MALARIA PARASITAEMIA AMONG FEBRILE UNDER-FIVE CHILDREN AT NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL, NNEWI, SOUTH-EAST, NIGERIA.

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ABSTRACT

BACKGROUND:
Malaria is an infectious disease caused by Plasmodium and transmitted by the bite of an infected female *Anopheles* mosquito. It continues to be a global challenge with about half of the world's population being at risk of the disease and under–5 children being the most vulnerable.

AIMSAND OBJECTIVES:
To determine the prevalence of malaria parasitaemia and some associated symptoms among febrile under-five children presenting at Nnamdi Azikiwe University Teaching Hospital Nnewi, Nigeria.

MATERIALS AND METHOD:
A total of 200 children under the age of five years were recruited for the study. Data on socio-demographic characteristics and symptoms were collected through interviewer administered questionnaire. They were physically examine and blood sample was collected from each of them. The Blood smear was Giemsa stained and examined microscopically for malaria parasite.

RESULT:
There were 118 males and 82 females, giving a male: female ratio of 1.44:1. Their ages ranged from 3-59 months and the average age was 27±17.49 months. Those in the age range of 12-23 months and 24-35 months constitute the highest number (23%) each. Forty-seven (23.5%) came from the rural area while 153(76.5%) came from the urban area. Average number of days the subjects had fever before presentation were 3.78±1.95 days with a range of 1-30 days. Body temperature ranged from 35.9-40.4^{0}C with average of 37.7±0.8^{0}C. Forty (20%) were positive to microscopy. Those in the age range of 47-59 months have the highest prevalence of malaria. Parasite density ranged from 40-136,000/µL with a mean of 18,687.2±3360/µL. All the children who are positive by microcopy had *Plasmodium falciparium* as the specie causing malaria.

CONCLUSION:
Malaria parasitaemia among these under-5 children is 20%.

KEYWORDS: Malaria, parasitaemia, under-5.

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INTRODUCTION

Malaria is an infectious disease caused by Plasmodium and transmitted by the bite of an infected female *Anopheles* mosquito. It continues to be a global challenge putting about half of the world's population at risk of the disease. Annually about 250 million cases of malaria occur globally with nearly a million deaths. Most of these fatalities are recorded in children under the age of 5years[1,2]. In Nigeria the prevalence of malaria is high, and it is one of the leading causes of morbidity and mortality in the country.[3-5] About 50% of Nigerians suffer at least one episode of malaria annually, and malaria accounts for over 45% of outpatient visits in Nigerian hospitals.[4,6] The World health organization also reported that one out of every five children die in Nigeria, and of these, 25% are caused by malaria.[7] The malaria burden is indeed a threat to life and a drain on the economy of the already impoverished communities of sub-Saharan Africa.[8] Following the introduction of roll back malaria by WHO in Nigeria and sub- Sahara Africa, several interventional programmes have been implemented under the scheme with obvious reduction in the proportion of febrile children with malaria. This is supported by a report of reduced prevalence of malaria among febrile children in Lagos, south-west Nigeria (20.7%) by Oladosu and Oyibo[9] and Enugu south-east

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Nigeria (29.2%), by Oguonu *et al*[10]

Over the years, major advances have been made in the diagnosis of malaria especially with the introduction of rapid diagnostic test (RDT) for malaria. These notwithstanding, presumptive diagnosis of malaria remain very high, even in tertiary health care facilities where expert microscopist should be available. Importantly, whereas this practice may have been allowed in the past, the availability of cost effective and simple malaria should encourage the clinician to discard the presumptive diagnosis of malaria especially with the decline in prevalence of malaria in the endemic areas.

This study is aimed at determining the prevalence of malaria among febrile under-5 children and ascertained the relationship between symptoms and parasitaemia in our locality.

SUBJECTS AND METHODS

The study was carried out at the Paediatric Clinic and Children's Emergency Room of Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, South-east Nigeria. The hospital amongs other services, maintains a Paediatric out-patients' clinic that is open from Monday to Friday every week, and a childrens' emergency room that is open 24 hours every day.. Nnewi is a commercial city located in Nnewi North Local Government Area of Anambra state, South-East, Nigeria. Its population based on 2006 census estimate is 391,227.[11] The people are predominantly Igbo-speaking and mainly traders and civil servants. Nnewi is located on latitude $6^0$0 01' N and longitude 6^0 55'E, has a mean daily temperature of 30.4^{0}C, and mean annual rainfall of about 200 cm.[12]

The study is a Cross–sectional, hospital based observational study. Malaria parasitaemmia was determined using the standard thick and thin Giensa stained microscopy. This study involved children aged 0-59 months attending the childrens' out-patients' clinic and childrens' emergency room of the Nnamdi Azikiwe University Teaching Hospital Nnewi, presenting with fever defined as axillary temperature of $\geqslant$ 37.5°C (measured with mercury in glass thermometer), or with history of fever within the last 72 hours.

All subjects who met the criteria for the study were recruited consecutively until the sample size was met. Mother or caregiver was interviewed and the subject physically examined. All information obtained were recorded on the proforma. Information sort was on demographic characteristics, symptoms like fever or history of fever, vomiting, abdominal pain, and convulsions, while signs recorded were weight, pallor, and axillary temperature. Two milliliters of blood was collected from each patient and kept in an ethylene diamine tetracetic acid (EDTA) bottle. Thick and thin blood smear were prepared and stained with 3% Giemsa stain, and examined microscopically using standard recommendations.[13] Parasite densities was determined from thick blood smear by counting the number of asexual parasites per 200 white blood cells and expressed as parasites/µL (microlitre) assuming a total WBC count of 8000/L14 Parasite density = No of parasites counted x Total WBC/200. A smear was considered negative if no parasites were viewed after 200-500 high-powered fields of thick blood smear fields.

Institutional ethical approval was obtained from the Ethics Committee of the Nnamdi Azikiwe University Teaching Hospital Nnewi. Individual informed/written consent was obtained from each parent/caregiver after education on the need for the study

Computer software SPSS (version-16 Chicago, IL) was used for data entry and analysis. The tests of statistical significance were done using chi-square (X^2). A p-value of $\leqslant$ 0.05 was assumed to be statistically significant.

RESULTS

A total of 200 children under the age of five years were recruited for the study. There were 118 males and 82 females, giving a male: female ratio of 1.44:1. Their ages ranged from 3-59 months and the mean age was 27 months $\pm$17.49 months. Those in the age range of 12-23 months and 24-35 months constituted the highest number (23%) each (Table I).

Forty-seven (23.5%) came from the rural area while 153(76.5%) came from the urban area. Fifty of the children (25%) were from the upper social class, 70(35%) from middle class while 80(40%) were from low class. (Table II).

The mean number of days the subjects had fever before presentation were 3.7$\pm$1.9 days with a range of 1-30 days. Body temperature ranged from 35.9-40.4^{0}C with mean of 37.7$\pm$0.80C, (Table III). Besides fever and history of fever, other symptoms the subjects presented with include cough, vomiting, catarrh, abdominal pain, convulsion, weakness, lose stool among others. Forty (20%) were positive to microscopy.

Of all the subjects recruited in this study (n=200), 132 (66%) presented with fever (temperature $\geq 37.5^0$C) while 68 (34%) presented with history of fever (temperature < 37.5^0C, but had fever within the past 72hours). Amongst the subjects who had malaria parasitaemia (n=40), 28 (70%) presented with fever while 12 (30%) presented with history of fever. The difference between malaria parasitaemia among those presenting with fever and those presenting with history of fever was not statistically significant. P-value = 0.550. (Table IV). Also amongst all the subjects with malaria, 30 (75%) presented with fever or history of fever plus other symptoms while 10 (25%) presented with fever or history of fever alone. However there was no statistical difference in malaria parastiaemia between these two groups, p-value = 0.111 (table V).

Parasite density ranged from 40- 136000/µL with a mean of 18,689/µL . Those in the age range of 0-11 months had the highest parasite density with a mean of 38,144/µL, (Table VI). All the children with malaria parasitaemia have *plasmodium* falciparium as the specie causing malaria.

TABLE I: AGE AND SEX DISTRIBUTION OF THE SUBJECTS

AGE (MONTHS)	MALES N (%)	FEMALES N (%)	TOTAL N (%)N=200
0-11	23 (11.5)	22 (11.0)	45 (22.5
12-23	24 (12.0)	22 (11.0)	46 (23.0)
24-35	28 (14.0)	18 (9.0)	46 (23.0)
36-47	14 (7.0)	5 (2.5)	19 (9.5)
48-59	29 (14.5)	15 (7.5)	44 (22.0)
Total	**118 (59.0)**	**82 (41.0)**	**200 (100.0)**

TABLE II: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF SUBJECTS

CHARACTERISTICS	NUMBER (PERCENTAGE)
(A) Place of domicile	
Rural	47 (23.5)
Urban	153(76.5)
Total	**200 (100.0)**
(B) Social Class	
Upper	50 (25.0)
Middle	70 (35.0)
Low	80 (40.0)
Total	**200 (100.0)**

TABLE III: CLINICAL CHARACTERISTICS AND OTHER MAJOR PRESENTING SYMPTOMS OF SUBJECTS

A

CHARACTERISTICS	MEAN±SD	RANGE
Duration of Fever (days)	3.78±3.9	1-30
Body Temperature (^{0}C)	37.76±0.8	35.9-40.

B.

MAJOR SYMPTOMS	NUMBER OF SUBJECTS (%)
Cough	60 (30.0)
Vomiting	39 (19.5)
Lose stool	19 (9.5)
Catarrh	17 (8.5)
Abdominal pain	15 (7.5)
Weakness	14 (7.0)
Convulsion	13 (6.5)
Others	30 (15.0)

NB ; others include loss of appetite, passage of yellow urine, body rash, passage of dark urine, body swelling, unconsciousness, fast breathing, etc.

TABLE IV: FREQUENCY OF MALARIA PARASITAEMIA AMONG SUBJECTS WHO PRESENTED WITH FEVER AND THOSE WHO PRESENTED WITH HISTORY OF FEVER .

	VARIABLE	Fever	History of Fever	TOTAL	X^2	P-value
MalariaParasitaemia	Yes	28	12	40	0.357	0.550
	No	104	56	160		
TOTAL		**132**	**68**	**200**		

TABLE V: ASSOCIATION BETWEEN SUBJECTS THAT PRESENTED WITH FEVER OR HISTORY OF FEVER ALONE AND THOSE THAT PRESENETED WITH FEVER OR HISTORY OF FEVER AND OTHER SYMPTOMS WHO HAD MALARIA.

Mode of presentation	Other symptoms Present	Absent	Total	X^2	P-value
Fever	19	9	26	0.245	0.111
History of fever	11	1	12		
Total	**30**	**10**	**40**		

TABLE VI: PREVALENCE OF MALARIA, MEAN AND RANGE OF PARASITE DENSITY ACCORDING TO AGE GROUPS

AGE GROUP (MONTHS)	MALARIA PREVALENCE BY MICROSCOPY N (%)	MEAN PARASITE DENSITY/µL	RANGE OF PARASITE DENSITY/µL
0 – 11	9 (22.5)	38,144	40 – 136,000
12 – 23	7 (17.5)	721	160 – 2,113
24 – 35	7 (17.5)	15,176	80 – 86,562
36 – 47	4 (10.0)	15,003	117 – 45,200
48 – 59	13 (32.5)	17,923	80 – 81,481
TOTAL	**40 (100.0)**	**18,689**	**40 – 136,000**

DISCUSSION

This study shows that the prevalence of malaria parasitaemia among these febrile under-five children in NAUTH is 20%. This is similar to 20.7% documented by Oladosu and Oyibo [9] in a study of malaria among febrile children in a primary health centre in Lagos, south-west, Nigeria, but lower than the 32% reported by Enwuru et al[15] in Owerri, south-east Nigeria . The lower prevalence in the present study compared to that documented by Enwuru et al [15] whose study was similar and conducted in the same region (South-East Nigeria) could be attributed to the different settings where both studies were carried out. Whereas Enwuru et al[15] carried out their study at a private hospital, the present study was conducted at a tertiary institution (a referral centre). Most of the subjects in this study may have attended one or more hospitals before presentation at NAUTH and may have been given some anti-malarial treatment before presentation. This may suggest that malaria is unlikely to be a possible cause of fever in these children presenting at the teaching hospital. Sani and co-workers 16 in Sokoto, northern Nigeria, had documented a prevalence of 40% in a similar study. But considering the fact that this work was done later than Sani et al's,[16] the possibility is that the effect of interventions like the Roll Back Malaria over this period may have contributed to the reduction in the prevalence noted. For instance, the use of insecticide treated nets by under-five children in Nigeria increased from 7% in 2008 to 30% in 2010.[17]

Importantly, in a recent result of Nigeria Malaria Indicator Survey released by the Federal Ministry of Health, South-East Nigeria has the least prevalence of malaria (28%) among under-five children.[17] This is 8% higher than the finding in this study, but it must be noted that like sani et al's work, the data was collected a little earlier than that of the present study..

Reyburn et al[18] in a study in Tanzania documented a prevalence of 14%, which is just a little lower than the finding of the present study, but this was following massive interventions like free distribution ACTs and insecticide treated nets (ITNs) by the government. Ahmed et al[19] and Endeshaw et al[20] documented prevalence rates of 3% and 3.3% in Sudan and Ethiopia respectively. This is quite low compared to the result of the present study but it is understandable because the Sudan and Ethiopian studies were conducted in areas of low malaria endemicity, while the present study was conducted in an area of high endemicity.

The low prevalence of this study may have given credence to the fact that the various intervention programmes by government and non-governmental agencies may have started yielding the desired results. SuNMaP (Support for National Malaria Programme) a DFID (Directorate for International Development) funded programme have since 2009 used Anambra state as one of its pilot states for massive malaria control programmes such as house-to-house distribution of long lasting insecticide treated nets with the subsequent follow up visits, and distribution of ACTs for children.

From the result of this study, it is likely that malaria is over diagnosed among febrile under-five children in our centre. Twenty percent prevalence against more than 90%[21] in presumptive diagnosis is quite a wide disparity. There is therefore need for us to improve and fine-tune the practice in our locality to ensure prompt parasite based diagnosis of malaria. This will also help in reducing wastage of antimalarial drugs, exposure of children to unwarranted treatments and protect the ACTs from developing resistance. In several years of its use, Gbotosho and co-workers,[22] had documented that ACTs are still efficacious against malaria in Nigerian children and that significant resistance has not emerged. Oladosu and Oyibo,[9] also documented this overdiagnosis of malaria in their study where they observed that 83% of children that were negative to microscopy received treatment for malaria. Reyburn et al [18] also documented this massive over diagnosis of malaria especially among febrile under-five children in Tanzanian and opined that such practice threatened the sustainability of deployment of free ACTs and that treatment of bacteria diseases are likely to be missed.

Another observation in this study is that there is no significant different in the prevalence of malaria amongst the subjects that presented with fever and those who presented with history of fever, (table IV).

Similar findings have been reported from malaria endemic areas.[23] The presence of malaria parasites without febrile illness could be explained in part by the acquired protective immunity following repeated infections.[24] Because of this, a proportion of children under the age of five years who have acquired partial immunity are likely to be asymptomatic or present with periodic fever. There is also a possibility that the caregiver of these children may have been over zealous with the administration of antipyretics. This is consistent with the WHO recommendations that malaria should also be suspected amongst subjects who do not have fever on presentation but had history of fever in the past 72hours. Also apart from fever and history of fever alone, reasonable percentage of the subjects with malaria parasitaemia presented with fever or history of fever plus other symptoms such as cough and vomiting which is common with other tropical diseases. Although there was no statistical difference in malaria parastiaemia between these two groups, there is need for the clinician to have a high index of suspicion especially in view of the possible overlap of these symptoms.

All the 40 subjects' positive by Giemsa-stained microscopy had *Plasmodium falciparum* as the specie causing malaria. This is not far from expectations as *Plasmodium falciparum* is the predominant cause of malaria in West African sub- region.[25] Study of malaria by Ike and Tedaire[6] in Jos, northern Nigeria among febrile under-five documented that of all the 250 subjects recruited in the study, 56% that had malaria parasitaemia had Plasmodium falciparum as the cause of malaria. Other studies in other parts of Nigeria and the sub-Sahara African sub-region documented similar findings.[9,24]

CONCLUSION

Prevalence of malaria in this study is 20% and is lower than earlier reports. This may suggest a decline in the burden of the disease, therefore a study on the effect of various control programmes is worthwhile.

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