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## Prevalence and clinical aspects of *Wuchereria bancrofti* among inhabitants of a resource limited irrigation project community, North Central Nigeria

Ebube Charles Amaechi<sup>1,2\*</sup>, Camelita Chima Ohaeri<sup>1</sup>, Onyinye Mkpola Ukpai<sup>1</sup>, Kalu Ukoha Ukoha<sup>1,3</sup>, Prosper Chidi Nwachukwu<sup>1</sup>, Blessing Uzoamaka Ejike<sup>1,4</sup>

<sup>1</sup>Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

<sup>2</sup>Department of Zoology, University of Ilorin, Ilorin, Kwara State, Nigeria

<sup>3</sup>Department of Zoology and Environmental Biology, University of Calabar, Calabar, Cross River State, Nigeria

<sup>4</sup>Department of Biology/Microbiology, Abia State Polytechnic, Aba, Abia State, Nigeria

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### ABSTRACT

**Objective:** To assess the prevalence and clinical manifestations of lymphatic filariasis among inhabitants of the study area.

**Methods:** A total of 1 069 persons of different age groups were examined using immunochromatographic test which detected *Wuchereria bancrofti* (*W. bancrofti*) antigens by finger prick blood collection. Physical examinations of the subjects were also carried out to check for signs of the infection on the individuals.

**Results:** Of these, 36 (3.4%) were infected with *W. bancrofti*. Males showed a higher prevalence than females (4.0% vs. 2.8%,  $P < 0.05$ ). Those that fell in the age group of 70 years and above were the most infected (23.8%). Regarding signs and symptoms of the disease, periodic fever was reported the most by the subjects (7.5%) followed by crawling sensation (4.9%). Periodic fever and crawling sensation tended to appear much earlier in life, while tenderness of limbs, elephantiasis and hydrocele were symptoms that showed up from the fifth decade of life.

**Conclusions:** Our study showed that lymphatic filariasis was caused by *W. bancrofti* as a serious health problem in irrigation communities of Nigeria. Realistic and sustained health interventions are required to effectively control the disease in this community and other related areas of Nigeria.

## 1. Introduction

Lymphatic filariasis (LF) caused by *Wuchereria bancrofti* (*W. bancrofti*) that dwells in the lymphatic system is a neglected tropical parasitic disease, common in resource-poor communities which has direct link with poverty[1]. The disease occurs mostly in rural communities where fishing and other irrigational activities occur[2]. Hydrocele, lymphedema and elephantiasis are the major

complications that develop as a result of inflammation of the lymphatic system. It is ranked as the 4th cause of permanent long-term disability. The global programme to eliminate LF reported that approximately 15 million people globally are affected by LF-related lymphedema (or elephantiasis) which includes swelling of the limbs, breasts or genitals, and almost 25 million people are affected by urogenital swelling and primarily scrotal hydrocele. About 81 countries including Nigeria are known to be endemic, with 1.43 billion people at a serious risk and 120 million people infected, 40 million people are affected as a result of LF-related morbidity[1,3].

Environmental modification such as dam construction has long been recognized to enhance LF transmission by creating ideal breeding sites for mosquito vectors, thereby bringing both the vectors and disease closer to the people[4]. As Nigeria continues its implementation on the LF Elimination Programme, a basic problem envisaged is the dearth of information on the distribution of LF in most endemic states of the country[5]. For effective control measures

\*Corresponding author: Ebube Charles Amaechi, Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria; Department of Zoology, University of Ilorin, Ilorin, Kwara State, Nigeria.

Tel: +2348039667283

E-mail: ebubeamechi@yahoo.com

The study protocol was performed according to the Helsinki declaration and approved by Kogi State Ministry of Health and the local government health authority. Informed written consent was obtained from inhabitants of the communities.

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to be designed and implemented, baseline data on the transmission dynamics and clinical manifestations of the disease must be fully understood. There is a paucity of information on the prevalence and clinical signs of LF in Omi dam irrigation project community. In the present study, we carried out an assessment on the prevalence and clinical manifestations of LF among inhabitants of the study area.

## 2. Materials and methods

### 2.1. Study area and population

Five communities of Omi dam irrigation project and surrounding communities, namely, Omi, Ogga, Iddo, Ogbo and Ejiba located in Yagba West Local Government Area of Kogi State, Nigeria formed the study area. The Local Government Area covers an area of 1276 km<sup>2</sup> with a population of 149023[6]. It is about 146 km from Ilorin, the capital of Kwara State. It lies between longitudes of 6°37' E and 6°42' E of Greenwich and latitudes of 8°34' N and 8°38' N of the equator[7]. The project is located in Omi village, a farming community of about 10000 people[2]. The primary aim of establishing this dam is to promote agriculture through irrigation activities involving more than 5000 farming households both within and outside Yagba West Local Government Area. There are many settlers particularly fishermen along the lake and this indicates the enormous fisheries potential of the lake. The dam is capable of irrigating about 4100 ha of land. The dam allows for agricultural production of maize, vegetables, sorghum and rice all the year round.

The study area has a high humidity with an annual mean temperature ranging between 28 °C and 35 °C. There are two main seasons in the area. The dry season starts from November to March while the rainy season starts from April and ends in October, though there could be fluctuations due to climate change. The study area is known to have the Guinea savannah type of vegetation while the soil is hydromorphic which contains a mixture of coarse alluvium and colluvial deposits. The annual rainfall is between 1100 and 1300 mm. Most of the inhabitants in the study area depend on the water body for drinking and for domestic activities within their rural dwellings since pipe borne water is lacking. The communities are schools, hospitals and dispensaries where the inhabitants seek treatment. Many of the houses have unscreened windows, holes in the walls and large open eaves that provide easy entry for mosquitoes. The houses are separated from one another either by agricultural land or small patches of natural vegetation.

The study period was March to November 2014. The study population consisted of all inhabitants of the area that have lived for a period of at least one year and who attended the clinics and health centers for one complaints or the other during the survey period and gave their consent to be part of the study. A total of 1069 volunteered respondents aged 2 years and above participated fully in the survey.

### 2.2. Ethical consideration

Before commencement of the study, authorities of Lower Niger River Basin Authority, Ilorin, gave official permission. Approval

was granted by the Kogi State Ministry of Health and the local government health authority. The traditional ruler of Omi (Olomi of Omi) and other community leaders also approved the study. Village heads assisted in coordinating meetings with inhabitants of the communities to explain the purpose of the study. The researchers made it clear to the participants that the study was voluntary and that it was possible to withdraw at will. The post-graduate committee board of the Department of Zoology and Environmental Biology, Michael Okpara University of Agriculture, Umudike, gave approval to the study.

### 2.3. Study questionnaire

A semi-structured questionnaire developed by the researchers was validated and pre-tested to ensure consistency, reliability and appropriateness of language before commencement of the field work. During the field work, questionnaires were administered with the help of medical doctors, nurses and health technicians who were indigenous to the research area to allow for proper translation and clear understanding by the respondents. For those who could neither read nor write, they were interviewed using Okun, the local language of the people of the area to determine clinical signs and symptoms of LF. The questionnaire used in the survey was written in English language.

### 2.4. Examination of blood for *W. bancrofti*

Thick blood films and immunochromatographic test were performed on each participant between the hours of 9 and 12 pm. The first sample was drawn onto a microscope slide and the second was dropped onto an immunochromatographic (ICT) card according to the manufacturer's instructions. For the thick blood film, a rectangular smear covering an area of approximately 80% of the slide was left to dry overnight at room temperature and read the next day. The slides were dehaemoglobinized in water, fixed in methanol for 3 min and stained with haematoxylin and later examined microscopically[8].

ICT card test (AMRAD ICT, New South Wales, Australia) were used to test filarial antigen in the blood of the study subjects. The test card was used to detect filarial antigens in the blood of infected humans by paired antibodies (polyclonal and monoclonal antibodies). The cards were stored in a refrigerator at 8 °C and carried to the field in polystyrene foam boxes. The reading and interpretation of the tests were performed the next day. Cards exhibiting the control line were considered valid. The reading and interpretation of the results followed the manufacturers' instructions which stated that any visible line in the T area (test line) indicated a positive result. The test was positive even when the T-line appeared lighter or darker than control line.

### 2.5. Clinical and physical examination of the subjects

A total of 1069 subjects (males and females) aged > 2 years from the communities studied gave their consent to be examined for

physical manifestations of filariasis. Those less than 18 years got their parents approval. This examination was done behind closed doors individually by trained medical personnel (comprising medical doctors and qualified nurses). The females were examined in the legs, arms and breasts while the males were examined in the genitals, legs, arms and lymph glands (groin and axilla). Presence of clinical signs and symptoms were identified and noted on a well prepared questionnaire sheet.

## 2.6. Data analysis

The data obtained from this research were analyzed using SPSS, version 16.0, Chicago, IL, USA. The data were double checked to ensure for correctness of the imputed figures before the analysis. Chi-square was used to test for independence of infection with microfilaria amongst age group and sexes. Fisher's exact test was used to determine the significance of differences of relative frequencies. Communities were considered endemic if at least one individual had a positive ICT result for *W. bancrofti* antigen.

## 3. Results

### 3.1. Prevalence of microfilariae of bancroftian filariasis in humans in Omi village

Table 1 shows the prevalence of microfilaraemia in Omi village where the overall prevalence of microfilaraemia was 3.4% and significantly higher in males (4.0%) than in females (2.8%) ( $\chi^2 = 1.22$ ,  $df = 7$  and  $P = 0.0015$ ).

**Table 1**

Prevalence of *W. bancrofti* infections in relation to age and sex groups in the relevant villages in the study areas.

Age group	No. of examined			No. of infected		
	Males	Females	Total	Males (%)	Females (%)	Total (%)
0–9	165	203	368	0 (0.0)	0 (0.0)	0 (0.0)
10–19	55	64	119	2 (3.6)	0 (0.0)	2 (1.7)
20–29	61	64	125	0 (0.0)	0 (0.0)	0 (0.0)
30–39	54	57	111	0 (0.0)	4 (7.0)	4 (3.6)
40–49	52	49	101	4 (7.7)	2 (4.1)	6 (5.9)
50–59	54	58	112	2 (3.7)	2 (3.4)	4 (3.6)
60–69	45	46	91	6 (13.3)	4 (8.7)	10 (11.0)
70 and above	19	23	42	6 (31.6)	4 (17.4)	10 (23.8)
Overall	505	564	1069	20 (4.0)	16 (2.8)	36 (3.4)

The age stratified microfilariae prevalences in Omi village were shown in Table 1 where prevalence of microfilaraemia was the highest in over 60 years. Difference in prevalence was not significant ( $\chi^2 = 1.22$ ,  $df = 7$  and  $P > 0.05$ ) amongst the age group.

### 3.2. Age related distribution of clinical signs and symptoms of Lymphatic filariasis amongst the subjects in Omi village

Symptoms like periodic fever, dermatitis and a crawling sensation showed up in the early part of life (0–49 years) and tenderness of

limbs, elephantiasis as well as hydrocele appeared much later in life (50 years and above) ( $\chi^2 = 2.03$ ,  $df = 7$  and  $P < 0.05$ ) (Table 2).

**Table 2**

Age related distribution of clinical signs and symptoms of lymphatic filariasis amongst the subjects [ $n$  (%)].

Age (years)	No.	Crawling sensation	Periodic fever	Tenderness of limbs	Elephantiasis	Dermatitis	Hydrocele
0–9	368	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
10–19	119	3 (2.5)	2 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
20–29	125	12 (9.6)	7 (5.6)	0 (0.0)	0 (0.0)	4 (3.2)	0 (0.0)
30–39	111	16 (14.4)	21 (18.9)	0 (0.0)	0 (0.0)	5 (4.5)	0 (0.0)
40–49	101	7 (6.9)	19 (18.8)	8 (7.9)	3 (3.0)	8 (7.9)	1 (1.0)
50–59	112	5 (4.5)	12 (10.7)	4 (3.6)	3 (2.7)	11 (9.8)	3 (2.7)
60–69	91	6 (6.6)	14 (15.4)	4 (4.4)	5 (5.5)	7 (7.7)	1 (1.1)
70 and above	42	3 (7.1)	5 (11.9)	3 (7.1)	7 (16.7)	5 (11.9)	3 (7.1)
Total	1069	52 (4.9)	80 (7.5)	19 (1.8)	40 (3.7)	40 (3.7)	8 (0.7)

## 4. Discussion

For the planning of a control programme towards a public health disease, it is necessary to gather information on the prevalence and distribution in a given area[9,10]. Reports on the distribution of filariasis due to *W. bancrofti* in irrigational communities of North Central Nigeria are rather scanty. This has made it difficult to assess the exact epidemiological situation of the disease in such communities, thus making it rather difficult to determine its public health importance. Our present study shows that LF around irrigation communities is common and the prevalence is fairly high. The findings will provide a comprehensive epidemiological baseline data for managing and controlling on-going LF elimination programme in Nigeria under the Global Programme for Elimination of LF. These data are of importance in this region of the country, but currently scarce in irrigation communities like Omi that happens to be a remote rural community. The occupation of the rural dwellers, which is mainly farming and fishing, makes them susceptible to contact with human-vector (*W. bancrofti*)[2]. The fairly high prevalence of infection in the communities studied could be attributed to high mosquito density and favorable climatic environment which help in facilitating breeding of mosquito. The dams around the communities formed conducive breeding sites for the vectors coupled with human behavioral patterns such as staying late at night outside the home, which made them susceptible to mosquito bite and played considerable roles in disease transmission. Residents of the communities live in houses with unscreened windows, holes in the walls, and large open eaves that provided easy access for mosquitoes to gain entry[2]. The overall prevalence of 3.4% microfilariae of *W. bancrofti* infection recorded in the study revealed that at present, the disease is a public health challenge in the area. However, the prevalence rate in the study area is comparable with the findings of Targema *et al.* in Benue State who reported a prevalence of 5.5%[11]. The prevalence of 3.4% is however lower than the findings of Udoidung *et al.* in rural communities of lower Cross River Basin, Nigeria, who reported a prevalence of 6.5%[12]. The prevalence observed could be attributed to factors that include occupational disposition, attitudinal influence, immunological and hormonal factors[1,13]. The occurrence of LF was higher in males (4.0%) than the females (2.8%) in the study area. Males were more exposed to

infection because most of them are involved in activities such as farming and fishing practices that involve coming in contact with water bodies that are ideal breeding place for the mosquito vector. Likewise it was found out that males within the study area could be seen sleeping outdoors during the night. Younger children were not infected in all the study communities (0–9 years age group). This could be as a result of their indoor sleeping habit using protective covering. Also for microfilaraemia infection to be established in an individual, it is required that such a person should have had series of infective bites over a long period of time[14]. The older age group (70 years and above) were found to be more infected. This might be because of high exposure towards outer environment, lack of awareness and carelessness towards the use of mosquito nets[10].

Subjects that were infected with *W. bancrofti* were seen manifesting symptoms such as dermatitis, elephantiasis and hydrocele. Dermatitis is a symptom associated with many filarial parasite species while hydrocele has been implicated as a major symptom of bancroftian filariasis[15]. Like subjects in ages 40 years and above were observed to have hydrocele, an elephantiasis was also found in endemic areas in Africa[16]. Generally, the hydroceles were mild in degree and asymptomatic in all cases, which is similar to the findings of Hati *et al.* in East Africa. Periodic fever and crawling sensation were the commonest morbid symptoms in the study area[17]. The proportion of individuals that were observed to have LF related hydrocele was rather low when compared to other studies in other endemic parts of Africa. Individuals with hydrocele were often stigmatized and this affected their disposition to social interactions within the community.

In conclusion, the findings show that LF due to *W. bancrofti* is a problem in an irrigation community of Omi, North Central Nigeria and so the urgent need to establish an elimination programme geared at controlling and eradicating transmission in the area.

### Conflict of interest statement

We declare that we have no conflict of interest.

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