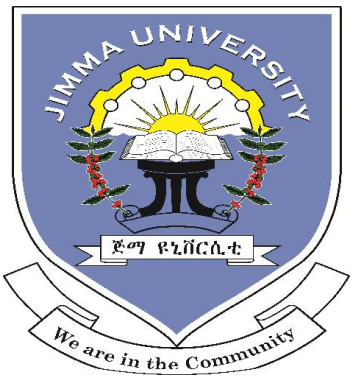
SOIL TRANSMITTED HELMINTHES AND *SCHISTOSOMA MANSONI*INFECTION AND ASSOCIATED RISK FACTORS AMONG SCHOOL CHILDREN OF MANNA DISTRICT, SOUTHWEST ETHIOPIA



BY: ASCHALEW GEMEDE (MSc)

A THESIS SUBMITTED TO SCHOOL OF MEDICAL LABORATORY SCIENCES, FACULTY OF HEALTH SCIENCES, INSTITUTE OF HEALTH, JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN MEDICAL PARASITOLOGY

MARCH, 2019

JIMMA ETHIOPIA

JIMMA UNIVERSITY
INSTITUTE OF HEALTH
FACULTY OF HEALTH SCIENCES
SCHOOL OF MEDICAL LABORATORY SCIENCES

SOIL TRANSMITTED HELMINTHES AND *SCHISTOSOMA MANSONI*INFECTION AND ASSOCIATED RISK FACTORS AMONG SCHOOL CHILDREN OF MANNA DISTRICT

BY: ASCHALEW GEMEDE (MSc Candidate)

ADVISORS
1. DANIEL DANA (Asst. Professor, PhD scholar)
2. NUREDIN ABDUSELAM (BSC, MSC)

MARCH, 2019

JIMMA ETHIOPIA

ABSTRACT

Background*:* Schistosomiasis and soil transmitted helminthiases (STH) are among the neglected tropical diseases which are widely distributed globally. The sub Saharan Africa (SSA) region carries the highest burden of these infections, mainly because of poor personal and environmental sanitations. Despite theextensive geographical overlap of STH and *Schistosoma mansoni* (*S.mansoni)* infection in SSA, there is limited information about the extent of its co-infection.

Objective: The aim of this study was to determine STH and *S.mansoni* infection and associatedrisk factors among school children of Manna district.

Methods: A school based cross-sectional study was conducted from May to June 2018. A total of 422 apparently healthy school children (SC) were included in the study. Semi-structured questionnaire was used to collect socio-demographic and hygiene practices. The stool samples processed using double Kato-Katz and examined under light microscopy for the diagnosis of STH and *S.mansoni.* The data was entered into EpiData version 3.1 and analyzed using SPSS-version 20 statistical software. Statistical analysis of the data was undertaken using binary and multivariable logistic regression. Statistical significance was decided when the $P< 0.05$.

Results: The prevalence of any helminths infection (STH and *S.mansoni*) was329(77.9%).While, prevalence of *S.mansoni* and STH was 300(71.1%) and 111(26.3%)respectively.The prevalence of STH &*S.mansoni* co-infection was 82 (19.4%). Higher co-infection rate was obtained between hookworms and S.*mansoni* (12.3%).The prevalence of STH &*S.mansoni* co-infection was 10.9% & 29.5% among Sayeodo and Korekonjo SC, respectively.The intensity of almost all STH infection was found to be light. Prevalence of *S.mansoni* infection was significantly higher in males [AOR 1.72, 95% CI (1.14-2.72)]. Heavy intensity infection of *S.mansoni* was higher in males (20.4%) than female students (11.1%).

Conclusion and recommendation: STH and *S.mansoni* co-infections are important public health problems among school children in the study area specially the co-infection of *S.mansoni* and hookworm. Moreover, there is high prevalence of *S.mansoni* among SC.Integrated prevention and control program that address STH and *S.mansoni* as oneshould beimplemented.

ACKNOWLEDGEMENT

First and foremost I am delighted to thank the almighty God of heaven shepherd of my life and all my beloved families who helped me in all situations from beginning of my life up to now and my hope of all my future life.

I would like also to express my great thanks to Jimma University faculty of health sciences school of medical laboratory science for giving me this opportunity.

My sincere and deepest gratitude goes to my Advisors Mr Daniel Dana and Mr Nuredin Abduselam for their motivation, enthusiasm, unreserved assistance, giving me timely comments and relevant guidance for the development of this thesis paper.

Next it is my pleasure to express my thank to Dr Zeleke Mekonnen the project managers of this study, have offered insight and constructive ideas throughout data collection & laboratory works. I am also grateful to have STH laboratory team members around me that are committed to work & helping me: Mr. Takele Tafese, Mr. Hundaol Girma, Ms. Elsa Meskele, Ms. Talile Dereje for their unreserved friendly cooperation during data collection &laboratory work.

Next I would like to thank School principals, teachers, families/ guardians of children & all school children participated in the study.

Finally, I express my very profound gratitude to my beloved wife for her continuous encouragement throughout my years of study and writing this thesis paper.

Table of Contents

LISTS OF TABLES

LISTS OF FIGURES

LIST OF ABREVIATIONS AND ACRONYMS

CI	Confidence Interval
DALYs	Disability Attributed Life Years
EPG	Eggs Per Grams
IRB	Institutional Review Board
PC	Preventive Chemotherapy
PSAC	Pre School Age
SAC	Children School Age Children
SC	School Children Standard
SOP	Operating Procedures
SPSS	Statistical Package for Social Science
SSA	Sub-Saharan Africa
STHs	Soil Transmitted Helminthes
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background

Schistosomiasis is a disease caused by six Schistosoma species, namely S.mansoni, Schistosoma haematobium (S.haematobium), Schistosoma guineensis, Schistosoma intercalatum Schistosoma japonicum, and Schistosoma mekongi(1). *Human schistosomiasis is an intravascular debilitating disease caused by infectious trematode of genus Schistosoma(2, 3). It is estimated to affect over 391-597million people worldwide(4). The main burden of SSA is usually attributed to two species, namely, S. mansoniand* S. haematobium *and are referred to as the major human schistosomes (5).*

Domestic & recreational activities such as washing clothes, fetching water and swimming in infected water and poor hygiene make children vulnerable to schistosomiasis(5). *S.mansoni* results in abdominal pain, bloody diarrhea and reduced appetite (6, 7). In chronic disease states, hepatic fibrosis can be developed 5 to15 years after initial infection(8, 9), which may lead to portal hypertension and hepatosplenomegaly, ascites and gastro-oesophageal bleeds that can be fatal if bleeding is uncontrolled(10).

STHs are nematodes, which inhabit gastrointestinal tract of human and estimated to affects more than 2 billion people worldwide, and the greatest numbers of infections occur in SSA, the Americas, China and east-Asia(11). STH of major concern to humans are *Ascaris lumbricoides (A.lumbricoides), Trichuris trichiura (T.trichuria), Necator americanus* and *Ancylostoma duodenale*. Infections are acquired either from ingestion of eggs or skin penetration while having contact with fecally contaminated soil, and occur primarily in areas where the sanitation is poor and water supplies are unsafe(12).STHs light infections usually have no symptoms. However, heavier infections cause a variety of symptoms including malnutrition, mal absorption, abdominal pain, cramping and tiredness, and impaired cognitive and physical development. Hookworms feed on host blood, which leads to a loss of iron and causes anemia (13).

Co-infection of parasite in humans is a situation in which an individual harbors multiple parasites from different species simultaneously(14). Co-infection of *S.mansoni* and STHs iscommon in tropical and subtropical regions of developing countries because of the overlap of conditions which is suitable for the survival of parasites, environmental conditions,inadequate and unsafe water supplies and inadequate sanitation(15) andare widespread (16).

1.2 Statement of problem

Schistosomiasis and STH together globally estimated to cause exceeding 8 million DALYs (17) and accounts for more than 40% tropical disease burden, excluding malaria (18). Studies show that population in SSA likely to lose US$3.5 billion of economic productivity every year due to burden of these diseases (19).

An estimated of 160 million SAC live in areas co-endemic for schistosomiasis and STH in the WHO regions of Africa, the Americas, the Eastern Mediterranean and the Western Pacific.Out of which, 20% were treated with PC for both STH & Schistosomiasis, 42% were treated for STH, and 10% were treated for Schistosomiasis (20).An estimated of 118.5 millionSAC living in 52 countries,accounts for 54.2% of the total number of people requiring treatment for schistosomiasis(20).

Co-infections of STH and *S.mansoni*may have significant impact on the health of the infected person. Hence, interactions between these parasites increase their deleterious effects(14). In presences of STH &*S.mansoni*co-infection, nutrient needs are greater due to the need to mount an immune response. But, often affect nutrient intake and absorption because they disrupt absorption or digestion of nutrients, and cause anorexia, and diminished appetite(21). The combined effects of co-infection cause chronic malnutrition and anemia in their intrinsically disabling effects (16). And related manifestations can often include reduced global functioning(22), decreased physical performance(22) and impaired cognition(23). In long term, decrease human capital among adults of affected populations(24) with a related loss in years of healthy life (22).

Factors that are responsible for persistent transmission of schistosomiasisin sub-Saharan countries includes climate changes and global warming, proximity to water bodies, dam construction, occupational activities such as fishing and irrigation, and poverty(5).

S. mansoni causes clinical abnormalities presented with bloody diarrhea, bowel ulceration, hepatomegaly, periportal fibrosis that can lead to portal hypertension, oesophageal varices and hematemesis(25, 26). Moreover, it is responsible for extensive growth retardation, fatigue, weakness, impairment of memory and cognitive reasoning, and increased risk of anemia, leading to poor academic performance by limiting the potential of infected children(5).These negative out comes in children add to the socioeconomic burden of the society(27). In SSA, around 8.5 million cases of chronic hepatosplenic schistosomiasis disease are attributed to the *S. mansoni* infection(25, 28).

Globally at least 102 countries across the tropics and subtropics are endemic for STH(29), estimated to affects more than 2 billion people worldwide and 4.5 billion individuals are at risk of STHs infections(12, 30). School-aged children (SAC) & pre-school aged children (PSAC) are the most vulnerable groups.More than 600 million SAC and 266 million PSAC requiring preventive chemotherapy (31).

The geographical distribution of STHs is influenced by various factors including external environmental conditions like soil (32), absence of sanitary facilities, unsafe waste disposal system, inadequacy and lack of safe water supply, toilet facility availability in the compound(33, 34) and human factors including age, sex, socio-economic status and occupation(35, 36).

STH causes stunting and diminished physical fitness, impaired memory and cognition on infected children(12), which results in impair childhood educational performance and reduce school attendance(30).

In Ethiopia**,**229 districts co-endemic for STH and Schistosomiasis(37) and an estimated of 79 million(38) people and 25.3 million(38) SAC are living in STH are living endemic areas, and an estimated of 37.3 million(39) people and 12.3 million(39) SAC are living in schistosomiasis endemic areas. An estimated of 12.3 million and 23.3 million SAC was requiring treatment for schistosomiasis and STHs,respectively(37).

In Ethiopia, numerous studies have been conducted separately on prevalence of STH and *S.mansoni* despite the co-endemicity of both infections is common.The presence of rivers and springs that may contain snail intermediate hostsin Manna district especially around schools that students swimming in, inadequate sanitationandlow coverage of access to drinking water may favoroccurrence of STH and *S.mansoni*infection. Prevalence of STH and *S.mansoni* co-infection and associated factors were not well addressed in Ethiopia including our study area. Therefore, the aim of this study was to determine the prevalenceof STH and *S.mansoni* co-infection and associated factors among SC in Manna district, Jimma zone, southwest Ethiopia.

1.3 Significance of the study

The information generated from thisstudy used by researchers, policy makers, stake holders and authorities at different levels.An integrated alternative prevention and control strategies that can increase the awareness of the problem at community level, delivery of treatment and infrastructural improvement can be formulated. An integrated strategies which involves social empowerment to intervene the problem as one so as to increase the cost-effectiveness of the interventions can be applied. It also, can be used as baseline information for further study in the area.

CHAPTER TWO

LITERATURE REVIEW

Co-infections of *S.mansoni* and STH are conditionshappen in human populations because of favorable environmental conditions for the development and survival of parasitic stages.The Federal Ministry of Health successfully scaled up schistosomiasis and STH intervention in endemic areas but infections are continued to be serious public health problems resulting in morbidity of mainly SAC.This study was aimed to determine the prevalence of STH and *S.mansoni*infection and associated factorsamong SC of manna district.

Studies conducted in different parts of world showed the following prevalence of STH and *S.mansoni*co-infection. In villages of southeastern Region of Brazil 2%(40), Brazilian children 18.1%(41), Ilha das Flores in Sergipe, Brazil 51.7%(42),western Kenya60.9%(43), Cameroon 18.8%(44), Kumusu western Kenya3.1%(45).

Different studies in Ethiopia showed the following co-infection of STH and *S.mansoni;*inMaksegnit and Enfranz towns, northwest Ethiopia 18.2%(46), Zarima town, northern Ethiopia 10.1%(15), Mizan Aman 34%(47),Bushulo village, southern Ethiopia 20.3%(48).

Studyof prevalence of *S.mansoni*in a villagesof southeastern Region of Brazilshowed 11.2%(40).Studiesof*S.mansoni*in different parts of Africa showed the following prevalence. In Ilemela district, northwestern Tanzania 80%(49), Mbita district of western Kenya 76.8%(50), Madagascar 73.6%(51), Kenya 69%(52), Nkombo island, Lake Kivu, Rusizi district of Rwanda 62.1%(53), Uganda 39.3%(54), Sengerema district in northwestern Tanzania 36.64 %(55).

Different studies in Ethiopia showed the following prevalence of *S.mansoni*amongSAC.In Demba Girara, Damot Woide district of Wolaita Zone, southern Ethiopia 81.3%(56), Waja-Timuga, district of Alamata, northern Ethiopia 73.9%(57), Fincha'a sugar estate, west Ethiopia 53.2%(58), Maksegnit and Enfranz towns, northwestern Ethiopia 49%(46), Zarima town,northern Ethiopia 37.9%(15)and Manna district, southwest 24 %(59).

Study of prevalenceof STHin northeastern Mindanaoshowed43.9%(60), Asembo district primary school of western Kenya 62.9%(43), Great Lakes region 50%(61), Kenya 25%(52),Kumusu western Kenya 16.2%(45), Mbita district of western Kenya 12.6%(50), Sengerema district in northwestern Tanzania 10.88%(55) and in Ethiopia, Durbete town,

northwestern Ethiopia 54.9%(62), Jimma Mendera elementary school 45.6%(63), Damot Woide district of Wolaita Zone, southern Ethiopia 32% (56), Mekele city 23.9 % (64) and Ambo 12.6% (65).

Study of STH and *S.mansoni*infection in Umolante(66) showed that male are highly infected than females with *S.mansoni* while females are more infected than males by hookworm(66). Another studies in Zarima town(15) and Teda health center(67) showed that shoe wearing and swimming habit(67) are associated with infection of *S.mansoni* and hookworm. While finding of study in Bushulo showed that prevalence of co-infection was not affected by age, gender or study sites(48).

Study in Yemen(68)showed the presence of association between prevalence of *S.mansoni* and distance from water source. Study in western Kenya(43) showed similarity in prevalence of *S.mansoni* infection in age ranges of 5-9 and 10-14 and study in Kano State, Nigeria(69)showed males are highly infected than females.

Studies in Mekelle city, northern Ethiopia(64) and Chuahit, Dembia district, northwest Ethiopia (70)showed the presence of association between prevalence of *S.mansoni* and distance from water source. Another studies in Mekelle city, northern Ethiopia(64),northeast Ethiopia, Gorgora town(71) showed similarity in prevalence of *S.mansoni* infection between age ranges of 5-9 and 10-14 years. Studies in Wolaita Zone, southern Ethiopia(56) and Umolante district, southern Ethiopia(66) showed males are more infected than females.

Study in Mount Cameroon showed high prevalence of STH among those participants who are practicing open field defecation(72).Study in Bagamoyo district, Tanzania(73)showed that not wearing shoes habit of Children has association with STH. Study in Kiwangwa, Bagamoyo district, Tanzania(73)showed that increased prevalence of STH among users of untreated drinking water and revealed absence of toilet facilities in the compound increased risk of STH infection. Study in Iraq(74) showed high infection rate of STH among males than female.

Study in Durbete town, northwestern Ethiopia (62)showed higher prevalence of STH infection among age ranges 10-14 than 5-9 years.Study in Jimma town, southwest Ethiopia(75) showednot wearing shoes habit of children had association with STH. Studies in Jimma town, southwest Ethiopia(75), Ambo town (65) revealed absence of toilet facilities in the compound associated with risk of STH infection .

CHAPTER THREE

OBJECTIVES

3.1 General objective

To determine the prevalence of *S.mansoni*and STH co-infection and associated factors among school children of Manna district.

3.2-Specific objectives

To determine the status of *S.mansoni* and STH co-infection among school children of Manna district

To determine the associated factors for STH and *S.mansoni* co-infection among school children of Manna district

To determine the Prevalence of *S.mansoni*and associate factors among school children of Manna district

To determine the prevalence of STH among school children of Manna district

To determine infection intensity of *S.mansoni* and STHamong school children of Manna district

CHAPTER FOUR

METHODS AND MATERIALS

4.1. Study area and period

The study was conducted between May and June 2018 among students of two primary schools namely Korekonjo and Sayeodo in Manna district, Jimma Zone, Oromiya Regional State Southwest Ethiopia. Manna is one of the districts in Jimma zone bordered on the south by Seka Chekorsa, on the west by Gomma, on the north by Limmu Kosa, and on the east by Kersa. Manna district contains5 rivers such as Aniso, Wanja, Doha, Yebu and Sogibo and many springs, and stagnant waters around schools.About 61% of the urban and 17% of the rural population has access to drinking water. Manna is found 382 km away from Addis Ababa and 32 km from Jimma town. Manna is found 1450 m above sea level and characterized by warm climate with mean annual maximum and minimum temperature of 25^0c and 18^0c, respectively. The annual rainfall ranges from 1138mm to 1690mm (Report obtained from document of 2013/2014 Jimma Zone administration).

4.2 Study Design

A school based cross sectional study design was employed.

4.3. Population

4.3.1. Source population

All school children in Korekonjo and Sayeodo primary schools in Manna district.

4.3.2. Study population

The study populations were all randomly selected school children attending in Korekonjo and Sayeodo primary schools in Manna district.

4.4. Eligibility criteria

4.4.1. Inclusion criteria:

School children of age between ages 5-14 years

4.4.2. Exclusion Criteria:

- Children who treated for STH or *S.mansoni* in the last three months

4.5. Sample size determination and sampling technique

4.5.1. Sample size determination

Sample size is determined using single population proportion

Using the formula $n=z^2p\ (1-p)/d^2$,

Where n= sample size

Z = statistic for a level of confidence (z =1.96 at 95% CI estimate considering the level of significances at 95%)

P= expected prevalence or proportion,

P= 0.5; P=0.5 taken because no co-infection of STH and *S.mansoni* study has been conducted in Ethiopia.

d = precision (if 5%, d= 0.05).

n= $(1.96)^2 x\ 0.5(1-0.5)/\ (0.05)^2=384$

Considering 10% non response rate, the final sample size is calculated to be 422.

4.5.2. Sampling technique

There were 2982 school children between 5-14 years found in two schools, of which Saye Odo and Kore Konjo accounts 1619 and 1363 students,respectively. A list of all these studentswas taken from student registration books in two schoolsand separately recorded.This separately recordedlist was used as sampling frames to enroll students in the study. Systematic random sampling technique was employed to select 422 students from two schools. The total sample size was proportionally allocated between two school based on size of school children between 5-14 years (figure 1).

To select individual student we have determined the value of K (sample interval). So, for Saye Odo k = 1619/229=7 and 1363/193=7 so that K=7 for both schools, and then random start student is selected by lottery method from 1-7 so that n(#2)was the first random in sampling frames in which the data was collected and continue every K in student sampling frame until the required sample size is maintained both schools.

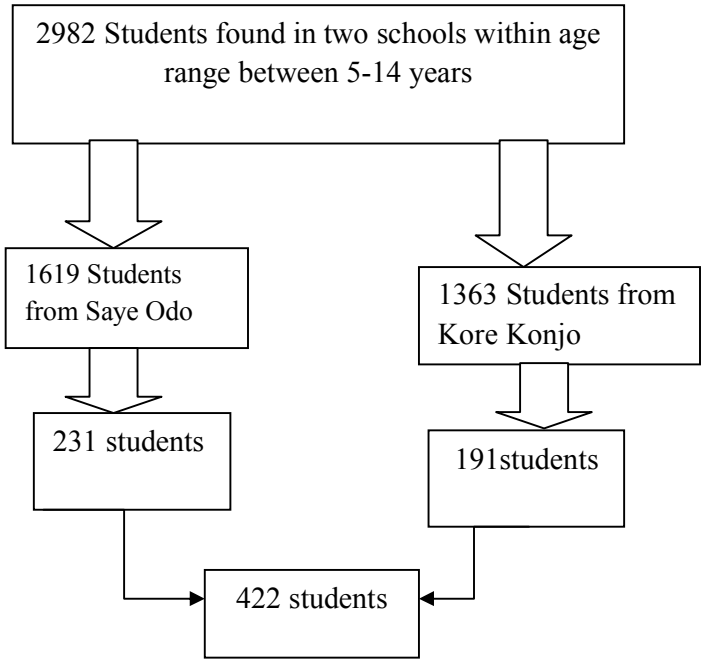


Figure 1- systematic data collection of STH &*S.mansoni* co-infection among schoolchildren of Manna district, Southwest Ethiopia, May to June 2018

4.6. Study variables

4.6.1 Dependent variables

- STH and *S.mansoni* infection

4.6.2 Independent variables

- Age
- Sex
- Source of water for drinking
- Treating drinking water
- Children habit of wearing shoes
- Presence of Toilet facilities in the compound

- Open field defecation
- Habit of defecation around river
- Hand washing habit
- Hand washing frequency
- Hand washing occasions
- Habit of fruit washing before eating
- Habit of crossing river water
- Frequency of crossing river water
- Reason for river water contact

4.7. Data collection and Sample processing

4.7.1 Data collection

The questionnaire was initially developed in English and then translated to Afaan Oromoo and back-translated by a different person who was blinded to the original questionnaire to check consistency. Each page was filled by data collectors according to the participants' response, which was obtained during interviewing.

4.7.2 Sample collection & processing

The stool sample collected from the study participants was processed and examined within 30-40 minutes for hookworm and after 24 hrs for other STHand*S.mansion* by double Kato-katz of 41.7mg template. After reading both slides, the average count was taken and multiplied by 24 to determine the EPG of the individual STHs and *S.mansoni* as follows.

Table 1:Classification of S. *mansoni* and STH infection intensity according to WHO criteria

	Light intensity	Moderate intensity	Heavy intensity
A. lumbricoides	1-4,999 epg	5,000-49,999 epg	≥50,000 epg
T. trichiura	1-999 epg	1,000-9,999 epg	≥10,000 epg
Hookworms	1-1,999 epg	2,000-3,999 epg	≥4,000 epg
S.mansoni	1-99 epg	100-399 epg	≥400 epg

4.8. Data Entry & Analysis

After data cleaning, the collected data were entered into a data base using EpiData version 3.1 and then analyzed using SPSS version 20. Statistical analysis of the data binary and multivariable logistic regression was done to see risk factor analysis. P-Value less than 0.05 wereconsidered as statistically significantand odd ratio was used to interpret the result.

4.9. Quality assurance

To ensure the quality of data, training /orientation was given to data collectors prior to data collection. English version questionnaire was translated to Afaan Oromoo by language experts. Standard operating procedures (SOP) for pre-analytical, analytical and post-analytical procedures were implemented. The results of all laboratory examination was recorded on standardized report format carefully and maintained with questionnaire according to subject's unique identification number and data was cleaned by checking for error. From all kato-katz slides, 10% was re-examined by experienced laboratory personnel who were blinded to the primary results. The difference between the two readings was corrected by selecting the third laboratory personnel.

1. No difference in presence/absence of *STH & S.mansoni* between two slides
2. Egg counts are +/-10 eggs for counts ≤100 eggs or +/-20% for counts >100 eggs

In case all discrepancies are within the given tolerance margin, no further action is required. When the discrepancies above the tolerance margin are noted in 1 or more slides, the slides are re-read by the experienced technician (blinded to the finding of the quality control). The new results are discussed with principal investigator and corrected.

4.10 Ethical consideration

Prior to data collection, ethical approval letter was secured from Institutional Review Board (IRB) of Jimma University. Support letter was submitted to Korekonjo and Sayeodo primary schools in Manna district before data collection. Before any data collection the purpose, objective and importance of study was explained and written informed consent was obtained from parents/guardians of each participant. Moreover, oral assent was obtained from participants aged 12 years and above. Confidentiality was maintained at all levels of the study. A participant who was unwilling to participate in the study and those who wished to quit from the study at any point in time were informed to do so without any restriction. Children having STH and *S.mansoni* infection were treated with Mebendazole and Praziquantil respectively based on the national anthelminthic treatment guideline in Saye health center by health officers.

CHAPTER FIVE

RESULTS

5.1- Demographic characteristics of the study participants

A total of 422 school children, 229 from Saye Odo and 193 from Kore Konjo enrolled to participate in the study of these study participants, females constitute 53.6% of the study subjects giving a sex ratio of 1.15:1. The mean age of the participants was 10.03 ± 2.235 (mean ± SD) years with age range from 5 to 14 years. Majority of 188(44.5%) of the study participants used protected spring followed by 134(31.8%) river water source for drinking. Almost all (99.3%) of participants had latrine at home, 98.6% of school children had shoes of which 80.8% of them always wear (Table 2).

Table 2- Socio-demographic characteristicsof SC in Manna district, southwest Ethiopia, 2018

Variables		Frequency n(%)
Sex	Male	196(46.4)
	Female	226(53.6)
Age group in years	5-9	163(32.6)
	10-14	259(61.4)
Name of School	Saye Odo	229(54.3)
	Kore Konjo	193(45.7)

Table 3.Hygiene and sanitation practice of SC in Manna district, southwest Ethiopia, 2018

Variable		Frequency n(%)
Presence of latrine in your compound	Yes	419(99.3)
	No	3(0.7)
Frequency using latrine	Always	358(84.8)
	Some times	62(14.7)
	Rarely	2(0.5)
Defecation around river	Yes	90(21.3)
	No	332(78.7)
Frequency of defecation around river	Always	17(18.9)
	Sometimes	73(81.1)
	Not at all	332(78.7)
Hand washing habit	Yes	417(98.8)
	No	5(1.2)
Frequency of washing hand	Always	289(68.5)
	Sometimes	129(30.6)
	Not at all	4(0.9)
Hand washing before eating	Yes	410(97.2)
	No	12(2.8)
Hand washing after eating	Yes	301(71.3)

	No	121(28.7)
Hand washing after defecation	Yes	189(44.8)
	No	233(55.2)
Habit of fruit washing before eating	Yes	416(98.6)
	No	6(1.4)
Frequency of fruit washing before eating	Always	60(14.2)
	Sometimes	356(84.4)
	Not at all	6(1.4)
water source	Tap	46(10.9)
	Well	54(12.8)
	River	134(31.8)
	Spring	188(44.5)
Habit treating drinking water	Yes	42(10)
	No	380(90)
Frequency of treating drinking water	Always	10(2.4)
	Sometimes	32(7.6)
	Not at all	380(90)
treating drinking water with chemical	Yes	12(2.8)
	No	410(97.2)
treating drinking water with boiling	Yes	12(2.8)
	No	385(97.2)
treating drinking water by other methods	Yes	17(4)
	No	405(96)
Habit of wearing shoe	Yes	416(98.6)
	No	6(1.4)
Frequency of wearing shoe	Always	341(80.8)
	Sometime	75(17.8)
	Not at all	6(1.6)
Presence of nearby river	Yes	402(95.3)
	No	20(4.7)
Habit of crossing the river	Yes	314(74.4)
	No	108(25.6)
Frequency of crossing the river	Always	56(13.3)
	Sometimes	258(61.1)
	Not at all	108(25.6)
Distance from the river in minute	≤10	374(88.6)
	11-2o	28(6.6)
	>20	20(4.7)
Using river water for drinking	Yes	134(31.8)
	No	288(68.2)
Swimming	Yes	135(32)
	No	287(68)
Bathing	Yes	317(75.1)
	No	105(24.9)

5.2- Prevalence of STH and *S.mansoni* co-infection

Theoverall prevalence of any helminth infection (STHs&*S.mansoni)* was 329(77.9%), of which prevalence of STH and *S.mansoni* accounts for *111 (*26.3%) and 300(71.1%), respectively. The prevalence of STH-*S.mansoni* co-infection was 82 (19.4%). Hookworm-S.*mansoni* co-infection was the most dominant (12.3%) (Figure 2). Prevalence of STH and

S.mansoni co-infection among Kore Konjo school student was found to be 57(29.5%) followed by Saye Odo 25(10.9%).

From the total of 111 STH infected study participants, 95 (85.6%) and 16 (14.4%) were infected with single and double STH infection respectively. Regarding STHs, hookworm was the predominant parasite, 63(14.9%) followed by *T.trichuria*, 43(10.2%) and *A.lumbricoid* 21(5%).Prevalence of STH among Kore Konjo students was found to be 67(34.7%) and Saye Odo 44(19.2%).Prevalence of *S.mansoni* among Kore Konjo school student was found to be 157 (81.3%) and Saye Odo was 143(62.4%).

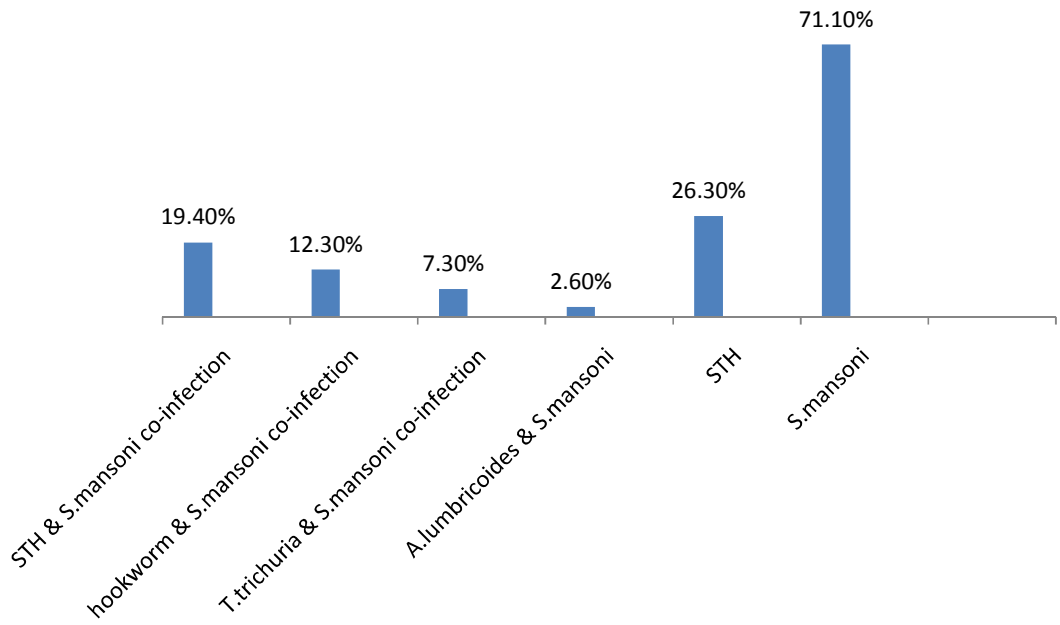


Figure 2:Prevalence of STH &*S.mansoni* among schoolchildren of Manna district, Southwest Ethiopia, May to June 2018

5.3. Associated risk factors

5.3.1- Factors associated with STH and *S.mansoni* co- infections

In bivariate logistic regression analysis, sex, age of students, source of drinking water, habit of treating drinking water and presence of nearby river watershowedp value< 0.25. However, in multivariate logistic regression analysis controlling the possible confounders, none of the variableswere significantly associated with STH and *S.mansoni* co-infection.Age related difference in prevalence of STH and *S.mansoni* co-infection was observed. The highest proportion of

parasite was reported among age groups of 10-14 years (22%)followed by 5-9 years (14.1%). However, the difference was not statistically significant (p=0.098 AOR= 1.6, 95% CI (0.92-2.76) (Table 4).

Table 4-Factors associated with STH and *S.mansoni* co- infections among schoolchildren in Manna district, Southwest Ethiopia, 2018

Variable		STH &*S.mansoni* co-infection n(%)		COR(95%CI)	P	AOR(95%CI)	P
		Yes	No				
Sex	Male	46(23.5)	152(77.5)	0.66(.4-1.1)	0.09	0.69(0.44-1.13)	0.136
	Female	36(15.9)	19(84.1)				
Age in group	5-9	22(14.1)	14(85.9)	1.72(1.01-2.92)	0.135	1.6(.92-2.76)	0.098
	10-14	60(22)	202(80)				
source of drinking water	Tap	7(15.2)	39(84.8)	1.32(.55-3.2)	0.135	1.18(0.9-1.54)	0.226
	Well	5(9.3)	49(90.7)	2.32(.863-6.2)			
	River	31(23.9)	102(76.1)	0.76(.44-1.29)			
	Spring	39(3.2)	182(96.8)				
Habit of crossing river	Yes	66(21)	249(79)	0.618(.336-1.137)	0.122	0.754(.394-1.443)	0.394
	No	16(14.8)	93(85.2)				
Presence of nearby river	Yes	80(19.9)	323(80.1)	0.22(.22-1.6)	0.137	0.26(.033-2.1)	0.201
	No	2(10)	18(90)				

COR = Crude odds ratio, AOR = Adjusted odds ratio, CI = Confidence Interval, P= P-value

5.3.2- Factors associated with *S.mansoni* infection

Multivariate logistic regression analysis showed that the prevalence *S.mansoni* was significantly associated with sex of children. Infection by *S. mansoni* was 1.72 times more likely to happen in male children than females [(p = 0.02, AOR= 1.72(1.14-2.72)].

The highest proportion of parasite was reported among 10-14 than 5-9 age groups (75.3% vs 64.4%), respectively though the difference was not statistically significant (Table 5).

Table 5-Factors associated with *S.mansoni* among schoolchildren in Manna district, Southwest Ethiopia, 2018

Variable		*S.mansoni*		COR(95%CI)	P	AOR(95%CI)	P
		Yes	No				
Sex	Male	154(78.6)	42(21.4)	2.01(1.298-3.11)	0.002	1.72(1.14-2.72)	0.02*
	Female	146(64.6)	80(35.4)				
Age group	5-9	105(64.4)	58(35.6)	0.59(0.39-0.91	0.017	0.65(0.42-1.02)	0.185
	10-14	195(75.3)	64(24.7)				
Swimming in river water	Yes	106(78.5)	29(21.5)	0.57(0.35-0.92)	0.022	0.61(0.35-1.1)	0. 088
	No	194(67.9)	93(32.4)				
Bathing in	Yes	212(73.1)	78(26.9)	0.74(0.47-1.15)	0.117	0.78(0.47-	0.28

river water	No	88(66.7)	44(33.3)			1.24)	

*Statistically significant at P < 0.05, COR = Crude odds ratio, AOR = Adjusted odds ratio, CI = Confidence Interval, P= P-value

5.4- Infection intensities of STH and *S.mansoni* infection

The highest intensity of *S. mansoni*infection was 5,208 epg observed in male children aged 10–14 years of Sayeodo primary school. The highest intensity of *A.lumbricoides* infection was 72,052 epg seen in male student of age 5-9 years, maximum infection intensity of *T.trichuria*, was 6,372 epg observed in male student aged 5-9 years and highest Hookworm infection, 1,116 epg was observed in male student aged 10-14 years. The mean infection intensity of *S.mansoni* and each STH is presented below (Table 6).

Table 6Arithmetic mean EPG for *S. mansoni* and STH among SC of Manna district, Southwest Ethiopia,from May to June 2018.

Variables		*A.lumbricoides*	*T.trichuria*	Hookworms	*S.mansoni*
Age	5-9	597.1	48	5.89	180.29
	10-14	110.79	27.04	20.34	263.65
Sex	Male	383.02	44.2	19.84	298.78
	Female	110.81	34.41	10.354	172.73

From the total of111 STH infected participants,108 (97.3%) ofinfection intensitieswas light.Out of 300 *S.mansoni* infected study participants, proportionof light, moderate and heavy infection intensitiesaccounted for 46.7%, 31.7% and 21.6%, respectively(Table 7).

From the total of 65 (21.6%) heavy infections,the highest 45 (69.2%) was observed in children aged 10–14 years followed by 20 (30.8%) in children aged 5–9 years. The heavy infection due to *S. mansoni* was higher in males 40 (61.5%) than females 25 (39.5%). Higher proportion of *S. mansoni* infection intensity was observed among SC of Kore Konjo (33.7% light, 27.5% moderate and 20.2% heavy) than Saye Odo (32.8% light, 18.3% moderate and 11.4% heavy).

Table 7: Proportion of infection intensity of *S. mansoni* and STH in SC of Manna district, Southwest Ethiopia, from May to June, 2018.

Parasite		**Frequency**	**Percentage**
S.mansoni	Light	140	46.7
	Moderate	95	31.7
	Heavy	65	21.6
A.lumbricoides	Light	19	90.4
	Moderate	1	4.8
	Heavy	1	4.8
T.trichuria	Light	42	97.7
	Moderate	1	2.3
Hookworm	Light	63	100

CHAPTER SIX

DISCUSSION

STH and *S.mansoni* co-infection was common among SC of the study area and higher in age group of 10-14 years. The infection intensity of almost all STH was light and 21.6% of *S.mansoni* was heavy. Sex was found to be the only independent predictor of *S.mansoni* infection.

The overall prevalence of STH and *S.mansoni* co-infection in the present study was 19.4%. The result of thisresult was higher than reports from Kumusu Western Kenya 3.1%(45),villages of southeastern Region of Brazil 2%(40)and Zarima town, northern Ethiopia 10.1%(15).The finding of this study was lower than result of Ilha das Flores in Sergipe, Brazil 51.7%(42), western Kenya 60.9%(43) and Mizan Aman, southwest Ethiopia 34%(47)This was comparable with findings from studies conducted in Brazilian children 18.1%(41), Cameroon 18.8%(44),Bushulo village, southern Ethiopia 20.3%(48), Maksegnit and Enfranz towns, northwest Ethiopia 18.2%(46).The reason for difference in result of these studies could be variation in socio-demographic and economic, methodologyand geographical environment.

The prevalence of *S.mansoni*in the present study was 71.1%.The result of this study was lower than finding in Sanja town, northern Ethiopia89.9%(76) and higher than results of studies conducted in Sengerema district in northwestern Tanzania 36.6%(55), Fincha'a sugar estate, rural part of west Ethiopia 53.2%(58) and Maksegnit and Enfranz towns, northwestern Ethiopia 49%(46). The result of this study was comparable with findings of studies conducted in Madagascar 73.6%(51), Kenya 69%(52), Waja-Timuga, district of Alamata, northern Ethiopia 73.9%(57) and Demba Girara, Damot Woide district of Wolaita Zone, southern Ethiopia 81.3%(56).The reason for difference in result of the studies could be variation in methodology, socio-demographic and coverage of MDA.

The prevalence of *S.mansoni* in present study was much higher than the finding of the same study area conducted in previous time 24%(59). The reason could be previous study was done by single Kato-Katz while the current study done by double Kato-Katz which may increase the detection rate and the presence of defecating around river practice; 90(21.3%) of our respondents, of which 62.2% infected with *S.mansoni* have habit of defecating around the river may favor risk of persistentcontamination of source of water by infected individual.

The overall prevalence of STH was 26.3%, of which 95 (85.6%) and 16 (14.4%) were single and double infection respectively.The result of this study was higher than reports from Sengerema district in northwestern Tanzaina 10.9%(55), Mbita district of western Kenya 12.6%(50) and Ambo 12.6%(65). This result of this study was lower than studies in Mainit area in Northeastern Mindanao 43.9%(60),and other studies conducted in Ethiopia such as Jimma Mendera elementary school 45.6%(63). Thisresult was comparable with studies in Kenya 28%(52) and Mekele city 23.9%(64)and Damot Woide district of Wolaita Zone, southern Ethiopia 32%(56). The reason for difference inresult of these studies could be variation in method of stool sample processing, environmental condition and, socio-demographic and economic factors.

In the present study, sex was significantly associated with *S.mansoni*infection. Males are 1.72 times more likely to be infected than female students. This finding was consistent with studies conducted in Kano State, Nigeria(69), Wolaita Zone, southern Ethiopia(56) and Umolante district, south Ethiopia(66).The existence of more outdoor activities like helping family in farm and keeping cattle among boys than girls,and the fact that few of the girls had any history of playing or swimming in local water sources could be the reasons for this finding.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATION

STH and *S.mansoni* co-infections are important public health problems among school children in the study area specially the co-infection of *S.mansoni* and hookworm. Prevalence of *S.mansoni* was high.Prevalence STH was moderate. The intensity of almost all STH infections was light. Prevalence *of S.mansoni* was higher infection of in males than female.

RECOMMENDATION

- Prevention and control program that address STH and *S.mansoni* as oneshould beimplemented.
- Urgent interventional efforts of treating community against *S.mansoni* irrespective of age, sex and infection status should be considered so as to reduce morbidity and adverse effect.
- Targeted treatment to SAC against STH offers the most efficient way to achieve the recommended strategy for morbidity control.

.

REFERENCES

1.Davis A, Cook G, Zumla A. Manson's tropical diseases. 2009.

2.Steinmann P, Keiser J, Bos R, Tanner M, Utzinger J. Schistosomiasis and water resources development: systematic review, meta-analysis, and estimates of people at risk. *The Lancet infectious diseases.* 2006;6(7):411-25.

3.Wang L, Utzinger J, Zhou X-N. Schistosomiasis control: experiences and lessons from China. The Lancet. 2008;372(9652):1793-5.

4.WHO Schistosomiasis: number of people treated worldwide in 2013. Weekly Epidemiological Record= Relevé épidémiologique hebdomadaire. 2015;90(05):25-32.

5.Adenowo AF, Oyinloye BE, Ogunyinka BI, Kappo AP. Impact of human schistosomiasis in sub-Saharan Africa. *Brazilian Journal of Infectious Diseases*. 2015;19(2):196-205.

6.Bustinduy AL, Sousa-Figueiredo JC, Adriko M, Betson M, Fenwick A, Kabatereine N, et al. Fecal occult blood and fecal calprotectin as point-of-care markers of intestinal morbidity in Ugandan children with Schistosoma mansoni infection. *PLoS neglected tropical diseases*. 2013;7(11):e2542.

7.Mohamed A, Al Karawi M, Yasawy MI. Schistosomal colonic disease. Gut. 1990;31(4):439-42.

8.Gryseels B. Morbidity due to infection with Schistosoma mansoni: *an update. Tropical and geographical medicine*. 1992;44(3):189.

9.Dessein AJ, Hillaire D, Elwali NEM, Marquet S, Mohamed-Ali Q, Mirghani A, et al. Severe hepatic fibrosis in Schistosoma mansoni infection is controlled by a major locus that is closely linked to the interferon-γ receptor gene. The American Journal of Human Genetics. 1999;65(3):709-21.

10.Hatz C, Jenkins J, Ali Q, Abdel-Wahab M, Cerri G, Tanner M. A review of the literature on the use of ultrasonography in schistosomiasis with special reference to its use in field studies: 2. Schistosoma mansoni. Acta tropica. 1992;51(1):15-28.

11.Hotez PJ, Bundy DA, Beegle K, Brooker S, Drake L, de Silva N, et al. Helminth infections: soil-transmitted helminth infections and schistosomiasis. 2006.

12.Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D, et al. Soil-transmitted helminth infections: ascariasis, trichuriasis, and hookworm. *The Lancet*. 2006;367(9521):1521-32.

13.WHO. Research priorities for helminth infections: technical report of the TDR disease reference group on helminth infections: World Health Organization; 2012.

14.Petney TN, Andrews RH. Multiparasite communities in animals and humans: frequency, structure and pathogenic significance. *International journal for parasitology*. 1998;28(3):377-93.

15.Alemu A, Atnafu A, Addis Z, Shiferaw Y, Teklu T, Mathewos B, et al. Soil transmitted helminths and Schistosoma mansoni infections among school children in Zarima town, northwest Ethiopia. *BMC infectious diseases*. 2011;11(1):189.

16.Ezeamama AE, McGarvey ST, Acosta LP, Zierler S, Manalo DL, Wu H-W, et al. The synergistic effect of concomitant schistosomiasis, hookworm, and Trichuris infections on children's anemia burden. *PLoS neglected tropical diseases*. 2008;2(6):e245.

17.Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2015;386(9995):743-800.

18.Crompton DWT. Preventive chemotherapy in human helminthiasis: coordinated use of anthelminthic drugs in control interventions: a manual for health professionals and programme managers: World Health Organization; 2006.

19.Lo NC, Addiss DG, Hotez PJ, King CH, Stothard JR, Evans DS, et al. A call to strengthen the global strategy against schistosomiasis and soil-transmitted helminthiasis: the time is now. *The Lancet infectious diseases.* 2017;17(2):e64-e9.

20.mondiale de la Santé O, Organization WH. Schistosomiasis: number of people treated worldwide in 2014. Weekly Epidemiological Record= Relevé épidémiologique hebdomadaire. 2016;91(5):53-60.

21.Hall A, Zhang Y, MacArthur C, Baker S. The role of nutrition in integrated programs to control neglected tropical diseases. *BMC medicine*. 2012;10(1):41.

22.King CH, Dickman K, Tisch DJ. Reassessment of the cost of chronic helmintic infection: a meta-analysis of disability-related outcomes in endemic schistosomiasis. *The Lancet*. 2005;365(9470):1561-9.

23.Ezeamama AE, Friedman JF, Acosta LP, Bellinger DC, Langdon GC, Manalo DL, et al. Helminth infection and cognitive impairment among Filipino children. *The American journal of tropical medicine and hygiene.* 2005;72(5):540-8.

24.King CH, Dangerfield-Cha M. The unacknowledged impact of chronic schistosomiasis. Chronic illness. 2008;4(1):65-79.

25.van der Werf MJ, de Vlas SJ, Brooker S, Looman CW, Nagelkerke NJ, Habbema JDF, et al. Quantification of clinical morbidity associated with schistosome infection in sub-Saharan Africa. *Acta tropica*. 2003;86(2-3):125-39.

26.Gryseels B, Polman K, Clerinx J, Kestens L. Human schistosomiasis. *The Lancet.* 2006;368(9541):1106-18.

27.Conteh L, Engels T, Molyneux DH. Socioeconomic aspects of neglected tropical diseases. *The Lancet*. 2010;375(9710):239-47.

28.Engels D, Chitsulo L, Montresor A, Savioli L. The global epidemiological situation of schistosomiasis and new approaches to control and research. Acta tropica. 2002;82(2):139-46.

29.Mitra A, Mawson A. Neglected tropical diseases: epidemiology and global burden. *Tropical medicine and infectious disease*. 2017;2(3):36.

30.Hotez PJ, Brindley PJ, Bethony JM, King CH, Pearce EJ, Jacobson J. Helminth infections: the great neglected tropical diseases. *The Journal of clinical investigation*. 2008;118(4):1311-21.

31.WHO. Soil-transmitted helminthiases: number of children treated in 2013. Weekly Epidemiological Record= Relevé épidémiologique hebdomadaire. 2015;90(10):89-94.

32.Merid Y, Hegazy M, Mekete G, Teklemariam S. Intestinal helminthic infection among children at Lake Awassa area, south Ethiopia. *The Ethiopian Journal of Health Development (EJHD)*. 2017;15(1).

33.WHO. Prevention and control of schistosomiasis and soil-transmitted helminthiasis: report of a WHO expert committee. 2002.

34.Belyhun Y, Medhin G, Amberbir A, Erko B, Hanlon C, Alem A, et al. Prevalence and risk factors for soil-transmitted helminth infection in mothers and their infants in Butajira, Ethiopia: a population based study. *BMC Public Health*. 2010;10(1):21.

35.Mofid LS, Bickle Q, Jiang J-Y, Du Z-W, Patrick E. Soil-transmitted helminthiasis in rural south-west China: prevalence, intensity and risk factor analysis. *Southeast Asian Journal of Tropical Medicine and Public Health*. 2011;42(3):513.

36.Naish S, McCarthy J, Williams G. Prevalence, intensity and risk factors for soil-transmitted helminth infection in a South Indian fishing village. *Acta Tropica*. 2004;91(2):177-87.

37.Negussu N, Mengistu B, Kebede B, Deribe K, Ejigu E, Tadesse G, et al. Ethiopia schistosomiasis and soil-transmitted helminthes control programme: progress and prospects. *Ethiopian medical journal*. 2017;55(Suppl 1):75.

38.Mengitsu B, Shafi O, Kebede B, Kebede F, Worku DT, Herero M, et al. Ethiopia and its steps to mobilize resources to achieve 2020 elimination and control goals for neglected tropical diseases: Spider webs joined can tie a lion. *International health*. 2016;8(suppl_1):i34-i52.

39.Deribew A, Kebede B, Tessema GA, Adama Y, Misganaw A, Gebre T, et al. Mortality and Disability-Adjusted Life-Years (Dalys) for Common Neglected Tropical Diseases in Ethiopia, 1990-2015: Evidence from the Global Burden of Disease Study 2015. *Ethiopian medical journal*. 2017;55(Suppl 1):3.

40.Enk MJ, Lima ACL, Barros HdS, Massara CL, Coelho PMZ, Schall VT. Factors related to transmission of and infection with Schistosoma mansoni in a village in the South-eastern Region of Brazil. Memórias do Instituto Oswaldo Cruz. 2010;105(4):570-7.

41.Brito LL, Barreto ML, Silva RDCR, Assis AMO, Reis MG, Parraga IM, et al. Moderate- and low-intensity co-infections by intestinal helminths and Schistosoma mansoni, dietary iron intake, and anemia in Brazilian children. T*he American journal of tropical medicine and hygiene*. 2006;75(5):939-44.

42.Rollemberg CV, Silva MM, Rollemberg KC, Amorim FR, Lessa NM, Santos MD, et al. Predicting frequency distribution and influence of sociodemographic and behavioral risk factors of Schistosoma mansoni infection and analysis of co-infection with intestinal parasites. *Geospatial health*. 2015;10(1).

43.Handzel T, Karanja DM, Addiss DG, Hightower AW, Rosen DH, Colley DG, et al. Geographic distribution of schistosomiasis and soil-transmitted helminths in Western Kenya: implications for anthelminthic mass treatment. T*he American journal of tropical medicine and hygiene*. 2003;69(3):318-23.

44.Aloho-Bekong D, Agbor G, Nkengazong L, Tchuente RN, Asonganyi T. OXIDATIVE STRESS IN SCHOOL CHILDREN CO-INFECTED WITH SCHISTOSOMA MANSONI AND SOIL-TRANSMITTED HELMINTHS. *HEALTH SCIENCES AND DISEASES.* 2013;12(3).

45.Odiere MR, Opisa S, Odhiambo G, Jura WG, Ayisi JM, Karanja DM, et al. Geographical distribution of schistosomiasis and soil-transmitted helminths among school children in informal settlements in Kisumu City, Western Kenya. Parasitology. 2011;138(12):1569-77.

46.Gashaw F, Aemero M, Legesse M, Petros B, Teklehaimanot T, Medhin G, et al. Prevalence of intestinal helminth infection among school children in Maksegnit and Enfranz Towns, northwestern Ethiopia, with emphasis on Schistosoma mansoni infection. *Parasites & vectors*. 2015;8(1):567.

47.Mengistie Z, editor High prevalence of Schistosoma mansoni and other intestinal parasites among elementary school children in southwest Ethiopia: a cross-sectional study. 17th International Congress on Infectious Diseases.

48.Terefe A, Shimelis T, Mengistu M, Hailu A, Erko B. Schistosomiasis mansoni and soil-transmitted helminthiasis in Bushulo village, southern Ethiopia. *Ethiopian Journal of Health Development*. 2011;25(1):46-50.

49.Ndokeji SD, Mazigo HD, Temu M, Kishamawe C, Malenganisho W, Todd J, et al. Prevalence and intensity of Schistosoma mansoni and hookworm infections among pre-school and school-aged children in Ilemela District, north-western Tanzania. *Tanzania Journal of Health Research.* 2016;18(2).

50.Nagi S, Chadeka EA, Sunahara T, Mutungi F, Justin YKD, Kaneko S, et al. Risk factors and spatial distribution of Schistosoma mansoni infection among primary school children in Mbita District, Western Kenya. *PLoS neglected tropical diseases*. 2014;8(7):e2991.

51.Spencer SA, Penney JMSJ, Russell HJ, Howe AP, Linder C, Rakotomampianina AL, et al. High burden of Schistosoma mansoni infection in school-aged children in Marolambo District, Madagascar. *Parasites & vectors*. 2017;10(1):307.

52.Samuels AM, Matey E, Mwinzi PN, Wiegand RE, Muchiri G, Ireri E, et al. Schistosoma mansoni morbidity among school-aged children: a SCORE project in Kenya. *The American journal of tropical medicine and hygiene*. 2012;87(5):874-82.

53.Lai Y-S, Biedermann P, Ekpo UF, Garba A, Mathieu E, Midzi N, et al. Spatial distribution of schistosomiasis and treatment needs in sub-Saharan Africa: a systematic review and geostatistical analysis. *The Lancet infectious diseases*. 2015;15(8):927-40.

54.Nalugwa A, Olsen A, Tukahebwa M, Nuwaha F. Intestinal schistosomiasis among preschool children along the shores of Lake Victoria in Uganda. *Acta tropica*. 2015;142:115-21.

55.Bukindu F, Morona D, Mazigo HD. Prevalence of Schistosoma mansoni and soil transmitted helminths and factors associated with uptake of preventive chemotherapy among school children in Sengerema District in north-western Tanzania. *Tanzania Journal of Health Research*. 2016;18(1).

56.Alemayehu B, Tomass Z. Schistosoma mansoni infection prevalence and associated risk factors among schoolchildren in Demba Girara, Damot Woide District of Wolaita Zone, Southern Ethiopia. *Asian Pacific journal of tropical medicine*. 2015;8(6):457-63.

57.Abebe N, Erko B, Medhin G, Berhe N. Clinico-epidemiological study of Schistosomiasis mansoni in Waja-Timuga, District of Alamata, northern Ethiopia. *Parasites & vectors.* 2014;7(1):158.

58.Mekonnen Z, Meka S, Zeynudin A, Suleman S. Schistosoma mansoni infection and undernutrition among school age children in Fincha'a sugar estate, rural part of West Ethiopia. *BMC research note*s. 2014;7(1):763.

59.Bajiro M, Dana D, Ayana M, Emana D, Mekonnen Z, Zawdie B, et al. Prevalence of Schistosoma mansoni infection and the therapeutic efficacy of praziquantel among school children in Manna District, Jimma Zone, southwest Ethiopia. *Parasites & vectors*. 2016;9(1):560.

60.Cassion CC, Pingal ET, Maniago RB, Medina JRC, Belizario Jr VY. Schistosomiasis and soil-transmitted helminth infections in school children in the Lake Mainit area in northeastern Mindanao: an opportunity for integrated helminth control in the school setting. Acta Medica Philippina. 2013;47(3):4-10.

61.Clements AC, Deville MA, Ndayishimiye O, Brooker S, Fenwick A. Spatial co□distribution of neglected tropical diseases in the East African Great Lakes region: revisiting the justification for integrated control. *Tropical medicine & international health*. 2010;15(2):198-207.

62.Alelign T, Degarege A, Erko B. Soil-transmitted helminth infections and associated risk factors among schoolchildren in Durbete Town, Northwestern Ethiopia. *Journal of parasitology research.* 2015;2015.

63.Tefera E, Belay T, Mekonnen SK, Zeynudin A, Belachew T. Prevalence and intensity of soil transmitted helminths among school children of Mendera Elementary School, Jimma, Southwest Ethiopia. *The Pan African medical journal*. 2017;27.

64.Assefa A, Dejenie T, Tomass Z. Infection prevalence of Schistosoma mansoni and associated risk factors among schoolchildren in suburbs of Mekelle city, Tigray, Northern Ethiopia. *Momona Ethiopian Journal of Science*. 2013;5(1):174-88.

65.Samuel F, Demsew A, Alem Y, Hailesilassie Y. Soil transmitted Helminthiasis and associated risk factors among elementary school children in ambo town, western Ethiopia. *BMC public health.* 2017;17(1):791.

66.Alemu M, Hailu A, Bugssa G. Prevalence of intestinal schistosomiasis and soil-transmitted helminthiasis among primary schoolchildren in Umolante district, South Ethiopia. Clin Med Res. 2014;3(6):174-80.

67.Abate A, Kibret B, Bekalu E, Abera S, Teklu T, Yalew A, et al. Cross-sectional study on the prevalence of intestinal parasites and associated risk factors in Teda Health Centre, Northwest Ethiopia. *ISRN parasitology*. 2013;2013.

68.Sady H, Al-Mekhlafi HM, Mahdy MA, Lim YA, Mahmud R, Surin J. Prevalence and associated factors of schistosomiasis among children in Yemen: implications for an effective control programme. *PLoS neglected tropical diseases*. 2013;7(8):e2377.

69.Dawaki S, Al-Mekhlafi HM, Ithoi I, Ibrahim J, Abdulsalam AM, Ahmed A, et al. Prevalence and risk factors of schistosomiasis among Hausa communities in Kano state, Nigeria. *Revista do Instituto de Medicina Tropical de São Paulo*. 2016;58.

70.Alemu A, Tegegne Y, Damte D, Melku M. Schistosoma mansoni and soil-transmitted helminths among preschool-aged children in Chuahit, Dembia district, Northwest Ethiopia: prevalence, intensity of infection and associated risk factors. *BMC public health*. 2016;16(1):422.

71.Essa T, Birhane Y, Endris M, Moges A, Moges F. Current status of Schistosoma mansoni infections and associated risk factors among students in Gorgora town, Northwest Ethiopia. *ISRN Infectious Diseases*. 2012;2013.

72.Ntonifor H, Green A, Bopda M, Tabot J. Epidemiology of urinary schistosomiasis and soil transmitted helminthiasis in a recently established focus behind Mount Cameroon. *International Journal of Current Microbiology and Applied Sciences*. 2015;4(3):1056-66.

73.Kumar DD, Kumari KR, James JK, Sekharan CB. Soil-Transmitted Helminth Infections and the Associated Risk Factors in Pre-Primary School Children, Kiwangwa Rural Ward, Bagamoyo District, Tanzania. Asian J Med Pharm Res. 2016;6(3):24-31.

74.Musa IS. Incidence of helminthiasis in humans in Iraq. *Karbala International Journal of Modern Science*. 2017;3(4):267-71.

75.Debalke S, Worku A, Jahur N, Mekonnen Z. Soil transmitted helminths and associated factors among schoolchildren in government and private primary school in Jimma Town, Southwest Ethiopia. *Ethiopian Journal of health Sciences*. 2013;23(3):237-44.

76.Worku L, Damte D, Endris M, Tesfa H, Aemero M. Schistosoma mansoni infection and associated determinant factors among school children in Sanja Town, Northwest Ethiopia. *Journal of Parasitology Research*. 2014;2014.

ANNEXES

Annex 1. Kato -Katz technique

1. Principle and application

In the Kato-Katz technique feces are pressed through a mesh screen to remove large particles a portion of the sieved sample is then transferred to the hole of a template on a slide. After filling the hole, the template is removed and the remaining sample is covered with a piece of cellophane soaked in glycerol (glycerine). The glycerol 'clears' the fecal material found around the eggs. The eggs are then counted and the number calculated per gram (g) of feces. This technique has proved efficient means of diagnosis of intestinal schistosomiasis and intestinal helminthes. Cellophane thick- smear slide can be prepared in field, stored in microscopic slide boxes and transported greater distance.

2. Health and safety warnings.

Use glove and wash hand after finalizing the procedure.

3. Interferences.

Time depend the visibility

T. trichura and *A. lumbricoides* eggs are visible at any time.

Hook worm are visible for up to 30minutes after preparation.

The ideal time for Schistosoma eggs is 24 hours after preparation but in bright sunlight the slide clear rapidly and a 24-hour delay may not be necessary

4. Material and regent

- Newspaper or glazed tile
- Gloves
- Forceps

.Malachite green

- Toilet paper or absorbent tissue
- Microscope slides (75 x 25 mm).
- Template with holes, screen, nylon or plastic, plastic spatula
- Cellophane as cover slip, soaked in Glycerol-malachite green solution at least for 24 hour Or ethylene blue

5. Procedure

1. Prepare the layer or Glazed tile or news paper.

2. Place a small amount of fecal material on newspaper or scrap paper and press the small screen on top of the fecal material so that some of the faces will be sieved through the screen and accumulate on top of the screen.

3. Scrape the flat-sided spatula across the upper surface of the screen so that the sieved feces accumulate on the spatula.

4. Place template with hole on the centre of a microscope slide and add faces from the spatula so that the hole is completely filled. Using the side of the spatula, pass over the template to remove excess feces from the edge of the hole (the spatula and screen may be discarded or, if carefully washed, may be reused again).

5. Remove the template carefully from the slide so that the cylinder of faces is left completely on the slide. Cover the fecal material with the pre-soaked cellophane strip. The strip must be very wet if feces are dry and less so with soft faces (if excess glycerol solution is present on upper surface of cellophane, wipe the excess with toilet paper). In dry climates, excess glycerol will retard but not prevent drying.

6. Invert the microscope slide and firmly press the fecal sample against the hydrophilic cellophane strip on another microscope slide or on a smooth hard surface such as a piece of tile or a flat stone. With this pressure, the fecal material will be spread evenly between the microscope slide and the cellophane strip.

7. The smear should be examined in a systematic manner and the eggs of each species reported. Kato-Katz template delivers 41.7 mg of feces. The number of eggs observed is multiplied by 24 to obtain the number of eggs per gram of faces.

Annex 2. Information sheet

English Version

Title: STH and S.mansoni co-infection and associated risk factors among school children of Manna District, Southwest Ethiopia.

Organization: Jimma University Institute of Health, Faculty of Health Sciences

School Of Medical Laboratory Sciences

Name of Principal Investigator: Aschalew Gemede

Mobile no: +251928894852

E.mail:- aschalewgameda@gmail.com

Supervisor:Daniel Dana

Mobile no: +251917800188

You are being invited to take part in a research project will be carried on STH and *S. mansoni* co-infection and associated risk factors among school children of Manna District, Southwest Ethiopia. Before making decision it is important for you to understand why the research is being done and what it will involve. Please take time to hear the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Descriptions and Purpose of the study

STH and *S.mansoni* parasites are among the most common cause of human infections which are distributed throughout the world and cause thousands of avoidable outpatient morbidity and mortality, especially in school-age children. They are also the leading cause of gastrointestinal pain, malnutrition, mal absorption, anemia, mental retardation and other diseases. The diagnosis of these infections commonly relies on the detection of parasites egg in stool. So, your child /you and another 421 students are chosen to participate in this study by simple random from your school.

Procedures

If you are willing to participate in the study, you will be asked to sign a consent form and the following procedures will be done.

1. Socio demographic and others potential associated factor of exposures for acquisition STH and *S.mansoni* parasites co-infection of your child will be interviewed.
2. You will provide us a maximum of 15 minutes interview
3. Adequate stool sample will be collected from your child.
4. The collected sample will be processed and tested for STH and *S.mansoni* parasites co-infection at JU STH laboratory.

Risks and discomforts

By doing this no any reasonably foreseeable discomforts, disadvantages and risks will happen on you.

Benefits and Compensation

By participating in this study, there will not be direct financial benefit. If your child is positive for either STH or *S.mansoni* parasites and co-infection and other nematodes, you can know your child's health situation concerning these intestinal parasites and get appropriate free treatment based on the national anthelminthic treatment guideline without seeking for treatment in health institution after your child is ill and get more complication by being within your school without being absent from class.

Confidentiality

All information that we collect about you during the course of the research will be kept strictly confidential. You will not be able to be identified in any reports or publications.

Voluntary participation and withdrawal:

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and you can still withdraw at any time without it affecting any benefits that you are entitled to in any way. It is not expected from you to give a reason to stop.

If you are willing to participate and didn't treated before in the past 2 months for these intestinal parasites, you will be requested to give single fresh stool samples about 2 gm. This information sheet's copy will be given for each participant. Finally I would like to thank you for taking time to hear the information given and willing to participate.

Guca Ibsihirmaattota qo'annootif guutamu (Afaan Oromoo)

Gucni kun kan guutamu warren qo'annaa irratti fedhiin hirmaataniif kan ooluu fi haallii qo'annaa sirritti erga ibsameefii booda kan guutamufi kan mallattaa'udha.

Mata-duree qo'annaa:-Qorannon ilbisoota biyyoo irraa gara namatti daddarbuuf S.mansoni*barattoota*kibba Lixa Itoopiyaa Godina Jimmaatti *Aanaa Manna* hojjatama.

Maqaan qorataa:-Aschaaloo Gammadee

Lak.bilbilaa:- +251928894852

E.mail:- aschalewgameda@gmail.com

Too'ataa :Daani'el Daana

Lak.bilbilaa : +251917800188

Dhimmi-qo'anicha:-ilbisoonni biyyoo irraa gara namatti daddarbuuf S.mansoni dhibeewwan addunyaa guututti tatamsa'aniif miidhaafi du'aatii guddo ijoollee umrii barumsaa keessa jiran irratti dhaqqabsan keessa isaan tokkoodha. Ilbisoonni kun dhibee garaa , hir'ina dhiigaa fi kkf nama irra qaqqabsa. Qorannoon ilbisoota kana kan gaggeeffamu booliin nama fudhatameet. Kanaafuu mucaan keessaniif barattoon biro 421 qorannoo kana keessatti akka hirmaatan filamaniiru.

Haala adeemsa qo'annichaa: - qo' aannaa irratti fedhiin hirmaachuu keessan mallattoo keessaniin nuuf ibsitaaniif ragaalee armaan gadii kanneen nuuf kennitan.

Gaaffiilee afaaniitiif daqiiqaa 15 waliin turra

Boolii qorannofi gahaa ta'e ni fudhanna

Qorannoon laboaraatorii yuniversitii Jimmatt hojjatama

Wantootni armaan olii Kun qorannoof kan barbaachisan tahu ni ibsina.

Sodaa fi miidhaa qabu:-Qorannoo kana keessatti hirmaachu keessan irran kan ka'e rakkinni kamiiyyuu isin irra hin qaqqabu.

Faayida qo'anniichaa fi kafaaltii hirmaataaf godhamu- qorannoo irratti hirmaachuun kanfaltii kan hin qabnee fi bu'aa qorannoo irraa argamuutti irratti hunda'uudhaan barattoonni haala fayyaa isaanii kan beekaniif ilbisooni eeraman kun boolii isaanii kessatti yoo argaman qorichi bu'uura qajeelfama yaala farra raammo biyyoolessaa irratti hunda'uun ni kennama.

Iccitii hirmaataa eeguu-wantootni qorannoo irraa argaman hundinuu icciitiin kan eeggamaniifi ragaaleen argaman hundinuu maqaa keessaniin osoo hin tahiin lakkoofsa addaatiin/koodiin kan beekkamaniifi odeeffannoon hundinuu iccitiidhan warra ragaa funaanan biratti kan hafu tahuu isaa isiiniif ibsina.

Mirga fedhaan hirmaachuuf dhiisuu- qorannoo irratti hirmaachuun fedhii kee qofa tahuu isaa beektee, yeroo barbaaddeettii qorannoo keessaa bahuu kan dandeessuu fi yeroo keessaa baatulee rakkoo tokkoo kan sirratti hin fidnee fi tajaajila argachuu qabdu hundumaa argachuu kan dandeessu tahuusaa.

Egan yoo hirmaachuuf walii galtaniif torbaan sadan darban keessatti qorichoota farra ilbisoota kanaa yoo hin fudhanne ta'e boolii gaha(giraama lama ta'u) qorannoo laboratooriif oolu naaf kennuun hirmaachuu nidandeessu.

Waan hirmaattaniif galatoomaa!!

Annex 3.Parent/ Guardian Consent

Informed Consent Agreement for School children.

I, Mr/Mrs _____ being an adult and

being the lawful parent/guardian of child's name _____Age_____

School_____

Do hereby give permission to Mr/Mrs _____ to include him/her in the intended study as detailed in the protocol that has been explained to me in Afaan Oromoo the language that I understand and understood by me. I have also understood the implications and benefits of the test. I accept the test to be carried out on my child.

Parent/guardian signature _____ Date_____

Name of the person obtaining the consent_____

Unkaa waliigaltee maatii/ guddistoota barataa (Afaan Oromoo)

Ani obboo/Adde _____ maqaa barataa _____ umrii _____ Mana barumsaa _____

Obboo/ Adde _____ haala, sababa, bu'aaf dhibbaan qorannoon kun qabu erga afaan oromootiin naaf ibsameen booda qorannoo kana keessatti mucaa akka hirmaachisan eeyyameera.

Mallattoo maatii/ *guddisaa* _____

Guyyaa _____

Maqaa nama eeyyamni kennameef _____

Annex 4.Assent for Child

You are being asked to give a stool sample that will be examined for schistosome eggs and STH. You do not have to do this if you do not want to but there is no danger in doing it.

Do you agree to give your stool specimen to be examined for schistosome eggs and STH?

Yes _____ No _____

Child's name _____

Child's signature_____

Name of person obtaining assent_____

Signature of the person obtaining the consent_____

Witness name _____

Signature_____

Date_____

Uunkaa Walii galtee barataa (Afaan Oromoo)

Lakk.addaa Hirmaattota_____

Maqaan guutuu Hirmaattota_____

Ani hirmaatan maqaan koo armaan olitti ibsame kun bu'aa fi miidhaan isaa erga sirritti natti himamen hubadhee booda, naamunaa qorannoon laboratoriitiif kan oolu boolii akkan kennuu fii dabalataaniis odeefannoo narraa argaman hunduu icciitiin akka qabaman nattii hiimameera. Akkasumas, gaaffileen gaafatamuuf deebii kennuu dhiisuu, hiirmachuu dhiisuu fi yeroon barbaadetti addaan kutuu akkan danda'uu bareen jira.Kana godhuu kiyyaaniis ammas ta'ee fuulduraaf fayyadamummaa tajaajila fayyaa kiyya irratti rakkoon tokkollee akka hin uumamanee hubadheen jira.

Walii galeera_____ **Walii hin gallee_____**

Kanaafuu qorannoo kana irratti fedhiin kootiin hirmaachuu koon nan ibsa.

Maqaa hirmaataa_____Mallattoo_____Guyyaa_____

Maqaa qoo'ataa_____Mallattoo_____Guyyaa_____

Ragaalee

1. Maqaa_____Mallattoo_____Guyyaa_____

2. Maqaa_____ Mallattoo_____Guyyaa_____

Annex 5. Data collection tool

Co-infection of Schistosoma mansioni and Soil transmitted helminthes & associated risk factors among school children of Manna district *Parent/care giver's Unique Code:*

I. Demographic and economic characteristics of parents/care givers			
S.No	**Questions or items**	**Response (tick or write)**	**Skip**
01.	Ethnic group	1. Oromo 2. Amhara 3. Kefa 4. Yem 5. Others :_____	
02.	What is the length of stay	_____years	
03.	What is your current educational status?	1. Illiterate 2. Literate, Grade:_____ 3. Diploma 4. Degree 5. Other:_____	
04.	What is your main occupation?	1. House wife 2. Government employee 3. Business owner 4. Farmer 5. Other:_____	
05.	What is the occupation of your partner?	1. House wife 2. Government employee 3. Business owner 4. Farmer 5. Other:_____	
06.	What is the educational status of your partner?	1. Illiterate 2. Literate, Grade:_____ 3. Diploma 4. Degree 5. Other:_____	
07.	What is your family size?	Response:_____	
08.	What is your household average monthly income (Birr)	Response:_____	

Questionnaire for school children who will be involved in the STH and S.mansoni co-infection survey in Manna District, southwest Ethiopia		
1	Participant ID	_____
2	Name of School	_____
3	Sex	1. Male_____ 2. Female _____
4	Age	in years_____
5	Grade	_____Class: _____
6	Is there a latrine in your compound?	1. Yes 2. No
7	How often are you using latrine	1. Always 2. Sometimes 3. Not at all
8	If no to Q9, where do you or your families defecate	1. Backyard 2. Open filed 3. Other, Specify: _____
9	Have you ever defecated around the river?	1. Yes 2. No
10	If yes to Q12, how often?	1. Always 2. Some times 3. Not at all
11	Hand washing habit	1.yes 2.No
12	How often are you washing your hand	1. Always 2. Sometimes 3. Not at all
13	The occasion of hand washing (check all)?	1. Before eating 2. After eating 3. After defecation 4. Not often
14	Habit of fruit washing before eating	1. Always 2. Some times 3. Not at all
15	What is your water source?	1. Tape 2. Well 3. River 4. Spring 5. If Others(specify): _____

16	Treating drinking water?	1. Yes 2. No
17	How often you treat the water	1. Always 2. Some times 3. Not at all
18	If yes, what methods of treating the drinking water	1. Chemical 2. Boiling 3. Not treating 4. If Others(specify): _____
19	Do you have shoe?(observe)	1. Yes 2. No
20	How often are you wearing shoe?	1. Always 2. Sometimes 3. Not at all
21	Any nearby river	1. Yes 2. No
22	Have you ever cross the river?	1. Yes 2. No
23	If yes to Q23, how often	1. Always 2. Sometimes 3. Rarely
24	Distance from the river (hours /minutes from home to the river)	_____hours _____minutes
25	Purpose of using river water (check all)	1. Drinking 2. Swimming 3. Bathing 4. Washing clothes

Unka gaaffileee Afaan Oromoo

Kutaa 1- Qoranno ilbisoota biyyoo irraa gara namatti daddarbuuf S.mansoni *barattoota* kibba Lixa Itoopiyaa Godina Jimmaatti *Aanaa Mannatti* hojjatamuuf gaaffilee haala jireenya hawaasaafi diinagdee maatii yookin guddistoota hirmaatichaa irraa gaafatamanii guuataman

Lakk maattii/guddisaa _____

I. Haala jireenya hawaasaafi diinagdee maatii yookin guddistoota hirmaatichaa			
Lak	Gaafii	Deebii	Darbi
1.	Saba	6. Oromoo 7. Amaara 8. Kafaa 9. Yem Kan biraa :_____	
2	Biyya kana hammam turte?	Woggaa _____	
3	Sadarkaa barumsaa keessanii	6. Hin baranne 7. Kutaa _____ 8. Dippiloomaa 9. Digrii	
4	Hojii keessan maalidha?	6. Haadha manaa 7. hojjataa mootumaa 8. Hojii dhunfaa 9. daldalaa 10. kan biraa:_____	
5	Hojii abbaa worra/ haaadha worraa keessan maalidha?	1. Haadha manaa 2. hojjataa mootumaa 3.Hojii dhunfaa 4.daldalaa 5.kan biraa:_____	
6	Sadarkaa barumsaa abbaa worra/ haaadha worraa keessanii	10. Hin baranne 11. Kutaa _____ 12. Dippiloomaa 13. Digrii	
7	Baaay'ini maatii keessanii	_____	
8	Galiin ji'aa maatii keessaniin	_____	

Qoranno ilbisoota biyyoo irraa gara namatti daddarbuuf S.mansoni *barattoota* kibba Lixa Itoopiyaa Godina Jimmaatti *Aanaa Mannatti* hojjatamuuf gaaffilee haala jireenya hawaasaafi diinagdee hirmaatichaa irraa gaafatamanii guuataman

Lak	Gaaffii	Deebii
1	Laakkobsa hirmaataa	_____
2	Maqaa mana barumsaa	_____
3	Saala	1- Dhiira 2-Dhalaa
4	Umrii	
5	Kuta meeqaffaa baratta?	_____
6	Mana fincanii qabduu?	1.Eeyye 2.Miti
7	Hammam ittiin fayyadamta?	1-Yeroo hunda 2- daebee darbee 3. Badaa miti
8	Deebiin gaaffii Lakk 6 miti yoo ta' e eessatti boolii baatu?	1-Hurufa 2-bakkeetti 3. Kan biraa ,ibsi _____
9	Laga qarqaratti boolii guddaa baatee beekta?	1-Eeyye 2- miti
10	Deebiin gaaffii Lakk 9 eeyye yoo ta' e hammam?	1-Yeroo hunda 2- daebee darbee 3. Badaa miti
11	Hark ni dhiqattaa?	1.Eeyye 2.Miti
12	Harka keeti hammam dhiqatta?	1- yeroo hunda 2- daebee darbee 3. Badaa miti
13	Yeroo maalii harka kee dhiqatta?	1-Nyaataan dura 2- nyaataan booda 3- mana fincanitiin yommuu deebi'u
14	Muuxanoo fuduraa nyaachuun dura miicuu	1- yeroo hunda 2- daebee darbee 3. Badaa miti
15	Mana keessatti bishaan kam fayyadamtan	1. Birkaa 2. Bishaan boolla 3. Bishaan lagaa 4- mincii haalan ijaarame 5- kan biraa ibsi ____
16	Qulqullina bishaan dhugaati in eegduu?	1-Eeyye 2- miti
17	Hammam wantoota qulqullina bishaanii eegan fayyadamtu?	1- yeroo hunda 2- daebee darbee 3. Badaa miti
18	Deebiin lakk 15 eeyyee yoo ta'e qulqullina bishaanii eeguuf maal fayyadamtu?	1- Keemikaala 2- bishhan danfisuu 3- kan biraa yoo jiraate ibsi _____
19	Kophee ni qabdaa	1-Eeyye 2- miti
20	Kophee hammam kaawwatta?	1- yeroo hunda 2- daebee darbee 3. Badaa miti

21	Bishaan lagaa nannootti jraa?	1-Eeyye 2- miti
22	Bishaan lagaa keessa ceetee beekta?	1-Eeyye 2- miti
23	Deebiin lakk 21 eeyyee yoo ta'e hammam?	1- yeroo hunda 2- daebee darbee 3. Badaa miti
24	Bishaan lagaa mana irraan hammam fagaata (daqiiqaan/sa'aatiin)	sa'aatiin _____ daqiiqaan _____
25	Bishaan lagaa maaliif fayyadamtan?	1.Dhugaatiif 2.daakuuf 3.dhagna dhiqachuuf 4.Uffata miicuuf

Declaration

I hereby certify that I have read and evaluated this thesis prepared, under my guidance, by Aschalew Gemede Abbo entitled "**STH and *S.mansoni* infectionand associated risk factors among SC of Manna district**" I recommend that it can be submitted as fulfilling of the thesis requirement.

Name of the Principal investigator	**Signature**	**Date**
Aschalew Gemede	_____	_____

Approval by internal examiner

Mitiku Bajiro(Asst. Professor, PhD scholar)_____ _____