Cibtech Journal of Microbiology ISSN: 2319-3867 (Online)
An Online International Journal Available at http://www.cibtech.org/cjm.htm
2012 Vol. 1 (1) April-June 2012, pp.13-23/Udujih et al.
Research Article

STUDIES ON SOME ASPECTS OF MALARIA AND LYMPHATIC FILARIASIS TRANSMISSION IN OHAUKWU LOCAL GOVERNMENT OF EBONYI STATE, NIGERIA

[1]Udujih H.I, [2]Nwoke B.E.B, [2]Ukaga C.N, [3]Udujih G.O, [1]Nnodim J.K, [2]Onyeka P.I.K, [2]Amaechi A and [1]Dike J

[1]*Dept of Medical Laboratory Sc., Faculty of Health Sc., Imo State University Owerri, Imo State, Nigeria,*
[2]*Department of Animal and Enviromental Biology, Imo State University*
[3]*Department of Public Health Technology, Federal University of Technology, Owerri*
**Author for Correspondence*

ABSTRACT

Parasitological and entomological studies were carried out to determine the prevalence of malaria and role of anophelines in the transmission of lymphatic filariasis in two villages; Orijiriafor and Ndiagu Obu both in Ohaukwu, Ebonyi State, Nigeria. This study was carried out between January 2010 and July 2010 using rapid diagnostic test kits for *Plasmodium falciparum* and standard entomological methods. The knowledge and practices on the role of mosquitoes in the transmission of malaria and lymphatic filariasis were also determined using self administered questionnaires. Of the 257 persons examined, 88 (34.24%) tested positive for *Plasmodium falciparum* antigens. The two villages showed inter-village variation with Ndiagu Obu having a higher prevalence of 41.60% as against Orijiriafor with prevalence of 26.52%. The infection rates showed no relationship to sex ($P>0.05$) but relationship to age ($P<0.05$) with the age range 0-15 years having the highest prevalence (48.67%). Of the 149 mosquitoes collected, *Anopheles gambiae* accounted for 75.17%. Lymphatic filarial larvae was recorded only in *Anopheles gambiae sl.* Overall, only 6(4.03%) mosquitoes were infected of which 3(2.01%) were infective. The people living in the study area had poor knowledge on the transmission and control of malaria and lymphatic filariasis. These findings have revealed the need for an effective community health enlightenment campaigns and provision of basic amenities like pipe-borne water and electricity which will reduce the breeding and biting rates of mosquito vectors while also improving the standard of living of the people in the study area.

Key Words: *Prevalence, Malaria, Lymphatic Filariasis, Ohaukwu, Ebonyi State*

INTRODUCTION

Mosquito-borne diseases such as malaria and lymphatic filariasis (LF) exact a devastating toll on global health and economics; killing as well as debilitating millions every year. They cause more than 300 million clinical cases of illnesses each year in humans (WHO, 1990). Malaria and lymphatic filariasis are the world's most important parasitic diseases transmitted by mosquitoes (Ephantus *et al.,* 2007). In most rural areas of the tropics, both diseases co-occur in the same human population and share common mosquito vectors (Burkot *et al.,* 1990; Chadee *et al.,* 2003). It is therefore common to find co infections of malaria and LF in a single mosquito vector and in human populations living in these areas (Ephantus *et al.,* 2007).

Malaria and lymphatic filariasis are the world's most important parasitic diseases transmitted by mosquitoes (Ephantus *et al.,* 2007). They are significant causes of morbidity and mortality wherever they occur, making them priorities for elimination and control programs (Nabarro and Tayler, 1998; Ottesen, 2000). Approximately 40% of the world's populations live in regions where malaria transmission is endemic, mainly tropical and sub-tropical regions (Aultman *et al.,* 2002). That malaria is a 'disease of poverty' greatly contributes to its persistence. Sachs and Malaney (2002) hypothesize that the apparent correlation between poverty and malaria runs both ways. Poverty may increase the incidence of malaria. Malaria may also increase the likelihood of poverty (Cahill, 2004). An increase in population of

malarious regions, compounded by weak public health systems in developing countries, climate changes (Hay *et al.,* 2002), increased resistance to antimalarial treatments and insecticides (Bozdech *et al.,* 2003) and the complexity and flexibility of the genetics (Gardner *et al.,* 2002) have all contributed to the increase in malaria.

The major *Anopheles* species that transmit malaria are also important vectors of *Bancroftian filariasis* (Ephantus *et al.,* 2007). In much of sub-saharan Africa, *Anopheles funestus* and members of the *Anopheles gambiae* complex are involved in transmission of malaria and *Bancroftian filariasis* (McMahon *et al.,* 1981; Trape and Rogier, 1996; Muturi *et al.,* 2006). Although the role of *Anopheles* mosquitoes as vectors of both human malaria and LF has long been established, little is known about the occurrence and prevalence of concomitant infections in the two diseases and how they interact with the vector (Ephantus *et al.,* 2007). Interaction among parasites is known to alter disease severity (Buck *et al.,* 1978). The nature of these interactions is not always predictable (Ephantus *et al.,* 2007) and need to be studied in order to design effective disease management programs.

MATERIALS AND METHODS

Study Area

The study area is the two villages; Orijiriafor and Ndiagu Obu in Ohaukwu L.G.A of Ebonyi State, Nigeria. The villages lie between co-ordinates $7^{o}30$'S and 8^{o} 18'N and 5^{o} 36'W and $6^{o}15$'E (Anosike *et al.,* 2003). Ebonyi state is a Southeastern state populated primarily by Igbos with a population of about 2,173,501 (Aliogo, 2009) and annual rainfall between 214 and 220cm with distinct wet and dry seasons which favour high breeding of mosquitoes, the insect vectors of malaria and lymphatic filariasis. The state has a typical rainforest climate with a mean daily temperature of 30 ± 5^{0}c.

The villages were positive for LF on ICT $\geq$ 20% positivity/prevalence results (Amaechi, 2009). The prevalence rates by ICT surveys were 31% and 61% respectively. The inhabitants live in rural area and are predominately peasant farmers with their activities having bearing on disease transmission (Anosike *et al.,* 2003).

This study was carried out between the months of January 2010 and July 2010.

LF Survey

Mosquito Collection:

One hundred and forty-nine Indoor resting mosquitoes were collected by pyrethrium knock down (PKD) between 6am to 10am daily. Two rooms from each selected compound were sprayed with Baygon insecticide; the mosquitoes knocked down on the spread white cotton sheets were picked up and preserved in petridishes lined with moist cotton wool. Only rooms that were slept in the previous night were sprayed. Prior to the day, the villagers were informed not to open their windows in the morning.

Mosquito Dissection:

The female mosquitoes were morphologically identified (Gilles and De Miller, 1987) and the female mosquitoes were dissected as recommended by Nelson and Pester, (1962). The parasite stages in the mosquitoes (L_1, L_2, and L3) and physiological age were determined. The mosquito parity determined by observing the degree of coiling of ovarian tracheoles (Detinova, 1962). Evaluation of filarial infection Profile was done by examining each of the three teased parts (head, thorax and abdomen) of the mosquito under compound microscopes.

Malaria Survey

Two hundred and fifty seven subjects from the selected compounds were examined for malaria parasite. Capillary blood obtained from finger prick was used to make rapid malaria diagnosis (Cheesbrough, 2006) using malaria rapid diagnostic test kit (RDT), a qualitative membrane based immunoassay for the detection of *P.falciparum* antigen in whole blood. Demographic data of subjects were collected.

Knowledge and Practice Survey

This involved administration of questionnaires to willing individuals of fifteen years and above living in the selected compounds. The information centered on perception of the people on LF and malaria, their

practices and treatment of the diseases. A total of 109 questionnaires were self administered to the respondents in oral interviews.

Data generated from the questionnaire, entomological findings and malaria survey were manually analyzed using percentage (%) to express the rate of variables of interest. The chi-square test was used to determine goodness-of-fit (hypothesis testing) and test of independence using a 5% (P=0.05) level of significance.

RESULTS

Malaria Survey Results

A total of 257 persons from two villages Ndiagu Obu (125) and Orijiriafor (132) of all ages and both sexes were examined for malaria parasite using rapid diagnostic test kits specific for *P. falciparum*. Overall, only 88(34.24%) persons tested positive for malaria antigen. The two villages showed inter - village variation in prevalence with Ndiagu Obu having a higher prevalence of 41.60% as against Orijiriafor with prevalence of 26.52%.Out of the 275 persons examined, there were 149 females and 108 males. There was no significant difference (P>0.05) in infection rate between males 38 (14.79%) and females 50 (19.46%).

Out of the 88 malaria RDT positive persons, 73(48.67%) belong within the age range of 0—15 years. The remaining RDT positive cases were scattered between age range 16-25(8), 26-35(3), 36-45(2) and 46^{+} (2). There was a significant difference in the infection rates in relation to age (P<0.05). Infection decreased with increase in age. Males within the age range 26-45 were all RDT negative. Among females, infection was seen in all the age ranges although it decreased with increase in age.

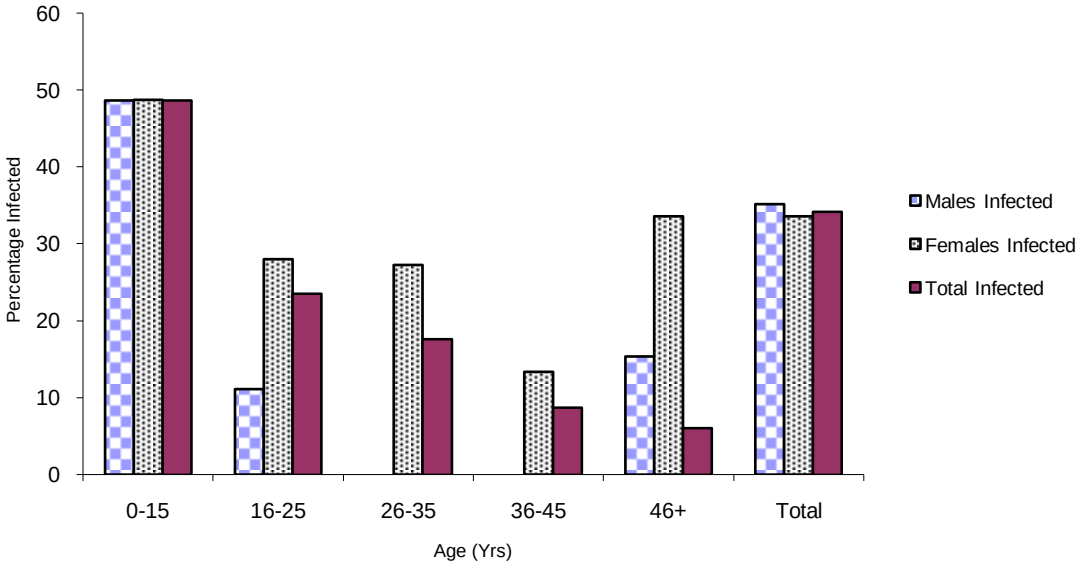

Figure 1: Overall prevalence of malaria in relation to age and sex in the study area

Fifty nine males and seventy five females were examined in Orijiriafor. Fifty nine out of the one hundred and thirty two persons examined belong to the age range 0—15 years. A total of 35(26.52%) persons tested positive for malaria parasite in this village. There is no significant difference in infection rates between males and females (P<0.05). The age range 16-25 years had the highest (47.06) infection. Infection was present through all the age ranges with the least being the age range 46^{+} with infection rate of 7.41%. The age range 26-45 had no infection in males. All the females within the age range 46^{+} had no

malaria infection whereas all other females (0-45 years) showed high infection rates with the least being the age range 36-45 (25%).

A total of 125 persons comprising of 51 males and 74 females were examined for malaria parasite at Ndiagu Obu out of which 22(43.14%) and 31(41.89%) were RDT positive respectively. All (42.40%) RDT positive persons were below 15 years. There was no significant difference in relation to sex (P<0.05). (See Figure 1)

Entomological Finding

Mosquito Collection:

A total of 149 female mosquitoes were collected and dissected. Out of these, *An.gambiae* had the highest (75.17%) frequency of occurrence while *Ae.aegypti* had the lowest (0.67%). Other species of mosquitoes dissected include *An.funestus* (6.71%) and *Cx.quinquefasciatus* (17.45%). All the mosquitoes encountered are potential vectors of LF whereas 122 out of the 149 mosquitoes are malaria vectors.

Only fifty one mosquitoes were collected from Orijiriafor comprising of *An. gambiae sl* (31), *An. Funestus sl* (3) and *Cx. quinquefasciatus* (17) whereas ninety eight mosquitoes were collected from Ndiagu Obu comprising of *An.gambiae sl* (81),*An.funestus* (7), *Ae.Aegypti*(1)and *Cx.quinquefasciatus* (9). *Ae.aegypti* was not collected in Orijiriafor. *Anopheles gambiae* had the highest frequency of occurrence in both villages with 31(60.78%) and 81(82.65%) in Orijiriafor and Ndiagu Obu respectively. There was interring village variation in mosquito abundance.

Mosquito Dissection:

A total of 6(4.03%) of mosquitoes out of the 149 dissected were infected with LF larvae. Only 3(2.01 %) out of the infected mosquitoes were infective. LF infection was recorded only in *An.gambiae* with infection and infective rates of 5.36% and 2.68% respectively.

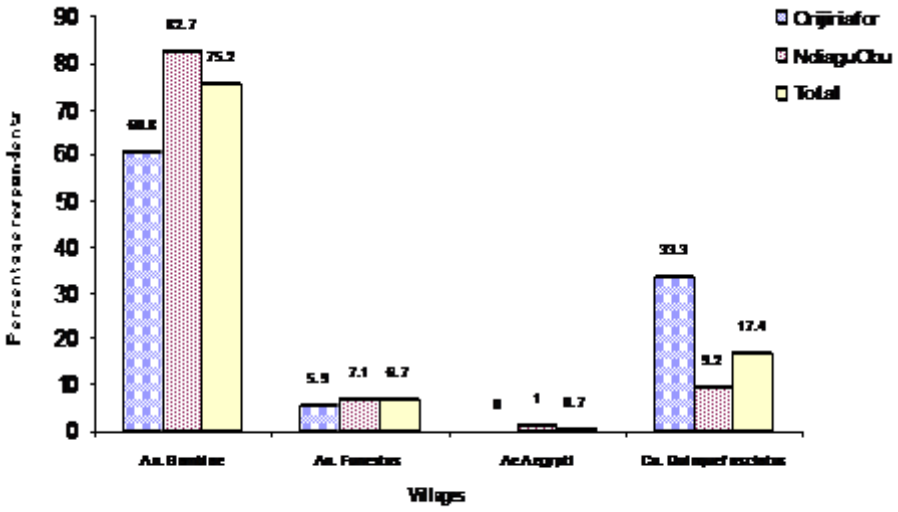

Figure 2: Composition and abundance of mosquito species in the study area by village

In both villages, LF infection was recorded only in *An.gambiae* species. In Orijjiriafor only one (0.67%) mosquito was infected out of the thirty-one dissected whereas at Ndiagu Obu a total of five (3.36%) mosquitoes were infected out the eighty one dissected. Overall, only 3 (2.10%) mosquitoes were infective of which 2(1.34%) were recorded from Ndiagu Obu. There was no significant difference in mosquito infection between the two villages (P<0.05). The L3 larval stages were found in the head (3) and thorax (9) only whereas L2/L1 where found in the thorax (11) and abdomen (1) only. Mosquitoes with MF were not recorded as infected but were found in the thorax (1) and abdomen (3).

RESULTS ON KNOWLEDGE AND PRACTICE

Knowledge

Most (49.66%) of the gravid mosquitoes dissected were nulliparous gravid. The rest were parous (15.08%), parous gravid (22.82%) and nulliparous (12.08%). Majority (42.90%) of the mosquitoes were previously fed while the others were freshly fed (35.50%) and unfed (21.48%).

Overall, most (72.48%) of the mosquitoes collected were gravid. mosquitoes collected in Ndiagu Obu had the highest (48.32%) number of gravid females. The *Ae.aegypti* and seven out of the nine *Cx.quinquefasciatus* collected in Ndiagu Obu were non-gravid.

The results of the study showed that a total of 109 respondents from two villages in Ohaukwu L.G.A were interviewed of which 61 and 48 were from Orijiriafor and Ndiagu Obu respectively. All (100%) of the respondents were knowledgable about mosquitoes and have also experienced mosquito bites. Majority (70.64%) had knowledge of the danger of mosquito bites (disease). However, only (37.61%) had knowledge of the breeding pattern of mosquitoes.

Most (70.64%) of the respondents know malaria to be a disease transmitted by the bite of a mosquito however, multiple responses was observed which include eating too much oil (20.18%), witchcraft (40.37%), cold or changing weather (78.90%), eating dirty food (10.09%) and getting soaked with rain (3.67%).

On the whole, respondents had good knowledge of the symptoms of malaria. All (100%) indicated fever as one of the symptoms amongst others which include feeling cold/chills (90.83%), Headache (97.25%), Nausea and vomiting (90.83%).However, diarrhea (11.93%), dizziness (48.62%), loss of appetite (85.32%), body ache or joint pain (2.75%), body weakness (69.72%) and pale eyes (0.92%) were also reported.

None (0.00%) of the respondents had knowledge of LF. Lymph oedema of the limbs and elephantiasis are known by the respondents 87(79.82%) as a disease which they call Ogbaa. Lymphoedema of the scrotum/hydrocele which is another morbidity caused by LF was perceived by respondents 60(55.05%) to be a different disease called Mkpu. None (0%) of the respondents knew mosquito to be the causative agent (vector) of these symptoms. Most of the respondents (43.12%) do not know the cause of lymphoedema and elephantiasis of the limbs whereas others (37.61%) believed it is caused by stepping on charm, lack of personal hygiene (3.28%), hard work (4.92%), and working in the sun (1.64%) or caught from other people (1.64%).Multiple responses was observed.

The respondents knew even less about hydrocele some (27.52%) believed it to be caused by promiscuity, charm (22.02%), lack of personal hygiene (4.59%) or caught from other people (1.64).The rest (25.69%) had no clue.

Practices

Majority of the respondents knew mosquitoes could be controlled by clearing bushes around the house (77.93%) and keeping the surroundings clean (92.66%). Other control measures reported were mosquito coils (3.67%), window nets and screens (1.83%), ITNs (23.85%), burning of leaves /herbs (9.17%) and insecticide sprays (0.90%).It was however surprising that some (14.68%) do nothing to control mosquitoes.

Multiple responses was reported on prevention of malaria they include drinking herbal brew (93.58%), avoiding mosquito bites (70.64%), taking anti-malaria drugs (33.94%), avoid drinking dirty water(1.83%) as well as oily food and rain.

The knowledge of LF and true preventive measures was lacking. Majority does not know any preventive measure for hydrocele (48.62%) and lymph oedema of the limbs (43.12%).There was no significant difference among the villages ($p > 0.05$). The rest of the respondent prevent hydrocele by avoiding sexual promiscuity (30.28%) along with keeping good personal hygiene (4.59%) and avoiding contact with infected people (1.64%). Lymph oedema of the limbs are prevented by avoiding people's farms (37.61%) as well as keeping good personal hygiene (3.28%), avoiding too much sun (1.64%) and labour (4.92%).

For the treatment of malaria, majority (92.67%) of the respondents use herbal brew as well as drugs prescribed by the health officer at the health center (53:21%) also by self medication with anti-malaria drugs obtained from patent medicine stores (17.43%). The herbal brew is usually the first line of treatment followed by self medication. Going to the hospital or health center is usually the last resort.

Majority (38.33%) of the respondents do not know how the morbidity caused by LF is treated while the rest treat LF morbidity by going to the hospital (34:86%) for medication, drinking herbal brews (18.35%), using poultice (4.92%) as well as prayers (11.93%). Only a few (6.42%) of the respondents do nothing to treat LF morbidity.

DISCUSSION

Malaria and lymphatic filariasis (LF) are the world's most important parasitic diseases transmitted by mosquitoes (Ephantus *et al.,* 2007). Both diseases are co-endemic in many areas of the tropics and are transmitted by a number of common vectors (Muirhead – Thomson, 1953; Burkot *et al.,* 1990; Chadee *et al.,* 2003). LF is endemic among the Ohaukwu people of Ebonyi State Nigeria (Wijeyara and Verma, 1982; Udonsi , 1986., Lu *et al.,* 1988; Nwoke *et al.,* 2000; Amaechi, 2009) and it has been established that in any given area, the most exposed households to malaria are those in the more remote parts of a district (Billingsely *et al.,* 2006). The results of this study have confirmed that the two villages (Ndiagu Obu and Orijiriafor) in Ohaukwu local Government Area of Ebonyi State are co-endemic with malaria and LF.

The rapid diagnostic test method has been described as the best qualitative assay for the detection of *P. falciparum* in blood samples (Ndao *et al.,* Perandin *et al.,* 2004). In this study, the overall point prevalence of malaria using RDT kits was found to be 34.24%. This result was similar to those reported by Clyde (1967), Moekenhaupt *et al.,* (2007), Ismaili *et al.,* (2003), Ukaga *et al.,* (2005) and Mboera *et al.,* (2006). However, this prevalence rate was lower when compared with the findings of Mboera *et al.,* (2002). This variation may be related to difference in altitudes, study population and methodology.

The prevalence of malaria was significantly higher in Ohaukwu (41.60%) than in Orjjiriafor (26.52%). The inter-village variation may be due to environmental factors such as vegetation and proximity to water bodies. Another factor that may have contributed to this variation is practices like storage of water around homes and polygamy as was observed in Ndiagu Obu. Polygamy increases the number of people living in a cluster therefore it directly influences vector-human contact. The preference of the mosquito vectors to such areas with high carbon dioxide content aided by poor ventilation, odour, heat and emanations from unwashed bodies (Goma, 1961; Nwoke, 1996 and 2000) increase the risk of malaria transmission (Christopher, 1960).

It was observed in this study that malaria prevalence was highest among individuals below 15 years. This observation is in accordance with similar studies carried out by Schleiermacher *et al.,* (2001) and Zhou *et al.,* (2002). This observation is usually attributed to low level of immunity in the young especially children below five years (Peterson *et al.,* 1999; Kitua *et al.,* 1996; Fried *et al.,* 1998; O'Neil-Funne *et al.,* 2001).

The malaria prevalence in this study showed no relationship to sex of the individuals. This correlates with findings of Mboera *et al.,* (2002) in Iringa district and many other districts of Tanzania.

In this study, the mosquito species encountered are potential vectors of parasitic and viral diseases which pose a danger to the public health of the people living in the study area. *Cx.quinquefisciatus* and *Ae.aegypti* have been implicated in the transmission and maintenance of arbovirial infection (Cornet *et al.,* 1979) and yellow fever (Mukwaya, 1974; Onyido *et al.,* 2001) respectively. *An. gambiae* and *An. funestus* are vectors of malaria parasites (Service, 1980; Smyth, 1996). All the mosquito species mentioned are potential vectors of LF (Awolala *et al.,* 2003) and were encountered in this study. The species encountered do not represent the overall mosquito species in the study area since mosquito abundance is dependent on factors like the time and method of collection.

An. gambiae was identified as the most abundant specie encountered. This finding is in line with the findings of Amaechi (2009) in Ebonyi State, Nigeria; Awolala *et al.,* (2003) in South Western, Nigeria and Okogun *et al.,* (2005) in Mid Western Nigeria. *An. gambiae* inhabit pools resulting from overflow to rivers, pools left by receding rivers, rain water harvested in natural depressions while *An.funestus* breed in bodies of clear water that are large and semi-permanent such as swamps and weedy sides of stream (Aniedu, 1992). These favourable environmental conditions are responsible for the presence of the *Anopheles* species in the study area since the two villages are in close proximity to water bodies. The reason for high abundance of *An.gamibae* may be due to storage of water collected from the streams in open clay pots around homes. This may also account for the presence of *Aedes* (Ezike, 2006) but the low number encountered in the study maybe due to its exophagic and exophilic behaviour. Similarly Amaechi (2009) recorded low *Aedes* abundance in his study whereas Mafiana *et al.,* (1998), Onyido *et al.,* (2002) and Mbanugo and Okpalanunuju (2003) reported *Aedes aegypti* to be in abundance more than other species in their studies. Their results could be attributed to difference in the study area, duration of study and inclusion of both exophilic and endophilic mosquitoes.

Cx. quinquefasciatus was second in abundance in this study. This differs from the result of Amaechi (2009) who reported *An.funestus* as the second most abundant specie. *An. funestus* co-breed with *An.gambiae* but prefer clear water that are large and semi-permanent such as swamps, weedy sides of streams etc (Aniedu, 1992). The variation in number of these species could be attributed to seasonal fluctuations in the factors conditioning the habitat. It would be expected that during dry season many habitat dry up and species adjust to changes in climate and environmental factors. The low abundance of *An.funestus* could also be attributed to its exophilic behaviour (Chadee, 1992). Also, it was observed in this study that the villagers practice open toilet systems which serve as breeding ground for *Culex*. Nwoke and Ebo (1992) and Ezike (2002) had placed *Culex* species as urban mosquitoes because of the prevailing urban conditions favourable for its breeding. The abundance of *Cx.quinquefasciatus* in this study is an indication of poor sanitary conditions and a gradual shift from rural to semi-urban environment.

A remarkable number of the mosquitoes were gravid. Most were nulliparous gravid which indicates maturity of a new generation of mosquitoes in the environment. *An.gambiae* had the highest number of bloodfed gravid females. This may be on account of the autogenous reproductive behaviour of *Anopheles* species (Packer and Gobbet, 1989). Hence there is increase in biting rate since gravid females were often the first to respond positively to the presence of host (Amusam *et al.,* 2003).

This study identified *An.gambiae* as the main bancroftian filariasis vector in the study area. This finding is in agreement with the findings of Amaechi (2009) in Ohaukwu, Ebonyi State although conversely to this study, Amaechi (2009) also reported infection in *An.funestus*.

Larval stages from microfilariae to the infective L_3 were found only in *An.gambiae*. This confirms that evidence from natural infection (Taylor, 1930; White, 1974 and Kuhlow, 1987) and experimental study (Anosike *et al.,* 2003) on this specie have remained unchanged in rural African communities. This is an indication therefore that there is compatibility between this specie and *W. bancrofti* (Amaechi, 2009). Majority of the L_3 larvae were distributed in the thorax compared to the head region and abdomen. This is in contrast with studies on the rhythmic movement of larva in the body of mosquitoes which showed tendency of L_3 to concentrate in the head, mouth parts and proboscis (Desowitz and Cheliapah, 1965; Laviopierre and Ho, 1966). The inefficiency of LF transmission has been supported by earlier studies (Gubber and Bhattacharya, 1974; Hailstone and De-Meillon, 1968) in endemic areas. The distribution of greater number of L_3 larvae in the thorax may be one of the factors responsible for this inefficiency in transmission.

The involvement by *Anopheles* in LF transmission in Northern Nigeria has long been reported (Taylor, 1930).Previous studies revealed low infection rate of *W. bancrofti* on these species (Kuhlow, 1987; Awolala *et al.,* 2003). In this study, infection rate of 4.03% was observed in *An.gambiae* with infectivity rate of 2.01 %. This is similar to the observation of Amaechi (2009) in the same area who recorded infection rate and infectivity rate of 4.62% and 0.79% respectively. These high infection rates when

compared with (0.5%) reported by Awolala *et al.,* (2006) in Niger State Nigeria could be attributed to overcrowded clusters of low income groups living in unhygienic conditions that attract female mosquitoes and increase infection (Clement 1963).

Infection rates of (0.00%) observed in the other species of mosquitoes dissected in this study agrees with similar studies carried out in parts of central Nigeria (Lenhart *et al.*, 2007) and Ohaukwu, Ebonyi State Nigeria (Amaechi, 2009).These findings may be related to unsuitable condition of alimentary tract of vectors (Amaechi, 2009; Nelson, 1964). Another factor could be the influence of genetics on the capacity of insect vectors to transmit filarial parasites (Mc Donald, 1976; Taylor, 1971 Cit: Ogunride, 1980). This finding therefore demonstrates that *Anopheles gambiae* is the major specie involved in the maintenance of LF transmission in Ohaukwu. This is in accordance with the work of Amaechi (2009) who reported high and sustained LF infection of *An.gambiae* in Ohaukwu, Ebonyi State. However, since *An.gambiae* comprises three major sibling species; *Anopheles gambiae ss, An.arabiensis and An.melas* (White *et al.,* 1972) in parts of Africa, there is need for identification beyond morphological level.

Genetic studies targeted to improve the refractiveness of anophelines to parasitic infections could stand a chance in the control of LF and malaria in co-endemic areas. In addition, measures that prevent the entrance of this highly endophilic specie into houses should be adopted to reduce the number of indoor mosquitoes. Also, health education should be given to the villagers on the importance of good ventilation and personal hygiene in mosquito control.

The result of respondents interviewed in the two villages shows that although people living in these rural areas can identify mosquito they do not have adequate knowledge of all the risks associated with the bites. The only risk associated with the bites of mosquitoes in these rural areas is the risk of malaria infection. This could be attributed to the mass campaign on malaria being carried out in the country. There was no variation in response among villagers in the two villages.

The people living in the study area are poor subsistent farmers who spend most of their time in the farm where they are continuously bitten by exophagic and exophilic mosquitoes. Moreover, these people live in poorly ventilated and crowded huts which attract female mosquitoes at night hence they are exposed to mosquito bites day and night.

Knowledge of breeding pattern of mosquitoes is poor among respondents who associated mosquito bites with the home, stream and farm which are surrounded by bushes. They therefore believe mosquitoes breed in the bushes. The persistent attack of mosquitoes has made the villagers to perceive them as omnipresent.

Previous studies have demonstrated the presence of and a long history of endemic diseases in Ebonyi State (Anosike *et al.,* 2003) as was observed in other diseases; Onchocerciasis (Nwoke, 2000) and Schistosomiasis (Anosike, 2002) the clinical symptoms of LF such as lymhoedema were well known by the villagers with local names (Amaechi 2009).

The result of the knowledge on cause of malaria revealed that respondents believe that malaria come from the bite of any mosquito infected or not, they also believe that other agents such as oily food, dirty food/water, dirty compound, changing weather and rain in addition to mosquitoes cause malaria. This implies that adequate knowledge on the cause of malaria is lacking among the villagers.

Similarly, knowledge of LF and its causative agents was poor. The villagers do not associate the bite of mosquitoes with the clinical presentations of LF. Studies elsewhere (Muhonowa, 1983; Haliza, 1986 and Nwoke, 2000) showed that not more than 20% of the people are aware of the role of mosquito in the transmission of LF. In other parts of the world, rural endemic villages also ascribed LF to a variety of causes; walking barefoot on dirty grounds or eating contaminated food (Haliza, 1986 in Malaysia) the ankle injury aggravated by bathing in the sea, through urine or food (Kessel, 1957; Cornet *et al.,* 1979 in Tahiti), contact with cold water after heavy work and sexual promiscuity (Lu *et al.,* 1988 in Philipines). In this study, the villagers associated lymphoedema of the extremites and elephantiasis with stepping on charm, hard labour, working in the sun and contact. However, majority didn't have knowledge on the cause of LF. Lymphoedema and elephantiasis was perceived to be a totally different disease which has no

connection to scrotal oedema. The later is known by the villagers to be a shameful disease caused by promiscuity, lack of personal hygiene and charm.

The respondents had no knowledge of LF as a disease. The clinical symptoms of LF were perceived to be entirely different diseases with different local names. Conversely, malaria was known as a disease with various symptoms. Headache, fever, body/joint ache, vomiting, weakness, chills, loss of appetite were given as main indicators of malaria by the respondents

This study also revealed that only a few of the respondents use insecticide treated bed nets as a measure against mosquito bites. This maybe because the nets are insufficient to cover all the sleeping spaces in the household hence, some members of these households sleep outside these bed nets and are exposed to mosquito bites. In this case, these people should be enlightened or provided with window and door nets/screens by the Government and Non Governmental Organizations involved in malaria and LF control programs.

The responses on mosquito and malaria control include such practices such as clearing of bushes, anti-malaria therapy, environmental sanitation and avoiding bites from mosquitoes. Knowledge of preventive measures of LF was lacking but the morbidity (Lymphoedema *and* hydrocele) are prevented by avoiding people's farms, sexual promiscuity, hard labour under the sun and keeping good personal hygiene. Braide *et al.,* (2003), Anosike *et al.,* (2005) and Onwuliri *et al.,* (2005) have reported similar finding in parts of Niger. Lu *et al.,* (1989), Ahorlu *et al.,* (1999) and Braga *et al.,* (2003) also reported similar elsewhere.

Responses from the villagers on the treatment of malaria and LF revealed that most use herbal brew as first line of treatment for malaria. From the interview with the villagers it was observed that they are not aware that anti-malaria drugs are given at no cost to pregnant women and children at the health centers. Also, they lack funds to pay for treatment at health centre or to purchase anti-malaria drugs from pharmaceutical shops (Chemists) hence; going to the chemist or heath center is usually the last resort. The villagers treat LF morbidity by seeking medication at the health center, using poultice, drinking herbal brew and praying. Majority do nothing probably because they have resigned their fate to the gods as a result, health seeking behavior may be made on oracles (Nwoke *et al.,* 2000).

CONCLUSION

Malaria and lymphatic filariasis (LF) are significant causes of morbidity and mortality wherever they occur making those priorities for elimination and control. It is evident from this study that Ndiagu Obu and Orijiriafor both in Ohaukwu, Ebony state are co endemic for both diseases. Sadly, the residents of these villages know little about these diseases and their control. The public health implication of this evidence need not be over emphasized. This being the case, health education therefore becomes very important in teaching the people the simple relationship between mosquito bite and LF/ malaria. This is because it is easier and cost-effective to work towards preventing the infection than using chemotherapy.

More so, it was established in this study that *An. gambiae sl* is the major vector involved in the transmission of LF in Ndiagu Obu and Orijiriafor. However, further studies should be carried out to determine which sub species of *An. gambiae* are responsible for transmission of either LF or malaria or both.

Furthermore, itinerant storage of rain and stream water has been established in this study to be one of the factors contributing to the abundance of mosquitoes in the study area. It is therefore necessary for the Government and Non Governmental Organizations (NGOs) involved in LF/ malaria control to provide functional pipe- borne water in these areas.

Finally, it was affirmed in this study that rapid diagnostic test kits can be used for mass screening to detect *P.falciparum* in a population. Thus, it will not be out of place to recommend its usage for the routine screening of *P.falciparum* infection in areas of malaria endemicity, especially in health centers where there is no laboratory scientist/technician experienced in microscopy.

REFERENCES

Ahorlu CK, Dunyo SK, Koran KA, Nkrumah FK, Agard Hansen J and Simonsen PF (1999). LF Related Perceptions and Practices on the Coast of Ghana: Implications for Prevention and Control. *Acta Tropica* **73** 251–264.

Anosike JC, Njoku AJ, Nwoke BEB, Ajero CMU, Osagiede UR, Okoro OU and Nwosu DC (2002). Schistosoma Parasites, their Epidemiology of Urinary Schistosomiasis in Ebonyi State, Nigeria. *International Journal of Environmental Health and Human Development* **3**(1) 59-63.

Anosike JC, Onwuliri COE, Nwoke BEB and Dozie INS (2003). Laboratory Investigation of the Infection Rates of *Anopheles Gambiae* and *A Funestus* in the Transmission of *W Bbancrofti Nigeria Journal of Parasitology* **24** 143–148.

Anosike JC, Nwoke BEB, Ajayi EG, Onwuliri COE, Okoro OU, Oku EE and Asor JE (2005). Lymphatic Filariasis among the Ezza People of Ebonyi State, Eastern Nigeria. *Annals of Agricultural and Environmental Medicine* **12** 181-186.

Aliogo JE (2009). *Nigeria Past Present and Future Current Affairs*. DeJoe Publishers, University of Nigeria, Enugu Campus.

Amaechi AA (2009). Studies on ITN for Control of Mosquito Vectors of Human Lymphatic Filariasis in Parts of Ebonyi State, *Nigeria (PhD Theses of Imo State University, Nigeria).*

Aultman KS, Gottlijeb M, Giovani MY, Fauci AS(2002). Anopheles gambiae genome: *Completing the Malariatriad Sience* **298** 13.

Bartholomay LC, WenLong Cho, Rocheleau TA, Boyle JP, Beck TE, Fuchs JF, Liss P, Rusch M, Butter KM, WU, CR, Lin S, Kuo H, Tsao I, Huang C, Liu T, Hsiao K, Tsai S, Yang U, Nappi AJ Perna NT, Chen C and Christensen BM (2004). Description of the Transcriptome of Immune Response–Activated Haemocytes from the Mosquito Vector *Aedes Aegypti* and *Armigeres Subalbatus*. *American Journal of Microbiology **72** 23-29.*

Bozdech Z, Linas M, Pulliam BL, Wong ED, Zhou J, DeRisi JL (2003). The Transcriptome of the Intraerythrocytic Developmental Cycle of *Plasmodium Falciparum. PLOS Biology **1** 85-100.*

Braga C, Dourado MI, Ximenes RA, Alves L, Brayner F, Rocha A and Alexander N (2003). Field Evaluation of the Whole Blood Immunochromatographic Test for Rapid Bancroftian Filariasis Diagnosis in the Northeast Brazil. *Review of Institute of Medicine and Tropical South Paulo* **45**(3) 125–129.

Braide EI, Ikpeme B, Edet E, Atting I, Ekpo UF, Esu B and Kale OO (2003). Preliminary Observations on the Occurrence of LF in *Cross* River State, Nigeria. *Nigeria Journal of Parasitological* **24** 9-16.

Buck A, Anderson R, MacRae A (1978). Epidemiology of Polyparasitism IV Combined Effects on the State of Health. *Tropical Medicine and Parasitology **29** 253–268.*

Burkot T, Garner P, Paru R, Dagoro H, Barnes A, McDougall S, Wirtz R, Campbell G, Spark R (1990). Effect of Untreated Bednets on the Transmission of *Plasmodium Falciparum, Plasmodium vivax, and Wuchereria Bancrofti* in Papua New Guinea. *Transactions of the Royal Society of Tropical Medicine and Hygiene **84** 773–779.*

Cahill EA (2004). Basic Malaria Epidemiology. Research Spons0ored by DARPA Grant DAAD19-02-1-0288 P00001. *Academic.reed.edu/epi/papers/malariacahill.doc.*

Chadee DD, Rawlins C, Tiwari T (2003). Short Communication:Concomitant Malaria and Filariasis Infections in Georgetown Guyana. *Tropical Medicine and International Health **8** 140–143.*

Chessbrough, M (2003). *District Laboratory Practice in Tropical Countries*. Part I. New York, London Cambridge University Press.

Cornet K, Robin Y, Heme G, Adam C, Valade M and Eyrad M (1979). Une Pussee Epizootique Defierre Jaune Selva Lique and Senegal Oriental. Isolement Du Virs De Lots De Moustiques Adults Males et Femelles. *Journal of Pathological Infections and Experimental Epidemiology* **33** 411-416.

Detinova TS (1962*).* *Age-Grouping Methods in Diptera of Medical Importance*. WHO Monography **47.**

Ephantus JM, Benjamin GJ, Chang Hyun K, Charles NM and Robert JN (2007). Are Coinfections of Malaria and Filariasis of any Epidemiological Significance? 176 *Parasitology Resours* **102** 175-181.

Gardner MJ (2002). Genome Sequence of the Human Malaria Parasite *Plasmodium Falciparum Nature* **419** 498-511.

Gillies MT and De-Meillon B (1968). The Anopheline of African South of the Sahara (Ethiopian Zoogeographical Region). In: *Publications of the South African Institute for Medical Research (*South African Institute for Medical Research Johanesburg) 54.

Haliza BAR (1986). Comparism of Knowledge of Filariasis and Epidemiological Factors between Infected and Uninfected Respondents in a Malaysian Community. *Southeast Asian Journal of Tropical Medicine and Public Health* **17** 457-463.

Hay SI, Cox J, Rogers DJ, Randolph SE, Stern DI, Shanks DG, Myers MF and Snow RW (2002). Climate Change and the Resurgence of Malaria in the East African Highlands. *Nature* **415** 905-909.

Kessel JF (1957). Disabling Effects and Control of Filariasis. *American Journal of Tropical Medicine and Hygiene* **6** 402-414.

Lu AG, Valencia LB, Aballa I and Prostrado L (1988). Filariasis: A study of Knowledge, Attitude and Practices of the People of Sorsogon. *Social and Economic Report* TDR/SER. WHO, Geneva, Switzerland.

McMahon J, Magayuka S, Kolstrup N, Mosha F, Bushford F, Abaru D (1981). Studies on the Transmission and Prevalence of Bancroftian Filariasis in Four Coastal Villages of Tanzania. *Annals of Tropical Medicine and Parasitology 75 415–431*.

Muhondwa EPY (1983). Community Participation in Filariasis Control: *The Tanzanian Experiment Tropical Disease Research Series* (World Health Organization Geneva) **4** 83.

Muirhead Thomson R (1953). Inter-Relations between Filarial and Malarial Infections in *Anopheles Gambiae Nature* **172** 352–353.

Muturi EJ, Mbogo C, Mwangangi JM, Nganga ZW, Kabiru EW, Mwandawiro C and Beier JC (2006). Concomitant Infections of *P. Falciparum and W.Bancrofti* on the Kenyan Coast. *Filarial Journal* **5** 8.

Nabarro DN and Tayler EM (1998). The Roll Back Malaria Campaign *Science* **280** 2067–2068.

Nelson GS and Pester FRN (1962). The Identification of Infective Inflarial larvae in Simulidae. *Bulletin of World Health Organisation* **27** 473-481.

Nwoke BEB (2000). *Feeding in Haematophagous Insects: Mosquitoes* (Lecture Note on Entomology 413) Unpublished Document.

Onwuliri COE, Anosike JC, Oguoma C, Onwuliri VA, Nwoke BEB, Dozie INS and Iwuala MOE (2005). Impact of Cultural Behaviour, Local Beliefs and Practices on Emerging Parasitic Diseases in Tropical Africa. *The Negro Educational Review* **56**(4) 311-325.

Ottesen EA (2000). The Global Program to Eliminate Lymphatic Filariasis. *Tropical Medicine and International Health 5 591–594.*

Sachs J and Malaney P (2002). The Economic and Social Burden of Malaria. *Nature* **415** 680-685.

Trape JF and Rogier C (1996). Combating Malaria Morbidity and Mortality by Reducing Transmission *Parasitology Today* **12** 236–240.

McMahon J, Magayuka S, Kolstrup N, Mosha F, Bushford F and Abaru
D (1981). Studies on the Transmission and Prevalence of Bancroftian Filariasis in Four Coastal Villages of Tanzania. *Annals of Tropical Medicine and Parasitology* **75** 415–431.

WHO (1990). *World Report on Tropical Disease*. WHO Feature March, No. 139 Geneva, Switzerland.