ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF MEDICAL MICROBIOLOGY, IMMUNOLOGY AND
PARASITOLOGY

The prevalence of geohelminth and *S. mansoni* infections and
associated risk factors among school children in Umolantie, South
Ethiopia.

By

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Acknowledgements

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Acronyms

AAU	Addis Ababa University
AL	Arthemetr Lumaphentrene
CDC	Centres of disease control and prevention
EPG	Egg per gram
GIT	Gastrointestinal tract
SNNPR	Southern nations, nationalities and peoples region
SOP	Standard operating manual
SPSS	Statistical Package for Social Scientists
STHs	Soil transmitted helminths
WHO	World health organizat

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Abstract

Introduction: The prevalence and distribution of intestinal helminths varies from place to place in Ethiopia. Intestinal parasitic infections have detrimental effects on the survival, appetite, growth and physical fitness, school attendance and cognitive performance of school age children. Higher parasitic disease rates occur in children with infection frequently found in those under 14 years in many risk areas due to poor hygiene and play habits.

Objective: To determine prevalence and associated factors of intestinal helminthic infections among Umolantie primary school children, South Ethiopia.

Methodology: A cross-sectional study, involving 405 schoolchildren, was conducted between Nov, 2010 and Jan, 2011. Systematic random sampling technique was applied. Interviews and observation were used to identify the risk factors. Stool specimens were examined using the Kato-Katz technique. Data was entered and analyzed using SPSS 16.0 and odds ratio, confidence intervals and p-value were calculated.

Results: six species of intestinal helminths were identified with an overall prevalence of 26.9% (109 of 405 children). The predominant parasites involved were hookworm *spp*. 59(14.6%) and *S. mansoni* 51(12.6%). Prevalence of *S. mansoni* infection was significantly higher in males (p=0.006), whereas hookworm infection was significantly higher in females (P=0.015). Bathing in the stream was strongly associated with higher prevalence of *S. mansoni* infection (p=0.03). Other helminths found were *E. vermicularis* 1% (4 cases), whipworm 1.5% (6 cases) and tapeworm 1.5% (6 cases) and *A. lumbricoide* 0.5% (2 cases). **Conclusion and recommendation:** A high percentage of primary school children from Umolantie have intestinal helminth infections and majority of them have hookworm and *S. mansoni.* Hence the community should be provided with safe water and should uphold awareness about the main routes of transmission of intestinal helminthes. School children should avoid water contact habits in the nearby stream and regular shoe wearing habits should also be developed among them.

Key words: geohelminths, *S. mansoni*, school children, Umolantie, South Ethiopia.

1. INTRODUCTION

Infection by intestinal parasitic worms (geohelminths) is widespread throughout the world, affecting hundreds of millions of people (http://www.diagnose-me.com/cond/C171466.html). These infections are common throughout the tropics, posing serious public health problems in developing countries (WHO 1990). In these parts of the world the high prevalence rate of intestinal parasite is attributed largely to socio-economic status, poor sanitation, inadequate medical care and absence of safe drinking water supplies (WHO 1987).

According to the World Health Organization estimate, globally there are 800 - 1000 million cases of Ascariasis, 700- 900 million of Hook Worm infection, 500 millions of Tricuriasis, 200 million of Giardiasis and 500 million of Entameba histolytica (Magambo *et al.,* 1998). Among the intestinal parasite infections, helminthic infections are the most common and are rampant in the poorest developing countries of the world often emanating from contamination of the environment by human excreta. The impure drinking water, low socio-economic conditions, poor sanitation coupled with play habits of children are the main causes (Ogwurike *et al.,*2010).

Children between the ages of three and twelve years are known to often acquire helminth infections, usually with high mean intensity values (Awogun, 1982; Anderson, 1986; Ferreira *et al.,* 1994) and there are an estimated 280 million hookworm infected children, 478 million with *Ascaris lumbricoides*, more than 207 million cases of schistosomiasis and 347 millions with *Trichuris trichiura* in the world (Michael et al., 1997).

In Ethiopia, like in other developing countries, intestinal parasitic infections are widely spread. A considerable proportion of annual visits at outpatient services of the health institutions are due to such infections (Woldemichael *et al.,* 1999). Several studies indicated that the prevalence of helminthic infections were high in the lower altitudes (Amare *et al*, 2007). Many reports illustrated that *A. lumbricoides* is the most prevalent intestinal parasite in different communities usually occurring together with trichuris infections (Tadesse & Tsehaye, 2008; Merid *et al*., 2001).

Hookworm infection, strongyloidiasis and enterobiasis are also public health problem though the magnitude is lesser compared to ascariasis. The prevalence of teaniasis alone ranges from 1- 48% and the infection rate with *Hymenolopis nana* is 3- 61% (Girum, 2005; Fekadu *et al*., 2008; Mengistu *et al*., 2009).

Intestinal Schistosomiasis is widespread in the country generally at altitudes ranging 1000 to 2000 meters above sea level. Rapid spread of the disease also appears to have been facilitated in areas which were originally non-endemic as a result of the initiation of water-based development schemes (Birrie et al., 1998).

Quantification of helminth eggs provides an indirect estimate of the intensity of infection so it is useful for identifying individuals most at risk of severe disease, tracking the effectiveness of anthelminthic treatment, and following the progress of control interventions (Crompton, 2007). The Kato-Katz procedure is now widely promoted as the method of choice for the diagnosis of schistosome infections during which eggs are released in stools (WHO, 1994).

Except for the intestinal parasite prevalence survey conducted in 1995 no other information is available regarding the present study area (Woldemichael *et al.,* 1999). Thus, the objectives of this study were to determine the prevalence of intestinal helminthic infections, to identify associated risk factors and to assess the intensity these infections among of school children of Umolantie.

2. Literature Review

Intestinal parasitic infections are among the major diseases of public health problems in sub-Saharan Africa. However, the role of intestinal parasites in causing morbidity and mortality as well as in the pathogenesis of other infectious diseases differs from species to species. Similarly, the distribution and prevalence of various species of intestinal parasites also differs from region to region because of several environmental, social and geographical factors. Hence, study on the prevalence of various intestinal parasitic infections is a prerequisite not only for formulation of appropriate control strategies but also to predict risk for communities under consideration (Mengistu and Berhanu, 2004).

2.1. Global Epidemiology of intestinal helminthic infections

The geographical disparities in prevalence of intestinal helminthic infections can be depicted by results of several articles. Results from a parasitological survey in rural Côte d'Ivoire among 500 school children indicated the prevalence of hookworms, *E. histolytica/E. dispar,* and *S. mansoni* to be 45.0%, 42.2%, and 39.8%, respectively with no significant difference among males and females. Infection prevalence of *T. trichuria* and *A. lumbricoides* were low, 6.0% and 2.0%, respectively, with no sex differences (Utizinger *et al*., 2000).

According to Rajini (2010), the overall prevalence of intestinal parasitic infection in Saint Lucia (island in the Eastern Caribbean Sea) was found to be 52.2%. The prevalence of parasites found were: *A. lumbricoides* (11.7%), hookworm *sp.* (11.6%), *S. stercoralis* (9.5%), *T. trichiura* (6.0%), *and E.vermicularis* (1.7%), *Taenia spp.* (0.2%), and *S. mansoni (0.2%). Ascaris* and hookworm were the most common helminths identified with a prevalence of 11.7% and 11.6%; *respectively.* They were more frequent in the 5-14 year age groups. Most infections were single occurrences and most helminth infections were light.

In another study conducted to determine the prevalence of intestinal worm infections among a primary school child in Kenya, the four intestinal worms investigated constituted a total prevalence of 12.9%. *A. lumbricoides* (6.4%) followed by *T. trichiura* (4.6%), hookworm *spp*

(0.1%) and *S. mansoni* (0.4%). Differences in prevalence between males and females were observed only with respect to *T. trichiura* and hookworm species. Fourteen to sixteen (14-16) and 11-13 years of age groups had the highest total prevalence of 47% and 30.6% respectively(Mutuku *et al.,2008*).

Prevalence of hookworm (42.5%), *A. lumbricoides (22.3%)* and *T. trichiura (17.9%)* was reported among school children from western Kenya. In this study, *S. mansoni* infections were predominately light (62.7%, 1−99 epg), with 27.4%, moderate (100−399 epg) and 9.8% heavy infections (> 400 epg). Prevalence was slightly higher in females (18.5%) than males (14.5%; *P=* 0.06) *(*Stephenson et *al.*, 1993*).*
A study by Basista *et al.*, (*2001)* showed an overall prevalence of 40% in Nepal with hook worm (14.8%)*, A. lumbricoides* (2.7%), *H. nana* (2.2%) and *T. trichiuria* (0.5%). More females than males were found to harbour intestinal parasites, 49.2% and 33.6% respectively. The difference was significant.

A pooled prevalence of 66.2% among school children aged 5-18+ years was reported from Southwest Nigeria out of which *A. lumbricoides* showed the highest prevalence (53.4%) (P < 0.001) followed by hookworms (17.8%), *T. trichiura* (10.4%), Taenia sp. (9.6%), *S. mansoni* (2.3%), *S. stercoralis* (0.7%), *S. haematobium* (0.6%), and *E. vermicularis* (0.3%).In the study each helminth had similar prevalence among both genders (P > 0.05). The commonest double infections were Ascaris and hookworms, while the commonest triple infections were Ascaris, hookworms, and Trichuris. *A. lumbricoides* showed the highest prevalence in all the age groups except 18+ years (*P* < 0.05). For hookworms, 15-17 years age group had statistically highest prevalence (*P* < 0.05). The remaining helminths had similar prevalence among the infected age groups (*P* > 0.05). The prevalence of double infections among males was (48.4%) and females (51.6%) (Olufemi *et al.*, 2007).

Prevalence of hookworm (68.2%), *A. lumbricoides* (48.8%), *S. mansoni* (45.3%), *T. trichiura* (1.1%) and *E. vermicularis*, *H. nana* and Taenia *spp*. respectively, 0.8%, 0.2% and 0.2% was reported among primary school children from rural Brazil. Prevalence and intensity of A. *lumbricoides* rose to a peak in the 5−10 years age group and declined thereafter. Prevalence of hookworm infection rose with age until the 15−20 years age group and stayed constant thereafter. Prevalence of S. *mansoni* infection also rose with age until the 10−15 years age group where it remained constant until peaking in the 40−45 years age group. Intensity of S.

mansoni infection peaked in the 10–15 years age group and again in the 20–25 years age group and declined thereafter. Overall, of those infected with a helminth`, 73.3% of individuals harboured mixed infections (Fiona *et al*., 2006).

A comparative study of helminthiasis in 2000 pupils of private and public primary schools in Jos North Local Government Area of Plateau State, Nigeria was carried out. The helminth parasites encountered and their prevalence were *S. mansoni*, 2.0%; *A. lumbricoides*, 7.7%; *S. stercoralis*, 5.3%; *T. trichiura*, 1.7%; and hookworm infection, 14.9%. The overall prevalence was 31.6% and double infections were encountered in 9.0% of the 2000 pupils with the *A. lumbricoides* and hookworm combination being the highest (3.0%). The highest infection rate of 19.58% was recorded among the 0-5 year olds followed by 6-10 year olds (32.50%) Infection prevalence was slightly higher in females (18.11%) compared to males (15.04%) (Ogwurike *et al*., 2010).

Findings from a study by Brooker, *et al*. (2000) in Busia district, Kenya, showed that 91.6% of the children were infected with *A. lumbricoides, T. trichiura,* and hookworm or *S. mansoni (2%).* No significant relationship between host age and infection prevalence was observed for the other helminth species (Hookworm, p=0.395; *T. trichiura,* p=0.993; *S. mansoni,* p=0.711). The prevalence of infection, heavy infection and mean egg count of *S. mansoni* were significantly higher in boys than in girls. There was no significant difference between the prevalence and intensity of A. *lumbricoides* and *T. trichiura* in boys and girls.

Results from a study conducted among 275 school children in Sudan revealed that Hook worm with a prevalence of 13.1% was the predominant nematode followed by *S. stercoralis* (3.3%), *Trichostrongylus* (2.5%), S. *mansoni* (2.2%) and T. *trichiura* (1.8%). A. *lumbricoides* and *cestodes* were not detected in this population. Children in the age group 6-10 years old were the most affected followed by the 11-15 year-old age group. The infection rate was slightly higher in males than females (Magambo *et al*., 1998).

2.2. Epidemiology of intestinal helminths in Ethiopia

In Ethiopia a number of epidemiological studies showed that geohelminthic and *S. mansoni* infections were widely distributed in several localities of the country with varying magnitudes of prevalence as high as 90% in school children in Ethiopia, (Mengistu *et al*., 2009).

Pooled prevalence of 35.6% was reported in Hintallo-Wejerat, North Ethiopia. There was no significant difference in the prevalence of intestinal parasites, except for *S. mansoni,* between the two sexes. The higher prevalence of *S. mansoni* infection was recorded in males (Tadesse & Tsehaye, 2008).

According to the study by Mengistu & Berhanu (2004), overall prevalence of intestinal parasites among schoolchildren in a rural area close to the southeast of Lake Langano, Ethiopia was 83.8%. Among the intestinal helminths, hookworm was the predominant parasite (64.7%) followed by *S. mansoni* (30.6%), *T. trichuria* (18.8%), *Taenia sp* (17.6%) and *E. vermicularis* (2.9%).

Nine species of intestinal helminths were identified with an overall prevalence of 27.2% (113 out of 415) among school children in Babile, eastern Ethiopia. The predominant parasite involved was H. *nana* which was observed (10.1%) followed by hookworm (6.7%) and S. *mansoni* (4.3%) The prevalence rate of S. *mansoni* infection among the children was 4.3% .Boys had higher prevalence of S. *mansoni* infection rate than girls (p<0.05). The rate of S. *mansoni* infection increased linearly with age from 1.8% for age 5 to 9 years, 4.3% for age 10 to 14 years, and 11.6% for age 15 to19 years old. However, the observed differences were not statistically significant (p>0.05) (Girum, 2005).

In a study conducted to determine hookworm species distribution among school children in Asendabo, Jimma Zone, South West Ethiopia a total of 100 school children with mean age 12.9 years were included in the study. The overall intestinal parasitosis among the study participants was 70.9% (66/93).hook worm (40.8%), A. *lumbricoides* (16%) and T. *trichuria* (7.5%) were reported (Fekadu *et al*., 2008).

Another study conducted in Western Abaya indicated overall prevalence of intestinal helminthic infections to be 60% in Umolantie village. Hookworm was found to be the most prevalent helminth (57.7%) followed by *S. mansoni (2.2%)* and *S. mansoni* infection was significantly higher in males (Woldemichael *et al*.,1999).

2.3. Disease burden due to *S. mansoni*

The public health significance of schistosomiasis is often underestimated partly because like all helminthic infections, its distribution is usually wide spread with few people having heavy infections and severe disease while the majority are asymptomatic with lighter infections. Different studies that revealed difference in prevalence and intensity of intestinal

schistosomiasis due to *S. mansoni* have been conducted in different parts of the world. For instance a 4.62% prevalence of *S. mansoni* was observed among public and private primary and secondary school students in Jos North Local Government Area of Plateau State, Nigeria. (Brooker *et al*., 2000). Out of the 129 males examined, 10(7.8%) were infected while only 3(2.00%) of the 151 females examined were infected. The age group 10-14years had the highest prevalence with more males infected 8(22.2%) than females. The study also revealed that those mostly affected with *S. mansoni* are those who drink pipe borne water 6(4.2%) and hand-dug well water 5(6.7%) (Ogwurike *et al*., 2010). Results from a study conducted among pupils in Apata and Laranto areas in Jos, Plateau State also showed   the prevalence of S. *mansoni* infection to be 1.0% (Okpala *et al*., 2004).

A study conducted among school children in the lower river basin of Volta in Ghana also revealed that the overall prevalence of disease in children was 10.6%. All the positive subjects fell in two age groups, i.e. 6-11 and 12-17 years. (15). Age groups 0-5 and 18-23 did not have the infection (Nkegbe, 2010).

A study from Uganda showed that prevalence of S. *mansoni* infection was 27.8% (103/370) with stool egg load ranging from 24– 6048 per gram of stool. 84.3 %(312) had light infections (<100 eggs/gm of stool), 10.8 %(40) had moderate infections (100–400 eggs/gm of stool) and 4.9% (18) had heavy infections (>400 egg/gm of stool). Prevalence was highest in the age group 12–14 years (49.5%) and geometric mean intensity was highest in the age group 9–11 years (238 epg). The prevalence and geometric mean intensity of infection among girls was lower (26%; 290 epg) compared to that of boys (29.6%; 463 epg) (t = 4.383, p < 0.05). In a multivariate logistic regression model, altitude and water source (crater lakes) were significantly associated with infection (Rubaihayo *et al*., 2008).

Parasitological survey applying the Kato-Katz method in 1186 schoolchildren in four public schools of Jaboticatubas, State of Minas Gerais, Brazil was conducted in 2001. Among these schoolchildren 101 (8.6%) were positive for *S. mansoni* eggs in their stool samples (Fiona *et al*., 2006).

S. mansoni is endemic and recorded from 50% of the communities studied with prevalence rates ranged from less than 1% up to more than 90% in Ethiopia. An epidemiological study on *S. mansoni* in Tigray and north Wello was conducted in1992 in six schools accessible by roads. The overall prevalence ranged from 1% in Maychew to 61.8% in Adwa. Among those whose stools were examined by Kato method in Adwa town; prevalence (68%) and intensity

(597EPG) were highest in the 10 to 14 years age group followed by (64%) prevalence and (591EPG) intensity in the 15 to 19 years of age respectively (Birrie et al., 1998).

In a rural area close to the southeast of Lake Langano 21.2% prevalence of *S. mansoni* infection was observed among students (Mengistu & Berhanu, 2004)). Similarly, in the study conducted in Wondo-Genent Zuria, Southern Ethiopia, the prevalence of *S. mansoni* was found to be 30.2% among students. The prevalence of infection was significantly higher in males than in females (56.7% vs. 21.5%, $p < 0.05$) (Mengistu & Berhanu, 2004).

In another study conducted in Jiga town, Gojam administrative zone, the prevalence of *S. mansoni* was 33.7%. The mean intensity of infection was highest for 15-19 age groups (450e.p.g) followed by 10-14 groups (301e.p.g), which showed bimodal pattern in prevalence and intensity peak (Shewakena, 1995).

3. Statement of the problem

Parasitic infections, particularly intestinal helminths, cause hundreds of thousands of avoidable deaths each year, and are among the world's most common infectious diseases. Intestinal helminths are more prevalent throughout the tropics, especially among poor communities (WHO1990, 1991).

These parasites are responsible for extensive morbidity and mortality in sub- Saharan Africa. It is estimated that worldwide more than 200 million persons are infected with schistosomes; 85% of the cases occurring in Africa, and more than 1.5 billion are infected with STHs (Thomas *et al.*, *2003*).

Records show increasing trends in helminth infections, particularly in developing nations (de Silva *et al*., 1997). School age children are one of the groups at high-risk for intestinal helminthic infections. The adverse effects of these parasites among children are diverse and alarming. These parasitic infections also have detrimental effects on the survival (Stephenson *et al*. 1993), appetite, growth and physical fitness, school attendance and cognitive performance of school age children (Hadidjaja *et al*., 1998). Higher disease rates occur in children with infection frequently found in those under 14 years in many risk areas due to poor hygiene and play habits (Ali *et al*., 1999).

Although several studies have been conducted on the distribution and prevalence of intestinal parasites in Ethiopia (Mengistu *et al*., 2009; Merid *et al*., 2001;Tadesse & Tsehaye,2008; Girum,2005), there are still several localities for which epidemiological information is not available (Mengistu and Berhanu, 2004). Ethiopia has one of the lowest quality drinking water supply and latrine coverage in the world. In 2000, Ethiopia had only 12% latrine coverage while Kenya had 87% (Amare *et al*, 2007;Kumie and Ali,2005).In light of this, the present study was planned to assess the prevalence and intensity of intestinal helminthic infections among schoolchildren of Umolantie primary school found (south Ethiopia) with emphasis on *S. mansoni*.

4. OBJECTIVE

4.1 General Objective

❖ To determine the prevalence of geohelminth and *S. mansoni* infections and associated risk factors among school children in Umolantie, South Ethiopia.

4.2 Specific Objectives

▶ To determine prevalence geohelminth and *S. mansoni* infections among school children in Umolantie, South Ethiopia.

▶ To determine intensity of geohelminth and *S. mansoni* infections among school children in Umolantie, South Ethiopia.

▶ To assess associated risk factors of geohelminth and *S. mansoni* infections among school children in Umolantie, South Ethiopia.

5. MATERIALS AND METHODS

5.1. Study design

A cross-sectional study was conducted among school children. At the time of the study school children were asked to complete questionnaires prepared based on common risk factors of intestinal helminthic infection. They were also provided with a piece of plastic to bring stool and stool samples were processed with Kato Katz technique and the slides were screened for any intestinal helminth.

5.2. Study area and period

This cross-sectional study was conducted among 405 school children in Umolantie village; Mirab Abaya woreda, South Ethiopia. The district is located about 491 km from Addis Ababa. It is situated in Gamogofa zone (SNNPR) between two nearby towns named: Arbaminch and Mirab Abaya. It is one of the 23 rural kebeles. There are 860 households with population of approximately 5079 and a male to female ratio of 1:1.02. The cash crops like Mango and Banana are the main source of income.

The latrine coverage is 100%. Regarding water supply, there were six water schemes until 2008 which are no more functional since the year. Pipe water transported through carts from Lantie (the nearby district) is the only water source for drinking and cooking. The district has a small stream, Basso that passes near the school and finally joins Lake Abaya. This may predispose the children to water-borne diseases during swimming, washing, playing, and etc.

There is only one health station and two private clinics and one full cycle primary school (1-8), with 31 sections, 13 of them in the first cycle (1-4) and the rest 5-8. There is no water supply in the school. The research was conducted at the Umolantie primary School from Nov-Jan 2010. At the time of the survey attendance at the school was 2,110(973 females and 1137 males.

5.3. Population

5.3.1 Source and Study population

The school attendance at the time of the study was 2110 in Umolantie primary school and all school children in that school were used as source population from which the sample was drawn using systematic random sampling technique.

5.4 Inclusion and Exclusion Criteria

5.4.1 Inclusion criteria

School children who can pass stool at the time stool sample collection were eligible.

5.4.2. Exclusion criteria

School children who were on antihelminthic therapy and/ or taking antimalaria drugs like Arthemetr Lumaphentrene (AL) during the study period or those who took these medications within 2 weeks period were excluded from the study.

5.5. Sample size and Sampling procedure

The sample children were selected using systematic random sampling techniques by using class rosters as the sample frame. Samples were then drawn proportionally from each grade and each class room. Sample size was determined using a general formula $\underline{\mathbf{(Z\alpha/_2)^2 p(1-p)}}$

$$\mathbf{d^2}$$

considering the level of significances at 5% and assuming the prevalence of intestinal helminthiasis to be 60% (Woldemichael et al., 1999). In line with it, 405 school children for the sample were calculated including the 10% contingency.

5.6. Variables

5.6.1. Independent variables
- ▶ Play habits of the children
- ▶ shoe wearing habits
- ▶ finger nail status
- ▶ hand washing habits
- ▶ Swimming habits
- ▶ Bathing habits
- ▶ Age
- ▶ Sex
- ▶ etc.

5.6.2. Dependent variables
- ▶ Prevalence of geohelminth and *S. mansoni* infection.
- ▶ Intensity of geohelminth and *S. mansoni* infection.

5.7. Data collection and Management

5.7.1. Data collection

5.7.1.1. Questionnaire

A pre-tested questionnaire based on known risk factors was developed and modified. To ensure reliable information, the children were interviewed in their mother tongues. The interview included information such as age, sex, source of drinking water, existence of latrines in their homes, and yes or no choice questions for domestic activities in the nearby stream such as swimming, bathing and dishwashing etc and their habits of latrine usage. At the time of conversation, finger nail status and foot wears were also inspected. At the end of the day all the questionnaires were checked for completeness.

5.7.1.2. Parasitological Examination

Students were supplied with a piece of plastic to bring about 3gms of faeces. Specimens were collected on-the-spot. In the field, the 405 samples were processed by Kato thick smear, examined with 10x objective then confirmed with 40x objective. One slide was prepared for each sample and examined once by well trained expertise. Quantification of egg load for evaluation of intensity of infection was performed at Addis Ababa University, Department of Microbiology, and Immunology and Parasitology Core laboratory.

Intensity of infection was estimated from the number of eggs per gram of faeces (epg). Based on egg counts, cut-off values for classification of intensity of infection were used. Intensity of *S. mansoni* is classified into: light infection (1-99epg), moderate (100-399 epg) and heavy (greater than 400 epg). Similarly, the classification for *A. lumbricoides* is: light infection (1-4999epg), moderate (5000-49999epg) and heavy (greater than 50,000epg). Intensity of *T. trichiura* is: light infection (1-999epg), moderate (1000-9999 epg) and heavy (greater than 10,000epg). Classification of hookworm is: light infection (1-1999epg), moderate (2000-3999 epg) and heavy (greater than 4,000epg) (Endriss *et al., 2005).*

5.7.2. Data management and quality control

Standard Operating procedure (SOP) was sternly followed during the course of preparation and examination of Kato thick smears.

5.8. Data processing and analysis

Data were entered into a computer and analyzed using SPSS windows version 16.0. Association of risk factors with infection with intestinal parasites was analysed using binary logistic regression. Descriptive statistics was also used. P-value less than 0.05 was considered as statistically significant.

5.9 Ethical clearance

Ethical clearance to conduct the research was sought from Department of Microbiology, Immunology and Parasitology and Institutional Review Board of Faculty of Medicine, Addis Ababa University via submission of the study protocol before the study commences. Prior to the study survey, the objectives of the study were clearly discussed with the school community. Written informed consent was obtained from the parents and teachers of the students before stool samples collection.

6. Results

6.1. Socio demography of study subjects

A systematic random sampling technique was applied to determine the prevalence of geohelminths and S. *mansoni* among Umo Lante Primary school children, Mirab Abaya Woreda, South Ethiopia. Four hundred five school children were included in the study. Females constitute 47.9 percent of the study subjects, giving a sex ratio of 1.09. The age composition of the study participants ranged from 5-18 years. The mean (sd) age of the participants was 11.2(3.4).

Table **1.** Age and sex composition of the study subjects among Umolantie primary school children, South Ethiopia, Nov-Dec, 2010.

Sex	Age in years			
	5-9	**10-14**	**≥15**	**Total**
Male	65	102	44	211(52.1%)
Female	64	105	25	194(47.9)
Total	129(31.9%)	207(51.1%)	69(17%)	405(100%)

6.2. Prevalence of Parasites

A total of 6 parasite species were identified, namely, *S. mansoni*, Hook worm species, Taenia species, *E. vermicularis*, *T. trichuria* and *A. lumbricodes*. Among the 405 study participants 109(26.9%) of them harboured at least one helminth species, out of which hookworms and S. *mansoni* account for 14.6% and 12.6% respectively which is the highest followed by Taenia spp,*T. trichuria*(1.5%) and *E. vermicularis*(1%). *A. lumbricoides* was the least prevalent helminth (0.5%).

A total of 18(4.4%) confections were found, hookworm-S. *mansoni* co-infection being the highest 13(3.2%) and the rest five coinfections constituted S. *mansoni*-Taenia *spp*.(0.2%),hook worm-T. *trichuria* (0.2%),T. *trichuria*-taenia *spp*(0.2%),T. *trichuria*- E. *vermicularis* (0.2%).

The highest parasite prevalence was reported among the age group of 10-14 years old subjects (31.4%) followed by the age groups ≥15(27.5%) and 5-9(19.4%).

However, the difference was not significant. The overall prevalence was slightly higher among boys than girls (27.5% vs. 26.3%).

Schistosoma mansoni infection was significantly higher in males [p = 0.006, OR 2.5, CI 1.3-2.5], while hook worm infection was significantly higher among females [p= 0.015]. Even though statistically insignificant, an infection from *taenia spp*. was higher among boys whereas trichuriasis and entrobiasis were a bit higher in females. A. lumbricoides showed no gender difference in prevalence [p>0.05].

Table **2**. Prevalence of single and multiple helminth infection by sex of 405 school children in Umolantie, South Ethiopia, 2010.

Parasite species	Sex			
	Male (n=211)	Female (n=194)	Total (n=405)	P-value[*]
Any single infection	58(27.5%)	51(26.3%)	109(26.9%)	0.77
Hookworm only	17(8.1%)	28(14.4%)	45(11.1%)	0.015
S. *mansoni* only	30(14.2%)	6(3.1%)	36(8.9%)	0.006
Taenia *sp*.only	3(1.4%)	1(0.5%)	4(1%)	0.38
E. *vermicularis* only	_	3(1.5%)	3(0.7%)	0.96
T.*trichuria* only	_	2(1%)	2(0.5%)	0.95
A. lumbricoides only	1(0.5%)	1(0.5%)	2(0.5%)	0.87
Any double infection	7(3.3%)	11(5.7%)	18(4.4%)	0.26
Hookworm and S. *mansoni*	5(2.4%)	8(4.1%)	13(3.2%)	0.32
S. *mansoni* and T.*trichuria*	_	1(0.5%)	1(0.2%)	0.99
S. *mansoni* and Taenia *sp*.	1(0.5%)	_	1(0.2%)	0.99
Hook worm and T. *Trichuria*	_	1 (0.5%)	1(0.2%)	0.99
E. *vermicularis* and T. *trichuria*	_	1 (0.5%)	1(0.2%)	0.99
Taenia *sp*. and T.*trichuria*	1 (0.5%)	_	1(0.2%)	0.99

*Binary logistic regression was used to calculate p- value.

The prevalence of each helminth was statistically similar for all age groups ($P > 0.05$). Among the infected school children, 18(4.4%) had double infections. The prevalence of double infections among males (3.3%) and females (5.7%) were statistically similar ($P > 0.05$). For double infections, S. *mansoni* + hookworm combination had the highest prevalence13 (3.2%).

All of the intensities of helminthic infections except S. *mansoni* were light. All T. *trichuria* infections were light. Two moderate infections of E. *vermicularis* and only one case of *A. lumbricoides* infection were found to be moderate.

Table **3**. Prevalence of single and multiple helminth infection among different age groups of 405 school children in Umolantie, South Ethiopia, 2010.

Parasite species	Age groups (years)			p-value
	5–9 (n=129)	10–14(n=207)	15+ (n=69)	
Any single infection	25(19.4%)	65(31.4%)	19(27.5%)	0.10
Hookworm only	14(10.9%)	26(10.6%)	9(13%)	0.70
S. *mansoni* only	**2(1.6%)**	28(13.5%)	6(8.7%)	0.02
Taenia *sp*.only		4(1.9%)	_	0.66
E. *vermicularis* only	2(1.6%)	1(0.5%)	_	0.22
T.*trichuria* only	2(1.6%)	_	_	0.99
A. lumbricoides only	_	2(1%)	_	0.76
Any double infection	5(3.9%)	9(4.3%)	4(5.8%)	0.56
Hookworm and S. *mansoni*	4(3.1%)	8(3.9%)	1(1.4%)	0.66
S. *mansoni* and T.*trichuria*	_	1(0.5%)	_	0.83
S. *mansoni* and Taenia *sp*.	_	_	1(1.4%)	0.12
Hook worm and T. *Trichuria*	1(0.8%)	_	_	0.90
E. *vermicularis* and T. *trichuria*	_	_	1(1.4%)	0.95
Taenia *sp*. and T.*trichuria*	_	_	1(1.4%)	0.97

*Binary logistic regression was used to calculate p- value.
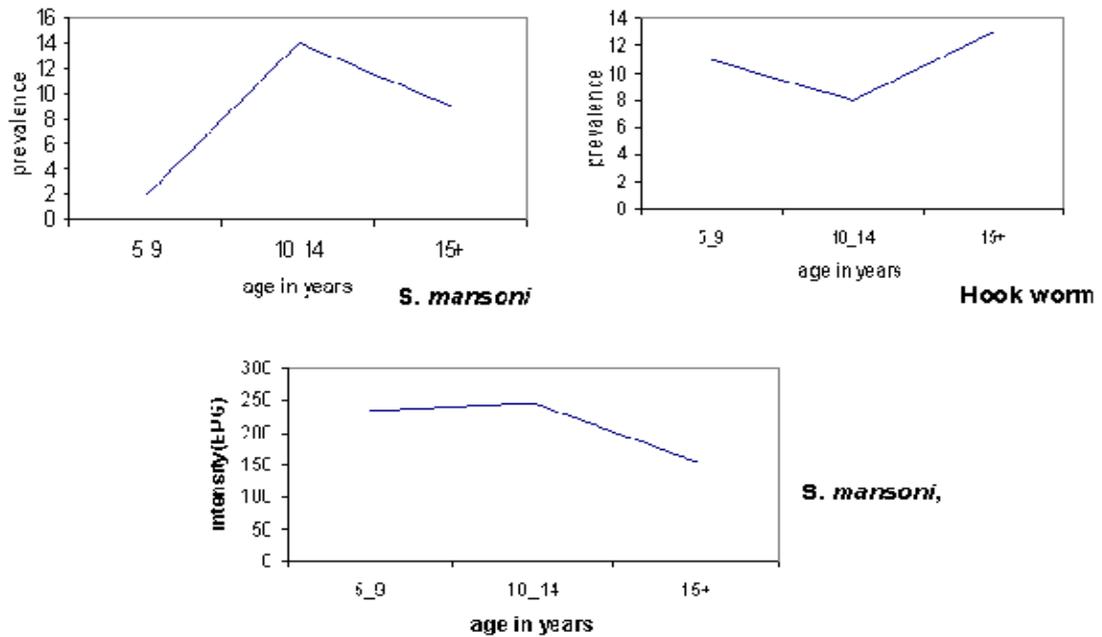
Figure **1**. Age-prevalence and-intensity curves for helminth infection among 405 school children, Umolantie primary school, South Ethiopia.

As shown in figure **2** above Prevalence of hookworm infection showed decline until the age group 10-14 and rose thereafter. Prevalence of S. *mansoni* infection also rose with age until the 10–14 years age group and declined thereafter. Intensity of S. *mansoni* infection peaked in the 10–14 years age group and declined thereafter.

6.2.1. Prevalence and Intensity of *S. mansoni* Infection

The overall prevalence of *S. mansoni* infection was 12.6% (51/405) with stool egg load ranging from 24–960 per gram of stool. *S. mansoni* infections were predominantly light; 70.5% % light (<100 eggs/gm of stool), 21.6 % moderate (100–400 eggs/gm of stool) and 7.8% heavy infections (>400 egg/gm of stool). The highest prevalence was reported in the age group 10–14 years (17.8%) followed by the age groups +15(11.6%) and 5-9 (4.7%) and the difference was statistically significant (P=0.02). Geometric mean intensity was also highest in age group 10–14 years (245 epg).

The overall prevalence of infection was 7.7% for girls and 17.1% for boys. The difference was statistically significant (p=0.006). The mean intensity of infection was also higher in boys (239 eggs/gm) compared to girls (184eggs/gm).

As illustrated in figure **2** above, the prevalence rates were higher in the 10-14 age groups. The overall infection rates were 4.7%, 17.8% and 11.6% in the 5-9, 10-14 and +15 age groups, respectively. In the male subjects, the intensities of infection were 248, 280 and 188 eggs per gram of stool, respectively in the 5-9, 10- 14 and +15 age groups. In the female subjects, infection intensities of 222 and 209 eggs per gram of stool were recorded for 5-9 and 10- 14 age groups respectively.

Table **4**. Prevalence and intensity of S. *mansoni* infection among 405 school children of Umolantie, South Ethiopia, 2010.

Age (Years)	No. (%) Males		No. (%) females		No. (%) overall		(Mean ± SD)intensity(EPG)	
	Examined	Positives	Examined	Positives	Examined	Positives	Males	females
5-9	65	2(3.1)	64	4(6.3)	129	6(4.7)	248(108)	222(96)
10-14	102	26(25.5)	105	11(10.5)	207	37(17.9)	280(73)	209(57)
+15	44	8(18.2)	25	0(0)	69	8(11.6)	188(132)	0(0)
Total	211	36(17.1)	194	15(7.7)	405	51(12.6)	239(126)	184(103)
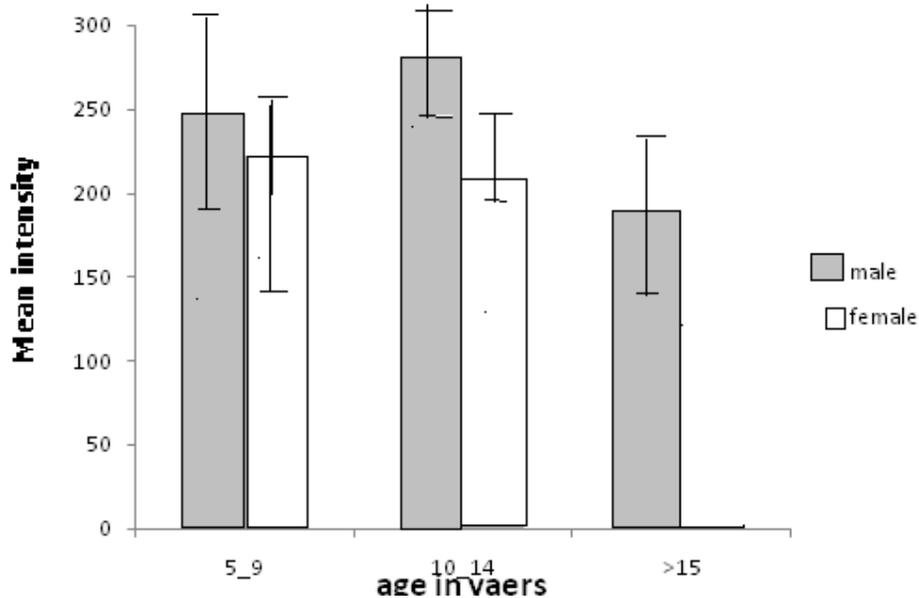
Figure **2**. Mean intensity of infection of S. *mansoni* infection by age and Sex among 405 school children in Umolantie, South Ethiopia. The column indicates geometric mean intensity of infection and vertical bars indicate standard deviation.

6.2.2. Local risk factors of geohelminth and *S. mansoni* infection

Streams are potential sources of schistosome infection. Domestic activities accounted for the majority of reported water contacts. 64.3% of subjects interviewed reported that they bathed in the stream. Similarly, about 60% of the respondents came into contact with water as the result of cloth and dishwashing. Although only 15% of the respondents swam or played in the stream, these activities exposed a large body area to the water. About 77% of the respondents reported that water for drinking and cooking was collected exclusively from pipes and the rest collected it from both pipe and stream.

This study showed that more boys than girls had water contact habits as regards bathing, swimming and cloth and dishwashing in the nearby stream (Baso). Thus, out of the 261 subjects who reported that they bathed in the stream, boys accounted for 65%. With regard to swimming, the male sex accounted for 85%. Nearly equal proportion of both sexes reported that they came into contact with stream water while washing clothes and dishes.

22
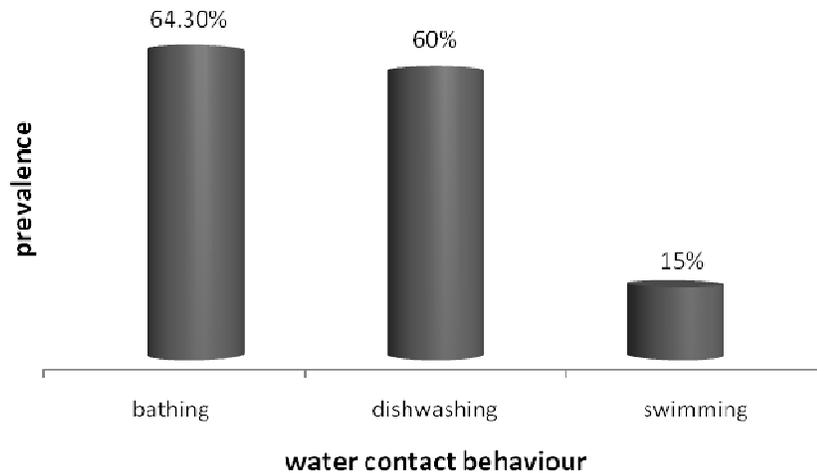
Figure **3**. Water-contact Behaviours among 405 school children of Umolantie, South Ethiopia, 2010.

As shown in table **5** below, logistic regression results pointed out significant association between S. *mansoni* infection and bathing in the stream (OR 3.4, 95.0%C.I.for OR 1.5-7.3, P=0.03).Higher risks of infection were also showed for water contacts during swimming and dishwashing even though the difference was not significant [p > 0.05).

The study also revealed that subjects mostly affected with *S. mansoni* were those who drunk both pipe and stream water (20%) (table **6**) compared to those who exclusively drunk pipe water. Among those who exclusively use pipe water for drinking and cooking 10% of S. *mansoni* infection was found (OR=0.5, 95.0%C.I.for OR, P-value 0.11).

All the (100%) of the students' households had latrines, and 85% of them used their latrines, the rest 13.3% sometimes defecated in open fields and the remaining 2.5% defecate under bushes. The pit latrines found in the school compound were not clean and were not used properly. Three hundred five (75.3%) of the children regularly practiced hand washing before meals. Three hundred twenty three (79.6 %) trimmed their fingernails.

Table **5**. Prevalence of S. *mansoni* by domestic activities in the nearby stream among Umolantie primary school children, South Ethiopia.Nov-Dec 2010.

Risk factors		S. *mansoni*		OR(95.0%C.I.for OR)	p-value*
		Positive	Negative		
Swimming	yes	10	52	1.4(0.67-3.0)	0.36
	no	41	302		
Bathing	yes	43	218	3.4(1.5-5.3)	0.03
	no	8	136		
Washing clothes and utensils	yes	34	210	1.4(0.74-2.5)	0.32
	No	17	144		
Water source	pipe	31	274	0.5(0.23-0.84)	0.11
	Pipe + stream	20	80	1.00	

*Binary logistic regression was used to calculate the OR, CI and p- value.

Analyses of local risk factors for the dominant parasite showed a higher rate of E. *vermicularis* infection among children who didn't wash their hands regularly before meals. Similarly the prevalence of E. *vermicularis* was higher among children who didn't trim their finger nails. The difference was not significant (p>0.05). The prevalence of other helminths among children who washed their hands regularly and trimmed their fingers was not different from children who didn't (p>0.05). Higher rate of intestinal helminth infection was found among children who did not use their latrines [p>0.05].

Two hundred eighty five (70.4%) of the children had shoes that gave full protection. The difference in the prevalence rate of hookworm infection between those with and without fully protective shoes was not statistically significant (p>0.05).

Table **6**. Prevalence of intestinal helminthic infections by local risk factors among school children in Umolantie, South Ethiopia.Nov-Dec 2010.

		Intestinal helminthic infection		OR(95.0%C.I.for OR)	p-value*
		Positive	Negative		
	Not at all(n=10)	3(30%)	7(70%)	1.29(0.71-2.32)	0.41
Latrine usage habit	some times(n=54)	12(22.2%)	42(77.8%)		
	Always (n=341)	94(27.6%)	247(72.4%)		
Hand washing before meal	Yes	86	220	1.02(0.75-1.41)	0.87
	No	23	76		
Trimmed Finger nail	Yes	92	213	1.2(0.78-1.52)	0.72
	No	17	83		
Protective Shoe	Present	38	241	0.62(0.32-1.19)	0.16
	Absent	21	105		

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7. Discussion

Epidemiological study on the prevalence of infection of intestinal parasites in different regions/localities is a primary objective to identify high-risk communities and formulate appropriate intervention (Brooker *et al., 2000*). In line with this view, the present study attempted to assess the prevalence of different intestinal helminthic infections in schoolchildren in Umolantie Primary school, South Ethiopia. The results of the study showed the occurrence of several intestinal helminths of public health importance among the schoolchildren.

The overall prevalence of geohelminths and *S. mansoni* infection was 26.9% in this study. This was comparable with findings from Tigray region and Eastern Ethiopia, which revealed overall prevalence of 28.6% and 27.2% respectively (Tadesse and Tsehaye, 2008**,** Girum, 2005).Still, this result was higher than reports from Kenya (Mutuku *et al., 2008;* Brooker *et al.,2000*) and Sudan (Magambo *et al., 1998*) that revealed prevalence of 12.9% and 12.3% respectively. However it was much lower than a report from the previous study in the same area (Woldemichael *et al*.,1999),South west Ethiopia(Fekadu *et al.,2008*),Lake Langano area (Mengistu and Berhanu,2004) that showed prevalence of 60%,70.2%,92.7%,83.3% and 91.6% respectively. Higher prevalence of intestinal helminthic infections than the present study were also reported from Saint Lucia (island from Eastern Carribian sea) (52.2%), Nepal (40%) and South east Nigeria (42.2%) (Rajini, 2010, Basista *et al., 2001***,** Olufemi *et al*., 2007).

The differences in findings among the studies can be explained by variations in geography, socio-economic conditions, and hygienic conditions of the population under consideration. The category of the study population, the methods employed for stool examination, and the time of study may also have contributed to the differences.

In the present study, hookworm was found to be the dominant STH (14.6%) consistent with previous study in this area and preponderance of hook worm infection could be attributed mainly to the sustainability of microclimate, soil type and humid environment favourable for

parasite development (Woldemichael *et al*., 1999).Studies by (Girum, 2004) used the same Kato thick technique but reported lower rates of hookworm infection (6.7%).

Higher rates of infection with hook worm than the present study were reported near lake Awassa (62.5%), Langano (64.7%) and South west Ethiopia (40.8%) (Merid *et al*., 2001; Mengistu and Berhanu, 2004; Fekadu *et al., 2008)*.

In the present study hook worm infection was significantly higher in girls (19.5%) compared to boys (10.2%). Similar results consistent with lower prevalence of hook worm infection in males were reported by (Girum,2005. and Basista *et al*., 2001).Contrary to this result, higher prevalence of hook worm was recorded for boys in southwest Ethiopia (Fekadu *et al.,2008*).

The overall prevalence of infections from taenia *sp*.and *T. trichuria* (1.5%), *E. vermicularis* (1%) and   *A. Lumbricoides* (0.5) were low. Comparably low prevalence of *T. trichuia was* reported in several other studies. (Basista *et al*., 2001, Fiona *et al***.,** 2006**,** Ogwurike *et al***.,** 2010**,** Magambo *et al*., 1998).Similarly, the present study showed low infection rate of *E. vermicularis*. This lower prevalence has also been found from other studies (Rajini, 2010, Olufemi *et al*., 2007, Fiona et al., 2006).

The finding that intestinal helminthic infections are more prevalent in the age groups 10-14 years in the study area is an indication that younger children are more exposed since they usually play in the open fields (Tadesse and Tsehaye, 2008) and they frequently involve themselves fully in activities that bring them in contact with the source of infection (Okpala *et al.,* 2004) and is consistent with the findings reported from Eastern Ethiopia (Girum, 2005).

Findings from Saint Lucia also showed the highest infection rate among the age groups 5-14 (Rajini, 2010).Results from rural Brazil also confirmed infection rates peaked in the age groups 11-15 (Fiona *et al***.,** 2006).Contrary to this finding, intestinal helminthic infections were found to be higher among the age groups 0-5 years from Jos North Local Government Area of Plateau State, Nigeria (Ogwurike *et al*.**,** 2010).

The prevalence of *S. mansoni* infection in this study was 12.6%, which indicated higher prevalence than the previous report in this area (Woldemichael *et al*., 1999). Reports by Shewakena (1995) and Fiona *et al***.,** (2006) also revealed higher prevalences. However it was higher than findings from Eastern Ethiopia (Girum, 2005), Sudan (Magambo et al., 1998) and

Nigeria (Okpala *et al.,* 2004).This difference in prevalence may be ascribed to altitude difference, availability of streams/rivers, ponds and playing habits of school children.

This study also revealed that *S. mansoni* infections were predominantly light with 70.5% light, 21.6% moderate and 7.8% heavy infections consistent with findings by Rubaihayo *et al*., (2008) from Uganda that showed 62.7%, 27.4% and 9.8% light, moderate and heavy infections respectively.

The prevalence of infection was 7.7% for girls and 17.1% for boys and the difference was statistically significant ($p<0.05$) and is consistent with the previous study in the same area (Woldemichael *et al*., 1999). In this study, mean intensity of infection was also higher in boys (239 eggs/gm) compared to girls (184 eggs/gm) consistent with findings by Mengistu and Berhanu (2004), Girum (2005) and Okpala *et al*.,(2004) that connoted higher infection rates and infection intensities in boys. The existence of more outdoor activities among boys than girls could be one of the reasons for this finding. This observation is supported by the fact that few of the girls had any history of playing or swimming in local water sources.

In the present study the highest prevalence and intensity of S. *mansoni* infection was found in the age group 10–14 years. Findings consistent with this result were reported from Nigeria Ogwurike *et al*., 2010) and Jiga (Shewakena, 1995) in which the age group 10-14 years were more affected. (Findings from Ghana also revealed the highest prevalence of infection in the age groups 6-11 and 12-17 years (Nkegbe, 2001). However, findings from a study conducted in Uganda disclosed the highest geometric mean intensity of *S. mansoni* infection in the age group 9-11(Rubaihayo *et al., .*2008).

8. Conclusion

➢ Geohelminth and S. mansoni infection was high in Umolantie primary school.

➢ Male sex and bathing in the stream were strongly associated with S. mansoni infection where as hook worm infection was significantly higher in girls.

➢ The highest parasite prevalence was reported among the age group of 10-14 years old.

➢ This study showed that more boys than girls had water contact habits as regards bathing, swimming and cloth and dishwashing in the nearby stream.

9. Recommendation

According to the present stud intestinal helminthic infections were higher so the community should be provide with safe water for drinking and cooking The community in general and children in particular should uphold awareness about the main routes of transmission of intestinal helminthes which is the basis for controlling them.

The study also signified that *S. mansoni* was associated with water contact behaviours of School children so they should avoid or at least minimize water contact habits in the nearby stream and regular shoe wearing habits should be developed.

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11.1. Laboratory procedure

Examination of faeces for helminth eggs- Kato-Katz technique

In the Kato-Katz technique faeces 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 (approx. 41.7 mg depending on size of template) is covered with a piece of cellophane soaked in glycerol (glycerine). The glycerol 'clears' the faecal material from around the eggs. The eggs are then counted and the number calculated per gram (g) of faeces.

a. Materials:

- Kato-set (Template with hole, screen, nylon or plastic, plastic spatula)
- Newspaper or glazed tile
- Microscope slides
- Cellophane as cover slip, soaked in Glycerol-malachite green solution
- Fresh stool
- Gloves

b. Procedure

1. Place a small amount of faecal material on the newspaper or plastic.

2. Press the screen on top so that some of the faeces filters through and scrape with the flat spatula across the upper surface to collect the filtered faeces.

3. Add the collected faeces in the hole of the template so that it is completely filled.

4. Remove the template carefully so that the cylinder of faeces is left on the slide.

5. Cover the faecal material with the pre-soaked cellophane strip.

6. Invert the microscope slide and firmly press the faecal sample against the cellophane strip on a smooth hard surface such as a tile. The material will be spread evenly.

7. Carefully remove the slide by gently sliding it sideways to avoid separating the cellophane strip. Place the slide with the cellophane upwards.

❖ The smear should be examined in a systematic manner and the eggs of each species reported based on cut-off values for classification of intensity of infection.

	Light	Moderate	Heavy
S. *mansoni*	1-99	100-399	>400
A. *lumbricoides*	1-4999	5000-49,999	>50,000
T. *trichuria*	1-999	1000-9999	>10,000
Hook worm *sp*.	1-1999	2000-3999	>4,000

11.2. Research subject information sheet and consent form

Title of the Research Project: The prevalence geohelminth and *S. msnsoni* infections and associated risk factors among school children in Umolantie, a rural locality, South Ethiopia.

Name of Investigator: Megbaru Alemu

Name of the Organization: Addis Ababa University, School of Medicine, Department of Microbiology, Immunology and Parasitology.

1. Introduction

We are planning to conduct a research among school children in Umolantie primary school. This study will be done by a research group which includes one principal investigator, laboratory professionals and advisors. If you agree to participate in the study you will be asked to give stool sample and giving stool samples does not cause any known harm. The results of stool examination will be kept confidential and you participation is purely voluntary and you can withdraw any time after you get involved in the study.

2. For participation as volunteer in research undertaking.

I am a post graduate student from the Faculty of Medicine, Addis Ababa University. I am here to study the current status of geohelminth and *S. mansoni* infection. I am requesting your child to participate in this study which would require his /her response to an interview on some related issues and providing his/her stool sample. The information that he/she provide during the interview and the results of the laboratory investigation would be kept confidential. The laboratory findings would be used to initiate appropriate treatment for the said infections of your child. The study findings would also be used to design and implement control strategies in the study area in the future.

Potential Risks and Discomforts

There are no expected risks to your participation.

Prospective benefits to subjects and/or to the society

The objective of this study is to determine the prevalence and associated factors of intestinal helminth infection. The laboratory findings would be used to initiate appropriate treatment for the said infections of your child. The study findings would also be used to design and implement control strategies in the study area in the future.

Payment /compensation for participation

You will not be payed for participating in the study.

If you have understood the explanation well enough, I am requesting you to your signature as illustrated below. I, the, undersigned have been informed about the study objectives. I have also been informed that all the information within the questionnaire is to be kept confidential and that I have the right to decline from or to cooperate in the study. Therefore, with full understanding of the study objective I agree to give the informed consent voluntarily to the researcher to identify the parasites from my child's stool specimen.

Name _____Signature_____Date_____

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Person to contact

1. **Megbaru Alemu (BSc,MSc candidate**): Department of Medical Microbiology, Immunology and parasitology, Faculity of Medicine,Addis Ababa University

E.mail: mgbeyney@gmail.com, amigbaru@yahoo.com

 Cell phone +251912492539

2. **Asrat Hailu (prof. PHD):** Addis Ababa University,faculty of medicine, department of microbiology,immunology and parasitology

E-mail: hailua_2000@yahoo.com

Cell phone: +251911480993

3. **Mr. Nigus Fikrie (BSc, MSc, PhD fellow):** Addis Ababa University,faculty of medicine, department of microbiology,immunology and parasitology

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Cell phone: +2519 11 66 37 28

11.3. Questionnaire

Department of Microbiology, Immunology and Parasitology Addis Ababa University Medical Faculty.

I. Subject code

1.Nameof school----------------------------

2. Name of the student-----------------------------

3. Grade /section of student-----------------------

4. Age---

5. Sex---

6. Religion--------------------------------------

II.Information on Risk Factors

7. Do you fish?	yes	No	
8. Do you swim?	yes No.	No	
9. Do you wash clothes and utensils in the stream?	yes No.	No	
10. Where do you bath?	Stream	Home	others (specify
11. Sources of water for drinking and cooking	Pipe water	Stream	Others
12. How often you use latrine?	Sometimes .	Always	not at all
13. Do you wash your hands before meal?	yes	No.	
14. Do you eat raw meat?	yes	No.	
15. How often do you wear shoe?	Always	Sometimes	Not at all.
16. Do you take any antiparasitic drug for the last 6 months?	Yes	No	

Information-at-spot

17. Finger nail status	trimmed	Not trimmed.

I.□□□□□□ □□□□ □□□

1. /   ------------------------------------
2.   -------------------------------
3.   /   /   -------------
4.   ---
5.   ---
6.   ------------------------------------
II.
7.   ?
8.   ?
9.   ?
10.   ?
11.
                                      ?

12.   ?   -

13.
        ?
14.   ?
15.   -
            /   ?
16.   6   -
                ?
17.

Name of the interviewer _____

Signature   _____

Date   _____

Checked by investigator _____

Signature   _____

11.4. Laboratory Data

1. Results of stool examination

Schistosoma mansoni eggs/ slide_____ eggs/gram _____

Ascaris lumbricoides eggs/slide_____ eggs/gram_____

Trichuris trichiura eggs/slide_____ eggs/gram_____

Hookworm eggs/slide   _____eggs/gram_____

Others_____, _____, _____

11.5. Assessment of School Environment Form

1. Name of School _____

2. Date   _____

3. Availability of water in school yes   No

 4. Type of water source _____

5. Availability of latrines in school yes   No

Declaration

I the undersigned declare that, this M.Sc. thesis is my own original work and has not been presented for a degree in any other University, and that all sources of materials used for the thesis work have been accordingly acknowledged.

Investigator:

Megbaru Alemu

Signature   _____

Date   _____

Addia Ababa, Ethiopia   _____

Advisors:

Professor Asrat Hailu

Signature   _____

Date   _____

Addia Ababa, Ethiopia   _____

Mr. Nigus Fikrie

Signature   _____

Date   _____

Addia Ababa, Ethiopia   _____