PRINT ISSN 1119-8362
Electronic ISSN 2659-1499

Full-text Available Online at
https://www.ajol.info/index.php/jasem
https://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 28 (5) 1421-1424 May 2024

Prevalence and Distribution of Falciparum malaria in Orita Obele and Gbogi Communities of Akure, South-western Nigeria

***[1,2]AWOSOLU, OB; [2]OLUOKUN, DI**

**[1]School of Biological Sciences, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia*
[2]Department of Biology, Federal University of Technology, Akure, Nigeria.

**Corresponding Author Email: obawosolu@futa.edu.ng*
**ORCID: https://orcid.org/0000-0002-5213-7397*
**Tel: +2348101130381*

Co-Author Email: oluokundamilare@gmail.com

ABSTRACT: Malaria is a devastating parasitic disease across the world particularly in Nigeria. This study investigates the prevalence and distribution of falciparum malaria in Orita Obele and Gbogi communities of Akure, Southwestern Nigeria. Standard parasitological method of thick and thin smear was employed and the malaria parasites were identified through microscopy. Overall prevalence of 171 (57.0%) was recorded. Sex related prevalence showed that more males were infected with 79 (60.8%) than females with 98 (57.6%). The differences in prevalence between males and females was significant (P<0.05). Individuals within the age group of less than 10 had the highest rate of infection 38 (76.0%) while individuals within the age group of 51 to 60 had the least rate of infection 10 (37.0). Furthermore, Orita Obele had a higher malaria prevalence (58.6%) compared to Gbogi (53.9%). Conclusively, there is need for sustainable interventions and awareness campaign among the residents of Orita Obele and Gbogi in order to enhance reduction of malaria parasite to the desired zero level.

DOI: https://dx.doi.org/10.4314/jasem.v28i5.12

Cite this Article as: AWOSOLU, O. B; OLUOKUN, D. I. (2024). Prevalence and Distribution of Falciparum malaria in Orita Obele and Gbogi Communities of Akure, Southwestern Nigeria. *J. Appl. Sci. Environ. Manage.* 28 (5) 1421-1424

Dates: Received: 21 February 2024; Revised: 22 March 2024; Accepted: 20 April 2024 Published: 09 May 2024

Keywords: Parasitic diseases, Malaria parasites, Prevalence, *Plasmodium falciparum*, Urban communities.

Malaria is an Apicomplexan parasitic disease caused by parasite of the genus *Plasmodium* and transmitted by female Anopheles mosquitoes. It is a devastating disease of major public health problem, particularly in the tropical and sub-tropical regions of the world. The World Health Organization (WHO) estimated that more than half of the world's population were at risk of contracting malaria infection in 2017 (Snow *et al*., 2005, WHO, 2018). Additionally, there were an estimated 228 million alarming cases and 405 000 deaths due to malaria in 2018 (WHO, 2019). In sub-Sahara Africa, particularly Nigeria, malaria is heavily endemic and elimination of this deadly disease proves to be unrealistic, as a result of avoidable factors such as poor socioeconomic development, highly adapted mosquito vector with great vectorial capacity, lack of adequate support from government, ignorance and even drug resistance (Yeka *et al*., 2012, Wielgosz *et al*., 2014). Controlling malaria in Ondo state requires an ongoing monitoring process and as such studies on malaria prevalence, risk factors and appropriate intervention strategy including mass distribution of insecticide mosquitoes treated bed net have been conducted in recent years (Dada *et al*., 2016, Simon-Oke *et al*., 2016, Adepeju, 2017, Awosolu *et al*., 2019). However, there is need to

**Corresponding Author Email: obawosolu@futa.edu.ng*
**ORCID: https://orcid.org/0000-0002-5213-7397*
**Tel: +2348101130381*

speed-up malaria elimination strategy in endemic regions such as Ondo State. Depending on obsolete data necessary for malaria control could be misleading. Therefore, there is a need for adequate and current epidemiological information upon which control could be based. Thus, this study was carried out to investigate the prevalence and distribution of falciparum malaria in Orita Obele and Gbogi communities of Akure, Southwestern Nigeria.

MATERIALS AND METHODS

Study Area: The study was carried out at Basic Health Centre, Orita Obele, Akure and First Mercy Specialist Hospital, 19C Gbogi, Akure South Local Government Area of Ondo State, Nigeria. Akure South has an area of 331 km^2 and population of 353,211.

The area lies within the zone of moderate annual rainfall of about 1,300 to 1,700 mm while humidity is relatively high during the wet season and low during the dry season with temperature varying between 22°C and 31°C throughout the year. The residents living in these areas are civil servants, traders, teachers, artisans, students and farmers.

Study Design: The study employed a cross-sectional and hospital-based design. It was conducted between the period of February and September 2019 at two different hospitals namely: Basic Health Centre Orita Obele, Akure and First Mercy Specialist Hospital, 19C Gbogi Street, Akure. Specimens were prepared and examined in the Department of Biology Laboratory, Federal University of Technology Akure.

Study Population: The study includes volunteer individuals visiting Basic Health Centre Orita Obele, Akure and First Mercy Specialist Hospital, 19C Gbogi Street, Akure. The population consists of age ranges of 10-82 years, with different occupations and status such as teachers, traders, students, civil servants, farmers and pregnant women.

Ethical Consideration: Ethical approval for the study was obtained from Ondo State Ministry of Health. Written informed consent from all the participants was also obtained. The participants were informed that participation in the research was voluntary and they could opt out at any stage of research.

Sample Size: A total of 300 blood samples were collected from different individuals who volunteered for examination of malaria parasites. The sample size was determined using the following equation (Lwanga and Lemeshow, 1991)

$$n = \frac{Z^2\, pq}{d^2} \quad (1)$$

78.3% prevalence of malaria infection from previous study was used (Awosolu *et al*., 2020).

Where; n =minimum sample size; z =Percentage point of standard normal distribution curve defined by 95% confidence interval which give rise to 1.96. P =prevalence from previous study = 78.3%; q =1-p; d =Maximum sampling error allowed at 95% confidence limit that is 0.05

Therefore z =1.96; P =78.3=0.783; q=1-p=1-0.783=0.217

$$n = \frac{(1.9)^2\,(0.783)(0.7)}{(0.05)^2} = 261.0 \quad (2)$$

A total of 300 volunteer individuals were finally selected to minimize the statistical error.

Collection and Preparation of Blood Samples: Blood samples were collected intravenously with the aid of a 5mL syringe and with the assistance of a Science Laboratory Technologist into an ethylenediaminetetraacetic acid (EDTA) to prevent the blood from clotting and ensure proper preservation of the samples. Thereafter, thick and thin blood smear were prepared and viewed under x 100 objective lens of the light microscope to determine the presence or absence of *P. falciparum.*

Microscopic Examination: This involves the examination of red blood cells for intracellular malaria parasites. 200 fields under 1000× magnification was examined from the thick film before the slide was considered negative. Parasite density was recorded as number of Parasite/µL of blood, assuming an average leucocyte count of 8,000/ µL of blood of an average individual.

$$PD(parasites\ per\ micro\ litre) = \frac{NPC}{NL} \times 8000 \quad (3)$$

Where PD = parasite density; NPC = number of parasite counted; NL = number of leucocytes

Data analysis: Data were analyzed using Statistical Package for Social Science (SPSS) version 22.0 using descriptive statistical analysis. The malaria parasite density was explored using Student's t-test to obtain dichotomous variable while variable with more than two levels were obtained using the one-way analysis of variance. Differences in prevalence of malaria were

determined by Chi square test. *P-value* less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Out of the 300 blood samples obtained, 170 (56.7%) were females, while 130 (43.3%) were males. A total of 171 (57.0%) were positive for malaria infection while 129 (43.0%) were negative.

Prevalence of malaria infection in relation to sex and age: Prevalence of *P. falciparum* with respect to sex from Table 1 showed that males had the highest rate of infection (60.8%) while females had a slightly lower rate of infection (57.6%). The results were statistically significant (P<0.05).

Table 1: Prevalence of *Plasmodium falciparum* in relation to sex

Variables	Number Examined	Prevalence	Prevalence (%)
Sex			
Male	130	79	60.8
Female	170	98	57.6
P value	300	171	< 0.05
Total			57

With respect to age groups, the results revealed that individuals less than 10 years of age had the highest rate of infection (76.0%) while the age group of 51 to 60 had the least rate (37.0%) of infection (Table 2). There was significant difference (P<0.05).

Table 2: Prevalence of *Plasmodium falciparum* in relation to age

Variables	**Number Examined**	**Prevalence**	**Prevalence (%)**
Age group (years)			
<10	50	38	76.0
11-20	60	32	53.3
21-30	72	30	41.7
31-40	46	31	67.4
41-50	30	19	63.3
51-60	27	10	37.0
>60	15	11	73.3
P-value			< 0.05
Total	**300**	**171**	**57**

Prevalence of *Plasmodium falciparum* in relation to location: Table 3 showed the overall prevalence of malaria infection in the study areas. Orita Obele had the highest level of infection (58.6%) compared to Gbogi (53.9%). The results differed significantly (P < 0.05).

Table 3: Prevalence of *Plasmodium falciparum* in relation to location (n=300)

Location	Number Examined	Prevalence	Prevalence (%)
Orita Obele	198	116	58.6
Gbogi	102	55	53.9
P value			< 0.05
Total	**300**	**171**	**57**

Malaria disease is a major public health problem worldwide particularly in Nigeria. The epidemiological information from this study reveal that malaria is still endemic in Akure. This agree with other studies conducted in Akure recently (Simon-Oke *et al*., 2016, Awosolu *et al*., 2019, Awosolu *et al*., 2020). This has been attributed to many prevailing factors enhancing the continuous transmission. These include but not limited to socioeconomic condition of the populace and environmental factors such as rainfall, temperature and humidity (Huang *et al*, 2011, Bai *et al*., 2013; Okoronkwo, 2013; Onyiri, 2015; Dawaki *et al*., 2016; Okunlola *et al*., 2019). In relation to sex, the outcome indicated that males had a higher prevalence than that of females. This may be as a result of the exposure pattern of male gender since they are usually involved in many activities outdoor which expose them to mosquito bites. This agrees with study conducted by Cotter *et al* (2013) who revealed that malaria affects both males and females due to variation in gender roles and gender dynamics which in turn give rise to different vulnerabilities, such as exposure patterns.

In relation to age, the results revealed that age groups less than 10 had the highest malaria prevalence. This finding agrees with the reports from other studies (Bassey and Nwakaku, 2017; Okonko *et al*., 2010). Malaria is most prevalent among children due to low immunity, poor living conditions and exposure to mosquito vectors (Awosolu *et al*., 2020). Furthermore, age group 51 to 60 years in this study had the least malaria prevalence. This may be as a result of their low level of exposure to mosquito bite, attitude towards health care, immunity and appropriate prevention methods (Okonko *et al*., 2010). Thus, all age group either young or old must always apply preventive measures to prevent mosquito bites while hospital checkup are carried out from time to time.

*Conclusions***:** Conclusively, it is apparent that malaria parasite is still prevalent in this study area and it poses a great public health problem to the residents in these locations. Thus, control measures should be deployed to these areas as appropriate. Individuals resident in these areas should also take cognizance of available preventive measures as appropriate.

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