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Research Paper

Prevalence of Malaria Among Patients Attending Bishop Murray Medical Centre (BMMC) and Federal Medical Centre (FMC), Makurdi, Nigeria

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ABSTRACT
Malaria is the most prevalent mosquito-borne parasitic disease throughout tropical and subtropical regions of the world and constitutes a major public health concern in Nigeria. This study aimed at assessing the prevalence of malaria in two major hospitals located in Makurdi, Benue State Nigeria. A cross-sectional study was adopted. Blood specimens were collected from individuals who came to the laboratory for tests and experiencing symptoms of the disease. The study population was made up of four hundred and ninety-six patients (496), (two hundred and forty-eight (248) patients from BMMC and FMC respectively). Samples of blood (about 5ml) were obtained intravenously with the assistance of hospital phlebotomist. Data collected were tabulated and carefully double entered and analyzed using computer statistical package SPSS 20.0. Results on the prevalence of malaria by use of insecticide treated net shows that patients who used insecticide treated net had a prevalence of 26.7% for malaria while 73.3% were negative. Prevalence of malaria was 34.9% in patients who did not use insecticide treated net but was 65.1% for those who used ITNs and were negative for malaria. Prevalence of malaria was 29.3% in those on prophylaxis while patients not on prophylaxis had 29.6% prevalence rate. The differences in prevalence were not statistically significant (X^2=0.003, df=1; p>0.05, p=0.953. Continuous provision of free antimalarial drugs and insecticide treated nets to households may reduce childhood deaths when used appropriately.

Keywords: *Prevalence, Malaria, Federal Medical Centre, Makurdi and Nigeria*

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I. INTRODUCTION

Malaria is the most prevalent mosquito-borne parasitic disease throughout tropical and subtropical regions of the world [1]. The disease is widespread in the tropical and subtropical regions where it exists in a broad band around the equator [1].This includes much of sub-Saharan Africa, Asia, and Latin America [2]. In 2021, 247 million cases of malaria worldwide resulted in an estimated 619,000 deaths, with 77 percent being 5 years old or less [3]. Around 95% of the cases and deaths occurred in sub-Saharan Africa. Rates of disease decreased from 2010 to 2014, but increased from 2015 to 2021 [3]. Malaria is a major public health concern in Nigeria, with an estimated 68 million cases and 194 000 deaths due to the disease in 2021 [3]. In humans, malaria is caused by six *Plasmodium species: P. falciparum, P. malariae, P. ovalecurtisi, P. ovalewallikeri, P. vivax*and*P. knowlesi*[4].Among those infected, *P. falciparum* is the most common species identified (~75%) followed by *P. vivax* (~20%) [5]. Although, *P. falciparum* traditionally accounts for the majority of deaths, recent evidence suggests that *P. vivax* malaria is associated with potentially life-threatening conditions ad about as often as with a diagnosis of *P. falciparum* infection [6]. *Plasmodium vivax* proportionally is more common outside Africa [7]. Some cases have been documented of human infections with several species of Plasmodium from higher apes, but except for *P. knowlesi*- a zoonotic species that causes malaria in macaques[8] these are mostly of limited public health importance [6].In Nigeria, malaria has been known to account for 11.5% of maternal death. The parasite *Plasmodium falciparum*, the predominant and most virulent malaria species in

Nigeria has been identified as major cause of low birth weight, still births, spontaneous abortion or death of the susceptible pregnant women [9]. It is to this end that this study aimed to assess the prevalence of malaria in patients attending Bishop Murray Medical Centre and Federal Medical Centre, Makurdi, Nigeria.

II. MATERIALS AND METHODS

Study Area

The hospitals are located in Makurdi Benue State which is in the mid-belt region of Nigeria with a population of about 4,253,641 in 2006 census [10]. Makurdi lies within the lower river Benue through in the middle belt region of Nigeria which lies at Longitude 7^0 47' and 10^0 0' East and Latitude 6^0 25' and 8^0 8' North. The wet season which runs from April to October, has well distributed rainfall with a monthly mean of 155.53 mm, an annual mean of 1 244.30 mm, and a peak in July/August and the dry season which runs from November to March with very little rainfall. Mean monthly relative humidity at 12.00 GMT range from 66%-68% in the rainy season and 15%-40% in the dry season, with an annual mean value of 60% (Encyclopedia Britannica, 2019) Mean daily temperature varies from 15.6^{o}C in December/January to 38^{o}C in February/March with an annual mean value of 27.5^{o}C [11].

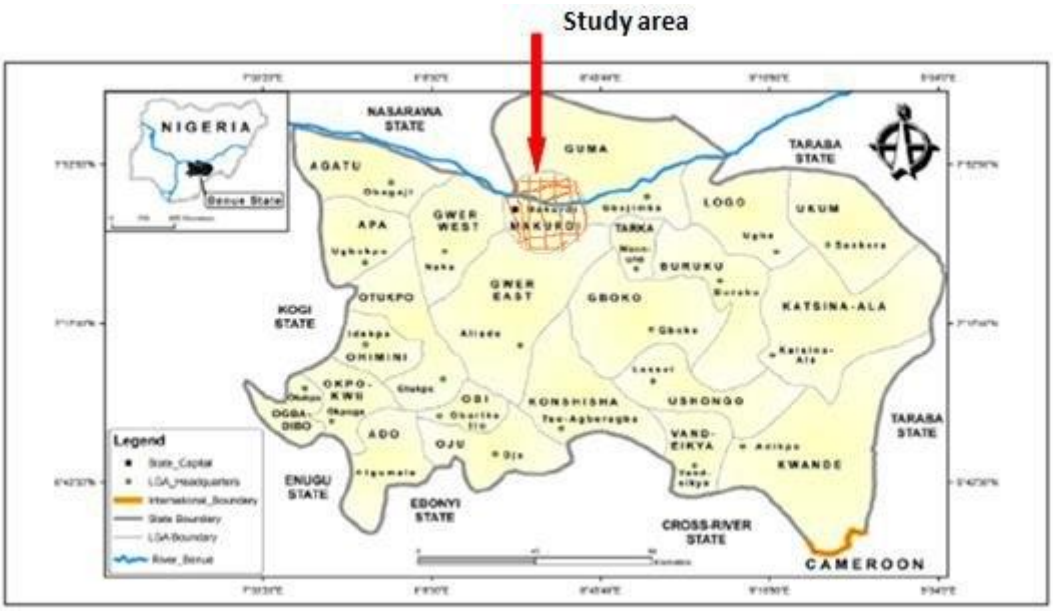

Fig 1: Map of Benue State showing Makurdi, the study area

Ethical clearance

Ethical clearance was sought and obtained from BMMC and FMC, Makurdi respectively. Consenting individuals were recruited for the study during the daily clinic. Semi-structured questionnaires were administered after explaining the details of the study and procedure.

Inclusion/ Exclusion criteria

Consented individuals with febrile illness were used for the study and they included patients who were sent to the laboratory for test.Those included are patients who do not have any symptoms of febrile illness.

Sample Size

Sample size was determined using this formula; $n=Z^2 P q/d^2$

Where n=desired sample size

Z=standard and normal deviation usually set at 1.96 or approximately 2.0 which correspond to 95% (0.05) confidence level.

P=proportion in the target population estimated to have the particular characteristics.

q=1.0-p

d =degree of accuracy usually set at 0.05 (source: Research Methodology, Prof. (Mrs). Araoye)

The sample size was determined in view of the prevalence rate of 25.5% for malaria and hepatitis from previous studies carried out in Kano, Nigeria [12]. Number of subjects who were studied in each group was calculated to be 200. An attrition rate of 10% was added to the number to arrive at the sample size.

The calculation was based on fisher's sample size formula [13].

$$N = \frac{Z^2 P(1-P)}{d^2}$$

N = minimum sample size,
Z = (1.96) constant mean deviate,
1= constant
P= local prevalence of similar previous study = 25.5% (Dabo et al., 2015).
d = Degree of precision adopted for the study = 0.05
$N = (1.96)^2$ X 0.25 X 0.83/$(005)^2$ = 0.535
N= 0.535/0.0025
N= 224

Using attrition rate of 10%, we have 224/0.9 = 248

Sample collection

Blood specimens were collected from individuals who came to the laboratory for tests and experiencing symptoms of the disease. The study population was made up of four hundred and ninety-six patients (496), (two hundred and forty-eight (248) patients from BMMC and FMC respectively). These included patients who were at the laboratory for test, (male, female, adult and children). Four hundred and ninety-six questionnaires were administered to adults who came to the laboratory for tests. The aim was to determine the prevalence rates of the disease, the associated risk factors of the diseases and the socio-demographic information of the patients.

Laboratory procedures for malaria test

Samples of blood (about 5ml) were obtained intravenously with the assistance of hospital phlebotomist. The blood samples were transferred into an ethylene aminetetraacetic acid (EDTA) bottle to prevent blood coagulation. Test procedure for malaria was carried out using care start. The strip from the sealed foil punch was gently removed and the sample number written on the strip. After which the sample number was also written on the cassette, then 5ul of whole blood was added into ''S'' well and 60ul assay buffer was added. The result was read after 20 minutes and written down.

Interpretation of test result

The presence of two colour band (One band in the control and another band in the test indicates a positive result).The presence of only one band in the control area indicates a negative result.The test was invalid if the Control band did not appear.

Data Analysis

Data collected were tabulated and carefully double entered and analyzed using computer statistical package SPSS 20.0. Chi square test was used to determine associations between variables; correlation coefficients were used to determine relationships between variables. Descriptive statistics (frequency and percentages) were used in data analyses. In all the analyses the confidence level was held at 95% and significance was held at 0.05 level.

III. RESULTS AND DISCUSSION

The prevalence of malaria by use of insecticide treated net in BMMC; Makurdi is presented in (Table 1). Patients who used insecticide treated net had a prevalence of 26.7% for malaria while 73.3% were negative. Prevalence of malaria was 34.9% in patients who did not use insecticide treated net but was 65.1% for those who used ITNs and were negative for malaria. The difference in prevalence rate of malaria among insecticide net use and non-insecticide net use was statistically significant (p>0.05; p=0.02).

Table 1: Prevalence of Malaria by the use of Insecticide treated Net in Bishop Murray Medical Centre, Makurdi

Insecticide net	Number examined (%)	Number positive (%)	Number negative (%)
Yes	165 (100)	44 (26.7)	121 (73.3)
No	83 (100)	29 (34.9)	54 (65.1)
Total	248 (100)	73 (29.4)	175 (70.6)

X^2 = 1.820, df=1; p>0.05 (p=0.02)

Table 2 below shows the prevalence of malaria by use of insecticide treated nets (ITNs) in Federal Medical Centre, Makurdi. Data showed that prevalence of malaria in those who used ITNs was 46.8% while 53.2% was negative to malaria. Prevalence was 70.7% was recorded for those who did not ITNs while 29.3% for those that used ITNs. The difference in the prevalence rates between them was statistically significant ($p \leq 0.05$; $p=0.01$).

Table 2: Prevalence of Malaria in those who used of Insecticide treated Net in Federal Medical Centre, Makurdi

Insecticide net	Number examined (%)	Number positive (%)	Number negative (%)
Yes	190 (100)	89 (46.8)	101 (53.3)
No	58 (100)	41 (70.7)	17 (29.3)
Total	248 (100)	130 (52.4)	118 (47.6)

$X^2 = 10.132$, df=1; $p>0.05$ ($p=0.01$)

The prevalence of malaria by income level in FMC, Makurdi among the low-income level was 7.3% and was positive for malaria while 93.1% were negative. Prevalence was 50% among middle income earners and 50% were negative. The difference in the prevalence of malaria by income level at FMC, Makurdi was not statistically significant ($p>0.05$; $p=0.852$) as shown in (Table 3) below.

Table 3: Prevalence of Malaria by Income Level in Federal Medical Centre, Makurdi

Income level	Number examined (%)	Number positive (%)	Number negative (%)
Low	224 (100)	123 (52.6)	111 (47.4)
Middle	14 (100)	7 (50.0)	7 (50.0)
High	0 (0)	0 (0.0)	0 (0.0)
Total	248 (100)	130 (52.4)	118 (47.6)

$X^2 = 0.035$, df=1; $p>0.05$ ($p=0.852$)

Prevalence of malaria by clinical manifestation in FMC, Makurdi is shown in (Table 4) below. Prevalence of 57.7% was observed in those with fever, 59.2% in those who had headache, and 44.4% in those with general body pains, 40.0% in those who had back pain, hotness of body 50%, persistent crying 0.0%, blurred vision 100%, stomach pain 0.0% and joint pain 100%. Differences in prevalence rates among them were not statistically significant ($p>0.05$; $p=0.351$).

Table 4: Prevalence of Malaria by Clinical Manifestation in patients that attended Federal Medical Centre, Makurdi

Clinical manifestation	Number examined (%)	Number positive (%)	Number negative (%)
Fever	137 (100)	79 (57.7)	58 (42.3)
Headache	59 (100)	29 (49.2)	30 (50.8)
General body pain	18 (100)	8 (44.4)	10 (55.6)
Back pain	25 (100)	10 (40.0)	15 (60.0)
Hotness of the body	4 (100)	2 (50.0)	2 (50.0)
Persistent crying	1 (100)	0 (0.0)	1 (100)
Blurred vision	1 (100)	1 (100)	0 (0.0)
Stomach pain	2 (100)	0 (0.0)	2 (100)
Joint pain	1 (100)	1 (100)	0 (0.0)
Total	248 (100)	130 (52.5)	118 (47.6)

$X^2 = 8.898$, df=8; $p>0.05$ ($p=0.351$)

The prevalence of malaria according to clinical manifestation of patients attending BMMC, Makurdi is shown in (Table 5), Data indicated that 28.5% of patients who complained of fever tested positive for malaria while 71.5% of fever patients were negative. Prevalence of malaria was 32.0% in patients experiencing

headache, while 68.0% were negative. Those with backpain had no malaria (0.0%), persistent crying also had no malaria (0%), hotness of body (100%), blurred vision (100%), stomach pain (100%) and joint pain all had 100% prevalence rates respectively. The difference in the prevalence rate of malaria according to clinical manifestation was not statistically significant (p>0.05; p=0.272).

Table 5: Prevalence of Malaria by Clinical Manifestation in Bishop Murray Medical Centre, Makurdi

Clinical manifestation	Number examined (%)	Number positive (%)	Number negative (%)
Fever	151 (100)	43 (28.5)	108 (71.5)
Headache	50 (100)	16 (32.0)	34 (68.0)
General body pain	41 (100)	10 (24.4)	31 (75.6)
Back pain	1 (100)	0 (0.0)	1 (100)
Hotness of the body	1 (100)	1 (100)	0 (0.0)
Persistent crying	1 (100)	0 (0.0)	1 (100)
Blurred vision	1 (100)	1 (100)	0 (0.0)
Stomach pain	1 (100)	1 (100)	0 (0.0)
Joint pain	1 (100)	1 (100)	0 (0.0)
Total	248 (100)	73 (29.4)	175 (70.6)

X^2 = 8.744, df=8; p>0.05 (p=0.272)

In (Table 6), prevalence of malaria was 29.3% in those on prophylaxis while patients not on prophylaxis had 29.6% prevalence rate. The differences in prevalence were not statistically significant (X^2=0.003, df=1; p>0.05, p=0.953). Those with tattoo or tribal marks had 31.4% prevalence rate while those without tattoo or tribal marks had 28.9%. The differences in prevalence were not statistically significant (X^2=0.116, df=1; p>0.05, p=0.733). It was also observed that 22.2% of the patients who had been transfused with blood tested positive for malaria while 30% of those who had not been transfused tested positive for malaria. The differences in prevalence were not statistically significant (X^2=0.486, df=1; p>0.05, p=0.486).

Patients who had been hospitalized had 28.6% prevalence of malaria while those who had never been hospitalized had 29.7% prevalence. The differences in prevalence were not statistically significant (X^2=0.30, df=1; p>0.05, p=0.862). Those who had undergone surgery had 26.7% while 29.6% of those who had never had surgery tested positive for malaria. The differences in prevalence were not statistically significant (X^2=0.059, df=1; p>0.05, p=0.808). For those who indulged in drug abuse, none (0.0%) tested positive for malaria while as high as 29.8% of those who did not indulge in drug abuse were positive.The differences in prevalence were not statistically significant (X^2=1.267, df=1; p>0.05, p=0.260). Those who consumed alcohol had 18.5% while those who did not had 30.8% prevalence of malaria. The difference in prevalence was statistically significant (X^2=1.738, df=1; p<0.05, p=0.01).

Table 6: Prevalence of Malaria according to Medical Records\History in BMMC, Makurdi

Medical information	Number examined (%)	Number positive (%)	Number negative (%)	Chi square value		
Prophylaxis						
Yes	140 (100)	41 (29.3)	99 (70.7)			
No	108 (100)	32 (29.6)	76 (70.4)			
Total	248 (100)	73 (29.4)	175 (70.6)	X^2=0.003, (p=0.953)	df=1;	p>0.05
Tattoo/Tribal Marks						
Yes	51 (100)	16 (31.4)	35 (68.6)			
No	197 (100)	57 (28.9)	140 (71.1)			
Total	248 (100)	73 (29.4)	175 (70.6)	X^2=0.116, (p=0.733)	df=1;	p>0.05
Blood Transfusion						
Yes	18 (100)	4 (22.2)	14 (77.8)			
No	230 (100)	69 (30.0)	161 (70.0)			
Total	248 (100)	73 (29.4)	175 (70.6)	X^2=0.486, (p=0.486)	df=1;	p>0.05
Previous Hospitalization						
Yes	63 (100)	18 (28.6)	45 (71.4)			

No	185 (100)	55 (29.7)	130 (70.3)			
Total	248 (100)	73 (29.4)	175 (70.6)			
				X^2=0.30, (p=0.862)	df=1;	p>0.05
Previous surgery						
Yes	15 (100)	4 (26.7)	11 (73.3)			
No	233 (100)	69 (29.6)	164 (70.4)			
Total	248 (100)	73(29.4)	175 (70.6)	X^2=0.059, (p=0.808)	df=1;	p>0.05
Drug abuse						
Yes	3 (100)	0 (0.0)	3 (100)			
No	245 (100)	73 (29.8)	172 (70.2)			
Total	248 (100)	73(29.4)	175 (70.6)	X^2=1.267, (p=0.260)	df=1;	p>0.05
Alcohol consumption						
Yes	27 (100)	5 (18.5)	22 (81.5)			
No	221(100)	68 (30.8)	153 (69.2)			
Total	248 (100)	73(29.4)	175 (70.6)	X^2=1.738, (p=0.01)	df=1;	p>0.05

IV. DISCUSSION

Prevalence of malaria was (46.8%) in patients who use insecticide treated net and 70.7% in patients who did not. The difference in the prevalence rate between them was statistically significant ($p<0.05$; $p=0.01$). Insecticide treated nets are a form of personal protection from mosquito bite and it has been shown to reduce malaria [3]. In several African settings, insecticide treated nets were shown to reduce the death of children under 5 years from malaria by about 20% [14].

Results of this study (BMMC, Makurdi) showed prevalence of malaria (28.5%) in patients who complained of fever, (32.0%) in patients experiencing headache, those with back pain had no malaria (0.0%), persistent crying also had no malaria (0%), elevated body temperature (100%), blurred vision (100%), stomach pain (100%) and joint pain all had (100%) prevalence rates respectively. The difference in the prevalence rate of malaria according to clinical manifestation was not statistically significant ($p>0.05$; $p=0.272$). Adults with malaria tend to experience chills and fever as well as headache, fatigue, abdominal discomfort, and muscle pain[15].Children tend to have more general symptoms: fever, cough, vomiting, and diarrhea [15].Initial manifestations of the disease common to all malaria species are similar to flu-like symptoms[16]. The presentation may include headache, fever, shivering, joint pain, vomiting, hemolytic anemia, jaundice, hemoglobin in the urine, retinal damage, and convulsions[17].

It was discovered that prevalence of malaria was higher (29.7%) among the low-income earners than the middle-income earners (25%). The difference in prevalence rate of malaria according to income level was not statistically significant ($p>0.05$; $p=0.687$).

It was observed in this study that malaria and clinical manifestation were positively correlated. This means that malarial patients experienced some clinical manifestation symptoms such as fever, headache and body pains. Malaria and use of insecticide treated net were highly negatively correlated. This means that the higher the prevalence of malarial the lower the number of patients using insecticide treated nets and vice versa. Use of insecticide treated nets has been shown to reduce malaria drastically [3]. Malaria and previous hospitalization were also negatively correlated

V. CONCLUSION

It was also observed that malaria was more prevalent in those who did not use ITNs compared to those who did. Clinical manifestation such as fever, headache, general body pains, elevated body temperature and blurred vision were associated with the high prevalence of malaria. Therefore, continuous provision of free antimalarial drugs and insecticide treated nets to households may reduce childhood deaths when used appropriately.

DISCLOSURE OF STATEMENT

There is no conflict of interest by the author (s)

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