Surveillance of Schistosoma species among Population of Elmanagil locality, Gezira State, Sudan (2016)

Altayeb Saeed Ibrahim Mohammed

B.S.c In Medical Laboratory Sciences Omdurman Islamic University 2008

A Dissertation

Submitted to the University of Gezira in partial fulfilment of the requirement for the award of Degree of Master of Sciences

In

Medical Parasitology

Department of Medical Parasitology

Faculty of Medical Laboratory Sciences

University of Gezira

2016
Surveillance of Schistosoma species among Population of Elmanagil locality, Gezira State, Sudan (2016)

Altayeb Saeed Ibrahim Mohammed

Supervision committee:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Adam Daoud Abakar Salim</td>
<td>Main supervisor</td>
<td>...............</td>
</tr>
<tr>
<td>Dr. Bakeri Yosif Mohammed Nour</td>
<td>Co supervisor</td>
<td>...............</td>
</tr>
</tbody>
</table>

Date / / 2016
Surveillance of Schistosoma species among Population of Elmanagil locality, Gezira State, Sudan (2016)

Altayeb Saeed Ibrahim Mohammed

Examination committee:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Signature</th>
</tr>
</thead>
</table>
| Prof. Adam Daoud Abakar Salim  | Chair man  | ...........
| Dr. Mohammed said Mohamed     | External   | ...........
| Dr badawi Abdalbagi Talha     | Internal   | ...........

Date / / 2016
Acknowledgment:

In the first and end all thanks to ALLAH.

Then after that, I would like to express my thanks to my:

Teachers staff in Department of Medical parasitology Prof Adam Daoud Abakar Salim, Dr. Bakri Yosif Mohammed Nour and Dr. Albadawi Talha.

I would like to thanks many colleagues and students who have helped shape my perspective regarding the field of medical parasitology over the years: (Sana Ibrahim, Abd Allah, Tasneem). I would like to express my thanks to my friends M. El Samani, Kheder Osman and Hani Elkhateeb who helping me all the time of Research and hopping that with this research I have proven to you that there is no mountain higher as long as god is on our side. Hopping that you will walk again and be able to fulfill your dreams.
Dedication

My parents, offer me unconditional support with my studies and giving me a chance to prove and improve myself through all my walks of life I am honored to have you as my parents thanks you for all this.

My family thanks you for believing in me for allowing me to further my studies.
Surveillance of Schistosoma species Among Population of Elmanagil locality, Gezira State, Sudan (2016)

Altayeb saeed Ibrahim mohammed

Abstract

Schistosomiasis is a parasitic disease caused by flukes. This infection creates a reaction in the human tissue that manifests as scarring of the bladder, urethra, or colon. Schistosomiasis is closely associated with water, as snails carry the parasite. The purpose of this study was to screening the Schistosoma mansoni And Schistosoma haematobium in Elmanagil locality, Gezira state in different people with different age male and female. sample size tow handered peoples from any one of this tow handered peoples taked two sample urine sample and stool sample. sample were preserved in formal water and diagnosed by five method three method to detect schistosomiasis and others species, direct wet preparation, formal either concentration technique, direct centrifugation, and tow method to counting Eggs number, kato-katz to stoole sample and filtration method to urine sample. The result of this screening is 11 samples from stool sample positive for Schistosoma mansoni, 45 samples positive for others species by direct wet preparation. and 21 samples from stool sample positive for Schistosoma mansoni, 50 samples positive for others species by formal either concentration. all urine samples is negative for Schistosoma haematobium.
مسح لأنواع البلهارسيا في سكان محلية المناقل ولاية الجزيرة (2016)
الطبيب سعيد إبراهيم محمد

ملخص الدراسة
مرض البلهارسيا مرض طفيلي سببه الديدان. يؤثر على أنسجة الإنسان في المثانة، الحالب أو القولون. يرتبط البلهارسيا بالماء حيث توجد القواقع التي تمثل الجزء الأساسي في دورة حياة البلهارسيا. أجريت هذه الدراسة لمسح نسبة نوعي البلهارسيا البولية والمعوية في ولاية الجزيرة - محلية المناقل. أجريت هذه الدراسة على مائتي فرد من كل فرد أخذت عينتان بول وفحضت العينات بالفورمليين ثم تشخيصها بخمسه طرق ثلاث لتحديد العينات الإيجابية(المسحة الرطبة، الطريقة المركزة لفحص الفسحة. طريقة الطرد المركزي لفحص البول). وطريقتان لحساب عدد البيض(طريقة التشريح لعينات البول وطريقة الكاتو-كاتز لعينات الفسحة).

نتيجة هذه الدراسة 11 عينة (11 عينة ذكور) وجدت فيها البلهارسيا معوية و45 عينة من عينات الفسحة أيضاً (15 إناث و30 ذكور) وجدت فيها أنواع أخرى من الطفيليات (النستراتاريا الأمبية - القارديا-الديدان الدموية - بواريا). و43 عينة (14 إناث و14 ذكور) تحمل أنواع أخرى من الطفيليات. لا توجد بلهارسيا بولية في كل عينات البول. هذا يعني أن القواقع الموجودة في هذه المنطقة للبلهارسيا المعوية فقط لا تصلح للبلهارسيا البولية. وجد أن كل الأفراد المصابين بالبلهارسيا المعوية من نوع واحد (ذكور) ومهنة واحدة (طلاب). لا توجد لديهم مراحيض يشربون من الترع مباشرة. تم توزيع العلاج لجميع المصابين بالبلهارسيا والأنواع الأخرى من الطفيليات. ووجهتهم لهم بعض الارشادات التي تقلل من التعرض للاصابة بمرض البلهارسيا والأنواع الأخرى التي وجدت عندهم.
Table of content

<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supervision Committee</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Examination Committee</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td>Acknowledgements</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Dedication</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>Abstract (English)</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Abstract (Arabic)</td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td>Table of contents</td>
<td>VII</td>
</tr>
<tr>
<td></td>
<td>List of tables</td>
<td>VIII</td>
</tr>
</tbody>
</table>

**Chapter one Introduction**

1.1 general introduction 1
1.2 Justification 2
1.3 Objective 2
1.3.1 General objectives 2
1.3.2 Specific objectives 2

**Chapter two Literature review**

2.1 Schistosomes 3
2.2 General life cycle 4
2.3 Symptoms 5
2.4 Diagnosis 5
2.5 Immunopathology 7
2.6 Schistosomiasis in Asia 8
2.7 History of Schistosomiasis in the Sudan 11

**Chapter three Material and Method**

3.1 Study design 12
3.2 Study area 12
3.3 Sample size 12
3.4 Inclusion criteria 12
3.5 Exclusion criteria 12
3.6 Data collection 12
<table>
<thead>
<tr>
<th>3.7</th>
<th>Data analysis</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8</td>
<td>Ethical concedration</td>
<td>13</td>
</tr>
<tr>
<td>3.9</td>
<td>Material</td>
<td>13</td>
</tr>
<tr>
<td>3.10</td>
<td>Method</td>
<td>14</td>
</tr>
</tbody>
</table>

**Chapter four  Results and Discussion**

| 4.1 | Result and discussion | 16 |

**Chapter five  Conclusion and Recommendation**

<table>
<thead>
<tr>
<th>5.1</th>
<th>Conclusion</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2</td>
<td>Recommendation</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Appendix</td>
<td>25</td>
</tr>
</tbody>
</table>
List of table

<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>frequency of study population according to gender</td>
<td>16</td>
</tr>
<tr>
<td>4.2</td>
<td>frequency of study population according Age group</td>
<td>16</td>
</tr>
<tr>
<td>4.3</td>
<td>frequency of study population according to employee</td>
<td>17</td>
</tr>
<tr>
<td>4.4</td>
<td>frequency of stool results by using wet preparation technique:</td>
<td>17</td>
</tr>
<tr>
<td>4.5</td>
<td>frequency of stool results by using Stool sedimentation</td>
<td>18</td>
</tr>
<tr>
<td>4.6</td>
<td>Stool kato-katz result .S.mansoni</td>
<td>18</td>
</tr>
<tr>
<td>4.7</td>
<td>correlation between Gender and stool result by using wet preparation technique.</td>
<td>19</td>
</tr>
<tr>
<td>4.8</td>
<td>correlation between Gender and stool result by using stool sedimentation technique</td>
<td>19</td>
</tr>
<tr>
<td>4.9</td>
<td>correlation between Age group and stool result by using wet preparation technique</td>
<td>20</td>
</tr>
<tr>
<td>4.10</td>
<td>correlation between Age group and stool result by using stool sedimentation technique</td>
<td>20</td>
</tr>
<tr>
<td>4.11</td>
<td>frequency of others prarsites by using Sedimentation technique</td>
<td>21</td>
</tr>
</tbody>
</table>
Chapter one

Introduction

1.1 Introduction

Schistosomiasis (also known as snail fever or bilharzia) is caused by blood fluke from the genus *Schistosoma*. More than 200 million people are infected worldwide. Mostly in freshwaters where there are many snails which are the intermediate host. Geographic distribution Africa: all freshwater in sub-Saharan and southern Africa, also in the Nile River valley in Egypt. Caribbean: Antigua, Dominican Republic, Guadeloupe, Martinique, Montserrat, Saint Lucia (low risk). South America: Brazil, Suriname, Venezuela. Southern China. Southeast Asia: Cambodia, central Indonesia, Laos, Mekong delta and Philippines. The Middle East: Iran, Iraq, Saudi Arabia, Yemen. Schistosoma species There are five main species infecting humans: *Schistosoma mansoni*, *S. haematobium*, *S. japonicum* and two geographically localized species *S. intercalatum* and *S. mekongi*. Archeological evidence in Africa and China indicates that the parasitic trematode infection schistosomiasis has been part of human life for at least four millennia. Internationally *Schistosoma mansoni* is the most prevalent of the schistosoma species that affect the intestines and liver. *Schistosoma haematobium* is prevalent in areas that infection have a reservoir of human infection, the presence of an intermediate Bulinus species snail host and the poor socioeconomic conditions or poor sanitation that allow urinary contamination of local freshwater. (Wang 2008)

Elmanagil locality it is agriculture area, so that most of people contact with water in agriculture and some people swimming in kanal, this give me motif to screening and study schistosoma mansoni and haematobium randomly covering most locality, to help those people to take the treatment of schistosomiasis and give them some health education.
1.2 Justification

Schistosoma with its all species that infect human are very dangerous with serious complication if not diagnosed and treated early, so it is very important to screen it for early diagnosis.

1.3 Objective

1.3.1 General objectives

To screen Schistosoma haematobium and mansoni in Gezira state (Managil Locality).

1.3.2 Specific objectives:

- To determine the prevalence of Schistosoma species in El managil locality.

- To know which test is more accurate and sensitive for detection of both species.
Chapter two

Literature review

2.1 Schistosomes

Schistosomes belong to the phylum Platyhelminthes, family Schistosomatidae, and are a group of digenetic, dioecious trematodes requiring definitive and intermediate hosts to complete their life cycles. Four species are important agents of human disease: *Schistosoma mansoni*, *S. japonicum*, *S. mekongi*, and *S. haematobium*. *S. intercalatum* is of less epidemiologic importance. Schistosomiasis affects between 200 million and 300 million people in 77 countries throughout the world and is a significant cause of disease in areas of endemic infections. In Egypt, approximately 20% of the population is infected; prevalence rates in some villages have been estimated to be 85%. (Zhou 2010)

The number of infected individuals in China is estimated to be 1.52 million. Although only about 10% of infected people have serious disease, this represents 20 million to 30 million individuals worldwide. Approximately half of the remaining 180 million to 270 million infected individuals have symptoms.

The earliest known instance of schistosomiasis was found in Egyptian mummies of the predynastic period (3100 BC), using enzyme-linked immunosorbent assay (ELISA) to detect circulating anodic antigen (Utzinnger 2005). Previously, eggs were detected in the kidneys of mummies from the Twentieth Dynasty (1250 BC to 1000 BC). Fujii in 1947 described schistosomiasis caused by *S. japonicum*, and Bilharz in 1951 noted *S. haematobium* infections in Cairo. Sambon proposed the name for *S. mansoni*. Schistosome infections in the New World probably began with the African slave trade in the Americas during the 16th and 17th centuries. Schistosomes are somewhat different from other human trematodes since they (i) have two sexes, (ii) live in the blood vessels, (iii) have nonoperculated eggs, and (iv) have no encysted metacercarial stage in the life cycle.

The human is the definitive host for *S. mansoni*, *S. japonicum*, and *S. haematobium*; for *S. mekongi* and *S. malayi* (both similar to *S. japonicum*); and for *S. intercalatum*. *S. mattheei*, which causes infections in sheep, cattle, and horses, also infects humans and can cause disease (yuan 2005). Other schistosomes have been found in humans
but do not tend to cause any pathology. Also, cercariae from birds and mammals can penetrate human skin but cannot complete the life cycle and tend to die without migrating or maturing; however, they do cause cercarial dermatitis. (Ohmae 2003)

### 2.2 General life cycle

*Schistosoma* requires the use of two hosts to complete the life cycle.

Depending on the *Schistosoma* species their eggs are shed either in the feces or urine of an infected human. Eggs can survive up to a week in dry land. If the feces end up in water, larvae called miracidia hatch and start finding certain species of freshwater snails. When they find a snail they penetrate its foot and transform into sporocysts. These primary sporocysts multiply asexually into secondary sporocysts and travel to the snail's hepatopancreas. They multiply asexually producing hundreds of cercariae (another larval form). (The process from sporocyst to cercaria takes a few months.) Cercariae exit the snail and start waiting in the water. They can survive about 48 hours in favourable conditions. When they sense that human skin is near, they quickly swim and attach with suckers. They find a suitable spot (usually a hair follicle) and penetrate the skin using special enzymes (Zhou 2007).

As they enter they transform into schistosomulae (another larval form). Only head parts enter, they leave tails behind. Each schistosomula stays a few days in the skin and then enters the bloodstream through dermal lymphatic vessels or blood venules. They travel in the bloodstream to get to specific blood veins (Wang 2009).

In humans *Schistosoma* reaches fertility in 6–8 weeks. The newly developed adult females and males find each other and pair up. Adult blood flukes are 1–2 cm long. Males make a gynaecophoric channel for the longer and thinner females to reside. The worm pair then travel to rectal or mesenteric veins (Zheng 2002).

They attach to the venous wall with oral and ventral suckers and can live for many years. Females lay eggs on the endothelial lining of the venous capillary walls at the rate of 300–3000 eggs per day depending on the *Schistosoma* species. Some eggs are flushed by circulating blood ending up causing inflammation in organs such as liver or lungs.
Most eggs however travel to the lumen of the intestinal tract (S. japonicum and S. mansoni) and of the ureters and bladder (S. haematobium), thus exiting the body in the feces or urine. Mature eggs produce special enzymes and can penetrate many membranes such as rectal veins or intestinal wall. The eggs get out of the body and the cycle starts again. Schistosoma species can migrate around and are not bound to just one location. But each species has a preferred location. For example, S. japonicum resides more frequently in the veins that drain the small intestine. S. mansoni is found more often in the veins that drain the large intestine. S. haematobium occurs usually in the venous plexus of bladder, but can also be found in the rectal venules (Zhu 2008).

### 2.3 Symptoms

The first symptoms are a rash or itch during the first few days.

Within two months chills, cough, diarrhea, fatigue, fever and muscle aches can occur.

Usually however during the first few weeks schistosomiasis is asymptomatic.

The disease is worse for children who can develop anemia, learning difficulties and malnutrition.

After years of infection eggs inflame organs such as the liver, bladder and lungs.

If eggs end up in the brain or spinal cord, they can cause paralysis, seizures or inflammation.

### 2.4 Diagnosis

Specific diagnosis of schistosomiasis by detection of eggs in stool or urine specimens is possible only after egg production has begun. Eggs may be found in feces as early as 5 weeks after infection. The ease of egg detection depends on the worm burden and the duration of the infection. Patients with a low worm burden or old (chronic) infections may have very few eggs in the feces or urine, and the infections may not be confirmed due to insensitive diagnostic methods. Multiple stool or urine examinations should be performed for any individual suspected of having schistosomiasis.
Occasionally, *S. mansoni* eggs are detected in the urine; adult worms may be found in vessels that are not their normal habitat, and this finding is known as “crossover.” *S. mansoni* eggs are yellowish brown and measure 114 to 180 μm long by 45 to 73 μm wide. The eggs are elongate and ovoid and have a large lateral spine projecting near one end. Direct detection or concentration techniques can be used to detect eggs in the stool or urine. Direct microscopic examination of stool smears is not very sensitive but may be useful for screening purposes (Seto 2008). The Kato thick smear is a simple and sensitive quantitation technique that has been used successfully in the field. In one study, more than 50% of the eggs were missed by the sedimentation technique; the geometric mean egg count was 94 eggs/g when two Kato-Katz smears were used and 43 eggs/g when the sedimentation technique was used. However, no details of the centrifugation speed and time were given. Another study indicated that examination of fewer samples collected on different days was more effective than examination of more slides from one stool specimen for accurate estimation of the real infection status. The zinc sulfate concentration technique is not recommended for schistosome eggs. The eggs rupture and do not float but instead are found in the sediment. The formalin-ethyl acetate technique is recommended for concentrating eggs; however, because it involves fixation, it cannot be used to detect egg viability. In chronic infections in which the worm burden is light, hatching tests can be performed. The stool specimens are diluted with non-chlorinated water in a sedimentation flask or a beaker. The sides of the flask or beaker are covered with aluminum foil to prevent light from passing through. A light source is used to project a perpendicular light beam through the water at the top. Miracidia that hatch from the live eggs will concentrate in the light and can be detected swimming around. This motility can easily be observed with a hand lens. Aliquots of the surface water can be transferred to a small petri dish and observed under a dissecting microscope for miracidia. Observation periods should be frequent because of the limited life span of the miracidia. Ideally, observations should be made every 30 min over a period of 4 h (Sutherst 2004). The hatching test is designed to mimic the conditions in nature with spring water and sunlight. Biopsy Specimens. Rectal biopsy specimens have been particularly useful in detecting eggs in patients with light, chronic, or inactive infections. The biopsy tissue can be crushed between two glass slides. This technique is more effective than histologic examination and allows assessment of the species and viability of the eggs. *S. mansoni* eggshells can be stained acid fast with a modified Ziehl-Neelsen stain. This
technique has been used in tissue sections to differentiate S. mansoni eggs from S. haematobium eggs, which are not acid-fast positive (Liang 2012).

2.5 Immunopathology

Schistosomes are parasitic worms that are a prime example of a complex multi cellular pathogen that flourishes in the human host despite the development of a pronounced immune response. Understanding how the immune system deals with such pathogens is a daunting challenge. The past decade has seen the use of a wide range of new approaches to determine the nature and function of the immune response to schistosomes. Here, we attempt to summarize advances in our understanding of the immunology of schistosomiasis, with the bulk of the review reflecting the experimental focus on Schistosomamansoni infection in mice. The immune system responds to eggs in liver causing hypersensitivity; an immune response is necessary to prevent damage to hepatocytes. The hosts' antibodies which bind to the tegument of the Schistosome don't bind for long since the tegument is shed every few hours. The schistosome can also take on host proteins. Schistomiasis can be divided into three phases:

(1) the migratory phase lasting from penetration to maturity,
(2) the acute phase which occurs when the schistosomes begin producing eggs, and
(3) the chronic phase which occurs mainly in endemic areas.

Granuloma: In infection with any schistosome species, chronic disease is the result of the ongoing host response to accumulating tissue-trapped eggs. In Schistosamansoni and Schistosoma japonicum infections, the liver is the principal site that is affected, because many of the eggs are carried by the blood flow into this organ, the sinusoids of which are too small for the eggs to traverse. This is a dead-end for the eggs, which eventually die within the tissue (Cao 2007). Intestinal damage by traversing eggs can also be problematic. During Schistosoma haematobium infection, the passage of eggs across the bladder wall causes damage to this organ. The CD4+ T-cell response that is induced by egg antigens orchestrates the development of granulomatous lesions — which are composed of collagen fibres and cells, including macrophages, eosinophils, and CD4+ T cells — around the individual eggs (2, 48) (see figure). As the eggs die, the granulomas resolve, leaving fibrotic plaques. Severe consequences of infection with S. mansoni and S. japonicum are the result of an
increase in portal blood pressure as the liver becomes fibrotic, congested and harder to perfuse. Under these conditions, the diameter of the portal vein increases and the wall of the portal vein becomes fibrotic. Associated with these changes is the development of ascites (the accumulation of serous fluid in the peritoneal cavity) and portal–systemic venous shunts (new blood vessels that bypass the liver), which can rupture, leading to life-threatening bleeding. The most serious effects of infection with S. haematobium are bladder cancer and genital schistosomiasis, a condition in which eggs pass through the cervix in women or into the testes in men. Paradoxically, granulomas might have an essential host-protective role (Zhou 2013). In mice that were tolerant against S. mansoni egg antigen, granuloma development did not occur during infection and the animals had severe hepatotoxic liver damage, which was evident as microvesicular lipid accumulations (or steatoses) within hepatocytes. This is thought to be mediated by hepatotoxins that are secreted from eggs, and the granuloma, together with egg-antigen-specific antibodies (which might act in a neutralizing capacity), is envisaged as sequestering these toxins away from hepatocytes. A central role for tumour-necrosis factor (TNF) in the development of the granuloma has been proposed on the basis of one finding that the injection of TNF into infected severe combined immunodeficient (SCID) mice is sufficient to allow the development of a focal lesion around parasite eggs (Katz, n 1972).

### 2.6 Schistosomiasis in Asia:

*S. japonicum* was discovered by the Japanese professor Katsurada in 1904 (Zhou 2008) and then found in China (Yu, j.m 2007). The life cycle was established by Fujinami and Nakamura in 1909. In the following year, human infection was found in the Philippines (1906) and later also in Indonesia (1937) and Lao PDR and Cambodia (1957). Schistosomiasis was thus established in six countries of the region. The transmission of *S. japonicum* has since been interrupted in Japan and, although animal reservoirs still remain there, no more new human cases have been discovered since 1977. In the other countries, a total of 860,000 annual human cases are currently reported though transmission intensity has been reduced significantly during the last 50 years (Poda 2003). However, there are great differences in the distribution and impact as schistosomiasis affects large areas and large numbers of people in some of the
countries, while it is limited to a few foci in others. Table 1 gives an overview of the situation based on estimates from 2005. The first scientific description of schistosomiasis japonica in China and its causative agent is just over one 100 years old (Jhebreyesus 2002). On the other hand, the disease is by no means new but has been a threat since ancient times. The full impact of schistosomiasis in China became evident in the mid 1950s when the first nationwide survey estimated the number of human infections at 11.6 million and reported that at least 100 million people in 433 endemic counties/cities were at risk (Licensee 2014). The endemic areas are stratified based on the prevailing environment to better characterize the local epidemiological situation, a system which still remains in use. These strata are i) the “plains and waterway networks”, ii) the “marshlands and lakes”, and iii) the “hilly and mountainous region”. The former two are situated in central and eastern China while the latter comprises areas in the East, South and Southwest of China, mainly in provinces of Sichuan and Yunnan. The most severely affected areas were, and still are, the Yangtze river valley, the plains around the great lakes of Dongting and Poyang, and certain mountainous areas in the West. S. japonicum is the only trematode affecting humans in the Philippines. The first case, a Filipino male who had never been out of the country, was reported in 1906 (Rollinson 2013). Subsequently, schistosome ova were found in several cases among 500 autopsies reported in 1908 and in the feces of some prisoners admitted to the Bilibid Prison, City of Manila in 1914 (Ross 2013). Several years later, in 1928, a case of Katayama disease presenting as chronic appendicitis was reported (Zheng 2013). However, in spite of all these human cases, attempts to demonstrate the intermediate host of the parasite were not successful until the discovery of the small, amphibious Oncomelania hupensis quadrasi freshwater snail in Palo, Leyte in 1932 (Lin 2008). The life cycle and the multi-host characteristics of the parasite were established when the infection could be transferred to mice, rabbits and monkeys with cercaria obtained from the Oncomelania snails. Since then, the distribution of O. h. quadrasi has been well characterized and shown to correspond to the major endemic areas for human schistosomiasis. As shown in Figure 9, schistosomiasis in Indonesia is only endemic in the Province of Sulawesi. The limited distribution in two very isolated marshes around Lake Lindu and an area in the Napu Valley, located in the centre of the Sulawesi island, illustrates strongfocality of the disease(Steinmann 2006). As in China and the Philippines, the disease is caused by S. japonicum which was initially discovered in 1937 by Müller and Tesch in a male patient who later died in a hospital (Yang 2006). Later, in the same year, Brug and Tesch traced the infection to the patient’s home village, which was recognized as a-endemic area by (Sow 2002). A large-scale study of schistosomiasis in the area was initiated in 1940 when the prevalence of infection
was reported to be 56% in this village (Int.j 2014). The human host seemed to be dominant but other mammalian hosts, e.g. deer and dogs, were also discovered. However, the intermediate host snail was not identified before 1971 when it was found under the grass of abandoned rice fields in the Pakusubvillage of Anca in Lindu valley. It was named Oncomelaniahupensisindoensis in 1973.

Schistosomiasismekongi has posed a persistent public health problem since its discovery in 1957 (29,30). The causative agent is the parasitic blood fluke Schistosomamekongi and the intermediate host is the caenogastropod snail Neotriculaaperta. Three strains of N. aperta have been identified on the basis of shell size and body pigmentation but only the Ó-strain is known to be epidemiologically significant. WHO coordinated the first praziquantel-based mass treatment programme at Khong Island in southern Laos in 1989. However, in spite of nine years of control efforts in Cambodia and Laos, the prevalence in Hat-Xai-Khoun village, Khong Island, is still 26.8% (but it has decreased from almost 80% in 1989), while it rose from 0% in 2004 to around 2% in 2005 at Sadao in Cambodia. The role of reservoir hosts in the persistence of transmission has been demonstrated. In addition, it has been shown that prevalence of infection in the snails at Khong Island and Sadao has not declined significantly in the face of marked reductions in prevalence in the human population. In 1969, the estimated human population at risk was 150,000 and all known endemic foci were along the lower Mekong river in Cambodia and the southern tip of Laos (i.e., over a distance of about 200 km). Prior to 1991, N. aperta was thought to occur in the Mekong river only with a patchy distribution between Kratie and Stung-Treng in Cambodia, at Khong Island and around the juncture of the Mul and Mekong rivers in Thailand. The first report of N. aperta outside the Mekong and Mul rivers was published in 1999 and in 2004 details of 11 new populations, occurring in six river systems of Laos and Cambodia, were published. It was originally assumed that the absence of S. mekongi transmission from most of Laos was due to ecological conditions unfavourable for N. aperta outside the Cambodian Mekong river. The potential human population at risk has risen from 150,000 to over 1.5 million following the discovery of these new snail populations. The aforementioned facts suggest that control of this disease will be difficult to maintain and that the factors driving reemergence of infection need to be understood (Gryseel 2006).
2.7 History of Schistosomiasis in the Sudan:

Schistosomiasis is an old disease. Its history dates back to the Pharaonic kingdoms 1500 B.C. Schistosome eggs have been identified in the Pharaonic mummies. The Asian schistosomiasis (S. japonicum) also is an old disease and eggs of japonicum infection were found in the rectum and liver in a female corpse which dates back to 206 BC. In 1852, Theodore Bilharz a German physician identified the adult worm in his postmortem study in Egypt, while the lifecycle was unraveled by the Scottish parasitologist, Robert Thomson Leiper in 1912(6,7). In the early 1900, Sudanese patients with schistosomiasis were thought to be infected in Egypt. However, during the investigation of outbreak of cases of Kala-azar in eastern and south eastern Sudan in 1909 in what was called ‘The Kala-azar Commission’ the investigators stumbled on many cases of hitherto unknown ‘bilharziosis’ in the region of Singa in the Blue Nile Province. This finding was mentioned in the part of the report of the commission published by Dr Douglas Stokes Brownlie Thomson in the 4th Welcome Report published in 1911. That was the first report of the presence of the disease in the Sudan. In 1921 pumping stations were introduced to the Dongola province. Canals from these irrigated land were found to beinfected with schistosomiasis, the source came from immigrants from Egypt. However, in 1925 when Sennar dam was completed and the Gezira canals were man dug with Egyptian-fellaheen (10,000 Egyptians were involved) infestation of the Gezira with schistosomiasis made this area the highest infected area. Sudan also figured high in the history of schistosomiasis following the Christopherson's discovery, the development of tartar emetic as a cure for schistosomiasis. It was the most significant contribution to medicine at the time.

John Brian Christopherson, was born in Yorkshire, U.K., and qualified in medicine from Cambridge and St. Bartholomew's Hospital in 1893. He first came to Sudan in June 1902 after a brief service in South Africa. He became the first Director of the civilian Sudan Medical department in 1904. He was also the first Director of Khartoum Civil Hospital. The hospital now is the headquarters of the Sudan Medical Specialization Board.
Chapter three

Materials and Method

3.1 Study design;

Analytical cross sectional study.

3.2 Study area;

Gezira state [Elmanagil]. Elmanagil is Agriculture area and most of population drinking from canal and swimming.

3.3 Sample size;

The total population of Gezira state is 3638988

The population sesus in managil locality 2008 is 906216

Incidence of population in managil =3638988/906216*100=25%

Sample size depended on incidence of population =200 samples

3.4 Inclusion criteria;

Individuals from different ages and sex not under treatment and approve to be included in the project ,resident more than three month, more than 5 years .

3.5 Exclusion criteria;

Any individual under treatment or be treated in short period.

Any individual that refuses to participate in the project.

3.6 Data collection;

Questionnaire was designed to collect the data.

3.7 Data analysis;

Used SPSS program to analyzed the data.
3.8 Ethical consideration;

This study approved from faculty of medical laboratory, department of medical parasitology, Locality health department and Ministry of health.

3.9 Material;

- Stool container
- Urine container.
- Slide.
- Cover glass.
- Wooden stick.
- Gloves.
- Pipettes.
- Normal saline.
- Iodine.
- Either.
- Centrifuge tube.
- Beaker.
- Sieve.
- Formal water.
- Microscope.
- Centrifuge.
- Filter forceps.
- Filter holder.
- Plasticsyring, 10ml.
-Nylon filter.

3.10 Methods;

3.10.1 Sample;
Stool-[200]-urine-[200]

3.10.2 Method;
- Direct preparation.
- Concentration-[sedimentation]-technique.
- Kato-Katz technique.
- Filtration technique.
- Centrifugation technique-[for urine].

Collection of sample;

Urine sample;

Urine samples were collected in sterile continer, one ml of formaline added to three ml of urine sample and labeled .

Stool sample ;

Collected the satisfactory amount for diagnosis preserved by formalin.

Direct preparation procedure; about 2gram from stool sample in a clean slide mix with pipette tip, cover with atake cover slip then see under microscope firstly by using low power objective [10x] , when a parasite like object comes into [40x] Concentration-[sedimentation]-technique; fecal concentration has become a routine procedure as apart of the complete ova and parasite examination for parasites and allows the detection of small numbers of organisms that may be missed by using only a direct wet smear. There are two types of concentration technique, sedimentation and flotation, both of which are designed to separate protozoan organisms and helminth eggs and larvae from fecal debris by centrifugation and ordifferences in specific
gravity. Procedure of Sedimentation [formal-either] concentration technique; take about 3 gram from stool sample in glass centrifuge tube add 7 ml formal water, mix, saving, then add 3 ml of either, mix, centrifuging and take the supernate by wooden stick then examining the deposit.

Procedure of Katokatz technique; the katotechnique also called kato-katz technique is a laboratory method preparation human stool samples prior to searching for parasite eggs.

**Procedure of Filtration technique:**

- place a nylon filter in the holder and close it. Agitate the urine sample by shaking it gently.

- draw 10 ml of urine into the syringe and attach the filter holder to the syringe.

- expel the urine from the syringe into the filter holder over a bucket or sink.

- Carefully remove the filter holder from the syringe, draw air into the syringe, re-attach the filter and expel the air. This is important it helps to remove excess urine and also makes sure the eggs, if present, are attached to the filter.

- remove the filter holder from the syringe, open it, seize the filter with the forceps and place it [top side up] on a microscope slide. Add one drop of lugols iodine and wait for 15 s for the stain to penetrate the eggs.

Procedure of Centrifugation technique; about 5 ml of urine sample centrifuging for 3 minits and examined the deposit under microscope by 10x, 40 x.
Chapter four

4.1 Results and discussion:

Table 4.1: frequency of study population according to gender.

The frequency of study population according to gender the female were 97 represented (48.5%) and male were 103 represented (51.5%).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>97</td>
<td>48.5</td>
</tr>
<tr>
<td>Male</td>
<td>103</td>
<td>51.5</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.2 frequency of study population according Age group:

The frequency of study population according to age group distributed as fallow (5 – 9) years were 22 represented (11%) , (10 – 14) years were 31 represented (15.5%) , (15 – 19) years were 19 represented (9.5%) and more than 20 years were 128 represented (64%).

<table>
<thead>
<tr>
<th>Year group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5 – 9)</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>(10 – 14)</td>
<td>31</td>
<td>15.5</td>
</tr>
<tr>
<td>(15 – 19)</td>
<td>19</td>
<td>9.5</td>
</tr>
<tr>
<td>More than 20</td>
<td>128</td>
<td>64</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 4.3: Frequency of study population according to employee:

The frequency of study population according to employee distributed as fallow: farmers were 32 represented (16%), housewife were 91 represented (45.5%), students were 73 represented (36.5%) and others employees were 4 represented (2%)

<table>
<thead>
<tr>
<th>Employee</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>House wife</td>
<td>91</td>
<td>45.5</td>
</tr>
<tr>
<td>Students</td>
<td>73</td>
<td>36.5</td>
</tr>
<tr>
<td>Others employees</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.4: Frequency of stool results by using wet preparation technique:

The results shown 144 samples were negative represented (72%), S. mansoni were 11 represented (5.5%) and other parasites seen were 45 represented (22.5%)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>144</td>
</tr>
<tr>
<td>S. mansoni</td>
<td>11</td>
</tr>
<tr>
<td>Other</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
</tr>
</tbody>
</table>
Table 4.5: frequency of stool results by using Stool sedimentation

The results shown 129 samples were negative represented (64.5%) , S. mansoni were 21 represented (10.5%) and other parasites seen were 50 represented (25%)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>129</td>
<td>64.5</td>
</tr>
<tr>
<td>S.mansoni</td>
<td>21</td>
<td>10.5</td>
</tr>
<tr>
<td>Others</td>
<td>50</td>
<td>25.0</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.6: Stool kato-katz result .S.mansoni.

This table show, 19 stool samples from 21 samples that is positive for Schistosoma mansoni in range (1---99) of kato-katz method. and 2 sample in range(1---449).

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1----99</td>
<td>19</td>
</tr>
<tr>
<td>100----449</td>
<td>2</td>
</tr>
<tr>
<td>More than 450</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
</tr>
</tbody>
</table>
Table 4.7: Correlation between Gender and stool result by using wet preparation technique.

11 of male peoples positive for Schistosoma mansoni, 30 positive for others by Direct wet preparation. In female no Schistosoma mansoni but others species is 15 positive.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Negative</th>
<th>Positive[s. mansoni]</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>82</td>
<td>0</td>
<td>15</td>
<td>97</td>
</tr>
<tr>
<td>Male</td>
<td>62</td>
<td>11</td>
<td>30</td>
<td>103</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>11</td>
<td>45</td>
<td>200</td>
</tr>
</tbody>
</table>

Table 4.8: Correlation between Gender and stool result by using stool sedimentation technique

21 of male peoples positive for Schistosoma mansoni, 35 positive for others species by sedimentation technique. But in the female no Schistosoma mansoni, others species is 15 positive.

<table>
<thead>
<tr>
<th>Genders</th>
<th>Negative</th>
<th>Positive[S. mansoni]</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>82</td>
<td>0</td>
<td>15</td>
<td>97</td>
</tr>
<tr>
<td>Male</td>
<td>47</td>
<td>21</td>
<td>35</td>
<td>103</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
<td>21</td>
<td>50</td>
<td>200</td>
</tr>
</tbody>
</table>
Table 4.10: correlation between Age group and stool result by using wet preparation technique

All positive samples by Direct wet preparation in peoples less than 14 years, 8 peoples between (10 - 14), and 3 peoples between (5 - 9).

<table>
<thead>
<tr>
<th>Age group</th>
<th>Negative</th>
<th>Positive [S. mansoni]</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5 – 9)</td>
<td>19</td>
<td>3</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>(10 – 14)</td>
<td>23</td>
<td>8</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>(15 – 19)</td>
<td>19</td>
<td>0</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>More than 20</td>
<td>128</td>
<td>0</td>
<td>41</td>
<td>128</td>
</tr>
<tr>
<td>Total</td>
<td>189</td>
<td>11</td>
<td>45</td>
<td>200</td>
</tr>
</tbody>
</table>

Table 4.11: correlation between Age group and stool result by using stool sedimentation technique

All positive samples by Direct wet preparation in peoples less than 14 years, 8 peoples between (10 - 14), and 3 peoples between (5 - 9).

<table>
<thead>
<tr>
<th>Age group</th>
<th>Negative</th>
<th>Positive [S. mansoni]</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5 – 9)</td>
<td>15</td>
<td>6</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>(10 – 14)</td>
<td>18</td>
<td>12</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>(15 – 19)</td>
<td>14</td>
<td>3</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>More than 20</td>
<td>82</td>
<td>0</td>
<td>46</td>
<td>128</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
<td>21</td>
<td>50</td>
<td>200</td>
</tr>
</tbody>
</table>
Table 4.12: Frequency of Other Parasites by using Sedimentation technique

This table shows the percentage of other species, where the percentage of Giardia lamblia is more than others (10%).

<table>
<thead>
<tr>
<th>Others</th>
<th>Frequency</th>
<th>Percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. lamblia</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>H. nana</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>E. histolytica</td>
<td>15</td>
<td>7.5</td>
</tr>
<tr>
<td>E. vermicularis</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>E. coli</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>25</td>
</tr>
</tbody>
</table>
Chapter five

Conclusion and Recommendation

5.1 conclusion

The percentage of Shistosoma mansoni is {10.5%}.

Others {hymenolepis nana-giardia lambelia-E.coli-E.vermicularis-E.histolytica} percentage {25%}. 
5.2 Recommendation

- Prevent people firstly by health education.

- Regular prophylaxis treatment for peoples ..

- Regular screening for schistosomiasis.

- Control the snail.
References


Yu, J.M.; de Vlas, S.J.; Jiang, Q.W.; Gryseels, B. Comparison of the Kato-Katz technique, hatching test and Indirect Hemagglutination Assay
(IHA) for the diagnosis of *Schistosoma japonicum* infection in China. 


© 2014 by the authors; licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/3.0/).
Appendix

University of Elgezira

Faculty of medical laboratory sciences

Questionnaire

The name

Phone number

Address

Serial number

Age

Gender: male(       ) female(       ).

Weight

Sample types: urine(       ) stool(       ).

Employee

Date of infect if present

Date of last treatment

Sources of drinking water

Type of water cycle

The result: 

Shistosomamansoni(       ) Haematobium(       ) others (       )