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Seroprevalence of Lymphatic Filariasis in Six Communities of Bungudu Lga, Zamfara State, Nigeria

Mu'awiyya Umar Ladan[2*], Tukur Adamu[1] and Sirajo Isma'ila Moyi[2]

[1]Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto State, Nigeria

[2]Department of Biological Sciences, Federal University Gusau, Zamfara State, Nigeria

*Corresponding Author E-mail: lmuawiyyaumar@yahoo.co.uk

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ABSTRACT

This study was conducted to determine the seroprevalence of lymphatic filariasis in six communities of Bungudu Local Government Area, Zamfara State, Nigeria. Blood samples from 501 volunteers were diagnosed for bancroftian antibodies using rapid diagnostic test (RDT) kits (filariasis IgG/IgM Combo). An overall prevalence of 38.72% was recorded. Rawayya-Bela ward was found to have the highest prevalence (45.24%) of infection among the wards, while least prevalence (27.38%) of infection was recorded in Kwatarkwashi ward. With respect to gender, the highest prevalence (48.46%) of infection occurred in males as against their female counterparts. The age-related prevalence showed people at age bracket 10-19 to be the highest infected (50.57%) group while those at age bracket 0-9 had the least prevalence (33.75%) of infection. With respect to occupation of the inhabitants, farmers were found to have the highest prevalence (45.61%) of infection than the other occupational groups. An analysis of the results using Chi-square indicated that males aged between 10-19 years are significantly at higher risk of infection. This study indicated that, the study area is endemic with lymphatic filariasis. Therefore, proper sanitation, public enlightenment and mass drug administration are urgently needed in the study area, if the elimination of the infection is to be achieved by the year 2020.

Key words: *Prevalence, Wuchereria bancrofti, Bungudu, Rawayya-Bela*

INTRODUCTION

Lymphatic filariasis, also known as elephantiasis**,** is a parasitic disease caused by microscopic thread-like worms (filarial worms) that belong to the Nematode superfamily Filarioidea which inhabit the lymphatic vessels and lymph nodes of a human host[1,2]. The worms are spread by the bites of infected mosquitoes. Three types of worms known to cause the disease are *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*[3].

Among the three species, *W. bancrofti* has the widest distribution and it is responsible for 90% of all the cases of lymphatic filariasis, extending throughout central Africa, the Nile Delta, Turkey, India, Southeast Asia, the East Indies, the Philippine, Oceanic Islands, Australia New Guinea, and parts of South America[4,5].

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Lymphatic filariasis is the fourth leading cause of long-term and permanent disability and is among the tropical diseases which lie second only to malaria in terms of disability-adjusted years[6,7]. *W. bancrofti* was once common in Japan, China, the Republic of Korea, Turkey, Egypt, and Oceania, but it is diminishing from these areas due to disease elimination programs[8]. Currently, 73 countries are considered endemic for filariasis, of which 6 (Cambodia, The Cook Islands, Maldives, Niue, Sri Lanka and Vanuatu) were acknowledged as achieving elimination of LF as a public health problem. There are thirteen (13) more countries that have successfully implemented the recommended strategies, stopped mass treatment and are under surveillance to demonstrate that elimination has been achieved[3].

About 947 million people in 54 countries worldwide remain threatened by lymphatic filariasis and preventive chemotherapy to stop the spread of this parasitic infection has not been delivered to all the endemic areas as at the end of year 2015. Approximately, 80% of the infected individuals are living in the following ten (10) countries: Angola, Cameroon, Côte d'Ivoire, Democratic Republic of Congo, India, Indonesia, Mozambique, Myanmar, Nigeria and the United Republic of Tanzania. Enhanced strategies are now required in about 29 countries to achieve elimination targets and stop treatment by 2020[3].

In year 2000, more than 120 million people of all ages and sexes were infected with one or more of the lymphatic filariae worldwide, and an estimated 25 million men suffer with genital disease and over 15 million people are afflicted with lymphoedema [3,9,10]. Nigeria was rated as the third most endemic country with lymphatic filariasis in the world after India and Indonesia. It was reported that 22.1% of the Nigerian population is thought to be infected, with 66% people at risk of being infected. The significant burden of lymphatic filariasis (LF) in Nigeria is caused by the *Wuchereria bancrofti* [11,12]. The Cater Center reported that, in Nigeria, lymphatic filariasis is transmitted by the same mosquito that transmits malaria [13]. The epidemiology of the infection is complicated due to the diversity of environmental conditions of different regions of the country[6].

As Nigeria prepares to implement the Lymphatic Filariasis Elimination Programme (LFEP) there is the need to have the necessary base line information on the disease, but unfortunately readily available information of some areas that could be endemic is lacking and until data on the distribution of the disease is available that the elimination of the disease will be achieved in the country. It is in this light coupled with the absence of a comprehensive report on the disease in Zamfara State, that this study was designed in order to determine the prevalence of lymphatic filariasis in Bungudu Local Government Area.

Objectives of the Study

The specific objectives of the study are to determine:

1. The overall seroprevalence of infection in the study area.
2. The seroprevalence of the infection with respect to gender, age, and occupation of the people in the study area.

MATERIAL AND METHODS

Study Area

The study was conducted at Bungudu Local Government Area, Zamfara State, located between latitude 12°09′00″-12°16′00″N and longitude 6°30′00″- 6°33′24″E occupying an area of 2,293 km² and estimated population of 367,729,[14,15]. The Local Government is divided into 10 wards [16]. Majority of the inhabitants are Fulani and Hausa people, hence the main languages spoken in the area are Hausa and Fulfulde while English is the official language [17]. Islam is the principal and major religion of the inhabitants; they practice similar customs and cultures[16,18]. Bungudu LGA is in the Northern Guinea Savannah and it is rich in agricultural lands[19].

The major occupation of the communities especially those living in rural agricultural areas is farming, hence its slogan "farming is our pride". Most inhabitants are

engaged in one or more of the following; wet and dry season farming, fisheries, poultry and livestock production. They produce both food and cash crops, like; Rice, wheat, tomatoes, guinea corn, maize, ground nut, cotton, beans, etc. Animals raised in the area include; sheep, cattle, goats, chicks, fishes etc[18, 20]. In addition to farmers, there are also public servants, traders, fishermen, artisans and other handwork related businesses. The sources of water supply to the inhabitants are river, ponds, wells and bore holes [21].

The climate of the area is warm tropical with temperature rising up to 38°C (100.4 °F) between March to May. Rainy season starts in late May, the onset of the rains tends to bring a cooling effect with temperatures dropping below 36°C. The peak of the rainy season is from about July to September [22,23]. The mean annual rainfall in the area is measured 798mm[19]. It is between October and November that the tropical continental air masses from the Sahara predominates and lower the temperatures to around 17°C–20°C which leads to the cold season known as harmattan that lasts from December to February[22,23].

Sampling Techniques

A cluster sampling techniques as described by[24] was employed in random selection of six out of 11 wards of Bungudu Local Government Area. However, 84 subjects each from Bungudu, Kwatarkwashi, Sankalawa, Nahuche, Rawayya-bela and 81 subjects from Gada karakai were randomly selected for the study. The study population comprised of males and females of all ages.

Ethical Clearance

Before commencement of the study, an approval from State Health Research Ethics Committee and permission from the Ministry of Health was obtained, so as to have a better access to the community members and to ensure consent of their leaders and confidentiality of the participants for the study.

Determination of Circulating Filarial Antigen

Circulating filarial antigen was determined using Aria Filariasis IgG/IgM Combo Rapid Test for the simultaneous detection and differentiation of IgG and IgM anti-lymphatic filarial parasites (*W. bancrofti* and *B. malayi*) in human serum, plasma or whole blood following the manufacturer's instructions[25]. The test cassette was labelled with the participant's ID number, and then placed on a clean flat surface. The volunteer's left finger was sterilized with methylated spirit and then punctured using a sterile blood lancet. The blood (about 40-50µl) was collected using EDTA capillary tube and then transferred to the sample well of the test cassette by making sure that, there are no air bubbles. Then, immediately one (about 35-50µl) of sample diluent was added to the sample well. The result of each cassette was read within 15 minutes. The test result whether positive or negative was recorded on the questionnaire that corresponds to the participant's ID number.

Questionnaire Administration

Questionnaires containing volunteer's socio-economic data and test result (whether positive or negative) were used to obtain some descriptive information about the volunteers. The questionnaires were labelled to correspond to the volunteer's test cassette ID number and then administered to each volunteer that provided the blood for the test as described by[26].

Statistical Analysis

The prevalence expressed in percentages was calculated as number of infected individuals divided by the total number of individuals examined and then multiplied by 100. The data obtained for the wards, age, gender, and occupation of the people was analysed using Chi-square. *P* values of 0.05 and 95% confidence interval (CI) were used for statistical significance.

RESULTS

An overall sero-prevalence of 38.72% was found in the study area. The prevalence of infection varied among the wards. Volunteers from Rawayya-Bela ward were found to have the highest sero-prevalence (45.24%), while the least prevalence (27.38%) was occurred in

volunteers from Kwatarkwashi ward. The occurrence of the infection significantly associates (P>0.05) with the settlement of the subjects (Table 1).

Table 1: Seroprevalence of Bancroftian Infection with Respect to Wards

Ward	No. Examined	No. Positive	Prevalence (%)
Bungudu	84	36	42.86
Kwatarkwashi	84	23	27.38
Sankalawa	84	32	38.09
Nahuche	84	31	36.90
Rawayya-Bela	84	38	45.24
Gada-karakai	81	34	41.98
Total	**501**	**194**	**38.72**

x^2=5.225; *df*=5; P>0.05

The results obtained with respect to gender of the people indicated that, male volunteers were significantly (P>0.05) more infected (48.46%) than their female counterparts (25.00%) (Table 2).

Table 2: Seroprevalence of Bancroftian Infection with Respect to Gender

Gender	No. Examined	No. Positive	Prevalence (%)
Male	293	142	48.46
Female	208	52	25.00
Total	**501**	**194**	**38.72**

x^2=7.492; *df*=1; P>0.05

In age-related sero-prevalence of infection, subjects at age bracket 10-19 were recorded to have the highest prevalence (50.57%) of infection than their counterparts at other age groups, the least prevalence (23.81%) was found at age bracket 30-39. However, Chi-square analysis revealed a significant (P>0.05) association between infection and different age groups (Table 3).

Table 3: Seroprevalence of Bancroftian Infection with Respect to Age Group

Age Bracket	No. Examined	No. Positive	Prevalence (%)
0-9	80	27	33.75
10-19	87	44	50.57
20-29	70	24	34.29
30-39	69	26	37.68
40-49	70	21	30.00
50-59	62	27	43.55
60-69	47	21	44.68
70-above	16	4	25.00
Total	**501**	**194**	**38.72**

x^2=13.128; *df*=7; P>0.05

The sero-prevalence of infection with respect to occupation of the people in the study area indicated the occurrence of highest prevalence (45.61%) of infection in farmers than in other occupational groups, however, the least prevalence (28.13%) was recorded in artisans. Chi-square analysis showed a significant association (P>0.05) between infection and occupation of the people (Table 4).

Table 4: Sero-prevalence of Bancroftian Infection with Respect to Occupation

Occupation	No. Examined	No. Positive	Prevalence (%)
Farming	141	78	55.32
Trading	74	24	32.43
Fishing	18	5	27.77
Students	113	53	46.90
Artisans	27	7	25.93
Civil Service	57	11	19.29
Others	71	16	22.54
Total	**501**	**194**	**38.72**

x^2=32.427; *df*=6; P>0.05

DISCUSSION

Several researches on lymphatic filariasis in many parts of Nigeria revealed the presence of infection and clinical signs of the disease in the country. The overall prevalence of 38.72% with bancroftian filariasis recorded in this study is higher than that of a study conducted by[11] on prevalence of bancroftian filariasis in five communities of Lau LGA Northern Taraba State, Nigeria which showed the presence of infection with overall prevalence of 23.57% and a work of [27] on prevalence of lymphatic filariasis in Oraeri, Aguata LGA of Anambra State, Nigeria that indicated the overall prevalence of 18.80%. However, the prevalence rate of infection in the presence study was shown to be lower than that of[6] on endemicity of lymphatic filariasis in three LGA of Imo State, Nigeria which revealed the overall prevalence of 73.00% and that of [28] on sero-prevalence of lymphatic filariasis at Puducherry, India which recorded overall prevalence rate of infection as 43.78%. The overall prevalence of infection recorded in our study could be attributed to the fact that majority of these communities where this study was conducted are living in rural areas. Most of their houses are not protected from mosquitoes and other insects. Another contributing factor may be the presence of microfilaraemic infected individuals in addition to poor environmental and hygienic conditions within the communities that permit close proximity to various mosquitoes breeding sites (e.g. abundant tires, unused plastic and glass containers, broken mud pots, dirty and contaminated gutters etc.), thus exposing them to mosquito vectors.

The highest prevalence of infection recorded in Rawayya-Bela could be due to the fact that it is more rural than the other communities, and could also be attributed to the relevant risks for infection which vary significantly among the communities. These depend on the lifestyle, cultural, societal, and environmental factors of the inhabitants, as well as number of infected individuals and mosquito vectors within the communities. Lacks of pipe borne water is another factor that forces the inhabitants to fetch water from the river, ponds, wells and boreholes, they kept these waters in various containers as preservation for future use eventually such waters become veritable breeding sites for mosquitoes. [11] and [28] had made similar observations from their researches conducted on lymphatic filariasis.

The significantly higher prevalence rate 48.46% of infection found in males from the present study is in conformity with that of [6,29,11]. However, in the other hand the result is not in line with that of[30] who discovered females with higher infection rate than males from their study in Ado-Odo Ota, Ogun state, Nigeria. The higher prevalence rate of infection discovered in males from our study is not surprising, because in communities where this study was conducted, it was observed that, males are more exposed to the outdoor activities than their female counterparts. According to religion and culture of these communities, females are strongly restricted at home, they usually wear long clothes (hijab) that cover whole of their bodies and do not sleep, play, swim, rest or do other works outdoors, thus minimizing their chances of exposure to mosquito bites. In contrast, males

are more exposed to mosquito bites by their habits of sleeping outside homes in addition to their various outdoors activities.

The significantly highest infection rate of 50.57% observed in age bracket 10–19 years than the other age group could be attributed to the fact that, these age group are school age children (primary to secondary) and in the villages this is the population most commonly found in prolonged exposure to different play grounds from where they may be bitten by infected mosquitoes. They may also be found in water contact activities like swimming and playing in bodies of water which are likely to be the mosquitoes breeding sites. The other age groups are either too young (0-9) to be actively involved in such activities or consider themselves (20 years and above) as adults or too old who are not expected to engage in such activities. This finding corresponded to that of[6,30].

Occupation related prevalence of infection indicated that, farmers (55.32%), students (mostly almajirai) (46.91%) and traders (32.43%) were more infected in the study area. This is probably due to the nature of their occupation that exposes them to the frequent mosquito bites. Farmers are usually in close association with mosquito breeding sites during irrigation farming, washing their farm produce, bathing, washing their bodies after a hard day's work. Students (Almajirai) are the less privileged population in these communities who are under nobody's care; they may be found resting, playing and sleeping everywhere without any protection from mosquitoes bites. Traders are mostly found sitting on benches outside, or in small shops selling various things, the nature of their business provide a better chance where mosquitoes can comfortably get access to them. The lower prevalence rate of infection obtained in other occupational groups; fishing (27.77), artisans (25.93) like mechanics, carpenters, blacksmiths, architects etc and others (22.54) which involved butchers, catering, tailoring, driving, etc., could be due to the nature of their occupation that causes disturbances and uncomfortable chances for the mosquitoes to feed on them frequently. The least prevalence of the infection observed in civil servants (19.29) could probably be due to the level of their education and awareness on the effect of mosquitoes, in addition to attending hospitals for treatment of their illness. This finding agreed with that of[11].

CONCLUSION

It is evident from the results obtained that bancroftian filariasis is present in the study area. Male study volunteers aged between 10-19 years are at higher risk of being infected. Therefore, improved sanitation, public enlightenment, mass drug administration and treatment of infected individuals are urgently needed in the study area, if the elimination of the infection is to be achieved by the year 2020.

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REFERENCES

1. Medicinenet. Definition of Lymphatic filariasis. *Medicinenet.com.* Retrieved on 16th November, 2016 from http://www.medicinenet.com/script/main/art.asp?articlekey=14970 (2016).
2. News-medical. What is Filariasis? *News-medical Life Science*. Retrieved on 16th

November, 2016 from http://www.news-medical.net/health/What-is-Filariasis.aspx (2016).

3. World Health Organisation. Lymphatic Filariasis. *Fact Sheets No. 102*. Retrieved on 6th September, 2016 from http//www.who.int/mediacenter/factsheets/fs102/en/ (2016).
4. Despommier, D. D. and Karapelou, J. W., *Parasites Life Cycle*. New York, London. Pp 72-82. (1987).
5. Roberts, S. L. and Janovy, J. J.R., Foundations of Parasitology. Eighth Edition. McGrawHill. Pp 463-477. (2010).
6. Obi, R. K., Oyibo, W. A., Okaba, C. C., Nwanebu, F. C., Oparaocha, E. T., Orji, N. M and Ndubuisi, U. U. Concurrent Parasitosis in an Onchocerciasis Endemic Community. *Asian Journal of Experimental Biological Sciences*. **1(2):** 262-270 (2010).
7. Omudu, E. A. and Okafor, F. C., Study of Chronic Lymphatic Filariasis Related Knowledge, Attitudes and Perception among Three Ethnic Groups in Benue State, Nigeria. *Nigerian Journal of Parasitology*. **32(1):** 135-142 (2011).
8. World Health Organisation. Forms of Lymphatic Filariasis and Diagnosis. Retrieved on 19th June, 2011 from http//www.who.int/lymphatic_filariasis/epidemiologyfprms/en/index.html (2011).
9. Samantha, N. M., Makedonka, M., Gary, J. W. and Peter, U. F. Inter and Intra-specific Diversity of Parasites that Cause Lymphatic Filariasis. *Infection, Genetics and Evolution* **14**:137–146. Retrieved on 7th March, 2015, from http://www.sciencedirect.com/science/article/pii/S1567134812003425 (2013).
10. USAIDS. Lymphatic Filariasis. *USAIDS NTD's Program Neglected Tropical Diseases*. Retrieved on 7th March, 2015 from http://www.neglecteddiseases.gov/targetdiseases/lymphaticfilariasis/index.html (2014).
11. Elkanah, O. S., Onyeka, J. O. A., Anyanwu, G. I., Debby-Sambo, E, O. and Madara, A. A., Prevalence of Lymphatic Filariasis in Five Communities of Lau LGA, Northern Taraba State, Nigeria. *Nigerian Journal of Parasitology*. **32**(2):197-201. (2011).
12. Federal Ministry of Health. *Guidelines for Malaria-lymphatic filariasis Co-implementation in Nigeria.* Department of Public Health. (2013).
13. The Cater Center. Fighting Disease: Nigeria. *Eliminating Lymphatic Filariasis*. Waging Peace. Fighting Disease. Building Hope. Retrieved on 18th March, 2016 from http://www.carter.org/countries/nigeria-health-lymphatic-filariasis.html (2016).
14. National Population Commission of Nigeria. The Population Development in Zamfara. Subdivision. *Zamfara* (*State in Nigeria*). Retrieved on 14th April, 2017 from http://www.citypopulation.de/php/nigeria-admin.php?adm1id=NGA037 (2017).
15. Nysczamfaranews. Local Governments in Zamfara State. Zamfara State *NYSC News.* Retrieved on 21st March, 2016 from http://nysczamfaranews.blogspot.com/p/blog-page_24.html#!/p/blog-page_24.html (2016).
16. Logbaby. Zamfara State, Nigeria (Overview, History and Summary Information). *Logbaby.com*. Retrieved on 19th March, 2017 from http://www.logbaby.com/encyclopedia/history-of-zamfara-state_9957.html (2017).
17. Revolvy. Zamfara State. *Revolvy.com*. Retrieved on 9th October, 2016 from http://www.revolvy.com/main/index.php?s=Zamfara%20State&uid=1575 (2016).
18. Facts. Zamfara. Facts.ng *Discover Nigeria*. Retrieved on 9th October, 2016 from https://www.facts.ng/nigerian-states/zamfara/ (2016).
19. Onlinenigeria. Zamfara State. *Online Nigeria*. Retrieved on 8th March, 2017 from http://www.onlinenigeria.com/zamfara-state/?blurb=398 (2003).
20. Placng. *Zamfara.* Retrieved on 9th October, 2016 from http://placng.org/situation

_room/sr/wpcontent/uploads/2015/02/ZAMFARA.pdf (2016).

21. Yaya, O. O., Dossah, B. and Chukwurah, M. A., An Appraisal of Handpump Boreholes in Zamfara State, Nigeria. Towards the Millennium Development Goals. *29th WEDC International Conference Abuja, Nigeria*. Retrieved on 19th February, 2016 from http://wedc.lboro.ac.uk/resources/conference/29/Yaya.pdf (2003).
22. Mamman, A. B., Oyebanji, J. O. and Peters, S. W., Nigeria. People United a Future Assured. *Survey of States*. Millennium edition, **2:** 547-550 (2000).
23. Zamfara State. *Zamfara State*. Wikipedia, the free encyclopedia. Retrieved on 9th October, 2016 from http://en.wikipedia.org/wiki/Zamfara_State. (2016).
24. Baba, M. N. *Introduction to Research Process in Education*. Midas Equitable Publishers, P. O. Box 34. Kaura Namoda Zamfara State. ISBN 978-37073-9-6. Pp. 44-51 (2005).
25. CTK-Biotech. *OnSite* Filariasis IgG/IgM Combo Rapid Test- (Serum/Plasma/Whole Blood). *Leaflet.* CTK Biotech, Inc. 10110 Mesa Rim Road San Diego, CA 92121, USA. E-mail info@ctkbiotech.com Pp. 1-2 (2016).
26. Adamu, T., Attah, O. A., Yahaya, M. M. and Bala, A. Y. Lymphatic filariasis in five wards in Bodinga Local Government Area of Sokoto state. *A paper presented at 38th Annual Conference of Parasitology and Public Health Society of Nigeria*, at University of Nigeria, Nsukka. Pp. 26 (2014).
27. Mbah, D. C. and Njoku, O. O. Prevalence of Lymphatic Filariasis (LF) in Oraeri, Aguata Local Government Area of Anambra State, Nigeria. *The Nigerian Journal of Parasitology*. **21:** 95-102 (2000).
28. Colleen L., Lau, K. Y., Won, L. B., Ricardo, J. Soares, M., Saipale, F., Wayne M., Patrick, J. L. and Graves, P. M. Seroprevalence and Spatial Epidemiology of Lymphatic Filariasis in American Samoa after Successful Mass Drug Administration. PLOS. *Neglected Tropical Diseases.* Retrieved on 30th December, 2017 from http://journals.plos.org/plosntds/article/figure?id=10.1371/journal.pntd.0003297.t001 (2014).
29. Parija, S. C. and Atul, G. Seroprevalence of Lymphatic Filariasis at Puducherry. *Journal of Parasitic Diseases*. **34(1):** 20–23. Retrieved on 10th December, 2017 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3081697/ (2010).
30. Okorie, P. N., Emmanuel, D., Olushola, O. O., Olusola, O., Saka, Y., Okoeguale, B. and Ekanem, I. B., Lymphatic Filariasis Baseline Survey in Two Sentinel Sites of Ogun State, Nigeria. *The Pan African Medical Journal.* 2015;20:397. doi:10.11604/pamj.2015.20.397.5686. Retrieved on 10th December, 2017 From http://www.panafrican-med-journal.com/content/article/20/397/full/ (2015).