PREVALENCE OF RIVER BLINDNESS (*ONCHOCERCIASIS*) IN KAJURU LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

BY

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M.SC/SCI/4761/2011-2012
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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA-NIGERIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

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NOVEMBER, 2015

DECLARATION

I hereby declare that this research work was written by me and it has not been accepted in any previous application for degree. All quotations are indicated and the sources of information used in the review are specially acknowledged by means of references.

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CERTIFICATION

This is to certify that this research work was carried out by Reuben BULUS and has been read, approved and found to meet the requirements for the award of Masters of Science degree.

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DEDICATION

To my parents who invested so much on me so that I am where I am today.

ACKNOWLEDGEMENTS

I am grateful to God almighty for giving me the grace to enroll in to this programmeand the journey so far in life.

To my supervisors, Prof. J.G. Laah and DrBenedineAkpu, without theirsupervision and kind support I would not have attained this status. They have always been attending to me whenever I called,in spite your busy schedules. Being under your supervision was historic. My gratitude goes to my dear parents and the entire family members who helped in shaping my life morally and financially. I am thankful to Prof. A. Adepetu, Prof. BalaDogo,Mr Sankey, Mal. Yunus, MrWendock, Mal. Salisu who have made remarkable input in my life, I am proud of you. I sincerely appreciate thesecretaries of the Dean's Office Faculty of Science and the Department of Geography, Kaduna State University. They have helped me in no small measure to achieve this goal. Finally, I thank all my friends especially YerimaNathan,Babangida Boniface andShedrach David and NomsherroGyuk, who sacrificed their finances toward the success of this research.

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ABSTRACT

River Blindness (*Onchocerciasis*) is a tropical disease that afflicts about 42million people in the world and about 99% of the victims of the disease live in Africa. The disease has been discovered in Kajuru Local Government Area. Blind people have been observed at junctions and road sides begging for arms. The study determined the prevalence of *onchocerciasis*as well as the spatial and temporal pattern of the disease within the area. The study also examined the socio-economic effect of the disease in the study area. Five wards were selected based on purposive sampling in which 382 copies questionnaire were randomly distributed. GPS was used to take geographic coordinates of the infected communities. The analysis was done using ArcGIS 10.0 and SPSS software packages.A variation was observed in the pattern of the disease.Maro ward had the highest prevalence of the disease (33.63%) while Afogo, Kufana, Kallah and KasuwanMagani had low prevalence (23%, 7.43%, 9.73%, and 6.19% respectively). The research discovered that males were mostly infected by the disease than females (64.7% vs 35.3%). Trend analysis was used to analyze the disease from 2008-2013. It was discovered that the month of August recorded the highest number of cases of *Onchocerciasis* while the months of May, June and September recorded the lowest number of cases. The disease was highest in 2009 with about 22% reported cases. More so, young people between the ages of 20-39years (60%) were mostly infected. Household size and type of accommodation were the only socio-economic variables that showed significant relationship with *Onchocerciasis*at 0.005% significance level. It is recommended that t here should be public enlightenment in the Local Government Area on the danger of living close to the breeding ground of black flies and cases of river blindness be reported to the hospital for immediate medical attention.

CHAPTER ONE

INTRODUCTION

1.1BACKGROUND TOTHESTUDY

The process of development in all its ramifications and in any given society depends greatly onthe productivity of its people. Human productivity has however been greatly interfered with,because of the occurrence of certain diseases in many parts of the worldespecially the tropics. One of the many diseases that have affected the productivity of people is *Onchocerciasis* (river blindness).*Onchocerciasis* is a perniciousdisease that afflictsapproximately 42 million peopleworldwide, with well over 99% of its victims residingin Sub-Saharan Africa (Richards, Boatin,Sauerbrey and Seketeli,2001). The authors argued thatprimarily a rural disease, *Onchocerciasis*disproportionately burdens theinhabitantsof some of thepoorest and most remote areas in Africa, Latin America and Yemen. In the most endemic areas, more than onethird of the adult population is blind, and infection caused by the disease often approaches 90% of the population (Keller, 2010).

It is to be noted that the spatial distribution of this disease (*Onchocerciasis*) around the world is greatly influenced by environmental factors. Thus, the disease is highly concentrated around the breeding grounds of the black flies which are naturally in fast flowing streams and rivers in the inter-tropical zones (Cook and Zumla, 2003; WHO, 2009).

Investigation by World Health Organization (2002) uncovered that about 99% of the people infected with river blindness are resident inAfrica, especially south of the Sahara. In addition, *Onchocerciasis* is endemic in 28 countries inAfrica; 6 countries in the Americas and

Yemen.(WHO, 2009).Some 18 million people are estimated to be infected with the parasite worldwide.Of this number, approximately 270, 000 have been permanently blinded with another 500,000 suffering from severe visual impairment. Also, a further 125 million people worldwide are currently at risk of being infected (Udall, 2007; WHO, 2009).

The principal clinical manifestations are ocular lesions, resulting in visual impairment and blindness that account for over 40% of persons and Onchocercal Skin disease (OSD) (WHO, 2004). The relative importance of ocular and Skin complications varies with the parasite strain involved, with blindness tending to predominate in the African Savannah and Skin disease in the Forest areas. In the West African Savannah, the risk of Onchocercal blindness used to be very high along the Rivers, where the vectors breed (Takougang, Meremekwu and Wandji, 2002).

According to Basanaz(2006) humans are the major host of the worms which can live between 11 and 16 years in the human body and continuously breeding microfilariae, though with depreciating fertility over that period. Both the physical and socio-economic aspects of the disease have been studied. Ubanchukwu, (2006) and Eldryd *et al* (2004) asserted that *Onchocerciasis* has various socio-economic effects which are detrimental both to the infected individual and the community within which such an individual resides. On the one hand, the physical effect of the disease especially blindness, reduces marriage prospects while the infection reduces vitality in married couples, thereby affecting the fertility rate of any endemic community. On the other hand, *Onchocerciasis* is a threat to the economic development of any affected community.

Hopkins (2005) discovered that high microfilarial load can negativelyaffect a host's life expectancy. Parasite-inducedimmunosuppression to specific and non-specific antigens, impairment of the ability to fend off infections andseroconvert successfully upon vaccinations, andmanifestations such as epilepsy possibly due to heavyinfection may be partially responsible for excess mortality. In furtherance, he discovered thatonchodermatitis and epilepsy areassociated with social stigmatization.

Benton(2002) studied the consequences of the disease on individuals. It was asserted that themost severe consequence of *Onchocerciasis*is blindness,which may affect one-third of the adult population ofthe most highly affected communities. The prevention ofblindness was the main clinical reason for initiating the*Onchocerciasis* Control Programme (OCP) in West Africain 1974.*Onchocerciasis* causes several symptoms, including unrelenting itching, physical scarsfrom constant scratching, de-pigmentation and thickeningof the skin, impaired vision, and complete blindness.Important pioneering studies in the last decade, sponsoredby the United Nations Development Programme(UNDP), the World Bank, and the World HealthOrganization (WHO) Special Programme for Research andTraining in Tropical Diseases (TDR), have shown thatOnchocercal skin disease (OSD) is associated with a greaterdegree of morbidity than was hitherto appreciated. Thesestudies demonstrated that severe OSD causes suffering tomillions of people, particularly to those in the forest zone,where the blinding form of the disease is less prevalent(Okulicz *et al* 2009; WHO 2008).

Nigeria is the most endemic country in the world for River blindness (RB), having as much as 40 percent of the global disease burden. It is estimated that up to 27 million Nigerians living in 32 endemic states need curative or preventative treatment with MectizanforRB (Carter Center,

2009). In Nigeria, River blindness manifests as *craw-craw* in many rural communities within the northern and southern parts of the country being endemic in 32 of the 36 states of the Federation; Kaduna state, as well as Kajuru Local Government Area (the study area) inclusive (Federal Ministry of Health, 1999; WHO, 2002; United Nations Children's Fund, 2009). The disease, first reported in Nigeria, was wide spread throughout the country. *Ocular Onchocerciasis*, the leading cause of blindness in Nigeria, was prevalent in parts of northern Nigeria and *Onchocercal* skin disease s (OSD) was widespread in rain forest and Savanna/mosaic areas (Enoch *et al* 2014).

Geographic Information System possesses immense potentials in epidemiology. According to Jenks and Malecki (2004) the application of geographic information systems(GIS) to public health practice holds great promisefor improving our understanding of the ecology andcauses of complex health issues. Odigwe (2003) described the utility of GIS as a tool in integratingdifferent ecological factors to understand disease occurrence andspread. According to the author, GIS was used in mapping the geographical and temporal patterns of diseases in Texas.The application of GIS to the field of public healthholds significant promise.By summarizing vastamounts of tabular data into insightful mapsrelevant to program and policy development, GIShas great potential for communicating complexissues to diverse audiences including public healthstaff, managers, planners, as well as policy makersand the public (Scotch et al, 2006). It can also be a powerful tool forsupporting decision making during public healthemergencies. Jenks and Malecki (2004) asserted that GIS has beendeployed in public health practice for over 150years, the most famous example being the use of ahand-drawn map by Dr. John Snow in London in themid-1850's to analyze the geographic location ofdeaths caused by cholera. His maps whichsuperimposed the location of cholera deaths withthose of

public water supplies pinpointed the BroadStreet pump as the source of the cholera outbreakand resulted in the removal of the pump handle (Jenks and Malecki, 2004).

Kajuru Local Government has been identified as one of the *Onchocerciasis* endemic areas in Kaduna state by the FMH (1999).Yet, little attention has been given to the area in combating the disease, which has led to thesuffering of many in the area.

1.2 STATEMENT OF THE RESEARCH PROBLEM

The World Health Organization (2009) estimates that 123 million people are at risk of being infected by river blindness world wide. A global estimate showed that some 270,000 persons are blind from *Onchocerciasis,* with another 500,000 severely visually impaired (WHO, 2005).In the West African Savannah, the risk of *Onchocercal* blindness used to be very high along the Rivers, where the vectors breed and blindness could affect up to 50% of adults in the most endemic communities (WHO,2002). According to a study by Sight Savers (2000) in Liberia, 29.7% of cases of blindness werecaused by *Onchocerciasis,* and this percentage was higher for malesubjects (32.7%) than for female subjects (22.8%).

Onchocerciasis has various socio-economic effects which are detrimental both to the infected individual and the community within which such an individual resides. On the one hand, the physical effect of the disease especially blindness, reduces marriage prospects while the infection reduces vitality in married couples thereby, affecting the fertility rate of any endemic community (Eldryd, Mabey & Gill 2004; Ubanchukwu 2006). Wogu and Okaka (2008) studied the socio-economic effect of *Onchocerciasis* in Okpuje, Owan West Local Government Area of Edo state. Theirstudy revealed that 13.5% of the subjects experienced unrelenting scratching which reduced

their strength and resulted in lack of concentration at work, 23.8% spent a lot of money to cure the disease, 14% gave up their jobs while 12.7% were forced out of school.

Geographic Information System has been in use for mapping of diseases for over 50 years (Jenks and Malicki, 2004).Ricketts (2003) unfolded that theFood Safety Office in the Ministry ofAgriculture, Food and Rural Initiatives, Manitoba, Canada, is using GIS to monitor zoonoticdisease patternsand to plan and respond to animaldisease emergencies. Nykiforuk and Flaman (2001) in a study on geographic information system for health promotion and public heaith, revealed that the Public Health Observatory, Saskatoon HealthRegion (SHR), has one of the most advanced publichealthmapping programs in Canada, and has usedGIS in a very innovative and impressive way tomonitor many disease and health issues includingWest Nile Virus, sexually transmitted infections,diabetes, immunization coverage, and the density ofdiscarded needles by injection drug users.

Several attempts have been made in combating *Onchocerciasis* worldwide. Colonial and ex-colonial entomologists attempted formany years to control the disease in the hardest-hitareas, but achieved mixed results. Lasting results provedelusive, because the blackflies cover long distances(exceeding 400 kilometers with the wind currents) andcross national boundaries, rendering uncoordinatednational control efforts ineffective (Benton, 2002). Njoku *et al* (2013) assessed *Onchocerciasis* and the distribution of Ivermectin in Enugu state. They discovered that there was marked reduction in overall prevalent rate of 85.1% to 76.3%. Moreso, female recorded a higher prevalent rate to infection than the males with prevalence rate of 407 (80.3%) and 352 (72.3%) respectively.

The disease has been widely reported in Nigeria, where about 7 million people are infected and another 40 million were at risk of infection (Levine, 2009). *Onchocerciasis* is one of the leading causes of blindness and death in Nigeria (Federal Ministry of Health, 1999). According to United Nations Children's Fund (2009) *Onchocerciasis* is endemic in Kajuru LGA of Kaduna State. The same document recorded that the disease is more prevalent in five wards within the Local Government Area. The wards include: Rimau, Kajuru, Kasuwan Magani, Kufana and Maro wards. This could be due to the dependence on rivers and streams for domestic water supply, which exposes the residents to black flies.

Akinbo and Okaka (2008) investigated the rate of occurrence of *Onchocerciasis*in Edo State. The research revealed that *Onchocerciasis*vary from one geographical area toanother with highest endemicity of 83% recorded in OviaNorth East L.G.A. Also, Akinboye*et al* (2010) researched and reported the occurrence of *Onchocerciasis* in Ibarapa Local Government Area of Oyo state and the results shows that 54.2% of the studied population was infected by the disease. In addition, the same research unveiled that men were more affected by the disease (38%) than women (26.7%).

Hougard (2009) studied the prevalence of *Onchocerciasis* in Bauchi state. Their study showed the prevalence rates of 37.2% and 37.0% at Bundi and Dagan Communities respectively. The same document recorded that prevalence rate in the other communities ranged from 11.1% in Gwaltukuwa to 36.4% in Birnin Ganye. They asserted that perhaps, the high prevalence of self medication with dietylcarbamazine citrate (D. E.C) among residents of Dass and climatic factors could be responsible for the differences in prevalence rate.

The absence of any concrete health facilities other than small inadequately equipped clinics within Kajuru LGA might have posed great difficulty to the infected persons in terms of seeking medical attention when onchocercal symptoms manifest. Also, poverty (which limits available clothing) as well as the inadequate presence of social amenities such as pipe-borne water and good housing facilities even exposes the Kajuru population to the bite of the disease vector; especially those residing near black fly breeding sites FMH (1999). In addition, even with the various ongoing control programmes, a good number of blind people are seen begging for alms at various locations within the local government area as observed by the researcher.

Sequel to the above problem, this researchstudied the prevalence of *Onchocerciasis* in Kajuru local government area, using Geographic Information System, with the aim of bringing to limelight the various scenarios surrounding the occurrence of the disease in the local government area, as no study of such was done before. The research addressed the following research questions:

1. What is the prevalent is *Onchocerciasis*in the study area?
2. What is the pattern of distribution of *Onchocerciasis in* Kajuru ocal government area?
3. What is the trend of the disease in the area from 2008 to 2014?
4. What are the socio-economic effects of *Onchocerciasis* on the residents of the local government area?

1.3 AIM AND OBJECTIVES

The aim of this study is to analyze the prevalence of *Onchocerciasis* in Kajuru Local Government Area of Kaduna State. The specific objectives are to:

i. determine the prevalence of*Onchocerciasis* and in Kajuru local government Area

ii. determine the pattern of distribution of the disease in the area

iii. examine the trend of the disease in the area from 2008 to 2014

iv. examine the socio-economic effects of *Onchocerciasis* in the area

1.4 RESEARCH HYPOTHESIS

The research has the following null hypothesis:

1. There is no significant relationship between river blindness and some socio-economic variables such as educational attainment, occupation, household size, accommodation type and ownership of accommodation.

1.5 SCOPE OF THE STUDY

This study analyzes the prevalence of *Onchocerciasis* in Kajuru Local government area. This research will only cover the wards where the disease is endemic which are: Kasuwan Magani, Kallah, Afogo, Kufana and Maro wards of the local government area. The study considered the effect of the disease in the area through a time period of 6 years (2008-2013). The research analyzed the prevalence of *Onchocerciasis*; pattern of the disease, trend as well as the socio-economic effects of the disease within the area of study. This is because the available records of the disease from 2008 to 2014 in the Health Care Centers are more reliable.

1.6SIGNIFICANCE OF THE STUDY

In the 1970s, when investigations of *Onchocerciasis* in theendemic villages and districts of West Africa began, scientistsmade astonishing and disturbing discoveries. Morethan 60% of the savanna population carried the parasite;10 percent of the adult population and half of the malesover 40 years of age were blind, 30% of the peoplewere visually impaired, and early signs of *Onchocerciasis*were common among children (WHO, 2008). This situation brought untold

hardship to the people, which still persist in recent times. Unless the disease is completely eradicated, it will perpetuate into the future generation.

For any community to develop, the level of productivity of its citizenry is of utmost importance. The productivity of such community would also depend to a large extent on the general health condition of its people. The various cases of blindness and skin infections associated with river blindness among the people of some communities in Kajuru LGA as observed by the researcher, as well as records of distribution of Mectizan tablets in various communities within the LGA are indications that *Onchocerciasis* is indeed a major health problem in Kajuru LGA. This implies that the development of the area in all ramifications is being greatly affected by the disease.

A research into the various scenarios surrounding the prevalence of *Onchocerciasis* in the area will go a long way in providing substantial information regarding the spread and impact of the disease. Thus, the local, state and federal governments as well as international organizations/NGOs, will be better informed of areas of priority in their fight against the disease within and even outside the area. The people of Kajuru LGA will also be better informed on ways of possible avoidance of the disease.

CHAPTER TWO

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1INTRODUCTION

This chapter is segmented into two parts. The first part is the theoretical/conceptual framework while the second part focuses on the review of literature.

2.2 CONCEPTUAL CONSIDERATION

Some pathogens live in the environment and are transmitted to humans either directly or indirectly and their mode of transmission influences which factor inpacts on the spread and overall impact of a specific infection (Edungbola, 1982). The socio-economic (behavioural) environment is one of the ways in which river blindness can be transmitted as seen below.

2.2.1 The Profile of *Onchocerciasis*

Onchocerciasis (river blindness) is a chronic parasitic disease caused by the filarial nematode*Onchocerca Volvulus* (later O. Volvulus), which can live in the human body for about 11-16 years (Cook and Zuma, 2003). It is transmitted through the bite of the blood sucking *simulium* black flies which breeds in fast-flowing rivers. The disease most adverse effect is blindness and thus the name *river blindness*(WHO, 2009). The discovery of the disease is attributed to the studies of John O' Neil who in 1875, while working in the Gold Coast (present day Ghana), associated the microfilariea of O. Volvulus with an irritating popular dermatitis called *craw-craw* in Africa (Cook and Zuma, 2003). Eighteen years later (1893), Leuckart decribed the adult warm of *Onchocerciasis* in subcutaneous nodules and named the parasite

filarial volvulus. In South America, Rodolfo Robles, working in Guatamala, first associated subcutaneous nodules with eye lesions. However, the disease vector was not known until about 32 years later (1926) when Donald Blacklock in Sierra leon discovered the vector to be simulium and as well described the life cycle of O. Volvulus (Okulicz *et al*, 2009).

Today, an estimated 18 million people are infected with river blindness worldwide, with about 270,000 persons permanently blinded and another 500,000 having severe visual impairment. The disease is thus a major leading cause of blindness in the world; fourth after cataract, glaucoma and trauchoma (WHO, 2009).

2.2.2 The Physical Environment

The relationship between man andhis environment is symbiotic. Although, itis generally believedthat the environmentinfluences human activities, theseactivities in turn influence the nature ofthe environment. Physical, social andeconomic factors are very importantfactors that determine the severity of*Onchocerciasis* in any given society. The breeding condition for the disease vector,the nature of social and economicactivities determines the level of contactwith the fly and therefore the intensity ofbites received by an individual at anypoint in time (Hunter, 1980). *Onchocerciasis*is a diseaseof rural communities. Studies have shownthat *Onchocerciasis* is more commonamongfarmers, fishermen, hunters,normads and others who are engaged inoutdoor activities that brings them inconstant contact with the simulium fly(Hunter, 1980).

The spread of *Onchocerciasis* is associated with the location of black flies which are naturally found close to fast-flowing streams and rivers (about 1.1-1.4m/s), in the inter-tropical zones(Hunter, 1980) . Consequently,the disease is mostly found in Africa, in a zone that spreads

from east to west (Cook and Zumla, 2003; WHO, 2009). This band extends between latitude 15°N and 15°S in the west, widening slightly towards the east (Cook and Zumla, 2003).*Onchocerciasis* is also found in six countries of Latin America (Columbia, Brazil, Venezuela, Ecuador, Guatemala and Mexico) as well as in Yemen in the Arabian Peninsula where the disease is believed to have been exported by slave trade (Cook and Zumla, 2003; WHO, 2009).

There are marked differences between forest and savanna *Onchocerciasis* in West Africa. The Savanna *Onchocerciasis* is much more severe as compared to its forest counterpart (Hunter, 1980; Ogunrinade, Boakye, Merriweather and Unnasch, 1999; FMH, 1999). The savanna strain of the disease is more severe than the forest strain (WHO, 2008).

In Nigeria, river blindness manifest as skin rashes in many rural communities within the northern and southern parts of the country. Nigeria hosts the highest number of *Onchocerciasis* patient globally with about 6-8 million infected persons (UNICEF, 2009). As at 2006, Nigeria had an at-risk population of over 28, 000, 000 people living in meso/hyper endemic areas (WHO, 2009). Furthermore, the disease was discovered in Kajuru LGA in 1984 at Agwala (a community drained by River Kaduna) after series of tests were conducted (FMH, 1999) .

2.2.3 The Vector(black fly)

The vector responsible for the transmission of river blindness is the black fly of the simulium specie (Eldryd *et al*., 2004; WHO 2009). Many species and subspecies of simulium flies can act as vectors. Over 28 simulium subspecies exist and transmit *Onchocerciasis* at varying degree of efficacy (FMH, 1999). The flies breed in fast-flowing, well-aerated rivers and streams, with their

larvae attached to submerged vegetation and rocks. Subspecies of the simulium flies have rainforest, sudan (dry) savanna and guinea (wet) savanna as their natural habitat (Eldryd *et al*., 2004).

Members of the *simulium damnosum* complex dominate most endemic areas of Africa, while species of the *simulium naevei* group are responsible for transmission of the disease in East and Central Africa (Hunter, 1980; Cook and Zumla, 2003). Flies of the simulium damnosum complex breed in large rivers or small streams where there is adequate food, oxygen supply and suitable attachment sites such as rocks, sticks, vegetation, etc., submerged in water.

The black fly when fully grown is less than ¼ the size of the housefly (Hunter, 1980). After mating, the female black fly seeks to take a blood meal and afterwards lays her eggs on substrates in swift flowing rivers (Cook and Zumla, 2003; Hunter, 1980). The female fly mates only once in a lifetime which lasts about a month. Also, the fly lays about 250 eggs per oviposition and these will hatch in about 48hrs (Hunter, 1980). Female black flies generally limit their movements within a few kilometers of breeding sites although wind-assisted flights over hundreds of kilometers from one river basin to another may not be ruled out (Cook and Zumla, 2003; Hunter, 1980).

Considering the egg laying capacity of about 250 per oviposition, and a five day gonotrophic cycle, the huge reproductive capacity of similium populations to generate an instantaneous population explosion under the right environmental conditions will be apparent (Hunter, 1980). With a huge reproductive capacity and the common restriction in long distance movement, the flies would bite most intensely in the immediate vicinity. Hence, the human population within

some few kilometers from black fly breeding sites is greatly at risk of infection. This would explain why at the peak of the disease in the 1970s, an estimated 250, 000km^2 of productive river valley were abandoned globally; thereby causing estimated annual losses of $30million (Akande, 2003; WHO, 2009).

2.2.4 The Host (Humans)

Humans are the only known definitive host of *Onchocerciasis* (Eldryd, Godfrey, Mabey and Gill, 2004; Ejere, 2009). The implications of the disease include physical damages to the eyes and skin as well as other socio-economic consequences. People (regardless of racial differences) who reside in areas of endemicity are at risk of infection. Also, rural dwellers are found to be those who are mainly affected (Remme, 2004; Levine, 2009).

On the other hand, the disease generally affects more males than females, although sex-related variations may not be obvious until a patient attains a certain age (Okulicz, Elston, Schwartz, 2009). More so, such sex-related differences are more conspicuous in hyper-endemic areas; especially the savanna (Okulicz*et al* 2009). The reason for the higher prevalence of the disease in men may not be far from their occupational risk of involvement in activities such as; fishing, farming and water navigation which exposes them to the bite of the black fly. Age-wise, river blindness occurrence is minimal within the 0-10 age group and rising sharply to peak within the 20-40 age group especially in ones 30s (Wogu and Okaka, 2008).

Building upon a framework initially proposed byBailey and Gattrell, this study outlined asix step framework for thinking about how tosuccessfully and realistically implement a spatialanalysis project in a public health context (Botton *et al*, 2005)

Step 1: Data Conceptualization

In the first step, data conceptualization, it is criticalto formally identify the types of spatial patterns oneis looking for, the relationships one expectsbetweenpredictor and outcome variables, and whyone would expect these to occur, drawing upontheoretical frameworks and previous studies. Thiswill help ensure that the project is nothaphazardlyorganized and to ensurethat the analytical processes areimplementedsystematically in order to answer particularquestions or to test certain hypotheses. This stage isalso critical for ensuring that all of the required datasources, analytical tools and skill sets for the projectare identified on the front end. This step mayrequire participation by content experts and anextensive review of the public health literature.

Step 2: Data Acquisition and Preparation

In the second step, data acquisition andpreparation, the data sets required for the spatialproject are acquired and assembled. This stagerequires significant skill in both database and GISanalyses in order to geocode health data sets to thetarget geographies to be used in the analysis, togenerate the required age-standardized andsmoothed rates for small geographic areas, and todevelop the predictor files that can be linkedgeographically to case data.

Step 3: Data Visualization

Data visualization, the third stage, aims to create aset of maps illustrating potentially important spatialpatterns in the outcome and predictor variables.This is the stage that is probably most familiar topublic health practitioners. It is also one of the mostimportant because it generates spatial patterns thathave perhaps never been observed before, andallows program and policy makers to combine whatthey know about local geographic areas with thepatterns on the map in order to generatehypotheses and ideas about what may be going on. Maps can also be very

powerful tools topique the interest of policy makers and the public.As indicatedpreviously, creating meaningful mapswhere the health concern varies by age, and wheredata are sparse because of small population andcase counts, may require that the data be spatiallymoothed and age standardized before beingmapped.

Step 4: Data Exploration

Unfortunately, many practitioners never go beyonddata visualization to the fourth stage, data exploration. In this stage the objective of theanalysis is to explore the statistical characteristics ofthe spatial patterns that were created in datavisualization . It is first important todetermine if disease patterns are real and not dueto random spatial variation. What may appear to bemeaningful spatial patterns on a map may havearisen because of random spatial variation (oftendriven by small numbers) and it is critical to ensurethat spatial hot spots and clusters areunlikely tohave occurred by chance alone.A second major activity in the data exploration stageis to use statistics such as the Gini Coefficientdescribed earlier to determine the public healthsignificance of observed spatial patterns and whatcould be potentially achieved using high risk vs.population based public health program strategies.

Step 5: Data Modeling

In the data modeling stage, the relationshipbetween predictor and outcome variables isassessed. Often practitioners will create andcompare separate maps of predictors and outcomesin order to try to identify relevant relationships.However, this approachis very haphazard and muchless efficient than developing either simple orcomplex statistical models which summarize thespatial relationships between outcome andpredictor variables. This stage can use a varietyof simple statistical techniques such as ordinaryleast squaresregression or logistic regression or canmove onto more complex modeling techniqueswhich take into account (and control for) the

spatialstructure of the data. One of the criticisms of spatial modeling is that itcan result in what is referred to as the “ecologicalfallacy” which results from the fact that both healthoutcomes and predictors are aggregated to the levelof geographic areas for the purposes of mappingand modeling .

As noted earlier, detailedsocio-demographic and environmental data areusually not resident on the health record, so inspatial analysis the cases are often attributed withthe characteristics of the small geographic areasthat they fall into. Asa result, it would be a mistake to make statementsabout the relationship between predictors andoutcomes at the level of the individual; rather it isimportant to express spatial modeling outcomes atthe level of the population.It is important to note however, that when smallgeographic areas are used for ecological modelingpurposes,ecologically derived measures of socioeconomicstatus perform similarly to individuallyderivedmeasures of socio-economic status.

Step 6: Data Dissemination

In the final stage, data dissemination, the results ofspatial analyses are distributed to end-users. Thisoften occurs via the use of static paper-based mapsand tables. However, interactive maps can bepublished out to software programs such as AdobeAcrobat and Google Earth which allow the end-userto interact with and explore the spatial data inuseful ways including the ability to turn layers onand off, identify features, and to measure distances.The production of full web-based mappingapplications is becoming much easier these dayswith the development of the on-line publishingtools now available through the ESRI ArcGIS On-Line. Some Pathogens live in the environment and are transmitted to humans either directly or indirectly, and their mode of transmission influences which factors impacts on the spread and overall impact of a specific

infection (Hunter, 1980). The socio-economic (behavioral) environment is one of the ways in which river blindness can be transmitted as seen below.

2.3 LITERATURE REVIEW

2.3.1 Prevalence of River Blindness

River blindness is a perniciousdisease that afflictsapproximately 42 million peopleworldwide, with most of its victims residingin Sub-Saharan Africa (Richardsand Boatin, 2001). The authors argued thatprimarily a rural disease, *Onchocerciasis*disproportionately burdens theinhabitantsof some of thepoorest and most remote areas in Africa, Latin America and Yemen. In the most endemic areas, more than onethird of the adult population is blind, and infection caused by the disease often approaches 90% of the population (Keller, 2010). There have been a number of studies on the prevalence of river blindness. Investigation by WHO (2004), revealedthat About 17.6 million people all over the world are infected with thedisease, out of which one million are totally or partially blind.

More than 95% of *Onchocerciasis* infected persons arein Africa (Shelley, 2002), and Nigeria is the most endemic country in theworld, harbouring about 60 % of all *Onchocerciasis* cases in WestAfrica (WHO, 2005) and 30% to 40% of all cases in the world (CarterCentre, 2009). Ogunirade *et al* (1999) researched on the prevalence of river blindness in Kwara State rural communities. The researchers discovered an average prevalencerate of about 64% in the rural communities. Particularly, a highprevalence rate of about 68% has been reported in Patigi area(Levine, 2009), thus making it the most endemic partof Kwara State. In fact, 100% prevalence was recorded in somecommunities in Patigi area. The fact that Nigeria is the most

endemiccountry in the world for *Onchocerciasis* has prompted the Federal Ministry ofHealth in the country to embark on control measures (Ejere, 2009).

According to WHO (2010) the prevalence rate of *Onchocerciasis* in the South Eastern part of Nigeria is alarming. The overall prevalence of onchocerca infection was 27.7 % and wassimilar for boys (28.4 %) and girls (26.9 %). Prevalence increased with age for both sexesfrom 24.6 % among 5-9 year olds and 27.7 % among 10-14 year olds.

Shelley (2002) conducted a study on the prevalence of *Onchocerciasis* in Ogun state. The result of the study showed that there was an overall prevalence of 27.71% among the communities studied. Olokemeji community had the highest prevalence(38.9%) while the lowest was found at Aba Bio (2.2%) community.

2.3.2 Pattern of River Blindness

Botto *et. al.*(2005) studied the relationship between the transmissions of *Onchocerciasis* in Southern Venezuela using GIS. Striking differences in the transmission dynamics of *Onchocerciasis* among rivers were detected. The study also showed a significant relationship between *Onchocerciasis* and temperature, geologic substrate and vegetation. Louise *et. al.*(2015) studied some previous highly endemic areas of Senegal and Mali in the basins of Gambia, Bakoye and Faleme rivers, where it was demonstrated that between 15 to 17 years of twice annual treatment reduced the prevalence to zero in most communities.

Mounkaila *et. al.*(2014) used GIS and Remote Sensing to study the geographic distribution of *Onchocerciasis* in the 20 participating countries of the African Programme for *Onchocerciasis*Control. 576, 368 persons were examined, of which 22% had palpable

onchocercacal nodules. The prevalence of onchocercercal nodules varied significantly between villages and countries. The study showed that a maximum prevalence of the disease per village varied from 4.8% in Kenya to 100% in 5 countries (Cameroon, Central African Republic, Democratic Republic of Congo, Tanzania and Uganda). For Gabon, Kenya and Rwanda, the highest prevalence of nodules per village was between 4.8% and 16.2% i.e., everywhere below the high risk threshold of 20%.

2.3.3 Trend of River Blindness

Onchocerciasis, a pernicious disease has been combated globally since 1974 through various programmes (OPEC Fund, 2006). In Africa, the disease has been studied over time. Abiose (1994) asserted that at the start of the*Onchocerciasis* control programin 1974, nearly 2.5 million of the programs' area30million inhabitants were infected, and approximately100,000 were blind. The same document contains that some 1.5 million peoplewho once were infected with the disease no longerexperienceany symptoms and 22 million childrenborn in the area since the program's inception arefree from the risk of river blindness. Hougard (2001) investigated the control of river blindness in West Africa. The finding of the research unfolded that in Testingof the trend in underlying incidence during 1989–2001, by useof a modified form of equation, revealed a statistically significant increasing trend in incidence.

Amazingo (2007) studied the control strategies of *Onchocerciasis* in Burkina Faso. The findings of the study were that before the beginning of vector-control operations in 1989, 66.9% of the individuals examined had ocular problems. In March 2000 (i.e., 11years after the definitive cessation of insecticide spraying), it was observed thatthe disease was no longer present in the eye cornea of the examined persons, which means the disease had virtually disappearedafter 10 years of vector control. Clearly, *Onchocerciasis* showed a downward movement over time.

2.3.4 Socio-Economic Effect of River Blindness

In much of Africa marriage and fertility areclosely associated with respect, happiness, andsecurity in old age. A study conducted by Amazigo*et al* (2002) in east Nigeria showed thatgirls appeared to be more disadvantaged than boysbecause of their greaterdependence on physicalappearance for social acceptance, marriage andwell-being.

Amazigo*et al* (2002) also documented the socialimpact of Onchocerca Skin Disease(OSD) on women in Eastern Nigeria. It was discovered thatthoseaffected appear to marry at a later age and weantheir children sooner than those without skinlesions. The same document recorded that during in-depth interviews and focus groupdiscussions, restlessness while breast-feeding; jointpain, backache, and fatigue due to incessant itchingfrom lesions were the predominantly mentionedreasons which motivated an infected mother todiscontinue breast-feeding

Wogu (2008) studied the economic productivity of people infected with river blindness in eastern Nigeria. Findings obtained from theresearch, showed that as a result ofgeneral weakness, body pains, joint pains, andheadache associated with itching, the personalproductivity of 67% of *Onchocerciasis*-affectedindividuals was reduced.

Another study by Peters (2004) showed that thedebilitating effects of dermal and ocular*Onchocerciasis* led toconsiderable loss of workingtime due to attendance at hospitals and clinics fortreatment. Thus, working efficiency is reduced bothdirectly and indirectly.

According to the results of a research by Evans (2004), about farmland size and onchocercal skin disease in northeast Nigeria,farmers with *Onchocerciasis* had an overall lower standard ofliving, as indicated by fewer personal wealthindicators such as owning motorcycles, radios, ironroofing and cement-plastered houses. Furthermorethese farmers did not seem to have

developedalternative cropping strategies such as diversificationor choice of less demanding crops. Onecould therefore conclude that individuals with *Onchocerciasis*had reduced holdings under cultivation anddemonstrated a real inability to work as strenuouslyas people without obvious signs of the disease.

WHO (2004) reported a research on the impact of *Onchocerciasis* on children's education in Northern Nigeria. The study revealed that the risk of becoming non-attenders wastwice as high if the head of their household had*Onchocerciasis*than if the head was unaffected.

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1INTRODUCTION

This chapter briefly describes the geology, drainage, climate, soil, vegetation as well as the socio-economic activities of the study area. It also describes the nature and type of data needed for the achievement of the stated research objectives (in chapter one). Also, the various methods utilized in collecting, collating, analyzing and presenting data for the research work are discussed here.

3.2 THE STUDY AREA

3.2.1 Location and Size

The LGA lies between Latitudes 10° 00'N and 10°37'N of the equator and Longitudes 7°35'E and 8°15'E of the prime meridian covering a total landmass of about 2,464 km^2 (KDSG, 2009).It is bounded by Igabi LGA to the north, Chikun LGA to the North-West, Kachia LGA to the South and South-West, Zangon Kataf LGA to the South and Kauru LGA to the East (KEPA, 1999). Kajuru LGA is one of the twenty-three (23) LGAs of Kaduna states. It was carved out of Chikun LGA in 1997 by the then military government of Gen. Sani Abacha (Kaduna State Government (KDSG), 2009). The newly created LGA took off with two districts namely Kufana and Kajuru. Twelve (12) districts were subsequently created out of the two existing ones, thus bringing the total number to fourteen (14**).** These districts as presently obtainable are; Kufana, Idon, Afogo, Maro, Kutura, Angwan Aku, Kyamara, Dutsen Gaiya, Kasuwan Magani, Rimau, Kallah, Iri, Kajuru and Buda. District heads are responsible for the administration of these

districts and are answerable to the Chief of Adara Land; the *Agom-Adara* with the exception of Kajuru and Buda districts which are under the control of Kajuru Chiefdom.

The Local Government Area consists of ten (10) wards namely; Kufana, Maro, Idon, Kallah, Kasuwan Magani, Kajuru, Buda, Rimau, Afogo and Tantatu. The LGA is administered by the Chairman and the Vice-Chairman while the various wards are represented by councilors.Kajuru LGA is one of the twenty-three (23) LGAs in Kaduna state; North-West, Nigeria. The LGA is located within the Kaduna Central Senatorial District and almost at the heart of the state. See figure 3.1.

3.2.2 Geology and Relief

Kajuru LGA is generally a lowland area characterized by extensive plains often intercepted by inselbergs. As in most parts of Nigeria, the surface rocks within Kajuru LGA are of the basement complex of crystalline rocks which forms parts of the African continent. It has been observed that these crystalline rocks include those carrying minerals such as tin, stone, columbite and gold (Iloeje, 1981).

Isolated granitic hills are more common in the north-western and south-eastern parts of the LGA while some little alluvial deposits occur within the major drainage channels in the area. These hills possess heights ranging from 150m above sea level around the northern half to around 500m above sea level in the extreme south-eastern part which borders Kauru LGA and as well close to the Jos Plateau region (Yerima, 2009).

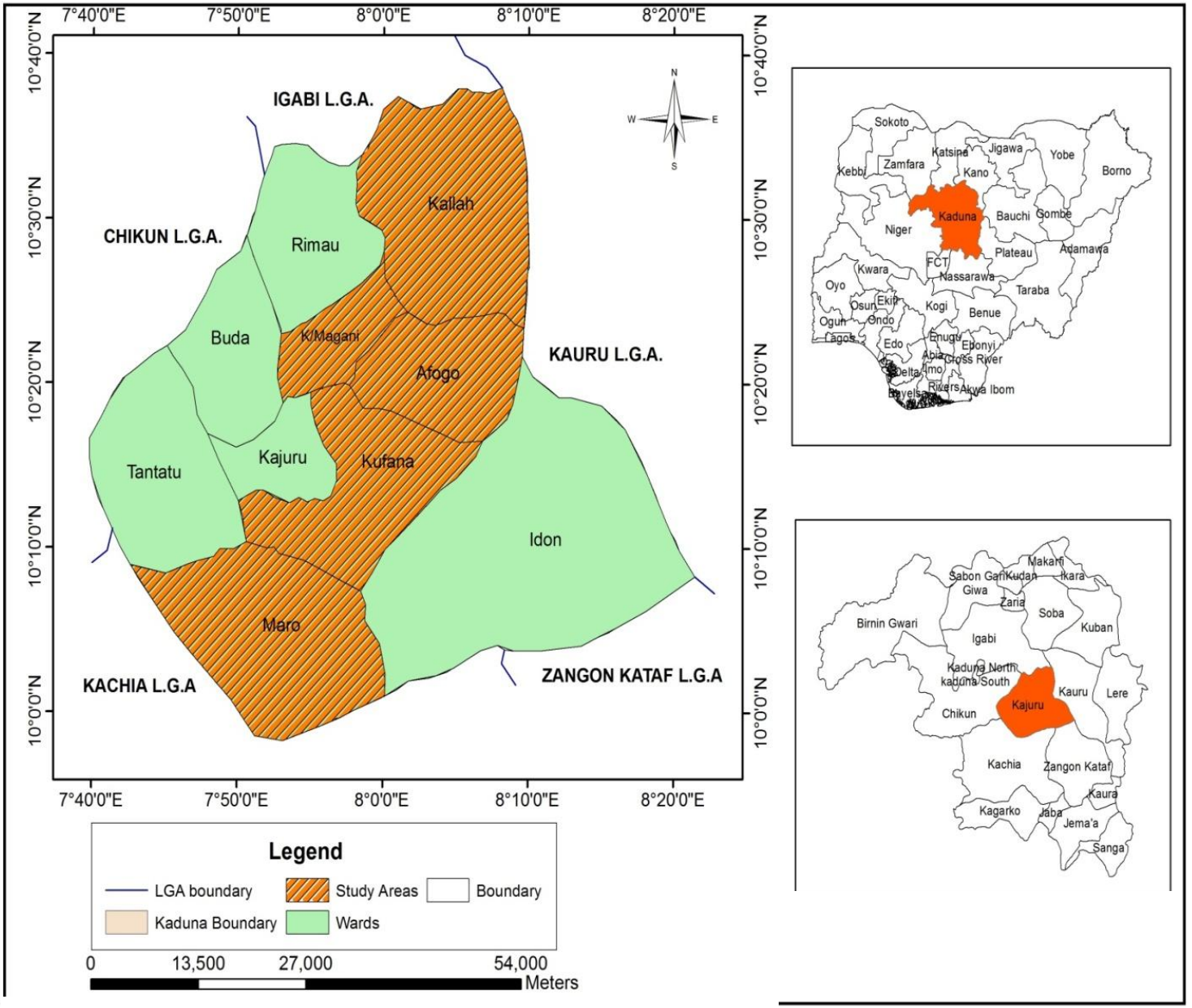


Figure 3.1: Kajuru Local Government Area

Source: Adapted and modified by Author, 2014

3.2.3 Drainage

Kajuru LGA is drained by several rivers and streams. Notable among them are river Kaduna, River Iri, River Romi among others. River Kaduna appears to be the primary and most extensive river draining the area (Yerima, 2009). The River enters the LGA through its eastern border and leaves through its northern border into Igabi LGA. Other rivers such as River Romi and River Iri are smaller and drain the western part of the LGA. (Yerima, 2009).

These rivers are characterized by rapids and flow very fast; hence serving as good breeding sites for black flies (Yerima, 2009). Most of the rivers and streams draining the area are seasonal; although the Kaduna River hardly dries up completely due to the virtual constant supply of water all-year-round from its source in the Kagoro Hills(Yerima, 2009). The rivers and streams that drain the LGA are being utilized for fishing activities especially in Agwala and Maro (Field Survey, 2014). Furthermore, navigation with small canoes occurs over some of these rivers especially during the wet season when communication between some communities can only occur through water transportation.

3.2.4 Climate

Kajuru LGA is located within the transitional zone between the wetlands of southern Nigeria and the arid lands of northern Nigeria. It is therefore an intermediate location with climatic conditions not different from what is obtainable within the northern guinea savanna belt which it belongs (Iloeje, 1981). The LGA experiences an average warm temperature throughout the year which ranges between 25°C-32°C with little annual variations but rather diurnal. Also, the LGA experiences its highest temperatures in April when the wet season begins while the lowest

temperatures are recorded around December through January during the *harmattan* period (Kaduna State Ministry of Economic Planning (KADSMEP, 2004). However, average temperature ranges are slightly lower as compared to that obtainable in Kaduna Township. This may not be far from the fact that the area is rural and thus air pollution is minimal as its purification is enhanced due to the occurrence of extensive vegetative cover in most parts of the LGA.

In relation to moisture, two distinct seasons exist; the wet and the dry season. The wet season begins around April through the first week of October; thus spanning for a period of about six (6) months (Kaduna State Government (KDGS,2009). Average rainfall ranges between 1200mm to 1500mm annually. Rainfall is usually at its peak in August (reaching 2000mm) thereby leading to some rivers and streams bank overflows and thus poses difficulty in communication between communities bounded by such water bodies. Intense flooding is however not common in the area (Field Survey, 2013). Also, the dry season begins in the last week of October through early April the following year. The dry season is at its peak around January when the severe dry dust-laden *harmattan* wind from the extreme north overwhelms the area.

3.2.5 Soils and Vegetation

Most of the soils within Kajuru LGA are products of the weathering of the crystalline rocks of the Precambrian basement complex found within the area. Just as in most tropical regions, ferruginous soils prevail in most parts of the area and are utilized for the cultivation of cereals and cotton (KDSG, 2009). Due to leaching and poor cover management, the soils are poor in fertility and thus depend greatly on manure and fertilizer application for its fertility (KADSMEP,

2004). Also, in the *fadamas*, the dark grey clay soils (vertisols) dominate and have become highly valued for intensive agricultural activities especially during the dry season. Also sandy soils often occur around river valleys and streams.

Kajuru LGA lies within the guinea savanna vegetation belt of northern Nigeria which comprises of grasslands and woodlands (Iloeje, 1981). As in most parts of Nigeria, the primary vegetation of the LGA have been tampered by man's activities such as bush burning and land clearance for farming, construction among other purposes. Thus, what is presently obtainable in most parts of the area is derived or secondary vegetation.

Furthermore, a vast part of the area is covered by grasses and shrubs with a few sparsely distributed forests which are mainly secondary. Areas where such forests exist include, Kasuwan Magani, Kutura, Agwala, Maro, and Doka – which harbours the government forest reserve. Gallery forests are also common around river valleys especially in Agwalla and Maro communities (Yerima, 2009). The vast grasslands are continually utilized for crop cultivation especially during the wet season while the forest trees are continually fell by the natives for firewood.

3.2.6 The People

In the 2006 population census, the population of Kajuru LGA was put at 110, 868, with 55,712 males and 55,156 females thus indicating an excess of males over females (National Bureau of Statistics (NBS), 2008). With a landmass of about 2,464 km², Kajuru LGA has a population density of about 45 people per square kilometer. This suggests that the area is sparsely populated.

3.2.7 Economic Activities

Over 80% of the active population in Kajuru LGA are farmers who engage mainly in the cultivation of cereals especially maize. Rice is also cultivated in *fadamas* around the streams and rivers that drain the area (KADSMEP, 2004). Other cultivated crops include, sorghum, millet and to some extent vegetables especially tomatoes and pepper. As aforementioned, the large expanses of grasslands are being utilized for the cultivation of these crops. Also, small backyard farms are utilized for planting vegetables and the development of seedlings which are later transplanted in the main farms usually far away. During the dry season, irrigation farming is practiced along the banks of rivers and streams but at a lower degree (Field survey, 2013).

Livestock such as cattle, chickens and goats are reared by a good number of the natives in the LGA. The nomadic Fulanis who are mainly located in Doka and Agwala communiies are the major people involved in intensive cattle rearing within the LGA. In most cases, children of school going age are responsible for the rearing of these cattle as well as the handling of some farming activities (Field survey, 2013). Also, fishing activities occur in areas drained by streams and rivers especially in Agwala and Maro communities.

In addition, mining activities occur at various locations within the LGA. Examples of mined minerals include; kaoline, quartz, cassiterite, among others. More so, small-scale chalk industries exist in the area as well as quarrying activities (Field survey, 2013). Kajuru LGA has a few tourist attraction sites such as the Ludo hill in Afogo ward, the Kajuru Castle in Kajuru ward among others.

3.3METHODOLOGY

This section discusses the various methods that were employed in obtaining data for the study as well as processing and analyzing the data. The section focused on the types of data needed, sources of data, the sampling design and the methods of data analysis. A reconnaissance survey has been conducted to provide adequate understanding of the study area.

3.3.1 Reconnaissance Survey

A reconnaissance survey of the study area was conducted in order to have a good knowledge of the area. This aided the researcher in getting acquainted with the area and helped in gaining insight into the research problem under investigation and the probable sample size used.

3.3.2 Types of Data

The above objectives required data on the following:

(i) prevalence of *Onchocerciasis*

(ii) coordinates of the endemic communities

(iii) base map of Kajuru Local Government Area; 1: 500,000

(iv) economic productivity: income generation capacity and healthcare expenditure

(v) socio-economic variables: sex, age, occupation, marital status, educational attainment

3.3.3 Source of Data

There are two sources of data, namely: primary and secondary sources of data. However, this research only utilized primary source of data.

3.3.3.1 Primary Source of Data

The researcher employed the use of questionnaire in eliciting data for the research. This included relevant and well structured questions, which were aimed at complimenting the study. The questions were as following: prevalence of *Onchocerciasis*, job promotion, income generation capacity, health care expenditure, occupation, marital status, and educational attainment. Data on time of infection and number of infected persons were sourced from hospital records.The use of GPS was employed to obtain coordinates of the location of endemic communities within the sampled wards. Hospital record was also used to obtain data on number of river blindness cases, month and year of infection. **L**iterature materials were obtained from Journals, published books and the internet.

3.3.4Sampling Technique and Sample Size

Kajuru Local Government Area has a projected population of 119987 by 2013. It was projected from the 1991 population census figure of 62,002. The Local Government Area is made up of 10 Wards, of which only five wards were considered. These wards are endemic, therefore selected purposively. Table 3.2 captures all the wards within the Local Government Area, the 1991 population figures for the wards and the projected population for 2013.

Table 3.1:Wards in Kajuru Local Government Area

S/N	Ward in Kajuru LGA	1991 population	Projected population for 2013
1	Afogo	5313	10271
2	Buda	3601	6961
3	Idon	6524	12625
4	Kajuru	4375	8464
5	Kallah	6066	11742
6	Kasuwan magani	9339	20255
7	Kufana	10461	18081
8	Maro	7023	13591
9	Rimau	5596	10832
10	Tantatu	3704	7165
	Total	**62002**	**119987**

Source: Author' analysis, 2014

To determine the sample size for this research, Krejcie and Morgan (1970) method of determining sample size was adopted which states that; for an area with a population between 75,000-999,999, the sample size to be used is 382. Since the projected population of the study area (132,608) falls within the range, the sample size of 382 was adopted.

Table 3.2: Sampled Wards in Kajuru Local Government Area

S/N	Ward	Projected Population, (2013)	Percentage of the population (%)	No. of Respondents
1	Afogo	10271	14.1	54
2	Kallah	11742	15.7	60
3	Kasuwan magani	20255	27.2	104
4	Kufana	18081	24.5	93
5	Maro	13591	18.6	71
	Total	**73940**	**100.0**	**382**

Source: Author' analysis, 2014

The 1991 population figures for each of the sampled wards were adopted and projected to 2013 at 3.1% population growth rate (for Kaduna state) as seen in Table 3.2. Questionnair was distributed proportionate to population size. The size of the sampledpopulation of each ward was determined with the formula bellow:

$\frac{n}{N} \times Q$

Where: n = population of ward

N = total population of wards

Q = total no. of questionnaire = 382

3.3.5Method of data analysis

Prevalence of *Onchocerciasis* in the study area was determined by processing the data obtained from hospital recordsin SPSS 16.0. The result was presented in tables. Prevalence rate of the disease was judged according to Mcmahun (1988) standard that the *Oncocerciasis* programme classified levels are sporadic, hypo, meso and hyper-endemic on the basis of the standardized mf prevalence being <10%, 10-29%, 30-59% and 64% respectively.

The pattern of distribution of *Onchocerciasis* within the area was mapped.The base map of the study area was digitized in the ArcMap10.0 environment. Shapefiles were created on the ArcCatalog to contain organized spatial data such as polygon and line features. The geographic coordinates of the endemic communities which were acquired using the GPS, were inputted into the Micro-soft Excel and uploadedinto the GIS environment. The polygon features (communities) were overlaid on the digitized map of Kajuru L.G.A. Chloroplate map was used to show endemic areas of the disease within the study area.

The trend of *Onchocerciasis* in the area was examined by processing hospital record (onchocerca cases, month and year of infection) in Microsoft Excel 2007. Time series technique was used to show the trend of the disease over time in the study area.

The socio-economic effect of the disease in the area was examined by processing data obtained from the questionnaire in SPSS 16.0. Logistic multiple regression was used to analyze the relationship between socio-economic variables and the effect of *Onchocerciasis*. The results were presented in tables.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter is categorized into three major sections. The first section deals with the prevalence of *Onchocerciasis* based on Hospital records. The second section deals with the socio-economic characteristics of the respondents while the third section is majorly concerned with the perception of the respondents on the prevalence of *Onchocerciasis*.

4.2 PREVALENCE OF RIVER BLINDNESS

This section deals with the prevalence of river blindness within the study area. The results presented in this section are based on the Hospital records obtained from the general Hospital Idon, Kajuru LGA and the geographic coordinates acquired from the field.

4.2.1 Cases of River Blindness

Table 4.1 deals with the cases of river blindness in the endemic wards of Kajuru LGA, from 2008-2013. This result is based on the data obtained from Hospital records.

Table 4.1: Cases of River Blindness by Ward from 2008-2013

WARD	NUMBER OF CASES	PERCENTAGE
Maro	38	33.62
Afogo	26	23.03
Kufana	31	27.43
Kallah	11	9.73
Kasuwan Magani	**7**	6.19
Total	**103**	**100**

Source: Author' analysis, 2014

Table 4.1 shows that the cases of river blindness varied across the wards under study. The disease is meso-endemic in Maro ward with a prevalence level of 33.62% while is hypo-endemic in Afogo and Kufana wards with prevalence levels of 23.03% and 27.43% respectively. River blindness is sparse in Kasuwan magani ward with a prevalence level of 6.19%. The prevalence levels of the disease fell within the ranges of levels of prevalence of river blindness established by Mcmahun, 1988 that when prevalence is <10% the disease is said to be sporadic; when prevalence is between 10%-29% the disease is hypo-endemic; when it is between 30%-59% the disease is said to be meso-endemic and when it is over 64% it becomes hyper-endemic.

4.3: PATTERN OF RIVER BLINDNESS

Figure 4.1 shows the distribution pattern of *Onchocerciasis*within the study area. Figure 4.1 shows that river blindness is more endemic in Maro ward than in any of the wards under study. Kufana and Afogo wards are next in terms of endemicity while endemicity in Kallah ward is relatively low. Kasuwan magani ward is the least in terms of endemicity of river blindness.

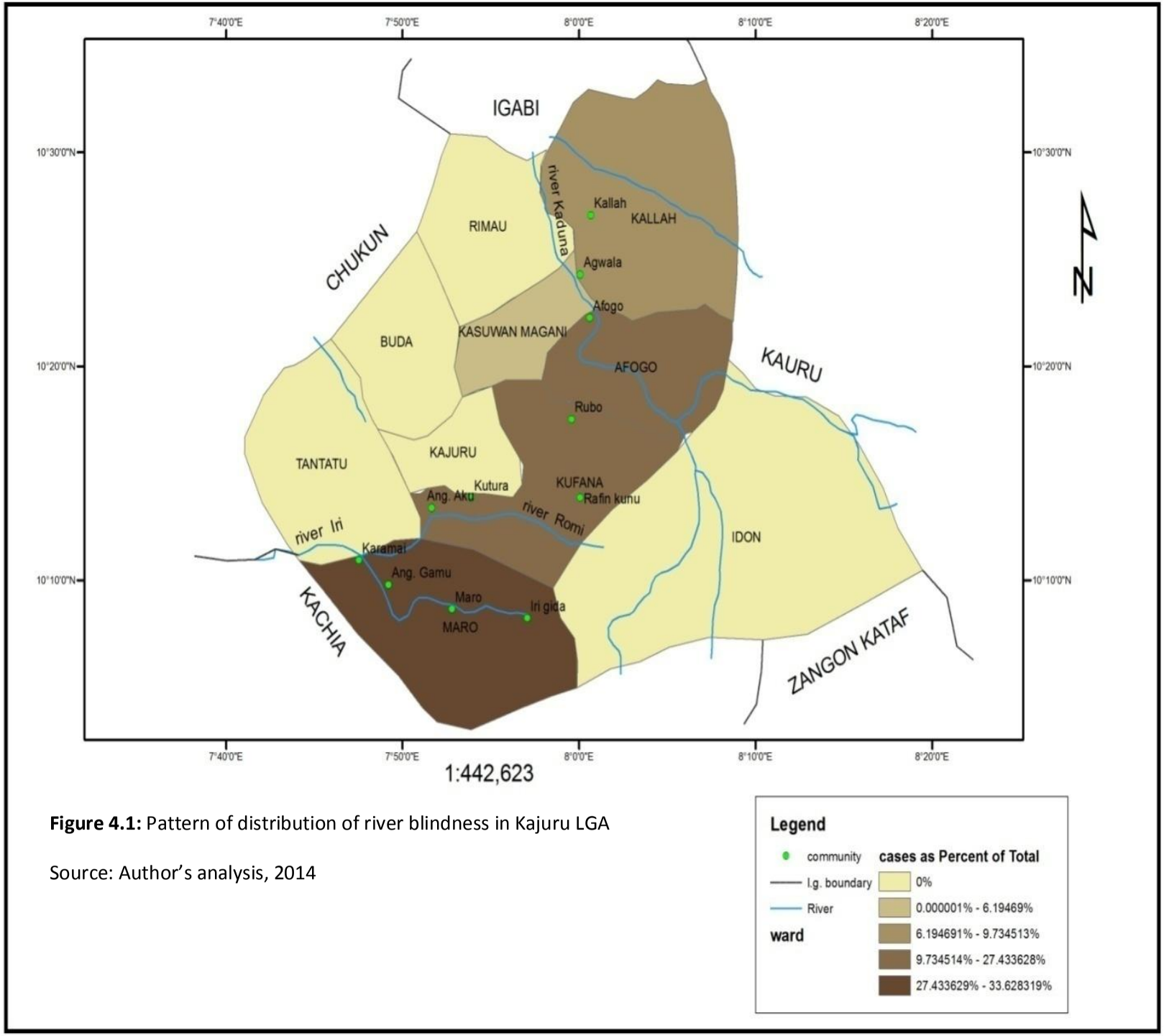


Figure 4.1: Pattern of distribution of river blindness in Kajuru LGA

Source: Author's analysis, 2014

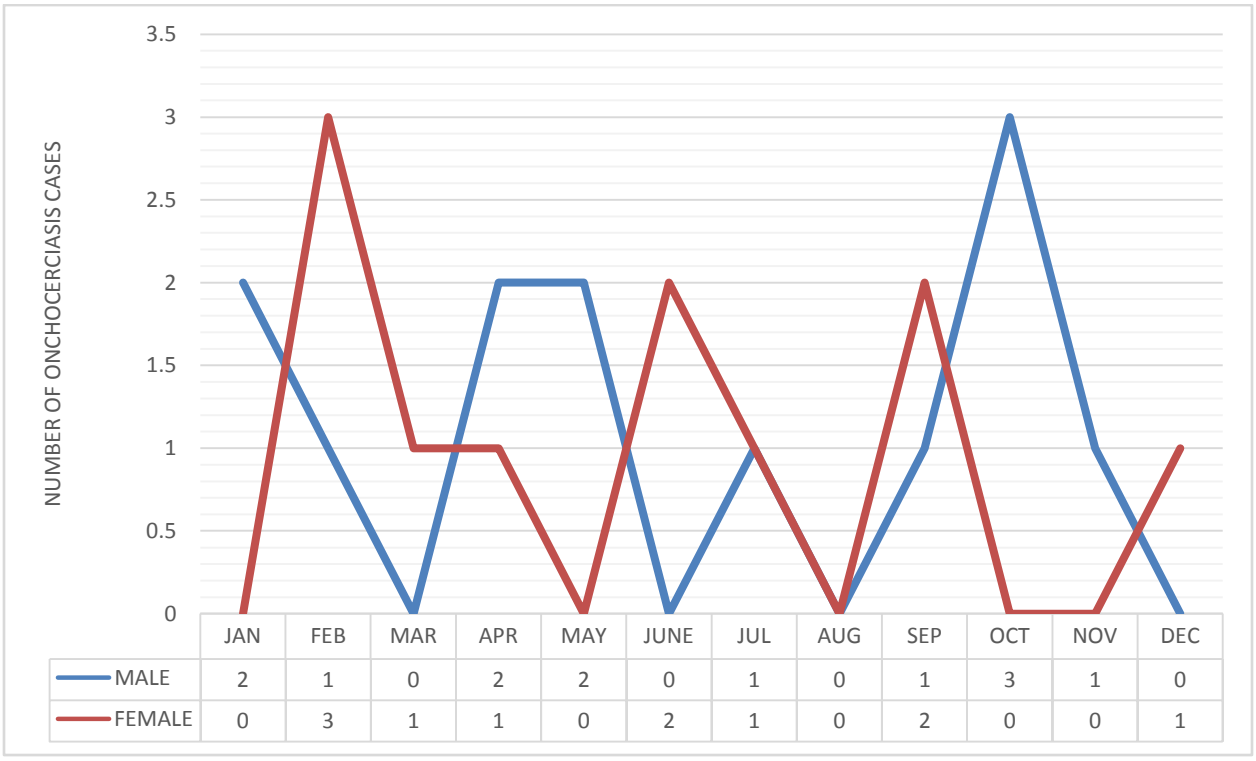
It could therefore, be said that Maro ward is most endemic with river blindness because most of the communities within the ward are located along River iri which trasverses the ward and the communities depend on the river for water supply. As such, the residents of the communities are more exposed to the bite of black flies, especially during farming and fishing activities. Communities within Afogo and Kufana wards are not too close to the rivers that trasverse them, as such, residents of these wards could be less exposed to the bites of black flies, hence the endemicity of the disease in the wards is relatively low. In addition, the endemicity of river blindness in Kasuwan magani is low. This could be as a result of the wide distance of the communities within the ward from the river as seen in figure 4.1

4.4 TREND OF RIVER BLINDNESS DURING THE STUDY PERIOD (2008-2013)

The trend of river blindness within the period of study (2008-2013) is considered for each year as shown in fig 4.2. These results are based on Hospital records.

4.4.1 Trend of River Blindness in 2008

Fig. 4.2 shows the trend of river blindness in 2008 for both males and females within the study area.



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
MALE	2	1	0	2	2	0	1	0	1	3	1	0
FEMALE	0	3	1	1	0	2	1	0	2	0	0	1

Figure 4.2: Trend of River Blindness in 2008
Source: Author's analysis, 2014

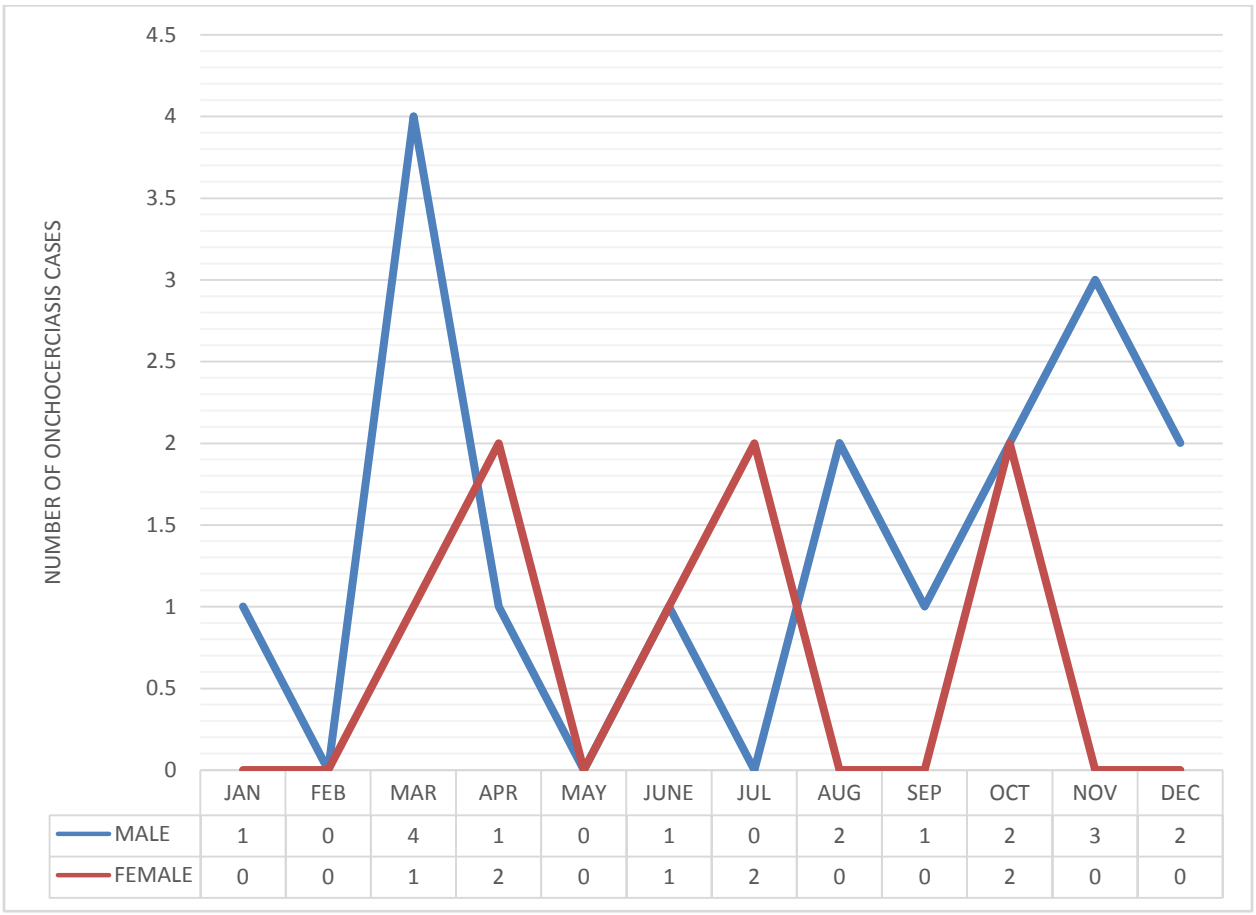
Figure 4.2 shows that in the month of January, 2 cases of river blindness were reported for male and non for the female folks while in February, there was an upward movement in trend for female as 3 cases were recorded and only 1 was recorded for the male. For the month of March, the number of cases for male declined from 1 in the month of February to 0 in March. Similarly, there was a decline in the trend for the female from 3 to 1 case in the month of March.

In April and May, there was steady increase in the number of cases from 0 in March to 2 for male, like wise for the female; the trend maintained the same level from March to April, except that it declined in May to 0. However, for the male folks, there was a decline from 2 in May to 0 cases in June while the trend took an upward dimension from 0 in May to 2 cases in June for the female folks. For the months of July and August, there were a few reported cases of river blindness for both sexes as in 1 and 0 case of the disease. However, there was an upward movement in pattern for the male from 0 case in August to 1 case in September and then 3 in October unlike the case for the female folks which shows an increase in the number of cases from 0 in August to 2 in September with a sharp decline to 0 in October.

On the other hand, there was a sudden decline in trend for the male from 3 reported cases in October to 1 in November and no case of river blindness was reported in December. However, there was no case among females in October and November except for the slight increase to 1 reported case in December. It could be deduced from the graph that the female and the male gender recorded highest number of cases (3) of *Onchocerciasis* in the months of February and October with steady records in July (1) and August (0).

4.4.2Trend of River Blindness in 2009

Fig. 4.3 shows the trend of river blindness in 2009. It is basically the trend for both males and females on a monthly basis within the study area.



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
MALE	1	0	4	1	0	1	0	2	1	2	3	2
FEMALE	0	0	1	2	0	1	2	0	0	2	0	0

Figure 4.3: Trend of River Blindness in 2009

Source: Author's analysis, 2014

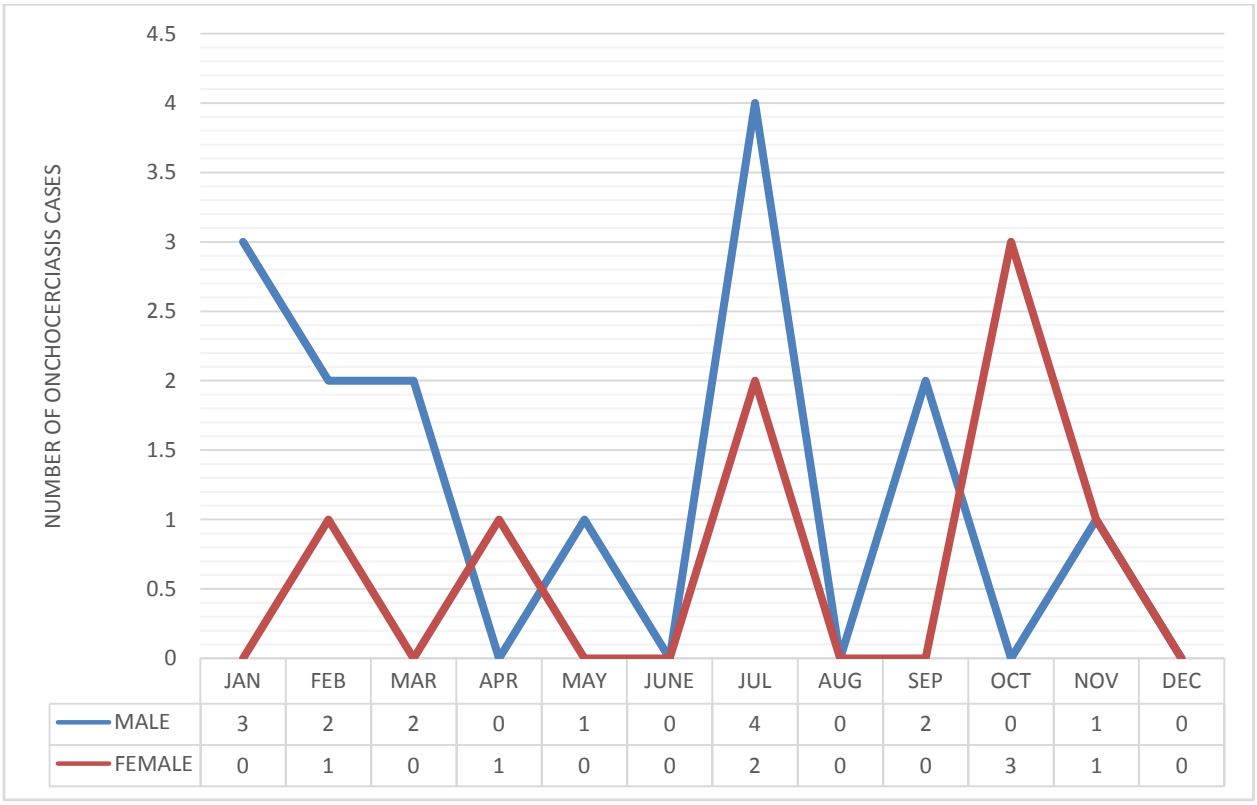
Figure 4.3 shows that in the month of January, the number of reported cases of river blindness for male was 1 and no cases of the disease was reported in February. No case of the disease was recorded for the female in the months of January and February. In March there was a

phenomenal increase in the number of cases to 4 but sharply declined to 1 in April for the male folks. However, there was a slight increase to 1 and then 2 cases in the months of March and April with respect to the female folks. Both genders did not record any case in the month of May, but the trend inclined in June where only one case of the disease was recorded for both sexes. In July, the number of case of the disease dropped to 0 and raised to 2 in August and slightly declined to 1 in September for the male while for the female, there was a slight increase in the number of reported cases to 2 in July but sharply declined to 0 in August and September.

In October, the number of reported cases of river blindness for the male increased slightly to 2 and then 3 in November with a further decline to 2 in December. However, the trend for the female experienced a phenomenal increase in the number of reported cases of the disease to 2 in October with a sharp decline to 0 in the months of November and December. Therefore, the trend shows that the number of Onchocerciosis cases was recorded highest in the month of March among the male folk and lowest for both sexes in February and May.

4.4.3 Trend of River Blindness in 2010

Fig. 4.4 shows the trend of river blindness in 2010 for both males and females within the study area.



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
MALE	3	2	2	0	1	0	4	0	2	0	1	0
FEMALE	0	1	0	1	0	0	2	0	0	3	1	0

Figure 4.4: Trend of River Blindness in 2010

Source: Author's analysis, 2014

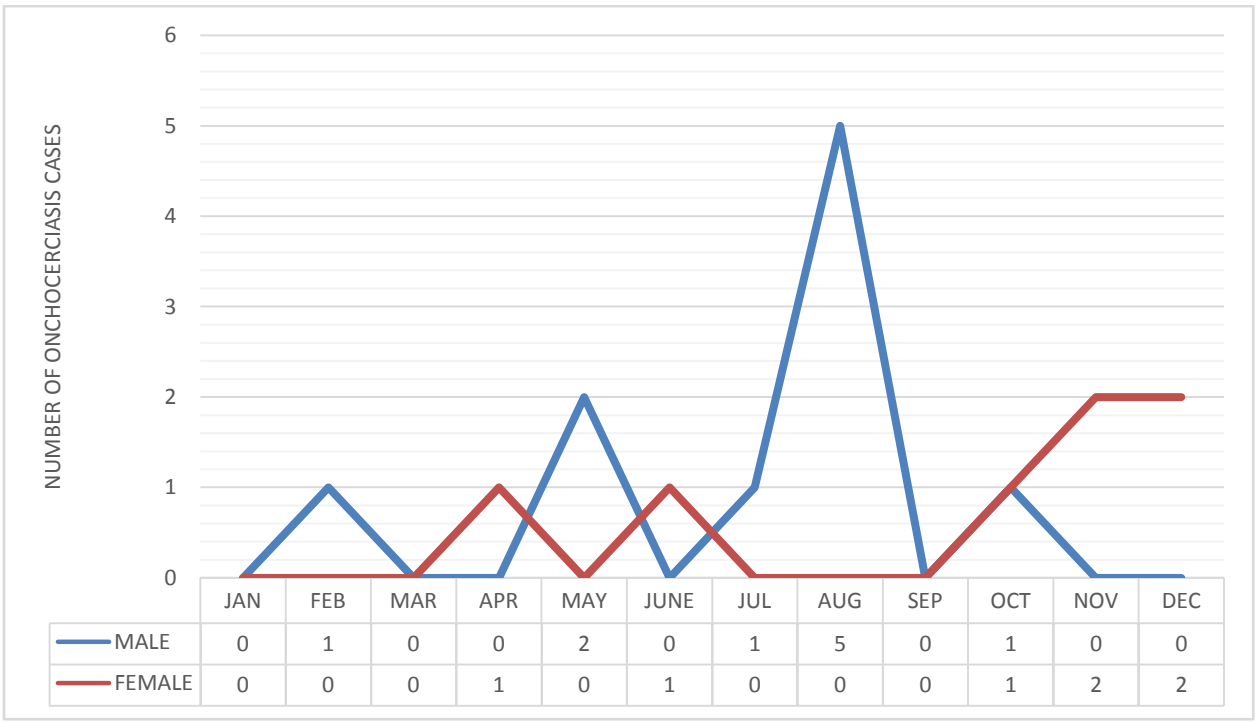
Figure 4.4 shows that in January, the number of reported cases of river blindness for the male folks was phenomenally 3 which decreased and maintained a level of 2 in February and March. However, there was no case of the disease recorded among female in January, but in February, only 1 case was recorded and the trend declined to 0 in March. In April, the trend sharply declined to 0 c with a slight increase to 1 in May among the male. There was an increase of 1

case of river blindness in April with a decline to O in May among the female. Both sexes recorded no case of the disease in June, except that there was a remarkable increase of 4 cases in July with a phenomenal decrease to 0 in August and increased to 2 in September for the male. Unlike the trend of the male folks, the female folks recorded an increase of 2 cases in July which decreased to 0 in August and maintained that level in September.

No case of the disease was recorded for the male in October, but the trend slightly inclined to 1 in November which declined to 0 in December. However, the trend of the disease for female sharply inclined to 3 in October with a remarkable decline to 1 in November and no case was recorded in December. In general, the curve indicates that *Onchocerciasis* cases were recorded highest in July among the Male and lowest for both sexes in August and December.

4.4.4 Trend of River Blindness in 2011

Fig. 4.5 shows the trend of river blindness in 2011 for both males and females within the study.



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
MALE	0	1	0	0	2	0	1	5	0	1	0	0
FEMALE	0	0	0	1	0	1	0	0	0	1	2	2

Figure 4.5: Trend of River Blindness in 2011

Source: Author's analysis, 2014

Figure 4.5 reveals that there was no case of river blindness recorded in the month of January for both sexes but 1 case was recorded in February for the male which the trend declined to 0 in March and April. However, with regard to the female, no case of the disease was reported in February and March except a slight incline of 1 in April. In May, there was an increase in the number of cases by 2 for the male with a further decline in trend to 0 in June and a slight rise by

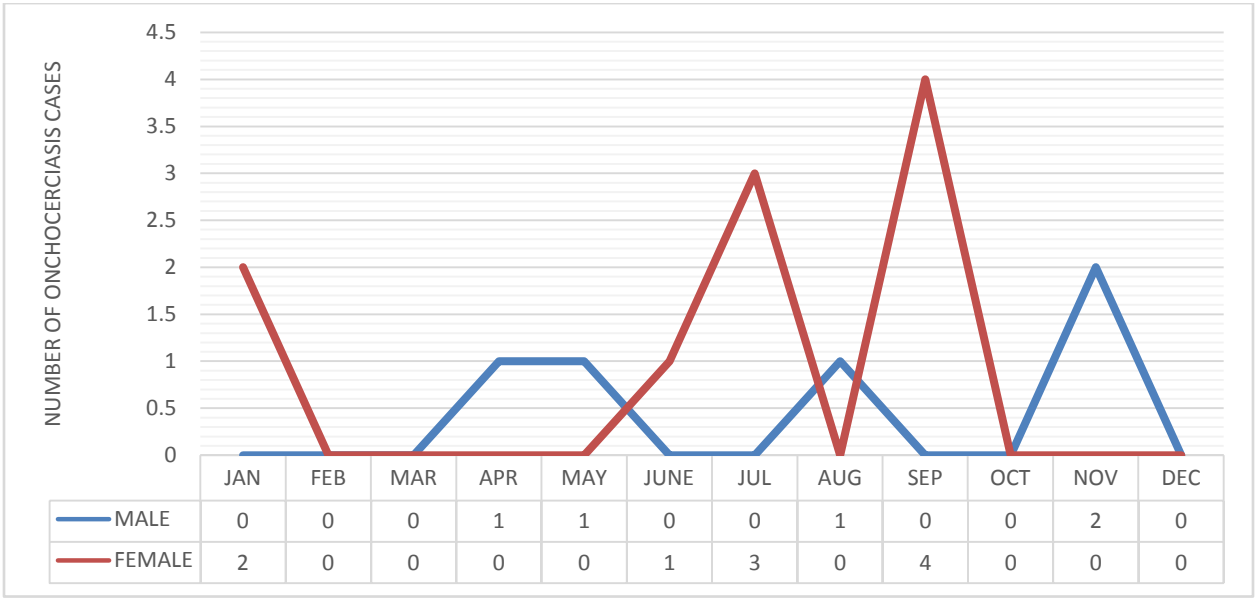
1 in July while the trend of the disease for the female shows a decline to 0 with a slight incline to 1 and however, declined again to 0 in July and August.

The Male trend shows a drastic incline of 1 in July and 5 cases in August. Both genders however, maintained a record of O and 1 case in September and October with a downward movement in trend to 0 in November and December for the male folks. The female folks on the other hand, recorded a little change in pattern from 1 in October to 2 cases in November and December, thereby causing the curve to maintain a steady level.

Therefore, the male folks recorded the highest number of river blindness cases in the month of August and lowest in January, March, April, June, September, November and December while the number of cases of the disease was at its peak for the female in November and December.

4.4.5 Trend of River Blindness in 2012

Fig. 4.6 shows the trend of river blindness in 2012 for both males and females within the area.



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
MALE	0	0	0	1	1	0	0	1	0	0	2	0
FEMALE	2	0	0	0	0	1	3	0	4	0	0	0

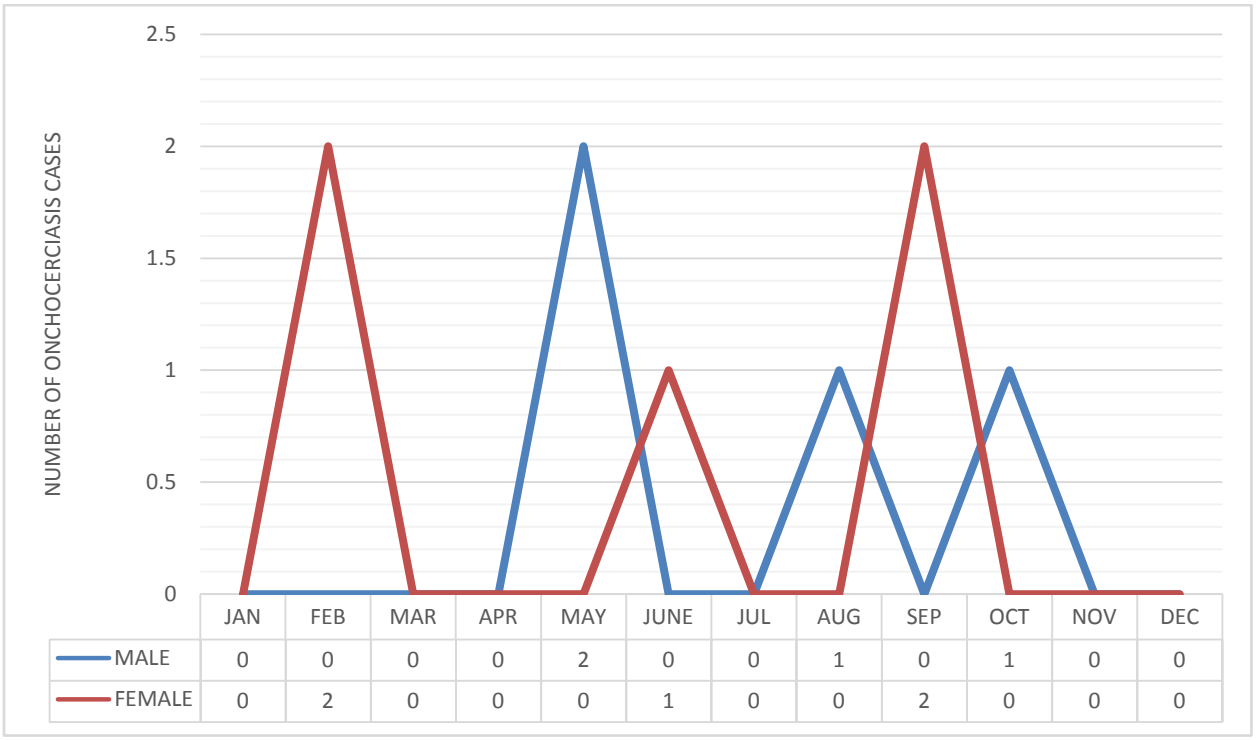
Figure 4.6: Trend of River Blindness in 2012
Source: Author's analysis, 2014

Figure 4.6 unfolds that in January, no case of *Onchocerciasis* was recorded for male, however, 2 cases of the disease was recorded for the female. The trend maintained a 0 level for both sexes in the months of February and March, because no case of river blindness was recorded. One case of the disease was reported for the male in April and May but no case of the disease was recorded in June and July, hence, the downward movement in trend while the female still maintained 0 level in April and May with a slight incline of 1 in June and a significant rise by 3 in July. One case of river blindness was recorded in August with non in the months of September and October but 2 cases were observed in November with a decline to 0 in December.

However, there was a sharp decline from 3 cases of the disease in July to 0 case in August for the female, but a remarkable increase of 4 cases were recorded in September with a sharp decline to 0 in October, November and December. It could be said from the trend that the number of *Onchocerciasis* cases was highest in the month of September among the female and lowest for both sexes in February, March, October and December.

4.4.6 Trend of River Blindness in 2013

Fig. 4.7 shows the trend of river blindness in 2013 for both males and females within the study area.



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
MALE	0	0	0	0	2	0	0	1	0	1	0	0
FEMALE	0	2	0	0	0	1	0	0	2	0	0	0

Figure 4.7: Trend of River Blindness in 2013
Source: Author's analysis, 2014

Figure 4.7 unveils that in January both sexes had no record of *Onchocerciasis* and in February, the same trend was maintained for the male but 2 cases of the disease were recorded for the female, thereby causing the trend to rise. The trend for both gender in March and April assumed a pattern of 0 cases with a rise by 2 cases and then a declined to 0 case in June. The female maintained a no recorded case pattern in May which slightly rose to 1 in June. Both sexes did not record any case of river blindness in July, however, the trend for the male rose by 1 in August with a drop in trend to 0 in September and an increase by 1 case in October.

The number of infected persons among the female still maintained a 0 level in August and suddenly inclined by 2 cases and then dropped to the O level in October. The trend declined to O level of no recorded case of the disease for both the male and the female residents through November and December. The number of reported cases of river blindness was highest for the male in May and also highest too for the female in February and September with 2 reported cases each for both sexes. This indicates that the endemicity of disease is fast reducing in the study area.

4.4.7 Trend of River Blindness from 2008-2013

Fig. 4.8 shows seasonal trend of river blindness from 2008-2013 for both males and females within the study area.

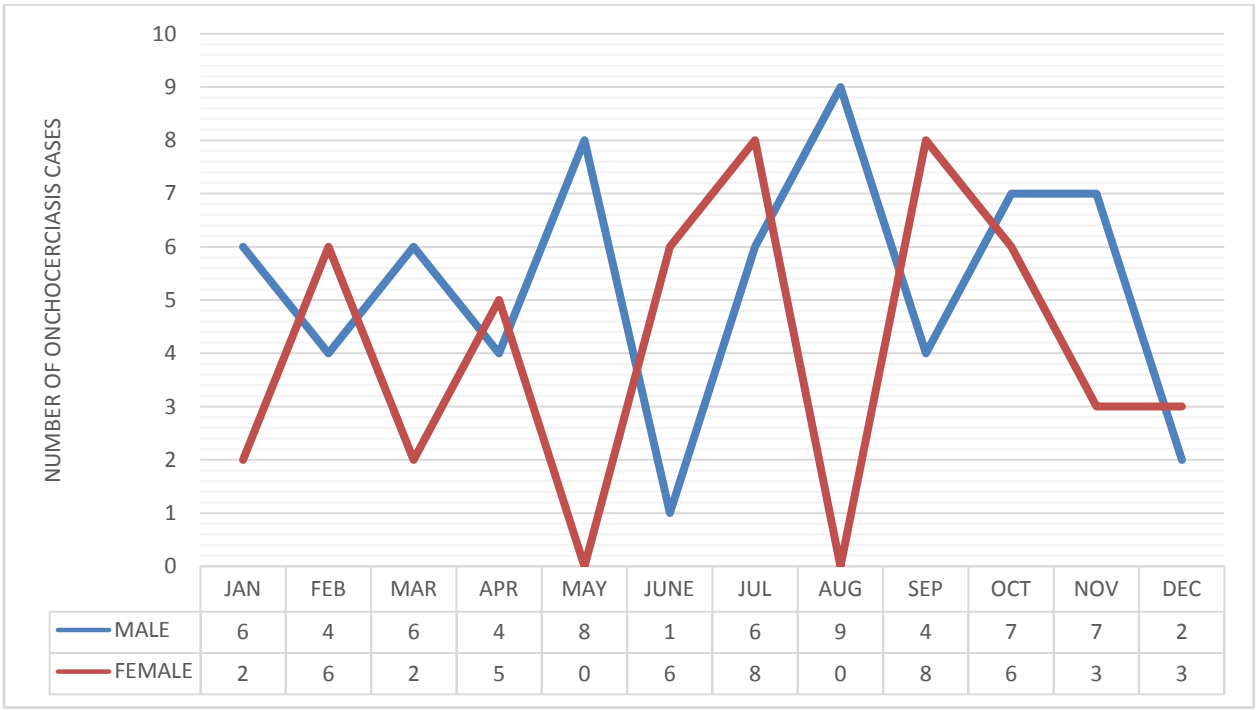


Figure 4.8: Trend of River Blindness from 2008-2013
Source: Author's analysis, 2014

Figure 4.8 shows the trend of river blindness combining the number of cases of the disease for each month from 2008-2013.From the curve, it could be observed that 6 cases of the disease were reported in January among the male which reduced to 4 and alternating pattern could be seen in March and April. A significant increase in the number of cases of river blindness was recorded by 8 in May which drastically declined to 1 case in June, with another remarkable upward movement to 6 cases in July. The female showed a low record of the disease by 2 in January which sharply increased to 6 cases in February and drastically declined to 2 cases in March. However, in April, there was an upward movement in trend to 5 cases which phenomenally declined to 0 in May. A remarkable increase in the number of cases of the disease was recorded in the months of June and July by 6 and 8.

In August, the male folks had a record of 9 cases of river blindness which dropped sharply to 4 in September while the female folks recorded no case of the disease in August but observed a remarkable incline of 8 cases in September. In October and November, 7 cases of Onchocerciosis were recorded among the male, thereby maintaining a stable pattern, which dropped significantly to 2 reported cases in December. However, for the female folks, the number of reported cases dropped from 8 to 6 in September and October with a further decrease to 3 cases which maintained a stable trending in November and December.

In general, the seasonal trend shows that the month of August recorded the highest number of Onchocerciacal cases (9), common among men. Next to it were the months of May, July and September, having a record of 8 cases. That could mean that people gets infected with the disease during the wet season, as they tends to depend on water from rivers which could be

contaminated, thereby putting the people of the study area on a high risk ground of being infected with the disease.

4.4.8 OverallTrend of River Blindness from 2008-2013

Fig. 4.9 shows overall trend of river blindness from 2008-2013 for both males and females within the study area.

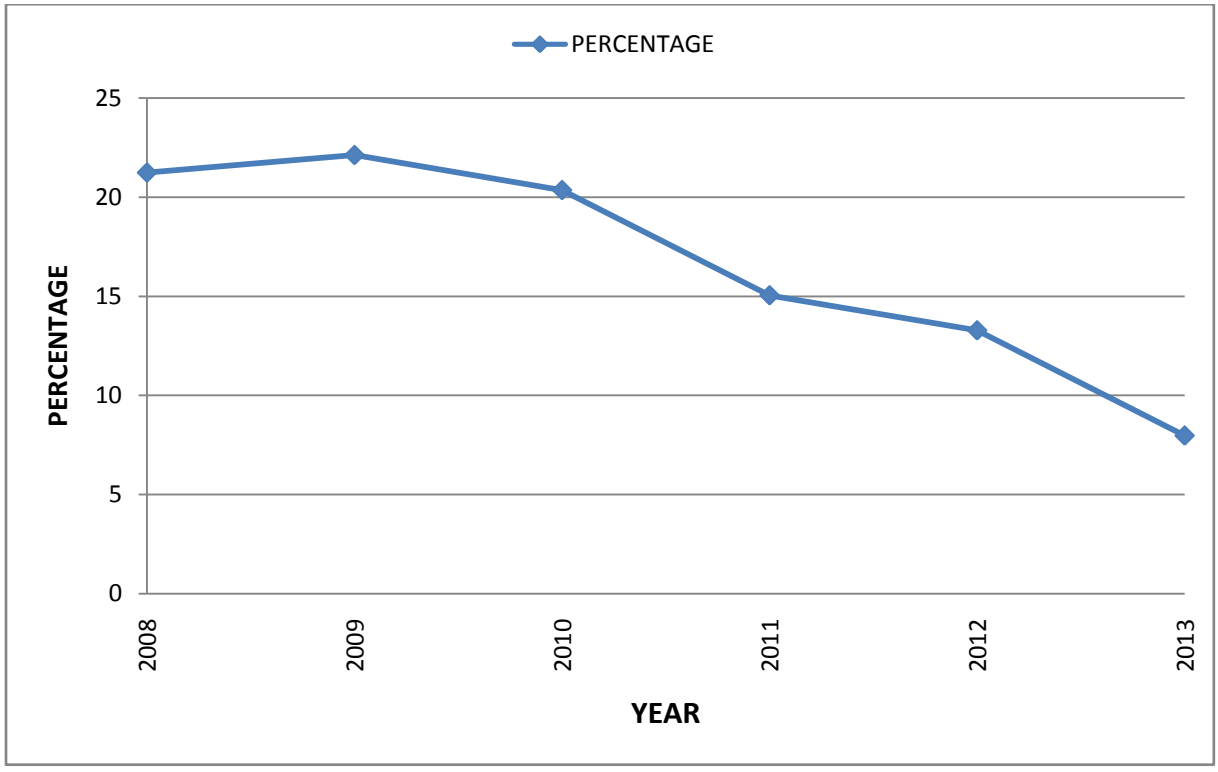


Figure 4.9: OverallTrend of River Blindness from 2008-2013

Source: Author's analysis, 2014

Figure 4.9 shows the trend of river blindness throughout the period under study. The research shows that in 2008, 21%cases of *Onchocerciasis* were reported. The trend shows an upward progression in 2009 having the highest reported cases 22%. This could be as a result of insufficient drugs provided at the healthcare centres, meant for combating the disease.However; the trend of the disease shows a downward progression from 2009 through 2013. That suggests

that the control measures in combating river blindness in the area and Africa as a whole have been effective.

4.5SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENT

This section gives a detailed account of the the socio-economic and socio-demographic characteristics of the respondents. The characteristics of the respondents were obtained from the questionnaire and each characteristic is discussed as a sub-heading.

4.5.1 Gender Distribution of Respondents

Table 4.2:Sex distribution as a socio-demographic characteristic of the respondents within the study area.

SEX	NUMBER OF RESPONDENTS	PERCENTAGE
Male	225	58.9
Female	157	41.1
Total	**382**	**100**

Source: Author's analysis, 2014

Table 4.2 presents the frequency distribution of the gender of respondents. About 58.9% of the respondents were males and 41.1% were females. The result shows more men because they are the heads of households and mostly engage in farming activities, as such they are mostly exposed to the bite of black flies.

4.5.2 Age Distribution

Table 4.3: Age distribution as a socio-demographic characteristic of the respondents within the study area.

AGE GROUP	NUMBER OF RESPONDENTS	PERCENTAGE OF TOTAL
Less than 15years	7	1.8
15-19years	32	8.4
20-24years	52	13.6
25-29years	51	13.4
30-34years	71	18.6
35-39years	42	11.0
40-44years	28	7.3
45-49years	42	11.0
50-54years	19	5.0
55-59years	14	3.7
60-64years	17	4.5
65 years and above	7	1.8
Total	**382**	**100**

Source: Author's analysis, 2014

Age distribution in most rural communities determines to a large extent the sharing of responsibilities. Table 4.3 shows that about 18.6% of the sampled respondents belonged to 30-34 years age group while about 6.3% belonged to the age bracket 60-64 years and above. This shows that the active group dominates the sampled respondents who are most likely to be infected with the disease because of their farming activities.

4.5.3 Marital Status

Table 4.4: Marital status of the respondents within the study area.

STATUS	NUMBER OF RESPONDENTS	PERCENTAGE OF TOTAL
Never married	104	27.2
Married	236	61.8
Divorced	14	3.7
Widowed	21	5.5
Separated	7	1.8
Total	**382**	**100**

Source: Author's analysis, 2014

The marital union in the five wards shows that 61.8% were married and 27.2% were single as shown in Table 4.4. This indicates the importance attached to marriage institution in the study area which is also in conformity with the culture and tradition of the people.

4.5.4 Type of Marital Union

Table 4.5: Type of marital union as a socio-demographic characteristic of the respondents within the study area.

TYPE	NUMBER OF RESPONDENTS	PERCENTAGE OF TOTAL
Polygamous	143	37.4
Monogamous	182	47.6
Single	57	14.9
Total	**382**	**100**

Source: Author's analysis, 2014

Table 4.5 reveals that 47.6% of the respondent hadmonogamous type of union while 37.4% had polygamous type of union. This could be as a result of the health implication of the disease which reduces vitality in marriage and also cause harsh economic consequence on its victims.

4.5.5 Educational Attainment

Table 4.6: Educational attainment as a socio-economic characteristic of the respondents the study area

TYPE	NUMBER OF RESPONDENTS	PERCENTAGE OF TOTAL
None	25	6.5
Quranic education	15	3.9
Primary education	61	16.0
Secondary education	189	49.5
Tertiary education	91	23.8
Others specify	1	.3
Total	**382**	**100**

Source: Author's analysis, 2014

Educational attainment is often used as one of the many social and economic indicators to ascertain the state of development in an economy. Education is of elevating the mind and raising the intellectual horizon of the recipient. It could inspire higher ethnical behavior; refine taste, cultural awareness, patriotic devotion and social responsibility. It is wisely agreed that it is the human resources of a nation which is largely responsible for its overall economic and social development. To make effective use of these human resources, it is very important to use education to broaden the knowledge, scope and understanding of the people. This is only possible through orienting the educational system towards the real and actual requirements and aspirations of the people.

Table 4.6 shows that 49.5% of the respondents had secondary education while 6.5% had no formal education. The study unfolds that the literacy level of residents within the study area is low. Perhaps, that is why majority of the residents are engaged in farming activities which exposes them to the bite of black fly.

4.5.6 Household Size

Table 4.7: Household size as a socio-economic characteristic of the respondents within the study area.

HOUSEHOLD SIZE	FREQUENCY	PERCENTAGE
1-3 Person	42	11.0
4-6 persons	136	35.6
7-9 people	77	20.2
10-12 people	76	19.9
13 people and above	51	13.4
Total	**382**	**100**

Source: Author's analysis, 2014

In most rural economy of developing countries for example Nigeria, size of family plays an important role in the family economy. This is because the family constitutes the basis of labour supply for most rural farmers. Table 4.7 shows that 35.6% of the respondents had household size of 4-6 persons, while 13.4% of the respondents accounted for household size of 13 persons and above. The average household size in the study area was about 5 persons per household. This indicates that families within the study area are mostly monogamous in structure.

4.5.7 Monthly Income of Respondents

Table 4.8: Monthly income as a socio-economic characteristic of the respondents within the study area.

INCOME (₦)	FREQUENCY	PERCENTAGE
Less than 5000	138	36.1
5000-14000	170	44.5
15000-24000	39	10.2
25000-34000	17	4.5
35000-44000	13	3.4
45000 and above	5	1.3
Total	**382**	**100**

Source: Author's analysis, 2014

The level of income determines the standard of living. The higher the income, the higher the standard of living and vice versa. Table 4.8 shows that 44.5% of the respondents earned between ₦5000-₦14000 per month whereas about 1.3% earned ₦45000 and above per month. The

average income per individual per month was ₦12,507. This shows that the study area is characterized by low income earners due to loss of man hour, lesions from sores, isolation, stigmatization and destitute from blindness (begging).

4.5.8 Occupation of Respondents

Table 4.9: Occupation as a socio-economic characteristic of the respondents within the study area.

OCCUPATION	FREQUENCY	PERCENTAGE
Civil/Public service	72	18.8
Farming	179	46.9
Petty trading	58	15.2
Full time housewife	49	12.8
others (Student, Arm seeker)	24	6.3
Total	**382**	**100**

Source: Author's analysis, 2014

Table 4.9 shows that about 47% of the sampled respondents were farmers while 18.8% of them were civil/public servants. About 6.3% were either students or beggars.The result of the study shows that majority of the populace within the study area were farmers and may have some other engagements that sustains them.

4.5.9 Type of Accommodation

Table 4.10: Type of accommodation as a socio-economic characteristic of the respondents within the study area.

TYPE	FREQUENCY	PERCENTAGE
One/two rooms	200	52.4
Self contain	101	26.4
Flat	78	20.4
Bungalow	3	0.8
Total	**382**	**100**

Source: Author's analysis, 2014

Table 4.10 unfolds that 52.4% of the respondents lived in one/two room apartment whereas 0.8% was accommodated in bungalow. This shows that majority of the populace of the area lived in houses built according to their economic power. Therefore, that suggests that the economic strength of the populace is low, perhaps because of the expenses they incurred in treatingonchocerca disease.

4.5.10 Ownership of Accommodation among Respondents

Table 4.11: Ownership of accommodation as a socio-economic characteristic of the respondents within the study area.

TYPE	FREQUENCY	PERCENTAGE
Self owned	268	70.2
Rented	89	23.3
Official	21	5.5
Squatting	4	1.0
Total	**382**	**100**

Source: Author's analysis, 2014

Table 4.11 unveils that 70.2% of the respondents were in owner occupier accommodation with about 23.3% as tenants. This implies that majority of the people of the study area are landlords but not necessarily wealthy.

4.5.11Prevalence of River Blindness Based on Perception of respondents

This section is mainly concerned with findings based on the perceptions of therespondents. The section complements the findings of the prevalence of river blindness based on hospital records.

4.5.11.1Knowledge of Prevalence of River Blindness among Respondents

Fig. 4.10: Knowledge of prevalence of river blindness among respondents. It shows the number of respondents that are knowledgeable of the disease and those that are not within the study area.

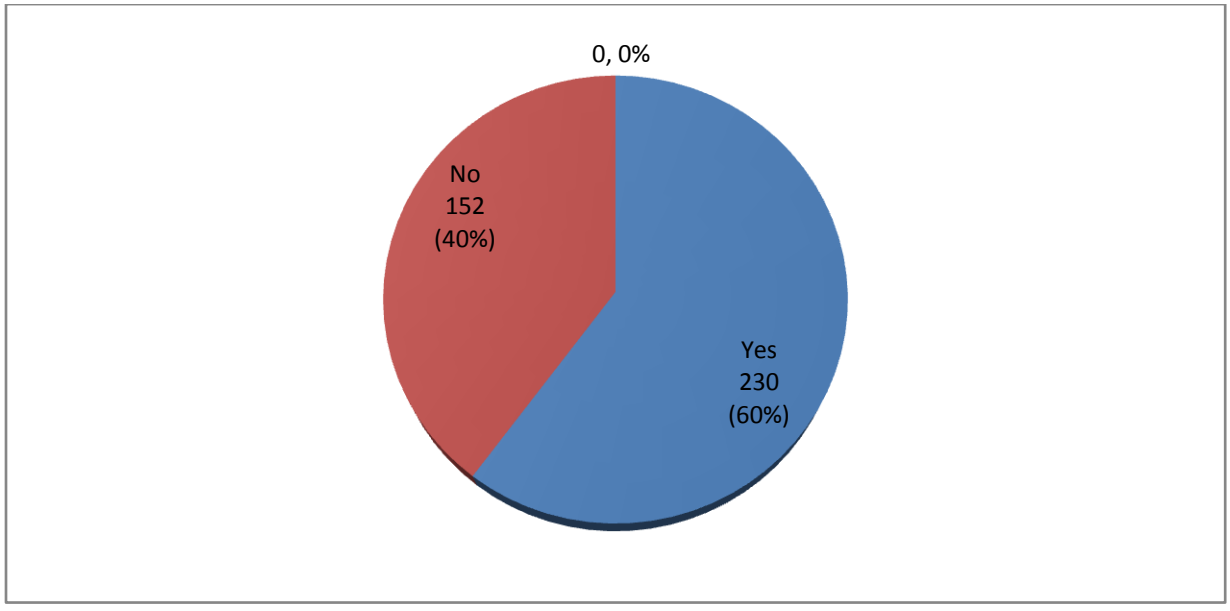


Figure 4.10: Knowledge of Prevalence of River Blindness among Respondents

Source: Author's analysis, 2014

Table 4.10 shows that 60.2% of the respondents confirmed they were aware of existence of the disease in the study area. About 40% of the respondents lack of knowledge of the disease within the area. That indicates that majority of the people that resides in the area were aware of the disease called river blindness.

4.5.12 Sources of Treatment for River Blindness

Table 4.12: Sources of treatment for onchorcerciasis. This result is based on the perception of respondents within the study area.

RESPONSE	FREQUENCY	PERCENTAGE
Hospital/Clinic	172	45.0
Herbalist home	175	45.8
Spiritual home	35	9.2
Total	**382**	**100**

Source: Author's analysis, 2014

From Table 4.12It is revealed that majority of 45% of the respondents who resides at Kasuwan magani, Kallah and Afogo wards recorded that Hospital/clinic served as the major source of treatment for river blindness. Only a few respondents from Maro, Kufana and Afogowent to the hospital for treatment. However, majority of 9.2% of the respondents that attested spiritual home as a source of treatment were residents of Maro and Afogo wards while a few residents of Kallah, Kufana and Kasuwan magani went to spiritual homes for treatment. That indicates that treatment gotten from the hospital has been very effective to the people within the area, hence, the prefered treatment from the hospital/clinic.

4.5.13 Perception of Respondents onPrevalence of River Blindness by Age

Table 4.13: Most infected age group by *Onchocerciasis* within the study area. This result is based on the perception of respondents.

AGE GROUP	FREQUENCY	PERCENTAGE
Less than 20 year	17	4.5
20 year -29years	68	17.8
30years-39years	161	42.2
40years-49years	64	16.8
50 years -59years	48	12.6
60years-69years	14	3.7
70years and above	10	2.6
Total	**382**	**100**

Source: Author's analysis, 2014

Table 4.13 shows that the most infected age group were people between the ages of 20-39 years, representing 60% of the respondents.Meanwhile about 3.7% and 2.6% of the respondents subscribed that people within the age bracket of 60- 69 years and people above 70 years suffered the most from the disease. This shows that the youth segment of the population that suffer most from *Onchocerciasis*, probably because of their activeness, as they tend to stay longer working on the farm and fishing. As such, are frequently exposed to the bite of black flies. Hence, they stand the chances of being the most vulnerable age group.

4.5.14 Perception of Respondents on Prevalence of River Blindness by Sex

Figure 4.11: Prevalence of oncherciasis by sex of respondents within the study area. This result is based on perception of the respondents.

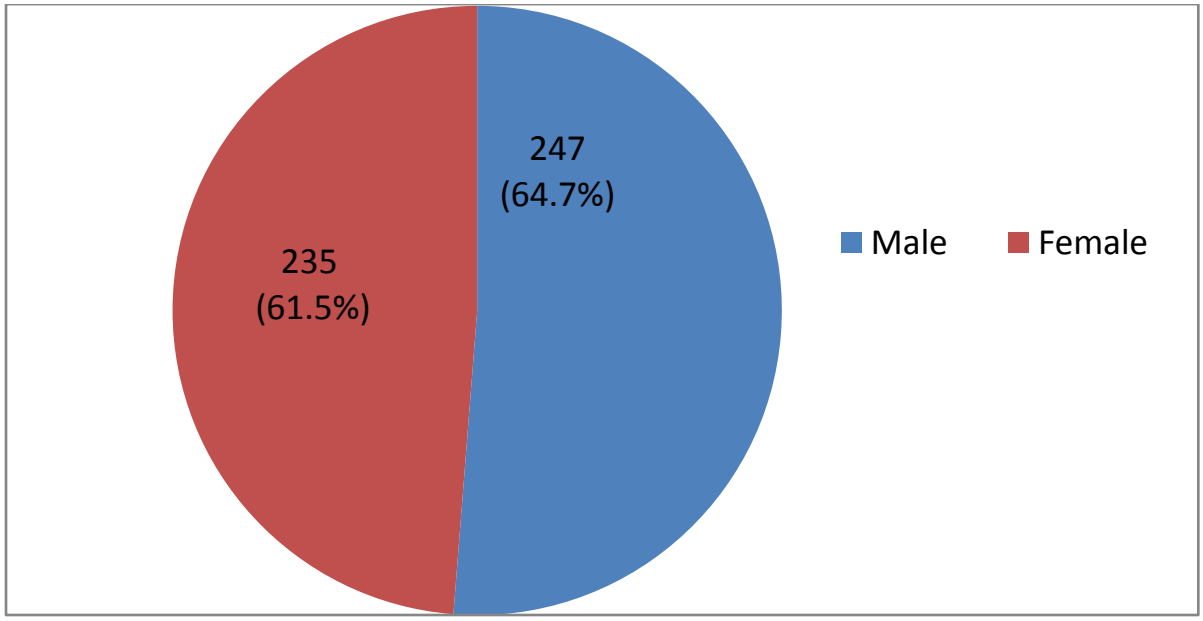


Figure 4.11: Disease Prevalence based on Sex
Source: Author's analysis, 2014

Figure 4.11reveals that about 65% of the respondents believed that the male folks were mostly infected by the disease while 61.5% of the respondents believed that females counterpart were the most infected sex. This finding is in line with the research of Akinbo and Okaka (2008) on the epidemiology of human *Onchocerciasis* among farmers in Ebonyi state. That suggests that male stand at risk of being infected by the disease; perhaps, because they are the bread winners of their families, hence, they are most exposed to the bites of black flies, either at the farm or when they go fishing.

4.5.15: Regression Analysis of *Onchocerciasis* and Socio-economic Factors

Table 4.14: Logistics multiple regression analysis of *Onchocerciasis* and Socio-economic Factors.

Socioeconomic factors	Coefficient of socioeconomic factors	P-value
Constant	0.214	0.160
Educational attainment	-0.016	0.496
Occupation	-0.015	0.496
Household size	0.068	0.002
Accommodation type	0.071	0.019
Ownership	-0.073	0.064

Source: Author's analysis, 2014

The result obtained from the regression analysis as seen in Table 4.14 reveals that there is a significant relationship between prevalence of *Onchocerciasis* and socio-economic variables at 5% significant value. Household size and type of accommodation were the only socio-economic variables that showed significant relationship with *Onchocerciasis* in the study since their p-values are less than 5% significance level. This indicates that the t-statistic (3.179) with p-value (0.002) forhousehold size has influence on *Onchocerciasis* in that the smaller the household size, the greater the effort to earn a living through farming, fishing and hunting, as such, one is susceptible to the bite of black flies. In the same vein, accommodation type with p-value (0.019) has caused influence on *Onchocerciasis* in that residents in houses that were not properly covered and were located near rivers were more prone to the bite of black flies than people who lived in houses that were properly covered and far from rivers.

Other socio-economic factors such as: educational attainment, occupation and ownership of accommodation did not show evidence of relationship with river blindness in the analysis performedwith respect to the study area.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter is segmented into three parts, namely: Summary, Conclusion and Recommendation.

5.2 SUMMARY OF FINDINGS

The study analyzed the prevalence of river blindness in Kajuru Local Government Area from 2008-2013, and the socio-economic effects of the disease within the area. The reaseach uncovered that the disease is meso-endemic (33.62%) in Maro ward and sporadic in Kallah and Kasuwan magani wards (9.73%, 6.19% respectively). The research also showed a pattern in the prevalence of the disease, so that communities close to the rivers had higher prevalence of river blindness than communities far away from the rivers. Communities close to the rivers ar majorly seen in Maro ward while communities that are far from the rivers are mostly found in Kallah and Kasuwan magani wards.It was discovered that the males suffered more from the disease (64.7%) than the females(35.3%).

Moreso, the study unveiled a seasonal trend in the prevalence of river blindness from 2008-2013. It was discovered that the month of August recorded the highest number of river blindness cases (9) while the months of May, July and September recorded the lowest number of cases (8). In addition, the percentage of infected persons was highest in 2009 (22%) and lowest in 2013(8%) under the period of study.Furthermore, a significant relationship between river blindness and socio-economic variables was discovered during the study.

5.3 CONCLUSION

Onchocerciasis is a pernicious disease affecting millions of people around the world. A lot of researches have been conducted on the prevalence of river blindness and how to combat it, yet, the disease still remain a major public health problem, in that it has rendered many people incapacitated in different ways.The pattern of distribution of river blindness within Kajuru LGA varied. The result of the study showed that ochocerciasis is meso-endemic in Maro ward with a prevalence of 33.62%, hypo-endemic in Afogo and Kufana wards with prevalence of 23% and 27.43% respectively. Moreso, a significant relationship between river blindness and the rivers within the study area was observed.The spatial analysis suggested that most communities in Maro ward are located along the river side and the residents tend to depend on river Iri for water, which is a breeding site for black flies, hence, water showed a significant relationship with the disease within the area.

Ochocerciasis was discovered to have a temporal characteristic during the study. The result of the analysis identified the month of August with the highest recorded cases of river blindness whereas the months of May, July and September with the lowest cases of the disease between 2008-2013. It also showed that the disease was highest in 2009 with about 22% reported cases and lowest in 2013 with about 8% reported cases. That suggest that people gets infected with the disease during the wet season as a result of bites from black flies, as they go fishing and farming.

A significant relationship between *Onchocerciasis* and socio-economic variables was noticed in the course of the research. Household size and type of accommodation were the only socio-economic variables that showed a significant relationship with the disease during the study. This could mean that the disease affectsthe vitality of marriage in terms of reproduction; hence, 35.6%

of the respondents belonged to the household size of 4-6 persons. In addition, the disease affects the economic strength of the residents of the study area which are mostly low income earners. This is evident by the fact that majority of them are ooccupants of rented apartments.

This research analyzed some critical issues surrounding the prevalence of river blindness in Kajuru LGA, in an attempt to bring to limelight the various challenging conditions of the disease.

5.4 RECOMMENDATIONS

The findings of this research have revealed that the occurrence of *Onchocerciasis* in Kajuru LGA has really hampered human and socio-economic growth and development in the area. Consequently, this researcher has come up with the following recommendations

i. The government and well to doNigerians should try and provide potable water supply such as pipe borne water or bore holes in endemic communities so that the villagers can farm and fish without necessarily going to the river side.
ii. There should be more awareness that cases of *Onchocerciasis* be reported to the Hospital for immediate treatment rather than relying on herbalist and spiritual homes.
iii. There should be awareness on proper covering of the body and the danger of building near rivers.

5.5 FURTHER RESEARCH

It was evident from the study that water is the major cause of river blindness in the study area. The research did not conform to findings of previous researches that black fly is the main cause of river blindness. Since this study has discovered a contrary cause, there is need for further

research on the nature of water from the in Kajuru LGA. This will help in providing information on the validity of water as the major cause of river blindness within the study area.

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APPENDIX 1: HOSPITAL RECORD OF RIVER BLINDNESS FROM 2008-2013

					2008							
GENDER	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
MALE	2	1	0	2	2	0	1	0	1	3	1	0	**13**
FEMALE	0	3	1	1	0	2	1	0	2	0	0	1	**11**
					2009							
GENDER	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
MALE	1	0	4	1	0	1	0	2	1	2	3	2	**17**
FEMALE	0	0	1	2	0	1	2	0	0	2	0	0	**8**
					2010							
GENDER	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
MALE	3	2	2	0	1	0	4	0	2	0	1	0	**15**
FEMALE	0	1	0	1	0	0	2	0	0	3	1	0	**8**
					2011							
GENDER	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
MALE	0	1	0	0	2	0	1	5	0	1	0	0	**10**
FEMALE	0	0	0	1	0	1	0	0	0	1	2	2	**7**
					2012							
GENDER	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
MALE	0	0	0	1	1	0	0	1	0	0	2	0	**5**
FEMALE	2	0	0	0	0	1	3	0	4	0	0	0	**10**
					2013							
GENDER	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	
MALE	0	0	0	0	2	0	0	1	0	1	0	0	**4**
FEMALE	0	2	0	0	0	1	0	0	2	0	0	0	**5**

APPENDIX 2: QUESTIONNAIRE

QUESTIONNAIRE

The researcher is an M.Sc Student in the Department of Geography, ABU Zaria conducting a research on the prevalence of river blindness in Kajuru Local Government Area of Kaduna State, Nigeria, as part of the requirement for the award of M.Sc Degree in GIS and Remote Sensing, at Ahmadu Bello University, Zaria. Any information given by you will be treated with utmost confidentiality.

Thank you.

SECTION A: SOCIO-DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS OF RESPONDENT.

1Community of Residence_____

2. Sex: A. Male [ ] B. Female [ ]

3. Age: A. <15 [ ] B. 15-19 [ ] C. 20-24 [ ] D.25-29 [ ] E.30-34 [ ] F. 35-39 [ ] G. 40-44 [ ] H. 45-49 [ ] I. 50-54 [ ] J. 55-59 [ ] K. 60-64 [ ] L. 65 > [ ]

4. Marital Status: A. Never married [ ] B. Married [ ] C. Divorced [] D. Widowed [ ]

E. Separated [ ]

5 Type of Marital Union: A. Polygamous [ ] B. Monogamous [ ] C. Others (Specify) _____

6. Educational Attainment:A .None [ ] B. Quranic [ ] C. Primary [ ] D. Secondary [ ] E. Tertiary [ ] F. Others (Specify) _____

7. Occupation: A. Civil/ Public Service [ ] B. Farming [ ] C. Petty trading [ ] D. Full time housewife [ ] Others [specify]_____

8. Household Size: A. 1 [ ] B. 1-3 [ ] C. 4-6 [ ] D. 7-9 [ ] E. 10> [ ]

9. Income per month: A. < #5000 [ ]B. #5000-#14000 [ ] C. # 15000-#24000 [ ] D. #25000-#34000 [ ] E. #35000-#44000 [ ] F. #45000> [ ]

10. Type of accommodation: A. One/two rooms [ ] B. Self contain [ ] C. Flat [ ] D. Bungalow [ ]

11. Ownership of accommodation: A. Self owned [ ] B. Rented [ ] C. Official [ ] D. Squatting [ ]

12. Household size: A. 1 [ ] B. 1-3 [ ] C. 4-6 [ ] D. 7-9 [ ] E. 10> [ ]

SECTION B:PREVALENCE OF RIVER BLINDNESS

12. Do you know of the disease called river blindness? A. Yes [ ] B. No [ ]

If yes answer the questions below;

13. Have you ever suffered from river blindness? A. Yes [ ] B. No [ ]

14. Do you know anybody that has suffered from river blindness? A. Yes [ ] B. No [ ]

15. What is the major cause of the disease in your area? A. Water [ ] B. Black fly [ ] C. Food [ ] D. Others (specify)_____

16. Source of treatment: A. Hospital/Clinic [ ] B. Herbalist home [ ] C. Spiritual home [ ]

17. How effective is the treatment? A. Very effective [ ] B. Effective [ ] C. Not effective [ ]

18. Which of the age groups do you think is mostly affected? A. <20 [ ] B. 20-29 [ ] C. 30-39[ ] D.40-49 [ ] E.50-59 [ ] F. 60-69 [ ] G.70> [ ]

19. Which sex do you think is mostly affected? A. Male [ ] B. Female [ ]