by subjects attending Cottage Hospital Ogidi-Oloje

Variables	Responses	Number (%)
Is Malaria transmitted?		
	Yes	368(96.8)
	No	8(2.1)
	I do not know	4(1.1)
Mode of transmission		
	Mosquito bite	289(76.1)
	Body contact	1(0.3)
	Drinking contaminated water	24(6.3)
	Malnutrition	24(6.3)
	I do not know	15(3.9)
	Excessive rainfall and sunlight	27(7.1)
Mosquito biting time		
	Night time	294(77.4)
	Day time	12(3.2)
	Day and night	689(17.9)
	I don't know	6(1.6)
Mosquito breeding site		
	In stagnant water	341(89.7)
	In running water	15(3.9)
	On leaves	5(1.3)
	Others	2(0.5)
	Do not know	17(4.5)
Knowledge about malaria		
	Good	307(80.8)
	Poor	3(19.2)
Bed net possession		
	Absent	189(49.7)
	One per house	184(48.4)
	Two per house	4(1.1)
	Thrice per house	3(0.8)
Receiving health extension service	Yes	141(37.1)
	No	239(62.9)
Is malaria a preventable disease	Yes	321(84.5)
	No	59(15.5)
Preventive methods		
	Taking drugs	33(8.7)
	Spraying with insecticides	72(1
	Proper environmental sanitation	51(13.4)
	Use of bed nets	90(25
	Appropriate nutrition	33(8.7)
	Drying stagnant water	18(4.7)
	Traditional practice	70(18.4)
	Take no drug	12(3.2)
	Others.	1(0.3)

Table 5: Association of malaria parasite infection with socio-demographic characteristic and level of knowledge about malaria among study participants

Characteristics	N= 380	No +ve	NO –ve	OR(95 % CI)	X2	P-value
Residence				0.651	1.301	0.272
Urban	81	18(22.2)	63(77.8)	(0.306-1.381)		
Rural	299	152(50.8)	147(49.2)			
Educational status						
Illiterate	166	94(56.6)	72(43.4)	0.951	0.401	0.935
Primary	134	57(42.5)	77(57.5)	(0.913-0.952)		
Secondary	50	12(24)	38(76)			
Tertiary	30	7(23.3)	23(76.7)			
Health education						
Yes	106	14(13.2)	92(86.8)	0.463	4.23	0.031
No	274	156(56.9)	118(43.1)	(0.232-0.910)		
Distance from health facility						
≥ 60 minute	166	95(57.2)	71(42.8)	0.868	0.000	0.93
< 60 minute	214	75(35.0)	139(65.0)	(0.506-1.86)		
Access to media						
Yes	113	68(60.2)	45(39.8)	0.847	0.517	0.617
No	267	102(38.2)	165(61.8)	(0.541-1.630)		
High level of biomedical knowledge						
Yes	274	114(41.6)	160(58.4)	0.314	22.471	0.00
No	106	56(52.8)	50(47.2)	(0.104-0.403)		
Type and quality of house						
Grass roof	52	39(75)	13(25)	0.761	0.274	0.512
Correlated Iron sheet	328	131(39.9)	197(60.1)	(0.347-1.393)		

Such factors are readily available in the tropics, hence, the high prevalent rates in these regions. Gender-wise, the study showed that males were more infected than the females although the difference was not significant. This findings agreed with that of other researches (Ukpai and Ajoku, 2001; Ani, 2004; Nwaorgu and Orajiaka, 2011; Okafor and Oko-Ose, 2012). This could be linked to behavioural differences such as refusal to adhere to preventive measures like sleeping under insecticide treated nets, travelling more to endemic areas for daily labour and exposure of the body to mosquito bites especially during unfavourable weather situation. This was however contrary to the findings of Amadi *et al*. (2017) who found out that females were more infected than males although not significant. In the present study, the age range less than 5 years had the highest prevalence followed by 5 – 10 years, while the age range 41 – 50 years had the least prevalence. This was in agreement with Ani (2004) who reported that children in the first decade of life had the highest prevalence of malaria. The most likely reason for decline in prevalence by age is that older individuals have developed anti- malaria immunity after many years of chronic exposure to mosquito bites and malaria infection. Majority of respondents identified fever, headache, shivering and body pains as main symptoms both in adults and children. Almost all the studied subject had knowledge of at least one of the classical symptoms. This was similar to the findings in south eastern parts of Nigeria where a majority of the respondents identified malaria mainly on the basis of the symptoms of fever and general body weakness with rigors and sweating (Amaechi and Ukpai, 2013; Ukpai *et al.,* 2017). The majority of respondents reported that malaria could be transmitted from infected person to a healthy one. This study was by far at higher rate compared to the findings of Ukpai *et al*. (2017). This study indicated that above 76 % of the subject knew that mosquito bites are responsible

for malaria transmission. This was however higher than the report of Oladepo *et al*. (2010) in Oyo State where above 12 % linked malaria with mosquito bite. Likewise in other parts of Africa, Mazigo *et al*. (2010) in Tanzania reported that only 49.1 % knew that mosquito bite was responsible for malaria transmission. However, our findings were lower than the result in Zambia, where 89.6 % were able to link mosquito as a vector of malaria (Shimaponda-Mataa *et al*., 2017). Lack of awareness may be a contributing factor to misconception about transmission of malaria. The majority of subjects knew that mosquitoes bite mostly at night. This knowledge in the present study was relatively higher than the level pointed in central Ethiopia study where 42.6 % knew that mosquitoes bite most at night (Legesse and Deressa, 2009). Majority 341(89.7 %) of the subjects indicated that stagnant water was the main breeding site of the mosquito vector. This was higher than reports made from Tanzania (Mazigo *et al.,* 2010). Use of bed nets 90(23.7 %) was low amongst the subjects. This was lower than 48.3 % ITN usage reported by Dawaki *et al*. (2016) in the northern part of Nigeria. This may have been a factor that led to the high prevalence rate recorded in present study. Kolawole and Ozokonkwo (2016) reported a lower prevalence rate of malaria amongst patients attending a health facility in Ilorin, Kwara State, Nigeria. This goes a long way to confirm that Government intervention in this area with regards to insecticide treated nets distribution will assist to cut down the infection rate. The result of statistical analyses showed that respondent's level of biomedical knowledge about malaria was significantly associated with prevalence of malaria ($p<0.05$). Subject who had secondary education was more likely to have a high score of malaria knowledge than those who had no formal education. Also, from the present study, subjects who had no formal education were more likely to be infected with malaria parasites than study subjects whose level of education is secondary and above. However, the level of education was not significantly associated with prevalence of malaria parasite infections among the study subjects in the study area ($p>0.05$). Subjects, from rural setting are more likely to be infected with malaria than subject from urban setting. However, there was statistical difference of prevalence of falciparum malaria. From 106 subjects that had received some form of health education regarding malaria, only 14(13.2 %) was infected with malaria parasites. However, 156(56.9 %) of the subjects that had not received some type of health education regarding malaria were infected. To not have received some type of health education regarding malaria was significantly associated with prevalence of *plasmodium* parasites (OR = 0.463; 95 % CI = 0.232, 0.910, P- Value = 0.031).

Conclusion: The high prevalence of falciparum malaria recorded in the present study calls for prompt intervention that include advice on the correct use of insecticide treated nets and the promotion of integrated malaria vector control. General health education of the community members is also advocated.

ACKNOWLEDGEMENTS

We are grateful to the management of Cottage Hospital, Ogidi-Oloje for permitting and providing logistic support to conduct this study. Thanks to all the study subjects for their cooperation all through the study period.

REFERENCES

ADELOWO, W. B. (2016). Measuring ill-health burden in Ilorin-West Local Government Area of Kwara State: the cost of illness approach. *Journal of Culture, Society and Development*, 20: 16 – 22.

AMADI, A. N. C., AMOKE, C. O. and GANIYU, K. (2017). The status of malaria parasitaemia and assessment of the use of long lasting insecticide treated bed net among Umudike community of Umuahia,

Abia State, Nigeria. *Animal Research International*, 14(3): 2876 – 2882.

AMAECHI, E. C. and UKPAI, O. M. (2013). Knowledge, attitude and practices about malaria among mothers and care-givers in Aba South Local Government Area, Abia State, Nigeria. *Animal Research International*, 10(3): 1786 – 1791.

ANI, O. C. (2004). Endemicity of malaria among primary school children in Ebonyi State, Nigeria. *Animal Research International*, 1(3): 155 – 159.

DAWAKI, S., AL-MEKHLAFI, H. M., ITHOI, I., IBRAHIM, J., ATROOSH, W. M., ABDULSALAM, A. M., SADY, H., ELYANA, F. N., ADAMU, A. U., YELWA, S. I. and AHMED, A. (2016). Is Nigeria winning the battle against malaria? Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. *Malaria Journal*, 15(1): 351.

EJIKE, B. U., OHAERI, C. C., AMAECHI, E. C., EJIKE, E. N., OKIKE-OSISIOGU, F. U., IROLE-EZE, O. P. and BELONWU, A. C. (2017). Prevalence of falciparum malaria amongst pregnant women in Aba South Local Government Area, Abia State, Nigeria. *Nigerian Journal of Parasitology*, 38(1): 48 – 52.

GARCIA, L. S. (2001). *Diagnostic Medical Parasitology*, 4th Edition, ASM Press, Washington DC, USA.

KOLAWOLE, O. M. and OZOKONKWO, O. C. (2016). Evaluation of certain preventive measures to malaria infection. *Animal Research International*, 13(3): 2504 – 2509.

MAZIGO, H. D., OBASY, E., MAUKA, W., MANYIRI, P., ZINGA, M., KWEKA, E. J., MNYONE, L. L. and HEUKELBACH, J. (2010). Knowledge, attitudes, and practices about malaria and its control in rural northwest Tanzania. *Malaria Research and Treatment*, 2010: doi:10.4061/2010/794261.

NAING, L., WINN, T. and RUSLI, B. N. (2006). Practical issues in calculating the sample size for prevalence studies. *Archives of Orofacial Sciences*, 1: 9 – 14.

LEGESSE, M. and DERESSA, W. (2009). Community awareness about malaria, its treatment and mosquito vector in rural highlands of central Ethiopia. *Ethiopian Journal of Health Development*, 23(1): 40.

NATIONAL MALARIA ELIMINATION PROGRAMME (NMEP), NATIONAL POPULATION COMMISSION (NPOPC), NATIONAL BUREAU OF STATISTICS (NBS), and ICF INTERNATIONAL (2016). *Nigeria Malaria Indicator Survey 2015*. Abuja, Nigeria, and Rockville, Maryland, USA.

NWAORGU, O. C. and ORAJIAKA, B. N. (2011). Prevalence of malaria among children 1-10 years old in communities in Awka North Local Government Area, Anambra State, south east Nigeria. *International Multidisciplinary Journal Ethiopia*, 5(5): 264 – 281.

ODUOLA, A. O., OBEMBE, A., ADELAJA, O. J., ADENEYE, A. K., AKILAH, J. and AWOLOLA, T. S. (2018). Outcome of capacity building intervention for malaria surveillance, control and research in Nigerian higher institutions. *Malaria Journal*, 17: 193.

OKAFOR, F. U. and OKO-OSE, J. N. (2012). Prevalence of malaria infections among children aged six months to eleven years (6 months – 11 years) in a tertiary institution in Benin City, Nigeria. *Global Advanced Research Journal of Medicine and Medical Sciences*, 1(10): 273 – 279.

OLADEPO, O., TONA, G. O., OSHINAME, F. O. and TITILOYE, M. A. (2010). Malaria knowledge and agricultural practices that promote mosquito breeding in two rural farming communities in Oyo State, Nigeria. *Malaria Journal*, 9: 91.

SHIMAPONDA-MATAA, N. M., TEMBO-MWASE, E., GEBRESLASIE, M. and MUKARATIRWA, S. (2017). Knowledge, attitudes and

practices in the control and prevention of malaria in four endemic provinces of Zambia. *Southern African Journal of Infectious Diseases*, 32(1): 29 – 39.

SHITTU, O., OPEYEMI, O. A., OMOTOSHO, O., FULANI, S. F., OLALEYE, A. D., ADEBO, P. O., IBRAHIM, A. O., BAMGBOYE, M., FAKAYODE, O. and AKOR, S. F.(2018). Malaria prevalence, blood film and risk factors for transmission in a peri-urban community, north central Nigeria. *Nigerian Journal of Parasitology*, 39(2): 1 – 8.

UKPAI, O. M. and AJOKU, E. I. (2001). The prevalence of malaria in Okigwe and Owerri areas of Imo State. *The Nigerian Journal of Parasitology*, 22(1&2): 43 – 48.

UKPAI, O. M., IROLE-EZE, O. P., AMAECHI, E. C., EJIKE, B. U., EJIKE, E. N. and OKOROCHA, N. A. (2017). A study of knowledge, attitude and practices regarding malaria among inhabitants of Ezinihite Local Government Area, Imo State, Eastern Nigeria*. Manila Journal of Science*, 10: 65 – 74.

WHO (2010). *Basic Malaria Microscopy. Part 1 Learners guide* Second Edition, World Health Organization, Geneva, Switzerland.

WHO (2014). *World Malaria Report 2013.* World Health Organization, Geneva.

WHO (2015). *World Malaria Report 2014.* World Health Organization, Geneva.

WHO (2016). *World Malaria Report 2015.* World Health Organization, Geneva.

WHO (2017). *World Malaria Report 2016.* World Health Organization, Geneva.