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Prevalence and Associated Factors of Soil Transmitted Helminths and *Schistosoma mansoni* Infections Among Communities Along Rivers in Guder Town, West Ethiopia

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Abstract: Soil-transmitted helminths (STHs) and *Schistosoma mansoni* (*S. mansoni*) are among the most common cause of human infections and are distributed throughout developing countries including Ethiopia. However, there is little information on the current status of these infections to guide intervention in the study area. Therefore, the aim of this study was to determine the prevalence and associated risk factors of STHs and S. mansoni infections among communities along rivers in Guder town from September to October 2021. A cross-sectional study design was employed from September to October 2021 among communities along rivers in Guder town, West Shewa, Ethiopia. A total of 279 study participants who fulfilled the inclusion criteria were sampled randomly. Data on the sociodemographic characteristics of the study participants and risk factors for STHs and *S. mansoni* infections were gathered using a structured questionnaire. For the quantification of STHs and S. mansoni eggs, the stool sample was processed using a single Kato-Katz technique. Data were entered into Epi-info and analyzed using SPSS. Binary logistic regression analysis was done and variables with a p-value ≤ 0.05 were considered statistically significant. Live snails were transferred to the Ambo University in a plastic container with water and weed for identification and cercaria infection. The overall prevalence of any STHs and *S. mansoni* was 59 (21.2%), of which the prevalence of STHs and *S. mansoni* accounts for 54 (19.4%) and 10 (3.6%), respectively. Among Soil-Transmitted Helminths, A. lumbricoides was the predominant parasite detected in 39 (14%) followed by T. trichiura 13 (4.7%) and hookworms 11 (3.9%). Light intensity was found in the majority of study participants infected with STHs and *S. mansoni*. Having untrimmed fingernails, Lack of washing vegetables and fruit, and open defecation habits were significantly associated with STHs infection while swimming in the nearby river was significantly associated with *S. mansoni*. A few of the live snails collected were identified as *B. pfeifferi* and cercariae shading was not detected. This study showed 19.4 % of Soil Transmitted Helminths and 3.6% of *S. mansoni* infections. So, case-by-case treatment is recommended to control morbidity associated with Soil-Transmitted Helminths and *S. mansoni* infections in the study area.

Keywords: Prevalence, Risk Factors, Soil-Transmitted Helminths, *S. mansoni*, Along Rivers, Guder Town

1. Background

Soil-transmitted helminthiasis and Intestinal Schistosomiasis are the main medical and public health issues in many parts of the world [1]. Soil-transmitted helminths (STHs) of the main concern to humans are *Ascaris lumbricoides (A. lumbricoides)*, *Trichuris trichiura (T.*

trichiura), and hookworms (*Necator americanus* and *Ancylostoma duodenale*) [2, 3]. STHs infection can happen when contaminated hands or fingers are placed in the mouth, or while eating vegetables and fruits that have not been thoroughly cooked or washed. Hookworm infection is spread mostly by barefoot walking on contaminated soil [4].

According to a global atlas of helminthic diseases, 819 million people are infected with *A. lumbricoides*, 464 million with *T. trichiura*, and 438 million with hookworm. Hookworm is responsible for the majority (62%) of the 5.2 million disability-adjusted life years (DALYs) caused by STHs. Infections are widely distributed in tropical and subtropical countries [5]. External environmental factors such as soil, lack of sanitary facilities, unsafe waste disposal systems, inadequacy and lack of safe water supply, and human factors such as age, sex, socioeconomic position, and occupation all influence the geographical distribution of STHs [6].

Intestinal schistosomiasis is a parasitic trematode worm infection caused by the genus *Schistosoma mansoni* (*S. mansoni*). It is transmitted through contact with fresh water that has been contaminated with human excrement that contains Schistosome eggs. These eggs hatch in fresh water and release free-swimming miracidia, which infect the aquatic snail Biomphalaria, an intermediate host for *S. mansoni* to complete its life cycle and release cercariae into the water. Humans can also become infected through contact with water used for various domestic purposes. Intestinal schistosomiasis due to *S. mansoni* is common in sub-Saharan Africa. In Ethiopia, the most common *Schistosoma* species is *S. mansoni*, which is transmitted by *Biomphalaria pfeifferi* and *Biomphalaria sudanica*. The former has a larger geographical area, whilst the latter is limited.

Schistosomiasis is endemic in 70 developing countries, affecting around 200 million people (almost 90% of whom live in SSA), with 20 million of them suffering from severe disease. It is expected to result in 3.3 million DALYs [5]. It is mostly linked to poverty, and efforts to alleviate poverty through the development of water-related projects are likely to hasten the spread of infection. Children, women, and farmers in poor rural communities who rely on water contact for recreational, domestic, or occupational purposes are disproportionately affected [7].

In Ethiopia, one-third of the population has *A. lumbricoides*, one-quarter has *T. trichiura*, and one in every eight people has hookworm, according to a systematic review and meta-analysis published in 2012. As a result, Ethiopia has the second-highest ascariasis, third-highest hookworm, and fourth-highest trichuriasis burdens in SSA. More than 5 million people are believed to be infected with schistosomiasis (*S. mansoni* and *S. haematobium*) and more than 37 million are at risk of infection, making the overall prevalence 25% [8]. Intestinal schistosomiasis caused by *S. mansoni* infection is common in numerous parts of the country, with prevalence rates as high as 90% in some areas [9]. Most of the studies conducted on STHs and *S. mansoni* infections measured the rate of infection in school children, however, the epidemiology in the broader population has not been adequately described.

2. Materials and Methods

2.1. Study Design, Area, and Population

A community-based cross-sectional study was conducted from September to October 2021 in Guder town, West Shewa, West Ethiopia. The town is 126km from Addis Ababa, and 12 km from Ambo city. The town has an altitude of 1850 m above sea level with an average annual temperature of 20.9°C, and total annual rainfall of 1,000 mm. Agriculture is the main occupation of the population of the area. Farmers at Guder grow potatoes, onion and tomato, cabbage, garlic, sugarcane, and various tropical fruit trees using irrigation. Agricultural activities are mostly mixed, with livestock and crop cultivation occurring simultaneously.

Guder town has a total population of 22306 of whom 10,800 are men and 11,506 are women, and 4,647 households with an average family size of 4.8. In Guder town, there are three main rivers (Chole, Guder, and Indris) that flow persistently throughout the year. An estimated total population of 5578 (1162 households) living along these rivers was surveyed.

All individuals above five years and who live along Chole, Indris, and Guder rivers were the source population. However, individuals who had stayed in the area for less than six months or had taken anti-helminthic drugs in the past three months before the time of data collection were excluded.

2.2. Sample Size Determination and Sampling Technique

The sample size was estimated using a single population proportion formula, considering the source population size 5578 (1162*4.8), the prevalence of 23.9% [10], level of confidence 95%, the margin of error 5%, and the sample size was calculated to be 279. The sample size was proportionally allocated to the villages depending on the number of households along rivers. The sample sizes for villages 01 and 02 were 126 and 153, respectively. A systematic sampling technique was applied to select households in the town.

The number of households for this study was 279 (279/1) (126 and 153 from 01 and 02 villages, respectively). Based on this, the ‘‘K” value became 4 (1162/279) and 279 individuals were selected. The first household was selected using a lottery method and every 4th house number was included. In each household, one individual who fulfilled the inclusion criteria was recruited randomly. If no eligible candidate or volunteer is located in a chosen household, the next household was chosen, with the interval staying constant.

2.3. Data Collection Tools and Procedure

To collect sociodemographic information and risk factors, a pre-tested structured questionnaire was used. The questionnaire was prepared originally in English and translated into the Afan Oromo (local language). Then, one trained clinical nurse and one laboratory technician interviewed the study participants and took the stool samples.

2.4. Collection and Examination of a Stool Sample

Using the name written on the questionnaire with their corresponding code number, about 2 gm of the stool sample were collected. The single Kato Katz method was used to process the stool samples, and a template containing 41.7 mg of stool was used. Hookworm testing was done within 30 to 60 minutes of the Kato Katz slide preparation. We left the slides for 24 hours to make it easier to visualize the eggs of *S. mansoni* and other helminths. Twenty-four hours later, two experienced laboratory technicians examined each slide individually, and finally, the results were checked by the principal investigator in the case where the results were discordant, and the results of the third expert reader were considered the final results. The EPG of feces was calculated by multiplying the total number of eggs counted by 24, which results in the STHs and S. mansoni infection intensity [11].

2.5. Malacological Survey

In the study area, all the water contact sites where people used to collect water, wash clothes, bathe, and swim, cross the river were surveyed. A standard scoop net with a mesh size of 300 mm, that was supported by a metal frame [12] and handpicking with a glove was used to collect snails. The sampling time was set at 20 min per site.

2.6. Identification of Snails

After collection, the snails were transported to Ambo University, Biology department lab in an open plastic bucket with a small amount of water and weeds for identification and infection determination. Based on shell morphology, the collected snails were classified to species level. After genus and species identification, snails were tested for cercariae shedding. Each species were placed in a separate glass beaker bearing labels showing the location of the collection; the name of the species and the date of collection. Ten snails were placed in each beaker at 500 ml capacity. One hundred (100 ml) of water were added before exposing them to sunlight for 30 minutes to facilitate the shedding of cercariae. Then, the water in the snail containers was examined for cercariae under a dissecting microscope.

2.7. Quality Control

All the test procedures and the interpretation of results were accomplished based on standard operating procedures. Questionnaire data quality control was assessed by conducting a pretest (5%) before the data collection period. Before the beginning of data collection, data collectors were trained on how to conduct the interview and collect the stool samples. All the necessary reagents and equipment's were checked by known positive and negative preserved stool samples. For quality control, 10% of the slides were randomly selected and examined by a third person who was blinded for the previous test result. Before data entry, the returned questionnaires were checked for completeness and any errors.

2.8. Data Analysis

The data entered into Epi info and analyzed using SPSS software. Results were summarized using frequencies and presented with tables. In binary logistic regression analysis, the crude odds ratio (COR) is used to evaluate the association between independent and dependent variables. Additionally, the adjusted odds ratio (AOR) was calculated using multivariable logistic regression analysis taking all factors yielding a p-value ≤ 0.25 in bivariate analysis. A P-value $\leq$ 0.05 was considered to be statistically significant.

2.9. Ethical Clearance

The Ethical clearance and letter of permission were obtained from the Institutional Review Board of Jimma University with Ref No. JHRPGn/165/. A supportive letter was obtained from Guder Town Health Office. Moreover, informed written consent and assent form were obtained from the study participants after clarifying the importance of the study. The study participants were informed about the nature and aims of the study and were also informed that their participation was only voluntary. After permission was obtained, participants were interviewed and a stool sample was collected. Individuals who were positive for intestinal helminth infections were linked to the health center.

3. Results

3.1. Socio-Demographic Characteristics of the Study Participants

A total of 279 individuals participated in the study and provided a stool sample for parasitic examination. The age of the study participants ranged from 5 to 72 years old with a mean age of 18.29 years. Out of these, 165 (59.1 %) were females. The highest number of study participants were selected from 5-9 (30.8%) years (table 1).

Table 1. *Socio-demographic characteristics of communities along rivers in Guder town, West Shewa, West Ethiopia, 2021.*

Variables	Responses	Frequency (%)	Variables	Responses	Frequency (%)
Sex	Female	165 (59.1)	Village	Village 1	126 (45.2)
	Male	114 (40.9)		Village 2	153 (54.8)
Age in year	5-9	86 (30.8)	Occupation	Unemployed	70 (25.1)
	10-14	66 (23.7)		Daily laborer	4 (1.4)
	15-19	37 (13.3)		Student	155 (55.6)
	20-24	13 (4.7)		Merchant	6 (2.2)
	≥25	77 (27.6)		Housewife	25 (9.0)

Variables	Responses	Frequency (%)	Variables	Responses	Frequency (%)
	2-4	137 (49.1)		Farmer	4 (1.4)
Family size	5-6	112 (40.1)		Employed	15 (5.4)
	≥7	30 (10.8)			
	Illiterate	67 (24)			
Educational status	Primary	172 (61.6)			
	Secondary	40 (14.3)			

3.2. Prevalence of STHs and S. Mansoni Infections Among Communities along Rivers in Guder Town, West Shewa, West Ethiopia, 2021

The overall prevalence of STHs and *S. mansoni* was 59 (21.2%), of which STHs and *S. mansoni* account for 54 (19.4%) and 10 (3.6%), respectively. Regarding STHs, *A. lumbricoides* was the predominant parasite detected in 39 (14%) followed by *T. trichiura* 13 (4.7%) and hookworms 11 (3.9%). The prevalence of STHs and *S. mansoni* co-infection was 4 (1.43%). Other intestinal parasites identified were *H. nana* 6 (2.2%), *Taenia* species 2 (0.7%), and *E. vermicularis* 1 (0.4%). *A. lumbricoides* and hookworm combination was the dominant recorded co-infection in 6/279 (2.2%) followed by a co-infection of *S. mansoni* and *A. lumbricoides* in 3/279 (1.1%) (Figure 1).

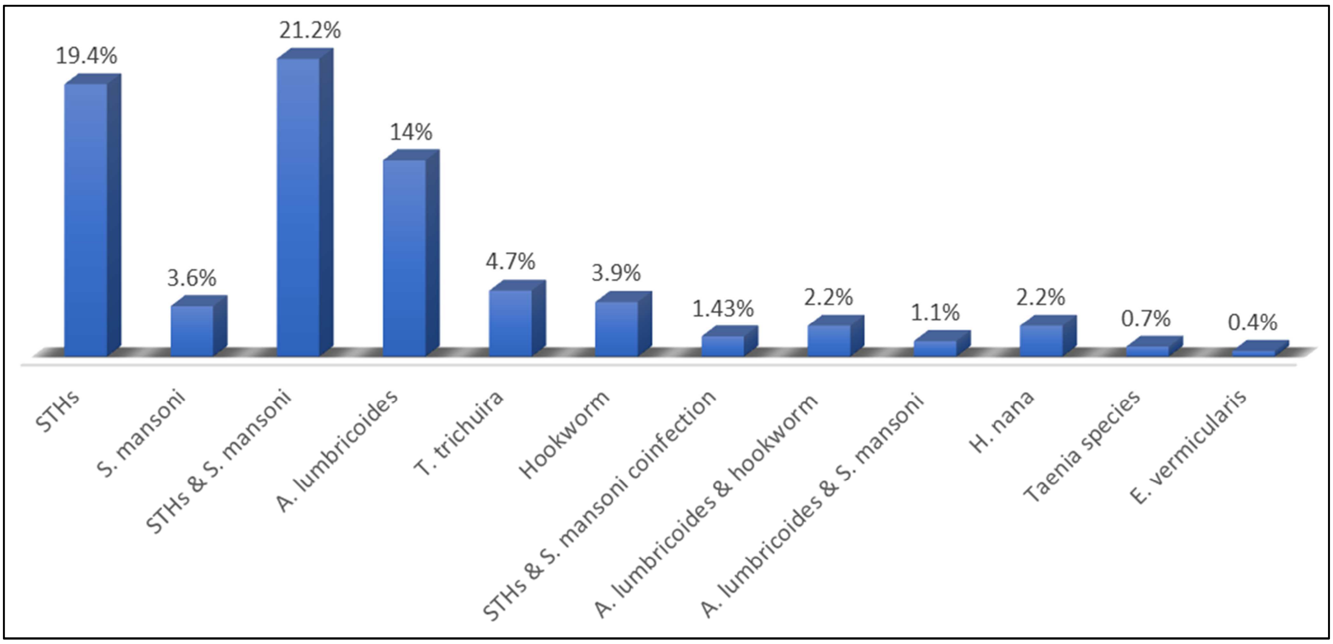

Figure 1. *Prevalence of Soil-transmitted helminths and Schistosoma mansoni infections among communities along rivers in Guder town, West Shewa, 2021.*

3.3. Infection Intensity of Soil-Transmitted Helminths and Schistosoma Mansoni

Table 2. *Intensity of soil-transmitted helminths and Schistosoma mansoni infections.*

Intestinal Parasite	Arithmetic mean	Class of infection intensity	
		Light	Moderate
S. mansoni	67.2	9 (90%)	1 (10%)
A. lumbricoides	3457	26 (66.7%)	13 (33.3%)
Hookworm	547.6	10 (90%)	1 (10%)
T. trichiura	90.46	13 (100%)	0

Out of 39 *A. lumbricoides* positives, light infection was observed in 26 (66.7%) and moderate infection in 13 (33.3%). Out of 11 hookworm-positive samples, light infection was observed in 10 (90%) and for *T. trichiura* all of the cases were light. out of 11 *S. mansoni*-positive samples, light infection was observed in 9 (90%) and moderate infection in 1 (10%). The arithmetic mean for *S. mansoni, A. lumbricoides*, hookworms, and *T. trichiura*, was 67.2, 3457, 547.6, and 90.46 EPG respectively (table 3).

3.4. Risk Factors Associated with Soil-Transmitted Helminths Infection

Study participants with untrimmed fingernails were about five times more likely to be infected by STHs than those who had trimmed fingernails [AOR: 5.0 (95% CI: 1.9, 13.8)], and who had a lack of washing vegetables and fruits [AOR: 13.8 (95% CI: 5.7, 33)] were more likely to acquire the infection. Infection by

STHs was 2.5 times more likely to happen in those who had open defecation [(AOR= 2.5 (1.0, 5.9)] (Table 4).

Table 3. *Association between Soil-Transmitted Helminths infection and risk factors among communities along rivers in Guder town, West Shewa, West Ethiopia 2021.*

Risk factors		No (%) STHs positive		COR (95 % CI)	p-value	AOR (95 % CI)	P-value
		Yes	No				
Age groups	5-9	20 (23.3)	66 (76.7)	1.5 (.674, 3.2)	.334		
	10-14	14 (21.2)	52 (78.8)	1.3 (.564, 3.02)	.535		
	15-19	6 (16.2)	31 (83.8)	.94 (.331, 2.75)	.906		
	20-24	1 (7.7)	13 (92.3)	.37 (.049, 3.4)	.362		
	≥25	13 (16.9)	63 (83.1)	1 (ref.)			
Sex	Male	31 (27.2)	83 (72.8)	2.3 (1.26, 4.22)	.007	.56 (.26, 1.2)	.142
	Female	23 (13.9)	142 (86.1)	1 (ref.)		1 (ref.)	
occupation	Daily laborer	1 (25)	3 (75)	2.2 (.12, 11.58)	.662		
	Unemployed	11 (15.9)	58 (84.1)	1.23 (.20, 5.37)	.960		
	Farmer	1 (25)	3 (75)	2.2 (.12, 11.58)	.662		
	housewife	5 (20)	20 (80)	1.63 (.208, 7.5)	.807		
	Merchant	1 (20)	4 (80)	1.63 (.058, 8.2)	.814		
	Student	33 (21)	124 (79)	1.73 (.31, 6.93)	.631		
	employed	2 (13.3)	13 (86.7)	1 (ref.)			
Education	Illiterate	11 (16.2)	57 (83.8)	.93 (.327, 2.6)	.885		
	primary	36 (21.2)	134 (78.8)	1.25 (.51, 3.05)	.628		
	secondary	7 (17.1)	34 (82.9)	1 (ref.)			
Fingernail trimmed	No	30 (47.6)	33 (52.4)	7.3 (3.8, 13.95)	.000	5 (1.9, 13.8)	.001*
	Yes	24 (11.1)	192 (88.9)	1 (ref.)		1 (ref.)	
Family size	2-4	29 (21.2)	108 (78.8)	1 (ref.)			
	5-6	21 (18.8)	91 (81.2)	.86 (.46, 1.6)	.636		
	≥7	4 (13.3)	26 (86.7)	.57 (.19, 1.77)	.334		
Latrine use	No	19 (31.7)	41 (68.3)	2.4 (1.27, 4.7)	.008	1.6 (.73, 2.8)	.088
	Yes	35 (16)	184 (84)	1 (ref.)		1 (ref.)	
Open defecation	Yes	22 (36.7)	38 (63.3)	3.4 (1.78, 6.5)	.000	2.5 (1.0, 5.9)	.016*
	No	32 (14.6)	187 (85.4)	1 (ref.)		1 (ref.)	
hand wash using soap	No	20 (34.5)	38 (63.5)	.89 (1.5, 5.56)	.001	.9 (.35, 2.37)	.849
	Yes	34 (15.4)	187 (84.6)	1 (ref.)		1 (ref.)	
unwashed vegetables	Yes	47 (42)	65 (58)	16.5 (7.1, 38.5)	.000	13 (5.7, 33)	.000*
	No	7 (4.2)	160 (95.8)	1 (ref.)		1 (ref.)	
hand wash before meal	sometime	36 (39.6)	55 (59.4)	6.2 (3.3, 11.75)	.000	.68 (.28, 1.7)	.403
	Always	18 (9.6)	170 (90.4)	1 (ref.)		1 (ref.)	
Wearing Shoe	sometime	18 (35.3)	33 (64.7)	2.9 (1.48, 5.72)	.002	1.2 (.39, 3.6)	.752
	Always	36 (15.9)	192 (84.1)	1 (ref.)		1 (ref.)	
shoe type worn	Open	31 (22.3)	108 (77.7)	1.46 (.8, 1.3)	.216	1.3 (.56, 2.9)	.570
	Closed	23 (16.4)	117 (83.6)	1 (ref.)		1 (ref.)	
Using river water	Yes	18 (23.7)	58 (76.3)	1.44 (.76, 2.7)	.264		
	No	36 (17.7)	167 (82.3)	1 (ref.)			

3.5. Risk Factors Associated with Schistosoma Mansoni Infection

Male study participants had higher *S. mansoni* prevalence than females. The highest proportion of *S. mansoni* was observed among the 10 - 14 years old (7.6 %%). The swimming habit of the study participants in the rivers was statistically significant with *S. mansoni* infection (table 4).

3.6. Malacological Survey

Snails were collected by scooping method and handpicking with gloves. Identified mollusks were *Biomphalaria* and *Physa* species. Based on shell morphology, of the total live snails collected a few of them were identified as *B. pfeifferi*. *Biomphalaria* species shading cercariae was not detected. It was observed that Chole River was more infested with *B. pfeifferi* compared to Guder River. No *B. Pfeifferi* was collected from the Indris River. During the snail survey, the physical characteristics of the Chole River revealed that the water was turbid. It has a low volume and speed throughout the dry season. Human activities such as swimming, bathing, washing clothes, and fetching water for other uses were seen.

Table 4. *Association between Schistosoma mansoni infection and risk factors among communities along rivers in Guder town, West Shewa, West Ethiopia, 2021.*

Risk factors		No (%) *S. mansoni*		COR (95 % CI)	P- value	AOR (95 % CI)	P-value
		Pos	Neg				
Age groups	5-9	2 (2.3)	84 (97.7)	1.78 (.159, 12)	.639		
	10-14	5 (7.6)	61 (92.4)	6.15 (.67, 14)	.101		
	15-19	1 (2.7)	36 (97.3)	2.1 (.13, 11.3)	.607		
	20-24	1 (7.1)	13 (92.9)	5.77 (.34, 18)	.225		
	≥25	1 (1.3)	75 (98.7)	1 (ref.)			
Sex	Male	5 (4.4)	109 (95.6)	1.47 (.42, 5.2)	.552		
	Female	5 (3)	160 (97)	1 (ref.)			
Working in agriculture	Yes	1 (2.0)	48 (98%)	.5 (.34, 4.13)	.530		
	No	9 (3.9)	221 (96.1)	1 (ref.)			
Education	Illiterate	1 (1.5)	67 (98.5)	.597 (.21, 6.9)	.718		
	Primary	8 (4.7)	162 (95.3)	1.98 (.24, 2.6)	.527		
	secondary	1 (2.4)	40 (97.6)	1 (ref.)			
Fetching water	Yes	4 (6.8)	55 (93.2)	2.59 (.70, 9.5)	.151	1.55 (.33, 7.3)	.582
	No	6 (2.7)	214 (97.3)	1 (ref.)		1 (ref.)	
Bathing place	River	7 (8)	81 (92)	5.42 (1.4, 21.5)	.016	3.5 (.76, 16.1)	.107
	Home	3 (1.6)	188 (98.4)	1 (ref.)		1 (ref.)	
Washing clothes	Yes	8 (4.7)	163 (95.3)	2.6 (.542, 12.5)	.232	1.94 (.31, 12)	.483
	No	2 (1.9)	106 (98.1)	1 (ref.)		1 (ref.)	
Swimming in river	Yes	7 (10.4)	60 (89.6)	8.13 (2, 32.3)	.003	6.69 (1.5, 26)	.012*
	No	3 (1.4)	209 (98.6)	1 (ref.)		1 (ref.)	
crossing rivers barefoot	Yes	9 (4.5)	193 (95.5)	3.54 (.44, 28.5)	.234	1.6 (.05, 8.4)	.716
	No	1 (1.3)	76 (98.7)	1 (ref.)		1 (ref.)	
Using river water	Yes	5 (6.6)	71 (93.4)	2.8 (.784, 9.92)	.113	1.7 (.38, 7.8)	.482
	No	5 (2.5)	198 (97.5)	1 (ref.)		1 (ref.)	

4. Discussion

The study determined the prevalence, intensity, and associated risk factors of STHs, and *S. mansoni* infections among communities in the Guder town along the Chole, Indris, and Guder Rivers, as well as a Malacological survey. The town's topography depicts a land with streams and rivers, which are frequently used for domestic and other uses by the town's population. There are bushes and weeds around the rivers, in which some people defecate openly. So, residents living along these rivers are more susceptible to STHs and *S. mansoni* infections while washing, playing, walking, fetching, swimming, and crossing rivers.

The overall prevalence of any STHs in the study area was 19.4%, which is low according to the WHO guideline [11]. This low prevalence could be due to ecological factors limiting STHs infective stages dispersion and development, such as soil Physico-chemical properties [13]. This low prevalence of STHs is comparable to studies conducted in Ukara Island, North-Western Tanzania (6.73%) [14], the rural setting of Busia County, Western Kenya (12.9%) [15], Ambo town, western Ethiopia (12.4%) [16], and Gurage zone, and South Central Ethiopia (9.5%) [17]. In contrast, reports from Nigeria (64.5%) [18], Myanmar (27.81%) [19], and other parts of Ethiopia like Wondo Genet (54.7%) [20], Bench Maj (70.3%) [21], Dembia district, Northwest Ethiopia (23.1%) [22], Hawassa (52.4%) [23], and West Shewa, Ejaji (38.2%) [24], showed moderate and high prevalence. These differences could be due to geographical variations, soil moisture, and relative humidity, and as well might be sociodemographic and socioeconomic differences.

The most common STH found in the study area was *A. lumbricoides*, which accounted for 39 (14%). This could be because *A. lumbricoides* eggs are less affected by extreme environmental circumstances and can survive for several months in the soil after aestivation, allowing them to survive in unusual and harsh weather conditions such as excessively hot and dry weather [25].

According to our study findings, STHs infection was higher in those study participants in the age group of 5-9 years old and males. This could be due to younger children having poor personal hygiene since they play in the dirt soil, eat without washing their hands, and put their fingers in their mouths [26]. Similarly, reports from Bench Maj [21] and Addiremets, Tigray [27] revealed that intestinal parasites were more prevalent in younger children and males.

In this study, the overall prevalence of *S. mansoni* was 3.6%, which is low according to WHO guidelines [11]. This low prevalence could be attributed to the low presence of snail intermediate hosts and environmental factors that favor snail dispersion in the area. This study agrees with those in Nigeria (7.2%) [18], Kenya (2.2%) [15], Babile (4.3%) [28], north Western Tigray (4.9%) [29], and Ambo, Western Ethiopia (0.9%) (16). Even though the prevalence of these studies is low according to the WHO, they differ in their prevalence.

In contrast, the present study was low compared to the prevalence of 12.94% from Ejaji district, Western Ethiopia [24], 11.2% from Dembia district, Ethiopia [22], and 11.8% from Kenya [30]. This variation could be due to water source expansion in those areas, water contact behavior of study participants, differences in climatic conditions of the area, awareness of the study participants, and the presence of fast-running rivers (in the present area) leading to low availability of vector snails, which prefer slow-moving water bodies [31].

The current study showed that the majority of the intensity of STHs was under the category of light infection 49 (78%). No heavy infection in any of the STHs and *S. mansoni* was observed. This finding was consistent with prior studies, which found that most people infected with STHs generally discharge a small number of eggs [14, 21]. A study in the Gurage zone [17] found that all 29 of the cases had light intensity. This might be due to the MDA program in the area. The majority of those infected with *S. mansoni* in the current study had light intensities, which is similar to the study reported from Dembia district [22], and southern Ethiopia [20].

In the present study, risk factors such as open defecation habits, having untrimmed fingernails during data collection, and eating unwashed vegetables and fruit habits of the study participants were associated with STHs infection. The prevalence of STHs was significantly higher in those who defecate openly than in those who use a latrine. This could be because persons who defecate somewhere other than a latrine are more likely to take up the parasites while touching the ground or soil contaminated with these parasites [32]. This was consistent with a study conducted in Bench Maj [21] and Hawassa [23]. However, it is different from the study done in Lumame town [33]. This difference may be due to the handwashing habit of the individuals after visiting those defecation sites.

This study also showed that individuals with untrimmed fingernails were five times more likely to have STHs infection. This might be due to the dirt under fingernails could harbor different stages of parasites, which can be ingested during nail-biting [34, 35]. This is in line with the finding of a study conducted in Lumame town [33]. The prevalence of STHs in the study area was also associated with the eating of unwashed vegetables and fruit behavior of the study participants. This could be because unwashed vegetables and fruits can harbor the parasite's infective stage. This was similar to the study done in Bench Maj [21], Lumame [33], and Tigray [29].

The study participants aged 10-14 years old had a higher proportion of *S. mansoni* infection. This could be because those in this age group appear to be at the greatest risk as a consequence of playing and swimming in water [9]. In the present study, swimming in the river was statistically associated with *S. mansoni* infection. This indicated comparable results with the results from the Ejaji [24] and Hawassa [23].

Snail collection was done to identify Biomphalaria species and cercariae shading of Biomphalaria species. Using the morphological identification method, most of the snails collected were identified as Physa species. During the study period, no *B. sudanica* was found. This could be due to the restricted geographic distribution of *B. sudanica* in Ethiopia.

In the current study, the prevalence of *Schistosoma* infection in *B. pfeifferi* was 0.0%. This absence of infected snails may be linked with snail age, pre-patent phase, water temperature, immune system status, and seasonality of Schistosoma species infection [36]. This finding is in line with a study conducted in Addiremets town, Ethiopia, 0.0% [27], and Wolaita Zone, Southern Ethiopia 0.0% [36].

On the other hand, there are reports of snails shedding cercariae finding from a study conducted in Omo Gibe River Basin, southwest Ethiopia, 4.6% [37], Hayk town, northeastern Ethiopia, 3.2% [38]. The reason for finding infected snails in these study areas in contrast to the current study could be environmental climatic and sociological patterns can contribute to variation in the prevalence of infection of snails [39].

5. Conclusion and Recommendations

This finding showed 19.4% of STHs and 3.6% of *S. mansoni* infections. The majority of the cases had light intensity. Even though the majority of infection was light, the reported polyparasitism may cause various health problems. This finding also showed untrimmed fingernails, the habit of eating unwashed vegetables and fruits, and open defecation were significantly associated with STHs infection while swimming in the rivers was significantly associated with *S. mansoni* infection. Thus, there is a need to impact the factors associated with the parasite's occurrence to maintain the parasite's low prevalence in the future.

Authors' Contributions

Mulugeta Getachew, Tariku Belay, Ukash Umer and Kinfu Yazachew are involved in the conception of the research idea, design and data collection, analysis and interpretation of the finding. The manuscript was written by Mulugeta Getachew, and all the other authors have read and approved the final manuscript.

Competing Interests

We declare that we do not have any competing interests related all activities about this research work.

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