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Research Article

Incidence of *Plasmodium falciparum* among Asymptomatic and Symptomatic out door Patients of Selected Hospitals in Benue State, Nigeria

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Abstract

Clinical diagnosis is the cheapest and has been found to be the most commonly used diagnostic method in sub-Saharan Africa without confirmatory diagnosis. However, malaria symptoms could be overlapping with other tropical diseases which have a diminishing effect on the specificity of malaria diagnosis; hence, posing indiscriminate use of antimalarial. This study was therefore conducted between April and August 2018 to determine the distribution of *P. falciparum* among asymptomatic and symptomatic subjects attending selected general hospitals in Benue State, Nigeria. Blood samples were obtained from 510 volunteered participants. Giemsa stain films were prepared and examined on the microscope using oil immersion. Clinical diagnosis indicated that 49.8% were asymptomatic while 50% were symptomatic. Out of the asymptomatic subjects 88.2% had malaria while 10.2% of the symptomatic had no malaria. Though there was no significant difference (χ^2= 0.08, df= 1, p>0.05) in the infection rate across asymptomatic and symptomatic subjects. There was a decrease in malaria infection with increase in adult age (χ^2= 4, df= 2, p>0.05). There was no association between malaria infection and gender across asymptomatic and symptomatic males and females (p>0.05). No significant p>0.05) association was observed between the use of insecticide treated nets (ITN), indoor residual spray (IRS) and malaria infection among asymptomatic and symptomatic subjects. Confirmatory diagnosis is required for malaria case containment since asymptomatic subjects could harbour malaria parasites and fever could be induced by another agent other than malaria.

Keywords: Asymptomatic; Symptomatic; *Plasmodium falciparum*; Clinical diagnosis; Malaria diagnosis.

Introduction

The tyranny of malaria and its devastations to mankind has continuous to be a global health challenge. Malaria burden according to the latest world malaria report indicated that, 228 million cases of malaria were recorded in 2018 while the estimated number of malaria deaths stood at 405,000 in 2018 [1]. The African region carries 93% of malaria cases and 94% of malaria deaths world-wide, while Nigeria carries the highest with 25%, followed by Democratic Republic of Congo with 12% [1].

In most endemic part of the world, malaria is treated based on clinical diagnosis [2,3]. A large population in the endemic region harbour malaria parasites without presenting its symptoms [4]. Clinical diagnosis practiced globally especially in African countries could be misleading some times, causing over and miss-diagnosis of malaria and over prescription of antimalarial drugs [5-7]. Over diagnosis of malaria has led to under-management of other fever- inducing condition mistaken for malaria [5,8].There are also several records of false positive rate of clinical diagnosis by both qualified and unqualified health personnel [9]. The inability to clinically diagnose asymptomatic patients has posed a severe health challenge to health personnel. The asymptomatic patient is a danger to the society since commencement of malaria treatment will be delayed on him and he will be a reservoir for on-going malaria transmission [10,11].

Clinical diagnosis is the cheapest, most commonly used method and basis for self-medication. However, the series of overlapping of malaria symptoms with other tropical diseases impairs its specificity and therefore encourages

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the indiscriminate use of anti-malarias for managing febrile conditions in endemic areas. World Health Organization has recommended that, all clinically suspected malaria cases should be confirmed using either malaria rapid diagnostic test kit (RDT) or direct visualization of asexual parasites using microscopy [12]. Contrary to this recommendation, most malaria suspected cases in endemic regions especially African regions are treated blindly without confirmatory diagnosis. This study was therefore conducted to determine the comparative distribution of malaria among asymptomatic and symptomatic subjects in some selected hospitals in Benue State, Nigeria.

Materials and methods

Study area and study design

The study was carried out in selected general hospitals in Benue State, North Centre Nigeria. River Benue, the second largest river in Nigeria is found within the Benue valley. Rain fall is between 900- 1000 MM annually. A cross sectional study using random sampling was carried out in Makurdi, Katsina-Ala, and Otukpo Local Governments. This study was conducted between April and August, 2018. One general hospital was chosen in each of the selected Local Government Areas of Benue State, Nigeria.

Sample size

Five hundred and ten (510) volunteered participants seeking health care in selected hospitals were included in the study. They consisted of 272 males and 238 females with their age ranging between 1-65 years.

Microscopic examination of thick blood films

Thumb prick blood samples were obtained from the volunteered participants directly onto the slides. Thick blood films were prepared as described in Ojurongbe *et al*. [13]. The slides were stained with 10% Giemsa for 15 min; air dried and examined using oil immersion with a high power objective lens (X100) for characteristic features of *Plasmodium falciparum* malaria.

Informed consent and ethical approval

Informed consent was sought and obtained from the volunteered participants and ethical approval with reference number OH/STA/204/VOL.1/79 obtained from the Benue State Ministry of Health and Human Services.

Data analysis

The generated data was analysed using Chi-square analysis. In all, P values < 0.05 were considered statistically significant.

Results and discussion

Table 1 shows that, a total of 89% (454/510) participants were infected with *Plasmodium falciparum* out of which 49.8% (254/510) were asymptomatic while 50% (256/510) were symptomatic. Among the 254 asymptomatic, 88.2% (224/254) were infected with *Plasmodium falciparum* while 89.8% (230/256) of the symptomatic patients were malaria positive.

Table 1. Prevalence of *P. falciparum* Among Asymptomatic and Symptomatic Subjects Using Standard Microscopy

Status	No. Examined	No. Positive (%)	No. Negative (%)
Asymptomatic	254	224 (88.2)	30 (11.8)
Symptomatic	256	230 (89.8)	26 (10.2)
Total	510	454 (88)	56 (22)

χ^2= 0.08, df= 1, P> 0.05

Table 2 shows the distribution of malaria in relation to age. Age group between 1-10 years recorded the highest malaria prevalence (100%) while the least was in age group >21 (47.4%) for asymptomatic participants. For the symptomatic participants age group 11-20 recorded the highest malaria prevalence (91.1%) while the least was recorded among age group > 21 (86.4%). Though there was no significant difference in the infection rates across asymptomatic and symptomatic age groups (χ^2= 4, df= 2, p>0.05).

Table 3 shows the prevalence of malaria infection in relation to gender. Females had the highest malaria infections for asymptomatic (90.5%) and symptomatic (96.8%) subjects compared to asymptomatic (87.1%) and symptomatic (79.4%) male participants. There was no significant infection rate across malaria status or gender (p>0.05).

Table 2. Distribution of asymptomatic and symptomatic malaria in relation to age

Age	Asymptomatic Number Examined	Asymptomatic Number Positive (%)	Symptomatic Number Examined	Symptomatic Number Positive (%)
1-10	2	2 (100)	7	6 (85.7)
11-20	233	213 (91.4)	227	205 (91.1)
>21	19	9 (47.4)	22	19 (86.4)
Total	254	224 (88.2)	256	230 (89.8)

(χ^2= 4, df= 2, P> 0.05).

Table 3. Distribution of asymptomatic and symptomatic malaria in relation to gender

Gender	Asymptomatic, N=254 No. Examined	Asymptomatic, N=254 No. Positive (%)	Symptomatic, N=256 No. Examined	Symptomatic, N=256 No. Positive (%)
Male	170	148 (87.1)	102	81 (79.4)
Female	84	76 (90.5)	154	149 (96.8)
Total	254	224 (88.2)	256	230 (89.8)

Table 4 shows the relationship between asymptomatic and symptomatic malaria. Majority of the asymptomatic (92.1%) subjects who used ITNs were infected with *Plasmodium falciparum.* All (100%) the symptomatic subjects that do not use ITN had malaria. Though, there were variations in the infection rate across symptomatic and asymptomatic participants who use or did not use ITN, the differences were not statistically significant (p>0.05).

Table 5 shows the relationship between insecticides use and asymptomatic and symptomatic malaria. Out of the 173 asymptomatic subjects who did not use insecticides, 98.3% of them had malaria while 62.3% of asymptomatic participants had malaria. The highest infection rate (90.7%) was recorded among symptomatic participants who do not use insecticides while the least infection rate (50%) was recorded among symptomatic subjects who used insecticides. The difference in the infection rates across the use or non-usage of insecticides was not statistically significant (p>0.05) in both asymptomatic and symptomatic participants.

Table 4. The relationship between use of ITNs and asymptomatic and symptomatic malaria

Use of ITN	Asymptomatic, No. 254 No. Examined	Asymptomatic, No. 254 No. Positive	Symptomatic, No. 256 No. Examined	Symptomatic, No. 256 No. Positive
Yes	140	129 (92.1)	100	74 (74)
No	114	95 (83.3)	156	156 (100)
Total	254	224 (88.2)	256	230 (89.8)

Table 5. The relationship between insecticide usage and asymptomatic and symptomatic malaria

Insecticide Usage	Asymptomatic, N= 254 Number Examined	Asymptomatic, N= 254 Number Positive (%)	Symptomatic, N= 256 Number Examined	Symptomatic, N= 256 Number Positive (%)
No	173	170 (98.3)	236	214 (90.7)
Yes	69	43 (62.3)	2	1 (50)
Some times	12	11 (91.7)	18	15 (83.3)
Total	254	224 (88.2)	256	230 (89.8)

Majority (88.2%) of the studied participants who showed no sign or symptoms of malaria were diagnosed with various levels of malaria parasitemia by microscopy. The detection of *P. falciparum* in asymptomatic participants in this study could probably be that, they had acquired partial immunity through repeated exposure to mosquito bites, also reported in Ondo State [14]. Ten percent (10.2%) of the symptomatic participants were diagnosed malaria negative. This study found out that, asymptomatic subjects could be infected with *P. falciparum* just like the symptomatic subjects without malaria symptoms. There was no association between *P. falciparum* infection and expression of severe malaria symptoms. The only way to achieve reduced morbidity and mortality results from malaria is that, the infection must be recognized quickly, so that patients can be treated promptly. In most

endemic and resource poor areas, malaria is usually diagnosed based on symptoms and clinical signs and not by detection of parasites in the blood using microscopy or rapid diagnostic test (RDT). The assessment of clinical symptoms alone is an imprecise means of diagnosis in malaria case management [15]. Fever is one of the major characteristic signs of clinical malaria. However, many *Plasmodium falciparum* malaria cases in endemic areas do not present with measurable temperature elevation [16,15].

Bell *et al.* [17] had it that health practitioners diagnose malaria based solely on clinical evaluation of symptoms. On the contrary, the present study found out that asymptomatic individuals could be infected with the plasmodia parasites just like the symptomatic subjects without showing symptoms of malaria. This finding is in agreement with studies conducted in Minna, Niger State [18] and Mali [19]. Clinical diagnosis is imprecise but remains the bases of therapeutic care for the majority of malaria cases in endemic areas where laboratory support is often out of reach [20]. Most of the subjects (89.8%) presented with one or more of history of fever, vomiting, coughs, headache, abdominal pains and convulsion were associated with positivity by microscopy. Rational prescription of anti-malaria not only reduces the cost of expensive drugs but also prevent drug overuse that might result in the development of resistance [21].

The highest prevalence of malaria for asymptomatic subjects was in age group 1-10 while the least was in age group >21. Malaria infection was highest in age group 11-20 for symptomatic subjects. There was no significant infection across the asymptomatic and symptomatic age groups. The result of this study corroborated with studies conducted by Adepeju*et al.* [14] and Munyekenye*et al*. [22] who found out that parasite density falls as age increases suggesting development of immunity as age increases.

The study found out that, female had the highest prevalence of malaria, (90.5% and 96.8%) compared to the males (87.1% and 79.4%) in both asymptomatic and symptomatic cases respectively. There was no significant difference ($p>0.05$) in the infection rate across asymptomatic and symptomatic males and females. The highest prevalence (90.5%) observed in this study among asymptomatic subjects corroborated with studies conducted in Awka [23] and in Abeakuta [24] but disagrees with a study conducted in Ondo State [14] where they found out that asymptomatic males had the highest malaria prevalence (59.0%) compared to the females (46.3%). However, there is no scientific evidence proving a link between malaria infection and gender [25] except in pregnant females who have suppressed immunity [26,27].

This study found out that, there was no significant ($p>0.05$) relationship between the use of ITN and malaria infection among the asymptomatic and symptomatic subjects. The high rates of malaria infections recorded in this study among asymptomatic and symptomatic subjects who use ITN could be as a result irregular use of ITN orchestrated by heat created, also reported in Ghana [28].

There was no significant difference ($p>0.05$) in malaria infection rates across asymptomatic and symptomatic participants who used insecticides and those who did not use. The result of this study is in agreement with a study conducted in Kano [29] where members of the community who did not use insecticides had higher malaria prevalence while those who used insecticides had lower malaria prevalence.

Asymptomatic malaria infection is an important challenge for disease control in nations where malaria is endemic. The reason is that, asymptomatic carriers do not seek treatment for their infections. They therefore, can have high levels of gametocytes and constitute a reservoir available for new infections [30]. Asymptomatic population normally have low parasite burdens hence a sensitive screening test is essential. This study confirms that, some subjects in our study area were infected with *P. falciparum* without symptoms. This could be as a result of long persistence of *P. falciparum* in the peripheral blood after cure has been instituted. Accurate diagnosis is therefore important in population based malaria studies.

Conclusions

Asymptomatic subjects could be significantly infected with malaria and there are other fever inducing factors or agents apart from malaria hence confirmatory diagnosis is imported for malaria surveillance and containment.

Conflict of interest

There was no conflict of interest at any point in time before, during, and after.

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