Pattern of Malaria Parasitaemia and Genotype among Residents of Orita Obele, Akure South Local Government Area of Ondo State, Nigeria

O. B. Awosolu, M. C. David, A. O. Lawal and F. A. Ikuesan

Parasitology and Public Health Unit, Department of Biology, Federal University of Technology, Akure, Nigeria.

Ondo State University of Science and Technology, Okitipupa, Nigeria.

Authors’ contributions

This work was carried out in collaboration among all authors. Author OBA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MCD and AOL managed the analyses of the study. Author FAI managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background and Aim: Malaria is a major disease of public health concern which requires adequate epidemiological information for proper management and control in Nigeria. This research was carried out to determine the pattern of malaria parasitaemia and genotype among residents of Orita Obele in Akure South Local Government Area of Ondo State, Nigeria.

Methods: A cross-sectional study was carried out in which blood samples were collected from volunteer individuals visiting Orita Obele Primary Health care Center in Akure South Local Government Area of Ondo State, Nigeria. Relevant information such as sex and age was obtained from their hospital record and a well-designed questionnaire. Thick and thin blood smears were prepared and microscopy was used to establish malaria infection, parasite identification and density.

Results: A total of 185 patients were examined, out of which 132 (71.4%) were positive for malaria infection. Male had higher prevalence of 73.9% while female had lower prevalence 70.5%. Out of the 185 samples that were analyzed, 132 (71.4%) were positive for malaria infection. The age group

*Corresponding author: E-mail: obawosolu@futa.edu.ng, awosconik@yahoo.co.uk;
11 to 20 years had the highest prevalence of 78.3% while age group 41 to 50 years had the lowest prevalence of 66.7%. The genotype HbAA had the highest prevalence of malaria (74.6%) while genotype HbAS had the lowest malaria prevalence of (64.3%).

**Conclusions:** It is apparent that malaria is prevalent in this study area and as such urgent control measures should be deployed to arrest the situation.

**Keywords:** Malaria; prevalence; genotype; parasitaemia; Orita Obele; Akure.

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### 1. INTRODUCTION

Malaria is a mosquito-borne parasitic disease affecting humans and other animals and it is caused by parasitic protozoan belonging to the genus *Plasmodium* [1]. Malaria causes symptoms that typically include fever, tiredness, vomiting, and headaches [2]. In severe cases it can cause yellow skin, seizures, coma and even death. Symptoms usually begin ten to fifteen days after infection. If not properly treated, people may have recurrences of the disease months later [1]. Among those who have recently survived an infection, reinfection usually causes milder symptoms. This partial resistance disappears over months to years if the person has no continuing exposure to malaria [2].

The disease is most commonly transmitted by an infected female *Anopheles* mosquito. The mosquito bite introduces the parasites from the mosquito's saliva into a person's [1]. The parasites travel to the liver where they mature and reproduce. Five species of *Plasmodium* usually infect humans [2]. Most deaths are caused by *P. falciparum* because *P. vivax*, *P. ovale*, and *P. malariae* generally cause a milder form of malaria. The species *P. knowlesi* rarely causes disease in humans except in recent times.

The disease is widespread in the tropical and subtropical regions that exist in a broad band around the equator. This includes much of Sub-Saharan Africa, Asia, and Latin America. In 2016, there were 216 million cases of malaria worldwide resulting in an estimated 731,000 deaths. Approximately 90% of both cases and deaths occurred in Africa [1]. Rates of disease have decreased from 2000 to 2015 by 37% but increased from 2014 during which there were 198 million cases. Malaria is commonly associated with poverty and has a major negative effect on economic development. In Africa, it is estimated to result in losses of US$12 billion a year due to increased healthcare costs, lost ability to work, and negative effects on tourism [3]. Malaria therefore being a leading cause of mortality and morbidity in Africa and other tropical regions of the world must be given due priority in order to map out control strategy that will enhance its control.

This study sought to determine the pattern of malaria parasitaemia and genotype among residents of Orita Obele in Akure South Local Government Area of Ondo State, Nigeria.

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### 2. MATERIALS AND METHODS

#### 2.1 Study Area

The study area was Orita Obele, Akure South Local Goverment Area of Ondo state, Nigeria. Akure South is located on latitude 7.205° north and longitude 5.1877° east with an elevation of 390 meters above sea level. Akure has a tropical climate with significant rainfall most months and a short dry season. The average annual temperature is 26.7°C with average annual rainfall of 2378 mm. The mean monthly temperature varies between from 27°C to 38°C.

#### 2.2 Study Population and Design

This study was hospital based and was conducted between February, 2018 and July, 2018 at Orita Obele Primary Health Care Center in Akure South Local Government Area. A total of 185 samples were collected from volunteers, and questionnaires were given in order to gather information such as age, sex, occupation e.t.c from them.

#### 2.3 Collection of Blood Samples and Preparation of Blood Films

Syringe was used to collect 2 mL of blood into an EDTA bottle through the assistance of a laboratory technician after which thin and thick blood films were prepared for the detection of malaria parasite.

#### 2.4 Staining and Microscopic Examination of Blood Films

After fixing thin blood films with absolute methanol, both thick and thin blood films were stained with 10% Giemsa for 20 minutes and
examined under the X 100 (oil immersion) objectives of a light microscope, for the detection and identification of malaria parasites, respectively. Slides were declared negative if no asexual parasites were found after examining 100 high-power fields.

2.5 Data Analysis

The data was analyzed using SPSS 20.0 (SPSS Inc., Chicago, IL). The student t-test was used to compare mean values. The prevalence of malaria infection was compared using the χ2 test. P-value less than 0.05 was considered statistically significant.

3. RESULT

The result of the prevalence of malaria infection with respect to age group among residents of Akure South Local Government Area is presented in Table 1. Of the 185 individuals examined, 132 (71.4%) were positive for malaria infection. Age group 11-20 has the highest prevalence (78.3%), followed by age group 21-30 (67.5%) while age group 41-50 has the lowest prevalence (66.7%). Statistical test using Chi-square analysis at P<0.05 showed that there was no significant difference in malaria prevalence between the age group.

The result of the prevalence of malaria infection with respect to genotype among residents of Akure South Local Government Area is presented in Table 2. Out of the 105 individuals examined, 74 were positive for malaria infection. Genotype HbAA has the highest prevalence (74.6%) followed by genotype HbAS (64.3%). It is obvious there was no HbSS and HbSC individuals encountered in the course of the study. When the data was statistically analysed using Chi-square at P<0.05, there was no significant difference in malaria infection between genotypes.

The result of the prevalence of malaria infection with respect to sex among residents of Akure South Local Government Area is presented in Table 3. Out of the 185 patients examined, 132 (71.4%) were positive for malaria infection. Males have the highest prevalence (73.9%) followed by females (70.5%) with no statistical significant difference at P<0.05.

Table 4 shows the result of the parasite density of malaria parasites with respect to genotype among residents of Orita Obele. Genotype HbAA has the highest parasite density of 3025 (parasite/µL of blood), followed by genotype HbAS with 2102 (parasite/µL of blood). No HbSS and HbSC patients were encountered in the course of the study.

Table 5 shows malaria parasites density with respect to age group among residents of the study area. The result reveals that age group 11-20 has the highest parasite density of 3250 (parasite/µL of blood) followed by age group 31-40 with 2397 (parasite/µL of blood) and age group 21-30 with 1954 (parasite/µL of blood), while age group 41-50 has the lowest parasites density with 1540 (parasite/µL of blood).

Table 1. Prevalence of malaria infection with respect to age groups among residents of Akure South Local Government Area

<table>
<thead>
<tr>
<th>Age group examined</th>
<th>Number infected</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20</td>
<td>37</td>
<td>78.3</td>
</tr>
<tr>
<td>21-30</td>
<td>78</td>
<td>67.5</td>
</tr>
<tr>
<td>31-40</td>
<td>15</td>
<td>75.0</td>
</tr>
<tr>
<td>41-50</td>
<td>3</td>
<td>66.7</td>
</tr>
<tr>
<td>Total</td>
<td>142</td>
<td>71.4</td>
</tr>
</tbody>
</table>

Table 2. Prevalence of malaria infection with respect to genotypes among residents of Akure South Local Government Area

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Number examined</th>
<th>Number infected</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb-AA</td>
<td>63</td>
<td>47</td>
<td>74.6</td>
</tr>
<tr>
<td>Hb-AS</td>
<td>42</td>
<td>27</td>
<td>64.3</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>74</td>
<td>70.5</td>
</tr>
</tbody>
</table>

Table 3. Prevalence of malaria infection with respect to sex among residents of Akure South Local Government Area

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number examined</th>
<th>Number infected</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>46</td>
<td>34</td>
<td>73.9</td>
</tr>
<tr>
<td>Female</td>
<td>139</td>
<td>98</td>
<td>70.5</td>
</tr>
<tr>
<td>Total</td>
<td>185</td>
<td>142</td>
<td>71.4</td>
</tr>
</tbody>
</table>
Malaria parasites density with respect to genotypes

Table 4. Malaria parasite density with respect genotype among residents of Akure South Local Government Area

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Number examined</th>
<th>Number infected</th>
<th>Parasite density (parasite/μL of blood)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbAA</td>
<td>63</td>
<td>47</td>
<td>3025</td>
</tr>
<tr>
<td>HbAS</td>
<td>42</td>
<td>27</td>
<td>2102</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>74</td>
<td>2564</td>
</tr>
</tbody>
</table>

Malaria parasites density with respect to age group

Table 5. Malaria parasitemia (parasite/μL of blood) with respect age group among residents of Akure South Local Government Area

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number examined</th>
<th>Number infected</th>
<th>Parasite density (parasite/μL of blood)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20</td>
<td>47</td>
<td>37</td>
<td>3250</td>
</tr>
<tr>
<td>21-30</td>
<td>115</td>
<td>78</td>
<td>1954</td>
</tr>
<tr>
<td>31-40</td>
<td>20</td>
<td>15</td>
<td>2397</td>
</tr>
<tr>
<td>41-50</td>
<td>2</td>
<td>3</td>
<td>1540</td>
</tr>
<tr>
<td>Total</td>
<td>185</td>
<td>142</td>
<td>2285</td>
</tr>
</tbody>
</table>

Malaria parasites density with respect to sex

Table 6. Malaria parasitemia (parasite/μL of blood) with respect sex among residents of Akure South Local Government Area

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number examined</th>
<th>Number infected</th>
<th>Parasite density (parasite/μL of blood)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>46</td>
<td>34</td>
<td>2657</td>
</tr>
<tr>
<td>Female</td>
<td>139</td>
<td>98</td>
<td>1913</td>
</tr>
<tr>
<td>Total</td>
<td>185</td>
<td>142</td>
<td>2285</td>
</tr>
</tbody>
</table>

4. DISCUSSION

This study showed that malaria parasite is still prevalent in Orita Obele, Akure. The only malaria parasite observed is *P. falciparum* and this is in tune with other studies in Nigeria [4,5]. The prevalence and parasites density is higher in males than females in this study area. This is in consonance with researches conducted in other regions [6,7]. This outcome may be due to the unprecedented exposure of males to mosquitoes during farming and this might have possibly been further aggravated as a result of the carefree attitudes of the male individuals towards the use of mosquito nets. Additionally, studies have shown that females are expected to have better immunity against malaria and a variety of other parasitic diseases, and this has been attributed to genetic and hormonal factors [8]. Females have been observed in studies by Mandal and White [9] to have stronger immune system against malaria infection due to proper nutritional standard and immediate treatment than in males. Control activities have been channeled mainly to children and pregnant women who are the high risk group which may account for the lower prevalence of malaria in females compared to males. According to Laloo, et al. [10], the problem of malaria in adolescent and young adults has been overshadowed by the huge burden in young children. This is also evident in this survey as people in the age group of 11-20 showed the highest level of prevalence and parasite intensity.

Also, studies have shown that specific genetic factors such as rhesus factors, ABO blood group and genotype play significant roles in the susceptibility of an individual to malaria. In the same vein, this study shows that individuals with HbAA are more susceptible to malaria infection compared to HbAS and HbSS which is in agreement with the work of Ebadan, et al. [11] who reported that genotype HbAA was more susceptible to malaria infection compared to genotype HbAS and HbSS.

5. CONCLUSION

This research showed that malaria is still endemic in the study area indicating that various
preventive and control measures have not been
effective enough in reducing malaria to the
barest minimum. Therefore there is a need to
pay attention to malaria infection in the study
area in order to reduce the rate of transmission.

CONSENT AND ETHICAL APPROVAL

Prior the commencement of the study, ethical
approval and informed and written consent was
sought from ministry of health in Ondo State and
from those volunteer individuals respectively.

ACKNOWLEDGEMENT

We sincerely appreciate all the volunteers who
submitted blood samples for examination at Orita
Obele Primary Health Care Center. We equally
thank Mrs Idowu for her guidance.

COMPETING INTERESTS

Authors have declared that no competing
interests exist.

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