Prevalence of Malaria in Patients Attending the General Hospital Makarfi, Makarfi Kaduna – State, North-Western Nigeria

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Abstract   Nigeria is a high endemic country for malaria. Its large population, diverse weather conditions and cultures make it a bit difficult implementing the same malaria control measures throughout the country. Prevalence studies are therefore essential for better understanding and implementation of intervention programs. This study determined some malariometric parameters such as malaria prevalence, transmission based on age and gender, parasite density, fever and anaemia in patients attending General Hospital Makarfi, during the malaria transmission season. All participants were screened microscopically for malaria and classified into 3 groups: under 5 years, 5 – 15 years and above 15. A total of 1173 participants were screened out of which 419 (35.7%) were positive. The geometric mean parasite density was 15,108 parasite/μL of blood. Children aged 5 – 15 years had a statistically significant higher infection rate compared to the other groups. Males were more prone to malaria than females. Presence of parasitaemia, fever or anaemia did not correlate with the presence of malaria. Some of the positive patients had high parasite densities and yet asymptomatic. More malariometric surveys are needed in Nigeria in order to adopt control efforts that best suit rural areas and smaller communities especially during peak malaria transmission season.

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1. Introduction

Tremendous gains have been made in the fight against malaria in the past few years. Between 2000 and 2012, the malaria incidence rate reduced by 25% globally, and by 31% in the WHO African Region [1]. The estimated malaria mortality rates fell by 42% in all age groups and by 48% in children under 5 years of age [1]. This success has been attributed to the adoption of the artemisinin combination therapy (ACT) as first line drug treatment in malaria endemic regions and also the scale - up of intervention efforts such as the use of long lasting insecticide nets (LLIN), intermittent prevention treatment (IPT) for pregnant women, vector control measures and more importantly increased funding [1]. Despite these gains, malaria still remains a major health challenge in Nigeria with high morbidity and mortality. The country is one of the two countries which accounts for 40% of all deaths associated with the disease [1]. The disease reportedly accounts for an estimated 60% of outpatient hospital visits in Nigeria, 30% of hospitalizations, 30% of under-five mortalities, 25% of infant mortalities and 11% of maternal mortalities [2, 3].

Malaria is holoendemic in Nigeria, with a steady transmission rate throughout the year which comprises of a distinctive rainy and dry season [4]. Nigeria is made up of several hundreds of communities and settlements with their own indigenous people, microclimate, topography, population densities, cultural practices and general way of life. These parameters greatly influence the transmission intensity and management of the disease. The Nigerian Ministry of Health had a targeted goal of reducing all malaria-related morbidity and mortality to as much as 50% by the year 2013 [5] but have so far been unable to achieve this. Generating data on malaria epidemiology and transmission dynamics, risk factors associated with infection, efficacies of available antimalarials are necessary and essential for effective interventions, planning strategies and implementation of control measures tailored to the requirements of individual communities or settings [6].

Prevalence studies and other community based malaria surveys are important tools for assessing the impact and effectiveness of malaria control measures and programmes at local and national levels. The surveys will also help in determining current malaria burden and appropriate measures for individual settings in order to achieve uniform and meaningful control of the disease throughout

the country. This study was carried to assess prevalence of malaria in patience attending the General Hospital Makarfi, Kaduna State, North-western Nigeria.

2. Methods

2.1. Study Site

The study was conducted at the General Hospital Makarfi, which is one of the Sentinel Study Sites for the antimalarial chemotherapy efficacy studies in Nigeria, from July to September 2011. Makarfi is located in the northern part of Kaduna state in the North - western region of Nigeria. It is located in the Guinea savannah belt of Northern Nigeria, and is one of the major towns bordering Kaduna and Kano states. There are distinct wet and dry seasons, with the wet season occurring between May and September (peaks between July and August), which is also the peak malaria transmission season [4]. The hospital is a secondary healthcare facility serving many smaller towns and villages both in Kaduna and Kano states.

2.2. Ethical Approval

The study protocol was approved by the ABUTH Ethical Review Committee. Before the commencement of the study, consent was sought from patients or parent/legal guardian after details of study was explained to them in English and Hausa language for those who could not understand English language.

2.3. Study Protocol

Patients attending the hospital, who were febrile or with a history of fever in the past 24 hours were screened for malaria. Finger prick blood samples were collected to prepare thick and thin films stained with Giemsa stain and used for microscopic identification and parasite density determination. All patients were classified into three age groups as: under 5 years of age, age 5 to 15 and above 15 or adult [7]. Fever (Axillary temperature $\geq 37.5°C$) was assessed in 324 patients while anaemia (PCV< 33%) were assessed in 322 patients. All malaria positive patients were treated with one of the following ACT: Artemether – Lumefantrine (Coartem®), Artesunate – Mefloquine (Artequin®) or Dihydroartemisinin – Piperaquine (P-Alaxin®), while Patients with complications were referred for immediate admission. Statistical analysis was done using Stata v12.0 (StataCorp LP) and GraphPad Prism® v5.00 (GraphPad Software).

3. Result

3.1. Baseline Data

A total of 1173 patients were screened during the study period. Females 612 (52.2%) were slightly more than males 561 (47.8%). The mean age was 13.0 ± 13.8 years (range 0.2 – 80 years). The distribution according age showed majority of the participants were children under 5 years of age with a total of 414 (35.3%), mean age of 2.3 ± 1.1 years (0.2 - 4.5). Patients 5 -15 years were 391 (33.3%) mean age 7.9 ± 2.6 years (5 - 15). The above 15 years were 368 (31.4%) with a mean age of 30.4 ± 11.9 years (15.5 - 80) (Table 1).

3.2. Malaria Prevalence

A total of 419 out of the 1173 patients were malaria positive. The overall prevalence was found to be 35.7% (95% CI 33.0 - 38.5%). The highest prevalence was recorded in the age group of 5 – 15 years, 19.3% (95% CI 17.0 - 21.6%), followed by the under 5 group with 11.7% (95% CI 9.9 - 13.7%). Only 4.8% (95% CI 3.6 - 6.2%) of the total positive patients were adults (Table 1). The difference in proportion of positive cases in each age group were statistically significant (Chi-square *p*<0.0001). A pictorial representation of positive and negative patients is shown on Figure 1.

The prevalence of the disease based on gender showed more males 19.4% (95% CI 17.1 - 21.7%) had malaria compared to females 16.4% (95% CI 14.3 - 18.6). This difference was statistically significant (Fisher's exact = 0.0012).

3.3. Malaria Indicators

The predominant *Plasmodium spp* seen was *P. falciparum* (98.8%). 4 (1.0%) cases of *P. malariae* were encountered, while 1 (0.2%) patient had a mixed infection of *P. falciparum* with *P. ovale*. The geometric mean parasite density was 15,108 parasites per µL of blood (range 1,333 - 368,955). Fever was assessed in 324 patients out of which 174 (53.7%) had temperature above 37.5°C. The same number of patients were assessed for anaemia, 176 (54.3%) had PCV below normal (33%), while 146 (45.1%) had PCV above 33% (Table 2).

Table 1. Baseline Characteristic Data of Study Participants

Age (years)	No. (%)	Mean age ± SD (range)	Malaria Parasite		Prevalence (%) (95% CI)
			Positive	Negative	
< 5	414 (35.3)	2.3 ± 1.1 (0.2 - 4.5)	137*	277	11.7 (9.9 - 13.7)
5 – 15	391 (33.3)	7.9 ± 2.6 (5 - 14)	226*	165	19.3 (17.0 - 21.6)
Above 15	368 (31.4)	30.4 ± 11.9 (15.5 - 80)	56*	312	4.8 (3.6 - 6.2)
All age groups	1173 (100)	13.0 ± 13.8 (0.2 - 80)	419	754	35.7 (33.0 - 38.5)
Male	561 (47.8)	10.9 ± 12.4 (0.2 -60)	227æ	334	19.4 (917.1 - 21.7)
Female	612 (52.2)	14.9 ± 14.8 (0.5 - 80)	192æ	420	16.4 (14.3 - 18.6)

* Statistically significant Chi square test p < 0001, æ Statistically significant Fisher exact test p = 0.0012
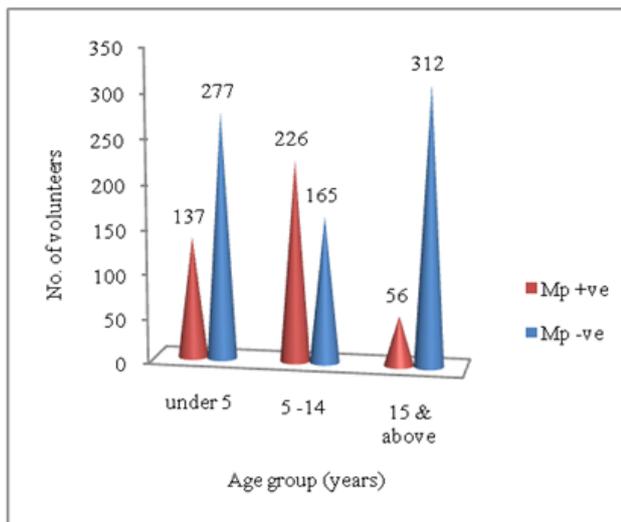
Figure 1. Proportion of malaria positive and negative participants according to age (Mp – malaria parasite)

Table 2. Malaria Prevalence, Fever and Anaemia Parameters

Malaria	No. (%)
Prevalence	419 (35.7)
P. falciparum	414(98.8)
P. malariae	4 (1.0)
Mixed (P. falciparum + P. ovale)	1 (0.2)
Parasite Density	geometric mean (range)
Age group (years)	
< 5	16,157 (2,000 - 368,955)§
5 – 15	15,428 (1,708 - 171,692)§
Above 15	10,790 (1,333 - 118,588)§
All age groups	15,108 (1,333 - 368,955)
Axillary temperature	(°C)
Mean ± SD	37.8 ± 1.23
Range	34.9 - 40.4
≥37.5	150 (46.3)
<37.5	174 (53.7)
PCV	(%)
Mean ± SD	33.8 ± 7.62
Range	20 – 57
≥ 33	146 (45.1)
< 33	176 (54.3)

4. Discussion

Maintaining and improving on current gains made on malaria is imperative for an effective control of the disease, especially in high endemic countries. Nigeria is made up many cultural diverse settlements and community and is essentially segmented into 6 geopolitical zones (Southwest, Southeast, South south, North central, Northwest and Northeast). Each of these zones has its own peculiar geographic and weather features and so requires strategic, well planned control intervention methods and tools targeted at individual settings in order to achieve the projected goal of 50% reduction in burden of malaria [2].

The overall prevalence of 35.7% reported in this study was quite high. A similar figure was reported for the same site the previous year [4]. The prevalence was also similar to figures obtained in Abia (Southeast) and Plateau (North central) states in Nigeria who reported prevalence of 36.1% and 36.6% respectively [3]. The figures are however lower than the 71.4% reported by Ekong et al. for Calabar in Cross River state (South south) [8] but significantly higher than the 14.7% reported for Ibeshe

community in Ikorodu, Lagos state (Southwest) by Aina et al. [6]. The large difference between our study and Aina et al. could probably be because Aina's study was conducted during the dry season, rather than in the raining season when malaria transmission is much higher. However, A study carried out in the 6 geopolitical zones of the country in 2010, concluded that the prevalence of malaria is higher in the southern part of the country than the Northern parts [4]. The 5 -15 years age category had the highest prevalence of 19.3% which was found to be statistically significant when compared with the other two groups, this trend has also been observed in other studies [3,9]. A six years cross – sectional studies in children less than 11 year in Gabon observed a shift in prevalence of malaria from children < 5, who are known to be more at risk of the disease to children age ≥ 5 years [9]. This presumed shift in prevalence among this age group could be due to the fact that more attention and care are given to children < 5 years of age than the older children. Therefore the < 5 may be benefitting more from the control measures put in place such as sleeping under ITN than the older children. Also children aged 5 - 15 years may be leaving the comfort of their homes for the first time for boarding school or other purposes, hence are away from direct parental care and supervision. WHO maintains that children less than 5 years are more at risk of the disease because they may not have developed protective immunity against the disease and its most severe form [10]. Prevalence based on gender showed that although more female participants were screened, the males had a higher prevalence of the disease which was statistically significant; this suggests that males may be more prone to the disease than females.

The predominant *Plasmodium spp*. identified in this study was *P. falciparum*, which is the most virulent and also has the greatest propensity for developing resistance [10,11], this findings is consistent with other reported studies [3,4,6,7,12,13]. There was a characteristic high parasite density among malaria positive patients with an average density of 15,108 parasites/µL of blood, this is significantly higher than the 285 parasites/µL of blood average reported by Aina et al. [6] but similar to reported values for the country [4]. Some other studies have reported higher densities [14,15]. 61.7% and 8% of the positive patients had parasite densities greater than 10,000 and 100,000 parasites/µL of blood respectively. The high parasitaemia levels observed in our study is not unusual because Nigeria is a high transmission area for malaria; older children and adult sometimes develop protective immunity to the disease and can be asymptomatic carriers for a long time without clinically manifesting symptoms/signs of malaria [16,17]. Some asymptomatic patients with high parasitaemia were seen during this study. A case to note during the study was that of a 4 year old male who came to the clinic with his mother and another sibling completely asymptomatic. While waiting for the test results, the child was very active playing and running around but the result soon showed that he had a very high parasite density of over 140,000 parasites per/µL. A similar event in Ikorodu Lagos state was also reported recently (personal communication) about a family of 5 (mother and children) who were all asymptomatic but had very high parasitaemia in their blood. This suggests that the presence of malaria

parasitaemia does not always result in the manifestation of clinical symptoms. A well-designed control study that can probe reasons for such occurrences is needed at this point and this may provide valuable information in our understanding of host – parasite interactions.

There was no significant difference between occurrence and absence of fever among the malaria positive cases. This buttresses the early assertions that parasitaemia does not necessarily always correlate to manifestations of clinical symptoms, similar findings were also discussed elsewhere [6]. Anaemia was not found to be associated with malaria infection, only 54.3% of malaria positive patients had haematocrit levels less than 33% and the average haematocrit level was 33.85%.

Majority of patients aged 40 years and above tested for this study negative for malaria. This further demonstrates that adults living in endemic regions have a form of protective immunity against the disease, even during peak transmission periods.

Data from this study emphasized the need to perform more rigorous control measures and enlightenment campaigns to further educate people on malaria, because it is entirely preventable and curable. This will lead to a further reduction in the morbidity and mortality associated with the disease.

4.1. Limitation

The study was not able to gather information on the number of patients using ITNs at home, which could have assisted in accounting for the high prevalence of the disease seen in the study. Some other studies have discussed the impact of the use such ITNs in other parts of the country [3,18,19].

5. Conclusion

There is a high prevalence of malaria in Makarfi and transmission may be classified as holoendemic. Children age 5 – 15 years had the highest rate of infection. The high prevalence observed is quite disturbing and continuous monitoring of the situation in Makarfi and other parts of the country is needed to have a clear picture of the impact of interventions programs carried out so far. And also elucidate areas where the interventions need to be strengthened and improved upon, so as to have an appreciable or better control of malaria in the country.

6. Recommendations

Greater attention should to be paid to population living in rural areas, towns and villages where there are no secondary or specialize health care facilities. Such areas should be designated as high priority targets for malaria intervention and control programmes. These efforts should be doubled during the malaria transmission season which coincides with the rainy season. Government should also ensure that these communities have access to quality and affordable ACTs considering that it is currently the most potent weapon against malaria.

Conflicts of Interests

The authors declare that they have no conflict of interests.

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