

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**



**PREVALENCE AND RISK FACTORS OF SOIL-TRANSMITTED
HELMINTHES AMONG SCHOOL CHILDREN IN ABOSA
AROUND LAKE ZWAY, SOUTHERN ETHIOPIA**

GEZAHEGN SOLOMON ALEMAYEHU

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ADDIS ABABA

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HELMINTHES AMONG SCHOOL CHILDREN IN ABOSA
AROUND LAKE ZWAY, SOUTHERN ETHIOPIA**

**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF
ADDIS ABEBA UNIVERSITY DEPARTMENT OF MICROBIOLOGY,
IMMUNOLOGY AND PARASITOLOGY, MEDICAL FACULTY IN PARTIAL
FULFILLEMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER
OF SCIENCE IN MEDICAL PARASITOLOGY**

GEZAHEGN SOLOMON ALEMAYEHU

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SCHOOL OF GRADUATE STUDIES
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Gezahegn Solomon

FACULTY OF MEDICINE

APPROVED BY THE EXAMINING BOARD

CHAIRPERSON

EXTERNAL EXAMINER

INTERNAL EXAMINER

RESEARCH ADVISOR

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	iv
ACKNOWLEDGMENT	v
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF ANNEX	viii
ABBREVIATIONS	ix
1. INTRODUCTION	11
1.1. Background.....	11
1.2. Statement of the problem.....	13
2. LITERATURE REVIEW	14
3. OBJECTIVES OF THE STUDY	17
3.1. General Objective.....	17
3.2. Specific Objectives.....	17
4. METHODS AND MATERIALS	18
4.1. Study Design.....	18
4.2. Study Area and period.....	18
4.3. Population.....	18
4.3.1. Source of population.....	18
4.3.2. Study population.....	18
4.4. Sample size and sampling technique.....	18
4.4.1. Sample size.....	18
4.4.2. Sampling technique.....	20
4.5. Data collection procedure.....	20
4.5.1. Questionnaires.....	20
4.5.2. Parasitological investigation.....	21
4.6. Reliability and validity of the study.....	21
4.7. Ethical consideration.....	22
4.8. Data analysis.....	22
5. RESULTS	24
5.1. Description of the study subjects.....	24
5.2. Distribution of intestinal helminths infections.....	25
5.3. Prevalence and intensity of soil-transmitted helminths infections.....	27
5.4. Risk factors associated with STH infection.....	32
6. DISCUSSION	35
7. CONCLUSION AND RECOMMENDATION	41
8. REFERENCES	42
9. ANNEX	46

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LIST OF TABLES

Table 1: Sociodemographic characteristics among Abosa elementary school children around Lake Zway, April 2007.	24
Table 2: Distribution of intestinal helminths by different age group and sex among Abosa elementary school children around Lake Zway, April 2007	25
Table 3: Categorization of intensity of infection with <i>A.lumbricoide</i> , <i>T. trichiura</i> and Hookworm by age group and sex among Abosa elementary school children around Lake Zway, April 2007.....	30
Table 4: Univariate and multivariate logistic regression analysis for factors potentially associated with STH infection among Abosa elementary school children around Lake Zway, April 2007.....	33
Table 5 : Signficant risk factors in multivariate logistic regression analysis associated with Hookworm infection among Abosa elementary school children around Lake Zway, April 2007.....	34

LIST OF FIGURES

Figure 1: Percentage of multiple intestinal helminths infection among Abosa primary school children around Lake Zway, April 2007.....	26
Figure 2: The age specific prevalence and intensity of soil transmitted helminthes infection (A. <i>A. lumbricoides</i> , B. <i>T. trichiura</i> , C. Hookworm, EPG computed as geometric mean) among Abosa elementary school children around Lake Zway, April 2007	29

LIST OF ANNEX

Annex -I: Parasitological investigation procedure	32
Annex –II: Socio-demographic and Laboratory data.....	33
Annex- III: Questionnaire.....	35
Annex-IV: consent form.....	37

ABBREVIATIONS

CI	Confidence Interval
EPG	Eggs per Gram of stool
OR	Odds Ratio
STH	Soil-Transmitted Helminth
WHO	World Health Organization

ABSTRACT

Soil-transmitted helminths infections represent a major public health problem in poor and developing countries. This is more so in school going children. To initiate prevention and control measure for these neglected diseases, adequate information is required among high-risk group. The objective of this study was to determine the prevalence, intensity and associated risk factors for Soil-transmitted helminths and S.mansoni infections among Abosa elementary school children, around Lake Zway in Southern Ethiopia. A cross-sectional parasitological study, involving 405 school children, was conducted at Abosa elementary school from April 8-15, 2007. A structured questionnaire and observation for demographic and associated risk factors for STH and S.mansoni infections were used. Stool Samples were collected and examined for helminth eggs by Kato-Katz technique to determine the prevalence and intensity of STH and S.mansoni infections. Data was entered and analyzed by SPSS version 13 Statistical packages software. The overall prevalence for at least one intestinal helminthic infections was 43.7 % (177/405). The most frequent intestinal helminths were A. lumbricoides, T. trichiura and hookworms with a prevalence of 20.5 % (83/405), 19.3 % (78/405) and 14.3 % (58/405), respectively. Majority 32.2 % (131/405) of the students had single infection. None of the samples were positive for S.mansoni. The intensity of STH infection as measured by geometric mean of egg per gram of stool was generally low. The strongest predictors for STH infection using multiple regressions were non-usage of drilled water, habit of hand washing and dirty material on finger nail. In hookworm infection, logistic regression analysis confirmed that male children ≥ 10 year old age and not wearing shoe were statistically significant risk factor. On the basis of these results, it can be concluded that STH infections is an important problem among Abosa school children. According to WHO recommendation, we suggest broad-spectrum anthelmintic treatment with school health program for delivering health education to enhance their awareness in the transmission and control mechanisms of intestinal helminths.

Keywords: Soil-transmitted Helminths,, prevalence, intensity and risk factors

1. INTRODUCTION

1.1. Background

Helminth infections caused by soil-transmitted helminths (STH) and schistosomes are among the most prevalent affliction of humans who live in areas of poverty in the developing world. The morbidity caused by STH and schistosomes is most commonly associated with infections of heavy intensity. Approximately 300 million people with heavy helminth infections suffer from severe morbidity that results in more than 150,000 deaths annually (Crompton, 1999; Montresor *et al.*, 2002).

Soil-transmitted helminth infections are widely distributed throughout the tropics and subtropics. The four most common STHs are roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), and hookworms (*Necator americanus* and *Ancylostoma duodenale*) (Stephan and Richard, 2001). Recent estimates suggest that *Ascaris lumbricoides* (*A. lumbricoides*) infects 1.221 billion people, *Trichuris trichiura* (*T. trichiura*) 795 million, and hookworms 740 million. The greatest numbers of STH infections occur in the Americas, China and East Asia, and Sub-Saharan Africa (De Silva *et al.*, 2003). These intestinal helminthic infections are also prevalent in Ethiopia (McConnel and Armstrong, 1976; Jemaneh, 1998b; Legesse and Erko, 2004; Girum, 2005).

The soil-transmitted helminths are group of parasitic nematode worms causing human infection through contact with parasite eggs or larvae. The life cycles of ascaris, trichuris, and hookworm follow a general pattern. The adult parasite stages inhabit the gastrointestinal tract (ascaris and hookworm in the small intestine; trichuris in the colon), reproduce sexually, and produce eggs, which are passed in human faeces and deposited in the external environment (Stephan and Richard, 2001).

The soil-transmitted helminths are one of the world's most important causes of physical and intellectual growth retardation in children leading to attention deficits, learning disabilities, school absenteeism and higher dropout rates (Stephenson *et al.*, 2000). Yet,

despite their educational, economic, and public-health importance, they remain largely neglected by the medical and international community. This neglect stems from three features: first, the people most affected are the world's most impoverished; second, the infections cause chronic ill health and have insidious clinical presentation; and third, quantification of the effect of soil-transmitted helminth infections on economic development and education is difficult (Jeffrey *et al.*, 2006; WHO, 2002).

Schistosomiasis is also known as bilharzia after Theodor Bilharz, who first identified the parasite in Egypt in 1851. These parasites have a complex, indirect life cycle involving an intermediate snail host (Stephan and Richard, 2001). Recent estimates suggest that *Schistosoma haematobium* infects 119 million people, *Schistosoma japonicum* one million, and *Schistosoma mansoni* 67 million in the world (De Silva *et al.*, 2003). Ethiopia is one of the endemic countries for both *S. mansoni* and *S. haematobium*. Infection caused by *S. mansoni* has a wide geographic distribution in Ethiopia. *Biomphalaria pfeifferi* and *Biomphalaria sudanica* are the known intermediate host snails for *S. mansoni*; and *Bulinus abyssinicus* and *Bulinus africanus* for *S. haematobium* in Ethiopia (Lo *et al.*, 1988; McConnel and Armstrong, 1976; Teklemariam, 1982, Erko *et al.*, 2002).

Both STH and schistosomiasis are endemic and cause considerable morbidity in Ethiopia. According to different studies in Ethiopia, the infection rate of STH and *S. mansoni* are high in School children (Jemaneh, 1998a; Girum, 2005; Legesse and Erko, 2004). Low socio-economic status, cultural practice, low level of the environmental sanitation and livelihood requiring daily and frequent contact with contaminated water favour the transmission and wide distribution of STH and schistosomiasis associated with *S. mansoni* (Jeffrey *et al.*, 2006).

1.2. STATEMENT OF THE PROBLEM

Soil-transmitted helminths are major public health problems in several tropical and subtropical developing countries like Ethiopia with poor socio-economic status. This is more common in school going children and is associated with high morbidity and mortality and economic loss to the country (Girum, 2005; Legesse and Erko, 2004; De Silva *et al.*, 2003; WHO, 2002). In 2001, the 54th World Health Assembly resolution set a global target for this neglected diseases to regularly treat at least 75% of all school-age children at risk of morbidity due to schistosomiasis and STH infections by the year 2010(WHO, 2001).

To respond to this resolution, adequate information on the distribution and extent of intestinal heminthic infection in a given community is required. It has been known for a long time that STH and *S. mansoni* are endemic around Lake Zway and its Island (Teklemariam and Tesfa-Michael, 1987; Tesfa-Michael, 1983). There is no data in intestinal helminths in Abosa around Lake Zway in Southern Ethiopia. For this reason, the present study is aimed to provide the current epidemiological information on STH and *S. mansoni* with respect to prevalence, intensity and associated risk factor among schoolchildren in Abosa, around Lake Zway in Southern Ethiopia.

Therefore, this study is believed to provide recent and valuable information for those who are working in the prevention and control of schistosomiasis and STH infection, and also it can be used as a base line data for further study on the area.

2. LITERATURE REVIEW

Soil-transmitted helminthes infections and human schistosomiasis infection are amongst the most common infections worldwide. Epidemiological research carried out in different countries has shown that the social and economical situation of the individuals and community are an important cause in the high prevalence of these infections (WHO, 2002).

Adequate warmth and moisture are key features for each of the soil –transmitted helminthes. *Ascaris* and *Trichuris* eggs are hardier than hookworm infective third-stage larvae (L3) and therefore survive drier climates better. However, even for *Ascaris* and *Trichuris*, the rates of infection are low in arid climates (Brooker and Michael, 2000). Altitude probably affects soil helminth transmission through the associated changes in temperature and humidity. *Ascaris* and *Trichuris* are widespread in Ethiopia but with prevalence rates varying considerably: rates are lowest in the low and dry areas of the country than in the more humid highland (Tedla and Ayele, 1986; Jemaneh, 1998b).

When cross sectional surveys are carried out in areas where *Ascaris* and *Trichuris* are endemic, three patterns become evident. First, prevalence rises rapidly once infancy has passed and tends to remain high. Second, intensity rises rapidly and peaks during childhood (among 5-15 year olds) before declining steadily. Third, the frequency distribution of numbers of worm per host is overdispersed (Crompton, 2001).

Specific occupation and behavior influence the prevalence and intensity of STH infection. For instance, engagement in agricultural pursuit remains a common denominator for human hookworm infection and playing habit of children with soil is also an important factor for prevalence and intensity of STH infection (Jeffrey *et al.*, 2006; Naish *et al.* , 2004).

In a study carried out in West Java, Indonesia, prevalence and intensity of ascariasis and trichuriasis was found to be closely related to socioeconomic conditions. Children who had a latrine at home, lived in homes with an electricity supply and a cement floor, who took their baths at home, defecated at home, and always wore slippers had low

prevalence rates, whereas those who washed themselves at a well or spring, and defecated in a hole around their houses had high prevalence rates (Pegelow *et al* , 1997).

According to the study of rural school children in Kenya, the prevalence of *S. mansoni* and hookworm infections increased with age but ascariis and trichuris infections decreased with age without any sex differences. Children under ten years of age tended to be more heavily infected with ascariasis, trichuriasis and hookworm than the older ones, while the intensity of *S. mansoni* increased gradually with age (Thiong'o *et al.*, 2001).

In an extensive study in 13 administrative regions between 1978-1981 in Ethiopia, *A. lumbricoides* (43.5%) was the most prevalent parasite, followed by *T.trichiura*(25.5%) and hookworm(10.3%). The highest rate of multiple infections was observed in the age group 10-19years, followed by 20-29 years while those below 10 and above 60 had the lowest rates (Shibru, 1986).

In studies conducted in twelve elementary school in the Dembia plains, Northwest Ethiopia, infection due to *A.lumbricoides* was registered in all school among children and was the most prevalent (41.3%) followed by *S.mansoni* (35.8%), hookworm (22.8%) and *T. trichiura* infection (16.5%). Infection was found in all ages and appeared to increase with age in schistosomiasis and ascariasis. The intensity of infection was generally higher for *A.lumbricoides* and *S. mansoni* (Jemaneh, 1998a). Similar findings have reported from schoolchildren in Fincha valley, Western Ethiopia (Erko *et al.*, 1997).

In April 2003, epidemiological research was undertaken in two primary schools located in Southeast of Lake Langano in Ethiopia. Of the 259 students surveyed for intestinal parasites, 217(83.8%) had one or more parasites. Prevalence of hookworm was the highest (60.2%), followed by *S. mansoni* (21.2%), *T. trichuria* (14.7%), *Taenia* species (13.9%), *Entamoeba histolytica/dispar* (12.7%), *A. lumbricoides* (6.2%), *Giardia duodenalis* (6.2%) and *Strongyloides stercoralis* (5.8%) (Legesse and Erko, 2004).

In the study of geohelminthiasis in Wondo Genet, Southern Ethiopia, the prevalence of infection for *A. lumbricoides* and *T. trichiura* among schoolchildren was 83.4% and

86.4%, respectively, and the respective intensity of infection was 7343 eggs per gram of stool (EPG) and 461 EPG(Erko and Medhin, 2003).

In the epidemiological study of South Gondar in Ethiopia, forty nine percent of the examined children had one or more types of helminths, of which 32.5%, 13.3% and 2.4% were single, double and triple infections, respectively. 14.6%, 28.4%, 8.3% and 12.1% of the children had moderate infections of *S. mansoni*, ascariasis, trichuriasis and hookworms, respectively (Jemaneh , 2000b).

In the study of intestinal helminthes infections in Lake Zway Islands in the Southern Ethiopia, 56.7 %(287 out of 506) were found to harbour one or more kinds of intestinal helminthes. In this study higher prevalence of *T. trichiura*(46.2%), low prevalence of *A. lumbricoides*(4.1%) and almost total absence of hookworm(less than 1%) was found (Tesfa-Michael and Teklemariam, 1983).

An epidemiological study of *S.mansoni* around Lake Zway and its Islands, Southern Ethiopia, was conducted in 1979 and 1980. The overall prevalence of *S.mansoni* was 27.5%. The prevalence in the different villages varied from 8.3% to 63.4% in the same locality. Quantitative stool examination revealed 13.8% light infection, 20.8%moderate and 16.6% heavy infections (Teklemariam and Tesfa-Michael, 1987).

Knowledge on the distribution and extent of intestinal helminthic infection in a given community is a prerequisite for planning and evaluating intervention programs. Therefore; this study was carried out to assess the status of STH and *S.mansoni* infection with respect to prevalence, intensity and associated risk factors among Abosa elementary schoolchildren, around Lake Zway in Southern Ethiopia.

3. OBJECTIVES OF THE STUDY

3.1. General Objective

To provide information on the magnitude of soil-transmitted helminths and *S. mansoni* infection among school children in Abosa, around Lake Zway in Southern Ethiopia.

3.2. Specific Objectives

- ❖ To determine the prevalence and intensity of soil-transmitted helminth infection
- ❖ To determine the prevalence and intensity of *S. mansoni* infection
- ❖ To assess the association of intensity and prevalence of the diseases.
- ❖ To assess associated risk factors for soil-transmitted helminths and *S. mansoni* infection

4. METHODS AND MATERIALS

4.1. Study Design

A cross-sectional study was undertaken to assess the status of STH infection and *S.mansoni* with respect to prevalence, intensity and associated risk factors among schoolchildren in Abosa, around Lake Zway in Southern Ethiopia.

4.2. Study Area and period

Abosa is found in the Adamitolo Gedo Kobolecha Woreda which is located 10km away from Zway town. Abosa is small village in Adamitolo Gedo Kobolecha Woreda which is located in the Southern part of Ethiopia at 150km from Addis Ababa and at altitude of about 1846m. The annual rainfall is 1000-1400 mm and mean annual temperature ranges from 20⁰C to 35⁰C. The population of Abosa is 2999 with 674 household (Projected for 2006/7). Majority of the inhabitants were farmers, while the rest were fishermen and government employees. The study was conducted at Abosa elementary school in April 8-15, 2007.

4. 3. Population

4.3.1. Source of population

The total number of children in the master list of Abosa elementary school was served as the source of population to this particular study.

4.3.2. Study population

The study population was Abosa elementary schoolchildren who attended the class during the study period.

4.4. Sample size and sampling technique

4.4.1. Sample size

In this study, sampling unit was students of Abosa elementary school with a total population of 1300. In estimating the sample size, prevalence rate of 56.7% of intestinal helminth previously reported around Lake Zway was used (Tesfa-Michael and Tekelemariam, 1983). The minimum number of the sample size (n) was determined using the statistical formula of sample size calculation (Danile, 1995) :-

$$n = \frac{z^2 p(1-p)}{d^2}$$

n = the number of the sample size
Where, **Z** = 1.96 at 95% confidence interval
d= margin of error assumed to be (0.05)

P - Prevalence rate of intestinal helminth

$$n = \frac{1.96^2 0.567(1 - 0.567)}{0.05^2}$$

n=377

By adding 10% for non-response, a total of 415 subjects were included. However, 10 patients were excluded because of incomplete data and a total of 405 subjects were enrolled in the study.

4.4.2 Sampling technique

To select the study subject, the students were first stratified according to their educational level (Grade 1 to Grade 8). Allocation of student was done proportional to the number of students in each grade. Finally, the study subjects were selected using systematic random sampling by using class roster as the sampling frame. Every fourth study subject was selected after the first study subject.

4.5. Data collection procedure

4.5.1. Questionnaires

Structured questionnaire was developed in English and then translated into the local language (Oromifa). The questionnaire was developed using questionnaires that were applied in different studies related to this study. For each student, structured questionnaire was completed for demographic and associated risk factor for soil-transmitted helminth and *S. mansoni* infection, which was administered by trained interviewers (primary school teachers) using the local language.

Inclusion criteria:

Willingness and ability to give informed consent

Had no treatment for the last one month

Exclusion criteria:

Study participant with watery and bloody diarrhoea

4.5.2. Parasitological investigation

4.5.2.1 Collection of stool specimen

Students were provided with labelled clean plastic sheet, toilet tissue paper and pieces of applicator sticks. Every child was instructed to bring his own sufficient amount of stool so that no mixing up occurs. On delivery of the stool specimen, each child was interviewed using a structured questionnaire for demographic and associated risk factors for soil-transmitted helminths and *S. mansoni* infection.

4.5.2.1. Processing of stool specimen

Stool specimen was processed by both direct smear (wet mount examination) and Kato-Katz technique.

4.5.2.1.1. Direct smear

Direct smear was done only for watery and blood stained stool to detect some intestinal protozoan parasites using 0.85% NaCl by 10x and 40x microscope objective.

4.5.2.1.2. Kato-Katz technique

The stool specimen was processed using Kato-Katz technique employing a 41.7mg template. The number of eggs of each species was recorded and converted into the number of eggs per gram of stool (EPG) in order to analyze intensity of infection. EPG was calculated by multiplying count by conversion factor i.e. 24. An infection status (light/moderate / heavy infection) was created for the three common STH infections following the standard procedure used by WHO (Montresor *et al*, 2002).

4.6. Reliability and validity of the study

To ensure reliable information:-

- Before the data collection period, the questionnaire and laboratory materials were pretested
- The children were interviewed by trained interviewers (Primary school teachers) in the local language (Oromifa).

- Standard operating procedures were used for specimen collection and processing for maintaining a good quality study(Annex I)
- The data collection was supervised by principal investigator
- Ten percent of samples were randomly selected and rechecked blindly to ensure quality control.

4.7. Ethical consideration

The M.Sc research project was approved by the Department of Microbiology, Immunology and Parasitology (DMIP), and ethically cleared by Faculty Research and Publications Committee (FRPC). Before the data collection period, a letter was written by Addis Ababa university of Medical Faculty about the objective of the study to the Adamitolo Gedo Koblecha Woreda Health Office, Educational office and Abosa elementary school.

Consent was obtained from children selected for study after explaining the purpose and the procedures of the study. Children who were unable to understand the purpose of the study, written consent were obtained from their family through school director. The study subjects who were found positive for intestinal helminth and some protozoa parasite was treated with the standard regimen of albendazole and metronidazole tablet by the nurse from Abosa clinic.

4.8. Data analysis

Data analysis was performed using SPSS software version 13. In order to analysis intensity of infection for STH parasites, the number of eggs were converted into the number of Eggs per Gram of stool and transformed to log scales for analysis of geometric mean. Logistic regression was performed to determine the independent effect of the variables by calculating the strength of the association between infection and risk factors using odd ratio (OR) and 95% confidence interval (CI). Crude OR were estimated by univariate analysis, and adjusted OR were then estimated by multivariate logistic

regression analysis. P value less than 0.05 (5%) was considered to be statistically significant.

5. RESULTS

5.1 Description of the study subjects

Out of 415 invited subjects, 405 students took part in the study and were included in the present analysis. Of these, 192(47.4%) were male and 213 (52.6%) female. The mean age of the study subject was 12.5 years with a minimum and maximum age of 7 years and 25 years, respectively. Majority of the study subjects were Muslims 316(78 %) (Table1).

Table 1: Sociodemographic characteristics among Abosa elementary school children around Lake Zway, April 2007.

characteristics	Total(n=405) n (%)
Sex	
Male	192(47.4)
Female	213(52.6)
Age group in years	
5-9	108(26.7)
10-14	171(42.2)
15-19	102(25.2)
20+	24(5.9)
Educational level (grade)	
1-4	235(58)
5-8	170(42)
Religion	
Muslims	316(78)
Christian	89(22)

5.2. Distribution of intestinal helminths infections

Of the total 405 stool samples examined, 177 (43.7 %) were positive for one or more of intestinal helminths. The distribution of intestinal helminths by different age group and sex is presented in table 2. The most frequent intestinal helminths were *A.lumbricoides* 83 (20.5%), *T. trichiura* 78 (19.3%) and Hookworm 58 (14.3%). The least encountered helminths were *Hymenolepis nana* (*H. nana*) 8 (2 %) and *Enterobius vermicularis* (*E.vermicularis*) 6(1.5%). None of the samples were positive for *S. mansoni*. The prevalence of infection did not differ significantly by gender in *A.lumbricoides* and *T. trichiura*, but there was significance difference by gender in hookworm infection ($P<0.05$) table 5.

Table 2: Distribution of intestinal helminths by different age group and sex among Abosa elementary school children around Lake Zway, April 2007

Intestinal helminths	Sex	Age(in years)				Total M + F(n=405) n (%)
		5-9 (n=108)	10-14 (n=171)	15-19 (n=102)	20+ (n=24)	
<i>A.lumbricoides</i>	M n(%)	18(16.7)	16(9.4)	7(6.9)	1(4.2)	83(20.5)
	F n (%)	19(17.6)	17(9.9)	3(2.9)	2(8.3)	
<i>T. trichiura</i>	M n(%)	25(23.1)	14(8.2)	8(7.8)	3(12.5)	78(19.3)
	F n (%)	15(13.9)	9(5.3)	4(3.9)	0(0)	
Hookworm	M n (%)	5(4.6)	14(8.2)	23(22.5)	5(20.8)	58(14.3)
	F n (%)	1(0.93)	6(3.5)	4(3.9)	0(0)	
<i>H. nana</i>	M n (%)	2(1.9)	1(0.58)	0(0)	0(0)	8(2)
	F n (%)	3(2.8)	2(1.2)	0(0)	0(0)	
<i>E.vermicularis</i>	M n (%)	1(0.93)	0(0)	0(0)	0(0)	6(1.5)
	F n (%)	3(2.8)	2(1.2)	0(0)	0(0)	
<i>S. mansoni</i>	M n (%)	0(0)	0(0)	0(0)	0(0)	0(0)
	F n (%)	0(0)	0(0)	0(0)	0(0)	

M=Male; F=Female

Among 177 positive individual, the majority 131(32.3%) of the students had single infection. Forty six (11.4%) of the students were infected with more than one intestinal helminth parasite; 36(8.9%) had double intestinal helminths infection and 10 (2.5%) triple infections. The most frequent combinations of helminths diagnosed in single patient were double infection of *A.lumbricoides* and *T. trichiura* 24(5.9%) and followed by triple infection of *A.lumbricoides*, *T. trichiura* and Hookworm 8(2.5%) (Figure- 1).

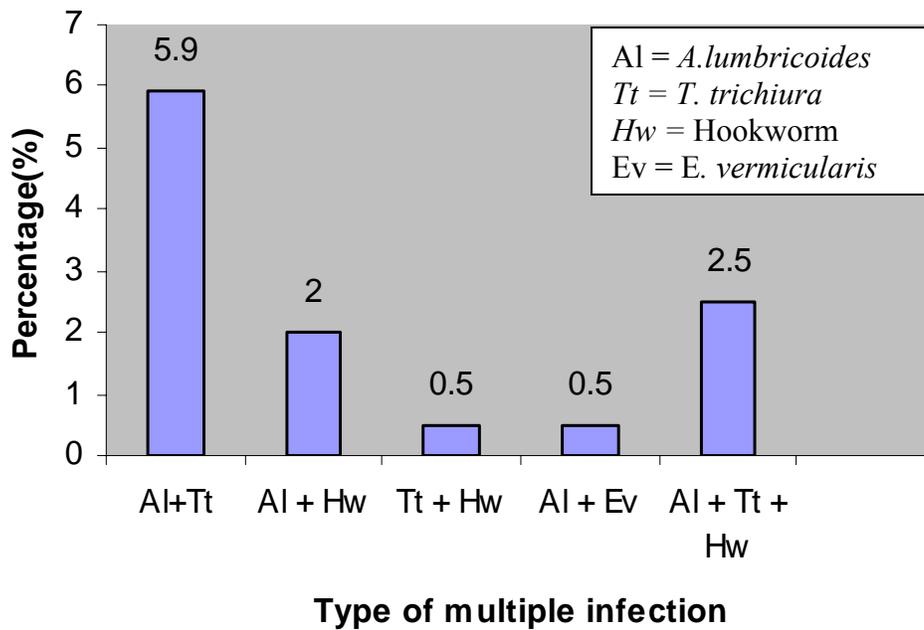
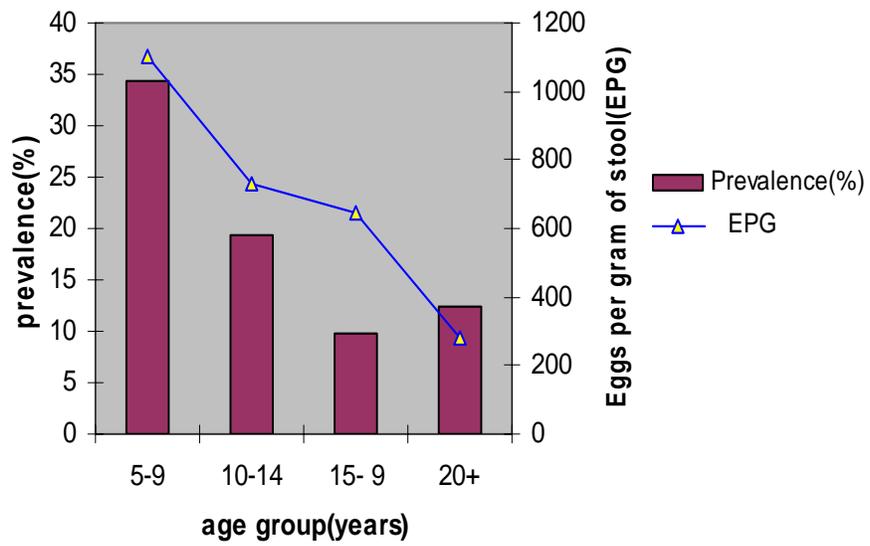


Figure 1: Percentage of multiple intestinal helminths infection among Abosa primary school children around Lake Zway, April 2007.

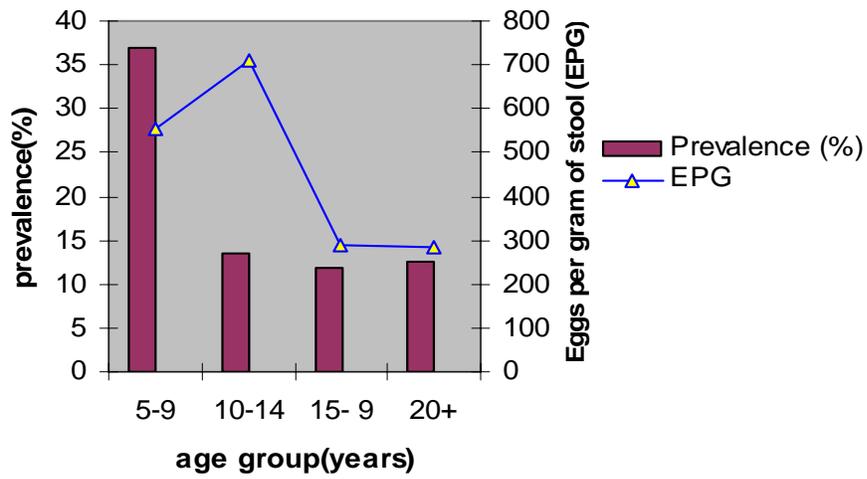
5.3. Prevalence and intensity of soil-transmitted helminths infections

As shown in Figure 2 age prevalence curve of STH, the pattern of infection was similar for *A.lumbricoides* and *T. trichiura*, with the highest prevalence seen among children of 5-9 years of age group, with a decrease 10-14 age group and then a further decline in each age group. In case of hookworm infection, the highest prevalence seen among the old age group 15-19 and the lowest in the youngest age group 5-9.

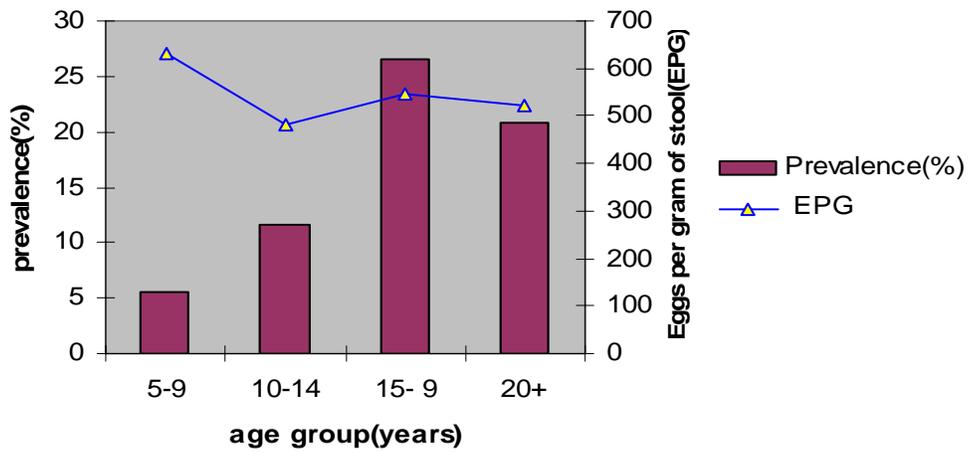
The age specific prevalence and intensity of soil-transmitted helminths infection is shown in figure 2. The overall prevalence of the three common soil-transmitted helminths infection (*A.lumbricoides*, *T. trichiura* and hookworm) was 219(54.1%). The overall intensity of STH infection expressed as geometric mean among the study subject for *A.lumbricoides*, *T. trichiura* and hookworm were 836, 525, and 528, respectively. The intensity and prevalence of infection tends to reach peak in the age group of 5-9 years old for *A.lumbricoides* with geometric mean of EPG of stool 1105. For *T. trichiura*, the intensity tends to reach peak in the age group of 10- 14 years old with geometric mean of EPG of stool 712. Even if the intensity of infection reach peak in the age group of 5-9 years old for hookworm infection, the number infected student was much lower than in the age group of 10-14 and 15 -19 years old.



A



B



C

Figure 2: The age specific prevalence and intensity of soil transmitted helminthes infection (**A.** *A.lumbricoides*, **B.** *T. trichiura*, **C.** Hookworm, EPG computed as geometric mean) among Abosa elementary school children around Lake Zway, April 2007

As shown in table 3, categorization of intensity of infection with *A.lumbricoides*, *T. trichiura* and Hookworm was defined according to WHO threshold (Montresor et al., 2002). The number of egg per gram (EPG) of stool indicated that the infection status was generally light for the three STH infections. The percentage of children with light and moderate infection decrease as the age of the children increase in both *A.lumbricoides* and *T. trichiura* but in the case of hookworm infection as the age reach peak the percentage of children with light infection increase. Analysis of EPG by the age showed that 4.4% of the 19.3% children infected with *T. trichiura* had moderate intensity of infection which was the highest from three STH infections. The percentage of male children was higher than that of female in light infection for hookworm. No one had heavy intensity of infection in any one of STH infection.

Table 3: Categorization of intensity of infection with *A.lumbricoide*, *T. trichiura* and Hookworm by age group and sex among Abosa elementary school children around Lake Zway, April 2007.

Age (years)	STH infection status								
	<i>A.lumbricoides</i>			<i>T. trichiura</i>			Hookworm		
	Light no (%)	Moderate no (%)	Heavy no (%)	Light no (%)	Moderate no (%)	Heavy no (%)	Light no (%)	Moderate no (%)	Heavy no (%)
5-9 (n=108)	34(31.5)	3(2.8)	0(0)	30(27.8)	10(9.3)	0(0)	6(5.6)	0(0)	0(0)
10-14 (n=171)	33(19.3)	0(0)	0(0)	16(9.4)	7(4.09)	0(0)	20(11.7)	0(0)	0(0)
15-19 (n=102)	10(9.8)	0(0)	0(0)	11(10.8)	1(0.98)	0(0)	27(26.5)	0(0)	0(0)
20+(n=24)	3(12.5)	0(0)	0(0)	3(12.5)	0(0)	0(0)	5(20.8)	0(0)	0(0)
Total (n=405)	80(19.8)	3(0.74)	0(0)	60(14.8)	18(4.4)	0(0)	58(14.3)	0(0)	0(0)
Sex									
Male (n=192)	34(17.7)	2(1)	0(0)	30(15.6)	11(5.7)	0(0)	47(24.5)	0(0)	0(0)
Female (n=213)	46(21.6)	1(0.5)	0(0)	30(14.1)	7(3.3)	0(0)	11(5.2)	0(0)	0(0)
infection status threshold	Light(1-4999EPG)	Moderate (5000-49999)	Heavy (≥50000)	Light (1-999EPG)	Moderate (1000-9999)	Heavy (≥10000)	Light (1-1999EPG)	Moderate (2000-3999)	Heavy (≥4000)

EPG: Eggs per gram of Stool, STH infection status (Light, Moderate and Heavy) based on WHO threshold (Montresor et al., 2002)

5. 4. Risk factors associated with STH infection

Crude odd ratio (OR) obtained from univariate logistic regression analyses and adjusted OR obtained from multivariate logistic regression analyses are shown in Table 4 and 5. Female were at lower risk of the three common soil-transmitted helminths infection, but the difference was not significant (OR, 1.412 for male versus female; 95% CI, 0.901-2.212). In the case of hookworm infection, there was significant difference by gender, with the risk being elevated in male 4.1 times than female. The children's susceptibility to STH decreases with age and age ≥ 10 year old was a protective factor, but difference was not significant. On the other hand, logistic regression analysis conformed that age ≥ 10 year old were at higher risk to acquire hookworm infection.

There was no significant association between grade level of student and infection rate of the three common STH infection ($P > 0.05$). Logistic regression analysis on STH infection showed that non-usage of drilled water was the risk factor and also statistically associated (OR, 2.589 for non-user versus user; 95% CI, 1.497-4.478). The rate of STH infection was not related to the usage of latrines ($P > 0.05$) and also open field defecation ($P > 0.05$). In addition, the infection rate of STH was also independent of religion ($p > 0.05$).

Three hundred and eighty nine (96%) of the students had the habit of washing hand before meals. There was significant difference of infection rate of STH between children who did and did not wash hand before meal ($p < 0.05$), with the risk elevated to 3.8 times. Two hundred and sixty three (65%) student had dirty material in their right and left hand fingernails, out of these 138 (52.5%) were positive for STH infection. Logistic regression analysis on STH infection indicated that dirty material in the finger nail was a risk factor and significant relation between infection rates of STH and dirty material in their finger nail was identified (OR, 4.345 for dirty versus clean finger nail, 95% CI , 2.604-7.248).

Three hundred and sixty six (90.4%) children had shoe wearing habit. In hookworm infection logistic regression analysis showed that not wearing shoe was the risk factor and statistically significant difference was also observed between those with and without

shoes (OR, 258.764 for without versus with shoe, $P < 0.05$). There was no regular health education program in collaboration with Woreda Health Office due to the shortage of health personal.

Table 4: Univariate and multivariate logistic regression analysis for factors potentially associated with STH infection among Abosa elementary school children around Lake Zway, April 2007.

Risk factors	STH		Crude OR (CI) (P-value)	Adjusted OR (CI) (P-value)
	Total positive	Total Negative		
Sex				
Male	90	102	1.467(0.987, 2.181)(0.058)	1.412(0.901, 2.212)(0.132)
Female	80	133	1.00	1.00
Age group in years				
5-9	67	41	1.719(0.706, 4.186)(0.233)	1.548(0.465, 5.159)(0.476)
10-14	67	104	0.689(0.291, 1.631)(0.397)	0.562(0.190, 1.668)(0.300)
15-19	32	70	0.540(0.218, 1.336)(0.183)	0.360(0.126, 1.028)(0.056)
20+	11	13	1.00	1.00
Grade level				
1-4	106	129	1.361(0.910, 2.036)(0.134)	0.740(0.393, 1.392)(0.350)
5-8	64	106	1.00	1.00
Religion				
Muslims	133	183	1.021(0.634, 1.646)(0.931)	0.830(0.477, 1.444)(0.510)
Christian	37	52	1.00	1.00
Water source drilled well				
Yes	48	116	1.00	1.00
No	122	119	2.478(1.627, 3.773)(0.000)	2.589(1.497, 4.478)(0.001)
Latrine usage				
Yes	109	155	1.00	1.00
No	61	80	1.084(0.717, 1.640)(0.701)	0.532(0.154, 1.840)((0.319)
Open filed defecation				
Yes	58	77	1.063(0.700, 1.614)(0.776)	1.558(0.451, 5.385)(0.484)
No	112	158	1.00	1.00
Hand washing habit				
Yes	159	230	1.00	1.00
No	11	5	3.182(1.085, 9.336)(0.034)	3.790(1.151, 12.483)(0.028)
Dirty material in the right and left finger nail				
Yes	138	125	3.795(2.391, 6.024)(0.000)	4.345(2.604, 7.248)(0.000)
No	32	110	1.00	1.00

OR: odd ratio, CI: 95% confidence interval,

Table 5 : Significant risk factors in multivariate logistic regression analysis associated with Hookworm infection among Abosa elementary school children around Lake Zway, April 2007

Risk factors	Hookworm		Adjusted OR (CI) (P-value)
	Total positive	Total Negative	
Sex			
Male	47	145	4.113(1.618, 10.458)(0.003)
Female	11	202	1.00
Age group in years			
5-9	6	102	1.00
10-14	20	151	4.549(0.989, 20.932)(0.052)
15-19	27	75	11.652(2.511, 54.076)(0.002)
20+	5	19	1.775(0.139, 22.641)(0.659)
Shoe wearing habit			
Yes	22	344	1.00
No	36	3	258.764(58.840, 1137.990)(0.000)

6. DISCUSSION

Soil-transmitted helminths are great public health problems in several tropical and subtropical developing countries like Ethiopia with poor socio-economic status and personal hygiene. This is more common in school going children and is associated with high morbidity and mortality and economic loss to the country (Girum, 2005; Erko and Legesse, 2004; Silva *et al.*, 2003; WHO, 2002). Thus, knowledge of the distribution and extent of these neglected diseases in a given community is important to identify high risk-group and design appropriate intervention program.

In this study, the overall prevalence of intestinal helminth infection (43.7%) was a bit lower when compared with the previous study around Lake Zway Island with an overall prevalence of 56.7% reported by Tesfa-Michael and Teklemariam, (1983). This result is also lower compared to that reported from near Lake Tana and Lake Awassa (Melake berhan *et al.*, 1993; Yared *et al.*, 2001). However, this finding was in agreement in other studies in Ethiopia including Eastern Ethiopia (45.9%) by Lo *et al.*, (1989) and South Wello (43.3%) by Assefa *et al.*, (1998). The lower prevalence obtained in the present study in comparison with report by Tesfa-Michael and Teklemariam, (1983) could be attributed to availability of latrine, educational level, and also the technique used in stool examination in the present studies less sensitive than the previous studies.

In the current study, of the three common STH infection identified in 405 school children, *A. lumbricoides* and *T. trichiura* were predominant with prevalence rate of 20.5% and 19.3%, respectively followed by hookworm (14.3%). The prevalence of *A. lumbricoides* (20.5 %) was found to be higher than previous report (4.1%) by Tesfa-Michael and Teklemariam, (1983) around Zway Island. The study subjects of the present study were school going children which is one possible of reason for the difference. In addition, environmental sanitation and difference in exposure to infection probably play an important role in affecting prevalence rate of ascariasis. In similar studies from Southeast of Lake Langano by Legesse and Erko, (2004) and Western Abaya by Tilahun *et al.*, (1999) slightly lower rate of ascariasis 6.2% and 10% were reported, respectively.

On the contrary, reports from near Lake Tana and Lake Awassa (Melake Berhan *et al.*, 1993; Yared *et al.*, 2001) were relatively higher in comparison of the present result.

However, this study was in agreement with reports by Tedla and Ayele, (1986) and Jemaneh, (1998b) which indicate a low prevalence of ascariasis and trichuriasis in lower altitude and dry area of the country because egg development in the soil is dependent upon a number of factors including optimal temperature, and adequate shade and moisture (Brooker and Micheal, 2000). Similar prevalence rates are also found in the coastal area of Kenya by Magnussen *et al.*, (1997) and Tanzania (partnership for child development, 1998).

The second most prevalent parasite in this study was *T. trichiura* (19.3%). Its prevalence was much lower than prevalence rate reported in Zway Island (46.2%) by Tesfa-Michael and Teklemariam, (1983) but higher than prevalence rate in Zway health center reported by Tesfa-Michael, (1983). In contrast, the current study was in line with previous report in different parts of the country (Tedla and Ayele, 1986; Jemaneh, 1998b).

The prevalence rate of hookworm was 14.3% in this study, contradicting the previous study by Tesfa-Michael and Teklemariam, (1983) which reported the total absence of hookworm (less than 1%) but slightly higher than from report (6.6% prevalence of hookworm) in Zway health center by Tesfa-Michael, (1983). In addition, the prevalence rate of hookworm in the present study is lower than prevalence observed in the Southeast of Lake langano by legesse and Erko, (2004); Western Abaya by Tilahun *et al.*, (1999) and near Lake Tana by Melake Berhan *et al.*, (1993). This could be attributed to difference in the study subject in the present study which was school going children and also the method used in stool examination. On the other hand, the prevalence rate of hookworm in this study concurs to outcomes of the previous studies elsewhere in the country (Jemaneh and Lengeler, 2001; Jemaneh, 1997).

The hookworm infection reported here was not differentiated into species level since it is impossible to differentiate without stool culture. As both *Ancylostoma duodenale* and

Necator americanus have a wide distribution in Ethiopia (Armstrong and Chane., 1975), it is expected that both species might be present in Abosa.

In this study, the least encountered helminths were *H.nana* (2%) and *E. vermicularis* (1.5%). This is in agreement with the previous study conducted in the area around Zway Island by Tesfa-Michael and Teklemariam, (1983). Since the sensitivity of the method used in the present as well as previous study was very low to diagnose enterobiasis, the reported prevalence of enterobiasis may not represent the true prevalence rates.

In the present study, none of the stool sample processed was found to be positive for schistosoma ova .This finding is not in line with previous report 20 years ago around Zway Island by Teklemariam and Tesfa-Michael, (1987). This is probably a site difference between the present and previous study. In the previous study, abundant density of snail and highest infection rate of *S.mansoni* were observed in Easter shore village of Lake Zway. On the other hand, the study site of the present study is located on the North Western shore of Lake Zway where the density of snail is very scanty as well as low infection rate of *S.mansoni* (Teklemariam and Tesfa-Michael, 1987). Further more, according to the information generated in this study, the frequency of water contact in Zway Lake for recreation and domestic activity were lesser. On the basis of these, it is not surprising to see zero prevalence of *S.mansoni* in the present study. However, when we see the sample size and technique used in the current study, it is difficult to conclude that this Zero prevalence rate of *S.mansoni* was only due to site difference and decrease in the frequency of water contact in Zway Lake. Therefore, further studies must be conducted together with malacological investigations before coming with any conclusions.

Age specific prevalence curve of both *A.lumbricoides* and *T. trichiura* in the current study showed similar pattern of infection with the highest prevalence seen among children of 5-9 year of age group, then a further decline in each age group. This is in agreement with previous studies (Tesfa-Michael and Teklemariam, 1983; Girum, 2005; Jemaneh, 2000a; Erko and Medhin, 2003; Haileamelak, 2005). Unlike ascaris and

trichuris, the highest prevalence of hookworm was seen among the older age group 15-19 and the lowest in the youngest age group 5-9. Similar varying findings have been reported from school children in other studies (Erko and Legesse, 2004; Yared *et al.*, 2001; Melake Berhan *et al.*, 1993). This phenomena probably reflects age related change in exposure to STH infection.

The intensity of STH infection in this study has been assessed using faecal egg count obtained by the kato-katz stool examination technique. This method is susceptible to error of sampling due to non –homogeneous distribution of egg in faeces: Variation in egg output by the female worm, difference in the male to female ratio and periodicity in the output of the eggs by the female worm (Crolle *et al.*, 1982; Fashuyi, 1998). However, it is still widely used and recommended by WHO as an indirect measure of intensity of intestinal helminth infection (Montresor *et al.*, 2002).

In this study, the intensity of STH infection as measured by egg per gram of faeces is generally low. The overall intensity of STH infection expressed as geometric mean among the present study subjects for *A.lumbricoide*, *T. trichiura* and hookworm were 836, 525 and 528, respectively. It is comparable with previous report from school children around north Lake Tana and Adarkay district (Melake Berhan *et al.*, 1993; Jemaneh, 1997). The low intensity level of STH infection in the current study might be due to long dry season, low humidity, unfavourable soil formation, and difference in the exposure to infection.

Prevalence and intensity of infection decline as the age of children increase in both *A.lumbricoides* and *T. trichiura*. This trend was also observed in others studies (Melake Berhan *et al.*, 1993; Jemaneh, 2000a; Girum, 2005). This could be because of high level of soil contact activity and low personal hygiene in the youngest age group. One expects lower chance of environmental contamination and transmission when majority of the children shown light intensity and single STH infection. Similarly, multiple STH infection was highest among the youngest age category in the present study; this might increase the risk of transmission and marked contamination by multiple helminth ova.

In contrast to ascaris and trichuris, peak prevalence and infection intensity for hookworm occur as the age increases. Similar findings have been reported in different studies (Melake Berhan *et al.*, 1993; Jemaneh, 2000b; Girum, 2005). This might be due to engagement in agricultural pursuit with their father in the field as the children age reach peak at about 10-14 years old. Even if there was no moderate and heavy infection intensity observed in hookworm infection in the current study, the influence of aging on the prevalence and intensity of hook worm has important public health consequence. Therefore, there is need for further study into the reasons for this pattern of infection.

Regarding gender, this study has shown that females were at lower risk for *A.lumbricoides* and *T. trichiura* infection though the difference was not significant (Table 4). This is in agreement with previous studies in Lake Zway Island and Zway health center (Tesfa-Michael and Teklemariam, 1987; Tesfa-Michael, 1983). In the case of hookworm infection, there was significant difference by gender, with risk being elevated in males 4.1 times than females. This is also in line with previous studies (Girum, 2005; Assefa *et al.*, 1998; Jemaneh, 1997). This is more likely to be influenced by cultural values that females do stay home with their mother which may decrease the exposure risk and also gives better access for washing, while males children especially the higher age group go to field with their father so that their exposure to geohelminths is likely to increase.

In the current study, logistic regression analysis confirmed that age ≥ 10 year old was at higher risk to acquire hookworm infection. On the contrary, the difference was not significant in ascaris and trichuris infection. This is similar with previous studies (Tesfa-Michael, 1983; Melke Berhan *et al.*, 1993).

This study showed that there was no significant association between grade level of students and rate of STH infection. This was also true in other studies (Pinar *et al.*, 2004; Holland *et al.*, 1998; Tshikuka *et al.*, 1995). This finding might be due to lack of regular health education program in the school which can enhance their awareness in the transmission

and control mechanism. Logistic regression analysis in this study indicated that non-usage of drilled water was the risk factor and also statistically associated on STH infection (Table 4). Inadequate water supplies can lead to poor personal hygiene and environmental sanitation which make the children susceptible to STH infection.

It is surprising to see that lack of relation between usage of latrine and the rate of STH infection in such high rate of affirmative response by the students (Table 4). In addition, the mere availability of the toilet, unless properly used, does not guarantee protection against STH infection.

This study documented the existence of relation between hand washing and rate of STH infection, with higher risk of STH infection in those children who did not wash their hands before meal (Table 4). Logistic regression analysis on STH infection in this study also showed that dirty material in the children finger nail was a risk factor. A significant relation between STH infection rate and dirty material in their finger nails was identified. This is probably due to insufficient water supplies, poor hygienic practice, socio-economic status and also playing habit of children with soil. These results are supported by most previous reports (Girum, 2005; Pinar *et al.* 2000; Ali *et al.*, 1999).

After adjustment in multivariate analysis, the association between walking barefoot and rate of hookworm infection was noted in this study (Table 5). This is similar to the result of other studies (Rebecca *et al.*, 2004; Naish *et al.*, 2004; Ali *et al.*, 1999; Girum, 2005). So, health education on transmission of hookworm and encourage children to wear shoe play an important role in prevention and control of hookworm infection.

7. CONCLUSION AND RECOMMENDATION

The present study has tried to point out relatively higher prevalence and lower intensity of STH infection among school children in Abosa where hot and dry environmental condition prevails. This study had also identified a number of risk factors associated with STH infection. Factors like habit of hand washing before meal, non-usage of drilled water, dirty material in the finger nail and shoe-wearing habit were significantly associated with STH infection, and play an important role in affecting prevalence of STH infection.

Therefore, it can be concluded that STH infection is Prevalent in Abosa and an intervention strategy should be designed and implemented for this neglected disease. So, the following recommendation can be forwarded:

WHO recommend introducing a programme of regular deworming for school children to keep STH infection intensities level low. On the basis of this, we suggest anthelmintic treatment to all school children as they are among the most vulnerable groups.

Local health sector should collaborate with school health program for delivering health education to increase the knowledge, attitude and practice (KAP) of school children as to how STH infection is transmitted and prevented such as improvement of personal hygiene and environmental sanitation, shoe wearing habit and use of safe water.

It should be emphasized that these STH infection tend to decline with increased economic development of the poorest and often least accessible people in the rural area of Ethiopia like small village Abosa around Zway.

In the present study, it was difficult to conclude that zero prevalence rate of *S.mansoni* only due to site difference between the present and previous study. Therefore, further studies must be conducted together with malacological investigation before any conclusion can be made.

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9. ANNEX

ANNEX -I: Parasitological investigation procedure

Operating procedure for parasitological investigation of Abosa Elementry school children at Abosa clinic

A. Direct examination of faecal specimens /wet mount smear preparations

Procedure

1. Place one drop of 0.85% NaCl on the slide.
2. Take a small amount of faecal specimen and thoroughly emulsify the stool in saline
3. Slide a 22mm cover slip at an angle into the edge of the emulsified faecal drop.
Push the cover slip across the drop before allowing it to fall into place.
4. Systematically scan the entire 22mm cover slip with overlapping fields with the 10x objective.
5. Switch to high dry (40X objective) for more detailed study of any suspect eggs or protozoa.

B. Kato-Katz technique

1. Take approximately 5 g of faeces and sieve it through fine wire mesh.
2. Scrape the stool off the underside of the mesh using a tongue depressor.
3. Place a metal plate with a hole at one end over a microscope slide. Fill the hole with the finely sieved faecal material, and then remove the metal plate. This calibrated hole holds 0.04g of stool.
4. Place a special cellophane strip (cut as a 22x40 mm cover slip) over the faeces and spread out the sample using an applicator stick.
5. Detection and counting of hookworm ova was made soon after the slide preparation following which the slide were kept for at least one hour before examination for *A.lumbricoides* and *T. trichiura* egg.
6. Finally the slide examined for the presence of eggs and counted the number of eggs.

ANNEX –II: Sociodemographic and Laboratory data
ADDIS ABABA UNIVERSITY MEDICAL FACULTY, DEPARTMENT OF
MICROBIOLOGY, IMMUNOLOGY AND PARASITOLOGY

For parasitological investigation at Abosa primary school children around Zway Lake, Southern Ethiopia.

1. Sociodemographic data

- 1.1. Study no -----
- 1.2. Name -----
- 1.3. Age
- 1.4. Sex 1.Male 2. Female
- 1.5. Address -----
- 1.6. Occupation -----
- 1.7. Level of Grade -----
- 1.8. Religion-----
- 1.9 Duration of stay-----
- 1.10. Date of sample collection ____/ ____/ ____

2. Laboratory data

2.1. *Microscopic Examinations*

2.2.1 Direct smear microscopic result

A. Intestinal parasite (protozoa) seen

_____, _____,

2.2.2. **Kato-Katz method**

A. No ova of parasite seen

B. Ova of helminthic parasite seen

➤ Type and the number of egg per gram of stool

(I) _____

(II) _____

(III) _____

(IV) _____

Name of Principal investigator (P.I)

Signature _____

Date ___/___/_____

ANNEX- III: QUESTIONNAIRE

ADDIS ABABA UNIVERSITY MEDICAL FACULTY DEPARTMENT OF MICROBIOLOGY, IMMUNOLOGY AND PARASITOLOGY

To assess associated risk factor of soil-transmitted helminth infection and Schistosoma mansoni at Abosa primary school children around Zway Lake, Southern Ethiopia.

1. From where do you fetch water for drinking, cooking and washing?

1. From the Lake 2. From the river 3. From the drilled well

4. From Tape water 5. If other specify _____

2. Do you use latrine? 1. Yes 2. No If yes, skip question no 3

3. If no to No 2, where do you defecate and dispose the feces?

1. Around the Lake 2. Near the river 3. Away from the river

4. By Using pits dispose to the river 5. Open filled

4. Do you swim in near by river or Lake? 1. Yes 2. No If No, skip question no 5

5. If yes to no 4, how often you swim to the river or Lake?

1. Sometimes 2. Regularly

6. Is their any river you cross it when you come to school or goes to other place? If No, skip question no 7

1. Yes 2. No

7. If yes to No 6, do you have contact to the river while you are crossing it?

1. Yes 2. No

8. Do you wear shoes? If No, skip question no 9

1. Yes 2. No

9. If yes to No 8, how often?

1. Sometimes 2. Regularly

10. Where do you wash the cloths?

1. River 2. Lake 3. at home

11. Where do you bath?

1. River 2. Lake 3. at home,

12. Do you wash your hand before eating food? 1. Yes 2. No

13. Is their dirty materials in the fingernails finger nails (right and left finger nails)?

Interviewer inspect it)

1. Yes 2. No

14. Is their regular health education program in the school? (This is for school director)

1. Yes 2. No

15. If no to No 14, what is the reason? _____

16. From Grade 1 to 8, does curriculum contains health related education like how to keep personal hygiene and the environment? (This is for school director).

1. Yes 2. No

Number _____

**ANNEX-IV CONSENT FORM (To be translated in the patient language-
Oromifa)
For participation as volunteer in the research undertaking**

Code number-----

Name of the study subject -----

Explanation on procedures and condition of the agreement

We are from Addis Ababa University, Faculty of Medicine. We are here to study about problem of intestinal helminthiasis. The objective of the study is to assess epidemiological information of Soil-transmitted helminthes and *S. mansoni* among School children. The information generated from this study will provide the current status intestinal helmithiasis in the given area.

We are asking you to participate in the study for intestinal helminthiasis investigation. The investigation will involve collection of faeces for parasitological examination and interview through pre-structured questionnaire for demographic and associated risk factors of the disease.

If the investigation is confirmed for *S.mansoni* and other intestinal parasite, you will be treated with appropriate drug. Dissemination of results will be forwarded, we assure you the confidentiality of all collected information in the questionnaire and faecal examination. If you have any questions regarding the purpose of the study, you have the right to ask question and get clarification. It is your right to withdraw from this study if you are not interested to participate in the study.

Finally, if you have understood the explanation very well, we are asking you kindly to participate in this study, and put your signature as illustrated below.

Signature:

It is with full understanding of the situation that I agreed to give the informed consent voluntarily to the researcher. I agree that I am contributing to prevention and control of the disease my fellows and myself by participating in this project.

Signature (participant) _____

Date _____

Signature (Investigator) _____

Date _____

Xumura III. Jecha Gaafii (Questionnaire)

1. Bishaan dhugaatii, Bilcheesuu f dhiqachu Essaa warabdan?
 1. Haroo irraa
 2. Laga irra,
 3. Bishaan boolaa
 4. Bishaan ujummoo
 5. Kan bira jira taanaan _____
2. Mana fincaanii qabdu? F Eyyee, irra darbi Graafii lakkoofsa 3
 1. Eyyee
 2. Lakki (miti)
3. Yoo deebiin kee lakki ta'e lakkoofsa 4, Eessatti Bobbaa tannii?
 1. Harroo bukkeet
 2. Laga cinaa
 3. Laga irraa fdgaanee
 4. Meeshaat fayadamne lagt gatu.
 5. Bakkeet
4. Bishann Haroo ykn laga ni daaktuu? F Lakki, irra darbi Gaafii lakkoofsa 7
 1. Teyee
 2. Lakki(hin daaknu)
5. You deebiinkee eeyyee ta'e lakkoofsa 6, Yeroo akkam daaktuu?
 1. Takka-takka
 2. Yeroo hundaa
6. Yogaa mana-barumsaaykn eddo biraa demtan bishaan ceetanii (qaxamurtanii) dhufan ji jira?
 1. Eeyyee
 2. Miti (Lakki) hinjiru
7. You deebin kee lakkoofsaa 8, Eeyyee ta'e lag asana kanaan dura ni beektaa?
 - A. Eeyyee
 - B. Lakki (hin beedu)
8. Kophee ni godhataa? F Lakki, irra darbi Gaafii lakkoofsa 11.
 1. Eeyyee
 2. Lakii (hingodhu)
9. You deebiin kee, eeyyee ta'e lakkoofsa 10, yeroo akkam?
 1. Takka-takka
 2. Yeroo Hundaa?
10. Huccu kee; Eessatti Micataa (qulqulleesataa)?
 1. Lagaatti
 2. Harootti
 3. Yoo manatti ta'e
11. Eessaatt Qaama kee dhiqataa?
 1. Lagaatti
 2. Harootti
 3. Yoo manatti ta'e
12. Harke kee nyaata dura dhiqaataa?
 1. Eeyyee
 2. Lakki
13. Xuriin Qeensa Hark kee irra hin jiruu? Keesumaa iyyu Qeensa harka miga keessaa?

1. Eeyyee 2. Lakki
14. Sagantaa barumsi fayyaa ni jiraa?F Eeyyee, irra darbi Gaafil lakkoofsa17
1. Eeyyee 2. Lakki
15. You deebin keei ta'e lakkofasa 16, sababni isaa maalidha?_____
16. Kutaa tokko hanga saddeetiitti (1-8),Naamusa ykn seeraa barumsa sana keessaa, barumsi fayyaa ida' ameeraa? Faddeenyaaaf Qulaqiina ofiif nannoo eeguu.
1. Eeyyee 2. Lakki

Xumura IV Unka Waliigaltee/Consent form/

Lakkofsaa Koodii _____

Magaa gosa Qorannaa kanaa _____

Ibsa seera kana irratti fi Haala Waliigaltte Isaa

Nuti yunveersiitii finfinne, Faakaaltii Qorica (facultiy of Medicene)Irra dhafne sabani Nuti itti dhufine,Waa'ee dhukuba Maxxantoota Mar'ummaan (intestinal helminthiasis)Qorachuuf. Kayyoon Qorannaa kanaas, barattoota kutta gadaanaafuummata nannoo kanaa wa'ee dhukuba kanaa sirriitti baranii irraa akka of eeganiif.Odeeffaanoon Qoranna kana ira argamu, naannookanaaf(Odeeffannoo)wa'ee dhukuba kanaa akka barna tasisa keesumayyu (Odeeffanno)amayaa kan ta'e.

Nuti Qorannaa keenyaaf tattaafii (Hirmannaa)heessan ykn akka irratti hirmaataan sin gaafanna.Qoranna kun kan inni of keessaatti qabatu, kuusama sagaraa ykn fincaaniif Jecha gaafii rakkoolee unmmater ti.Dhukuba kana ilaachisee.

Otoo Qurannaaa kun Mirkanaa'ee dhukubni Bilahaarziyaa fi dhukubniMaxxantoot Mar'ummaaii Qorichi sirriit a'e akka argatan shakkii hin gabu.Bu'aan Qorannaa knnaa illee sirritti akke tamsaasa'u iciitii deefannoo kana illee sirritti akka eegamu nimirkaneesina. Yoo gaafii gabatan,Qorannaa keenya ilaal chisee,gaafachuu ni dandeesu.Yoo feedhii Hirmanaa hin qabdamta'e dhiisuu akka dandesan dha.

Dhuma irratti,yoo ibsikun sirriit singaaleera taanaan,Nuti hirmaannaa keessaan kabajaan sin gaafanna mallatto keesian illee ni barbaana.

Mallatto:-

An' kaayyoon Qoranna kana naa galee,ittiamanee Qorannaa kanaaf raga Eyyamum keneera.Walumagalati ani dhukukubni kunis akka inni baduuf uumanni illee kana irratti akka hirmaatu ni carraa gaarii hawwai

Mellattoo (Hirmaata)_____ Mellattoo (Qorataa)_____
Bara (Guyyaa)_____ Bera (Guyyaa)_____

DECLARATION

I, the undersigned, declare that this MSc thesis is my original work, has not been presented for a degree in Addis Ababa University or any other universities. I also declare that all sources of materials used for the thesis have been duly acknowledged.

Name of the candidate

Signature

Place

Date of submission

_____/_____/_____

This thesis has been submitted for examination with my approval as university advisor.

Name of advisor

Signature

Place

Date of submission

_____/_____/_____

Name of examiner

Signature

Place

Date of submission

____/____/____