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Studies on Malaria, Bancroftian Filariasis and Insecticide Treated Bed Nets in Mmiata Anam, Anambra West Local Government Area, Nigeria

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A B S T R A C T

Studies on malaria prevalence, intensity and co infection with bancroftian filariasis as well as bacteria profile of larval habitats was carried out in Mmiata Anam community of Anambra West LGA between September and October 2018 with the objective to provide epidemiological data much needed for surveillance. Rapid diagnostic test kits were used to determine prevalence, microscopy of thick and thin blood films was used to determine intensity of malaria infection while questionnaire was used to collect information on insecticide treated bed net (ITBN) usage. The result showed a prevalence of 22% for malaria and 1% for *W. bancrofti* infection with no co infection. Intensity of malaria infection increased with age and differed significantly ($p<0.05$) among the age groups. Infection persisted despite extensive (89.00%) ITBN usage. There is need to emphasize the proper use of ITBNs in malaria and bancroftian filariasis endemic areas.

Introduction

Malaria and lymphatic filariasis (LF) are the world's most important parasitic diseases transmitted by mosquitoes (Muturi *et al.,* 2006). They exact a devastating toll on global health and economics; killing as well as debilitating millions every year (Bartholomay *et al.,* 2004). Lymphatic filariaisis in its advanced forms can manifest as severe lymphodema, hydrocele and elephantiasis (Taylor *et al.,* 2010). It is caused by infections with nematodes of the family *Filariodidea.* About 9l% of infections is caused by *Wuchereria bancrofti* and most of the remainder (9%) by *Brugia malayi* and *Brugia timori* (Ottesen *et al.,* 1984; Addis, 1998). The major vectors of *Wuchereria bancrofti* are mosquitoes of the genus *Culex* (In urban and semi urban areas), *Aedes* (in endemic islands of the pacific) and *Anopheles* (in rural areas of Africa). Bancroftian filariasis is widespread in Nigeria (Nwoke *et al.,* 2010). The availability and proximity of human settlement contribute

to the transmission and intensity in both rural and urban areas (Nwoke *et al.,* 2010). Numerous breeding sites of vectors play important role in the disease.

Malaria is a major public health problem in Nigeria where it accounts for more cases and deaths than any other country in the world (WHO, 2015). It is a disease caused by protozoan parasites of the genus *Plasmodium.* In humans, malaria is caused by *P.falciparum, P.malariae, P.ovale and P.vivax. Plasmodium falciparum* is the most common cause of infection responsible for about 90% of deaths (Mockenhaupt *et al.,* 2004). The parasite's primary hosts and transmission vectors are female mosquitoes of the *Anopheles* genus. Malaria is endemic throughout most of the tropics with 95% countries and territories having ongoing transmission (WHO, 2015). The degree of malaria infection varies from region to region in Nigeria (Onwuemele, 2014).In southern part of Nigeria, malaria transmission rate is approximately uniform throughout the year where it is holoendemic in the rural areas and mesoendemic in the urban areas (Nworgu and Orajiaka, 2011).

There is need to highlight current information on the prevailing picture of malaria, BF and BF in co endemic communities hence this study.

Materials and Methods

Study area

The study was carried out in Mmiata Anam community in Anambra West on the coordinates: N $6^{0}25^{1}5^{11}$ and E $6^{0}47^{1}35^{11}$ Alt 74.73. The study community lie within the humid tropical rainforest belt of south eastern Nigeria. The prevailing climatic conditions are rainfall ranging from 1400mm in the north to 2500mm in the south with four months of dryness (November to February), constant high temperature and a mean of 30% atmospheric humidity. The main occupation of the people is fishing, subsistence farming and trading. The nature of their occupation predisposes them to frequent mosquito bites. Anambra is a state in South- Eastern Nigeria. Its boundaries are formed by Delta State to the west, Imo State to the south, Enugu State to the east and Kogi State to the north. The origin of the name is derived from the Omambala River. Anambra state are Onitsha including Okpoko, Nnewi and Awka. Anambra. Anambra West is co endemic for malaria and bancroftian filariasis (FMOH, 2013).

Ethical approval was obtained from the State Ministry of Health Anambra State, village level consent was obtained through the traditional ruler and informed oral consent was obtained from each participant before collection of sample.

Sample collection and processing

Hundred adults made up of 52 males and 48 females, fifteen years and above were randomly recruited from Mmiata Anam. A pre-tested questionnaire was used to obtain demographic information (age and sex) and ITBN usage. Two sets of 20µl of capillary blood were collected from the middle finger of adults using a capillary tube. Ten micro litres of blood each was dropped on SD Bioline immunochromatographic test kits for *P. falciparum* Ag HRP2 antigen and *W.bancrofti* W123 IGg4 antibody using the manufacturers guide. Kits with two lines indicative for control and test lines were reported as positive while those with single lines on test or control were reported as invalid or negative. All invalid tests were repeated. Twelve micro litres of blood was dropped on the inner end of a clean grease free slide for thick film making while two micro litres was dropped on the outer end of the slide for thin film making. The thin film was fixed in 70% methanol. All

blood films were stained using 3%Giemsa stain for 30 minutes. The stained slides were sent to the laboratory to be viewed microscopically for parasite detection, speciation and parasite count. The films were counted and Parasite density was reported according to WHO (2015) as low (<50-2000 parasites/ µl), medium (>2000<10,000 parasites/ µl) and high (>10,000 parasites/ µl) using the formula: Parasite count x 8000 /set range of WBC.

Results and Discussion

Prevalence of malaria infection was 22(22.00%) of the 100 adults examined in Mmiata Anam, 23(23.00%) was infected. Prevalence of *W. bancrofti* was 1(1.00%). Co infection of malaria and bancroftian filariasis was not observed.

Sex related prevalence of malaria showed that of the 52 males and 48 females, malaria was higher among males 12(23.08%) than females 10(20.83). Prevalence of malaria was statistically not significant in relation to sex ($p<0.05$). *W. bancrofti* infection was seen only among males 1(1.92%).

The age related prevalence showed that the age group 36-45 years, 4(57.14%) had the highest malaria prevalence while no infection was observed among those <35 years (0.00%). Statistically, malaria prevalence was significant among the different age groups ($p<0.05$). *W. bancrofti* 1(1.69%) infection was seen in the age group 65 years and above. The result showed that of the 22(22.00%) malaria positive cases, 20(90.9%) had densities within the medium range (>2000<10,000). Only two (9.09%) cases had high malaria density counts >10,000. There was equal distribution of malaria parasite densities among males and females. However, high density parasitaemia was observed in only males. There were no low density parasitaemia among adults in the area. (Table 1).

Wuchereria bancrofti morbidity was seen in twenty eight cases of which hydrocele 1(1%), lymphodema 26(26%) and elephantiasis 1(1%) were seen. There was no co -morbidity among the cases.

Table (2) showed that adults who do not use ITBNs were more infected with malaria (45.45%) than those who use ITBN (19.10%). There was a significant difference ($P<0.05$) in malaria infection between ITBN users and non users.

Of the 89 adults who use ITBN, BF infection was 1.12%. Difference between BF infection among ITBN users and non users was not statistically significant ($P>0.05$). BF showed no relationship to ITBN use ($P=1.000$) and non use ($P=0.9859$).

Table.1 Prevalence and Intensity of Malaria in Mmiata Anam Village

Sex	No examined	No positive (%)	Parasite Density (%)		
			Low <50-2000	Medium >2000-10,000	High >10,000
Males	52	12(54.55)	0(0.00)	10(45.45)	2(9.09)
Females	48	10(45.45)	0(0.00)	10(45.45)	0(0.00)
Total	100	22(22.00)	0(0.00)	20(90.90)	2(9.09)

Table.2 Relationship between Insecticide Treated Bed Net Usage and Infection among Adults In Mmiata Anam

ITBN	Frequency N=100	Infection	
		MP (%)	BF (%)
Usage	89	17 (19.10)	1 (1.12)
Non Usage	11	5 (45.45)	0 (0.00)

In Nigeria, malaria and LF are co-endemic and both are transmitted by *Anopheles* mosquitoes (Okorie, 2011; FMOH, 2008). This study recorded a 22% prevalence of malaria in adults aged 15years and above by immunochromatographic test (ICT) for *P.falciparum*. It is similar to that obtained by Mgbenena *et al.,* (2016) who recorded a prevalence of 25% among students of Federal University of Technology Owerri, Imo State. Onyido *et al.,* (2011) recorded a prevalence of 70.8% in a previous study while Anyaegbunam and Obi (2017) in contrast recorded prevalence 40.2% among adults in Anambra State. The Nigeria Malaria Indicator Survey (NMIS) of 2010 recorded malaria RDT prevalence of 52% and in 2015 it recorded a RDT prevalence of 45%. This indicates a progressive reduction in malaria prevalence possibly as a result of increase in the use of long lasting insecticide treated nets from 42% in 2010 to 69% in 2015 (NMIS, 2010; NMIS, 2015). It can be said that Insecticide Treated Net (ITN) use may account for the differences in reports of malaria prevalence in any given area.

There was no difference in the infection in relation to sex among adults however, only males recorded high (>10,000) malaria parasite densities. The fact that males expose themselves to bites of mosquitoes and other vectors more than females, may account for this difference. During hot weathers, adult males are mostly seen sleeping outdoors, sometimes for the whole night exposing themselves to the risk of residual outdoor mosquito bites.

Age-specific prevalence of malaria in adults showed an increase in infection prevalence with increasing age ($P<0.05$). Most efforts towards malaria management and control are aimed at children under five years and pregnant women (Warred *et al.,* 2001). Those in the older age category are not adequately considered in most of those programs, amounting to some kind of neglect for those in the older age groups (Kieler *et al.,* 2011). The age group 35-45 years recorded the highest prevalence (57.14%) Members of this age group are economically active, leaving for farm work in the early hours and returning at dusk. They are also usually the care givers in the family where the health of children and the elderly are high priorities.

Malaria parasite density among adults studied showed a medium (>2000 <10,000) to high (>10,000) intensity. The highest malaria intensity was seen among the geriatrics (65^{+}). Partial immunity develops with age after repeated infection and episodes of clinical illness would possibly increase the threshold of parasitaemia that would elicit clinical symptoms. Evidence suggests that clinical immunity to malaria develops after exposure to malaria parasites as one progresses in age, however, this immunity is partial and is influenced by certain variations such as endemicity (Carol *et al.,* 2013). Repeated exposure to communicable and non-communicable diseases can affect this partial immunity in elderly people resulting to the

risk of unexpected illness in the genetics (Karapelou, 2001).

Nigeria has a significant burden of lymphatic filariasis (LF) caused by the parasite *Wuchereria bancrofti* (Okorie *et al.,* 2013). In this study, there was a 1% prevalence of bancroftian filariasis (BF) among adults. According to Okorie *et al.,* (2013), Nigerian mean filarial antigen is 14%. Ajero *et al.,* (2007) recorded a prevalence of 12.38% in Niger Delta Area of Eastern Nigeria. There have been records of higher prevalence in other parts of Nigeria. A study in Ose, Ondo State recorded a prevalence of 27% (Adekunle *et al.,* 2016). Similarly, Okonofua *et al.,* (2013) in a previous study recorded a prevalence of 21%. The use of ITN's has shown to be effective at reducing LF transmission in endemic areas (Emuka *et al.,* 2009). It is likely that Ivermectin had already impacted on LF and possibly interrupted transmission in low prevalence areas, especially those that have also received LLINs for malaria control (WHO, 2011; WHO, 2012; Okorie *et al.,* 2013; Van den Berg *et al.,* 2013). Mmiata Anam is a village in the LGAs currently under the NTD program of the Federal Ministry of Health where ITBNs and mass drug administration of Ivermectin in on-going.

Co- infection occurs when prevalence of both diseases is high (Muturi *et al.,* 2007). Co-infections of malaria and BF were not recorded in this study. Previous studies (Prasad *et al.,* 1990; Gosh and Yadav, 1995; Ravidran, 1998) reported co infection rates below 1%. Similarly, an epidemiological study along the Kenyan Coast did not detect any co infections of malaria and LF in a study site with 17.4% malaria prevalence and 2.8% LF prevalence. The result of this study differs from the report of Muturi *et al.,* (2006) and Chadee *et al.,* (2003) who recorded co infection rates of 4.3 and 3.3% respectively. Micro-stratification overlap mapping (MOM) by Okorie *et al.,* (2013) reported that Majority of sites with medium to high LF prevalence rates >25%, were found in low loaiasis prevalence areas (<20%). LF non-endemic Local Government Areas were found in the high risk loaiasis areas. This indicates a possible inhibitive interaction between filarial parasites in endemic areas.

BF infection was found among the geriatrics (65^{+}). The fact that infection was observed among this age group corroborates with previous studies which showed that prevalence of LF rises with age (Udonsi, 1988; Akogun, 1992; Anosike, 1996; Uneke *et al.,* 2005; Onyido *et al.,* 2011). Contrary to this, other reports observed lower prevalence in the older group (Nwuba *et al.,* 2002; Anosike, *et al.,* 2005; Okon *et al.,* 2010; Ezugbo *et al.,* 2011). It takes prolonged exposure to infective bites to initiate BF infection due to the inefficiency of BF transmission (Nwoke, 2009). Infection of *W.bancrofti* can then be said to relate with length of stay hence exposure to infective bites in an endemic area.

The BF morbidity encountered in this study which include hydrocele (1%), lymphoedema (26%) and elephantiasis (1%) could be attributed not only to BF infection but also other causes which include heart or circulatory diseases, obesity and multiple sclerosis often evident among those in older age groups or genctrics (Knoecne and Perdomo, 2004)

Malaria and BF infection persisted despite the extensive (89.0%) use of ITBNs by adults in this study. Some (19.10%) of those infected were among those that use ITBNs. This may be due to residual outdoor feeding by *Anopheles* mosquitoes, or lapses in proper ITBN hanging, washing and compliance.

In conclusion, it is evident from this study that there is ongoing, malaria and possible BF

transmission in the study area. *Plasmodium falciparum* is the malaria parasite responsible for malaria disease in the study area. The density of malaria parasitaemia is high among adults although prevalence is low. ITBNs were being used by adults in the study area. There was a correlation between infection and ITBN. The results have highlighted the need for emphasis on proper use of ITBNs as well as the need to monitor and control the burden of malaria and Bf in the older age groups.

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