

**EVALUATION OF URINARY AND INTESTINAL SCHISTOSOMIASIS
AMONG PRIMARY SCHOOL PUPILS IN GIWA LOCAL GOVERNMENT
AREA, KADUNA STATE, NIGERIA**

BY

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APRIL, 2017

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AREA, KADUNA STATE, NIGERIA**

BY

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APRIL, 2017

DECLARATION

I declare that the work in this dissertation entitled, “**Evaluation of Urinary and Intestinal Schistosomiasis among Primary School Pupils in Giwa Local Government Area, Kaduna State, Nigeria**” has been carried out by me in the Department of Biology under the supervision of Dr. S. A. Luka and Prof. I. H. Nock. The information derived from literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other Institution.

Aisha Abdulkadir YAYA _____

Signature

Date

CERTIFICATION

This dissertation entitled, “**Evaluation of Urinary and Intestinal Schistosomiasis among Primary School Pupils in Giwa Local Government Area, Kaduna State, Nigeria**” by **Aisha Abdulkadir YAYA**, meets the regulations governing the award of the degree of Master of Science in Biology of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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ABSTRACT

The study evaluated the prevalence of urinary and intestinal Schistosomiasis among Primary School Pupils in Giwa Local Government Area, Kaduna State, Nigeria in relation with associated risk factors. Three hundred and eight consenting pupils from 10 primary schools between ages 5 and 14 years were screened for the study. Urine and stool samples of each pupil was collected and examined for *Schistosoma haematobium* responsible for urogenital schistosomiasis and *Schistosoma mansoni* responsible for intestinal schistosomiasis. The urine samples were examined both macroscopically and microscopically using standard Sedimentation methods while the stool samples were examined using Kato-Katz and formol-ether concentration technique. A well-structured pre-tested questionnaire was administered on 308 pupils to obtain socio-demographic data such as age, sex, educational status of parents and risk factors. The overall prevalence for both forms of schistosomiasis in the study area was 7.5%. The prevalence of urinary schistosomiasis was 5.5% while intestinal schistosomiasis was 0.7% and 1.3% using kato-katz and formol-ether methods respectively. There was no statistically significant difference ($p>0.05$) for all forms of schistosomiasis and the primary schools. There was also no statistically significant relationship ($p>0.05$) between the prevalence of urinary schistosomiasis and the different schools. However, there was significant difference ($p<0.05$) between the prevalence of intestinal schistosomiasis and the different schools by Kato-Katz method. There was no significant difference between the infections and age. However gender significantly influenced *S. haematobium* infection but there was no significant association between gender and *S. mansoni* infection by both the Kato-katz and formol-ether Method. Odds ratio showed association between the infection and pipe borne water (OR=1.1), borehole (OR=3.3), river/stream (OR=5.3), defecating in the bush (OR=8.8), having ponds around houses (OR=3.5), fishing (OR=8.0), do wash clothes (OR=7.8), swimming (OR=8.2) and playing (OR=9.4). There was no significant difference between formol-ether concentration method and Kato-Katz technique used in detecting *Schistosoma mansoni*. The study therefore concluded that the overall prevalence for both forms of schistosomiasis in the study area was 7.5% having 5.5% urinary schistosomiasis and 0.7%, 1.3% intestinal schistosomiasis by Kato-Katz and Formol-ether concentration methods respectively. It was therefore recommended that the teaching of Health Science as a subject in primary schools should be intensified and the pupils should be taught more on personal hygiene, preventive measures and control of certain parasites.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of Study

Schistosomiasis, also known as bilharziasis or snail fever, is primarily a tropical parasitic disease caused by eggs of adult stages of the blood fluke known as *Schistosoma*. The name bilharziasis was coined from the name of Theodor Bilharz, a German pathologist, who first identified the worms in 1851 (Nawal, 2010; WHO, 2010a). It is a chronic and debilitating water-borne parasitic infection that leads to a significant ill health and economic burden. Schistosomiasis is a disease caused by *Schistosoma* spp and is a prevalent tropical disease, ranking second to malaria and posing a great public health and socio-economic threat in sub-Saharan Africa (Moleneux, 2004; Hotez *et al.*, 2007). More than 200 million people in 76 countries have schistosomiasis of which 85 percent live in sub-Saharan Africa (WHO, 2008). A recent World Health Organisation (WHO, 2010b) report estimated that more than 600 million people are at risk for schistosomiasis. Human schistosomiasis is a chronic disease caused by the blood flukes belonging to the genus *Schistosoma*. The main disease causing schistosome species are *Schistosoma haematobium*, *S. mansoni*, *S. japonicum*, *S. mekongi* and *S. intercalatum* (Gryseel *et al.*, 2006). Schistosomiasis is estimated to affect 249 million people worldwide, of which at least 224 million people that are affected live in sub-Saharan Africa (WHO, 2015a). An estimated 280,000 people each year in the African region alone are killed as a result of the disease (CDC, 2011). *Schistosoma haematobium* is the aetiologic agent of urinary schistosomiasis and it is most prevalent in Africa (NATHNAC, 2008). In sub-Saharan

Africa, *S. haematobium* infection is estimated to cause 70, 32, 18 and 10 million cases of haematuria, dysuria, bladder-wall pathology and major hydronephrosis, respectively (vander-Werf *et al.*, 2003). The infection is also responsible for nutritional deficiencies and growth retardation (Stephenson, 1993), adverse effects on cognitive development (WHO, 2002), as well as for decreasing physical activity, school performance, and work capacity and productivity (Stephenson, 1993).

Transmission of urinary schistosomiasis is dependent on availability of specific snail hosts and human activities with water contacts (WHO, 2010b). Therefore, the risk and reemergence of urinary schistosomiasis is attributed to the range of snail habitats promoted by water development schemes such as dam construction (Jamison *et al.*, 2006). On the other hand, school age children have frequent water contact that make them more vulnerable to schistosomiasis, and therefore this age group is associated more frequently with schistosomiasis (Deribe *et al.*, 2011; Bala *et al.*, 2012).

Globally, report from Global Burden of Disease (GBD) has it that; schistosomiasis caused the loss of 1.7 million disability- adjustment life years (DALYS) worldwide in 2001, out of which 82% Africa (1.4 million DALYs) were lost in sub-Saharan (SSA) alone. Worldwide, more than 700 million people are at risk of infection and more than 207 million people are infected (WHO, 2016).

In Africa, it has been estimated that 85% of the world's cases of schistosomiasis are in Africa, where prevalence can exceed 50% in local populations with *Schistosoma mansoni* and *S. haematobium* being distributed throughout Africa; report from Ethiopia showed

that both *S. haematobium* and *S. mansoni* are endemic, with an estimated 4 million people infected and 30–35 million being at risk of infection (Kassa *et al.*, 2005). Mbah and Useh (2008) studied a relationship between the transmission of urinary schistosomiasis and prevailing socio-economic factors in some villages in Lagdo District of the Republic of Cameroon and *Schistosoma haematobium* was confirmed amongst 39.2% of the study population. Mixed infections of *S. mansoni* and *S. haematobium* occurred in only 4.5% of the pupils. In 2009 report from sub-Saharan Africa revealed that 192 million people are estimated to be infected with the two forms of schistosomiasis (intestinal and urinary), with Nigeria recording the largest number of infection with about 29 million cases (Hotez and Kamath, 2009). Schistosomiasis has a long history in Egypt, and the government has been over sixty years of schistosomiasis control efforts. It is well documented that *Schistosoma haematobium* was endemic in Ancient Egypt. Infection was diagnosed in mummies 3000, 4000 and 5000 years old (Barakat, 2013). Scott was the first to describe the pattern of schistosomiasis infection in Egypt. *Schistosoma haematobium* was highly prevalent (60%) both in the Nile Delta and Nile Valley South of Cairo in districts of perennial irrigation while it was low (6%) in districts of basin irrigation. *Schistosoma mansoni* infected 60% of the population in the Northern and Eastern parts of the Nile Delta and only 6% in the Southern part. Neither *S. mansoni* cases nor its snail intermediate host were found in the Nile Valley South of Cairo (Barakat, 2013). Also, El-Khoby *et al.* (2013) reported a 4.8%, 13.7%, 7.8% prevalence of *S. haematobium* in 4 governorates in Upper Egypt.

In Nigeria, diverse prevalence of schistosomiasis has been reported in various part of the country. These includes; the 28.8% reported by Agere *et al.* (2010) in Jalingo and

Ardokola Local Government Areas of Taraba State, 4.6% recorded in Jos (Goselle *et al.*, 2010), 82% recorded in Ogun State (Sowole and Adegbite, 2012), 9.8% recorded in Afikpo North Local Government Area of Ebonyi State (Nworie *et al.*, 2012), 41.5% reported in Benue State (Houmsou *et al.*, 2012), 6.0% reported in Potiskum Yobe State (Bigwan *et al.*, 2012), 48.2% recorded in southwestern Nigeria (Babatunde *et al.*, 2013), 44.3% reported in North Central Nigeria (Okwori *et al.*, 2014) And the 17.5% reported in Ezza-North Local Government Area of Ebonyi State (Nwosu *et al.*, 2015).

In Kaduna State, 19.0% was recorded among students in a Local Government Area (LGA) of Kaduna State (Damen *et al.*, 2006), 25.1% was recorded among sedentary fulani settlements of Dumbi, Igabi LGA (Kanwai *et al.*, 2011), 20.3% was reported in Birnin Gwari LGA (Alhassan *et al.*, 2013), 11.7% in Gwagwada, Chikun LGA (Timothy *et al.*, 2013). 18.7% in Kawo District, Kaduna North LGA (Mahmood *et al.*, 2015). However, little is known about the status of schistosomiasis among primary school pupils in Giwa Local Government Area, Kaduna State. In order to put in place appropriate interventions against schistosomiasis in the area, information on the distribution and associated risk factors of the disease in different transmission settings is a pre-requisite. This study therefore aimed to determine the prevalence and associated risk factors of *S. haematobium* and *S. mansoni* infection among primary school pupils in Giwa Local Government Area, Kaduna State.

1.2 Statement of the Research Problem

Despite more than a century of control efforts and the introduction of highly effective anti-schistosomal drugs such as niridazole, metrifonate, oxamniquine, and praziquantel,

the eradication of the disease is still far from actualization. The prevalence and risk factors of schistosomiasis in Giwa LGA have not, to our knowledge, been investigated thus the disease status is largely unknown.

1.3 Justification

The research has provided baseline information on the status of *Schistosoma* infection among primary school pupils in Giwa LGA, from which the disease burden and risks of transmission will be assessed towards adequate intervention so as to save the lives of primary school pupils, thereby reducing the rate of transmission.

1.4 Aim

To evaluate the prevalence of schistosomiasis among pupils of some primary schools in Giwa Local Government Area, Kaduna State.

1.5 Objectives

The objectives of this study are to determine;

- i. The prevalence of urinary and intestinal schistosomiasis infections among primary school pupils in Giwa LGA, Kaduna State.
- ii. The association between urinary and intestinal schistosomiasis with age and gender.
- iii. The association between urinary and intestinal schistosomiasis and risk factors.
- iv. To compare the Kato Katz and Formol Ether concentration methods used in testing intestinal schistosomiasis.

1.6 Hypotheses

- i. Urinary and intestinal schistosomiasis are not prevalent among primary school pupils in Giwa Local Government Area, Kaduna State
- ii. There is no significant association between urinary and intestinal schistosomiasis with age and gender.
- iii. Risk factors are not significantly associated with schistosomiasis.
- iv. There is no significant difference of intestinal schistosomiasis between Kato Katz and Formol Ether concentration methods.

CHAPTER TWO

2.0

LITERATURE REVIEW

2.1 Overview of Schistosomiasis

Schistosomiasis caused one quarter of the tropical disease cluster burden (WHO, 2002). Sometimes referred to as bilharziasis, schistosomiasis was discovered by Theodore Bilharz, a German surgeon working in Cairo, who first identified the etiological agent, *Schistosoma haematobium* in 1851 (Nawal, 2010).

Schistosomiasis also known as Katayama fever is a disease caused by parasitic worms of the genus *Schistosoma* (Freitas *et al.*, 2010) which are transmitted by snails of the genus *Bulinus* and *Biomphalaria*. It is one of the most prevalent of the waterborne diseases and one of the greatest risks to health in rural areas of developing countries (Ogbe, 2002). Schistosomiasis is considered second only to malaria as the most devastating parasitic disease in tropical countries. It causes renal and bladder dysfunction or liver and intestinal disease, and it contributes to anemia and growth retardation in children (Ogbe, 2002). In sub-Saharan Africa, more than 200,000 deaths per year are due to schistosomiasis depending on the species of parasite. Signs and symptoms may include abdominal pain, diarrhea, bloody stool, or blood in the urine. In those who have been infected for a long time, liver damage, kidney failure, infertility, or bladder cancer may occur. In children, it may cause poor growth and learning difficulty (Freitas *et al.*, 2010). People who come into contact with water bodies that are infested with the snail's intermediate host are at risk of infection.

2.2 History of Schistosomiasis

Schistosomiasis has been affecting human health for at least 4,000 years; characteristic symptoms are described in early Egyptian papyri and analysis reveals immunological clues as to its presence in ancient mummies (Mahmoud, 2001). The etiology of schistosomiasis in humans was first discovered in 1851 by the German physician Theodor Bilharz. Working in Cairo, Egypt he first identified adult male and female *Schistosoma haematobium* during postmortem exams (Mahmoud, 2001).

2.2.1 History of schistosomiasis in Nigeria

Different studies on the prevalence of schistosomiasis in Nigeria have been reported following the extensive survey of the former Northern Nigeria by Ramsey in 1935. According to Blair (1956), the Fulani tribe of Northern Nigeria brought schistosomiasis with them during their migration from the Upper Nile Basin. The disease therefore has a long history in Nigeria. It is essentially an infection of rural agricultural communities where rural lifestyle and behaviour encourage the contamination of inland water with human excreta and urine. Until recently, schistosomiasis was not considered a public health problem in Nigeria for two reasons. Firstly, schistosomiasis was restricted to rural communities where personal hygiene is inadequate, where poverty prevails, where malnutrition and infection with other parasites are common (Coutinbo *et al.*, 1992). Secondly, it is a disease common to school aged children in whom the disease remains silent or mildly asymptomatic for many years. To this end, most previous studies on schistosomiasis in Nigeria were concentrated in rural areas (Arinola, 1995).

According to Cowper (1963), the distribution of *S. haematobium* was described as being almost universal in the North, and patchy elsewhere. *S. haematobium* is probably endemic in the Northern region, and some areas are marked particularly by heavy infection rates. These areas include Katsina, Kano, Zaria, Kaduna, Birnin Kebbi and Argungu. Infection of man by both *S. mansoni* and *S. haematobium* is wide-spread in two of the former regions of Nigeria – West and North, and less in the East. Other parts of the Northern region from which high or fairly high infection rates have been reported are Plateau area, Yola, Biu area, Maiduguri, Potiskum area, the Wulgo area of Lake Chad Basin, the Riverine area along the Niger from Wawa to Pategi and Bida. Various studies have been carried out to show prevalence and intensity of schistosomiasis in various States in Nigeria (Okpala 1961; Gilles *et al.*, 1965; Abayomi *et al.*, 1971). Akogun and Obadiah (1996) also reported that schistosomiasis is common in Nigeria and is especially associated with water related activities. In its geographical distribution in Nigeria, urogenital schistosomiasis is regarded as a disease mainly of the semi and dry savannah region, especially areas where there are irrigation schemes. In Nigeria, the earliest known report of high prevalence of haematuria relates to the dry North (Donges, 1967). There were some reports on the epidemiology in the city area of Ibadan (Akinkugbe, 1962). Investigations indicate that the disease may be increasing in prevalence and importance particularly in the remote poorly accessible rural communities (Amole and Jinadu, 1994). Dams and irrigation projects which are wide-spread in Nigeria, electric power, as water emanating from the water- flow creates suitable environment for snail breeding and industrial developments have contributed significantly to the spread of schistosomiasis (Okpala *et al.*, 2004). Ironically, these otherwise beneficial development activities favour

increased transmission of water based diseases. Migrants, workers, and herdsmen, who represent a significant number of people in endemic areas, are both carriers and target for infection. Thus schistosomiasis will be very much a concern for some time in Nigeria (Okpala *et al.*, 2004).

2.3. Life Cycle of Schistosome Parasite

Schistosomes have a typical trematode vertebrate-invertebrate lifecycle with humans being the definitive host (WHO, 2013). The life cycles of all five human schistosomes are similar (WHO, 2013). The parasite eggs are released into the environment from infected individuals, hatching on contact with fresh water to release the free-swimming miracidium. Miracidia infect freshwater snails by penetrating the snail's foot. After infection, close to the site of penetration, the miracidium transforms into a primary (mother) sporocyst (WHO, 2002). Germ cells within the primary sporocyst will then begin dividing to produce secondary (daughter) sporocysts, which migrate to the snail's hepatopancreas. Once at the hepatopancreas, germ cells within the secondary sporocyst begin to divide again, this time producing thousands of new parasites, known as cercariae, which are the larvae capable of infecting mammals (WHO, 2002).

Cercariae emerge daily from the snail host in a circadian rhythm, dependent on ambient temperature and light (Rudan, 2005). Young cercariae are highly mobile, alternating between vigorous upward movements and sinking to maintain their position in the water. Cercarial activity is particularly stimulated by water turbulence, by shadows and by chemicals found on human skin (Rudan, 2005).

The most common way of getting schistosomiasis in developing countries is by wading or swimming in lakes, ponds and other bodies of water that are infested with the snails(usually of the genera *Biomphalaria*, *Bulinus*, or *Oncomelania*) that are the natural reservoirs of the *Schistosoma* pathogen (WHO, 2013).

Penetration of the human skin occurs after the cercaria have attached to and explored the skin. The parasite secretes enzymes that break down the skin's protein to enable penetration of the cercarial head through the skin. As the cercaria penetrates the skin it transforms into a migrating schistosomulum stage (Rudan, 2005). The newly transformed schistosomulum may remain in the skin for two days before locating a post-capillary venule; from here the schistosomulum travels to the lungs where it undergoes further developmental changes necessary for subsequent migration to the liver (Asaolu and Ofoezie, 2003). Eight to ten days after penetration of the skin, the parasite migrates to the liver sinusoids. *S. japonicum* migrates more quickly than *S. mansoni*, and usually reaches the liver within eight days of penetration (Kabatereine, 2006).

Juvenile *S. mansoni* and *S. japonicum* worms develop oral suckers after arriving at the liver, and it is during this period that the parasite begins to feed on red blood cells (Steinmann *et al.*, 2006). The nearly-mature worms pair, with the longer female worm residing in the gynaecophoric channel of the shorter male. Adult worms are about 10 mm long. Worm pairs of *S. mansoni* and *S. japonicum* relocate to the mesenteric or rectal veins. *S. haematobium* schistosomula ultimately migrate from the liver to the perivesical venous plexus of the bladder, ureters, and kidneys through the hemorrhoidal plexus (Koukounari *et al.*, 2007).

Parasites reach maturity in six to eight weeks, at which time they begin to produce eggs. Adult *S. mansoni* pairs residing in the mesenteric vessels may produce up to 300 eggs per day during their reproductive lives (Koukounari *et al.*, 2007).

Schistosoma japonicum may produce up to 3,000 eggs per day. Many of the eggs pass through the walls of the blood vessels, and through the intestinal wall, to be passed out of the body in faeces. *S. haematobium* eggs pass through the ureteral or bladder wall into the urine (Koukounari *et al.*, 2007). Only mature eggs are capable of crossing into the digestive tract, possibly through the release of proteolytic enzymes, but also as a function of host immune response, which fosters local tissue ulceration. Up to half the eggs released by the worm pairs become trapped in the mesenteric veins, or will be washed back into the liver, where they will become lodged. Worm pairs can live in the body for an average of four and a half years, but may persist up to twenty years (Kabatereine, 2006).

Trapped eggs mature normally, secreting antigens that elicit a vigorous immune response. The eggs themselves do not damage the body (Figure I). Rather it is the cellular infiltration resultant from the immune response that causes the pathology classically associated with schistosomiasis (Kabatereine, 2006).

2.4 Scientific Classification

Family: Schistosomatidae

Unlike all other trematodes, schistosomes are not hermaphroditic but dioecious, forming separate sexes. Adult worms have elongate tubular bodies, each male having a unique gynecophoral canal (*schistosoma* = split body) in which a female worm resides (Hotez, 2008).

Schistosomiasis

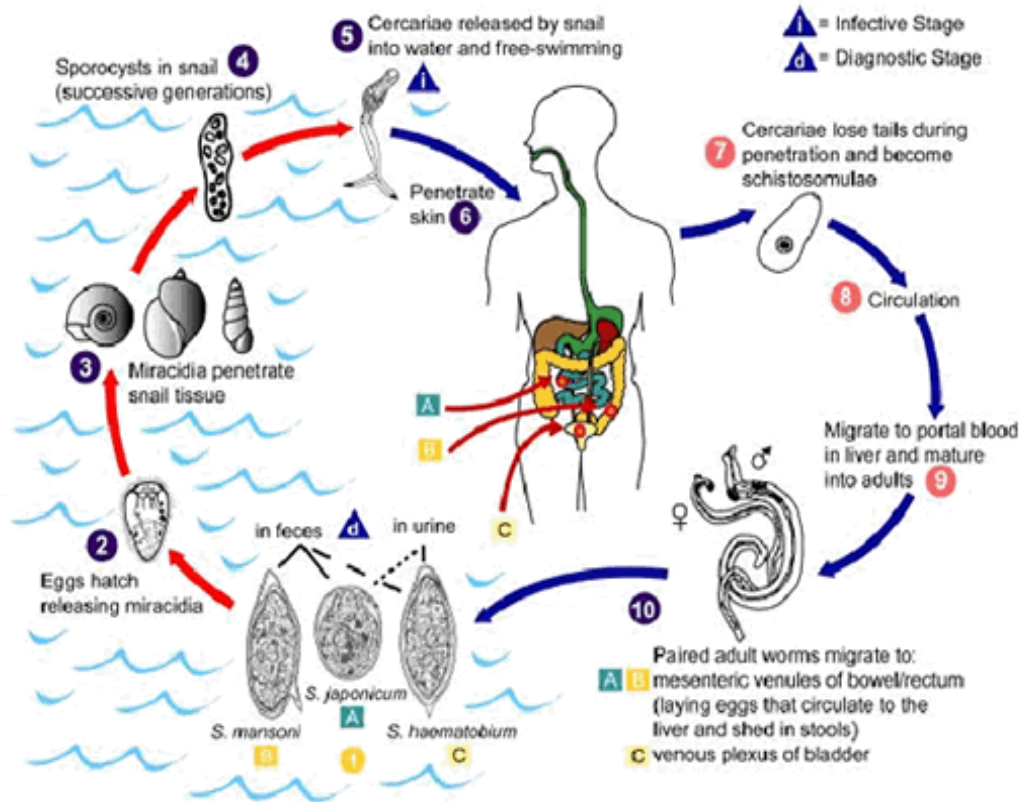


Plate I: Life cycle of *Schistosoma Spp*

Source: CDC (2011)



Plate II: Egg of *Schistosoma haematobium*

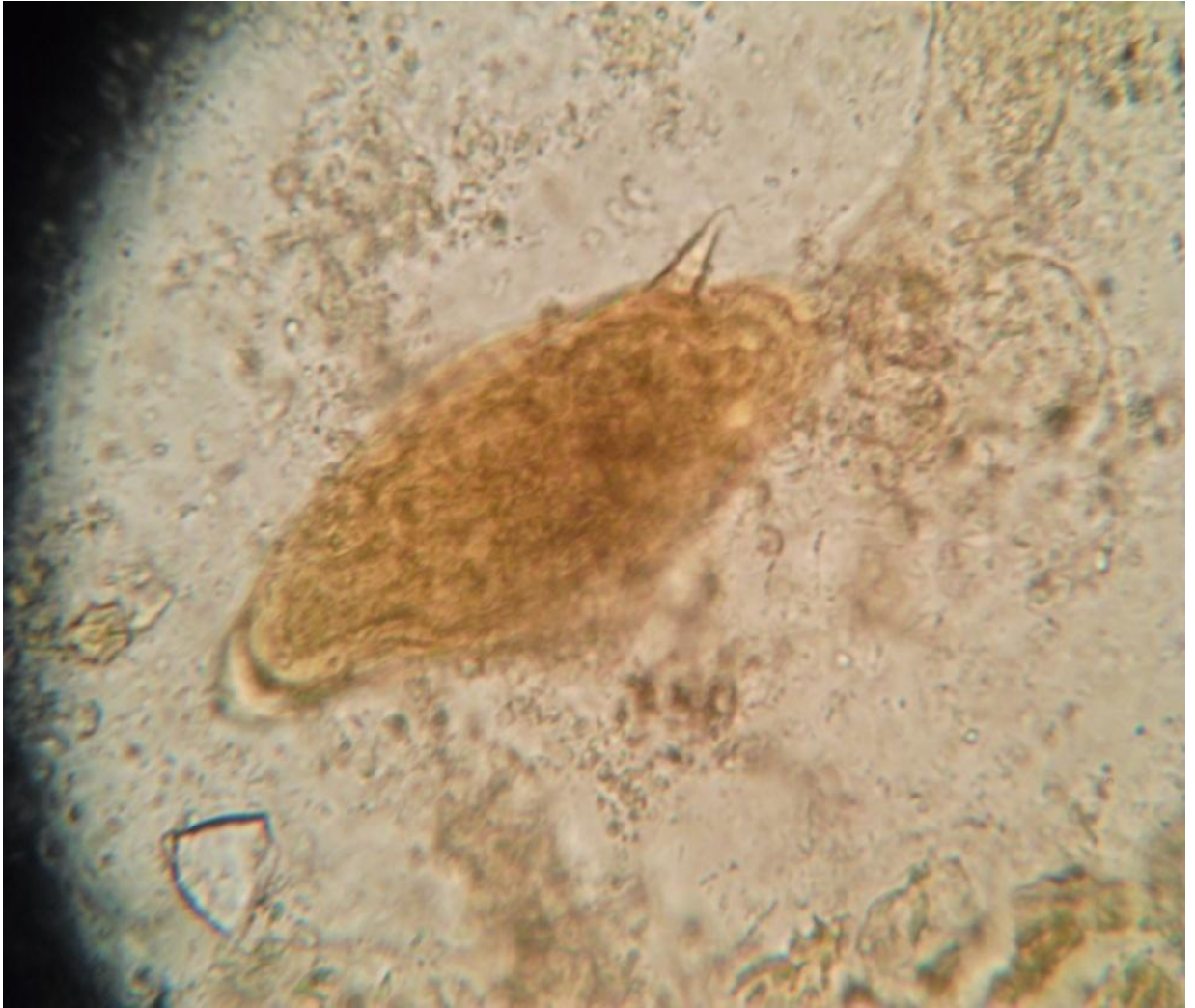


Plate III: Egg of *Schistosoma mansoni*

They live inside visceral blood vessels and are commonly known as blood flukes. They have digenetic life-cycles involving aquatic snails as obligate intermediate hosts. Eggs deposited in the circulation penetrate the gut or bladder to be excreted with faeces or urine (Hotez, 2008). In water, the eggs release miracidia which infect snails and undergo asexual proliferation through sporocyst stages eventually releasing cercariae back into the water. Vertebrate hosts become infected by direct penetration of the skin. Infections may cause chronic debilitating diseases in humans and some domestic animals (Steinmann *et al.*, 2006).

Schistosoma species

Parasite morphology

Blood flukes form five different developmental stages: eggs, miracidia, sporocysts, cercariae and adult worms (Steinmann *et al.*, 2006). Eggs are round to oval in shape, operculate (hinged at one end) and contain a developing embryonic larva (miracidium). Differences in egg morphology can be used to distinguish between *Schistosoma* species; *S. mansoni* producing oval eggs (115-175 x 45-70µm) with a sharp lateral spine, *S. japonicum* forming round eggs (70-100 x 50-70µm) with a rudimentary lateral spine; and *S. haematobium* producing oval eggs (110-170 x 40-70µm) with a sharp terminal spine. Miracidia are elliptical free-swimming larval stages (~200µm long) covered with cilia (Hotez, 2008). Sporocysts appear as pleomorphic sac-like bodies which contain developing cercariae. Mature cercariae are elongate free-swimming larval stages (400-600µm long) consisting of a tapering head (with prominent penetration glands) and a forked tail (furcocercous). Adult flukes are elongate tubular worms (10-20mm long), with rudimentary oral and ventral suckers. Males are shorter and stouter than females,

and they have a longitudinal cleft (gynecophoral canal or schist) in which the longer slender female lies folded (Steinmann *et al.*, 2006).

2.5 Epidemiology

People become infected with schistosomiasis usually by contact with water contaminated with schistosome parasites during some activities such as bathing, swimming, or performing daily chores, such as washing laundry, fetching water, and herding animals (Asaolu and Ofoezie, 2003). Thus, patterns of sanitation, water supply, and human water use are crucial elements in determining the risk of infection (Asaolu and Ofoezie, 2003). The geographic distribution of the various species of schistosomes is dependent on the distribution of the species of their intermediate freshwater snail hosts (Chitsulo *et al.*, 2000). Schistosomiasis can be found in 74 tropical countries including Africa, the Caribbean, South America, East Asia, and the Middle East, with 62 percent of the burden occurring in 10 countries in Africa. Worldwide, more than 700 million people are at risk of infection and more than 207 million people are infected (Asaolu and Ofoezie, 2003). Schistosomiasis infection is usually acquired in childhood when children tend to spend time swimming or bathing in water containing the larval form of the parasite (Chitsulo *et al.*, 2000). Prevalence and intensity of infection increase with age, peaking in the 5 to 14 year age group. Children also suffer the most side effects of the disease, especially poor growth and impaired cognitive development (Chitsulo *et al.*, 2000). The disease also contributes to malnutrition and disrupts school attendance. In older people, there is a drastic decline in intensity of infection but not in the prevalence of the disease (WHO, 2002).

Schistosoma mansoni which is the major source of intestinal schistosomiasis is found in Africa (distributed throughout continent): There is risk of infection in fresh water in southern and sub-Saharan Africa, including the great lakes and rivers as well as smaller bodies of water (WHO, 2002). Transmission also occurs in the Nile River Valley in Sudan and Egypt, South America: including Brazil, Suriname, and Venezuela, Caribbean (low risk): Antigua, Dominican Republic, Guadeloupe, Martinique, Montserrat, and Saint Lucia. *S. japonicum* which also causes intestinal schistosomiasis is found in Indonesia and parts of China and Southeast Asia while *S. mekongi* is found in Cambodia and Laos (WHO, 2002).

2.6 Site of Infection

Paired adult worms live inside blood vessels in specific sites within the human body. *Schistosoma mansoni* lives principally in the portal veins draining the large intestine, *S. japonicum* in the mesenteric veins of the small intestines, and *S. haematobium* infects veins of the urinary bladder plexus (Morel, 2000). Fluke eggs penetrate into the lumen of the intestines or bladder to be voided with host faeces or urine. Many eggs, however, may be swept away in the host circulation and become trapped in various host tissues and organs (Morel, 2000).

2.7 Pathogenesis

Schistosomiasis (or bilharziasis) is unusual amongst helminth diseases for two reasons: much of the pathogenesis is due to the eggs (rather than larvae or adults); and most of the pathology is caused by host immune responses (delayed-type hypersensitivity and granulomatous reactions) (Morel, 2000). The course of infection is often divided into three phases: migratory, acute and chronic. The migratory phase occurs when cercariae

penetrate and migrate through the skin (King and Dangerfield-cha, 2008). This is often asymptomatic, but in sensitized patients, it may cause transient dermatitis ('swimmers itch'), and occasionally pulmonary lesions and pneumonitis (King and Dangerfield-cha, 2008). The acute phase (sometimes called Katayama fever) is coincident with first egg release and is characterized by allergic responses (serum sickness due to overwhelming immune complex formation), resulting in pyrexia, fatigue, aches, lymphadenopathy, gastrointestinal discomfort and eosinophilia (Morel, 2000). The chronic phase occurs in response to the cumulative deposition of fluke eggs in tissues and the host reactions that develop against them. Not all the eggs laid by female worms successfully penetrate the gut or bladder walls, many are swept away in the circulation and become trapped in organs where they elicit strong granulomatous responses (Koukounari *et al.*, 2007). Eggs become surrounded by inflammatory cells forming characteristic pseudotubercles, which may coalesce to form larger granulomatous reactions (polyps). The encapsulated eggs die and eventually calcify (Koukounari *et al.*, 2007). The resultant effects on host organs and tissues are manifold, and include intestinal polyposis, abdominal pain, diarrhoea, glomerulonephritis, pulmonary arteritis, cardiovascular problems including heart failure, and periportal (Symmer's clay pipe-stem) fibrosis. Portal hypertension often leads to hepatomegaly, splenomegaly, ascites, and sometimes gross enlargement of oesophageal and gastric veins (varices) which may burst (Morel, 2000). Cerebral granulomas have been associated with focal epileptic convulsions, while spinal cord granulomas may cause transverse myelitis. Infections by *S. haematobium* often cause haematuria (blood in urine) and progressive disruption of the bladder wall may lead to carcinoma (Koukounari *et al.*, 2007).

2.8 Clinical Presentation

The incubation period is typically 14–84 days for acute schistosomiasis (Katayama syndrome), but chronic infection can remain asymptomatic for years (Olufemi *et al.*, 2007). Penetration of cercariae can be associated with a rash that develops within hours or up to a week after contaminated water exposures. Acute schistosomiasis is characterized by fever, headache, myalgia, diarrhea, and respiratory symptoms. Eosinophilia is present, as well as often painful hepatomegaly or splenomegaly (Okodua *et al.*, 2003). The clinical manifestations of chronic schistosomiasis are the result of host immune responses to schistosome eggs. Eggs secreted by adult worm pairs enter the circulation and lodge in organs and cause granulomatous reactions (Hotez, 2008). Eosinophilia may be present. *Schistosoma mansoni* and *S. japonicum* eggs most commonly lodge in the blood vessels of the liver or intestine and can cause diarrhea, constipation, and blood in the stool. Chronic inflammation can lead to bowel wall ulceration, hyperplasia, and polyposis and, with heavy infections, to periportal liver fibrosis (Hotez, 2008). *Schistosoma haematobium* eggs typically lodge in the urinary tract and can cause dysuria and hematuria. Calcifications in the bladder may appear late in the disease. *S. haematobium* infection can also cause genital symptoms and has been associated with increased risk of bladder cancer (Olufemi *et al.*, 2007).

Rarely, central nervous system schistosomiasis may develop; this form is thought to result from aberrant migration of adult worms or eggs depositing in the spinal cord or brain. Signs and symptoms are related to ectopic granulomas in the central nervous system and can present as transverse myelitis (Okodua *et al.*, 2003).

2.9 Symptoms

Most people have no symptoms when they are first infected. However, a person who becomes infected with schistosomiasis parasites may develop a rash or itchy skin within days of becoming infected (WHO, 2013). Within 1 to 2 months of infection, flu-like symptoms may develop. Symptoms of chronic schistosomiasis infection are caused by the body's reaction to the parasites' eggs, which become lodged in the intestine or bladder, causing inflammation or scarring (WHO, 2013). In children, infection can cause anemia, malnutrition, and learning difficulties. With urinary schistosomiasis, the parasites' eggs damage the bladder and kidneys, which causes painful urination, blood in the urine, and abdominal pain. Intestinal schistosomiasis damages the intestines and liver, resulting in abdominal pain, fever, and bleeding (WHO, 2002). Damage to the liver can produce swelling of the abdomen, which is a classic sign of infection. Symptoms of chronic schistosomiasis include abdominal pain, enlarged liver, blood in the stool or in the urine, and problems passing urine; it also can increase the risk of bladder cancer (Hotez *et al.*, 2009). In women, urogenital schistosomiasis may cause genital lesions, vaginal bleeding, pain during sexual intercourse, and nodules in the vulva. In men, urogenital schistosomiasis can induce pathology of the seminal vesicles, prostate, and other organs (Hotez *et al.*, 2009). This disease may also have other long-term irreversible consequences, including infertility. In rare cases, eggs are found in the brain or spinal cord and can cause seizures, paralysis, or spinal cord inflammation (WHO, 2013).

2.10 Diagnosis

Infections are conventionally diagnosed by the detection of fluke eggs in faecal or urine samples, often after concentration by sedimentation/flotation or filtration techniques. The

eggs are sufficiently characteristic to facilitate specific diagnosis (Kings and Dangerfield-cha, 2008). On occasion, microscopy of rectal biopsies has been used to diagnose *Schistosoma haematobium* infections. Immunoserological tests have been developed to detect host antibodies against infection but they have experienced cross-reactivity problems and cannot discriminate between previous and active infection. More recently, molecular techniques have been used to detect parasite antigens or DNA in host samples; some tests showing good correlations with parasite burdens (WHO, 2002).

2.11 Treatment and Control

The drug of choice for the treatment of all *Schistosoma* spp. is praziquantel, a single oral dose being very effective, with low toxicity and good tolerance, even in severe clinical cases (Doenhoff *et al.*, 2008). Nitridazole and metrifonate are effective against *S. haematobium*, and oxamniquine against *S. mansoni*, but they have mild side-effects. While timely treatment is effective, cured individuals rapidly become re-infected in endemic areas (Doenhoff *et al.*, 2008). Various control programmes have therefore been developed based on mass chemotherapy in conjunction with preventive measures, including improved sanitation, snail vector control, modifying habitats and farming practices, and public education campaigns. Water contamination can be reduced by preventing the ingress of parasite eggs as well as curtailing the asexual amplification cycle in snail hosts. The provision and use of latrines contains sources of infection, and modern biocomposting toilets appear to be effective in killing parasite eggs when used properly. Snail populations may be reduced by the strategic use of molluscicides (niclosamide or copper sulphate), draining marshes and swamps, and clearing channels of vegetation. Irrigation practices can be modified to avoid long-standing still waters, and

different or improved crops can be used which are less dependent on lengthy immersion in water. In endemic areas, farmers (and visitors) need to be aware of the dangers of immersion in potentially contaminated waters. Considerable resources have been devoted to the development of cellular, subcellular and recombinant vaccines, and promising results have been obtained with animal models of disease (WHO, 2013).

2.12 Prevention

The elimination of the water-dwelling snails that are a natural reservoir of the parasite may be effective; they may be eradicated with acrolein, copper sulfate, and niclosamide (WHO, 2013). Some studies have shown that the introduction of crayfish populations to areas where the snails exist may help control the snail population (Nwosu *et al.*, 2005). As with any ecological intervention, this must be carried out with caution. It is possible to design irrigation schemes that make it difficult for the snails to colonize the water; thus reducing potential human exposure (Nwosu *et al.*, 2005).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Area

Giwa Local Government Area is located between latitude 10°15'N to 11°20'N and longitude 7° 00'E to 8° 00'E. Kaduna State, Nigeria. Its headquarters is Giwa. It has an area of 2,066km² and a population of 286,427 recorded during the 2006 census (NIPOST, 2010). It shares borders with Katsina State to the North, Birnin Gwari Local Government Area to the west, Igabi Local Government Area to the south and Sabon Gari and Zaria Local Government Areas to the East (Figure 1). Giwa Local Government Area is in the Northern Guinea and Southern tip of the Sudan Savanna and about 640m above sea level. The average annual rainfall is 1100mm and this spreads from late April or early May to late October (wet season). The mean maximum ambient temperature varies from 27-35°C depending on the season while the average humidity during the wet season is between 72 and 21% during the period of dry cool weather of November to January known as harmattan (NIPOST, 2010).

The climatic conditions in Giwa Local Government Area greatly influence the activities of the people, who are predominantly engaged in agriculture during the rainy season and engage in fishing and petty trading during the dry season.

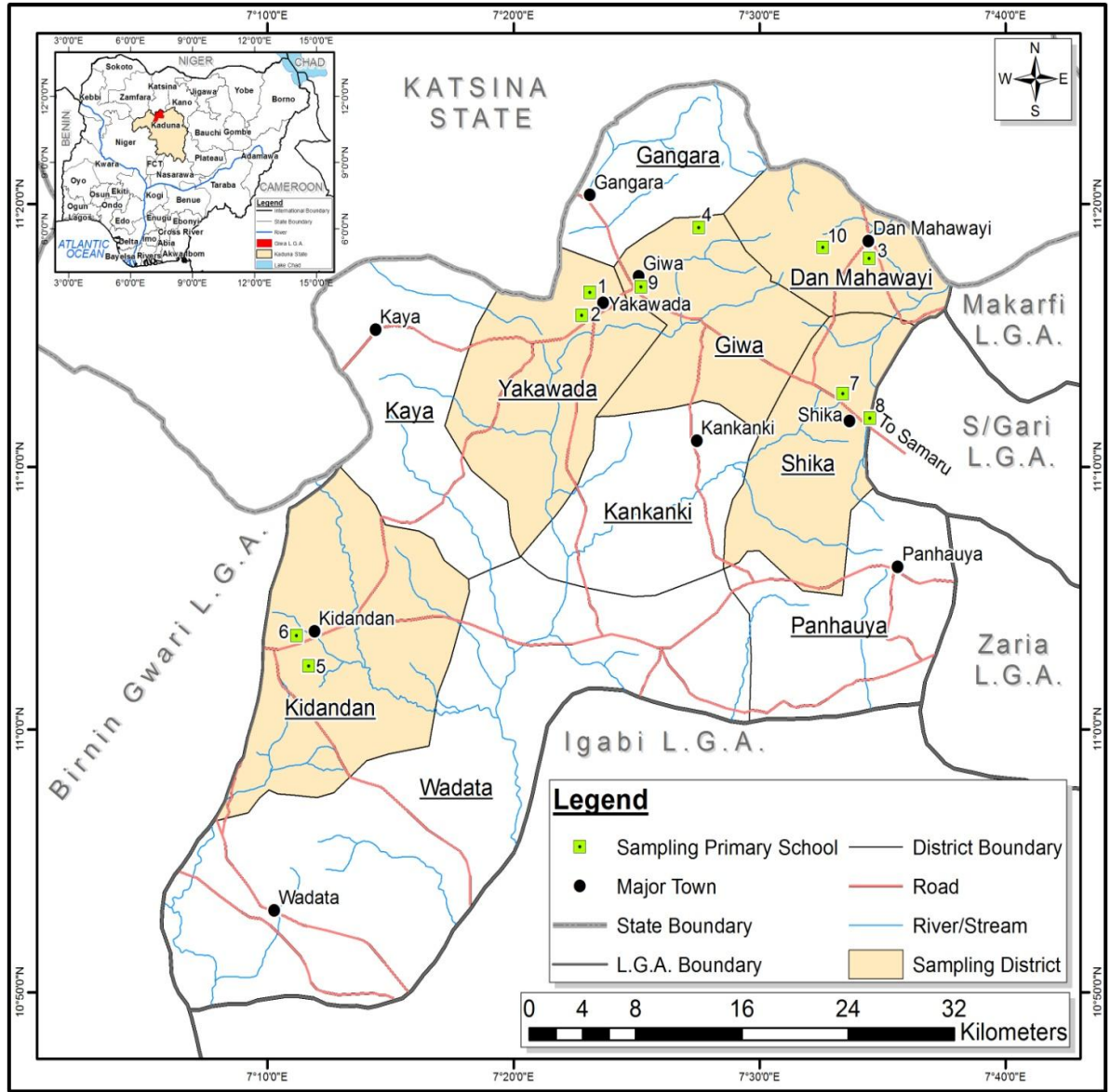


Figure 1: Giwa Local Government Area showing Sampling Districts and Primary Schools
 Source: Modified from the Administrative Map of Giwa L.G.A. (2013)

3.2 Study Population

The study population comprised 300 male and female primary school pupils between the ages of 5 to 14 years whom were randomly selected from 10 primary schools in the study area. The ten primary schools used for the study included

1. Model Primary School, Yakawada,
2. LGEA Unguwar Pah,
3. Yakawada, LGEA Kuringa, Dan Mahawayi,
4. LGEA Hayin Madara, Giwa,
5. Model Primary School, Kidandan,
6. LGEA Sabon Layi, Kidandan,
7. Model Primary School, Shika,
8. Katsinawa Primary School Shika,
9. LGEA, Giwa and
10. Model Primary School, Dan Mahawayi.

3.3 Ethnical Consideration

Permission was obtained from the Education Secretary, Giwa Primary Education Board, the Head Teachers of the 10 primary schools and data the consent of the pupils.

3.4 Determination of Sample Size

Sample size was calculated using the formula of Sarmukaddan and Gerald (2006) as follows:

$$N = \frac{Z^2 pq}{L^2}$$

Where;

N = Sample size

Z = Standard normal distribution at 95%

P = prevalence of 16%= 0.16 (Alhassan *et al.*, 2013)

q = 1-P= (1-0.16) = 0.84

L = Allowable error which is equal to 5%= 0.05

Confidence interval= 1.96%

Substituting the values

$$N = (1.96^2 \times 0.16 \times 0.84) / 0.05^2$$

$$= (3.8416 \times 0.16 \times 0.84) / (0.0025)$$

$$= 0.51631104 / 0.0025$$

$$= 206.524416 = 207$$

Accordingly, 207 was taken as the minimum number of samples to be collected. However, a total of three hundred and eight (308) samples were collected from the ten primary schools visited with at least a minimum of 30 samples from each primary school, which was dependent on the number of pupils that consented to participate.

3.5 Survey and Examination of Snails

The water bodies located close to the schools in Giwa Local Government Area, Kaduna State were examined for the presence of snails in them. A scoop net was extended into

the streams and ponds especially in areas where human water contact activities take place. The snails that were collected were taken to the Parasitology and Entomology Laboratory, Faculty of Life Sciences, Ahmadu Bello University, Zaria for further examination. In the laboratory, the snails were separated and identified using the standard keys described by Brown and Christensen (1993). Two separate containers were used and in each of the containers, each genus- *Biomphalaria* and *Bulinus* was placed in separate containers. The snails were placed in a group of five placed in a 250ml petri dish each in preparation for exposure to the sun. The snails were then exposed to sunlight for 30min after adding 100ml of distilled water so as to enhance the shedding of cercariae by the snails. The snails were examined under the dissecting microscope.

3.6 Administration of Structured Questionnaire

A structured questionnaire was administered to each pupil to obtain information such as sex, age, occupation of parents, source of drinking water and water contact activities.

3.7 Collection of Urine and Stool Samples

Three hundred and eight (308) urine and faecal samples each were collected from the pupils who consented to participate.

3.7.1 Urine collection

Dark (black) sterile, plastic universal labeled containers were given to the 308 pupils to collect the urine samples. This was done between the hours of 10.00 am to 2.00 pm after ensuring that the first and the last few drops of the urine were included. This was to ensure accumulation of schistosome eggs (WHO, 1980; Cheesbrough, 1998; Ochei and Kolhatkar, 2007). The 308 urine samples collected were taken to the Parasitology and

Entomology Laboratory, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria for analysis.

3.7.2 Stool collection

Clean, transparent, wide-mouthed, screw capped specimen bottles were given to the 308 pupils after they have been trained on how to collect their early morning fecal samples into specimen bottles. The 308 stool samples were preserved in 10% formalin. All samples collected were transported to the Parasitology and Entomology Laboratory, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria for analysis.

3.8 Laboratory Analysis

3.8.1 Examination of urine samples for *Schistosoma haematobium* eggs

The urine sample were well mixed, 10 ml of the well mixed urine sample were centrifuged at RCF 500-1000 g to sediment the schistosome eggs. The supernatant was decanted and the sediment transferred to a clean grease-free glass slide to which a cover slip was added. This was mounted on a light microscope and examined at 10 × objective with the condenser iris closed sufficiently to give good contrast so as to identify *Schistosoma haematobium* eggs characterised by a terminal spine (Cheesbrough, 1998).

3.8.2 Examination of stool samples for *Schistosoma mansoni*

A. Formalin-ether concentration technique (FEC)

Using an applicator stick, about 1g of faeces was emulsified in 4 ml of 10% formol water contained in a screw cap bottle or tube. About 3-4 ml of 10% formol water was further added and the bottle was capped and mixed well by shaking. The emulsified faeces was sieved and the sieved suspension was collected in a beaker. The suspension was

transferred into a conical (centrifuge) tube and 3-4 ml of diethyl ether or ethyl acetate was added. The tube was stoppered and mixed for 1 minute. With a tissue around the top of the tube, the stopper was loosened and centrifuged immediately at 750-1000 g (approximately 3000 rpm) for 1 minute. Using a stick, the layer of the faecal debris was loosened from the side of the tube and the tube was inverted to discard the ether, faecal debris and formol water leaving the sediment. The tube was returned to an upright position and the fluid from the side of the tube was allowed to drain to the bottom. The bottom of the tube was tapped to re-suspend and mix the sediment. And the sediment was transferred to a slide and covered with a cover glass. The preparation was examined microscopically using the 10× objective with the condenser iris closed sufficiently to give good contrast. The number of schistosome eggs in the preparation were counted to give the approximate number per gram of faeces (Cheesbrough, 1999).

B. Kato-Katz technique (cellophane faecal thick smear)

The pieces of cellophane were soaked in the glycerol malachite green solution for 24 hours before use. Wearing protective gloves 0.5 g faeces was transferred on to a piece of scrap paper and the screen was pressed on the faeces. Using a scapula the screen was scraped across to sieve the faeces. A template was placed on the slide and the sieved faeces were added with the spatula so that the hole in the template was completely filled. The template was carefully removed with care so as not to remove any of the faeces. Using forceps, the faecal sample was covered with glycerol-malachite green soaked strips. Absorbent paper was used to wipe clean the upper surface of the cellophane. A clean slide was placed on top of the preparation and carefully pressed downwards to spread evenly the faecal sample. The preparation was left for 1-2 hours for the faecal

matter to clear. The entire preparation was examined microscopically for the schistosome eggs using the 10× objective with the condenser iris closed sufficiently to give good contrast. The number of eggs counted was multiplied by 24 to give the number of eggs per gram of faeces.

3.9 Data Analyses

All the data obtained were analyzed using SPSS version 21. Comparisons of the association between prevalence with respect to schools, age and sex were made using Chi-Square tests. The association between the prevalence and various parameters obtained from the questionnaires such as water contact activities, sources of water, faecal disposal and other risk factors were analyzed using Odd's Ratio (OR), P value less than 0.05 were considered significant.

CHAPTER FOUR

4.0 RESULTS

4.1 Prevalence of *S. haematobium* and *S. mansoni* infections among Primary School Pupils in the Study Area

The prevalence of urinary and intestinal schistosomiasis among the primary school pupils is presented in Table 4.1. The overall prevalence for both forms of schistosomiasis in the study area was 7.5%. The prevalence of urinary schistosomiasis was 5.5% while that of intestinal schistosomiasis was 0.7% and 1.3% by the Kato-Katz smear and formol-ether concentration method respectively. The prevalence of urinary schistosomiasis by schools showed that LGEA Unguwar Pah, Yakawada had the highest prevalence (13.3%) followed by Model Primary School Kidandan (11.4%). Urinary schistosomiasis was not recorded (0%) in Hayin Madara, Giwa and Model Primary School Shika. There was no statistically significant difference between the prevalence of both forms of schistosomiasis and the schools ($p > 0.05$).

Using the Kato-Katz technique, a prevalence of 6.7% intestinal schistosomiasis was observed at LGEA Unguwar Pah, Yakawada only. No single parasite was observed in pupils of other schools (Table 4.1). There was statistically significant difference of prevalence in the different schools ($P \leq 0.05$).

Table 4.1 also showed that the formol-ether concentration method record the highest prevalence of 3.3% was observed in 3 schools namely; Model Primary School Yakawada,

Table 4.1: Total Number Positive for Schistosomiasis

S/N	School	Total Number Examined	<i>Schistosoma haematobium</i>	Number Positive (%)		Total Number Positive (%) with both forms of Schistosomiasis
				<i>Schistosoma mansoni</i>		
				Kato Katz Method	Formol Ether Method	
1	Model Yakawada	30	1 (3.3)	0 (0.0)	1 (3.3)	2 (6.67)
2	Ung. Pah Yakawada	30	4 (13.3)	2 (6.7)	0 (0.0)	6 (20.0)
3	Kuringa Dan Mahawayi	30	1 (3.3)	0 (0.0)	0 (0.0)	1 (3.3)
4	Hayin Madara Giwa	32	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
5	Model Kidandan	35	4 (11.4)	0 (0.0)	1 (2.9)	5 (14.3)
6	Sabon Layi Kidandan	30	2 (6.7)	0 (0.0)	1 (3.3)	3 (10.0)
7	Model Primary Shika	30	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
8	Katsinawa Primary Shika	31	3 (9.7)	0 (0.0)	0 (0.0)	3 (9.7)
9	LGEA Giwa	30	1 (3.3)	0 (0.0)	1 (3.3)	2 (6.7)
10	Model Dan Mahawayi	30	1 (3.3)	0 (0.0)	0 (0.0)	1 (3.3)
	Total	308	17 (5.5)	2 (0.7)	4 (1.3)	23 (7.5)
		Chisquare	11.681	18.654	5.978	16.215
		Df	9	9	9	9
		P value	0.232ns	0.028*	0.742ns	0.063

* - significant ($P \leq 0.05$), n.s – not significant ($P > 0.05$).

LGEA Primary School Sabon Layi, Kidandan and LGEA Giwa. Model School Kidandan had 2.9%. Differences in the infection by the Formol-ether concentration method was not statistically significant among the schools ($P \leq 0.05$).

4.2 Gender-Related Prevalence of *S. haematobium* and *S. mansoni*

Out of the 308 primary school pupils examined, 168 were males while 140 were females. The prevalence of *S. haematobium* was higher in the males 8.3% (19/168) than females 2.1% (3/140). There was statistically significant difference between the prevalence of all forms of schistosomiasis and gender and there was also statistically significant difference ($p \leq 0.05$) between the prevalence of *S. haematobium* and gender (Table 4.2).

Gender specific prevalence of *Schistosoma mansoni* by Kato-Katz technique showed that the infection was recorded only among the males 2(1.2%) while the females were not infected (0%). There was no statistically significant difference ($p > 0.05$) between *Schistosoma mansoni* infection and gender by this technique (Table 4.2).

Gender specific prevalence of *Schistosoma mansoni* using the formol-ether concentration technique showed that the males had higher prevalence of 1.8% (3/168) than the females 0.7% (1/140). There was no statistically significant difference ($p > 0.05$) between *Schistosoma mansoni* infection and gender by this method (Table 4.2).

4.3 Age-Related Prevalence of *S. haematobium* and *S. mansoni*

The prevalence of *S. haematobium* and *S. mansoni* among primary school pupils in Giwa Local Government Area by Age is presented in Table 4.3. For *S. haematobium* infection,

Table 4.2: Gender-related prevalence of *S. haematobium* and *S. mansoni* infection

Gender	Total Number Examined	Total Number Positive for both forms of schistosomiasis(%)	Number Positive (%)		
			<i>Schistosoma haematobium</i>	<i>Schistosoma mansoni</i> Kato Katz Method	Formol Ether Method
Female	140	4 (2.9)	3 (2.1)	0 (0.0)	1 (0.7)
Male	168	19 (11.3)	14 (8.3)	2 (1.2)	3 (1.8)
Total	308	23 (7.5)	17 (5.5)	2 (0.7)	4 (1.3)
	Chisquare	13.839	9.881	2.416	1.427
	Df	1	1	1	1
	P value	0.000*	0.002*	0.120ns	0.232ns

* - significant ($P \leq 0.05$), n.s – not significant ($P > 0.05$).

Table 4.3: Age-related prevalence of Schistosomiasis

Age (Years)	Total Number Examined	Total Number Positive for both forms of schistosomiasis (%)	Number Positive (%)		
			<i>Schistosoma haematobium</i>	<i>Schistosoma mansoni</i> Kato Katz Method	Formol Ether Method
5-6	7	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
7-8	42	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
9-10	67	5 (7.5)	3 (4.5)	0 (0.0)	2 (3.0)
11-12	97	8 (8.3)	6 (6.2)	0 (0.0)	2 (2.1)
13-14	69	6 (8.7)	4 (5.8)	2 (2.9)	0 (0.0)
> 14	26	4 (15.4)	4 (15.4)	0 (0.0)	0 (0.0)
Total	308	23 (7.5)	17 (5.5)	2 (0.7)	4 (1.3)
	Chisquare	6.549	7.947	6.973	3.822
	Df	5	5	5	5
	P value	0.256ns	0.159ns	0.223ns	0.575ns

n.s – not significant (P>0.05).

The overall prevalence was 5.5%. The prevalence was highest (15.4%) in the >14years group followed by 11-12years group (6.2%), followed by 13-14years (5.8%) and 9-10years (4.5%);The 5-6 years and 7-8years age groups were not infected at all. There was no statistically significant difference ($P>0.05$) between the prevalence of *S. haematobium* and age of pupils.

The prevalence of *S. mansoni* by Kato-Katz technique revealed that infection was detected only in the age group 13-14 years (2.9%) while the remaining age groups showed no infection. The Prevalence of *S. mansoni* by formol-ether concentration method revealed that infection was detected in the 9-10years group (3%) and 11-12years age group (2.1%). The remaining age groups recorded no infection at all. There was no statistically significantly difference ($P>0.05$) between the prevalence of *S. mansoni* using both techniques and age groups.

4.7 Prevalence of *S. haematobium* and *S. mansoni* in relation to Risk Factors

Table 4.4 showed the list of risk factors examined in this study. The risk factors with Odds ratio (OR) values greater than or equals to one, indicated association with schistosomiasis, while the risk factors with odds ratio values less than one indicates no association with schistosomiasis. The following risk factors; pipe borne water (OR=1.1), Borehole (OR=2.4), rivers/stream (OR=5.6), defaecating in the bush (OR=8.6), having ponds around houses (OR=3.5), fishing (OR=8.0), washing clothes in the stream/river (OR=7.8), swimming (OR=8.2) all showed association with the infection.

Table 4.4: Prevalence of *S. haematobium* and *S. mansoni* in relation to risk factors

Risk Factors	Number Examined	Status		Odds ratio	C.I.
		Number Positive (%)	Number Negative (%)		
Water Source					
Well	268	16 (5.93)	252 (94.07)	0.400	1.280-8.721
Pipe Borne	12	1 (8.33)	11 (91.67)	1.132	0.140-9.179
Borehole	21	4 (19.05)	17 (80.95)	3.319	1.015-10.849
River/Stream	7	2 (28.57)	5 (71.43)	5.330	0.976-29.157
Types of Toilets					
Pit Latrine	287	17 (5.92)	270 (94.4)	0.400	0.068-0.835
Water System	3	(33.33)	2 (67.67)		
Bush	18	6 (27.78)	13 (72.22)	8.8	2.955-27.778
Pond Around House					
Yes	74	11 (14.9)	63 (85.1)	3.5	1.466 - 8.545
No	234	12 (5.13)	222 (94.87)		
Fishing					
Yes	37	14 (37.84)	23 (62.16)	8.0	3.160 - 20.222
No	271	9 (3.32)	262 (96.68)		
Washing					
Yes	50	15 (30.00)	35 (70.00)	7.8	3.165 - 19.379
No	258	8 (3.10)	250 (96.90)		
Swimming					
Yes	42	14 (33.33)	28 (66.67)	8.2	3.294 - 20.540
No	266	9 (3.38)	257 (96.62)		

4.5 Examination of *S. mansoni* using Kato-Katz and Formol-ether Concentration Methods

Table 4.5 showed the prevalence of *S. mansoni* by Kato-Katz technique and formol ether concentration method respectively. The result revealed that infection was detected only in the age group 13-14 years (2.9%) while the remaining age groups showed no infection using Kato-Katz. The Prevalence of *S. mansoni* by formol-ether concentration method revealed that infection was detected in the 9-10years group (3%) and 11-12years age group (2.1%). The remaining age groups recorded no infection at all. Comparing the two techniques, there was no statistically significant difference ($P>0.05$) between the prevalence of *S. mansoni* using both techniques and age groups.

4.6 Snails Surveyed in Giwa Local Government Area

The species of snails surveyed in water bodies in Giwa Local Government Area is shown in Table 4.6. Yakawada and Dan Mahawayi harboured *Bulinus* snails only. While *Bulinus* and *Biomphalaria* snails were both found in Shika and Kidandan streams. No snails were found in Giwa pond.

Table 4.5: Examination of *S. mansoni* using Kato Katz and formol-ether methods

Age (Years)	Kato Katz Method	Formol Ether Method
5-6	0 (0.0)	0 (0.0)
7-8	0 (0.0)	0 (0.0)
9-10	0 (0.0)	2 (3.0)
11-12	0 (0.0)	2 (2.1)
13-14	2 (2.9)	0 (0.0)
> 14	0 (0.0)	0 (0.0)
Total	2 (0.7)	4 (1.3)
P-value	0.415ns	

n.s – not significant (P>0.05).

Table 4.6 Occurrence of snail vectors of schistosomiasis in Giwa Local Government Area

Location	Type of water bodies	Genus of snails
Yakawada	Stream	<i>Bulinus</i> sp
Giwa	Pond	None
Shika	Stream	<i>Bulinus</i> and <i>Biomphalaria</i> sp
Dan Mahawayi	Pond	<i>Bulinus</i> sp
Kidandan	Stream	<i>Bulinus</i> and <i>Biomphalaria</i> sp

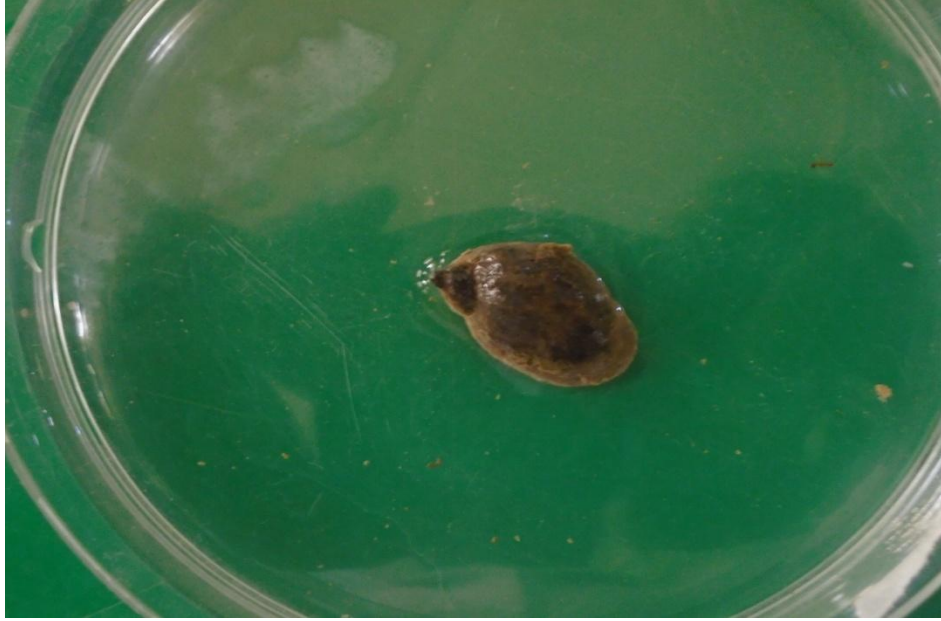


Plate IV: *Bulinus globosus*

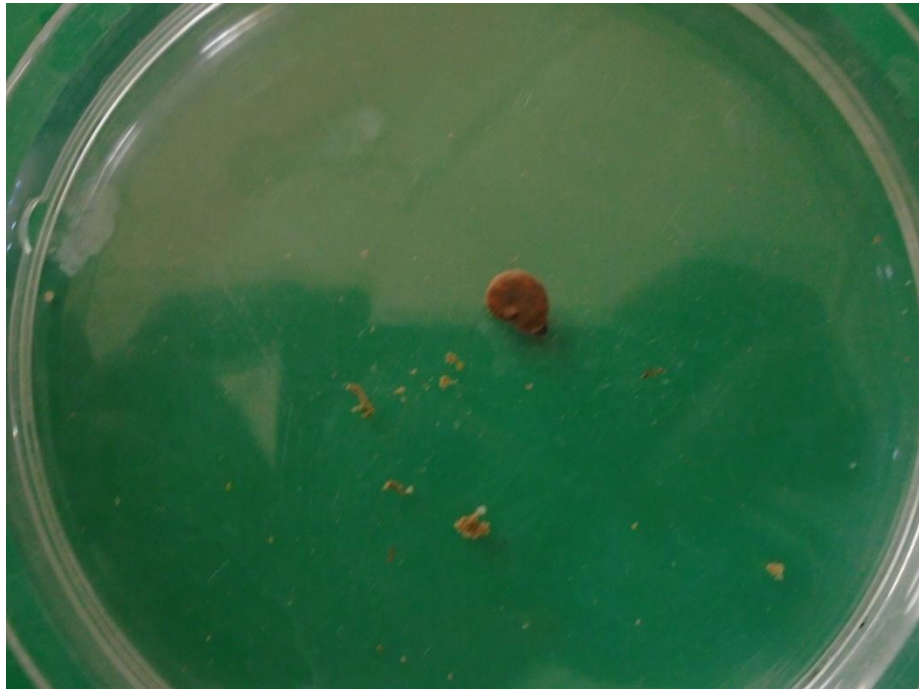


Plate V: *Biomphalaria pfeifferi*

CHAPTER FIVE

5.0 DISCUSSION

In this study the overall prevalence recorded is said to be low based on World Health Organization categorization areas with schistosomiasis as follows; high-risk = $\geq 50\%$, moderate-risk = $\geq 10\%$ but $< 50\%$ and low-risk = $< 10\%$ (WHO, 2015b). This could be attributed to good hygiene and proper awareness of the populace on the infection. The overall prevalence for both forms of schistosomiasis reported in this study is lower than other prevalence reported from different parts of Nigeria and Africa at large. Such as the 19.0% recorded among students in a LGA of Kaduna State (Damen *et al.*, 2006), 58.1% reported near Abeokuta (Uwem *et al.*, 2010), 25.1% recorded among sedentary fulani settlements of Dumbi (Kanwai *et al.*, 2011), 41.5% in Benue (Houmsou *et al.*, 2012), 20.3% reported in Birnin Gwari (Alhassan *et al.*, 2013). Other prevalence include the 11.7% (Timothy *et al.*, 2013), 60% (Barakat, 2013), 44.3% (Okwori *et al.*, 2014), 17.5% (Nwosu *et al.*, 2015) and 18.7% (Mahmood *et al.*, 2015).

However, the results from this study were higher than the findings of Okpala *et al.* (2004) and Goselle *et al.* (2010) who reported a prevalence of 0.67% and 4.6% in Jos, the 6.0% reported in Yobe State (Bigwan *et al.*, 2012) and the 6.0% in districts of basin irrigation, Egypt (Barakat, 2013). Statistically, there was no significant difference recorded between the overall prevalence for both forms of schistosomiasis in the schools. This means all the primary schools had equal chances of being infected. This findings disagrees with earlier report from Bigwan *et al.* (2012) who stated that the prevalence of schistosomiasis in relation to schools indicated a significant relationship in Yobe State, Alhassan *et al.* (2013) in Birnin-Gwari and Okwori *et al.* (2014) also found a statistically

significant difference between the prevalence and the schools. The difference in prevalence may be influenced by peculiar ecological characteristics and level or contact of individuals with water bodies. The result however agrees with the findings of Uwem *et al.* (2010) in a study carried out in schools near Abeokuta, Nigeria who reported no significant difference in prevalence of schistosomiasis among pupils in different schools.

The overall prevalence for both forms of schistosomiasis in relation to gender revealed higher prevalence of infection among males than their female counterpart. This findings agrees with earlier reports from different parts of the country such as the one reported in Ebonyi State (Uneke *et al.* 2007), in Niger State (Chidozie and Daniyan, 2008), in four states in Nigeria (Sulyman *et al.*, 2009) and in the Niger-Delta (Uneke *et al.*, 2010) who reported higher prevalence in males than females. However, this finding is not in agreement with the findings of Etim, (1998) who stated that more females are exposed to urinary schistosomiasis than males in rural communities of Nigeria. The higher prevalence recorded in this study in relation to gender could be attributed to higher tendencies of water contact among the males through swimming, playing and engagement in other activities like the molding of mud bricks close to streams and ponds, besides the primary domestic activities of washing in water bodies and fetching water which exposes the males to the infection. On the other hand, the female pupils were less likely to be infected because of social restriction to water contact activities like swimming, bathing, fishing and farming. This is in agreement with the observations of Ugbomoiko *et al.* (2010) in Osun State, Ladan *et al.*, (2011) in Gusau, Nanvya *et al.*, (2011) in Ndinjor district of Langtang North, Plateau State who reported significant association of schistosomiasis with gender. However, this finding is not in agreement

with the report of Abubakar *et al.* (2006) in Sokoto and Babatunde *et al.* (2013) in two peri-urban communities in Southwest Nigeria, where both sexes were equally at risk of acquiring the infection.

The overall prevalence for both forms of schistosomiasis in relation to age groups showed that the infection was recorded in age groups 9-14years only while the 5-8years age groups were not infected at all. The observed prevalence among the 9-14years and above age groups in this study is in agreement with the findings of Nmorsi *et al.* (2007) in a rural community of Edo State, Sarkinfada *et al.* (2009), in Danjarima community of Kano State, Bigwan *et al.* (2012) in Potiskum and Okwori *et al.* (2014) in North-Central Nigeria who reported the highest prevalence of their findings among the age group 10-14years. However, this result is in disagreement with the reports of Albonico *et al.*, (1998), Naish *et al.*, (2004) and Nworie *et al.* (2012), who reported that the age group 6-9years are most responsible for contaminating the environment and also having high contact with soil activity than 10-15years. However, the difference between the overall prevalence for both forms of schistosomiasis and age groups was not statistically significant. This means that infection was common among all the age groups with no specific age group being at more risk to the infection.

There were associations between infection and the different risk factors such as: Pipe borne water (OR=1.1) and borehole (OR=3.3), though pipe borne water and borehole water are known to be clean sources of water, however, the association recorded in this study from pipe borne water and bore hole could be due to the fact that the pupils must have visited infested streams for one or more water contact activities which might have

exposed them to the water containing cercariae thereby acquiring the infection. It could also be attributed to the occupation of the pupils' parents which is predominantly farming which predisposes the pupils to the infection. This is in agreement with the earlier report of Chigozie *et al.* (2007) in Ebonyi State who reported that the use of ponds as the major source of water supply predisposes the inhabitants to the risk of acquiring schistosomiasis.

The association recorded between the use of river/stream water (OR=5.3) and the infections in pupils could be due to the fact that the rivers contain infective stages known as the cercariae that infect the pupils. This agrees with the findings of Okpala *et al.* (2004) and Nwosu *et al.* (2005) who found a statistical significant association with river and stream.

Defecating in the bush (OR=8.8) also had association with the prevalence of the infections in the pupils. This could be attributed to the fact that the inhabitants of those areas get exposed to water bodies harbouring the infective stage of the schistosome parasites in the bush where they defaecate. They could get exposed when bathing, walking through, defaecating in the water bodies or drinking the infested water. This agrees with the findings of Okpala *et al.* (2004).

Having ponds around houses (OR=3.5), swimming (OR=8.2) and fishing (OR=8.0) are water contact activities that associated with the prevalence of Schistosomiasis among pupils. This still goes down to exposure of the populace to infective stage of the schistosome parasites.

Do wash clothes (OR=7.8) showed association with the infections. This could be attributed to poor socioeconomic status of parents, unhygienic environment that facilitate the transmission of parasite and lack of proper knowledge about schistosomiasis and the danger it caused.

In this study, Kato-Katz technique and formol-ether concentration method (FEC) were used to examine the stool samples to check for the presence of *Schistosoma mansoni* eggs. These gave varying prevalence with the Kato-Katz technique having lower detecting capacity than the formol-ether concentration method. This finding is similar to the findings of Mengistu *et al.* (2013) who also found a lower detection capacity of Kato-Katz technique than formol-ether concentration method in Ethiopia. The difference was not statistically significant, which means that both techniques have high detecting capacity.

The presence of snails in most of the water bodies examined is an indication that the ecological factors favourable for the survival of the snails are available in the study area. This agrees with the work of Alhassan *et al.* (2013) in Birnin Gwari L.G.A. Giwa Local Government Area experiences two climatic seasons; the dry season (October to April) and the wet season (May to September). The low snail population density observed in some of the water bodies could be attributed to low water level due to the season because the snail survey was carried out in April-which is the end of the dry season in the study areas. This observation agrees with that of Etim (1998) who reported that the snail population fluctuates and strongly decreasing at the peak of rainy season and dry season.

CHAPTER SIX

6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

This study was carried out to determine the prevalence of urinary and intestinal Schistosomiasis among primary school pupils in Giwa Local Government Area, Kaduna State, Nigeria. Ten primary schools were selected for the study which included: Model Primary School, Yakawada, LGEA Unguwar Pah, Yakawada, LGEA Kuringa, Dan Mahawayi, LGEA Hayin Madara, Giwa, Model Primary School, Kidandan, LGEA Sabon Layi, Kidandan, Model Primary School, Shika, Katsinawa Primary School, Shika, LGEA, Giwa and Model Primary School, Dan Mahawayi. Out of the 308 primary school pupils recruited for the study 22(7.5%) were positive. The overall prevalence for both forms of schistosomiasis amongst the schools varied significantly from 20% to 0%. Infection varied significantly among males (11.3%) and females (2.9%). However there was no significant difference observed among the age groups with the highest prevalence recorded in the >14years group followed by 11-12years group, 13-14years and 9-10years while the 5-6 and 7-8years age groups were not infected at all. All the risk factors were associated with the spread of the infection in the study area except for well water and pit latrine. There was no significant difference between Kato-Katz and formol-ether concentration methods used in detecting *Schistosoma mansoni*

6.2 Conclusions

- i. This study reveals an overall prevalence of 7.5% for both forms of schistosomiasis with 5.5% urinary schistosomiasis and 0.7%, 1.3% intestinal schistosomiasis by Kato-Katz and Formol-ether concentration methods respectively with formol-ether

- concentration being more sensitive. It can therefore be deduced that both *S. haematobium* and *S. mansoni* infections are low among primary school pupils in Giwa Local Government Area, Kaduna State, Nigeria.
- ii. There was no statistically significant difference between the infections and age. However gender significantly influenced *S. haematobium* infection but there was no significant association between gender and *S. mansoni* infection by both the Kato-katz and formol-ether Method.
 - iii. Association was recorded between the infection and the following risk factors; pipe borne water (OR=1.1), borehole (OR=3.3), river/stream (OR=5.3), defecating in the bush (OR=8.8), having ponds around houses (OR=3.5), fishing (OR=8.0), wash clothes in water bodies (OR=7.8) and swimming (OR=8.2). All these showed association with the infections.
 - iv. There was no statistically significant difference ($P>0.05$) between the prevalence of *S. mansoni* using both techniques and age groups.

6.2 Recommendations

The recommendations are based on the result from this study, though schistosomiasis had low endemicity in the study area, it is therefore recommended that efforts be made by avoiding further spread of the infections in the area. This can be done through the following measures;

- i. Pupils or individuals in Giwa Local Government Area who are already infected should be identified and given prompt treatment in order to avoid further spread of the disease in the Local Government Area.

- ii. There should be snail surveys at time intervals so as to check for the snail-intermediate host towards destroying them to avoid harboring infective stages.
- iii. There is need to provide safe water, for drinking and domestic use by Federal and State governments so as to reduce the rate of exposure to infested water bodies.
- iv. The teaching of Health Education as a subject in primary schools should be intensified and the pupils should be taught more on personal hygiene, preventive measures and control of certain parasites.

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APPENDICES

Appendix1: Questionnaire



DEPARTMENT OF BIOLOGICAL SCIENCES
SCHOOL OF POSTGRADUATE STUDIES
AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA.



RESEARCH QUESTIONNAIRE

NOVEMBER, 2014

This questionnaire has been designed as a tool to assist in generating data on “**An Evaluation of Urinary and Intestinal Schistosomiasis among Primary School Pupils in Giwa Local Government Area, Kaduna State, Nigeria**”. This questionnaire is a part of the research exercise; it will provide the necessary basic information needed for the research study for appropriate evaluation and conclusion.

Dear Sir/Ma,

I **Aisha Abdulkadir YAYA**, is a Postgraduate Student of the department of Biological Sciences Ahmadu Bello University, Zaria undertaking a research on the above topic. Kindly assist to fill in the appropriate answer to the questions below for each of the pupil enrolled for the study. Answers provided will be used for the purpose of this research **ONLY**.

SECTION A: BIO DATA

Instruction: Please fill in the blank spaces and tick () where appropriate.

- i. Reference number _____
- ii. Name of pupil _____
- iii. Age of pupil _____
- iv. Sex of the pupil _____
- v. Name of primary school _____
- vi. Occupation of parents _____
- vii. Educational status of parents _____
 - a. Primary school ()
 - b. Secondary School ()
 - c. Tertiary institution ()
 - d. Others ()

SECTION B: RISK FACTORS

Instruction: Please tick the appropriate option

1. Where do you get your drinking water? a. Well () b. Pipe borne water () c. Stream water () d. Pond () e. Tap ()
2. If you are using a well as your source of water, is the well covered?
 - a. Yes () b. No () c. Sometimes ()
3. Do you boil and sieve your water before drinking?
 - a. Yes () b. No () c. Sometimes ()
4. What type of toilet do you use?
 - a. Pit toilet () b. Water system () c. Bush () d. Direct into water body ()
5. Do you wash your hands after defaecation? Yes () No ()
6. Do you have a pond or sewage around your house? a. Yes () b. No ()
7. Do you have bushes around your house? a. Yes () b. No ()
8. How often do you wash fruit and vegetables before eating?
 - a) Always () b) Occasionally () c) Not at all ()
9. How often do you wash your hand before eating food?
 - a) Always () b) Occasionally () c) Not at all ()
10. Do you walk barefooted?
 - a) Yes () b) No ()
11. Do you swim in streams or river? Yes () No ()
12. How often do you go to a river?
 - a) Always () b) Occasionally () c) Not at all ()
13. Where do you dispose your refuses and garbage?
 - a) In bushes () b) in Water bodies () c) in town dustbin ()
14. Have you been experiencing bloody stool or urine? Yes () No ()
15. Have you been experiencing frequent stomach ache? Yes () No ().

16. Do you play around in damp places or near water bodies? Yes () No ().
17. Do you trim your nails often? Yes () No ()
19. Have you heard of schistosomiasis before? Yes () No ()
20. Do you deworm your children always? Yes () No ()
21. How often do you take your child to the hospital for checkup? a. always () b. Not always () c. Not at all ().

FOR RESEARCHER USE ONLY

Result of Lab. Examination:

a) Nature of faecal sample: formed () Diarrheic () Blood () Mucus ()

b) Types of eggs seen:

Schistosoma mansoni eggs.....

Schistosoma haematobium eggs.....