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Research Article

Prevalence, Intensity of Infection and Associated Risk Factors for Schistosoma mansoni and Soil Transmitted Helminthes among Two Primary School Children at nearby Rivers in Jimma Town, South West Ethiopia

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- Risk factors
- Jimma town
- Ethiopia

Abstract

Background: Intestinal Schistosomiasis and Soil transmitted helminthes infections are among the major public health problems especially in Sub-Saharan African countries including Ethiopia. However, little is known about the distribution of these infections in area where there is risk factors for infection, especially schools at nearby rivers. Therefore objective of this study is to determine the prevalence, infection intensity and associated risk factors among two primary school children at nearby rivers of Jimma town.

Methods: A cross-sectional study was conducted among two primary school children aged from 6 to 19 years in Jimma town from March to April/15 2016. For diagnosis of *Schistosoma mansoni (S. mansoni)* and soil transmitted helminthes (STHs), a single stool sample was obtained from each child and processed using single Kato Katz and examined using light microscope. A questionnaire was used to collect demographic information of the school children participated in the study and variables used for risk factors assessments. Data were analyzed using SPSS version 20.0 and variables with *P*-value < 0.05 were considered as significantly associated with *S. mansoni* and STHs infections.

Results: The overall prevalence of intestinal helminthes infection with S. *mansoni* and STHs was 50.64 %(118/233). The prevalence of *S. mansoni* among school children of the two primary schools was 26.6 %(62/233) with the prevalence of 29.2% in males and 23.3% in females. The prevalence of *T. trichuira*, *A. lumbricoides* and hookworms among the school children in Jimma town was 22.3%, 20.2% and 3.4% respectively. Majority of the infection intensity for both *S. mansoni* and STHs were classified as low.

Water contact habits has significantly associated with *S. mansoni* infection where as finger trimming status, frequency of handing washing habit before meal and after toilet were significantly associated with, *A. lumbricoides* and *T. trichuira* infections (P < 0.05).

Conclusion: The prevalence of intestinal helminthes infection with S. *mansoni* and STHs were 50.64 %; with the prevalence of *S. mansoni*, *T. trichuira*, *A. lumbricoides* and hookworms were 26.6%, 22.3%, 20.2% and 3.4% among the school children in the two schools. Majority of the infection intensity for both *S. mansoni* and STHs were classified as low. The school children were at moderate risk of infection with *S. mansoni* and STHs based on WHO 2012 prevalence classification in which once a year MDA is required for STHs and biannual MDA for *S. mansoni*. Health information regarding the transmission and prevention of *S. mansoni* and STHs should be given for school age children in the area.

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ABBREVIATIONS

STHs: Soil-Transmitted Helminthes; SSA: Sub Saharan Africa; NTDs: Neglected Tropical Diseases; PC: Preventive Chemotherapy; DALYs: Disability Adjusted Life Years

INTRODUCTION

Intestinal schistosomiasis and STHs are the main medical and public health problems in many parts of the globe. Schistosomiasis remains a serious public health concern in sub-Saharan Africa (SSA) countries and approximately one-third of the 192 million cases of schistosomiasis in the SSA are caused by *S. mansoni*, the causal agent of intestinal schistosomiasis [1].

Schistosomiases and STHs are among the most widely distributed neglected tropical diseases (NTDs) affecting people are living in the tropical and developing countries [2,3].

Schistosomiasis is caused by 6 species of trematodes of the genus *Schistosom*a: *S. guineensis, S. haematobium, S. intercalatum, S. japonicum, S. mansoni* and *S. mekongi*. The predominant causes of disease are *S. haematobium* and *S. mansoni.* Schistosomes are transmitted through contact with fresh water contaminated with human faeces and urine containing parasite eggs; a snail host needs to be present in the water to allow the parasite to complete the life cycle and infect individuals. The disease manifests in intestinal for intestinal schistosomiasis and urogenital for urinary schistosomiasis [4]. Of the 249 million cases of schistosomiasis occurring in 78 endemic countries of the world, 90% (192 million cases) occurs in SSA and an estimated 779 million individuals live in areas potentially risky for the transmission of schistosomiasis [1,5].

The main and most widely distrusted parasitic species of THs that cause human diseases are, *Ascaris lumbricoides (A. lumbricoides)*, *Trichuris trichiura (T. trichuira)*, and the Hookworms (Family Ancylostomatidae) with latest estimates showed a global burden of human infections is more than 2 billons[6]. Infections caused by STHs are transmitted by faecal contamination of the soil, adversely affecting nutritional status and impairing cognitive processes with the global burden of disability adjusted life years (DALYs) of STH is estimated about 5, 266, 000 [7].

The public health intervention recommended by WHO for the control of morbidity associated with schistosomiases and STHs infections in endemic areas is preventive chemotherapy (PC) the periodic administration of the anti-helminthes drugs, praziquantel for schistosomiasis and albendazole or mebendazole for STH based the prevalence of the parasites among school age children in the area [4].

An estimated 160 million school-aged children live in areas co-endemic for schistosomiases and STHs in the World Health Organization (WHO) regions of Africa, the Americas, the Eastern Mediterranean and the Western Pacific. Of those children, 20% were treated with PC, co-administering praziquantel and albendazole or mebendazole, 42% were treated with albendazole or mebendazole only, and 10% were treated with praziquantel only [4].

In addition to the morbidity and mortality associated with intestinal helminthiasis, infections have the consequences of impairing physical growth and development, mental function, verbal ability, and cognitive domain [8,9]. It has been estimated that 400 million infected school-age children are often physically and intellectually compromised by anemia, leading to attention deficits, learning disabilities, school absenteeism and higher dropout rates [10].

Most infections with intestinal parasites occur in poor communities where the biophysical, cultural and environmental factors favor transmission[11]. Low standard of living, poor personal hygiene, unsanitary waste management, unsafe and inadequate water supply are some of the factors that allow intestinal parasites and other communicable diseases to flourish in developing countries. A rapid spread of schistosomiases is associated with water resource development and intensive population movements [12].

Younger children are particularly at higher risk of contracting STHs as they habitually play in faecally contaminated ground and place soiled fingers into their mouth [13]. Moreover, their active involvement in activities that increase an exposure to water bodies put children at increased risk of getting schistosomiasis [14].

There were different reports regarding the prevalence of *S. manosni* and STHs among schoolchildren with variation in difference among these from Kisumu city Western Kenya 34% overall prevalence with one or more intestinal helminthes and 16.2% with one or more STHs species of which 21% of *S. mansoni*, hookworms 6.1%, *A. lumbricoides* 4.9% and *T. trichuira* 7.7% [15], Northwestern Tanazania 84.01% of *S. mansoni*, 1.4% of *A. lumbricoides* and 1.4 hookworms[16] , Lake Victoria Basin of Tanzania 15.1% of *S.mansoni*, 12.6% of hookworms, 3.2% of *A. lumbricoides* and 0.008% of *T. trichuira* [17].

In Ethiopia, like in other developing countries, intestinal helminthes infections with STHs and *S. mansoni* are reported in different parts of Ethiopia.

There is reports 35.2% with single infection and 12.8 %with double intestinal infection from northwest Ethiopia, from this 11.2% with *S. mansoni* ,19.2% *A. lumbricoides*, 2.2 with hookworms and 1.7% with *T. trichuira* [18], 51.5% over all intestinal helminthes infection with STHs 46.4% and *S. mansoni* 7.3% and *A. lumbricoides* 28.8%, hookworms 12.7% and *T. trichuira* 1.0% from Bahir Dar Northwest Ethiopia[19], 66.7% with one or more intestinal helminthes, 39.8% *A. lumbricoides*,6.1% *T. trichuira*, 4.9% hookworms and 33.7% *S. mansoni* from North Gonder, Northwest, Ethiopia[20].

There are also reports from Southern parts of Ethiopia with 85.4% of intestinal helminthic infection from Wolita, with prevalence of *S. mansoni* 81.3%, and STHs 32% [21], 72.2% of intestinal helminthes infection with *S. mansoni* infection 58.6%, *A. lumbricoides* 8.7%, hookworms 27.6%, *T. trichuira* 1.2% southern part of Ethiopia Wolita[22] and 67.3%of any STHs infection with *T. trichuira* 41.5%, 37.2% *A. lumbricoides*, 28.4% with hookworms and 73.7% of *S. mansoni* from Bushullo village Southern Ethiopia [23], 52.4% of STHs infection and 31% *S. mansoni* with 44.4% *A. lumbricoides*, 11% *T. trichuira*,7.7% hookworms [24].

There are also reports from Jimma zone Manna districts of *S. mansoni* 24.0% & 27.6 % [25,26], SigimoJimma Zone with STHs 41.7% with prevalence of *A. lumbricoides* 19.8%, *T. trichuira* 19.8% and hookworms 1.67% [27] and 45.6% of STHs from Jimma Town with prevalence of *A. lumbricoides* 23.6%, *T. trichuira* 23.1 and 9.4% hookworms [28] and 8.4% of *S. mansoni* among school children in Jimma town [29].

In Jimma town there is Awetu River which pass through the town which has near to some schools and the students have contact with this river at different junction while they are crossing. In addition there is Kito river near to Kito elementary school and Kaba river near to SetoYido elementary school and these two schools are found at periphery of Jimma town where most of the waste products from home and town deposited and contaminated the environment near to the schools and contaminate the river and other water sources near these areas. There is also a report of infections with STHs and *S. mansoni* from health center laboratory registration books and majority of the cases was from these two sites and from Jimma Town health office which indicate the presence of these parasites in the town.

Therefore the present study was aimed to assess the prevalence, infection intensity of *S. mansoni* and STHs infection and their associated risk factors at nearby river primary schools in Jimma Town.

METHODS AND MATERIALS

Study area

The study was conducted in Jimma Town, which is located approximately 350 km Southwest of the capital Addis Ababa at a latitude and longitude of 7 ° 40 ′ N 36 ° 50 ′ E and at 1,720 – 2,010 meters above sea level. The area is characterized by a semi-arid type climate with an average annual rainfall of 800 – 2,500 mm. The mean daily temperature is 19 °C, but ranges from 12°C to 30°C. The female/male ratio across the different schools was approximately 1:1 (Report Document 2011/2012 of Jimma Education Bureau).

Study period

The study was conducted from March 15 to April 30/ 2016 in two selected primary schools in Jimma town**.**

Study design

A cross-sectional study was conducted to assess prevalence, infection intensity and risk factors for S*. mansoni* and STHs infections amongtwo selected primary schools in Jimma Town.

Study population

Study populations were all school children enrolled in two selected primary schools in Jimma town during study period. In each school, we stratified students according to three age groups (age 6-9 years, age 10-14 years and age 15-19 years)

Sample size determination and sampling technique

The sample size was determined by using single proportion formula at 95% confidence interval (CI) level (Z (1-ά/2) = 1.96). A prevalence of 82.4% was taken from similar study conducted before [30]. A 5% of marginal error was also taken. Therefore, sample size was calculated as $n = [Z\ 1- \alpha/2]^2\ P\ (1-p)/d^2$. So the calculated sample size was 222 with 5% non-response the final sample size used was 233 school children.

Proportional allocation was given to each school to determine the number of student from each school based on the total number of students in the schools. Then students were selected from each class by simple random sampling technique from school from selected sections using roster as sample frame.

Data collection and processing

Data on socio-demographic characteristics and other related risk factors for *S. mansoni* and STHs infections were collected by using pre-structured questionnaire prepared for the intended study.

The questionnaire was prepared in English and then translated to the local language (Oromifa & Amharic) and checked for fitness. A pre-test was carried out on 10% of the school children that are not included in the study from Amharic shift since the class is given two shift and appropriate corrections were made based the results obtained.

Sample processing and parasitological technique

The stool samples were collected using dry, clean, and labeled plastic containers. Kato-Katz thick smear was prepared from each stool sample for the detection and quantification of the eggs of *S. mansion* and STHs. A single Kato-Katz thick smear was applied to quantify the eggs of *S. mansoni* and STHs and the smear was read after 24hr of preparation except for Hookworm was read with in 1hr of preparation [31].

Data analysis

Data were coded, entered and cleaned by using EPIIFO. The processing and analysis of the data were carried out using SPSS version 20.0. The Prevalence of *S. mansion* and STHs presented in percent, whereas the intensity of S*. mansoni* was classified into low, moderate and high based on the thresholds described by the WHO guidelines (low: 1 EPG ≤ FEC <99 EPG; moderate: 100 EPG ≤ FEC <399 EPG; and high ≥ 400 EPG) [32] and *A. lumbricoides* in to low(1-4999 EPG), moderate (5000- 49,999 EPG) and heavy (>50,000 EPG), *T. trichuira* classified as low(1-999 EPG), moderate(10,000- 9,999 EPG) and heavy (>10,000 EPG), Hookworms classified as low (1-1,999 EPG), Moderate (2000-3,999 EPG) and heavy(>4000 EPG)[6]. In addition, the mean fecal egg counts (FEC; expressed as eggs per gram of stool)

Chi-square was used to assess the association between risk factors for S*. mansoni* and STHs infections and variable with P-value < 0.05 was considered as significantly associated with *S. mansoni* and STHs infections

Data quality assurance

Refreshment training was given for data collectors and laboratory technician about Kato-katz smears by experienced personnel in the field. During data processing, the quality of data was assured by coding and double entry. From both positive and negative Kato-Katz smears, 10% were randomly selected and re-read by two independent medical laboratory experts who are

blind to the primary result. Moreover, fresh working solution of malachite-green was used routinely to maintain the quality of the smear.

RESULTS

Socio-demographic characteristics of study participants

A total of 233 school children were screened from two primary schools in Jimma Town; of which 130 (55.8%) and 103(44.2%) were male and female respectively. Of the total 102 school children were from SetoYido where as 131 were from Kito Primary. The largest number of study participants, 147(63.1%) were from age groups of 10–14 years (Table 1).

Prevalence and intensity of S. mansoni and soil transmitted helminthes infection

The overall prevalence of infection of S. *mansoni* and either of STHs was 50.64 %(118/233). The prevalence of *S. mansoni* among school children of the two primary schools was 26.6 %(62/233) with the prevalence of 29.2% in males and 23.3% in females where as the prevalence of *T. trichuira*, *A. lumbricoides* and hookworms among the school children in Jimma town was 22.3%, 20.2% and 3.4% respectively with the infection intensity of *S. mansoni* and STHs species among school children in Jimma town was classified as low (Table 2).

Co-infection of S. mansoni and STHs

The infection prevalence of *S. mansoni* with A. *lumbricoides*, *T. trichuira* and Hookworms was 21.5 % (50/233) and co-infection of *S. mansoni* with *A. lumbricoides*, *T. trichuira* and Hookworms was 4.3 %(10/233) among school children in Jimma town (Table 3).

Co-infections of other STHs, A. *lumbricoides* with *T. trichuira* and *A. lumbricoides* with Hookworms *were* 11.6 %(27/233) and *2.6* %(6/233) respectively (Table 3).

Assessments of risk factors for S. mansoni and STHs infections

Socio-demographic characteristics such as age, sex and other related risk factors for *S. mansoni* and STHs were analyzed, based on the analysis swimming habits, frequency of swimming, bathing habits in open water bodies and crossing river on bare foot were significantly associated with *S. mansoni* infection where as finger trimming status, frequency of hand washing before meal and after toilet were significantly associated with *A .lumbricoides* and *T. trichuira* infections ($P < 0.05$) (Table 4).

Table 1: Socio-demographic characteristics of School children of two primary schools in Jimma Town, Jimma Zone, Southwest Ethiopia, 2016.

Variables			
Sex	**Frequency**	**Percentage**	**Total**
Male	130	55.8	233
Female	103	44.2	
Age (years)			
6-9	81	34.8	233
10-14	147	63.1	
15-19	5	2.1	
Schools			
SetoYido	102	43.8	233
Kito	131	56.2	

DISCUSSION

In the present study, the overall prevalence with one or more intestinal helminthes infection was 50.64% and the infection prevalence of STHs species was 45.9%. The prevalence of identified species of intestinal helminthes in the present study was 26.6%*S. mansoni*, 22.3% *T. trichuira*, 20.2% *A. lumbricoides* and 3.4% hookworms respectively. Co-infection of *S. mansoni* with either of STHs species and *S. mansoni* with *A. lumbricoides*, *T. trichuira* and hookworms was 21.5% and 4.3% respectively in the study area.

The finding in the present study was lower than the one reported from North Gondar, Northwest Ethiopia, 66.7% prevalence of one or more intestinal helminthes infection with 39.8% *A. lumbricoides*, 33.7 % of *S. mansoni*, hookworms 4.9% and *T.trichuira* lower 6.1 % [20] and *A. lumbricoides* 41.3%, *S. mansoni* 35.8%, hookworms 22.8% [33] and *S. mansoni* 54.3%, *A. lumbricoides* 43.0%, hookworms 23.3% and lower prevalence of *T. trichuira* in both study 16.5% and 11.8% [34]. This difference might be due to difference in geographical location of study area, sample size difference, long endemicity of the parasites in the study area.

The present study is lower than the one reported from Wolita, Southern part of Ethiopia with over prevalence of intestinal helminthes infection 85.4% and less with STHs 32%, 81.3% of *S. mansoni* and the present study is higher compared *A. lumbricoides* 9.6%, *T. trichuira* 4.7% and less with hookworms 13.8%[21]. This difference might due to sample size, geographical location, time of study period.

The present study is lower than study reported from Bushulo village of southern Ethiopia, with overall prevalence STHs 67.3%, *S. mansoni* 73.7%, *T. trichuira* 41.5%, *A. lumbricoides* 37.2%, hookworms 28.4% [23], 89.9% of *S. mansoni*[35], 45% Hayk Town Northwest Ethiopia [36], 72.2% overall prevalence intestinal helminthes, with *S. mansoni* 58.6%, hookworms 27.6% and *A. lumbricoides* 8.7% and *T. trichuira* 1.2% from Wolita Southern Ethiopia[22], infection with one or more helminthes 67.9% and STHs 52.4% with *S. mansoni* 31.0%, *A. lumbricoides* 44.4%, hookworms 7.7% and *T. trichuira* was lower 11.0% from Hawassa southern Ethiopia [24].

The present study is higher than the study reported from Northern parts of Ethiopia with over all prevalence intestinal helminthes 35.2% with *S. mansoni* 11.2%, *A. lumbricoides* 19.2%, hookworms 2.2% and *T. trichuira* 1.7%[18] and 26.9% with overall prevalence intestinal helminthes, *A. lumbricoides* 0.5%, *S. mansoni* 12.6% and higher with hookworms 14.6% from Umolante southern Ethiopia [18]. *S. mansoni* 8.4% Jimma Town [29], 27.6% and 24.0% from Jimma Zone Mana District[25, 26].

The present study is almost comparable with STHs prevalence in Jimma Town 45.6%, with *A. lumbricoides* 23.6%, *T. trichuira*

Table 2: Prevalence and infection intensity of *S. mansoni* and STHs among school children of two primary schools in Jimma Town, Southwest Ethiopia 2016.

Parasites identified	*Male* (N=130)		Female (N=103)		Total (N=233)		X^2	*P-value*
	No	%	No	%	No	(%)		
S. mansoni	38	29.2	24	23.3	62	26.6	1.035	0.309
A. lumbricoides	28	21.5	19	18.5	47	20.2	0.341	0.559
T. trichuira	31	23.9	21	20.4	52	22.3	0.396	.529
Hookworms	3	2.3	5	4.9	8	3.4	1.124	.289
Total	100	76.9	69	67.1	169	72.5		

Infection intensity	*S. mansoni*		*A. lumbricoides*		*T .trichuira*		Hookworms	
	No	%	No	%	No	%	No	%
Negative	171	73.4	184	79.0	181	77.7	225	96.6
Low	46	19.7	42	18.0	47	20.2	5	2.1
Moderate	12	5.2	5	2.1	5	2.1	3	1.3
Heavy	4	1.7	0	0.0	0	0.0	0	0.0
Total positive	62	26.61	47	20.2	52	22.32	8	3.4
Total	233	100	233	100	233	100	233	100

Table 3: Co-infection of S. *mansoni* and STHs among school children of two primary school in Jimma Town, Southwest Ethiopia 2016.

Co-infection of *S. mansoni* and soil-transmitted helminthes		
	No	%
S. mansoni & A. lumbricoides	16	6.9
S. mansoni &T. trichiura	28	12
*S. mansoni &*Hookworms	6	2.6
A. lumbricoides & T. trichiura	27	11.6
A. lumbricoides & Hookworms	6	2.6
*S.mansoni, A .lumricoides, T. trichuira &*Hookworm	10	4.3
Total	93	40

Table 4: Determinants factors potentially associated with *S. mansoni* and STHs infections among school children of two primary schools Jimma town, Southwest, Ethiopia 2016.

Variables		*S. mansoni infection*		Total	X^2	*P*-value
		Positive (%)	Negative (%)			
Age in year	6–9	21(25.9)	60(74.1)	81(34.8)	0.158	0.924
	10–14	40(27.2)	107(72.8)	147(63.1)		
	15–19	1(20.0)	4(80.0)	5(2.2)		
Sex	Male	38(29.2)	92(70.8)	130(55.8)	1.035	0.309
	Female	24(23.3)	79(76.7)	103(44.2)		
Swimming habits	Yes	62(42.6)	0(58.4)	62(26.6)	48.519	0.001
	No	86(2.2)	85(97.8)	171(73.4)		
Frequency of swimming	Always	8(0)	0(100)	8(3.4)	57.376	0.001
	Sometimes	54(42.6)	94(58.4)	148(63.5)		
	Not at all	0(2.2)	77(97.8)	77(33.1)		
Bathing habits	Yes	62(33.3)	0(66.7)	62(26.6)	116.375	0.001
	No	36(1.4)	135(98.6)	171(73.4)		
Crossing river on barefoot	Yes	62(34.3)	0(65.7)	62(26.6)	136.686	0.001
	No	27(1.8)	144(98.2)	171(73.4)		
Positive for A. lumbricoides						
Age in year	6–9	16(19.8)	65(80.2)	81(34.8)	0.14	0.993
	10–14	30(20.4)	117(79.6)	147(63.1)		
	15–19	1(20.0)	4(80.0)	5(2.1)		
Sex	Male	28(21.5)	102(78.5)	130(55.8)	0.341	0.559
	Female	19(18.5)	84(81.6)	103(44.2)		

Availability of latrine	Yes	47(100.0)	0(0.00)	47(20.2)	0.510	0.475
	No	184(98.9)	2(1.1)	186(79.8)		
Finger trimming status	Trimmed	1(2.1)	46(97.9)	47(20.2)	46.306	0.001
	Untrimmed	107(57.5)	79(42.5)	186(79.8)		
Frequency of hand washing before meal	Always	2(4.3)	45(95.7)	47(20.2)	13.412	0.001
	Sometimes	56(30.1)	130(69.9)	186(79.8)		
Frequency of hand washing habit after toilet	Always	2(4.3)	45(95.7)	47(20.2)	10.339	0.001
	Sometimes	48(25.8)	138(74.2)	186(79.8)		
Positive for *T. trichuira*						
Age in year	6–9	24(29.6)	57(70.4)	81(34.8)	4.841	0.089
	10–14	28(19.1)	119(80.9)	147(63.1)		
	15–19	0(0.00)	5(100.0)	5(2.1)		
sex	Male	31(23.8)	99(76.2)	130(55.8)	0.396	0.529
	Female	21(20.4)	82(79.6)	103(44.2)		
Availability of latrine	Yes	52(100)	0(0.00)	52(22.3)	0.580	0.446
	No	179(98.9)	2(1.1)	181(77.7)		
Finger trimming status	Trimmed	4(7.7)	48(92.3)	52(22.3)	40.232	0.001
	Untrimmed	104(57.5)	77(42.5)	181(77.7)		
Frequency of hand washing before meal	Always	7(13.5)	45(86.5)	52(22.3)	4.679	0.031
	Sometimes	51(28.2)	130(71.8)	181(77.7)		
Frequency of hand washing habit after toilet	Always	2(3.8)	50(96.2)	52(22.3)	12.321	0.001
	Sometimes	48(26.5)	133(73.5)	181(77.7)		
Positive for hookworms						
Age in year	6–9	3(3.7)	78(96.3)	81(34.8)	0.196	0.907
	10–14	5(3.4)	142(96.6)	147(63.1)		
	15–19	0(0.00)	5(100.0)	5(2.1)		
Sex	Male	3(2.3)	127(97.7)	130(55.8)	1.124	0.829
	Female	5(4.9)	98(95.1)	103(44.2)		
Shoe wearing habit	Yes	8(100)	0(0.00)	8(3.4)	0.36	0.85
	No	224(99.6)	1(0.4)	225(96.6)		
Frequency of shoe wearing	Always	3(37.5)	5(62.5)	8(3.4)	0.277	0.599
	Sometimes	65(28.9)	160(71.1)	225(96.6)		

23.1% and hookworms higher 9.4% [28] and Jimma Zone Sigimo elementary school with STHs prevalence 41.7% with *A. lumbricoides* 19.8%, *T. trichuira* 15.6% and hookworms 1.67% [27], 51.5% of overall prevalence intestinal helminthes infection and STHs 46.4% with *A. lumbricoides* 28.8%, hookworms 12.7% higher and *S. mansoni* 7.3% and *T. trichuira* 1.0% from Bahir Dar Northwest Ethiopia [19].

The present study higher than the one reported from Lake Victoria basin of Tanzania with prevalence of *S. mansoni* 15.1%, *A. lumbricoides* 3.2%, *T. trichuira* 0.008% and higher prevalence of hookworms 12.6% [17], higher prevalence of *S. mansoni* 84.01% and lower prevalence of *A. lumbricoides* 1.4% and 1.4% hookworms from northwestern Tanzania [16] and 34% with overall prevalence of one or more helminthes, *S. mansoni* 21%, *T. trichuira* 7.7%, *A. lumbricoides* 4.9% and 6.1% hookworms which is a little beat higher from Kisimu City Western Kenya [15].

Majority of the infection intensity in the present study classified as low both for *S. mansoni* and STHs species, which is in line with study reported for STHs from Sigimo elementary school Jimma Zone [27], Mendara elementary school Jimma town [28], Bahir Dar special zone Northwest Ethiopia for *S. mansoni* and STHs [19] , and similar with intensity of infection of *S. mansoni & T. trichuira* from Umolante district, South Ethiopia [37], light infection intensity of *S. mansoni* from Chuahit, Dembia district, Northwest Ethiopia[18], Manna districts Jimma Zone [25].

The present study is different from other studies reported from different area in which the infection intensity was moderate for *A. lumbricoides* reported from Umolante district, South Ethiopia [37], Chuahit, Dembia district, Northwest Ethiopia for *S. mansoni* [18] and Wolita Zone Southern Ethiopia[22] and Rorya District, Northwestern Tanzania[16]. This difference may be due to difference in frequency of contacts with water bodies and infection intensity in the study.

In present study water contact habits like swimming habits, frequency of swimming, bathing habits and crossing river on bare foot were risk factors *S. mansoni* infections which is in line with reports from Manna district Jimma Zone [26], Hawassa, Southern Ethiopia[24], Saja Town, Northwest Ethiopia[35], Demba Girara, Damot Woide District of Wolaita Zone, Southern Ethiopia[21], Zarima town, northwest Ethiopia[30], Umolante district, South Ethiopia [37], Wolaita zone, Southern Ethiopia[22], Northern Gonder, Northwest Ethiopia [20].

Finger trimming status, frequency of handing washing before meal and after toilet were risk factors for *A. lumbricoides* and *T. trichuira* infections which is similar with findings reported from Bahir Dar special Zone Northwest, Ethiopia[19], Hawassa,

Southern Ethiopia [24], University of Gonder community school, Northwest Ethiopia [38], Lake Tana, Northwest Ethiopia[39], Umolante district, South Ethiopia [37].

Shoe wearing habit has not significant association with hookworms' infection in this study which is in line with the study reported Chuahit, Dembia district, Northwest Ethiopia[18].

CONCLUSION

The prevalence of intestinal helminthes infection with *S. mansoni* and STHs were 50.64 %; with the prevalence of *S. mansoni*, *T. trichuira*, *A. lumbricoides* and hookworms were *26.6%,* 22.3%, 20.2% and 3.4% among the school children in the two schools. Majority of the infection intensity for both *S. mansoni* and STHs were classified as low.

The school children were at moderate risk of infection with *S. mansoni* and STHs based on WHO 2012 prevalence classification in which once a year MDA is required for STHs and biannual MDA for *S. mansoni*.

Water contact activities like bathing, washing clothes, swimming habits and crossing river on bare foot were risk factors for *S. mansoni* infection and finger trimming status, frequency hand washing before meal and after toilet were risk factors for *A. lumbricoides* and *T. trichuira* infections.

Health information regarding the transmission and prevention of *S. mansoni* and STHs should be given for school age children in the area.

ETHICAL CONSIDERATION

The study was ethically approved by the Institutional Review Board of Jimma University, Institute of Health. Supportive letter was written to the respective school directors and Jimma town health office to get permission and select the study participants, to arrange specimen collections schedule and to use institutional facilities. After selecting the study participants, data collectors obtained written consent from parents/guardians and assent from students. Finally, Children who had any intestinal helminthic infection were treated according to the national treatment guideline.

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COMPETING INTERESTS

There is no competing of interests among the authors

AUTHORS' CONTRIBUTIONS

MB, SG, NH, YA designed study protocol, conducted survey, drafted the manuscript and analysis of the data. MB, NH and YA conducted the survey and manuscript writing. MB, SG, YA, final manuscript writing. All authors have read and approved the manuscript.

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