

The Prevalence of Malaria Infection among Patients attending the Health Centre of the Federal University of Technology, Akure, Nigeria.

Abstract

Aim: This study determined the prevalence of malaria among patients that reported for malaria test at the Health Centre of the Federal University of Technology, Akure.

Place and Duration of Study: The research was carried out in the Health Centre of the Federal University of Technology, Akure, Ondo State, Nigeria between January to December 2015.

Methodology: Prior the commencement of the research work, approval was given by the Health Research Ethics Committee (HREC) of the University. A total of 2,616 patients were examined, out of which 1,253 were males and 1,363 were females. Information about sex, age, status (Student and Staff) and date of collection of each patient whose blood sample was collected were recorded. Malaria parasite screening was done using the thick blood film microscopy technique with Giemsa stain while Chi-square analysis was used to analyze the data obtained from the study.

Results: The results showed that the highest prevalence of 91.1% was recorded among the children aged 1-10, followed by age 21-30 (79.7%) while the lowest prevalence of 56.8% was recorded among the age group above 60 years. Also, high prevalence of 79.7% was recorded during wet season (March to October), while a lower prevalence of 75.4% was recorded during dry season (November to February) with significant difference at $P = 0.001$.

Conclusion: The result showed that there was high prevalence of malaria infection throughout the year among the patients. There is a need for constant check on all possible predisposition factors that could be responsible for the high prevalence, which could be achieved through public enlightenment on effective malaria control programs such as the use of insecticide treated nets, environmental management and sanitation and perfect engineering works.

Key words: Prevalence, Malaria infection, Patients, Health Centre, Nigeria.

1. Introduction

Human malaria is a protozoan disease that is widely distributed in the tropics [1]. It is caused by the protozoan parasite of the genus *Plasmodium*. The disease is transmitted to man through the bite of an infected arthropod vector of some species of *Anopheles* mosquito.

Five species of *Plasmodium* can infect and be transmitted by mosquito species [2]. Out of the five, most deaths are caused by *Plasmodium falciparum* but *P. vivax*, *P. ovale*, *P. malariae* and *P. knowlesi* generally cause a milder form of malaria [2],[3]. In Africa, *P. falciparum* is the major cause of the most severe form of malaria which accounts for over 60% of outpatient visits and 30% of hospital admissions in Nigeria [4].

Malaria is a complex disease that varies widely in epidemiology and clinical manifestation in different parts of the world. This variability is caused by factors such as the species of malaria parasites that occur in a given area, their susceptibility to commonly used or available antimalarial drugs, the distribution and vectorial capacity of mosquito vectors, climate and other environmental conditions and the behaviour and level of acquired immunity of the exposed human populations. In particular, young children, pregnant women, and non-immune visitors to malaria endemic areas are at greatest risk of severe or fatal illness [5].

With the rate of deaths; approximately 40% of the world's total population, mostly those living in the world's poorest countries are at risk of malaria, and is found throughout the tropical and sub-tropical regions of the world. More than three hundred million (300m) acute illnesses and at least one million (1m) deaths are been recorded annually due to malaria infection, there is therefore a need for constant research to be carried out in endemic areas to know the prevalence of this infection and all possible factors that could be responsible.

Comment [RGK1]: You say "staff and students" in the methodology

Comment [RGK2]: Were they ill? Were they symptomatic or was this a routine diagnosis for anybody at this health center? How was malaria defined?

Comment [RGK3]: How were they selected?

Comment [RGK4]: It is customary to write both number and percentage.

Comment [RGK5]: What is the current strategy for malaria control in Nigeria?

Comment [RGK6]: Of all factors related to malaria transmission, the number, human biting habits and longevity of the mosquito vectors are the most important. Which other ones were checked for this research?

Comment [RGK7]: Public enlightenment? Knowledge of which malaria control strategies are most cost effective is more important for a program to have some impact. What useful information does this research provides to the malaria program of Nigeria?

Comment [RGK8]: [2,3]

Comment [RGK9]: Why not concentrate in one or two more specific and attainable factors? I cannot make out the proposed objectives for this research in this paragraph.

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2. Materials and Methods

2.1 Study Area

Federal University of Technology (FUTA) is located in Akure the capital city of Ondo State, Southwest Nigeria. Akure is located in the rain forest zone between latitude 7°15'0"N and longitude 5°11'42"E. Akure has two seasons, which includes the rain (wet) season that ranges from March to October and the dry season that ranges from November to February. Akure has an average annual rainfall of 2378 mm, with temperatures ranging from 25.2 to 28.1 °C and relative humidity of 80%. The University Health Centre is located at Obaekere region of the Campus which attends to both Staff and Students of the University.

2.2 Ethical clearance

Prior the commencement of the research work, approval was given by the Health Research Ethics Committee (HREC) of the University, the chief medical director of the health Centre and from patients for collection of blood who were clearly informed on the aims and objectives of the research.

2.3 Blood Sample Collection

Both staff and students who were in the health centre within the time frame of the research for malaria test were selected for sampling. With the use of needle and syringe, through the vein, two to three milliliter of blood were collected from patients who came for malaria test in the Health Centre. The collection was done through the help of the laboratory technologist. After collection, the blood samples were transferred into an Ethylenediamine tetra-acetic acid (EDTA) container to prevent coagulation of the blood sample. Daily blood collection was done from January 2015 to December 2015.

2.4 Malaria Parasite Screening

Thick blood film microscopy was done for malaria screening. With the use of pasteur pipette, two drops of blood from the EDTA bottle was taken and placed on a clean grease-free glass slide, after which it was stained with Giemsa stain and allowed to dry for 15 minutes [6]. After 15 minutes, the stain was washed off rapidly with distilled water and allowed to dry. Two drops of immersion oil was added to the film and then viewed under the microscope at x100 objective lens for characteristic features of malaria parasite [7].

2.5 Weather data collection

Data of average rainfall and temperature of each month in year 2015 was obtained from the meteorology Department of the Federal University of Technology, Akure.

2.6 Statistical Analysis

Prevalence was calculated using the formula; $Prevalence = \frac{Numbers of Positive Samples}{Total Number Examined} \times 100$.

The data generated were analyzed using the Statistical Package for the Social Sciences (SPSS) version 19. The statistical parameter that was used for the analysis of the data was the Pearson's Chi-Square Test, P at 0.05. All charts were created using Microsoft Excel.

3. Results

3.1 Prevalence of Malaria among Patients

A total of 2,616 Staff and Students who were symptomatic were tested for malaria parasite, out of which 2,058 (78.7%) were positive for malaria parasite. Their results were taken to the medical Doctors and were given appropriate prescriptions of drugs.

3.2 Monthly Prevalence of Malaria infection in relation to mean rain fall and temperature

The month of November with an average rainfall and temperature of 78mm and 27.2°C respectively recorded the highest prevalence of 95.6% of malaria infection while the month of October with an average rainfall and temperature of 287mm and 26.2°C respectively recorded the lowest prevalence of 45.2% of

Comment [RGK10]: For those of us not familiar with Nigeria geography, how far is Obaekere region from the patient catchment area? 10 Km? one day driving? Across the street? How long did it take between sample collection and examination?

Comment [RGK11]: ...of the university?? Are there any one year olds at the university as students!?

Comment [RGK12]: Is the staff different every day? By staff you mean staff from the clinic? Public schools staff? University staff? This explanation is not acceptable. You have to state how the participants were selected. The first ten to arrive at any one day? Every third staff? Only those with fever? What kind of students? From where? Did you have any exclusion parameters? Did you ask whether they were taking antimalarials? When was the last time they were sick? Took antimalarials? How often they came for malaria check to the clinic? Etc. Please explain carefully and clearly.

Comment [RGK13]: You still are not clear. Do you mean, just place the drops on the slide? No spreading to prepare a thick smear? No thin smear on the same slide? No allowing the "drops of blood" to dry? From this I gather you are not familiar with malaria smear preparation. Not accepted.

Comment [RGK14]: Need for capital letters? Throughout the Ms there is improper use of capital letters.

Comment [RGK15]: Out of how many? What is the total population between staff and students? Are all of them new participants? How many repeats are there?

Comment [RGK16]: Nowhere are symptoms explained. What did those participants complain of? what is your definition of malaria? Nowhere is this defined.

101 malaria infection. Statistical analysis revealed that there was a significant difference ($P = 0.01$) in the
102 prevalence of malaria for the months (Figure 1a and Figure 1b).
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104 **3.3 Prevalence of Malaria infection in relation to Sex.**

105 A total of 1,253 (47.9%) male and 1,363 (52.1%) female patients were tested out of which 973 (77.7%)
106 and 1,085 (79.6%) were positive respectively. There was significant difference in the prevalence of
107 malaria infection between the sexes ($P = 0.001$) (Figure 2).
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109 **3.4 Prevalence of Malaria infection in relation to Status (Staff and Students)**

110 Figure 3 shows the Prevalence of Malaria infection in relation to Status. A total of 1,878 (71.8%) Students
111 were tested out of which 1,592 (84.8%) were positive while out of 738 (28.2%) Staff that were tested 466
112 (63.1%) were positive. Statistical analysis showed that the prevalence of malaria was statistically
113 significant ($P = 0.001$).
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115 **3.5 Prevalence of Malaria Infection in relation to Age Group**

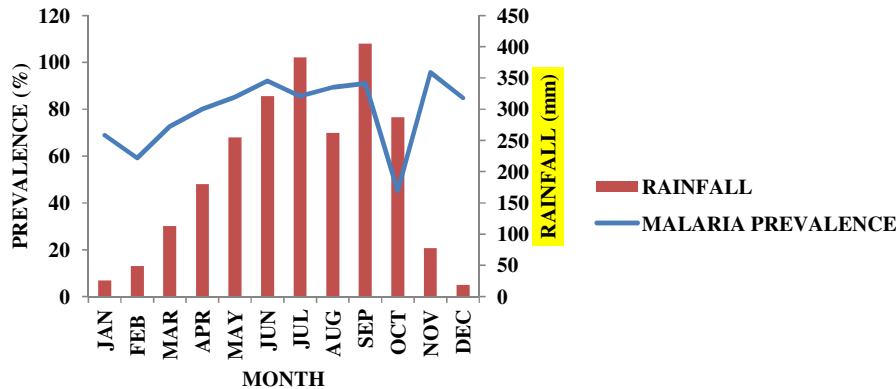
116 Table 1 shows the prevalence of malaria infection in relation to age group. The highest prevalence of
117 malaria infection of 91.1% was recorded in the age group 1-10 years, followed by age groups 21-30
118 (79.7%), 11-20 (79.2%) while the lowest prevalence rate was recorded in age group above 60 years
119 (56.8%). Statistical analysis revealed that there was a significant difference ($P = 0.027$) in the prevalence
120 of malaria in the age groups.
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122 **3.6 Seasonal Prevalence of Malaria infection among Patients**

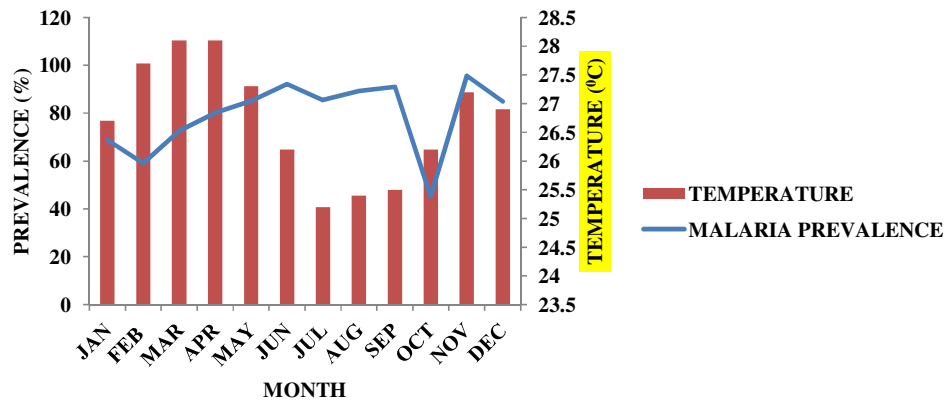
123 From November to February 2015 (dry season), a total of 601 (23.0%) patients were tested for malaria
124 parasite out of which 460 (75.4%) were positive; while between the months of March to October (wet
125 season), a total of 2,006 (76.7%) patients were tested for malaria parasite out of which 1,598 (79.7%)
126 were positive. Statistical analysis showed that the prevalence of malaria was statistically significant
127 between the seasons ($P = 0.001$) (Figure 4).
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Comment [RGK17]: Students at one year of age? I don't think so. This is why your population description and selection has to be CLEARLY STATED

Comment [RGK18]: There were three times more patients between March and October than between Nov to Feb. Why? More individuals came due to illness? This is not explained in the methodology at participant selection.

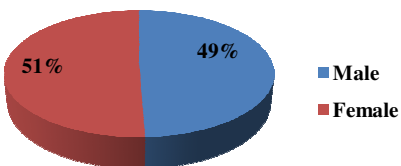


130 Figure 1a: Monthly Prevalence of Malaria infection among Patients in relation to the monthly mean rainfall
131 in the study Area.
132 $\chi^2=333.943$, $df = 1$, $P = 0.001$
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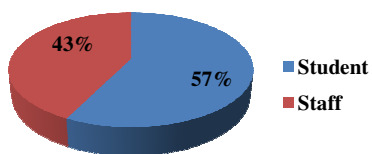
135
 136 Figure 1b: Monthly Prevalence of Malaria infection among Patients in relation to the monthly mean
 137 temperature in the study Area.
 138 $\chi^2=333.943$, $df = 1$, $P = 0.001$
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% Infected



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 142 Figure 2: Prevalence of Malaria infection in relation to Sex.
 143 $\chi^2=117.901$, $df = 1$, $P = 0.001$
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% Infected



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 146 Figure 3: Prevalence of Malaria infection in relation to Status.
 147 $\chi^2=117.901$, $df = 1$, $P = 0.001$
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Age Group	Number Examined	Positive	Negative	Prevalence Rate (%)
1-10	90	82	8	91.1
11-20	654	518	136	79.2
21-30	1162	926	236	79.7
31-40	258	202	56	78.3
41-50	218	165	53	75.7
51-60	197	144	53	73.1
Above 60	37	21	16	56.8
Total	2616	2058	558	78.7

Table 1: Prevalence of Malaria Infection in relation to Age Group
 $\chi^2 = 14.294$, df = 6, P = 0.027

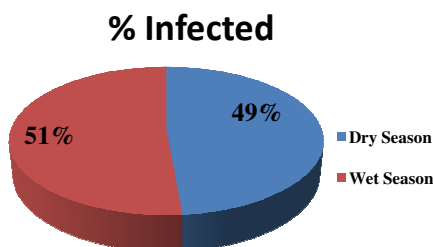


Figure 4: Seasonal Prevalence of Malaria infection among Patients
 $\chi^2 = 117.901$, df = 1, P = 0.001

4. Discussion

The prevalence and distribution of malaria was evaluated among patients that reported for malaria test at the Health Centre of the Federal University of Technology, Akure between January to December 2015. During the study, *Plasmodium falciparum* was the only species found which has been reported to be the major cause of malaria in Africa [1].

The 78.7% overall prevalence of malaria infection recorded among the patients is high which correlates with 76.8% prevalence recorded by [8] among students in Igbinedion University Okada and 77.4% prevalence recorded in Owerri, Nigeria by [9]. However, the result is dissimilar to 4.5% prevalence recorded by [1] in Edo State and 6.0% prevalence recorded in Maiduguri by [10]. The variation in the prevalence of malaria infection in different parts of the country might be attributed to different climatic factors [1]. The high prevalence of 78.7% of malaria infection in the study area might be attributed to several factors such as indiscriminate disposal of waste, poor water drainage system, abandoned wells, and vegetation which harbour and serve as breeding sites for female *Anopheles* mosquito [11].

Comment [RGK19]: The Discussion could be more appropriate if better references had been consulted....

Comment [RGK20]: In the Methodology you stated "staff and students"

Comment [RGK21]: Really? What are the preferred breeding sites for *Anopheles*?

Comment [RGK22]: Intrinsic (human, parasite, mosquito) and extrinsic (environmental, social, economic, political) condition determinants as well as efforts of control

172 For the year 2015, the World Health Organization epidemiological profile stated that the high transmission
173 was 139,000,000 while the low transmission was 43,000,000 with *A. gambiae*, *A. funestus*, *A. arabiensis*
174 being the major *Anopheles* species and *P. falciparum* 100% (12). The pattern of distribution of malaria
175 infection between January to December, 2015 (figures 1a and 1b) revealed that there was high level
176 (78.7%) of infection throughout the year. The highest prevalence of infection was recorded in the month
177 of November with low average rainfall and high average temperature. This could also be attributed to the
178 presence of *Anopheles* species such as *Anopheles funestus* that thrives well during little or no rainfall
179 [13]. The month of October with high average rainfall and low average temperature recorded the lowest
180 prevalence, compared to the month of November; this could be as a result of a situation known as
181 premonition which is a condition in which there is presence of parasitaemia but the disease is absent and
182 sometimes individuals carry the parasites in their blood without disease manifestation [1]. Also, the life
183 cycle stage of the parasite in most of the examined patients could still be in the pre-erythrocytic
184 schizogony stage (in the liver) which is not yet in the blood where the parasite can be diagnosed or
185 disease condition can manifest.

Comment [RGK23]: Of what? Where? In Nigeria? In Akure? All over the world?

186 Comparing the prevalence of malaria infection between male and female patients, it was observed that
187 prevalence of malaria among the female patients was higher than the prevalence among the male
188 patients, which is similar to the previous report of [8]. The difference in prevalence among the sexes could
189 be as a result of the Genotyping in the patients as previously reported that people with genotype AA are
190 highly susceptible to malaria infection compare to people with genotype AS or SS. Also, their exposure to
191 their immediate environment could be a factor since females are in constant touch with the immediate
192 environment through their daily job or activities.

Comment [RGK24]: Premonition? Premunition?

Comment [RGK25]: Partially immune patients.... How does this relate to mosquito abundance or scarcity?

Comment [RGK26]: However, you stated in the methodology "symptomatic" therefore, this statement does not apply

193 High prevalence of infection was recorded among students than staff which is similar to the high
194 prevalence also recorded by [8] among students of Igbiniedion University Okada, Nigeria. This high
195 prevalence might be caused by the student's behavioural habits such as indiscriminate dumping of used
196 cans, unkempt environment, improper disposal of refuse that can lead to blockage of drainages, the
197 presence of stagnant pool of water and so on which serve as breeding sites for *Anopheles* mosquito
198 vectors. Other likely pre-disposing factors might be as a result of overcrowding in hostels which could
199 increase the chance of malaria parasite transmission through infected mosquitoes bite and unavailability
200 or lackadaisical attitudes towards the use of nets or insecticide treated nets.

Comment [RGK27]: Reference? Was genotyping done in this area of Nigeria?

Comment [RGK28]: Seems to me that this has more to do with lack of protective immunity, living in areas of intense and stable transmission, drug resistance, poor treatment compliance, poor health delivery systems....??

201 Among the age groups, it was observed that pattern of prevalence of malaria infection within age
202 decreases as the age group increases with the exception of the age group 11-20 and 21-30. It was
203 observed that age group 11-20 had lower prevalence than age group 21-30 which is the age group
204 category of the students. Though all the age groups were susceptible to the infection, differences in
205 habits could be as a result of the different prevalence values within the different age group [1]. The
206 highest prevalence that was observed among children (age group 1-10) could be as a result of absence
207 of acquired immunity, which makes them to be more susceptible to the infection; this reason could also
208 be the cause of high prevalence among patients within age group of 11-20 [1]. The higher prevalence that
209 was recorded among the age group (21-30) than the teenage group (11-20) could be as a result of level
210 of exposure of the latter to the former to their environment. Older age groups that recorded lesser
211 prevalence could be as a result of the adult having acquired immunity which they might have developed
212 due to previous exposure to the infection [13].

213 5. Conclusion

214 This research has revealed that there was high prevalence of malaria infection in the study area. The
215 study showed that patients within the children age group (1-10) are most susceptible to malaria infection,
216 also, patterns of distribution of the disease in different seasons and among different groups is in a very
217 high rate. Therefore, there is a need for constant check on all possible predisposition factors that could be
218 responsible for the high prevalence, which could be achieved through public enlightenment on effective
219 malaria control programs such as the use of insecticide treated nets, environmental management and
220 sanitation and perfect engineering works.

Comment [RGK29]: In the study area? This particular population?

Comment [RGK30]: You have not shown a single one.

221 **Acknowledgement**

222 Authors are grateful to Dr. M. O Oniya and the entire staff and corp members of the Medical Laboratory of
223 FUTA Health Centre for their support towards the accomplishment of this research.

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225 **References**

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251 48.

Comment [RGK31]: References listed cannot be poorer. This may be one reason why this Ms is lacking in many respects. I find this Ms not fit for publication in IJTDH.

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