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Malaria Infection and Associated Risk Factors in Pyakasa Community in Abuja Municipal Area Council, FCT, Abuja, Nigeria

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Abstract
Malaria is a vector-born life-threatening disease transmitted by Mosquito and is widespread in many tropical countries, including Nigeria causing illness and death in diverse demographics. *The study, therefore,* determined the prevalence of malaria and associated risk factors among the residents of Pyakasa Community in Abuja Municipal Area Council (AMAC) of Abuja. A descriptive cross-sectional study was conducted among 423 participants, aged 2 to 80 years, who were randomly selected in the community. Malaria prevalence was determined by using malaria rapid diagnostic test (RDTs). Data on socio-demographic factors and associated risk factors were assessed through a structured self-interview questionnaire. Data collected were analyzed using Microsoft excel 2013 and SPSS version 27 software. The result of the data analysis showed that out of 423 participants, 259 (61.2%) of them had malaria infection. 66.0% of the males were infected, while 57.2% of the female counterparts had malaria infection. The age group of 2-10 years has the highest malaria infection rate of 66.7%, followed with those within the age cohort of 11-20 years who got 60.0% infection rate. Age-group of 21-30 years had 59.7% infection rate. Those of 31-40 years, 41-50 years and 51-60 years, had 56.6%, 58.5%, 50.0% and 33.3% infection rates respectively. Housing type (p=0.000), presence of waste (p=0.011), insecticide treated net (p=0.000), indoor residual spray (p=0.041), mosquito coil (p=0.000), presence of stagnant water (p=0.004) and history of malaria (p=0.004) where found to be the associated risk factors of malaria in the community. There is a significant relationship between education (p=0.000), occupation (p=0.001) and malaria infection. A multi-faceted approach, encompassing health education, improved access to preventive tools, environmental management, and sanitation practices, are crucial in combatting malaria and improving the overall health and well-being of the Pyakasa community residents.

Keywords: Pyakasa community, Mosquito, Prevalence, Malaria, Infection, Risk factors.

Introduction

Malaria is a vector-borne disease significantly influencing worldwide public health and putting approximately 3.4 billion individuals at risk. It is a fatal illness that is widespread in many tropical countries, including Nigeria and is caused by four known Plasmodium species namely: Plasmodium *vivax,* Plasmodium *falciparum*, Plasmodium *malariae* and Plasmodium *ovale* (WHO, 2018). Among the species, only Plasmodium *vivax* displays a presence across tropical, sub-tropical, as well as temperate climates. In tropical and sub-tropical regions, the infection of individuals persists due to Plasmodium *falciparum*, standing as the primary cause of a lethal form of malaria (Deress *et al*.,2019). Malaria continues to pose a significant challenge to public health, despite notable achievements and progress in enhancing well-being and reducing the impact of the disease, and ranks among the leading ten contributors to illness and death in diverse demographics, encompassing infants and toddlers under five years old, expectant mothers, senior citizens,

individuals with limited economic means, and those residing in impoverished rural areas without access to healthcare or the means of obtaining protective insecticide-treated bed nets (WHO, 2018). According to World Health Organization, in 2019, Nigeria was responsible for about a quarter (25%) of the approximately 229 million instances of malaria documented across the globe (WHO, 2020). Data collected from 85 malaria endemic nations reveals that the global burden of malaria escalated from 227 million cases in 2019 to 241 million cases in 2020, with most of the increase coming from African nations (WHO,2020). On a global scale, the year 2021 saw an estimated 247 million occurrences of malaria across reported 84 countries prone to the disease. This marked an increase from the 241 million cases reported in 2020, with the majority of this rise, stemming from nations falling under the purview of the World Health Organization African Region.

Being a significant focus of the Millenium Development Goals, the World Health Assembly set a crucial objective in 2005: to decrease malaria instances and fatalities by 75% from 2005 to 2015 (WHO, 2005). Consequently, in the last ten years, there has been a notable resurgence in interest regarding research and advancements in diagnostic techniques, medications and immunizations, as well as the creation of strategies to eliminate malaria. This effort led to a 30% global reduction in malaria incidence rates and a 34% decrease in Africa between 2000 and 2013 (Murray *et al.*,2013).

The incidence of malaria per 1000 individuals at risk went through a decline, dropping from 82 cases in 2000 to 57 cases in 2019. However, it subsequently experienced a slight rise to 59 cases in the year 2020. Notably, there was a stable pattern between 2020 and 2021 without any alteration in case of numbers. This increase in 2020 was directly linked to the influence of the COVID-19 pandemic on healthcare services. Moreover, the period between 2019 and 2021 saw an estimated additional 13.4 million cases attributed to disruptions caused by the COVID-19 pandemic (WHO, 2022). According to the world malaria report (WMP, 2022), 96% of malaria cases world wide were reported from 29 countries. Nigeria had the highest number of global malaria cases (27%), followed by the Democratic Republic of the Congo (12%), Uganda (15%), and Mozambique (4%) accounting for nearly half of all cases. Nigeria accounted for the highest global malaria deaths (31%), along with 3 other countries, the Democratic Republic of Congo (13%), the Niger (4%) and the United Republic of Tanzania (4%), making up over half of all malaria deaths globally (WHO, 2022). As reported by the World Health Organization in the year 2022, approximately 2.0 billion cases of malaria and around 11.7 million malaria-related fatalities were prevented on a global scale between 2000 and 2021. The majority of these prevented cases (82%) and deaths (95%) occurred in the WHO African Region, with the WHO South-East Asia Region accounting for a smaller proportion (10% of cases and 3% of deaths).

The spread of the disease is present across Nigeria, impacting a vast majority of the population with a 97% risk of contracting malaria. The time frame for malaria disease transmission varies, ranging from continuous transmission throughout the year in the southern regions to a duration of three months or less in the northern areas (Okwa *et al*.,2009). As a result, Nigeria documented the highest occurrence of malaria among all nations globally in 2007(FMOH, 2008). This situation has contributed to heightened levels of poverty due to unforeseen financial burdens associated with treatment, control, and preventive efforts. Additionally, the time that could be dedicated to work and education is squandered as a result of malaria-related illness, exacerbating challenging conditions in both rural and urban settings (Okonko *et al*., 2010).

Key contributors to the increased transmission of malaria encompass various elements, including demographic, environmental, and socio-economic factors. The demographic aspect comprises characteristics such as age and gender. While, the environment plays a role, with the availability of foliage and wooded areas promoting mosquito breeding sites. Climatic conditions, like temperature, humidity, and rainfall, also play a crucial role in supporting the

rapid proliferation of mosquito vectors. Moreso, socio-economic conditions, including educational level, occupation and income directly influence human vulnerability and treatment approaches. Extensive documentation of these influences exists, especially in past research conducted within rural and peri-urban areas (Awosolu *et al*., 2019).

The prevailing viewpoint suggests that the process of urbanization will result in a decline in the transmission of malaria. A recent study utilizing modelling techniques envisions a 53.5% decrease in malaria transmission by the year 2030. This reduction is primarily attributed to anticipated shifts in demographics (Saugeon *et al*.,2009). The rationale behind this connection lies in the notion that urbanization brings about enhanced infrastructure, improved housing that is more resistant to mosquitoes, greater availability of healthcare services, and a decrease in breeding sites for disease-carrying vectors. These vectors, responsible for malaria transmission, tend to favor clean water sources for breeding, which are scarce in polluted urban environments. Additionally, the higher proportion of humans to mosquitoes is believed to contribute to a lower rate of mosquito bites on humans. Despite these promising factors, malaria transmission remains persistent within African cities. In certain instances, the levels of transmission are even higher than those observed in the surrounding areas (Matthys *et al*., 2006).

The Nigerian environment has become a favorable environment for the spread of malaria infection due to the abundance of mosquito breeding sites, constant rainfall, unsanitary environmental conditions, ignorance, poor behavioral attitudes, and poorly planned socio-economic projects (Okorpiwu *et al*., 2018). Several research had been carried out in Abuja, FCT, Nigeria on the prevalence of malaria and its associated risk factors and none has been done in Pyakasa community. In an unexplored area such as the Pyakasa Community in AMAC, Abuja, there is need to gain a comprehensive understanding of malaria epidemiology and possible risk factors associated with the disease, thereby filling the knowledge gap. Therefore, this study is aimed at determining the prevalence of malaria and associated risk factors in Pyakasa community, AMAC, FCT, Abuja, in order to create more awareness, provide evidence-based for future references and proffer solutions to environmental sanitations as well as effective intervention strategies.

Materials and Method

Study Design

This was a cross-sectional descriptive study design of the prevalence of malaria infection and associated risk factors in Pyakasa Community, in Abuja Municipal Area Council, FCT, Abuja, Nigeria.

Study Area

Pyakasa is a satellite town with large rural area, in Abuja Municipal Area Council (AMAC) of Federal Capital Territory (FCT), Abuja, Nigeria. It is located along the Umaru Musa Yaradua Expressway, formally called Airport road. It is about 30 to 40 minutes drive to the central Business District and about 15 minutes' drive to the Nnamdi Azikiwe International Airport, Abuja. Abuja is situated in the North Central geopolitical zone of Nigeria, shares borders with Kaduna state to the North, Nasarawa to the South-East, Kogi to the South -West, and Niger state to the West. It spans a land area of 7,315 square kilometers.

The study site is a metropolitan slum characterized by weather and ecological factors, conducive to year-round malaria spread. The inhabitants of this region are primarily involved in agricultural activities, small-scale commerce, government employment, and business endeavors. A minority of the population is employed in professional sectors, and there are also retirees. Malaria transmission takes place consistently throughout the entire year.

FCT map showing Abuja Metropolitan Area Council (AMAC).

Map showing study area (PYAKASA) within AMAC

Study Population

The study population was made up of all individuals aged 2 to 80 years living in Pyakasa community, FCT, Abuja and environs for at least six months.

Ethical Consideration

Ethical clearance was obtained from the Ethics Committee of National Open University of Nigeria. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from all study participants before enrollment in the study. Participants were duly informed that they had the option to discontinue their involvement in the study at any point without any negative repercussions. Confidentiality of the data was ensured by using anonymous identifiers. Participants who tested positive for malaria were referred to nearby health facilities for treatment.

Sample Size Determination

A suitable size of 423 inhabitants of Pyakasa Community and environs aged 2 years to 80 years was chosen, using the formula; Z^2P (1-P) / e^2. According to Duguma *et al.* (2022) (with a 95% confidence level and a margin of error of 5% (0.05). Thus;

$$n = \frac{Z^2P(1-P)}{e^2}$$

n = Sample Size
e = 0.05 (margin of error)
Z = 1.96 (Statistical standard)
p = 0.5 (Previous population; estimation prevalence rate of malaria 50%)

$$n = \frac{(1.96)(1.96)(0.5)(1-0.5)}{(0.05)^2}$$

$$n = \frac{(1.96)(1.96)(0.5)(0.5)}{(0.05)^2}$$

n=384.16

Since we cannot have a fraction of a participant, 386.16 was rounded up to the nearest whole number, giving a sample size of 385. Adding 10% attrition (sample sizes are often subject to nonresponse and dropouts), the final sample size was: 385 + 38 (10% of 385) = 423

Therefore, a sample size of 423 participants was used.

Sampling Technique

A simple random sampling technique was used to select the sample participants. Since the study also adopted the questionnaire format, the participants were selected randomly and the questions given to them accordingly.

Study criteria

Inclusion criteria

1. Residents within the community and who have lived in the community for at least six months.
2. Participants aged 2 to 80 years.
3. Participants who were willing to comply and with the ability to provide informed consent.

Exclusion criteria

1. Children below 2 years of age and adults over 80 years.
2. Participants who decline to participate in the study or withdraw their consent at any stage will be excluded.
3. Participants who had cognitive impairments or mental health conditions that might impede their capacity to offer dependable answers or comprehend answers or comprehend the study protocols were not included.
4. Temporary residents or residents who have been living in the community for less than six months.

Data collection

Socio-demographic data

Data was gathered through a standardized interviewer-administered questionnaire (adapted from the household questionnaire of the malaria indicator survey by FMOH, 2008. Please refer to the appendix, annex A). The questionnaire was structured into six distinct parts and aimed to obtain insights regarding the socio-demographic characteristics of the participants (including age, gender, educational background, occupation and residence), environmental aspects (like the existence of stagnant water or exposed waste), housing conditions (such as type of building materials and usage of window nets), understanding of malaria, past experiences with malaria contraction, and actions taken for prevention.

Laboratory Analysis

With the assistance of a skilled Medical Laboratory Scientists from the community's primary health centre, blood specimens were obtained from the individuals for malaria diagnosis through the utilization of rapid diagnostic test (RDT) kits. This process involved cleaning the patient's ring finger with 70% alcohol and then puncturing it using a sterile safety lancet. A tiny 5 µl blood sample was collected using the provided micro-pipette via a finger-prick technique. The entire blood sample was introduced into the sample port labeled "S," while 110 µl of buffer solution was introduced into the buffer port labeled "B." The test results were then assessed after a waiting period of 20 minutes.

Data analysis

Data collected was entered on Microsoft excel and analyzed using IBM-SPSS software version 27. Descriptive statistics such as frequencies, percentages, and means were used to summarize the socio-demographic characteristics of the study population, knowledge of malaria prevention and control measures, and risk factors associated with malaria. Graphical presentation of the data was done using Microsoft Excel 2013. Chi-square test and logistic regression analysis was used to examine the relationship between malaria and associated risk factors.

The RDTs were used to detect the HRP-II (Histidine Rich Protein-II) antigen of Plasmodium falciparum in whole blood specimens. Individuals who yielded positive results for malaria were directed to the nearest healthcare facility for necessary treatment.

Results

This study involved four hundred and twenty-three (423) participants with the age-range of 2 year to 80 years, 194 males representing 46.0% and 229 (54.0%) of females were involved in the study. Of the 423 participants, 259 of them representing 61.0% were positive for malaria infection, while 164(39.0%) were negative. Age-group of 2-10 years had the highest infection, followed by 11-20 years with infection rate of 60.0%, while age-groups of 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61-70years and 71-80 years recorded infection rates of 59.7%, 56.6%, 58.5%, 50.0%, 33.3% and 0.0% respectively. The male participants had a 66.0% prevalence rate, while the female counterparts had 57.2% of the infection. Education, Occupation, Presence of waste, Insecticide treated net, and Presence of stagnant water were found to be associated risk factors of malaria infection in the area.

Table 1: Overall prevalence of Malaria infection in Pyakasa Community.

No Screened	No Positive (%)	No Negative (%)
423	259(61.2)	164(38.8)

Out of 423 participants screened, 259(61.2%) were infected with malaria infection, while 164 representing 38.8% of them were negative.

Table 2: Age-related prevalence of malaria infection in Pyakasa Community, FCT, Abuja.

Age groups	No Screened	No Positive (%)	No Negative (%)
2 – 10	105	70 (66.7)	35 (33.3)
11-20	92	55 (60.0)	37 (40.0)
21-30	87	52 (59.7)	35 (40.3)
31-40	53	30 (56.6)	23 (43.4)
41-50	41	24 (58.5)	17 (41.5)
51-60	18	9 (50.0)	9 (50.0)
61-70	27	9 (33.3)	18 (66.7)
71-80	0	0	0

Table 2: showed that Age-group of 2-10 years had the highest infection, followed by 11-20 years with infection rate of 60.0%, while age-groups of 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61-70years and 71-80 years recorded infection rates of 59.7%, 56.6%, 58.5%, 50.0% , 33.3% and 0.0% respectively.

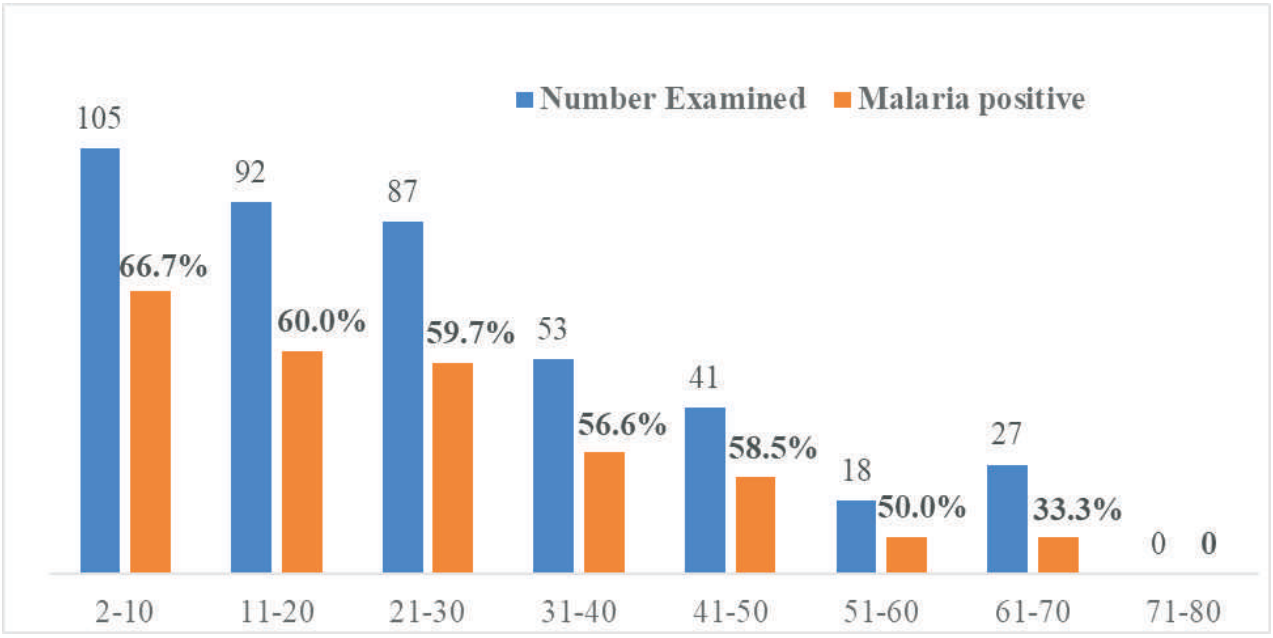

Figure 1: Age-related prevalence of malaria infection in Pyakasa Community, FCT, Abuja.

Table 3: Gender-related prevalence of malaria infection in Pyakasa Community, FCT, Abuja

Gender	No screened	No Positive (%)	No Negative (%)
Male	194	128 (66.0)	66 (44.0)
Female	229	131 (57.2)	98 (42.8)

Table 3 showed that the male participants had a 66.0% prevalence rate, while the female counterparts had 57.2% of the infection.

Table 4: Risk factors associated with malaria infection in Pyakasa Community, FCT, Abuja

Variables	No Screened	No Positive (%)	X^2	P-value
Age-groups				
2-10	105	70(66.7)	2.088	0.679
11-20	92	55(60.0)		
21-30	87	52(59.7)		
31-40	53	30(56.6)		
41-50	41	24(58.5)		
51-60	18	9(50.0)		
61-70	27	9(33.3)		
Gender				
Male	194	128(66.0)	3.406	0.080
Female	229	131(57.2)		
Educational Status				
None	75	51(68.0)	26.346	0.000*
Primary	169	116(69.0)		
Secondary	148	81(58.0)		
Tertiary	11	8(26.0)		
Occupational Status				
Artisan	27	20(74.0)	19.6	0.001*
Civil Servant	13	4(30.7)		
Farmer	69	52(75.3)		
Student	210	126(60.0)		
Trader	73	35(60.0)		
Unemployment	31	22(71.0)		
Presence of Waste				
Yes	223	180(80.7)	27.320	0.003*
No	200	110(55.0)		
Insecticide Treated Net				
Yes	190	70(36.8)	30.687	0.000*
No	233	197(84.5)		
Presence of Stagnant Water				
Yes	198	130(65.7)	29.869	0.002*
No	225	109(48.4)		

Table 4 showed that Education, Occupation, Presence of waste, Insecticide treated net, and Presence of stagnant water were the associated risk factors of malaria infection in the area.

Discussion

Malaria continues to pose a significant challenge to public health putting approximately 3.4 billion individuals at risk despite notable achievements and progress in enhancing well-being and reducing the impact of the disease (WHO, 2018). Malaria worldwide is a major health challenge to humans living in endemic regions, as such it could cause obstruction and/or delay in daily activities thereby leading to low productivity among the labor force due to absenteeism (Ughasoro *et al*., 2013) and great loss of lives, the cost of treatment of patients and the negative impact of the disease are also highly social and economic burden (Ukpai and Ajoku, 2001). In this cross-sectional descriptive study of prevalence and associated risk factors of malaria among the residents of Pyakasa Community in Abuja Municipal Area Council (AMAC), FCT, the overall prevalence of 61.2% constitute a major public health threat to the inhabitants of the Community and showed that malaria is endemic in the community. This may be attributed to a number of factors such as lifestyle of the residents, topography and population density (Umaru and Uyaiabias, 2015) as well as the effect of climatic factors such as temperature, humidity and rainfall which regulates the biology of development of both mosquitoes and parasites (Martin and Lebvre, 1995), and this is consistent with previous works of Emeka *et al*.(2021); Nas et al.,(2017); Awosolu *et al*.,(2021) and Jennifer *et al*.,(2016), who variously reported 72.0%; 84.0%; 55.0% and 51.0% in their respective works.

On the age-related prevalence, this study showed that the age-group of 2-10 years was severely affected with a prevalence rate of 66.7%, and this is in line with the works of Okoroiwu, (2021) and Olusegun *et al.* (2019) who reported high prevalence of 76.9% and 63.0% in their respective studies among children of the ages, 2-10 years bracket. This may be due to the fact that children below the age of 10 years might not have established sufficient immunity against malaria infection, as seen in their older counterparts. The World Health Organization in 2018 corroborated this fact when it emphasized the fact that children are the most vulnerable group of people, particularly in Africa. Therefore, attention should be given to the children, especially those under the age of 5 years. The gender-related prevalence of malaria infection in this study, showed that males were more infected with infection rate of 66.0%, while their female counterparts had 57.2% of the infection. This result agrees with the works of Awosolu *et al.,*2021 and Oladele *et al.,*2018, and this may be as a result of the fact that males are mostly engaged in outdoor activities or being involved in occupation in environment where mosquitoes are prevalent, such as farming and trading. Nevertheless, this is not in line with the works of Nas *et al.*,2017 and Emeka *et al*.,2021, who reported high prevalence of 54.0% and 77.0% in females than in males.

On the associated risk factors, the study revealed that educational status, occupational status, mosquito control, source of water, gender, housing type, presence of waste, insecticide treated net, indoor residual spray, mosquito coil, presence of stagnant water, toilet type and history of malaria were the associated risk factors of malaria in the Community and its environs. All these findings are strongly supported by Hill *et al*.,2020, Daguma *et al*.,2022; Ibrahim *et al*., 2022 and Dawaki *et al*., 2016 who had the same in their various studies.

In conclusion, the high prevalence of malaria underscores the urgency of implementing effective interventions to reduce the burden of the disease and addressing associated risk factors such as proper waste management, stagnant water issue and housing conditions can contribute to a comprehensive malaria control strategy. Health education and community-based interventions are essential in promoting better preventive practices such as consistent use of mosquito nets, insecticide sprays and sanitation practices are crucial in combating malaria and improving the overall health and well-being of the Pyakasa residents.

Conflict of Interest: No conflict or clash of interest

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References

Awosolu, O. B., Yahaya, Z. S., Farah Haziqah, M. T., Simon-Oke, I. A., & Fakunle, C. (2021). A cross-sectional study of the prevalence, density, and risk factors associated with malaria transmission in urban communities of Ibadan, Southwestern Nigeria. *Heliyon*; **7(1)**: e05975. https://doi.org/10.1016/j.heliyon.2021.e05975.

Awosolu, O.B., David, M.C., Lawal, A.O. & Ikuesan, F.A. (2019). Pattern of Malaria Parasitaemia and genotype Among Residents of Orita Obele, Akure South Local Government Area of Ondo State, Nigeria, *South Asian Journal of Parasitology; **3(2)**:1-5.*

Awosolu, O. B., Yahaya, Z. S., Farah Haziqah, M. T., Simon-Oke, I. A., Olanipekun, I. T., & Oniya, M.O. Epidemiology of falciparum malaria among residents of some rural and periurban communities in Ekiti State, Southwestern Nigeria. *Tropical Biomedicine;**38(1)**:* 14-21.

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., Ahmed, A., Al-Areeqi, M. A., Subramaniam, L. R., Nasr, N. A., & Lau, Y. L. (2016). Is Nigeria winning the battle against malaria Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. *Malaria Journal; **15***: 351. https://doi.org/10.1186/s12936-016-1394-3

Deress, T., & Girma, M. (2019). Plasmodium falciparum and Plasmodium vivax Prevalence in Ethiopia: A Systematic Review and Meta-Analysis. *Malaria Research and Treatment*; **2019**: https://doi.org/10.1155/2019/7065064.

Danguma, T., Nuri, A., & Melaku, Y. (2022). Prevalence of Malaria and Associated Risk Factors among the Community of Mizan-Aman Town and Its Catchment Area in Southwest Ethiopia. *Journal of Parasitology Research*: 3503317. https://doi.org/10.1155/2022/3503317.

Emeka, A., Eze, C.C., Okeke, C.E., Nweze, K.E., & Okemadu C.O. (2021). Prevalence and intensity of malaria infection and associated risk factors, in Anambra State, Nigeria. *World Journal of Biology Pharmacy and Health Sciences;* **07(03)**: 030-045.

FMOH, Federal ministry of Health. National Malaria Control Programme (2008), Nigeria Abuja, Strategic Plan 2009-2013. A Road Map for Malaria Control in Nigeria, June 2008. Draft 16,

Ibrahim, A. O., Bello, I. S., Shabi, O. M., Omonijo, A. O., Ayodapo, A., & Afolabi, B. A. (2022). Malaria Infection and its association with socio-demographics, preventive measures, and co-morbid Ailments among adult febrile patients in rural Southwestern Nigeria: A cross-sectional study. *SAGE Open Medicine*;***10**:* 20503121221117853. https://doi.org/10.1177/20503121221117853

Jennifer, O.A., Dogara, & Musa, M.A. (2016). Prevalence of malaria and risk factors among patients attending Dutse General Hospital, Jigawa State, Nigeria. *International Research Journal of Public and Environmental Health*;**3 (11)**: 270-277, DOI: 10.15739/irjpeh.16.033

Matthys, B., N'Goran, E. K., Koné, M., Koudou, B. G., Vounatsou, P., Cissé, G., Tschannen, A. B., Tanner, M., & Utzinger, J. (2006). Urban agricultural land use and characterization of mosquito larval habitats in a medium-sized town of Côte d'Ivoire. Journal of vector ecology: *Journal of the Society for Vector Ecology*; **31(2)**: 319-333. https://doi.org/10.3376 /1081-1710(2006)31[319:ualuac]2.0.co;2

Murray, C.J., Ortblad, K.F., Guinovart, C., Lim, S.S., Wolock, T.M., Roberts, D.A.(2014). Global, regional, and National incidence and mortality for HIV, tuberculosis, and malaria during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet;* **384**:1005-1070. doi: 10.1016/S0140-6736(14)60844-.

Nas, F.S., Yahaya, A., & Ali, M. (2017). Prevalence of Malaria with Respect to Age, Gender and Socio-Economic Status of Fever Related Patients in Kano City, Nigeria. *Greener Journal of Epidemiology and Public Health*; **5(5)**: 044-049. *DOI: http://doi.org/10.15580/ GJEPH.2017.5.091017126*

National Malaria Elimination Programme. (2019). National Malaria Strategic Plan

2019□2023. Abuja, Nigeria: Federal Ministry of Health. https://www.health.gov.ng/index.php□option=com_content&view=article&id=328&Itemid=550.

Okonko, I.O., Donbraye, E., Donbraye, E., Abubakar, M.J., Fowotade, A., Fadeyi, A., Babalola, E.T., Ojezele, M.O., & Adeyi, A.O (2010). Malaria parasitaemia among patients in Ibadan, Southwestern Nigeria. *Journal of Applied Bioscience*; **29**: 1774-1780.

Okoroiwu, I.A; Gideon, Okolo, M Okoronkwo, M.O (2018). Malaria Parasitaemia and Morbidity among the Staff of the National Open University of Nigeria, Victoria Island, Lagos, Nigeria. *NOUN Journal of Physiology and Life Science*; **2(1)**:24-37.

Okoroiwu, G. I. A. (2021). Assessment of Malaria Parasitaemia among the Residents of Abuja Municipal Area Council (AMAC), FCT, Abuja, Nigeria. *Journal of Applied Science and Environmental Management; **25(5)***: 787-792.

Okwa, O. O., Akinmolayan, F. I., Carter, V., Hurd, H. (2009). Transmission dynamics of malaria in four Selected ecological zones of Nigeria in the rainy season. *Annals of African Medicine*; **8:1-**9. doi: 10.4103/1596-3519.55756.

Olusegun-Joseph, T.S., Oboh, M.A., Godwin, O., Ovioma, G.O., Fagbohun, I.K., Okorafor, U., Aina, D.D. (2019). Differential prevalence of malaria infection in rural and urban out-patient clinics in Lagos state, Nigeria. *Pan African Journal of Life Sciences*: DOI:10.36108/pajols/9102/20(0140).

Oladele, O. V., Onuoha, S. C., Hamafyelto, H. S., *et al.* (2018). Prevalence of malaria infection among patients attending Murtala Muhammed Specialist Hospital, Kano, Nigeria. African *Journal of Clinical and Experimental Microbiology*; **19(3)**: 214-220.

Saugeon, C., Baldet, T., Akogbeto, M., & Henry, M. C. (2009). Will climate and demography have a major impact on malaria in sub-Saharan Africa in the next 20 years□ *Medecine Tropicale: Revue Du Corps De Sante Colonial;* **69(2)**: 203-207.

Umaru, M. L., & Uyaiabasi, G. N., (2015). Prevalence of Malaria in Patients Attending the General Hospital Makarfi, Makarfi Kaduna State, North-Western Nigeria. *American Journal of Infectious Diseases and Microbiology*; **3**: 1-5.

Ughasoro, C.N, Onyido, A.E., Obiukwu, M.O., Umeanaeto, P.U., Egbuche, M.C., & Obiechina, I.O. (2013). Stable endemic malaria in a rainforest community of Southeastern Nigeria. *Nigerian Journal of Parasitology and Public Health*; **6(3)**: 6-15.

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

World Health Organization (2005). 58th World health assembly. Technical document. Geneva:2005. http://www.who.int/nutrition/topics/WHA58.24_idd_en.pdf. Accessed 12 Jan 2016.

World Health Organization. (2022). World Malaria Report 2022. World Health Organization. https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022.

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https://dx.doi.org/10.4314/sokjmls.v9i4.25