VOL. 05 NO. 9,
AUGUST, 2024
E-ISSN 3026-958X
P-ISSN 3027-1169

African Scholar Publications & Research International
www.africanscholarpub.com

Journal of Science Innovation & Technology Research (JSITR)

Survey of Malaria Infection among In-Patients at Federal Medical Center Keffi, North Central, Nigeria

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Abstract
Malaria remains a major health concern in Nigeria. Despite efforts made in controlling the rate of infection, several people are still at risk of this parasitic infection. This study is aimed at surveying malaria infection among in-patients at Federal Medical Center Keffi, Nasarawa State between the period of August 2023 to August 2024. Five milliltres (5mls) of blood was collected from the patient using a well labeled ethylene diamine tetraacetic acid tubes and malaria parasites were examined using Giemsa stained microscopy. Out of the 400 blood samples collected, 142 (35.5%) were positive for malaria infection. Females had higher prevalence 95 (66.6%) than the males 47 (33.0%), there was signifiacnt diffence between males and females variable ($p>0.05$). Age groups 6–10, 11–20 and 3–40 had the highest prevalence of 26 (18.3%), 26 (18.3%) and 25 (17.6%) while that of 41–50 had the least infection 13 (9.1%). With respect to occupation, civil servants are more prone to the infection 29 (20.4%) followed by traders 27 (19.0%), the least infected were the house wives 14 (9.8%). Patients who hails from rural areas had higher rate of infection 92 (64.7) than those from the urban settings 50 (35.3%). With respect to their educational background, the non educated had higher rate 98 (69.0%) of infection than the educated ones 44 (30.9%). An overall prevalence of 35.5% was observed among in-patients in the study area. This prevalence calls for concern and warrants urgent attention for the implementation of effective preventive and control strategies within the metropolis and satellite towns receiving medical care at the center.

Keywords: In-patients, Keffi, Malaria, Parasites Patients.

Introduction
Malaria constitutes a significant public health challenge in Nigeria, with an estimated 69 million cases and 194,000 fatalities attributed to the disease in 2021 (World Health Organization [WHO], 2022). Nigeria bears the highest malaria burden globally, representing almost 27% of the worldwide malaria load. The risk of malaria transmission persists across the nation throughout the year. Malaria continues to stand as a crucial human ailment in tropical and subtropical regions worldwide, with an

estimated 249 million cases reported in 85 countries in 2022, marking a rise of 5 million cases from 2021, with Nigeria prominently contributing to this surge in infections (WHO, 2023). The Federal Ministry of Health in Abuja disclosed that a minimum of 50.0% of Nigerians grappled with varying forms of malaria, solidifying its status as the most paramount health issue in Nigeria (Amini *et al.,* 2020). The elevated prevalence and transmission rate of malaria stem from the diverse breeding grounds of mosquitoes, encompassing reservoirs such as tins, cans, discarded tires, tree hollows, cisterns, stagnant pools, drains, streams, and ponds (Grech *et al.,* 2019; Oguche *et al.,* 2022). This study's objective is to enlighten the public and enrich the existing literature by investigating malaria infections in in-patients seeking care at a Federal Medical Centre (FMC) in Central Nigeria.

Materials and Methods

Study Area

This study was carried out in Keffi metropolis, the administrative center of Keffi Local Government Area in Nasarawa State, Nigeria. Keffi is located approximately 58km from the Federal Capital Territory (Abuja) and 128km from Lafia, the capital of Nasarawa State. Positioned at latitude 8° 5′ North and longitude 7°5′ East, Keffi sits at an elevation of about 850 meters above sea level. According to the national population census of 2006, Keffi has a population of 92,664, making it the second most populous city in the State (Akwa *et al.,* 2007).

Duration of Study

The research was carried out over the course of one year (from August 2023 to August 2024).

Sample Size Determination

The sample size was determined by utilizing the formula proposed by Bartlett *et al.* (2001) for calculating the appropriate sample size in a prevalence study.

$$n = \frac{p(100-p)\mathrm{z}^2}{E^2}$$

n is the required sample size
P is the percentage occurrence of a state or condition
E is the percentage maximum error required
Z is the value corresponding to level of confidence required

Therefore, the total number of subjects screened in this study was four hundred (400) after substituting the variables.

Ethical Consideration

After a successful defense of the research proposal in the Committee's ethical screening interview, the study obtained ethical approval from the Health Research Ethics Committee at the Federal Medical Centre in Keffi, Nigeria (FMC/KF/HREC/0205/23). The approval was granted on the condition that the research would strictly adhere to internationally recognized ethical standards governing research practices, and that all rights and privileges of the voluntary participants would be upheld.

Administrative clearance for this investigation was secured from the Head of the Laboratory Department at the Federal Medical Centre in Keffi, and consent was obtained from the participants.Sample Collection.

Samples Collection

The inclusion criteria for this investigation were predicated on the patient's presentation of symptoms akin to those characteristic of malaria infections, such as discomfort, elevated body temperature, and queasiness. A volume of five milliliters (5mls) of whole blood was extracted from the patient using a properly labeled EDTA tube (WHO, 2010; Center for Disease Control [CDC], 2020).Examination under a Microscope.

Microscopy Analysis

Microscopic examination was conducted at the Federal Medical Center in Keffi. Thin and thick blood films were meticulously prepared on identically labeled slides using peripheral blood samples in the field. The slides were meticulously fixed in methanol and subsequently stained with a 10% Giemsa stain solution for a duration of ten minutes. The Giemsa stock solution was appropriately diluted with distilled water of pH 7.2. Following the staining process, the excess stain was delicately washed off, and the slides were allowed to air-dry before meticulous examination under a ×100 oil immersion lens (Cheesbrough, 2017). The blood slides were meticulously scrutinized by a certified medical laboratory scientist.

Data Analysis

The data generated were entered in Microsoft Excel Spreadsheet and analyzed using SPSS version 23.0. Simple frequencies and tables were generated, while categorized variables were compared using Chi-square test. P-value less than 0.05 ($p<0.05$) was considered statistically significant.

Results

Malaria infection among In-patients attending Federal Medical Centre Keffi in terms of demographics.

Out of the total of 400 patients examined for malaria parasite in this study, 142 (35.5%) were infected with malaria infections. Females had higher prevalence 95 (66.6%) than the males 47 (33.0%), statistically, there was no signifiacnt diffence between males and females variable ($p>0.05$) (Table 1).

Among the age groups, patients who are 6–10 and 11–20 had the highest infection rate of 26 (18.3%), 26 (18.3%) followed by age 31-40 who had 25 (17.6%), then age groups that are less than five (<5) and above fifty years had 21 (14.7%) each, then 21-30 years ha 19 (13.3%), the least infection of 13 (9.1%) as found in age groups 41-50 years, however, there was a significant difference statistically among the age groups with the exception of age 6-10 which showed no significant difference ($p>0.53$) (Table 1).

With respect to occupation, civil servants are more prone to malaria infection having a prevalence rate of 29 (20.4%) followed by traders 27 (19.0%), then the unemployed ones had

a prevalence rate of 26 (18.3%), then farmers 24 (16.9%) followed by the students 2 (15.4%), the least infected were the house wives 14 (9.8%), statistically, there was no significant difference among the patients occupation (Table 1).

Patients who hails from rural areas had higher rate of infection 92 (64.7) than those from the urban settings 50 (35.3%) and with respect to their educational background, the non educated had higher rate 98 (69.0%) of infection than the educated ones 44 (30.9%). The observed malaria infection rate of 33.5%, there was a significant difference among the predisposing factors associated with malaria infections in in-patients in Federal medical center Keffi ($p<0.05$) (Table 2).

Table 1: Malaria in In-patient Attending Federal Medical Centre Keffi based on demographics

Demographics	No. Examined	Positive Microscopy (%)	df	p-value
Gender				
Males	158	95 (33.0)	1	
Females	132	47 (69.9)		0.068
Age				
<5	36	21 (14.7)	6	
10-Jun	50	26 (18.3)		0.535
20-Nov	48	26 (18.3)		0.017
21-30	72	19 (13.3)		0
31-40	55	25 (17.6)		0.091
41-50	45	13 (9.1)		0
>50	45	21 (14.7)		0.011
Occupation				
Farmers	53	24 (16.9)	5	
Civil Servant	75	29 (20.4)		0.442
Traders	81	27 (19.0)		0.159
House Wife	40	14 (9.8)		0.306
Students	84	22 (15.4)		0.034
None	67	26 (18.3)		0.366
Total	**400**	**142 (35.5%)**		

Table 2: Predisposing factors associated with Malaria in In-patient Attending Federal Medical Centre Keffi.

Risk factors	No. Examined	Positive Microscopy (%)	df	p-value
Educational Background				
Educated	162	44 (30.9)	1	
Non-educated	238	98 (69.0)		0
Residence				
Rural	217	92	1	

Urban	183	50	0.002
Total	400	142 (35.5)	

Discussion

This current result revealed that out of the 400 blood samples examined for malaria parasite in this study, 35.5% were infected, this is in accordance with the findings of Abah *et al.* (2017) who investigated the prevalence of malaria infection and socioeconomic status of some residents of Portharcourt metropolis in Rivers State Nigeria, and comparable to the ork of Oviedo *et al.* (2023). The findings of this study is lower than that of Mac *et al.* (2019) who had the prevalence rate of 54.4% and higher than the 15.83% prevalence rate documented by Kurmi *et al.,* 2023 in a study in Bauchi State of Nigeria.

Females had higher prevalence (66.6%) than the males (33.0%), the is in accordance with the work of the report of Otojareri, *et al.* (2023), Jemimah, *et al.* (2019) Quaresima *et al.* (2021) and Briggs *et al.* (2020) who stated that men do more self-medication than females, when they are sick they just go to the pharmacy shop because they want to appear healthy and also women are more likely to be infected as a result of wearing outfits that exposes their body parts and also trading which is one of the most commonactivity in this region. The study contradicts the report of Zeleke, *et al.* (2023), Madkhali *et al.* (2022) and Runmomkun *et al.* (2019), who stated that males may be more prone to the disease than the females.

This study revealed that malaria prevalence is linked to two factors which include level of education and residence (settlement patterns) and is in line with the findings of Benjamin *et al.,* (2019) who studied demographic factors associated with malaria in Zaria, Kaduna State Nigeria, and found out that the highest prevalence was detected among individuals who are not educated. Also, in their study of the prevalence, trends, and associated factors of malaria in the Shai-Osudoku District Hospital, Ghana, Tatteh *et al.,* (2023) recorded higher rate of malaria infection among the uneducated and rural dwellers compared to the educated and urban dwellers.

Conclusion

The study's findings of a 35.5% prevalence of malaria indicate a significant public health concern, highlighting the ongoing burden of the disease in the area studied. This high prevlenceunderscoresthe need for intensified malaria controland prevention efforts, including enhanced public health education, improved access to treatments and the implementation of more effective vector control strategies. Addressing these factors will be crucial in reducing the incidence of malaria infection and improving the overall community health.

Acknowledgement

We express our sincere gratitude to all the patients who graciously participated in this study, members of parasitology unit, Federal Medical Center Keffi for their unwavering support and invaluable guidance throughout the duration of this research.

Conflict of Interest

The authors declare no competing interest.

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