Prevalence of malaria among symptomatic outpatient children of Hasiya Bayero Pediatric Hospital, Kano Nigeria

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Abstract

A cross sectional study was carried out to evaluated the incidence of malaria among symptomatic outpatient children of Hasiya Bayero Pediatric Hospital, Kano Nigeria. A total of 150 symptomatic outpatients children randomly participated, were diagnosed for malaria infection and identified the Plasmodium species in the blood samples infected individuals. The result obtained showed 80% (120/150) prevalence of malaria infection among the sampled population. The high positive predictive value 80.4% recorded indicated the quality of the diagnostic test employed (thin films) in the study. While low negative predictive value 20.8% shows that malaria infection is not excluded among the outpatient children. The odd ratio of 1.075 suggested that children presented with fever and other symptoms are more likely to have malaria infection than those presented with fever only. The diagnostic test results and the gender of the children are not related significantly (p>0.05). Male children are less likely to be infected with malaria than the female children (odds ratio=0.599). Also the age categories of the outpatient children are not related with the test results significantly (p>0.05). The age group 1-3 years were more likely to be infected with malaria disease than the age group 4-6 years (odds ratio=2.213). The Clinical presentations are less likely to occur in children infected with P. malariae than those infected with P. falciparum (odds ratio=0.610) and there was no significant relationship (p >0.05) between clinical presentations of the children and the species of Plasmodium in the blood samples of infected individuals. The prevalence of malaria was higher among the participants with more females aged 1-3 years presented with fever and other symptoms having high risk of infection with P. falciparum.

Keywords: Malaria, children, outpatient, symptoms, *Plasmodium* species.

Introduction

Malaria is among the most important diseases causing human morbidity and mortality with enormous medical, emotional and economic impact in the world[1,2] and occurs in nearly 100 countries worldwide. It is found in all age of group, but young children and pregnant women are mostly affected[3]. Malaria incidence is one of the major public health problems with significance among children living in hilly and rural villages where the disease is endemic[4]. Majority of the children with malaria infection about 85% were positive for *Plasmodium falciparum*[5]. The least studied species of *Plasmodium* that infects humans is *Plasmodium malariae*, compared to other species because of its milder clinical manifestation and low prevalence[6]. Under certain conditions, higher prevalence of *Plasmodium ovale* is possible; a study conducted in Cameroon recorded >10% prevalence of *P. ovale* infection[7]. Nigeria, contributes a quarter of malaria burden[8], the country is holo-endemic with intense all year round transmission peaking in the rainy season. At this peak, over 70% of children age 1-5 years suffer high rate of disability with the associated high parasite load. According to the latest malaria risk charts, the prevalence of malaria in Nigeria was estimated between less than 20% to over 70%[9]. Studies conducted in Kano State of Nigeria identified 62.5% (250/400) malaria prevalence in patients from two hospitals of Kano Metropolis, also in a specialist Hospital 51.7% (155/300) positive malaria cases were reported among pregnant women of antenatal clinic[10,11]. Currently, in Aminu Kano Teaching Hospital, the high prevalence of 61.3% was reported for pregnant women[12]. However, during year 2015, over 22,000 deaths as a result of malaria infection were reported in Kano State[13].

The initial symptoms of malaria are nonspecific and may also include tachycardia, tachypnea, chills, malaise, fatigue, diaphoresis, headache, cough, anorexia, nausea, vomiting, abdominal pain, diarrhea, arthralgias, and myalgias[14]. Although *P. falciparum* malaria is the most potent, it is often not possible to determine the species of malaria infection on clinical grounds alone, there are some unique characteristics associated with each species[15]. Symptoms of malaria infection are misunderstood for other diseases and treated without a diagnostic test, this misconception about malaria is occurring in endemic regions. The significance of the study is to ascertain the level of malaria infection with respect to various symptoms among outpatient children. Therefore, the data conveyed will pave way for the stakeholders to emphasis on the importance malaria test in hospitals and pharmaceutical shops prior to any prescription of treatments which will facilitate malaria control.

Materials and methods

Study area: The study was carried out in the laboratory of Hasiya bayero Pediatric Hospital (HBPH). Kano State, Nigeria. The hospital was locate in Kano Municipal local government, approximately on latitude of $12^0 17$'N and longitude $8^0 36$'E.

Sampling population: A total of 150 out patients children from the age of 1 year to 6 years attending Hasiya Bayero Pediatric Hospital were randomly sampled and tested for Malaria infection. Majority of children attending the hospital were from urban area of Kano state, these areas were densely populated and the houses are clustered with little or no drainage facilities.

Study design: A descriptive cross sectional study for the prevalence of malaria among out-patient children Attending Hasiya Bayero Pediatric Hospital Kano State was carried out between November and December 2017.

Ethical considerations: Approval at the Hospital was obtained prior to the commencement of the study. Ethical approval for the research with assigned number MOH/OFF/797/T.I/603 dated 29th November 2017, was obtained from Kano State Ministry of Health, Ethic Committee and was done in accordance with universal ethical principal; the informed consent of all the subjects for the study was sought from the patient's guidance.

Blood samples collection: The blood samples collection was done according to the standard produce of WHO[16]. The third finger of the subjects' left hand with palm upward was used, these were cleaned with a cotton wool lightly soaked in alcohol, using firm strokes unit and grease was removed from the ball of the finger. With a sterile lancet of ball of the finger was punched using a quick rolling section. Gentle pressure was applied on the finger to expressed the first drop of blood which was wiped away with a dry cotton wool making the sure no strands of the cotton remained on the finger. Gently pressure was again applied on the finger to collect a single small drop of blood on the middle of a cleaned slide for thin film. The age, gender and the clinical presentations were collected from the patient's guidance and recorded.

Preparation of blood films: A clean slides 'spreader' was used to touched the small drop of the blood on the slide, which was rested on a flat, film surface, the blood was allowed to ran along the edge of the spreader this was firmly used along the slide way form the largest drops, keeping this spreader at an angle or 45^0 and making sure is in contract with the surface of the slide. After spreading the blood and allowed to dried, individual's name, number and date was labeled on the portion of the slide using lead pencil[16].

Staining of the parasite: The standard procedure[16] was adopted for staining of the parasite. A small drop of the field stain was placed on the smear (thin film) and clean water was immediately added to it, so as to dilute the stain. After an hour the smear was then examined under a light microscope.

Examinations of blood films and identification of parasite: Using a microscope (Model: Olympus CX21) the sampled stained blood smears were observed for malaria parasites in accordance with the standard of WHO[16]. The positive samples were further subjected to the identification of parasite using standard guide provided by WHO[16].

Data analysis: The data collected were subjected to sensitivity and specificity analysis to check the prevalence of malaria and the credibility of the diagnostic test employed using Statdisk software (version 10.0.0)[17]. Also the data were subject to chi square test using WINKS software (version 7.0.8)[18] to check for significance of the results.

Results and discussion

The study determined the incidence of malaria among outpatient children presented with symptoms to HBPH, Kano. Table-1 shows the malaria test result and the clinical presentations of the outpatient children attending HBPH, Kano. The incidence of malaria infection among the outpatient children participated was 80% (120/150) among these children 52% were presented with fever and other symptoms while 28% with fever only. The total of children presented with fever and other symptoms was 64.7% out which 12.7% were tested negative while fever symptomatic children were 35.3% with 7.5% tested negative for malaria. The High positive predictive value 80.4% indicated the quality of the diagnostic test employed (thin films) in the study. While the low negative predictive value 20.8% shows that malaria infection was not excluded among the outpatient children. The children presented with fever and other symptoms are more likely to have malaria infection than those presented with fever only (odds ratio=1.075). The male participants were 53.4% with 40.7% positive for malaria and the female were 47.6% among which 39.3% were positive. The relationship between the diagnostic test results and the gender of the children did not differ significantly (P>0.05). The odds ratio 0.599 had it that male children are less likely to be infected by malaria than the female individuals (Table-2). About 68.0% of the children are of age range 1-3 and only 23% were between the age of 4-6. The test result and the age of the participants are not significantly related (p>0.05). The age group of 1-3 years were more likely to have malaria infection that the age group of 4-6 years (odds ratio=2.213, Table-3). The blood samples of participants identified with *P. falciparum* was 96.7%, only 3.3% samples were identified with *P. malariae*. Clinical presentations are less likely to occur in children infected with *P. malariae* than those infected with *P. falciparum* (odds ratio=0.610, Table-4).

In this study, the prevalence of malaria was high, where 80% of the outpatient children were found to be infected with malaria. This agreed with previous studies conducted in Kano and other

parts of Nigeria. Furthermore[8] stated that over 70% of children age 1-5 years suffer high rate of disability with the associated high parasite load of malaria. Current malaria risk charts estimated the prevalence of malaria in Nigeria between less than 20% to more than 70%[9]. Recently in Kano State 61.3% malaria prevalence among pregnant women visiting Aminu Kano Teaching Hospital was reported[12]. This study was in contrast with the findings of Oche A.O. et al[19] and Gajida A.U. et al.[20] who independently reported low prevalence rate of malaria; 29.4% among 160 blood donors in Kaduna State and 39.2% among pregnant women in Kano state attending facilities of Primary Health Care respectively.

With respect to clinical presentations, it was observed from the odds ratio that children with fever and other symptoms are more likely to have malaria infection than those with fever only. According to Beare N.A. et al.[21] sequence of recurrent attacks are characteristically yield by malaria, each of the attack has three stages; chills, fever and sweating along with these person is likely to develop malaise, muscular pains, headache and fever also sporadically nausea, vomiting and diarrhea. The body temperature rises as the skin feels hot and dry within one or two hours. Then the falls asleep as the body temperature falls with a drenching sweat feeling tired and weak[22]. Malaria symptoms occur between 10 to 16 days after the bite of infected mosquito which correspond with the bursting of the infected RBCs. The high positive predictive value showed the credibility of the diagnostic test employed (thin blood smear) for the study. Thick blood smears help to determine when infection is present, but a single smear without parasites is not sufficient to rule out malaria. Thin blood smears aid in identifying the species of parasite[23]. The most economic, preferred, and reliable diagnosis of malaria is microscopic examination of blood films because each of the four major parasite species has distinguishing characteristics. Thin blood films are similar to usual blood films

and allow species identification because the parasite's appearance is best preserved in this preparation[24].

The study recorded comparable incidence rate of malaria among the gender of children. This agreed with the studies conducted by Dawaki S. et.al.[25], Temu E.A. et.al.[26] and Brooker S. et. al.[27] suggests that distribution of malaria is heterogeneous. The high risk of malaria in females than males recorded was in agreement with[28] who identified that males were at lower risk of malaria when compared to females owing to repeated exposure to malaria which may result into the occurrence of partial immunity. In contrast researchers[29-30] reported that due to exposure, inherent and cultural determinants males were at high risk of malaria.

The children aged 1-3 were more likely exposed to malaria infection compared to those aged 4-6 in the study. According to MDG Region[31] the estimation in 2000 had that, children of age less than 5 years constituted 86% of malaria deaths and globally malaria caused 12% of all deaths in children between the ages of 1-59 months with 22% in sub-Sahara. At the 2000 United Nations General Assembly combating malaria and HIV/AIDS, was identified as priority due to their devastation.

Almost all the children with various clinical presentations were positive for *P. falciparum*, only few were positive for *P. malariae*. This agreed with the findings[25] who reported 60.6% positive cases of P. *falciparum*. These *Plasmodium* species is so virulent because the parasite infects red blood cells in all stages of development, leading to very high parasite levels in the blood[32]. In endemic regions, the prevalence of *P. malariae* ranges from less than 4% to more than 20% and is one of the least studied species of *Plasmodium* that infects humans due to low prevalence and milder clinical manifestations[6]. There are evidences that *P. malariae* infections are vastly under reported[33].

Table-1: Prevalence of malaria and diagnostic test among out-patients children attending Hasiya Bayero Pediatric Hospital Kano.

Test	Clinical presentations		Total (%)
	Fever and other Symptoms (%)	Fever (%)	
Positive result	78(52.0)	42(28.0)	120(80.0)
Negative result	19(12.7)	11(7.5)	30(20.0)
Total	97(64.7)	53(35.3)	150(100.0)
Sensitively (probability of true positive): 0.650(65.0%)			
Specificity (probability of true negative): 0.367(36.7%)			
Prevalence: 0.800(80.0%)			
Positive predictive value: 0.804(80.4%)			
Negative predictive value: 0.208(20.8%)			
Odds ratio: 1.075			

Values in parentheses are percentage.

Table-2: Incidence of malaria infection among the gender of out-patients children attending Hasiya Bayero Pediatric Hospital Kano.

Test	Gender		Total (%)
	Male (%)	Female (%)	
Positive result	61(40.7)	59 (39.3)	120 (80.0)
Negative result	19(12.7)	11 (7.3)	30 (20.0)
Total	80(53.4)	70 (46.6)	150 (100.0)
X^2 : 1.507			
P value: 0.220			
Odds ratio: 0.559			

Table-3: Incidence of malaria infection among the age categories of the children attending Hasiya Bayero Pediatric Hospital Kano.

Test	Age		Total (%)
	1-3(%)	4-6(%)	
Positive result	86(57.3)	34(22.7)	120 (80.0)
Negative result	16(10.7)	14(9.3)	30 (20.0)
Total	102(68.0)	48(32.0)	150 (100.0)
X^2 : 3.707			
P value: 0.055			
Odds ratio: 2.213			

Values in parentheses are percentage.

Table-4: Clinical presentation of outpatient children attending Hasiya Bayero Pediatric Hospital Kano and the specie of *Plasmodium* in their blood.

Clinical presentations	*Plasmodium* species		Total (%)
	P. falciparum(%)	*P. malariae*(%)	
Fever & other symptoms	75(62.5)	3(2.5)	78(65.0)
Fever	41(34.2)	1(0.8)	42(35.0)
Total	116(96.7)	4(3.3)	120(100.0)
X^2 : 0.182			
P value: 0.670			
Odds ratio: 0.610			

Values in parentheses are percentage.

Conclusion

Malaria infection prevalence among children with clinical presentations is high particularly the virulent *P. falciparum.* Consequently, there is an earnest need to provide sufficient malaria parasite diagnostic equipments and reagents in hospitals and primary health care facilities for evaluation of malaria infection status of all patients and make it free particularly in endemic regions. Massive enlightenment of general public over their malaria infection status should be embark on, so as to facilitate the control of this devastating disease.

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