ORIGINAL ARTICLE

AFRICAN JOURNAL OF CLINICAL AND EXPERIMENTAL MICROBIOLOGY ISBN 1595-689X JULY 2018 VOL19 No.3
AJCEM/1830 http://www.ajol.info/journals/ajcem
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AFR. J. CLN. EXPER.MICROBIOL. 19 (3): 214-220

PREVALENCE OF MALARIA INFECTION AMONG PATIENTS ATTENDING MURTALA MUHAMMED SPECIALIST HOSPITAL KANO, NIGERIA

Oladele, O. V.[1,2], Onuoha, S. C[5]*, Hamafyelto, H. S.[1] Omisope, O.[6] Fauziyya, A[3] Akindigh M[4], Abdullahi, T[3], Ilu, M. L[1], Ikeh, E[1]

[1]Department of Medical Microbiology, Faculty of Medical Sciences, University of Jos, P.M.B 2084 Jos, Plateau State, Nigeria. [2]Department of Educational Services, Universal Basic Education, P.M.B 163 Garki, Abuja, Nigeria. [3]Department of Microbiology, Murtala Muhammed Specialist Hospital, Kano State, Nigeria. [4]Jos University Teaching Hospital-Infectious Diseases Unit (APIN) Laboratory, Jos Plateau State,Nigeria.[5]Department of Biotechnology, Ebonyi State University, Abakaliki, Ebonyi State,Nigeria. [6]Department of Chemical Pathology, Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, Osun State

***Corresponding authors' email & phone: sconuoha@yahoo.com; Tel: +2348032385682**

ABSTRACT

Malaria is one of the most common diseased conditions in Nigeria and across most developing countries triggered by one of four species of *Plasmodium*. The objective of this study was to screen and detect for the presence of *Plasmodium* species via microscopic analysis on Malaria patients attending a healthcare facility Northern Nigeria and present the epidemiological data of malaria.Finger prick blood samples, Thick and Thin Giemsa-stained blood smears, were collected from 350 malaria-suspected individuals representing all age groups. The Giemsa-stained blood smears were examined microscopically. Demographic information on rural and urban dwellings, use of insecticides and mosquito nets were collected using structured questionnaires. Malaria cases were detected in in 227 (64.9%) of the participants with a higher infection rate amongst the males (147) than the females (80). The predominant specie found was *Plasmodium falciparum*. All age groups in this study were vulnerable in the order of 61-above>31-40>51-60>41-50>1-10>21-30> 11-20 years of age.A large number of participants dwelling in urban area (219) were tested positive for malaria in contrast to eight(8) from the rural area. Not using insecticides and mosquito treated nets were significantly associated with the prevalence of malaria as 59.4% of participants who were tested positive for *Plasmodium falciparum* infection utilized insecticides, while 66.9% of those who did not were also tested positive. Individuals residing close to gutters and bushes were the most susceptible (85.6%) to *Plasmodium* infection.

Keywords: Prevalence, Malaria, *Plasmodium falciparum*, Kano.

PRÉVALENCE DE L'INFECTION PARMI LES PATIENTS FRÉQUENTANT L'HÔPITAL SPÉCIALISTE MURTALA MUHAMMED KANO, NIGÉRIA

Oladele, O. V[1,2], Onuoha, S. C[5]*, Hamafyelto, H. S[1] Omisope, O[6], Fauziyya, A[3] Akindigh M[4], Abdullahi, T[3], Ilu, M. L[1], Ikeh, E[1].

1Département de MicrobiologieMédicale, Faculté des Sciences Médicales, de l'Université de Jos, P.M.B 2084 Jos Plateau State, Nigeria.
2Ministère de l'enseignement, l'ÉducationUniverselle de Base, P.M.B 163 Garki Abuja, Nigeria.3Département de Microbiologie, HôpitalSpécialiséMurtalaMuhammed, l'État de Kano, Nigeria.L'enseignementUniversitaire Hospital-Infectious 4Jos UnitéMaladies (APIN), Laboratoire de l'État du Plateau de Jos au Nigéria,. 5Département de Biotechnologie, Université de l'étatd'Ebonyi, Abakaliki, étatd'Ebonyi,leNigéria. 6Département de PathologieChimique, UniversitéObafemiAwolowo, Ile-Ife (Complexe de l'Hôpitald'Enseignement, de l'étatd'Osun

***Des auteurs correspondants email &Téléphone : sconuoha@yahoo.com ; Tel : 2348032385682**

Résumé

Le paludismeestl'une des plus fréquentes conditions malades au Nigéria et dans la plupart des pays en développement, déclenchéparl'une des quatreespèces de Plasmodium. L'objectif de cetteétudeétaitd'écran et de détecter la présenced'espèces de Plasmodium par analysemicroscopiquesur le paludisme les patients fréquentantunétablissement de santé dans le nord du Nigéria et présente les donnéesépidémiologiques du paludisme. Des échantillons de sang par piqûre au doigt, épaisseset minces colorées au Giemsa, frottis de sang ontétérecueilliesauprès de 350 personnessoupçonnées de paludismereprésentanttous les groupesd'âge. Les frottissanguinscolorés au Giemsa-ontétéexaminées au microscope.L'informationdémographiquesur les logementsruraux eturbains, l'utilisationd'insecticides et de moustiquairesontétérecueillies à l'aide de questionnaires structurés. Les cas de paludismeontétédétectésdans la région de 227 (64,9 %) des participants avec un tauxd'infection plus élevéparmi les hommes (147) que les femelles (80). La principaleespècetrouvéeétait Plasmodium falciparum.

Tous les groupesd'âgedanscetteétudeontété exposés dansl'ordre de 61-au-dessus de >31-40 >51-60 >>1-10 41-50 21-30 >>11-20 ans. Un grand nombre de participants en zone urbained'habitation (219) ontététestéspositifs pour le paludisme en revanche à 8 de la régionrurale. N'utilisez pas d'insecticides et de moustiquairesimprégnéesontétésignificativementassociée à la prévalence du paludismecomme 59,4 % des participants qui ontététestéspositifs pour l'infection à Plasmodium falciparum insecticides utilisésalorsque 66,9 % de ceux qui n'ont pas ontégalementététestéspositifs. Les individusrésidant à proximité de gouttières et les buissonsétaient les plus susceptibles (85,6 %) infection à Plasmodium.
Mots-clés : la prévalence, le paludisme, Plasmodium falciparum, Kano.

1. INTRODUCTION

The scourge of malaria which has a high incidence across most of the developing world, particularly the tropical and subtropical regions of the world is caused by the bite of the female anopheles mosquito, thereby transmitting one of four protozoan parasites of the *Plasmodium family; Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale and Plasmodium malariae*(1, 2). Of these, *Plasmodium falciparum* is the most common and deadly (3).

Recent data indicated that an estimated 1 million lives globally has been claimed by malaria infection of which Africa bore the highest rate of mortality (90%), particularly among victims under the age of 5 years old across the sub-Saharan African continent (4,5).

Studies reported that in Nigeria, malaria infected patients represent approximately 60% of outpatient hospital visits in Nigeria, 30% of hospitalizations, 30% of under-five mortalities, 25% of infant mortalities and 11% of maternal mortalities (6). In the last decade, the fight against malaria and its propagating agents in Nigeria and across Africa has not been as effective due to the emergence of resistant species of the parasites, coupled with the advent of vectors that appear resistant to commercially available insecticides (7). This has caused a paradigm shift in behavioral pattern of the malaria vectors in which they are now just as devastating when encountered outdoors as well as indoors. Its rate of transmission is characteristically distinct between the rainy and dry seasons (8). Data revealed that the countries microclimate, topography, population densities, cultural practices, etc also contribute towards the spread of the disease (9). These include residence and leisure activities within close proximity to stagnant bodies of water, public exposure to rural lavatories, general neglect for routine check-up or screening, monthly rainfall, etc (10, 11, 12, 13).

It has long been established that the emergence and spread of drug resistance to commonly used chemotherapeutics are major factors contributing to this increasing burden and most of the mortality and morbidity are borne by children and pregnant women. Pregnant women and their infants are susceptible to common and preventable infectious diseases including malaria but are woefully left unscreened and untreated. According to an estimate, approximately 125 million pregnant women worldwide are exposed to the risks of malaria in pregnancy (MIP) each year, resulting in 200,000 infant deaths (14).

In Nigeria, the federal ministry of health in conjunction with the then millennium development goals (MDG) had proposed the goal of reducing the malaria associated rate of mortality and morbidity by half as of 2013 (8). With the inability to achieve the set target at the end of the set project date, it is necessary to conduct community-wide malaria surveys as a means of monitoring the impact and effectiveness of malaria control measures and programs at different levels. Data obtained from such studies would aid in defining up-to-date malaria burden as well as develop suitable measures of intervention whilst attempting to address adequate control measures for the disease throughout the country.

This study was carried to assess prevalence of malaria in patience attending the Murtala Mohammed Specialist hospital in Kano State, Northern Nigeria. It would also attempt to establish the prevalence of *P. falciparum* infection among different age groups of consenting participants in order to provide information useful to relevant government agencies involved in the control of malaria towards the development of suitable policies for maximum efficiency.

2. MATERIALS AND METHODS

2.1. Study Area

The study location is Kano metropolis, Nigeria situated between latitudes 11^{o} 25′ N to 12^{o}47′ N and longitude 8^{o} 22′ E to 8^{o}39′ E east and 472m above sea level and a population of over 3 million (16). Kano metropolis is bordered by Madobi and Tofa Local Government Areas (LGAs) to the South West, Gezawa LGA to the East, Dawakin Kudu LGA to the South East, and Minjibir LGA on the North East.

2.2. Study Population and Ethical Permission

The study population was made up of 211 male and 139 female patients attending the Murtala specialist hospital Kano state, Nigeria who all gave their consent to participate in the study.

2.3. Ethical Permission

Approval to conduct the study was obtained from the Ethical Clearance committee, Kano State Ministry of Health prior to sample collection. Subjects used in this study were those who's informed consent or that of their guardian were sought. They were patients within the all age groups examined for malaria parasite infection at the general outpatient department (GOPD) of Murtala Mohammed specialist hospital Kano state, Nigeria.

2.4. Blood Collection and Screening

Patients attending the hospital, who were feverish with asymptotic signs of malaria were screened for Plasmodium infection. Finger prick blood samples were collected to prepare thick blood films (in duplicate) were also prepared, stained with 10% Giemsa stain for 20 minutes and examined for malaria parasites by microscopy. Each of the films was assessed and the mean value was recorded. The parasite density was estimated by counting the number of asexual parasites against a minimum of 200 white blood cells (WBCs) (15).

2.5. Statistical Analysis

Statistical analysis was done using SPSS Software.

3. RESULT

This result in (Table 1, Figure 1) revealed that the male patients had the highest cases of malaria infection (69.7%) positive for *Plasmodium falciparum* while the female patients recorded (57.6%) positive cases of malaria infection for *Plasmodium falciparum*. More so, (30.3%) and (42.4%) of the respondents (male and female respectively) were found to be negative for all the *Plasmodium* species out of 350 samples tested in the study. There was also no significant association between the prevalence of *Plasmodium* species that causes malaria infection in relation to gender status of respondents that participated in this study ($P < 0.05$.The prevalence rate of malaria infection caused by *Plasmodium falciparum* in relation to mode of settlement pattern of the respondents with respect of those living in the urban settlement is having the highest cases of malaria infection of (65.6%) cases while those living in the rural settlement recorded the least prevalence rate of (50%) cases (Table 2). There was no significant association between prevalence of *Plasmodium* species that causes malaria infection in relation to gender status of respondents ($P < 0.05$). Results of the about prevention and control of respondents or guardians obtained in this study shown in (Table 3). Statistical analysis of the findings from the results above, revealed that

there were significant associations ($p > 0.05$) the prevalence of *Plasmodium* species that causes malaria infection in relation to knowledge about prevention and control of malaria infection by the respondents or guardians that participated in this study. Finally, all the 350 respondents that participated in this study were found to be negative for *Plasmodium malariae, Plasmodium vivax* and *Plasmodium ovale* under this category.

TABLE 1: DISTRIBUTION OF *PLASMODIUM* SPECIES IN RELATION TO AGE OF RESPONDENTS

Age/years	Number examined	Male		Female	
		Positive	Negative	Positive	Negative
1 – 10	19	5	4	7	3
11 – 20	77	30	16	15	16
21 – 30	118	43	22	26	27
31 – 40	65	32	10	18	5
41 – 50	28	13	6	5	4
51 – 60	28	14	4	7	3
61 and above	15	10	2	2	1
Total	350	147	64	80	59
Total Percentage (%)		69.66	30.34	57.55	42.45

P < 0.05.

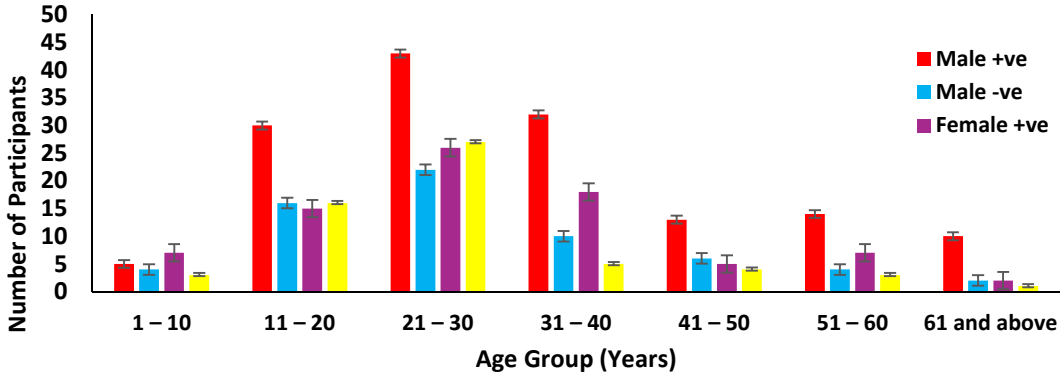

FIGURE 1: AGE DISTRIBUTION OF MALARIA POSITIVE AND NEGATIVE PARTICIPANTS (+VE: POSITIVE, -VE: NEGATIVE)

TABLE 2: DISTRIBUTION OF *PLASMODIUM* SPECIES IN RELATION TO AGE OF RESPONDENTS

	No. examined	Malaria Positive	Malaria Negative
Age Group (years)			
1 – 10	19	12	7
11 – 20	77	45	22
21 – 30	118	69	49
31 – 40	65	50	15
41 – 50	28	18	10
51 – 60	28	21	7
61 and above	15	12	3
Sex			
Male	211	147	64
Female	139	80	59
Residence			
Urban	334	219 (65.6%)	115 (34.4%)
Rural	16	8 (50%)	8 (50%)

TABLE 3: DISTRIBUTION OF MALARIA IN RELATION TO PREVENTION AND CONTROL

Method	No. examined	*P. falciparum*	*P. malarae*	*P. vivax*	*P. ovale*	% positive
Use of insecticide						
Yes	**96**	**57**	**-**	**-**	**-**	**59.4**
No	**254**	**170**	**-**	**-**	**-**	**66.9**
Bushes and gutters						
Yes	**139**	**119**	**-**	**-**	**-**	**85.6**
No	**211**	**108**	**-**	**-**	**-**	**51.2**
Use of mosquito nets						
Yes	**43**	**22**	**-**	**-**	**-**	**51.2**
No	**307**	**207**	**-**	**-**	**-**	**67.4**

4. DISCUSSION

The frequency of malaria infections across all age groups in Nigeria and Africa as a whole is worrisome particularly for community health establishments, primary and secondary schools as well public or private businesses. It is of major concern in the 21st century as it is one of the most prevalent causes of human mortality in developing countries as a direct result of either the increase in regular over-the-counter anti-malaria agents or a high level of parasitemia, the latter which if detected early would fast track the treatment and recovery process. Apart from death, malaria infection greatly diminishes the overall effectiveness of humans thereby impacting negatively on commerce, economy and tourism in the affected location. The spread of malaria is high all across Nigeria, making the country one of those in the area among the malaria-endemic regions of the world. In this study, data obtained revealed that a large number of the studied population (227 of 350) were infected with *Plasmodium falciparum* (Table 1-3, Figure 1) as assayed via the gold standard of malaria detection (microscopy). Among the infected individuals, data revealed that the males were far more susceptible to infection (147 out of 211 male patients) in comparison to 80 out of 139 female participants (Table 1). Data obtained revealed that the most vulnerable age group in the study population for each sex was 21-30. The result suggests that if the retirement age within the study location is set at 60 years, then at any given time, over 50% (58.4% for ages 21-30, 76.9% for ages 31-40, 64.3% for ages 41-50 and 75% for ages 51-60) of the active workforce suffers from malaria infection, thereby diminishing their efficiency in the workplace or in institutions of higher learning (Table 1, Figure 1).The finding of the current study revealed that malaria infection in the study participants was 64.85%, representing almost double the figure obtained in other recent studies that revealed a 36.6-39.5% rate of infection in northern Nigeria (16, 9). This variation may be attributed to climate change which could affect the reproductive rate of *Plasmodium* species, dwindling or ineffective control measures in the target location as well as the level of infrastructural development pertaining to the conditions of the participants dwelling over the last decade (17).

Majority of the participants in this study (334 out of 350) resided within the peri-urban environment of Kano metropolis of which 219 were tested positive for malaria (Table 2). 16 of the 350 participants resided in the rural area of Kano state of which 8 (50%) were tested positive for malaria. These results were in stark contrast to that obtained for studies in other countries of Africa where it is generally expected that the more urban the environment, the lower the chances of malaria infection (17). It is generally perceived that in homes made of mud, local bricks and sticks, the prevalence of mosquitos would be higher as such materials used in building the homes provide the preferred porous surfaces for propagation of the mosquito vectors (12). Industrial activities coupled with the need for more stringent environmental practices in the urban areas may contribute for increased numbers of stagnant water bodies which provides the avenue for increased mosquito growth, thereby accounting for the higher incidence of malaria amongst residence in the urban areas. Between the rural and urban dwellers of the study location, the immediate exposure to not only stagnant water bodies but bushes and gutters as well as the use of control measures like mosquito nets and insecticides would also aid in the reduction of malaria incidence, thus was also accessed (Table 3). In this study, it was discovered that out of 307 out of 350 participants who did not utilized WHO approved mosquito nets, 207 representing 67.4% were tested positive for *Plasmodium falciparum* infection. By contrast, 22 out of 43 patients who slept in mosquito nets were infected by *P. falciparum* (Table 3). These findings suggest that other environmental factors are responsible for the propagation of malaria in the study region which should be responsible for the change in breeding and transmission pattern of the malaria vectors to account for the high incidence of *P. falciparum* infection detection (8, 9). Assaying the use of

insecticides to prevent malaria as another control measure revealed that 59.4% of the population who apply this measure were still tested positive for *P. falciparum* infection (Table 3). The significance of this discovery was further exacerbated by the findings that 66.9% of participants who did not use insecticides were found to be infected further confirms that an overwhelming environmental factor is responsible for the failing anti-malarial regimes employed by the study population. To this end, the proximity of bushes and gutters to the dwellings of the studied populace was accessed for which it was discovered that the highest recorded incidence of infection was among participants (119 out of 139, 85.6%) who reside close to such (Table 3). Almost half the populations of participants' living far away from bushes and gutters by at least 1 kilometer away from their places of residence were at risk (Table 3). The frequency of infection recorded among the high risk groups pertaining to individuals residing close to gutters and bushes is similar to data obtained in various studies across Nigeria, Africa and major developing countries (18, 19, 17, 20).

The major limitation of this study was that since it was carried out at a certain interval in time, it does not represent annual seasonal pattern of the disease. It is therefore conceivable that seasonal variations could and may have affected the findings in this study. Furthermore, the data obtained in this study does not embody that of the entire metropolis as the findings were obtained from only willing participants that attended the Murtala Mohammed Specialist hospital whilst the study was conducted.

5. CONCLUSION

As part of the Sustainable Development Goals mandate geared towards the global control and eradication of malaria, *Plasmodium falciparum* is the overarching dominant *Plasmodium* specie in Nigeria which impacts negatively on commerce, economy and tourism in the affected locale (16, 9). Findings from this study revealed a high prevalence of malaria among the males (69.66%) than the females(57.55%). The prevalence of malaria was highest for participants between age group 31-40 (76.9%) of the workforce age but highest overall for participants age 61 and above. The most significant observation was the high prevalence of *P. falciparum* infection amongst participants residing in urban areas (Table 2). The culmination of these two results buttresses the need for early, routine screening and treatment of malaria among the males in the study location. Additionally, in light of the use of WHO approved mosquito netting, only 43 participants' use the nets for which 51.2% were tested positive for *P. falciparum* infection. Also, in the face of a malaria endemic in Northern Nigeria, 66.9% of the study population who did not use insecticides were diagnosed with malaria. As environmental factors are generally considered to be the medium by which mosquito breed and spread, the number of participants diagnosed with malaria was highest amongst patients living in close proximity to gutters and bushes (Table 3).

In view of the sizable population at risk in this malaria endemic region of Nigeria, it is suggested that effective environmental sanitation, geared towards the clearing of bushes and gutters could substantially reduce the spread of mosquitos, hence reduce the incidence of malaria in endemic regions. The findings of this study would assist in decision making towards improved malaria prevention and control.

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