PERCEPTION, KNOWLEDGE AND SEASONAL DISTRIBUTION OF SYMPTOMATIC MALARIA IN CALABAR, CROSS RIVER STATE, NIGERIA

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ABSTRACT

Background: Malaria is a major public health problem in Nigeria and sub-Saharan Africa. The disease kills an estimated 660,000 people yearly, mostly children under five years in this region, with Nigeria and the Democratic Republic of Congo responsible for about 40% of world deaths. Malaria infection is increased during the rainy season due to high rainfall which provides a conducive environment for the breeding of the vector. This study aimed to determine the seasonal effect on the prevalence of Plasmodium infection, and also to assess the perception and knowledge of the aetiology agent of the infection among study subjects.

Methods: Blood films stained with Giemsa were examined microscopically for the detection of the parasite. Structured questionnaire was also administered.

Results: The prevalence of malaria parasite in the study area was 16%. Males (17%) were more infected than females (16%). The difference in the infection rate was not statistically significant (P < 0.05). Those in the age group 0-10 years had the highest infection rate (21%) while those in the age group 41-50 and 51-60 had the least infection rate (10%) respectively. The difference in infection rate by age group was statistically significant (P < 0.05). P. falciparum was the most detected species of the parasite (16%), while P. malariae was 0.04%. No infection with P. ovale and P. vivax was detected. Infections were more during the rainy season with 19% than dry season with 13%. The difference in infection rate was statistically significant (P < 0.05). Subjects who had knowledge of Plasmodium as the causative agent were 52.8%, while those who had knowledge of mosquito as vector agent were 77%, whereas (8.8%) had knowledge of grasses, stagnant water, and bushes as a predisposing factor. Subjects who did not know any preventive measures for malaria infection were 1%, while 99% knew of at least one of the malaria preventive measures.

Conclusion: This study shows that malaria infection is higher during the rainy season than the dry season. We, therefore, recommend preventive and control measures to reduce the high prevalence of malaria infection in the study area during the rainy season.

Keywords: Malaria, Mosquito, Climate Change, Calabar, Nigeria.

INTRODUCTION

Malaria infection leads to over one million deaths, of which over 75% occur in Africa and affects mostly children and pregnant women [1]. The distribution of malaria relies on climate factors such as rainfall. This promotes the breeding of anopheline mosquito, the vector of malaria responsible for transmitting the parasite from one host to another. “Rainfall and temperature affect the development of larvae in the aquatic environment and the survival of adult mosquitoes. An increase in rainfall increases the availability, persistence, and dimensions of Anopheles larval habitats, although this depends on parameters such as local evaporation rates, soil percolation and slope of the terrain”. Vectors and parasites survival is temperature dependent, with “too cold and too warm temperatures generally having a negative impact. Some studies suggest that probabilistic seasonal climate forecasts can be used to predict malaria incidence in epidemic-prone areas. The influence of climatic parameters is “complex and varies according to the region and the ecology” of the vectors. Climatic conditions considered suitable for the development of the malaria parasite and its transmission through the mosquito stage of its life cycle are temperatures within the range from 18°C to 32°C. Below 18°C, the parasite development decreases significantly, while above 32°C the survival of the mosquito is affected [10]. Plasmodium species exhibit a complex, heterogeneous life cycle involving a vertebrate human host and invertebrate mosquito host.

In a related study in Mali, the prevalence of malaria infection ranges was reported to have from 70–85% in the south of Mali with 1,000 mm of annual rain to 0.5% in the north, where the annual rainfall is below 400 mm [3]. Malaria parasite prevalence was also reported to be higher in the cold season than during the hot period” in Mali [4].

In a similar study in Ilorin, Kwara State, Nigeria, a higher prevalence of malaria infection were reported during “the rainy season compared to the dry season” [8]. This has been attributed to the high precipitation during the rainy season which results in the proliferation of anopheline breeding habitats, in addition to providing favorable humidity for the survival and dispersal of adult mosquitoes [8].

In a related study in Uganda, both rainfall and relative humidity showed significant positive correlations with malaria infection [14].

In a similar study in North Eastern Nigeria, “the month of September recorded the highest Geometric Mean Asexual- Densities of 13,655 while the lowest parasite densities were observed at the peak of the dry season, especially during March and April” [11].

In Calabar, Cross River State malaria parasite infection has been reported to be responsible for about 60% of all out-patient attendances and 30% of all hospital admissions [2].

This work aimed to determine “the seasonal effect on the prevalence of Plasmodium infection in Calabar”.

METHODOLOGY

Study Area

This study was carried out in the University of Calabar Teaching Hospital, Calabar, Cross River State, Nigeria. Calabar is the capital of Cross River State in the South-South geopolitical zone of Nigeria. Calabar lies between 4° 34’ 27” North and 6° 58’ 32” East. Calabar has a population of approximately 372,000 [5]. The vegetation in Calabar is typical of the tropical rain forest which makes malaria transmission stable throughout the year but more intense between April and early October (wet season) with a peak period in June/July due to relatively heavy downpour during this period which usually helps to propagate the vector of malaria resulting in malaria being hyper-endemic in the area with about 43.7% of the population infected with malaria infection [2]. Calabar is one of the coastal areas in Nigeria and is considered a hyper-endemic malaria state due to heavy rain and typical rainforest vegetation. The transmission of malaria has a seasonal
variation in Calabar, with a peak prevalence rate of 43.7% in the wet season [2].

Calabar has an average annual temperature of 26.1°C and average annual rainfall of 2750mm. Calabar has four main hospitals around it namely, University of Calabar Teaching Hospital, Nigerian Navy Hospital, General Hospital, and Federal Neuropsychiatric Hospital, Police clinics, and other private hospitals.

Ethical Approval/ informed consent
Ethical approval was obtained from the Health Research Ethics Committee of the University of Calabar Teaching Hospital, Calabar. Informed consent was also signed by patients before being incorporated into the study group.

Study population
Subjects were patients visiting the University of Calabar Teaching Hospital with clinical symptoms consistent with malaria infection.

Sampling Method
This study used a convenient sampling method

Questionnaire Administration
A structured questionnaire was administered to consenting subjects to obtain information on the following Bio-data, Awareness, perception, and knowledge of the causative agent and preventive measures for the control of malaria.

Inclusion criteria
- Subjects who had clinical signs and symptoms related to malaria-like chills, headache, high fever, and vomiting and agreed to sign the informed consent form.
- Subjects who were not on antimalarial therapy.

Exclusion criteria
- Subjects without any of the clinical signs and symptoms of malaria.
- Subjects who refuse to sign the consent form.
- Subjects who were on antimalarial therapy.

Sample Size
The number of samples for this research was determined using the formula by Amin et al. [6], using a malaria prevalence rate of 68% reported for Calabar in 2016 by Monjol et al. [7]. Approximately Two Thousand Three Hundred and Twenty Nine (2329) subjects were involved in the study.

Blood Collection/Processing
Finger-prick was used to collect samples for the thick and thin film after swabbing the area with 70% alcohol. Thin films were made by using 2µl of blood on a clean slide, and a spreader was used at an angle of 45° firmly to make a thin film with a length of 25mm on the glass slide, whereas Six microliters (6µl) of blood was used to make a thick film. Absolute methanol was used to fixed the thin film before they were stained with 2% Giemsa stain for 30 minutes. Both the thin and thick slides were examined under the light microscope using X 100 oil immersion objective for malaria parasite.

Data Analysis
Data obtained from this study were analyzed using the statistical package for Social Science Program (SPSS version 22.0 Chicago). A 95% confidence interval was be used to allow for a workable probability value of 0.05 (p=0.05).

RESULTS
Table 1 shows the prevalence of malaria parasite by the age of the subjects examined. Subjects aged 31-40 years had the highest infection rate of 25%, while those aged 41-50 years and 51-60 years had the lowest infection rate of 10 % respectively.

The difference was statistically significant (X²=34.273; df=6; P = 0.004).

Table 2 shows that males were more infected in the study with 17% than females 16%. There was no statistically significant difference in the infection rate by gender (P >0.05).

Table 3 shows the occurrence of different species of Plasmodium in the study area. *P. falciparum* had the highest occurrence of 16% and *P.malariae* had 0.04% where there were no cases of *P. ovale* and *P. vivax*. The difference in occurrence rate was statistically significant (P< 0.05). Malaria parasite was highest in the rainy season with 19% and dry season with 13%. The difference in infection rate was statistically significant (P< 0.05).

(X²=15.645; df=1; P = 0.005).

The perception of the aetiology of malaria infection among the citizens of Calabar, Cross River State, Nigeria shows that, of the 2329 subjects that filled the questionnaire, 1230 (52.8%) had knowledge of Plasmodium as the causative agent of malaria, 1800 (77%) had knowledge of mosquito as the agent of transmission while 205(8.8%) had knowledge of grasses, stagnant water, dirty gutter and bushes as risk factors for malaria as shown on Table 5.

Table 6 shows the knowledge of control measures in controlling and or preventing mosquito bite, where (31%) correspondents use insecticides treated net in their homes, 982(42%) correspondents make use of door/window net, 595(26%) correspondents use residual insecticides whereas 20(1%) subjects had no knowledge of any control/preventive measures.

Table 1: The distribution of malaria parasite by the age of subjects.

<table>
<thead>
<tr>
<th>Age (year)</th>
<th>No. examined</th>
<th>No(% infected)</th>
<th>No(% not infected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>550</td>
<td>155 (21)</td>
<td>435 (79)</td>
</tr>
<tr>
<td>11-20</td>
<td>235</td>
<td>32 (16)</td>
<td>197 (84)</td>
</tr>
<tr>
<td>21-30</td>
<td>416</td>
<td>68 (16)</td>
<td>348 (84)</td>
</tr>
<tr>
<td>31-40</td>
<td>310</td>
<td>76 (25)</td>
<td>234 (75)</td>
</tr>
<tr>
<td>41-50</td>
<td>400</td>
<td>38 (10)</td>
<td>362 (90)</td>
</tr>
<tr>
<td>51-60</td>
<td>260</td>
<td>18 (10)</td>
<td>242 (93)</td>
</tr>
<tr>
<td>≥61</td>
<td>158</td>
<td>26 (17)</td>
<td>132 (84)</td>
</tr>
<tr>
<td>Total</td>
<td>2329</td>
<td>379 (16)</td>
<td>1950 (84)</td>
</tr>
</tbody>
</table>

Table 2: The occurrence of malaria infection among study subjects by gender.

<table>
<thead>
<tr>
<th>Gender</th>
<th>No. examined</th>
<th>No(% positive)</th>
<th>No(% negative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1,003</td>
<td>172 (17)</td>
<td>831 (83)</td>
</tr>
<tr>
<td>Female</td>
<td>1,326</td>
<td>207 (16)</td>
<td>1119 (84)</td>
</tr>
<tr>
<td>Total</td>
<td>2,329</td>
<td>379 (16)</td>
<td>1950 (84)</td>
</tr>
</tbody>
</table>

Table 3: Distribution of the different *Plasmodium* species among the study subjects.

<table>
<thead>
<tr>
<th>No. examined</th>
<th>No (%) infected with <em>P. falciparum</em></th>
<th>No (%) infected with <em>P. malariae</em></th>
<th>No (%) infected with <em>P. ovale</em></th>
<th>No (%) infected with <em>P. vivax</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>2329</td>
<td>378 (16)</td>
<td>1 (0.04)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4: The occurrence of malaria parasite infection by seasons.

<table>
<thead>
<tr>
<th>Season</th>
<th>No. Examined</th>
<th>No. (%) infected</th>
<th>No. (%) not infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainy season</td>
<td>1448</td>
<td>268 (19)</td>
<td>1180 (81)</td>
</tr>
<tr>
<td>Dry season</td>
<td>881</td>
<td>111 (13)</td>
<td>770 (87)</td>
</tr>
<tr>
<td>Total</td>
<td>2,329</td>
<td>379 (16)</td>
<td>1950 (84%)</td>
</tr>
</tbody>
</table>

Table 5: Perception of the aetiology of malaria among the study participants.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>No of awareness</th>
</tr>
</thead>
</table>

Vol 8 Suppl 2, Apr-June 2019 www.mintagejournals.com
The high difference in the occurrence of malaria parasite infection in the study may be due to “a high rainfall and location of Calabar in the Tropical rainforest in Southern Nigeria.” Female anopheline mosquitoes were more abundant in Calabar during rainy season due to the presence of stagnant water, blocked gutters, grasses, and bushes as a result of heavy rainfall. The result obtained in this study is in agreement with other works in Nigeria and other African countries with similar climatic conditions [11, 13]. This may be due to high rainfall associated with the rainy season which provides a good breeding environment for the vector agent. This agrees with work done by Olayemi [8] in Nigeria and Delley [6] in Mali which records high malaria prevalence during the rainy season than the dry season.

This situation has been largely attributed to the high precipitation during the wet season which leads to the high breeding habitat and creating favorable humidity for the breeding and dispersal of an agent of the malaria parasite (mosquito). However, the result of this study indicates that malaria transmission in Calabar, South-south of Nigeria is influenced by the season with very high transmission occurring in the rainy season. Intensive malaria control measures must be extended to the other seasons when an appreciable number of malaria transmission are also recorded. Significantly, the infection rates were greatly reduced in the dry season because of a reduced level of stagnant water, little or no rainfall and bushes which leads to a reduce humidity which favors the breeding of the vector agent.

The finding of this study aligns with the report of Beier [14] who reported a high malaria transmission rate in Kenyan during the rainy season. The rainy season also increases the life expectancy and increase the breeding rate of the vector because of favorable humidity.

The destruction of mosquito breeding sites during the rainy season clearing of grasses, clearing of gutters and proper disposal of cans that harbours water will help in reducing the population of anopheline mosquitoes (vector agent of malaria). Good sanitary conditions around residential buildings and maintenance of high hygiene in refuse dump site also help in the reduction of mosquito breeding during both seasons.

**DISCUSSION**

Knowledge of the aetiology of the infectious agents will help in the education of the citizens in controlling and modification of life style to avoid mosquito bites.

Knowledge of measures to the prevention of mosquito bite which includes the use of insecticide-treated nets, use of door/window nets, use of residual insecticides also helps in the reduction of mosquito bite in both seasons.

**Acknowledgment**

We acknowledged the effort of associate Professor P.C.Inyang-Etoh for his careful corrections and guidance and all those who contributed to the success of this article.

**REFERENCES**


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