PREVALENCE, CLINICAL EPIDEMIOLOGY AND ASSESSMENT OF THE KNOWLEDGE, PERCEPTION AND PRACTICES OF LYMPHATIC FILARIASIS AMONGST SELECTED COMMUNITIES IN KOTANGORA, NIGER STATE

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSIY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY IN APPLIED PARASITOLOGY AND ENTOMOLOGY

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ABSTRACT

Lymphatic filariasis caused by mosquito borne filarial nematode, *Wuchereria brancrofti*, is a debilitating Neglected Tropical Disease of major public health importance. This study was carried out to determine the status of Filariasis among five (5) selected communities include Rugan gandu/Tudun Fulani, Sabon garin mangu/ matachibu, Sabon garin Madara, Tashan badukke and Dogon fili in Kotongora Local Government Area, Niger State. In this study, standard parasitological techniques, rapid assessment method and structured questionnaire were employed. The result of this study showed that out of the 1015 blood samples collected and examined for the presence of filariasis using Filariasis Test Strip (FTS), 111(10.94 %) were positive. The prevalence of infection varies among the communities with Rugan gandu/Tudun Fulani having the highest infection rate (17.37 %) followed by Sabon garin mangu/ matachibu (14.51 %) while Tashan Baduke had the least infection rate of (4.52 %). In relation to age group 56-65 years had the highest rate of infection (22.5 %) followed by the age group 66-75 years (21.43 %) while the age group 46-55 years had the least infection rate (7.44 %). Among the respondents infected with the disease, 17(60.71 %) believed that stepping on charm is the cause of the disease, while 104(37.68 %) of the unaffected respondents believed that fever is the cause. Majority of the infected respondents, 24(85.71 %), believed that avoiding mosquito bites is the most accurate preventive measure. The disease is therefore, endemic in Kotongora Local Government Area, Niger State with high chances of prevalence, intensity and clinical symptoms increasing overtime. There is therefore, urgent need to implement control measures with the aim of halting the transmission of this disease.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Lymphatic filariasis, commonly known as elephantiasis which is a disease caused by microscopic, thread-like nematode worms of the family Filariodea. It is a parasitic neglected tropical disease (NTD) targeted for global elimination by the year 2020 as part of the Global Programme to Eliminate Lymphatic Filariasis (GPELF) World Health Organization (WHO, 2017). Infection occur when filarid parasite are transmitted to human as definitive host through infected mosquitoes bite in tropical and sub-tropical region of the world,center for disease control and prevention (CDC, 2013). Infection acquired in children usually cause hidden damage to the lymphatic system.

There are three different filarial species that can cause lymphatic filariasis in humans. Most of the infections worldwide are caused by *Wuchereria bancrofti*. In Asia, the disease can also be caused by *Brugia malayi* and *Brugia timori* (CDC, 2019). The parasitic filarid nematode worm *Wuchereria bancrofti* is one of the species of organism that cause such disease called lymphatic filariasis in Africa with high risk endemic in Nigeria (WHO, 2010). *Anopheles* and *Culex* mosquitoes are the main vector that transmit *Wuchereria bancrofti* causing the disease in Africa (WHO, 2010; WHO, 2014).

One-sixth of the world's populations, mostly in developing countries are infected with one or more of this Neglected Tropical Disease (Amal and Anthony, 2017). Currently 856 million people in 52 countries are living in areas that require preventive chemotherapy to stop the spread of the infection. The global baseline estimates of people affected by lymphantic filariasis were 25million men with hydrocele and over 15 million people with lymphoedema. At least 36 million people remain with the chronic disease manifestation (WHO, 2018).

The painful and disfiguring visible manifestation of the disease, lymphoedema, elephantiasis and scrotal swelling occur later in life and can lead to permanent disability as such infected people are not only physically disable but suffer mental, social and financial lost contributing to stigma and poverty (WHO, 2018).

Lymphatic filariasis is the second leading cause of permanent and long-term disability in the world, inflicting serious public health and socio-economic problem in endemic communities and the disease is usually seen among the poorest of the poor, in the priorities of most of the countries where it is prevalent for many years having a very low public health rating. People living for a long time in tropical or sub-tropical areas where the disease is common are at the greatest risk for infection and about 30 % of people at risk reside in the African region while 65 % of those at risk reside in South-East Asia Region, with the remainder in other parts of the world (WHO, 2010, Terranella *et al.,* 2006, Nilmini *et al.*, 2018).

The visible manifestations of the disease are severe and disfiguring, it has been reported that one third of infected individuals present with overt clinical manifestations such as lymphoedema and elephantiasis of the limbs, or genitals, hydrocoele, chyluria, or recurrent infections associated with damaged lymphatic vessel lives in Africa (Sherchand *et al.,* 2003). According to Person *et al*., (2006) acute attacks of adenolymphangitis (ADL) are characterized by fever, chills, local warmth and inflammation of the inguinal node. Patients are usually weak for 4-7 days while the attack lasts and the swelling later becomes permanent in the form of lymphoedema of lower extremities and at times there is dysfunction of the genital lymphatic that leads to hydrocoeles (WHO, 2010).

The Global Program to Eliminate Lymphatic Filariasis (GPELF) was launched in the year 2000 with the aim of interrupting transmission, reducing morbidity and preventing disability. Interruption of transmission is possible through mass drug administration (MDA), using once-yearly treatment with a single dose of albendazole plus either ivermectin or diethylcarbamazine (DEC) for 4-6 years (WHO, 2010). Such programs are under way in more than 66 countries in reducing transmission of the filarial parasites and decreasing the risk of infection for people living in or visiting these communities (CDC, 2019).

Nigeria has the heaviest burden of lymphatic filariasis (LF) in sub-Saharan Africa, which is caused by the parasite *Wuchereria bancrofti* and transmitted by *Anopheles* mosquitoes which is believed to be the third most endemic country in the world after India and Indonesia with the prevalent of Lymphatic filariasis (Eigege *et al.*, 2003; Tara *et al.*, 2018). Studies in Nigeria have reported prevalence rates ranging from 6% - 47 % (Eigege *et al.*, 2002; Anosike *et al.*, 2005; Nwoke *et al.*, 2006; Omudu and Okafor 2007; Udoidung *et al.*, 2008,). About 106 million people in Nigeria are at risk of the disease (Federal Ministry of Health (FMoH), 2013).

Elkana *et al.* (2017) posits that various clinical manifestations of lymphatic filariasis range from: itching, elephantiasis, hydrocoele, and lymphoedema of breast are at varying rates. Lymphatic filariasis (LF) has a major social and economic impact with an estimated annual loss of $1 billion and impairing economic activity up to 88 %. Hydrocoele, lymphoedema and elephantiasis are the overt, chronic disabling consequences observed in patients with these damaging parasitic infections of the lymphatic vessels (WHO, 2016).

Though according to Yisa K, Saka, director of Neglected Tropical Disease programmed with Nigeria Federal Ministry of Health together with Carter center (2017), reported that, lymphatic filariasis as a public health problem in Plateau and Nasarawa states of Nigeria has been eliminated completely with a significant achievement and the states are placed under surveillance. Success in these two states not only protects the 7 million people who live there, but it also sets a pattern for similar success throughout the rest of Nigeria, as well as in other highly endemic countries (Carter center (2017).

The main vectors of lymphatic filariasis in Nigeria are mosquitoes of the *An. gambiae* (principally *An. gambiae s.s.* and *An. arabiensis*) and *Anopheles funestus* complexes (Lenhart *et al*., 2007; Sinka *et al.*, 2010). Lymphatic filariasis is prevalent in all states and geopolitical zones of Nigeria before the success of the two states and a total of 241 lymphoedema and 205 hydrocele cases have been reported from mapping surveys conducted in the country (Okorie *et al*., 2011). Programs to eliminate lymphatic filariasis are under way in more than 66 countries. These programs are at eradicating transmission of the filarial parasites and reducing the risk of infection amongst people living in or visiting these communities, targeted for elimination and the national programme is scaling up mass drug administration (MDA) across the country to interrupt transmission, (Brant *et al.,* 2018; CDC, 2018).

1.2 Statement of Research Problem

Lymphatic filariasis as one of the Neglected Tropical Disease cause a serious burden with various clinical manifestations such as itching, elephantiasis, hydrocoele, and lymphoedema of breast at varying rates, it also has a major social and economic impact with an estimated annual loss of $1 billion and impairing economic activity up to 88 % (WHO, 2019). Most of the clinical sign and symptoms such as swollen legs, scrotal itching and thickening of the skin seen in the other part of the region in the country were observed in the communities of Kontagora L.G.A and has become a serious burden of pains and disfiguring visible manifestation of the disease resulting to a permanent disability not only physical disable but also suffer mental, social and financial loss contributing to stigma and poverty.

The National Lymphatic Filariasis Elimination Programme (NLFEP) has set 2015 to eliminate such disease in the country and success of this programme depends on identifying as well treating endemic communities. Unfortunately, information on the distribution and nature of the disease from many parts of the country is lacking (Dogara *et al.,* 2012, WHO, 2019). Upon the concerted control efforts by the government and international bodies yet, lymphatic filariasis is still a disease of public health concern in Nigeria resulting too many factors such as prevention of marriage, personal discomfort, special infidelity, spouse dissertation and also affect work and income; at times there is dysfunction of the genital lymphatic that leads to hydrocoele among the people of the

Most of the community problem in strategies the elimination of the disease is the range of people's knowledge, practice and perceptions towards the disease in the community, One of the rapid assessment procedures in assessing the burden and the effectiveness of a Lymphatic Filariasis elimination program is the Focus group discussion of knowledge, attitude and practices of a community;

1.3 Justification for the Study

Lymphatic filariasis is caused by infection with filarial worm that are transmitted by mosquito's bites**.** There has been wide estimate globally of millions of people infected which such disease and a lot also has been disfigured and disabled by complication caused by LF such as swelling of the lower extremities such as the leg (elephantiasis) or scrotum (hydrocoele). Nigeria has the heaviest burden of lymphatic filariasis (LF) in sub-Saharan Africa, caused by the parasite *Wuchereria bancrofti* and transmitted by *Anopheles* mosquitoes which is believed to be the third most endemic country in the world after India and Indonesia with the prevalent of Lymphatic filariasis (Tara *et al.*, 2018).The global programme to eliminate lymphatic filariasis (GPELF) was lunch in response to the call proposed at the 50th world Health assembly aimed at interrupting the disease transmission through Mass Drug Administration and to control illness and suffering in affected persons by 2020. The goal of the (GPELF) is to ensure that the counties where the disease is endemic would have been transmission free or would have entered post-intervention mass drugs administration (MDA) surveillance by 2020. Nigeria as a country with highest estimate of the disease in Africa caused by lymphatic filariasis is yet to be on the tracks to discontinue MDA as planned. This issue remains regarding the achievement of the stated goal and how to effectively monitor the disease in the post-control and post elimination phase. In accordance with the vision 2020, the knowledge, practice and perception of the individual in a giving community towards the disease caused by lymphatic filariasis is needed to be taken into consideration so as to reduce the spread, burden or probably eliminate the disease as stated by World Health Organization vision 2020 (WHO, 2019).

1.4 Aim of the study

The aim of this study is to assess the clinical epidemiology of lymphatic filariasis knowledge, practices and the perceptions amongst five selected communities of Kontagora Local Government Area, Niger state.

1.5 Objectives of the study

The objectives of the study are:

i. prevalence of lymphatic filariasis amongst people of Kontagora communities.
ii. The morbidity levels of lymphatic filariasis amongst people of Kontagora communities.
iii. effect of community knowledge, practice and perception on the distribution of lymphatic filariasis (LF) amongst people of Kontagora Local Government Area of Niger State.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 General Overview

Lymphatic filariasis, commonly known as elephantiasis, is a painful and profoundly disfiguring disease. In communities where filariasis is transmitted, all ages are affected. While the infection may be acquired during childhood its visible manifestations may occur later in life, causing temporary or permanent disability. In endemic countries, lymphatic filariasis has a major social and economic impact with an estimated annual loss of billions of dollar and impairing economic activity with high percentage (Dogara *et al.,* 2012).

The disease is caused by three species of thread-like nematode worms, known as filariae *Wuchereria bancrofti, Brugia malayi* and *Brugia timori*. Male worms are smaller in length compare to the female worms. The male and female worms together form “nests” in the human lymphatic system, the network of nodes and vessels that maintain the delicate fluid balance between blood and body tissues. The lymphatic system is an essential component of the body’s immune system. Filarial infection can cause a variety of clinical manifestations, including lymphoedema of the limbs, genital disease (hydrocele, chylocele, and swelling of the scrotum and penis) and recurrent acute attacks, which are extremely painful and are accompanied by fever. The vast majority of infected people are asymptomatic, but virtually all of them have subclinical lymphatic damage and as many as fourty percent have kidney damage, with proteinuria and haematuria (Badaki *et al.,* 2013).

Lymphatic filariasis is among the neglected tropical diseases being the second most common vector-borne parasitic disease after malaria, lymphatic filariasis was also ranked, the second leading cause of long-term and permanent disability after mental illness worldwide (Badaki *et al.,* 2013) . An estimated 25 million men suffer with genital disease and over 15 million people are afflicted with lymphoedema. In year 2000, more than 120 million people of all ages and sexes were infected with one or more of the lymphatic filariae worldwide. Approximately, 80 % of the infected individuals are living in the following ten countries: Angola, Cameroon, Côte d’Ivoire, Democratic Republic of Congo, India, Indonesia, Mozambique, Myanmar, Nigeria and the United Republic of Tanzania. About 947 million people in 54 countries worldwide are at risk of being infected with lymphatic filariasis. Enhanced strategies are now required in about 29 countries to achieve elimination targets and stop treatment by the year 2020 (CDC, 2016). 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 in Nigeria is caused by the *Wuchereria bancrofti* (Eneanya *et al.,* 2018).

2.2 Geographical Occurrence in Nigeria

In 2003, the Nigerian Lymphatic Filariasis Elimination Programme (NLFEP) commenced LF mapping on a national scale, and to date, 761 out of 774 Local Government Areas (LGAs) have been mapped using immunochromatographic card tests (ICT). Of these, 574 LGAs are classed as endemic and targeted for mass drug administration (MDA), and 187 LGAs non-endemic for LF. In total, an estimated 128 million people in Nigeria are thought to require preventive chemotherapy, and as of 2016, 54% of this population had been treated. After more than five rounds of MDA in Plateau and Nassarawa states, Transmission Assessment Survey 1 (TAS-1) showed evidence of interruption of LF transmission in these areas. However, for the vast areas of the country in which LF is present, understanding disease distribution on a finer scale is key for more focused targeting of control measures (Eneanya *et al.*, 2018).

The work of Obiora *et al.* (2018) provides an insight into the regional distribution of LF in Nigeria, and they find out that the areas less suitable for LF transmission correspond to mangrove ecosystems and freshwater swamps in the southern parts of the country, and also to short grass savanna in the north-east. The availability of temporal breeding sites during the driest period is critical for the major LF vectors, *Anopheles spp*.

mosquitoes, to sustain the transmission. The probability of LF occurrence appeared to increase with increasing elevation, and levels off at around 500 metres above sea level. This phenomenon has been previously recorded (Cano *et al.*, 2016) and is thought to reflect the negative effect of decreasing temperature with increasing altitude on mosquito survival and the rate of parasite development within the vector.

Obiora *et al.* (2018) found a negative correlation between higher terrain slope and suitability of environment to LF, perhaps because steeper inclinations of terrain cause more rapid surface water runoff, thus reducing the collection of water pockets which may serve as breeding sites for mosquito vectors. As the distance from stable night-light increased, the probability for LF occurrence decreased. This drop may be explained by the absence of stable lights in uninhabited areas where the mosquito population is more likely to be of low abundance, or in more rural settings where stable lights are less likely to be present, as electricity is in short supply in large parts of rural Nigeria.

Although LF has always been associated with more rural areas, a recent study in Tanzania has highlighted the burden of LF in urban settings and corroborated in a study conducted in an urban Nigerian setting. Studies have also illustrated that mosquitoes are more likely to aggregate around human populations (Mwingira *et al.*, 2017).

Smith *et al.* (2004) reported that the distribution of the human population influenced the aggregation of adult mosquitoes because mosquitoes are more likely to gravitate towards the human host. These authors demonstrated that mosquito density was lowest in rural settings but higher in peri-urban and urban settings.

2.3 Epidemiology of Lymphatic filariasis

Lymphatic filariasis (LF) is caused by infection with threadlike worms called nematodes of the family Filarioidea: 90 % of infections are caused by *Wuchereria bancrofti* and the remainders by *Brugia* spp. Humans are the exclusive host of infection with *W. bancrofti*. Although certain strains of *B. malayi* can also infect some animal species (felines and monkeys), the life cycle in these animals is perceived as epidemiologically distinct from that in humans (WHO, 2016). The infection spreads from person to person by mosquito bites. The adult worm lives in the human lymph vessels, mates, and produces millions of microscopic worms, also known as microfilariae. Microfilariae circulate in the person's blood and infect the mosquito when it bites a person who is infected. Microfilariae grow and develop in the mosquito. When the mosquito bites another person, the larval worms pass from the mosquito into the human skin, and travel to the lymph vessels. They grow into adult worms, a process that takes 6 months or more. An adult worm lives for about 5–7 years. The adult worms mate and release millions of microfilariae into the blood. People with microfilariae in their blood can serve as a source of infection to others (CDC, 2016).

The major vectors of *W. bancrofti* are mosquitoes of the genus *Culex* (in urban and semi-urban areas), *Anopheles* (in rural areas of Africa and elsewhere) and *Aedes* (in islands of the Pacific). The parasites of *B. malayi* are transmitted by various mosquito species of the genus *Mansonia*; in some areas, anopheline mosquitoes are responsible for transmitting infection. Brugian parasites are confined to areas of east and south Asia, notably India, Indonesia, Malaysia and Thailand. The transmission of filariasis in a community is influenced by the number of infected persons (prevalence), the density of microfilaria in the blood of infected persons, the density of vector mosquitoes, characteristics of the vector that affect development of infective larvae and frequency of human-vector contact (WHO, 2016).

2.4 Signs and Symptoms Lymphatic filariasis

Lymphatic filariasis infection involves asymptomatic, acute, and chronic conditions. The majority of infections are asymptomatic, showing no external signs of infection while contributing to transmission of the parasite. These asymptomatic infections still cause damage to the lymphatic system and the kidneys and alter the body's immune system. When lymphatic filariasis develops into chronic conditions it leads to lymphoedema (tissue swelling) or elephantiasis (skin/tissue thickening) of limbs and hydrocele (scrotal swelling). Involvement of breasts and genital organs is common. Such body deformities often lead to social stigma and sub-optimal mental health loss of income-earning opportunities and increased medical expenses for patients and their caretakers. The socioeconomic burdens of isolation and poverty are immense (WHO, 2016).

Acute episodes of local inflammation involving skin, lymph nodes and lymphatic vessels often accompany chronic lymphoedema or elephantiasis. Some of these episodes are caused by the body's immune response to the parasite. Most are the result of secondary bacterial skin infection where normal defences have been partially lost due to underlying lymphatic damage. These acute attacks are debilitating, may last for weeks and are the primary cause of lost wages among people suffering with lymphatic filariasis (CDC, 2016).

The skin condition the disease causes is called "elephantiasis tropica" (also known as "elephantiasis arabum") (WHO, 2014). Elephantiasis mainly affects the lower extremities; the ears, mucous membranes, and amputation stumps are affected less frequently. However, various species of filarial worms tend to affect different parts of the body: *Wuchereria bancrofti* can affect the arms, breasts, legs, scrotum, and vulva (causing hydrocele formation), while *Brugia timori* rarely affects the genitals (WHO, 2014). Those who develop the chronic stages of elephantiasis are usually amicrofilaraemic and often have adverse immunological reactions to the microfilariae as well as the adult worms. The subcutaneous worms present with skin rashes, urticarial papules, and arthritis, as well as hyper- and hypopigmentation macules. Serous cavity filariasis presents with symptoms similar to subcutaneous filariasis; it may also be associated with ascites following the severe inflammatory reaction in the lymphatics (Lizaola *et al.*, 2017). Elephantiasis leads to marked swelling of the lower half of the body and thickening of the skin, making it look like that of an elephant, a term called "pachyderm".

2.5 Life Cycle of *Wuchereria bancrofti*

Different species of the following genera of mosquitoes are vectors of *W. bancrofti* filariasis depending on geographical distribution. Among them are: *Culex (C. annulirostris, C. quinquefasciatus,* and *C. pipiens); Anopheles (A. arabinensis, A. bancroftii, A. funestus, A. gambiae, A. melas); Aedes (A. aegypti, A. darlingi, A. rotumae* and *A. vigilax); Mansonia (M. pseudotitillans, M. uniformis); Coquillettidia (C. juxtamansonia*). During a blood meal, an infected mosquito introduces third-stage filarial larvae onto the skin of the human host, where they penetrate into the bite wound. They develop in adults that commonly reside in the lymphatics (Figure 2.1). The female worms measure 80 to 100 mm in length and 0.24 to 0.30 mm in diameter, while the males measure about 40 mm by .1 mm. Adults produce microfilariae measuring 244 to

296 µm by 7.5 to 10 µm, which are sheathed and have nocturnal periodicity, except the South Pacific microfilariae which have the absence of marked periodicity. The microfilariae migrate into lymph and blood channels moving actively through lymph and blood. A mosquito ingests the microfilariae during a blood meal. After ingestion, the microfilariae lose their sheaths and some of them work their way through the wall of the proventriculus and cardiac portion of the mosquito's midgut and reach the thoracic muscles. There the microfilariae develop into first-stage larvae and subsequently into third-stage infective larvae. The third-stage infective larvae migrate through the hemocoel to the mosquito's prosbocis and can infect another human when the mosquito takes a blood meal.

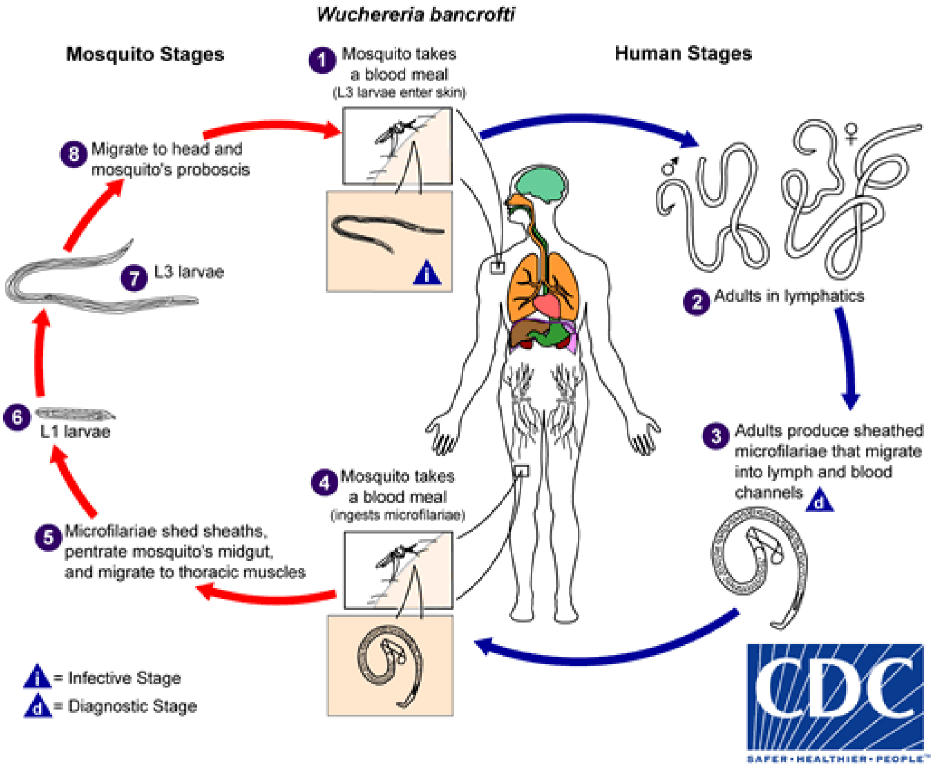

Figure 2.1: Life cycle of *Wuchereria bancrofti*, a parasite that causes lymphatic filariasis
Source: CDC, (2016).

2.6 Burden of Lymphatic filariasis

Lymphatic filariasis caused by mosquito-borne filarial nematode, *Wuchereria bancrofti* is a debilitating Neglected Tropical Disease of major public health importance and more than 100 million individuals worldwide are estimated to suffer from the disease (WHO, 2016). According to literature on the status of the disease indicates that about 1.1 billion people are at risk of becoming infected in the world (Amaechi, 2014). Nigeria with an estimated population of 170 million people is Africa's most endemic country with approximately 80 to 120 million people at risk. The disease is prevalent and widespread in the six geo-political zones of the country. In sub-Saharan Africa, an estimated 28 million people are infected with lymphatic filariasis while 512 million people are at risk of infection (Elkanah *et al.,* 2017).

In endemic communities, *L. filariasis* is most prevalent in the rural and slum areas, predominantly affecting the poorest of the poor "at the end of the road" (Udoidung *et al*., 2008, Okon *et al*., 2010). In Nigeria, L. filariasis has been reported in rural communities in the lower Cross River Basin (Udoidung *et al.,* 2008, Okon *et al.,* 2010), Ezza in Ebonyi State (Anosike *et al.,* 2005), Igwun basin of Rivers State and parts of the Niger Delta (Agi and Ebenezer, 2019) as well as parts of Central Nigeria including rural communities in Plateau and Nassarawa States (Eigege *et al.,* 2003).

The impact of *L. filariasis* on marriage and sexual life is a serious problem in endemic areas. Women, more than men, depend on their physical presentation for their self-esteem and the destruction of the skin and beauty of the physical appearance of adolescent girls and women by lymphedema and elephantiasis seriously affect women, including hindering marriage prospects/opportunities. In addition to economic impact, *L. filariasis* afflicts heavy psychosocial consequences and stigmatization on the affected individuals. For instance, skin destruction (by lymphoedema and elephantiasis) of women by *L. filariasis* primarily imposes psychological problems on the affected women long before it hampers their marriage and sexual life. This situation creates feeling of remorse, recrimination, apathy, and resignation, resulting in the desire to conceal the lesions. Also, stigmatization of men with hydrocoele is also observed in some of the endemic countries. Villagers in some parts of Nigeria expressed fear and insecurity towards people with filarial skin lesions and towards men with genital complications and elephantiasis of the extremities (Nwoke *et al.,* 2000).

The visible manifestations of the disease are severe and disfiguring. Lymphoedema and elephantiasis of the limbs and or genitalia, hydrocoel and scrotal pathology in men, recurrent infections associated with damaged lymphatics, chyluria or abnormalities of the renal functions occur in an estimated 44 million people. The socio-economic and psychological burden of the disease are enormous and included direct cost of treatment, losses resulting from incapacitation and loss of labor (Elkanah *et al.,* 2011).

2.7 Prevalence of Lymphatic Filariasis in Nigeria

Okorie *et al.* (2013) used Micro-stratification Overlap Mapping (MOM) to highlight the distribution and potential impact of multiple disease interventions that geographically coincide in LF endemic areas of Nigeria and which will impact on LF and vice versa. LF data from the literature and Federal Ministry of Health (FMoH) were collated into a database. LF prevalence distributions; predicted prevalence of loiasis; ongoing onchocerciasis community-directed treatment with ivermectin (CDTi); and long-lasting insecticidal mosquito net (LLIN) distributions for malaria were incorporated into overlay maps using geographical information system (GIS) software. LF was prevalent across most regions of the country. The mean prevalence determined by circulating filarial antigen (CFA) was 14.0 % (n=134 locations), and by microfilaria (Mf) was 8.2 % (n=162 locations). Overall, LF endemic areas geographically coincided with CDTi priority areas, however, LLIN coverage was generally low (<50 %) in areas where LF prevalence was high.

A baseline epidemiological investigation on lymphatic filariasis (LF) was conducted by Okorie *et al.* (2015) in two sentinel sites of Ogun State; Ado-Odo Ota and Abeokuta South Local Government Areas (LGAs) to determine LF prevalence, microfilarial density and the abundance of *Wuchieraria bancrofti in* the mosquito vectors. The results revealed that microfilaria prevalence was 4.0 % and 2.4 % in Ado-odo Ota and Abeokuta South LGAs. The microflarial density (mfd) was 30.6mf/ml and 23.9 mf/ml in the same areas. No clinical manifestations of the infection were found at both sites. Knowledge of Lymphatic filariasis by inhabitants was very low in the two areas. In addition, *Anopheles gambiae s.l* and *Culex* species mosquitoes were collected but none was found positive for stage L3 infective larvae.

The overall mean Microfilariasis prevalence rate of 8.2 % with a range of 0 to 47.4 % has been recorded in previous studies across Nigeria (Addiss and Brardy, 2007, Okorie *et al.,* 2013). The results of Okorie *et al.* (2015) revealed lower prevalence of LF in Abeokuta South compared to Ado-Odo Ota which was attributed to mass ivermectin distribution for onchocerciasis treatment in the community for the past 11 years (FMoH, 2012). It has been shown that that long-term use of ivermectin has the ability to eliminate *W. bancrofti*. Ado-Odo Ota on the other hand is yet to commence onchocerciasis treatment.

As of 2017, Nigeria accounted for 14.3 % of the global population of people that required LF treatment as an estimated total of 128,342,058 people in 583 out of 774 LGAs required preventive chemotherapy for LF. According to WHO, 79,831,396 people had been reached with treatment for LF at least once in 2018. LF treatment is supposed to be taken once yearly for five years (WHO, 2017).

Elkanah *et al.* (2018) carried out a study to determine the status of the disease in five rural communities in Yorro LGA, Taraba State, Nigeria. The overall prevalence of infection in the study area was high (30.8 %) but low mean microfilarial densities (3.90 mf/60). Infection rates among the five communities vary but not statistically significant (ANOVA, $p>0.05$). However, chi square analysis showed a significant difference in infection among the different age groups ($x2 = 31.34$, $p>0.05$) with the highest infection recorded among 40-50 years. Lymphoedema was very common among men (5.6 %) than in females (2.7 %). Result from qualitative data indicates good knowledge of lymphatic filariasis with the psychosocial burden that is associated with the disease.

The result of Mu`awiyya *et al.* (2019) on the sero-prevalence of Lymphatic Filariasis in Six Communities of Talata Mafara Local Government Area, Zamfara State, Nigeria revealed *a*n overall sero-prevalence of 37.8 %. Shiyar Galadima had the highest sero-prevalence (43.1 %) of infection among the communities. An analysis of the results using chi-square indicated that males (38.9 %) aged between 51-60 years (63.6 %) is significantly at higher risk of infection. The highest prevalence of 43.3% was occurred in farmers than those in the other occupational groups.

According to WHO (2016), the microfilariae prevalence and density are the best indicators of epidemiology, management and control of LF. Okorie *et al.* (2015) found a microfilarial density of 30.6 and 25.1 mf/ml in the infected population of Ado-Odo Ota and Abeokuta South LGA respectively. This microfilarial density is higher than the 22.25 mf/ml (Ojurongbe *et al.,* 2010) and 21.4 mf/ml (Owoseni *et al.,* 2014) previously reported in Ogun State. Similarly, other researhers have reported different mean microfilarial density in other parts of the country, Iboh *et al.* (2012) 5.6 mf/50 µl among the Yakurr people of Cross River State, Okon *et al.* (2010), 9.9 mf/50 µl, among the Mbembe people of Cross River state, Ajero *et al.* (2007), 9.5 mfd in the Niger Delta area of eastern Nigeria and Anosike *et al.* (2005) 10.4 mfd per 20 mm3 of night blood collection among the Ezza people of Ezza people of Ebonyi State, Eastern Nigeria.

In Ado-Odo Ota and Abeokuta South Local Government Area the results of Okorie *et al.* (2015) showed no clinical manifestation of LF (elephantiasis or hydrocele), although some individuals claimed to have seen cases of swollen limbs and enlarged scrotum in the community. Majority of the individuals examined (93.8%) did not know the cause of lymphatic filariasis. Only 6.2% of people in Abeokuta South Local Government Area knew that lymphatic filariasis was caused by mosquito bites. Other causes mentioned by the participants were: unhygienic behavior, Kwashiokor, metaphysical powers, and unhygienic water source.

2.8 Diagnosis of Lymphatic filariasis

The standard method for diagnosing active infection is the identification of microfilariae in a blood smear by microscopic examination. The microfilariae that cause lymphatic filariasis circulate in the blood at night (called nocturnal periodicity). Blood collection should be done at night to coincide with the appearance of the microfilariae, and a thick smear should be made and stained with Giemsa or hematoxylin and eosin. Testing the blood serum for antibodies against the disease may also be used. For increased sensitivity, concentration techniques can be used. Serologic techniques provide an alternative to microscopic detection of microfilariae for the diagnosis of lymphatic filariasis. Patients with active filarial infection typically have elevated levels of antifilarial IgG4 in the blood and these can be detected using routine assays. Because lymphedema may develop many years after infection, lab tests are most likely to be negative with these patients (CDC, 2016).

2.9 Treatment of Lymphatic filariasis

Treatments for lymphatic filariasis differ depending on the geographic location of the area of the world in which the disease was acquired. In sub-Saharan Africa, albendazole is being used with ivermectin to treat the disease, whereas elsewhere in the world, albendazole is used with Diethylcarbamazine (DEC) (CDC, 2016). In developed country where DEC is administered, the Centre for Disease Control and Prevention (CDC) gives the physicians the choice between 1 or 12-day treatment of DEC (6 mg/kg/day). One day treatment is generally as effective as the 12-day regimen. DEC is generally well tolerated. Side effects are in general limited and depend on the number of microfilariae in the blood. The most common side effects are dizziness, nausea, fever, headache, or pain in muscles or joints. DEC should not be administered to patients who may also have onchocerciasis as DEC can worsen onchocercal eye disease. In patients with loiasis, DEC can cause serious adverse reactions, including encephalopathy and death. The risk and severity of the adverse reactions are related to *Loa loa* microfilarial density (CDC, 2016).

Geo-targeting treatments are part of a larger strategy to eventually eliminate lymphatic filariasis by 2020. The antibiotic doxycycline is also effective in treating lymphatic filariasis (Taylor *et al.,* 2014). Its drawbacks over anthelmintic drugs are that it requires 4 to 6 weeks of treatment, should not be used in young children and pregnant women, and is photosensitizing, which limits its use for mass prevention (Taylor *et al.*, 2014). The parasites responsible for elephantiasis have a population of endosymbiotic bacteria, Wolbachia, that live inside the worm. When the symbiotic bacteria of the adult worms are killed by the antibiotic, they no longer provide chemicals which the nematode larvae need to develop, which either kills the larvae or prevents their normal development. This permanently sterilizes the adult worms, which additionally die within 1 to 2 years instead of their normal 10 to 14-year lifespan.

According to Dakshinamoorthy *et al.* (2013), vaccine is not yet available for the disease, but in 2013 the University of Illinois College of Medicine was reporting 95 % efficacy in testing against *B. malayi* in mice. Additionally, surgical treatment may be helpful for issues related to scrotal elephantiasis and hydrocele. However, surgery is generally ineffective at correcting elephantiasis of the limbs (Dakshinamoorthy *et al.*, 2013).

2.10 Prevention and Control of Lymphatic filariasis

The best way to prevent lymphatic filariasis is to avoid mosquito bites. The mosquitoes that carry the microscopic worms usually bite between the hours of dusk and dawn. If one live in an area with lymphatic filariasis, it is advisable to sleep in an air-conditioned room or sleep under a mosquito net at night, between dusk and dawn, one can wear long sleeves and trousers and Use mosquito repellent on exposed skin (CDC, 2016). Another approach to prevention includes giving entire communities medicine that kills the microscopic worms and controlling mosquitoes. Annual mass treatment reduces the level of microfilariae in the blood and thus, diminishes transmission of infection. This is the basis of the Global Programme to Eliminate Lymphatic Filariasis.The World Health Organization recommends mass deworming, treating entire groups of people who are at risk with a single annual dose of two medicines, namely albendazole in combination with either ivermectin or diethylcarbamazine citrate (WHO, 2014). With consistent treatment, since the disease needs a human host, the reduction of microfilariae means the disease will not be transmitted, the adult worms will die out, and the cycle will be broken (WHO, 2016). In sub-Saharan Africa, albendazole (donated by GlaxoSmithKline) is being used with ivermectin (donated by Merck and Co.) to treat the disease, whereas elsewhere in the world, albendazole is used with diethylcarbamazine (CDC, 2016). As of 2019 WHO recommend prevention with a combination of ivermectin, diethylcarbamazine, and albendazole in areas were onchocerciasis does not occur (WHO 2019). Transmission of the infection can be broken when a single dose of these combined oral medicines is consistently maintained annually for duration of four to six years. Using a combination of treatments better reduces the number of microfilariae in blood. Avoiding mosquito bites, such as by using insecticide-treated mosquito bed nets, also reduces the transmission of lymphatic filariasis (CDC, 2016).

Experts consider that lymphatic filariasis, a neglected tropical disease (NTD), can be eliminated globally and a global campaign to eliminate lymphatic filariasis as a public health problem is under way. The elimination strategy is based on annual treatment of whole communities with combinations of drugs that kill the microfilariae. As a result of the generous contributions of these drugs by the companies that make them, hundreds of millions of people are being treated each year. Since these drugs also reduce levels of infection with intestinal worms, benefits of treatment extend beyond lymphatic filariasis. Successful campaigns to eliminate lymphatic filariasis have taken place in China and other countries (CDC, 2016).

Mosquito control is a supplemental strategy supported by WHO. It is used to reduce transmission of lymphatic filariasis and other mosquito-borne infections. Depending on the parasite-vector species, measures such as insecticide-treated nets, indoor residual spraying or personal protection measures may help protect people from infection. The use of insecticide-treated nets in areas where Anopheles is the primary vector for filariasis enhances the impact on transmission during and after MDA. Historically, vector control has in selected settings contributed to the elimination of lymphatic filariasis in the absence of large-scale preventive chemotherapy (WHO, 2016).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

Niger state is one of the 36 states created on the 3rd of February 1976 in the Federal Republic of Nigeria, a tropical country on the west coast of Africa with Minna as the State capital; The state derives its name from River Niger one of the largest river in the country and is located in the central region of the nation where it lies on the latitude 3.20^0 E and longitude 11.30^0 N. Kaduna State and FCT are her border to the North-East and South-East respectively; Zamfara State border the North, Kebbi State in the West, Kogi State in the South and Kwara State in the South West, while Benin Republic along Agwara LGA boarders her North West. The state covers an area of about 76,363 square kilometers with a population of over 3,954,772 million people (National Population Commission, 2007) while population projection at 2016 was 5,556,200 by National Population Commission. Majority of the inhabitants live in rural agricultural areas and engage in peasant agriculture, the state's reputation as the power state of the nation is being seriously jeopardized by the socio-economic consequences of parasitic diseases. The state has twenty-five (25) local governments Areas including Kontagora Local Government Area (LGA) where the research was carried out as one of the twenty-five (25) LGAs of the state with a population of 151,968, (77,782 males and 74,186 females). (National Population Commission, 2007). The Local Government is made up of thirteen major wards, which include Arewa, Central, Gabas, Kudu, Madara, Magajiya, Masuga, Nagwatse, Rafin gora, Tungan kawo, Tunganwawa, Usalle and Unguwan Yamma. The LGA is located in the northern senatorial distric of Niger state otherwise known as Niger North and has boundaries with Mariga, L.G.A North East and to the South boarder with Mashegu LGA while to the West by Magama. The L.G.A covers an area of 2,081km^2. The inhabitants are mainly peasant farmers and live in small farming settlements. The Kontagora River is the predominant rivers that provide breeding ground for vectors of some filarial diseases and therefore research was conducted from May to June, 2019.

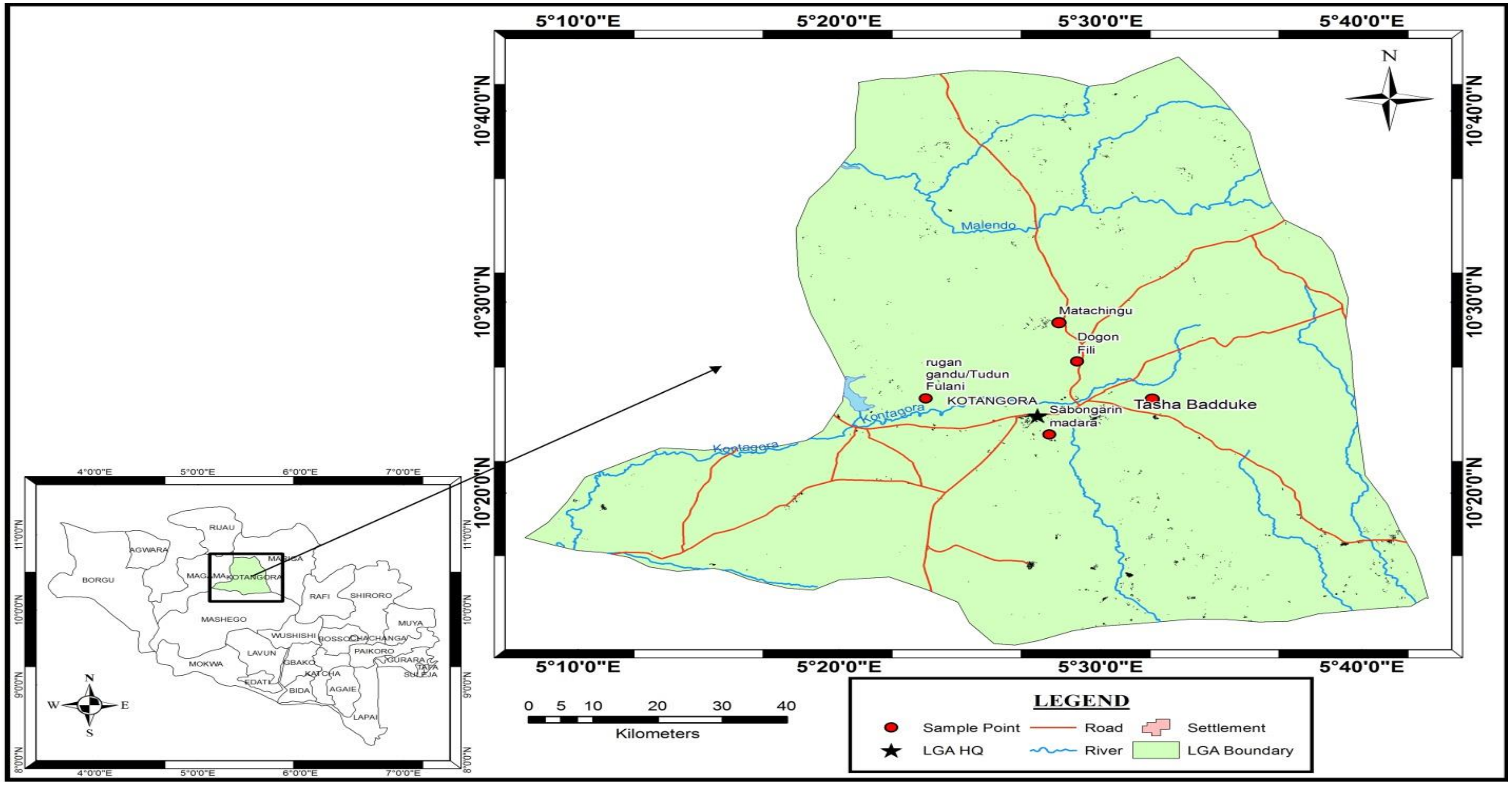

Figure 1: Map of Niger State Showing the Study Area with an Arrow
Source: Remote Sensing/ Geographical information system (GIS) laboratory, Geography department, FUTMINNA (2019).

3.2 Ethical Clearance

The ethical clearance for the survey was obtained from the Ethics Review Committee of Niger State Hospital Ethical Committee State Ministry of Health and the Informed consent was obtained from the health director for local government and all the participants after the explanation of the procedures and the likely benefits of the study. The purpose of the study was explained to the village chiefs and traditional leadership councils obtaining their permission and consent, all participating individual (5 years of age and older) were asked to gather at the village Primary Health Care (PHC) Centre and randomly selected. Before clinical examination and testing could be carried out, the objectives of the survey were briefly explained based on the language of the community and each consenting individual were able to provide demographic data. The participants were assigned identification numbers and their names, age, occupation and marital status was taken

3.3 Study Group

3.3.1 Age group of participants

The entire participants were between the age of 5 years and above. The reason for this age group is that clinical signs and symptom of lymphatic filariasis interference to appear takes a longer period of time which means a long incubation period is required, in addition to repeated exposure over an extended period of time before lymphatic filariasis is noticed as infection

3.3.2 Criteria of the inclusion and exclusion

Inclusion Criteria includes:

i. The participant must be permanent residents of that community for not less than 5 years

ii. Consent must have been given by targeted participant

Exclusion Criteria includes

i. Participants below the ages 5 years

ii. People who are not permanent resident in the communities

iii. People who have been residents in the communities for less than 5 years

iv. Refusal to provide informed consent by the subject

3.4 Sample Size

A total of one thousand and fifteen (1,015) persons from five communities of Kontogora, Niger state were sampled. This was calculated by using Yamane (1976) formula for determining the sample size for the research activities.

Sample size is calculated as follows:

$$n = \frac{N}{1} + Ne^2$$

n = desire sample size

N = population size

e = merging of error at 0.05 or 5percent

3.5 Collection and Examination of Blood Samples

The collection of blood was done at any time of the day. Finger pricks from the middle fingers were collected from 1,015 persons from the communities using aseptic method, though the microfilariae exhibit nocturnal periodicity and any participants with positive result was revisited at night for the blood smear. The parasitological examination was done by the use of Standard diagnostics SD Bioline rapid filariasis test for the detection of antibodies wb123 antigens.

3.6 Parasitological Examination

All positive SD Bioline tests, venous blood was collected in the night between 8 to 10 ppm for thick and thin smear slide preparation and stained for microscopic reading. From each positive participant, 2 ml venous blood was collected from the arm into EDTA tubes. These tubes are immediately stored at 4 ^{0}C for the night in the communities prior to transport.

With the use of micropipette, 12 µl and 2 µl of well-mixed whole blood was used to prepare thick and thin films respectively on each of pre-cleaned appropriately labeled slides following standardized procedure. The blood films were stained after 24-48 hours with freshly prepared 3 % Giemsa stain solution at pH 7.2 and then examined with oil immersion (x100) objective microscope. Two hundred oil-immersion high power fields are examined on the thick smear before any slide is interpreted as being negative; the thin smear is used only for determination of species. Positive slides are reported according to species observed in the microscopic examination from thin blood film with the specific unique feature that is; presence of sheath and nucleus spacing before the tail ends (Omudu and Okafor, 2007).

3.7 Serelogical Examination

The test is a rapid, qualitative test for the detection IgG4 antibodies against the *Wuchereria bancrofti* 123 antigens in human serum, plasma and whole blood. The test kits components allow to equilibrate to ambient temperature (15-37 ^{0}C) before testing and the test strips were removed from the foil pouch immediately prior to use. It is an in vitro test intended for professional use as an initial screening test or as a population surveillance tool. Since there is a geographical overlap of lymphatic filariasis elimination programs in central Africa and the test is relatively simple to use, The SD Bioline LF IgG4 biplex (Wb123) test contains a membrane strip, which is pre-coated with recombinant wb123 capture antigen on a separate test line region (L).the anti-human IgG4 gold colloid conjugate and the sample move along the membrane chromatographically to the test regions (L) and form a visible line as the antigen-antibody gold particle complex forms with high degree of sensitivity and specificity. The test lines and control line in the result window have been clearly labeled “L” for the lymphatic filariasis test line and “C” for the control line. Both test and control lines are not visible before applying any sample. The control line is used for procedural control and should always appear if the test procedure is performed correctly.

The strip was placed on a work tray, showing the indicator arrow pointed toward the operator. The participant is left middle finger was cleaned with methylated spirit and then punctured using a sterile lancet. The initial sample of blood was removed using a cotton swab, and sufficient fresh blood was obtained to fill a 100-ql capillary tube.

The blood was then transferred from the capillary tube to the pad on the FTS kit card and the 4 drops of assay diluents was added into the square assay diluents well. The results of each FTS card were read after 10- 15 mins. A positive result showing two pink lines appear on the card’s window and a negative result showed when a single line is seen. Test results with the individual’s identification code was recorded on the participant’ diagnostic data sheet (Omudu and Okafor, 2007).

3.8 Test Interpretation

Lymphatics filariasis reactive: Positive for IgG4 antibodies to *W. Bancrofti* (wb123): When the both purple lines “C” and “L” appear in the viewing window, then the respondents is said to be positive

Note: Positive even if “L” line is weak purple color

Negative: When only the control line “C” appears in the viewing window, then the respondent is said to be negative.

Invalid: When no “C” lines appear in the viewing window, then the result is said to be invalid and another SD Bioline LF IgG4 biplex (61FK20) test device will be used.

Note: All positive SD Bioline LF IgG4 biplex (61FK20) test device, venous blood was collected the night for slide thick smear preparation and stained for microscopic reading and blood spots.

3.9 Searches for Hydrocoele and Lymphoedema.

Information on LF morbidity was obtained during the survey. Participants were shown the pictures of LF clinical manifestations, including lymphoedema (limb swelling) and hydroceles (scrotal swelling) and asked if anybody is suffering from any of the signs and symptoms (World Health Organization, 2013). Participants who are indicated with such clinical symptoms were examined and their condition was confirmed by a medical officer in that locality. The number of clinical cases was recorded for each community. After obtaining demographic information (age, occupation, marital status, sex), the participants with the sign and symptoms were asked to partially undress for diagnosis of the various manifestations of filariasis include lymphoedema Hydrocoele based on the finding of a non-tender, soft, fluid-filled mass bigger than the size of an orange (Eigege *et al.*, 2005). Clinical examination also involving the search for lymphoedema was conducted which was better and easier than the search for hydrocoele. Participants were simply asked to lift up their clothing to expose their legs. Swollen limbs and leopard skin were observed and noted (Anosike *et al.*, 2005; Eigege *et al.*, 2003Nwoke *et al.*, 2006, Omudu and Okafor, 2007).

3.10 Interviews and Questionnaire Administration

Interviews, using semi-structured questionnaire were conducted with selected individuals from all the selected communities to gather descriptive information on villagers' knowledge and beliefs about the cause, mode of transmission and how to prevent the disease. Based on the descriptive information, a structured questionnaire was developed. It includes some questions on villagers' awareness, knowledge, beliefs and health seeking behaviour in relation to filariasis. Questionnaire was administered to 28 affected and 276 unaffected people in the study communities. A total number of volunteers participated in the questionnaire aspect of the study are recorded.

3.11 Data Analysis

Data collected were analyzed using Statistical Package for Social Sciences (SPSS) (Version 20) and presented as, frequency tables and percentages. Chi-square test was used to test for significance of relationship between variables ($p<0.05$).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Results

4.1.1 Overall Prevalence of Lymphatic Filariasis (LF) in Kontagora LGA of Niger State

One thousand and fifteen (1015) persons from five (5) selected communities situated in Kotangora Local Government Area of Niger State, Nigeria, were clinically examined for manifestations of filariases and detection of circulating *W. bancrofti* using the Filariasis Test Strip (FTS) card. One hundred and eleven (10.94 %) out of the 1015 persons were positive for circulating filarial antigen (CFA). Infection rates of CFA ranged from 8(4.52 %) in Tashan badukke to 41 (17.37 %) in Rugan Gandu/Tudun Fulani (Table 4.1). Rugan Gandu Tudun Falani had the highest rate of LF infection (17.37 %), followed by Sabon Garin Mangu/Matachibu with 14.51 % rate of LF infection. Dogon Fili had 10.69 % rate of LF infection, while Sanbon Garin Madara had 5.67 % rate of LF infection and the least rate of LF infection (4.52 %) in the communities was recorded in Tashan Badduke. Chi-square analysis showed that there is significance difference in the overall prevalence of LF in the communities of Kontagora Local government areas of Niger State at $p<0.05$.

Table 4.1: Overall Prevalence in the Communities of Kontagora Local Government Areas Niger State

Communities	Total Number Examined	Number Infected (%)
Sabon Garin Mangu/Matachibu	193	28 (14.51)
Rugan Gandu Tudun Falani	236	41 (17.37)
Sanbon Garin Madara	194	11 (5.67)
Tashan Badduke	177	8 (4.52)
Dagon Fili	215	23 (10.69)
Total	**1015**	**111 (10.94)**

$X^2_{\text{cal}} = 25.58$, $X^2_{\text{tab}} = 9.488$, df =4, P<0.05

4.1.2: Community Prevalence of Clinical Manifestation of Filariasis and Lymphatic Filariasis Antigen as Detected by Filariasis Card Test Strip (FCT).

The results of the community prevalence of clinical manifestation of filariasis and lymphatic filariasis antigen as detected by Filariasis Card Test Strip (FCT) are presented in Table 4.2. From the results it was observed that clinical manifestations associated with Onchocerciasis were also prevalent in the communities. These include leopard skin which had overall prevalence of 9(0.89 %) and skin rashes or itching and/or crawling sensation with overall prevalence of 24(2.36.2 %). The clinical manifestations of lymphatic filariasis exhibited by members of these communities as shown by table 4.2 are hydrocoels with the overall prevalence of 23(2.27 %) and Lymphoedema 14(1.38 %). Out of all these clinical manifestations, skin rashes or itching and/or crawling sensation was the most abundant (2.34 %) clinical manifestations seen among members of the communities. Leopard skin on the other hand was the least (0.89 %) observed clinical manifestations among the communities. Plates I and II show the pictorial representation of the clinical manifestations of LF diseases as seen in the study area. The result of the chi square analysis showed that there is significant difference in the community prevalence of clinical manifestation of lymphatic filariasis at $P<0.05$.

Table 4.2: Community Prevalence of Clinical Manifestation of Filariasis and Lymphatic Filariasis Antigen as Detected By Filariasis Card Test Strip (FCT).

Community	Number Examined	No. positive (%)	Number Unit Hydrocoels (%)	Number Unit Lymphoedema (%)	Number Unit Leopard Skin (%)	Number Unit Crawling Sensation (%)	Number Who Had Taken/Ivermectin (%)
Sabon Garin Mangu/Matachibu	193	28 (14.51)	6(3.11)	4(2.07)	0(0.00)	0(0.00)	49(25.39)
Ruggan Gandu/Tudun Falani	236	41 (17.37)	8(3.39)	7(2.97)	3(1.27)	4(1.69)	51(21.61)
Sanbon Garin Madara	194	11 (5.67)	4(2.06)	0(0.00)	1(0.52)	6(3.09)	23(11.86)
Tashan Badduke	177	8 (4.52)	3(1.69)	3(1.69)	0(0.00)	3(1.69)	31(17.51)
Dagon Fili	215	23 (10.69)	2(0.93)	0(0.00)	5(2.33)	11(5.12)	93(43.26)
Total	**1015**	**111 (10.94)**	**23(2.27)**	**14(1.38)**	**9(0.89)**	**24(2.36)**	**247(24.33)**

$X^2_{cal} = 36.33$, $X^2_{tab} = 26.30$, df =16, P<0.05

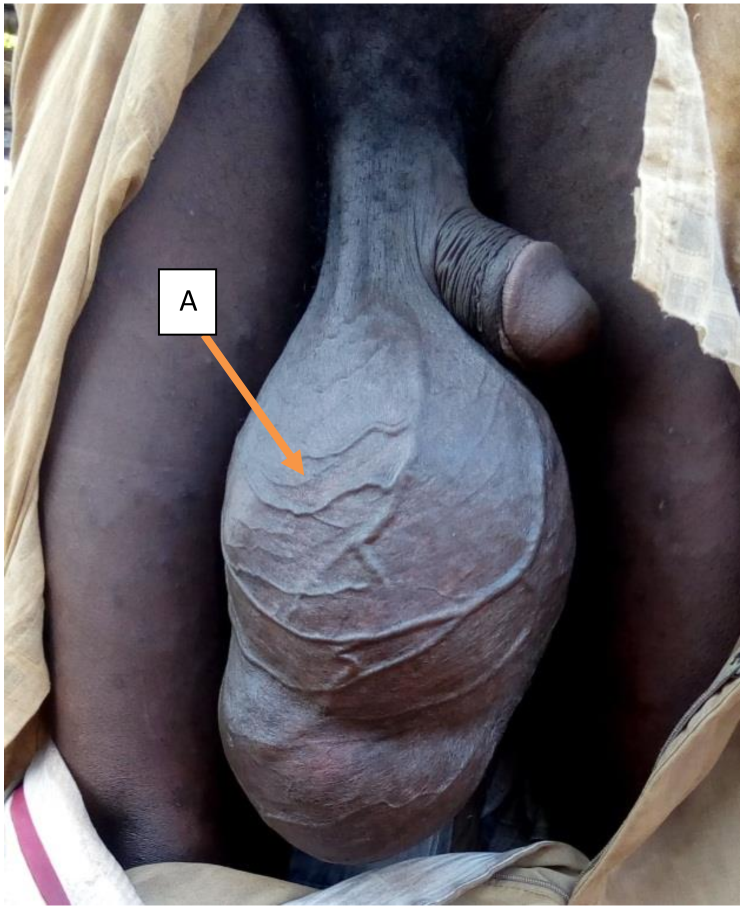

Plate I: Clinical Manifestation of Lymphatic Filariasis
A: Hydrocoele

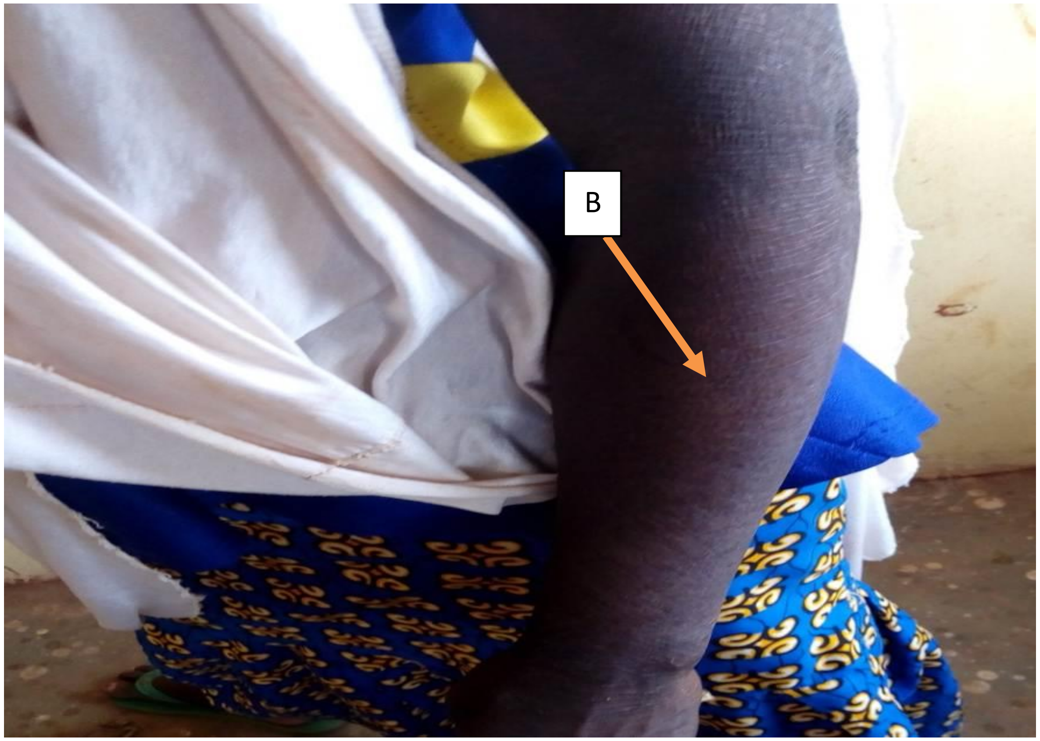

Plate II: Clinical Manifestation of Lymphatic Filariasis
B: Leopard Skin

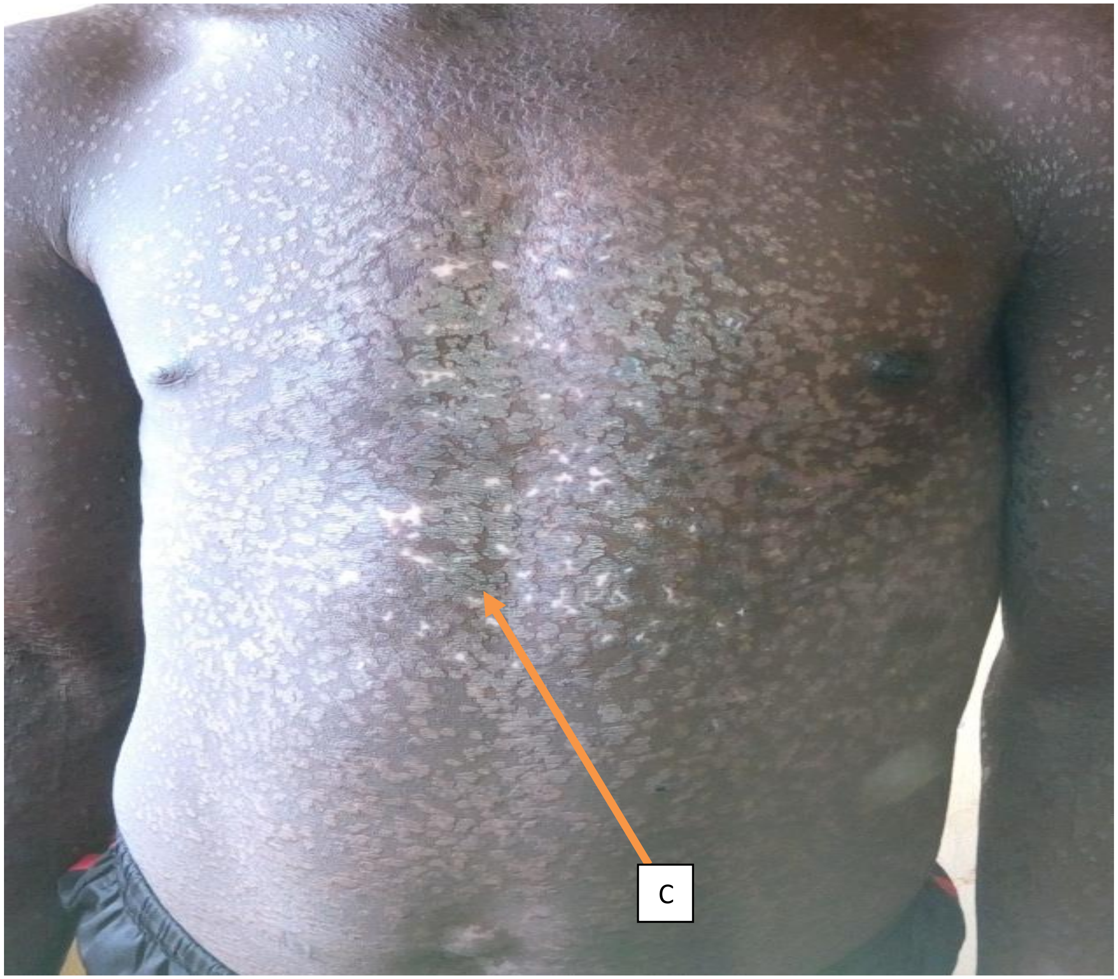

Plate III: Clinical Manifestation of Lymphatic Filariasis
C: Skin rashes

Plate IV: Clinical Manifestation of Lymphatic Filariasis
D: Lymphoedema

4.1.3 Age-Related Prevalence of Clinical Manifestation of Filariasis and Detection of Lymphatic Filariasis Antigen Using Filariasis Card Test Strip (FTS).

Table 4.3 shows the result of the prevalence of clinical manifestation of filariasis in relation to age among communities of Kontagora Local Government Area of Niger State. Among the age group 5-15 years, crawling sensation was the most common clinical manifestations with a prevalence of 5(6.25 %) while the least observed clinical manifestations in this age group was Lymphoedema with a prevalence of 1(1.25 %). In the age group 16-25 years, crawling sensation was the most abundant clinical manifestations with a prevalence of 7(6.36 %), followed by hydrocoel 6(5.45 %) and the least was Lymphoedema 3 (2.73 %). There was no evidence of leopard skin in this age group. On the other hand, Lymphoedema, leopard skin and crawling sensation were most common in the age group 26-35 years with the prevalence of 5(2.49 %). There was less manifestation of hydrocoel (0.99 %) among this age group. Among the age group 36- 45 years, there was equal manifestations of hydrocoel and crawling sensation 4 (1.69 %) and Lymphoedema and leopard skin 1 (0.42 %). Hydrocoel 4 (1.29 %) was the most abundant clinical manifestations among the age group 46-55 years, followed by crawling sensation 3 (0.97 %) while the least observed clinical manifestation was leopard skin 1 (0.32 %). The result showed no manifestation of Lymphoedema among the age group 46-55 years. Among the age group 56-65 years, there was no manifestation of leopard skin and crawling sensation. Meanwhile, Lymphoedema 3 (7.50 %) was most abundant while hydrocoel 2 (5.00 %) was the least observed clinical manifestations. Similarly, in the age group 66-75 years, the only observed clinical manifestation was hydrocoel with the overall prevalence of 3 (10.71 %). Among the people within the age group of 76 and above, Lymphoedema was the only observed clinical manifestation with the prevalence of 1 (9.09 %). From the result of this present study, it was observed that while hydrocoel and crawling sensation appeared much earlier in life, lymphoedema showed up from the age range of 35 and above. Chi-square analysis showed that there is significance difference in the prevalence of clinical manifestation of filariasis in relation to age among communities of Kontagora of Niger State at $P<0.05$.

Table 4.3: Age-Related Prevalence of Clinical Manifestation of Filariasis and Detection of Lymphatic Filariasis Antigen Using Filariasis Card Test Strip (FCT).

Age Group	Number Examined	No. Positive (%)	Number Unit Hydrocoels (%)	Number Unit Lymphoedema (%)	Number Unit Leopard Skin (%)	Number Unit Crawling Sensation (%)	Number Who Had Taken/Vemection (%)
5 – 15	80	8(10.00)	2 (2.50)	01(1.25)	02(2.50)	05(6.25)	00(0.00)
16 – 25	110	16(14.55)	6(5.45)	03(2.73)	00(0.00)	07(6.36)	41(37.27)
26 – 35	201	19(9.45)	2 (0.99)	05(2.49)	05(2.49)	05(2.49)	49(24.38)
36 – 45	236	28(22.31)	4(1.69)	01(0.42)	01(0.42)	04(1.69)	52(22.03)
46 – 55	309	23(7.44)	4(1.29)	00(0.00)	01(0.32)	03(0.97)	63(20.39)
56 – 65	40	9(22.58)	2(5.00)	03(7.50)	00(0.00)	00(0.00)	29(72.50)
66 – 75	28	6(21.43)	3(10.71)	00(0.00)	00.(0.00)	00(0.00)	08(28.57)
76 – above	11	2(18.43)	0(0.00)	01(9.09)	00(0.00)	00(0.00)	05(45.45)
Total	**1015**	**111 (10.94)**	**23(2.27)**	**14(1.38)**	**09(0.89)**	**24(2.36)**	**247(24.33)**

$X^2_{cal} = 175.79$, $X^2_{tab} = 43.77$, df =35, $P<0.05$

4.1.4: Respondents knowledge on cause of lymphatic filariasis

Most of the respondents (60.71 %) among the infected persons believed that stepping on charm is the major cause of LF disease, (50.00 %) of the infected individuals believed that feeding on contaminated food is the major causes of LF disease. Conversely, (39.29 %) of the infected persons are of different opinion, they believed that sexual intercourse is the major cause of the LF disease. On the other hand, some of these infected persons (32.14 %) believed that fever is the major cause of this disease, (25.00 %) believed that working in the sun is the major cause of LF disease, while (7.14 %) are of the opinion that mosquito bites is the major cause of LF disease. On a different note, majority of the uninfected persons (37.68 %) believed that fever is the major cause of LF disease; however, (35.14 %) believed that stepping on charm is the major cause of LF disease. (30.43 %) on the other hand believed that contaminated food is the major cause of LF disease while (1.81 %) of the uninfected respondents are of the opinion that mosquito bite is the major cause of LF disease. Chi-square analysis revealed that there is significant difference between the respondents' perceptions on the major cause of lymphatic filariasis disease.

Table 4.4: Respondents Knowledge on Cause of Lymphatic Filariasis

Cause	Affected n=28 (%)	Unaffected n=276 (%)
Working in the sun	07(25.00)	20(7.25)
Working long distance	04(14.29)	12(4.35)
Sexual intercourse	11(39.29)	13(4.71)
Stepping on charm	17(60.71)	97(35.14)
Contaminated food	14(50.00)	84(30.43)
Lack of personal hygiene	03(10.71)	24(8.69)
Fever	09(32.14)	104(37.68)
Mosquitoes bites	02(7.14)	05(1.81)

$X^2_{cal} = 26.25$, $X^2_{tab} = 14.067$, df =7, $P<0.05$

4.1.5: Respondents knowledge on the Mode of Transmission of Lymphatic filariasis

Table 4.7 showed respondents believe on the mode of transmission of lymphatic filariasis. Among the infected persons, (39.29 %) believed that mosquito bite is the major mode of transmission of LF disease, (17.86 %) believed that stepping on charms is the mode of transmission of LF disease, while (14.29 %) believed that witchcraft is the mode of transmission of LF disease. On the other hand, (7.14 %) of the infected respondents are of the opinion that sexual intercourse is the mode of transmission of LF disease. (3.57 %) believed that food poisoning and inheritance are the mode of transmission of LF disease. However, (77.17 %) of the uninfected respondents believed that stepping on charms is the mode of transmission of LF disease, (43.84 %) are of the opinion that witchcraft is the mode of transmission of LF disease, while (18.48 %) believed that sexual intercourse is the mode of transmission of LF disease. On the other hand, (2.54 %) of the uninfected respondents are of the opinion that food poison is the mode of transmission of LF disease. From the result, it was observed that majority of the people in communities of Kontagora believed that stepping on charms is the mode of transmission of LF disease. Chi-square analysis therefore revealed that there is no significant difference in the respondents' opinion on the mode of transmission of LF disease at $P>0.05$.

Table 4.5: Respondents Believe on the Mode of Transmission of lymphatic filariasis

Mode of transmission	**Infected n = 28 (%)**	**Uninfected n = 276 (%)**
Sexual intercourse	2(7.14)	51(18.48)
Body contact	9(32.14)	36(13.04)
Witch craft	4(14.29)	121 (43.84)
Food poison	1(3.57)	07(2.54)
Mosquitoes bite	11(39.29)	17(6.16)
Stepping on charms	5(17.86)	213(77.17)
Inheritance	1(3.57)	13(4.71)
Personal hygiene	3(10.7)	50(18.12)

$X^2_{cal} = 4.12$, $X^2_{tab} = 14.067$, df =7, P>0.05

4.1.6: Respondents knowledge on the prevention of Lymphatic filariasis

The result of respondents believe on the prevention of LF disease is presented in table 4.6. The result revealed that (85.71 %) of the infected persons believed that avoiding mosquito bites is the best way to prevent the transmission o9f LF disease. (21.43 %) are of the opinion that sacrifices to appease gods and good personal hygiene is the preventive measure of LF disease. Only a few (10.71 %) believed that avoiding body contact with affected person is the mode of prevention of LF disease. Among the uninfected persons, (53.26 %) believed that sacrifices to appease gods and good personal hygiene are the best way to prevent LF disease. (9.78 %) of the uninfected persons on the other hand are of the opinion that avoiding sexual intercourse with affected persons and avoiding body contact with affected persons are the best way to prevent LF disease. Only (5.79 %) of the uninfected persons believed that avoiding mosquito bite prevents LF disease. This result therefore revealed that majority of the people of Kontagora LGA communities believed that good personal hygiene and sacrifice to gods is the best way to prevent LF disease. The result of the chi-square analysis showed that there is no significant difference in the respondents believes on the prevention of LF disease at $P>0.05$.

Table 4.6: Respondents Believe on the Prevention of Lymphatic Filariasis

Prevention measures	**Affected n=28 (%)**	**Unaffected n=276 (%)**
Avoid sexual intercourse with affected person	7(25.00)	27(9.78)
Avoid body contact with affected person	3(10.71)	27(9.78)
Sacrifice to appease gods	6(21.43)	142(53.26)
Good personal hygiene	6(21.43)	147(53.26)
Avoid mosquitoes bites	24(85.71)	16(5.79)
Avoid eating with affected person	0(0.00)	0(0.00)

$X^2_{cal} = 3.21$, $X^2_{tab} = 11.070$, df =5, P>0.05

4.1.7 Respondent Perception on Some Socio-Economic and Psychological Consequence of Lymphatic Filariasis

Table 4.7 showed the respondent perception on some socio-economic and psychological consequence of lymphatic filariasis. From the result, it was inferred that (100 %) of the infected persons are of the opinion that personal discomfort and effects on the work and income are the socio-economic and psychological consequence of lymphatic filariasis. Similarly, (97.10 %) of the uninfected persons opined that personal discomfort and effects on the work and income are the socio-economic and psychological consequence of lymphatic filariasis. The least perceived socio-economic and psychological consequence of lymphatic filariasis by the people is hindrance to marriage prospect, spouse desertion and divorce and specials infidelity. However, the result of the chi-square analysis showed that there was no significant difference in the respondents' perception on some socio-economic and psychological consequence of lymphatic filariasis at $P>0.05$.

Table 4.7: Respondent Perception on Some Socio-Economic and Psychological Consequence of Lymphatic Filariasis

Consequence	**Affected n =28 (%)**	**Unaffected n=276 (%)**
Personal Uncomfortable	28(100.00)	268(97.10)
Affect Work and Income	28(100.00)	268(97.10)
Affected Sexual Relation with Spouses	09(32.14)	173(62.68)
Hinder marriage prospect of other members of the family	04(14.29)	96 (34.78)
Spouse desertion and divorce	04(14.29)	38 (13.77)
Specials Infidelity	03(10.71)	35(12.68)

$X^2_{cal} = 6.35$, $X^2_{tab} = 11.070$, df =5, P>0.05

4.1.8 Respondents Perception on the Monthly Expenditure Lymphatic Filariasis Related Health Expenditure and Factors That Influence Choice of Health Providers

The result of the respondent's perception on the monthly expenditure lymphatic filariasis related health expenditure and factors that influence choice of health providers is presented in table 4.8. Considering the fact that the disease caused by LF had led to health expenditure in which most of the infected individuals (67.86 %) believed between 1000-2000-naira monthly expenditure, while (57.14 %) believed that convenience is the major factor that influences the choice of health providers. However, only 10.71 % of the infected persons are of the opinion that confidentiality is the major factor that influences the choice of health providers. Among the uninfected people, (48.55 %) opined that affordability is the major factor that influences the choice of health providers, (35.51 %) on the other hand opined that family decision is key to the choice of health providers. Only (7.61 %) of the uninfected people are of the opinion that confidentiality is the major factor that influences the choice of health providers. Furthermore, (39.29 %) of the uninfected people said the monthly expenditure of LF disease is below 5000 naira, (13.41 %) are of the opinion that the monthly expenditure is between 500-1000 naira monthly, while (7.61 %) opined that 1000-2000 naira is the monthly expenditure of LF disease. It can be inferred from the result that, majority of the respondents are of the opinion that affordability is the major factor that influence choice of health providers while the monthly expenditure is between 500-1000 naira monthly. Only a few of the people perceived the monthly expenditure to be below 500 naira monthly and factor that influence choice of health providers to be confidentiality respectively. Meanwhile, chi-square analysis therefore shows that there is significant difference in the respondents' perception on the monthly expenditure lymphatic filariasis related health expenditure and factors that influence choice of health providers at $P<0.05$.

Table 4.8: Respondents Perception on the Monthly Expenditure Lymphatic Filariasis Related Health Expenditure and Factors That Influence Choice of Health Providers

Expenditure	**Affected n=28 (%)**	**Unaffected n=276 (%)**
Below 100 monthly	13(46.43)	11(39.29)
Between #500 – #1000 monthly	8(28.57)	37(13.41)
Between 1000 – ₦2000 monthly	19(67.86)	21(7.61)
Convenience	16(57.14)	28(10.14)
Affordability	9(32.14)	134(48.55)
Family decision	6(21.43)	98(35.51)
Provider reputation	12(42.86)	46(16.67)
Confidentiality	3(10.71)	21(7.61)

$X^2_{cal} = 53.48$, $X^2_{tab} = 14.067$, df =7, $P<0.05$

4.1.9 Prevalence of Lymphatic Filariasis in Communities of Kontagora Local Government Area in Relation to Sex and Ages

The results of the prevalence of lymphatic filariasis in communities of Kontagora Local Government Area in relation to sex and age are presented in table 4.9. The age range 5-15 years had 8 (10.00 %) rate of L F infection; 16-25 years had 16 (14.55 %) rate of L F infection. The rate of L F infection in the age range 26-35 years was 19 (9.45 %), 36-45 years age range had 28(22.31 %) rate of infection, while 23 (7.44 %) rate of L F infection was recorded in the age range 45-56 years. The rate of LF infection in the age range 56-65 years was 9 (22.58 %), while the age range 66-75 years had 6 (21.43 %) rate of L F infection. The age range 76 years & above had 2 (18.43 %) rate of L F infection. This result revealed higher rate of L F infection (22.58 %) among people within the age range of 56 – 65 years, followed closely by the age range 36-45 years with (22.31 %) rate of LF infection. The least rate of LF infection (7.44 %) therefore was recorded among the age 46-55 years old. In relation to gender, males of the communities were more infected with L F with the overall prevalence of 49 (10.86 %) than their females 52 (9.22 %).

Table 4.9: Prevalence of Lymphatic Filariasis in Communities of Kontagora Local Government Area in Relation to Sex and Ages

Age Group	**Male**		**Female**		**Total**	
	Number Examined	**Number Infected (%)**	**Number Examined**	**Number Infected (%)**	**Number Examined**	**Number Infected (%)**
5 – 15	53	3(5.66)	27	5(18.52)	80	8(10.00)
16 – 25	71	9(12.68)	39	7(17.95)	110	16(14.55)
26 – 35	93	5(5.38)	108	14(12.96)	201	19(9.45)
36 – 45	69	11(15.94)	167	17(10.18)	236	28(22.31)
46 – 55	134	15(11.19)	175	8(4.57)	309	23(7.44)
56 – 65	11	2(18.18)	29	7(0.24)	40	9(22.58)
66 – 75	16	4(25.00)	12	2(16.67)	28	6(21.43)
76 – above	4	0(0.00)	7	2(28.57)	11	2(18.43)
Total	**451**	**49(10.86)**	**564**	**52(9.22)**	**1015**	**111 (10.94)**

X^2_{cal} = 12.52, X^2_{tab} = 14.067, df =7, P>0.05

4.2 Discussion

The overall prevalence of infection as determined by the presence of microfilariae in the communities investigated was 10.94 % of the study population. The higher of anti-filarial IgG4 compare to micro-filaraemia has been observed and it indicate that anti-filarial IgG4 may allow the detection of prepatent and single sex infection and deposition in the skin which concord with the finding of Elkanah *et al.*, (2018). There was variation in the prevalence of Lymphatic filariasis in the communities investigated and this show similarity to the findings of Elkanah *et al.* (2018) who also observed variation in the prevalence of LF in the communities investigated in Yorro, LGA of Taraba state, Nigeria. According to Okon (2010), the variation in prevalence between communities could be attributed to similarities on the socio-economic status, local environmental condition and the presence of ecological conditions that favour the breeding of the vectors in each of these communities.

The endemicity of lymphatic filariasis in these communities could be due to several factors, especially the local environmental conditions like the availability of numerous domestic and peri-domestic mosquitos breeding sites and deteriorating sanitary conditions. The various activities of the local population such as rice farming, and other outdoor related activities tend to increase man-mosquito contact rates in different communities. Lymphatic filariasis vectors have been reported to breed in pots used for cassava fermentation. The topography of the area also created conducive environment for breeding of other vectors of filariases, such as clear, highly-oxygenated and fast flowing rivers like Kontagora and rice swamping site which provide breeding grounds for black flies (vector of onchocerciasis). This accounted for the cases of leopard skins, onchocerca nodules and onchodermatitis encountered during clinical examinations.

The findings of this present study show that lymphatic filariasis is endemic in Kontagora Local Government Area of Niger State, Nigeria with an overall hydrocoele prevalence of 2.27 %, lymphoedema prevalence of 1.38 % and CFA prevalence of 10.94 %. Lymphatic filariasis due to *W. bancrofti* infections is indeed a serious public health problem in this area. This prevalence rate is higher than that of earlier observation in other parts of Benue State by Omudu and Okafor (2007) and parts of Nigeria by Anosike *et al*. (2005), Anosike (1994) in Bauchi State, Braide *et al.* (2003) and Udiodung *et al*. (2008) in Cross River State, Eigege *et al.* (2003) in Plateau State and Mba and Njoku (2000) in Anambra State. This result is however contrary to the findings of Elkanah *et al.* (2018) who reported an overall prevalence of 30.90 % in Yorro LGA of Taraba state, Nigeria.

The clinical manifestations observed in the current study include, lymphedema of limbs, hydrocoel, leopard skin, crawling sensation and breast lymphoedema. This finding is consistent with that of Elkanah *et al.* (2018) who observed similar trend in Yorro LGA of Taraba state, Nigeria. However, prevalence of lymphoedema, hydrocoele and CFA in this area is relatively low when compared with findings from Taraba State (Badaki and Akogun, 2000) and Kogi State (Nwoke *et al*. 2006).

On the communities' knowledge and beliefs in relation to lymphatic filariasis in the area, findings revealed significant differences in lymphatic filariasis related knowledge between affected and unaffected respondents. This contrast with similar study in South India (Ramaiah *et al*. 1996) which reported that unaffected people, irrespective of their educational status, are more knowledgeable than the affected on the cause of filariasis. The general awareness of the cause transmission and prevention of the disease is poor; the role of mosquitoes in transmitting the parasitic agents of filariasis is poorly appreciated in many of the communities investigated. This study has demonstrated several other shortcomings in the communities' understanding of the disease. Our findings corroborate similar studies in Nigeria and elsewhere (Anosike *et al*. 2005; Braide *et al.,* 2003; Omudu and Okafor, 2008) and clearly underscored the importance of comprehensive community education to address identified gaps in perception and practices. The chronic manifestations of lymphatic filariasis can have significant, and often very negative social impacts. Clinical manifestations like lymphoedema of the limbs and external genitalia as seen in this area have a profoundly detrimental effect on the quality of life of affected individuals and their family members. The degree of social disability varies between cultural settings and prevailing community perceptions and practices, but the degree of stigmatization appears to be directly correlated with the severity of visible disease (Addiss and Brady, 2007). There is significant evidence that patients experience stigma as a result of lymphatic filariasis in the communities investigated and this results from general community beliefs and perception on the causes and mode of transmission of the disease. While patients may experience withdrawal from social gathering, their family members could experience difficulty in finding desired spouses. Similar findings have also been reported in Ghana (Sri-Lanka (Wijesinghe *et al.,* 2007), Haiti (Person *et al.*, 2006) and Dominican Island (Person *et al.*, 2006).

The level of antifilarial IgG4 in the microfilaraemia group were significantly higher in male showing that findings from this study male were more infected (10.86 %) than females (9.22 %), there was no significant difference in the rate of infection among gender. This is consistent with the findings of Elkanah *et al.,* (2018) who observed no significant difference between females and males subjects, the females had slightly lower (28.41 %) infection than their male counterparts (32.6 %)but not statistically significant. This result is however contrary to the findings of Mu`awiyya *et al.*, (2019) who observed that males were found to be significantly ($p<0.05$) more infected 72 (38.9 %) than their female counterparts with 44 (36.1 %). Absence of significant difference in infection among gender as observed in this study suggests that both sexes are equally exposed to the bites of mosquito species since they engaged in similar activities.

In this study, prevalence of infection was highest in the age-group 56-65 years (22.58 %). This is conformity with the findings of Obadiah *et al*. (2018) and Mu`awiyya *et al.* (2019). The fluctuation of the prevalence rate of infection observed among the age groups is inexplicable but could be depend on the type of activities that exposes each group vulnerable to the mosquito bites. For example, subjects within the age of 5-25 years are considered school age children who expose themselves to different play grounds from where they may be biting by mosquitoes. The other age groups (26 above years) within these communities considered themselves as responsible adults who are expected to engage in different occupational activities especially farming. Therefore, the exposure to mosquitoes by these age groups is largely depends on the social and cultural activities of the communities. These observations corresponded to that of Federal Ministry of Health (2013) and Okorie *et al*. (2015).

Age-related infection rates observed in this study agree with previous findings (Anosike *et al*., 2005; Eigege *et al.*, 2003; Nwoke *et al.*, 2006; Omudu and Okafor, 2007), which showed that prevalence of hydrocoele, lymphoedema and CFA increased with age. Apart from immunological reasons, duration of exposure to vectors in middle age and farming age group may be the major reason (Anosike *et al*., 2005; Eigege *et al.*, 2003).

The use of clinical manifestations of lymphatic filariasis as rapid assessment procedures for community diagnosis has been suggested (Eigege *et al*., 2003; Nwoke *et al.,* 2006).

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The present study provides information on the status of lymphatic filariasis in Kontagora communities and it's interesting to note filariasis prevalence of 10.94 % in Kontagora community. There was variation in the prevalence of LF in the communities investigated with Rugan Gandu Tudun Falani having the highest rate of LF infection (17.37 %), followed by Sabon Garin Mangu/Matachibu with 14.51% rate of LF infection, while the least rate of LF infection (4.52 %) was recorded in Tashan Badduke. There was significance difference in the overall prevalence of LF in the communities of Kontagora Local government areas of Niger State at $p<0.05$.

The clinical manifestations observed in the current study include, lymphedema of limbs, hydrocoel, leopard skin, crawling sensation and breast lymphedema. On the communities' knowledge and beliefs in relation to lymphatic filariasis in the area, our findings revealed significant differences in lymphatic filariasis related knowledge between affected and unaffected respondents. Although findings from this study shows that males were more infected (10.86 %) than females (9.22 %), there was no significant difference in the rate of infection among gender. In this study, prevalence of infection was highest in the age-group 56-65 years (22.58 %).

The study also highlighted the importance of patient-search as a means of estimating the burden of lymphatic filariasis morbidity in rural setting; findings in this work also confirm that lymphatic filarisis cause considerable psychosocial and economic suffering all of which adversely affect the mental health of the person. Therefore, it's important to incorporate mental health care as a major component of morbidity management programmes.

5.2 Recommendations

In assessing the community knowledge, practice, perception and clinical manifestation on the distribution of lymphatic filariasis among people living in such community;

i. This study has demonstrated the need for health education programs to be established which will help people to be able to protect themselves against mosquito's bite.
ii. Though Nigerian vision 2020 on neglected tropical disease has been established and commence the lymphatic elimination programs, morbidity management activities also need to be developing urgently so as to alleviate burden of the affected individual.
iii. Due to critical condition of this study to delineating lymphatic filariasis communities, there is needed to be replicated in other parts of the state and the country at large where the status of the disease is unknown.

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APPENDICES

Appendix A:

Plate I: showing drop sample of blood on the strip

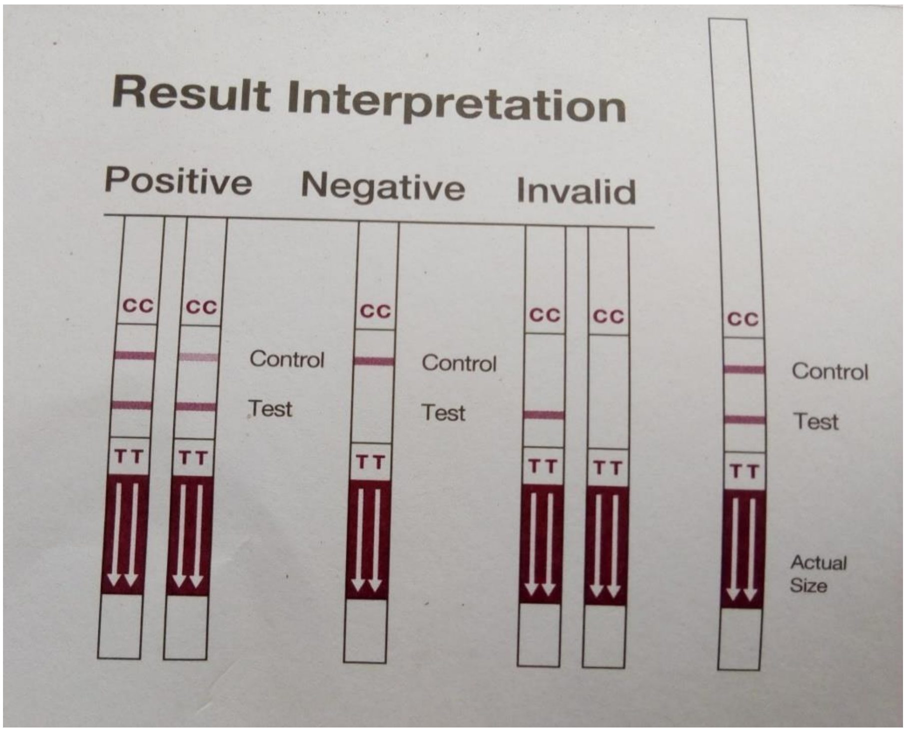

Plate II: Strip Sample showing result interpretation

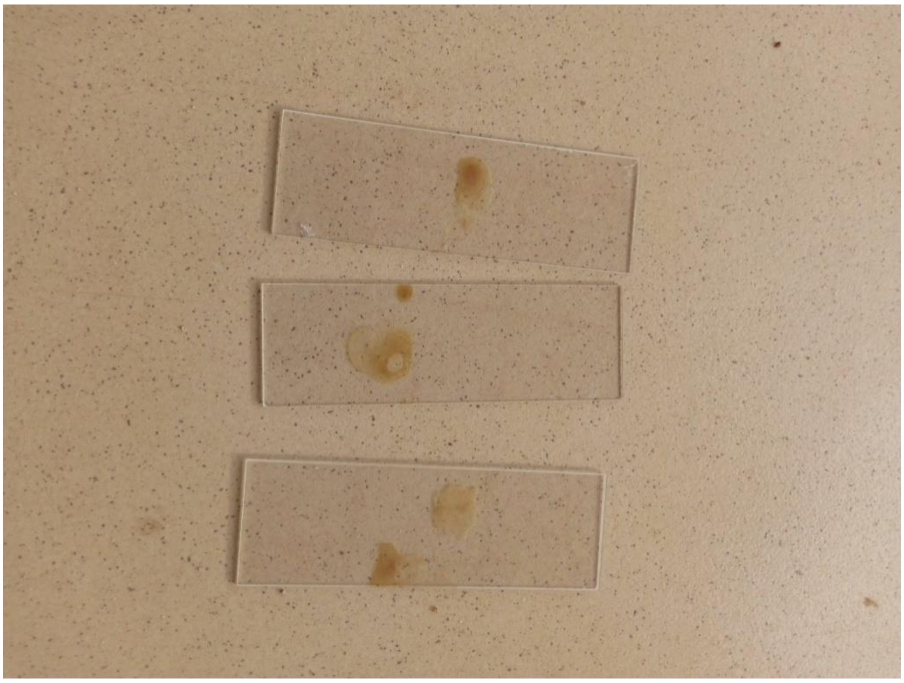

Plate III: showing absence of microfilariae

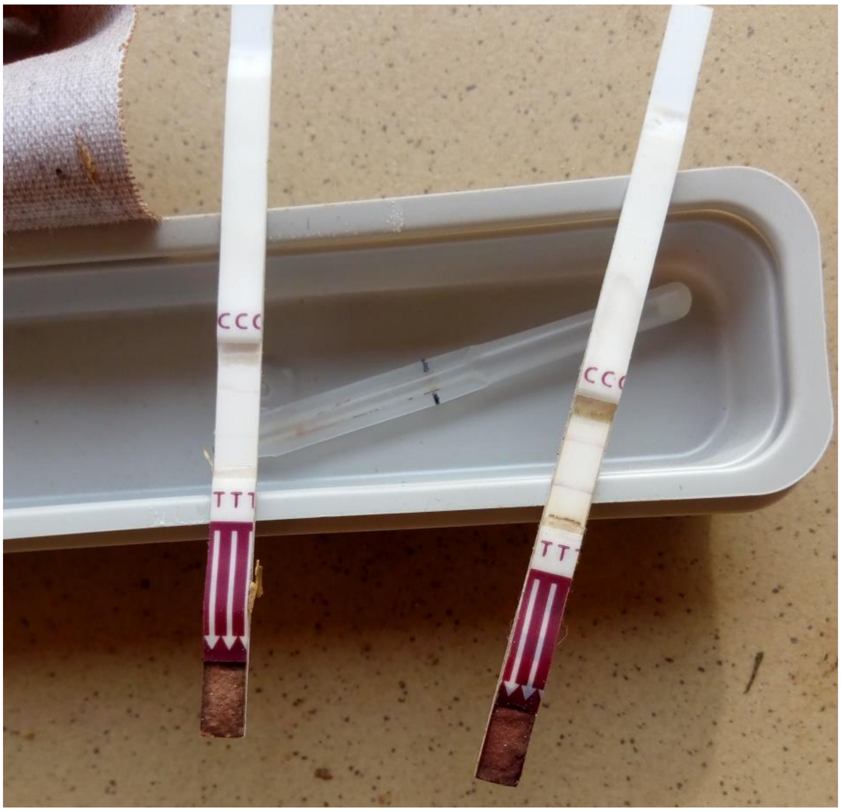

Plate IV: Strip showing Positive

Appendix B.

Plate: Parasitological Examination