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Prevalence of Intestinal Helminths and Associated Risk Factors in Rural School-Children in Were-Abaye Sub District, Tigray Region, Northern Ethiopia

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Abstract: A cross sectional study was conducted from January to March, 2013 to determine the prevalence and intensity of helmith infection and associated risk factors in school-children of Were-Abaye sub district of Raya Azebo District, Southern Tigray, Ethiopia by the Kato-Katz technique. Semi-structured interview questionnaire were used to collect data on the risk factors for infection of children with intestinal helminths. Data were analyzed using SPSS statistical software version 16.0. Six intestinal helminth species were identified with an overall prevalence rate of 54(12.22 %). The prevalence of Ascaris lumbricoides was significantly different among the age groups (p=0.004) with higher infection prevalence occurring in children aged 5-9 years. Factors such as source of drinking water, working in irrigation canals as well as absence of latrine were associated with prevalence of intestinal helminths in the study area. Intestinal helminths are prevalent and school aged children are at high risk of infection in the study area. Therefore, this calls for control and interventions methods including school and community based deworming.

Key words: Intestinal Helminths · Risk Factors · Were Abaye · Tigray · Ethiopia

INTRODUCTION

Infections with helminths are continued to be the major health problem in tropical and sub-tropical developing countries and result in considerable morbidities (eg., poor appetite, growth retardation and impaired cognitive development in children) as well as poor socioeconomic development [1,2]. It is estimated that globally more than 2 billion people are chronically infected with intestinal helminths [3]. Similarly, in Ethiopia it was reported that helminthiasis is the second most common cause of outpatient morbidity next to malaria [4]. School-aged children are frequently affected by helminthic infections associated with poor personal and environmental hygiene [5]. Chronic effects intestinal helminths are mainly due to nematodes such as *Ascaris lumbricoides*, *Trichuris trichiura* and hookworms [6].

Epidemiology of intestinal helminthiasis varies throughout the developing world and severity is influenced by factors such as climatic condition, geographical location, type of parasite species, nature of host- parasite interaction as well as nutritional and immunological status of the host population [7, 8].

Prevalence of intestinal helminths has been recorded from nearly all corners of Ethiopia [9 -13]. Despite efforts to control helminthiasis in Ethiopia, the disease continued to cause high morbidity and people live exposed to the potential risks [14]. In the Tigray Regional State of Ethiopia, expansion of micro-dams for irrigated agriculture is associated with incidence and prevalence of intestinal helminths [11].

Furthermore, new schistosomiasis foci are continued to be reported in Ethiopia [15]. Epidemiological studies on intestinal helminths are still required to add up on the

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existing data for better mapping of the disease in Ethiopia. Therefore, the present study was designed to generate epidemiological information on prevalence and intensity of intestinal helminths in school children of isolated rural sub district, Were-Abaye, Tigray Region, Ethiopia.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted from January to March, 2013 in Hujira and Latie primary schools in Were-Abaye sub district of Raya Azebo District, Southern Zone of Tigray region, Northern Ethiopia. wereThe schools are located 20Km south of Mokhoni, the capital town of Raya Azebo district, at an altitudes of 1749m.a.s.l and 1687m.a.s.l, respectively (Fig. 1). The rationale behind selecting the above primary schools for the study include: (1) there is limited supply of safe drinking water supply in the sub district where the schools are situated. (2) presence of longstanding irrigated agricultural activities which can potentially contribute for the occurrence of new foci intestinal schistosomiasis due to *Schistosoma mansoni* in the sub district.

Estimated total population of Raya Azebo district is 136, 039 out of which 67,774 and 68,265 are males and females, respectively. About 11.8% of the population is urban and irrigated or rain fed subsistence agriculture is the means of income for 95% of the population [16]. Livestock provides 5% of the household income in the district [17].

Study Design and Population: The present cross-sectional study envisioned determining prevalence of intestinal helminths infections in the study area. Primary school children were selected as study population. Students were first stratified according to their educational level from grade 1 to grade 8 and the roster containing their list was taken as a sampling frame. Based on the quota allocated for each grade level, children were selected by systematic random sampling. Each sample child was provided with clean plastic sheet and an applicator stick to bring his/her own stool. Orientation was given to the sample children not to mix their stools with soil or urine while passing

Sample Size Determination: The required sample size for this study was obtained as suggested by Daneil [18], that is., $n= p (1-p) z^2 / d^2$. No previous data were available on the overall prevalence rate (p) of intestinal helminths for the study area the value of p was considered 50%. For determining the minimum sample size (n), 95% confidence interval (z) and 5% marginal error were used. Hence, the minimum sample size was 384. To minimize sampling error 8 students were added. Thus, the total number of students was 442.

Table 1: Age and gender composition of the study subjects

	Age in years			
Sex	5-9	10-14	15-20	Total (%)
Female	93	107	7	207(46.8)
Male	80	138	17	235(53.2)
Total	173	245	24	442(100%)

Ethical Consideration: Ethical approval was obtained from Mekelle University Health Science College. Informed verbal consent was obtained from district Health Bureau and Principlas of the schools to get permission for the study. The objective of the study was also explained to the school teachers and students during sample collection. Willingness of the students to participate or not to participate in the study was fully explained. The students' privacy during the interview and stool collection was maintained and the information recorded was strictly kept confidential. All study subjects with positive stool test for intestinal helminths were provided treatment for free with appropriate drugs.

Parasitological Examination: A Kato-Katz slide was prepared from stool sample of each child and transported to the Microbiology and Parasitology laboratory, Department of Biology, Mekelle University, for microscopic examination. A Kato-Katz slide prepared for each child was used to determine egg per gram of stool (EPG) for *S. mansoni* and other soil transmitted helminths (STHs) except for hookworm. Since a template delivering 41.7 mg of stool was used to prepare Kato slides, the egg of each parasite in the slide was counted and the number of eggs was multiplied by 24 to calculate its EPG and the mean EPG of the helminths was compared using one way ANOVA. Moreover, the prevalence of schistosomiasis and STH infections were determined qualitative by microscopic examination.

Assessment for Risk Factors: Semi-structured interview questionnaires with known risk factors were developed first in English and then translated into the local language, Tigrigna and administered to the children to assess for potential risk factors of infection with intestinal helminths.

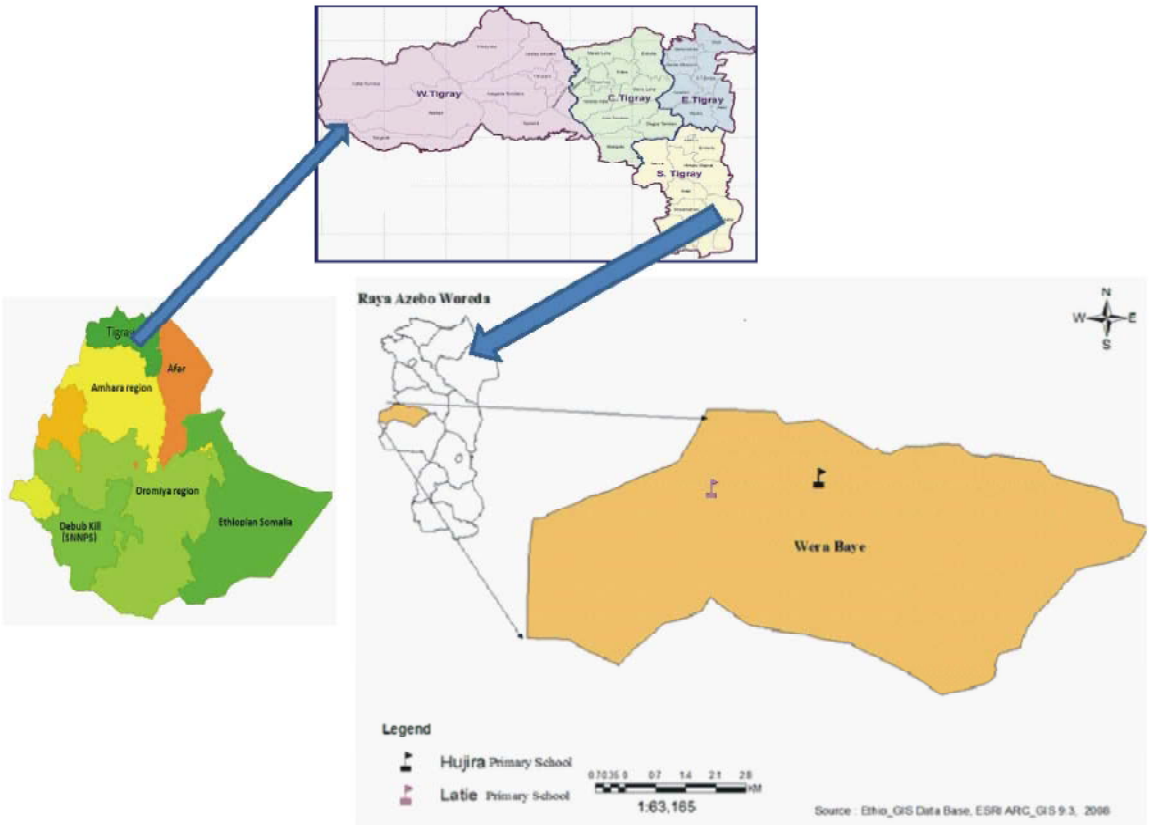

Fig. 1: Map of the study area (Source: Ethio_ GIS Data Base, ESRI ARC_GIS 9.3, 2008)

Data Analysis: The collected data were analyzed using SPSS windows version 16.0. Logistic regression was used to see the relationship between parasitic infection and potential risk factors. Prevalence and intensity of infection were determined by Chi-square tests and one-way ANOVA, respectively. All p- values less than 0.05 were considered statistically significant.

RESULT

Overall Prevalence of Intestinal Helminths Among School-Ahildren in the Study Area: Out of 442 school-children examined in the present study, 54(12.23%) were positive for at least one intestinal helminth (Table 2). The most prevalent helminth species identified in this study was *A. lumbricoides* 22(4.98%) followed by two equally prevalent helminths, *H. nana* and *E. vermicularis* 9(2.04%) each.

Higher infection prevalence of intestinal helminths was observed in children of Latie primary school 41 (16.4%) than in children of Hujira primary school 13 (6.4%) ($P < 0.05$). Moreover, the prevalence of *A. lumbricoides* was also significantly different between the two schools ($p < 0.05$). *S. mansoni* and *T. trichiura* were least prevalent in Hujira primary school. On the other hand, no child of Hujira primary school was found infected with *Taenia* species (Table 3).

Table 2: Overall prevalence of intestinal helminths in school children of Were Abaye sub district, Southern Tigray, Ethiopia, 2013

Parasite species detected	No.(%) positivity
A. lumbricoides	22(4.97)
T. trichiura	7(1.6)
H. nana	9(2.04)
E. vermicularis	9(2.04)
Taenia species	5(1.13)
S. mansoni	2 (0.45)
Overall Prevalence	54 (12.23)

Prevalence of intestinal helminths was also recorded in different hamlets of the study area. The highest prevalence 50% was observed in Kalanane. The infection prevalence of *H. nana* was statistically significant in different hamlets ($p< 0.05$) (Table 4).

The Prevalence of Intestinal Helminths Infections According to Age and Sex: Prevalence of intestinal helminths was found to be significant among the different

Table 3: The prevalence of intestinal helminths in children of Hujira and Latie primary Schools of Were Abaye sub-district, Southern Tigray, Ethiopia, 2013

	Schools			
Parasite helminths detected	Latie primary school (n =250) No(%)	Hujira primary school (n = 192) No (%)	Total No(%)	P-value
Al	19(7.6)	3(1.6%)	22(9.2)	0.004
Tt	6(2.4)	1(0.52)	7(2.92)	0.117
Ev	5(2)	4(2.1)	9(4.1)	0.951
Hn	5(2)	4(2.1)	9(4.1)	0.951
Tae	5(2)	0(0)	5(2)	0.049
Sm	1(0.4)	1(0.52)	2(0.92)	0.851
Total	41(16.4)	13(6.8)	54(23.2)	0.002

Note: Al = *Ascaris lumbricoid*es; Tt = *Trichuris trichiura*; Hn = *Hymenolepis nana*; Ev = *Enterobius vermicularis;* Sm = *Schistosoma mansoni;* Tae = *Taenia* species

Table 4: Prevalence of intestinal helminths in children according to their hamlets in Were Abaye sub district, Southern Tigray, Ethiopia, 2013

		Intestinal helminths n (%)						
Hamlets	No. Children examined	Sm	Al	Tt	Hn	Ev	Tae	Total n(%)
Latie	218	1(0.5)	16(7.3)	5(2.3)	4(1.8)	6(2.7)	4(1.8)	36 (16.4)
Kelanane	4	0(0)	1(25)	0(0)	1(25)	0(0)	0(0)	2(50)
Dinku	1	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)
Werebaye	1	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)
Badish	39	0(0)	3(7.7)	1(2.6)	0(0)	0(0)	1(2.6)	5 (12.9)
Genda Ajo	99	1(1)	2(2.0)	1(1)	1(1)	3(3)	0(0)	8 (8)
Genda Babo	2	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)
Fendel	41	0(0)	0(0)	0(0)	3(7.3)	0(0)	0(0)	3 (7.3)
Warsa	7	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)
Lalo	2	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)
Hujira	28	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)
P- value		0.999	0.245	0.991	0.047	0.961	0.957	0.07

Al = *Ascaris lumbricoides*; Tt = *Trichuris trichiura*; Hn = *Hymenolepis nana*; Ev = *Enterobius vermicularis;* Sn = *Schistosoma mansoni;* Tae = *Taenia* species

age groups for *A. lumbricoides* infection with highest prevalence in children aged 5-9 (P < 0.05). However, age did not have significant effect on the prevalence of other intestinal helminths (p > 0.05). Infection prevalence intestinal helminths were not significantly different in males and female school children in the study area (P > 0.05) (Table 5).

Infection Intensity of Intestinal Helminths: Mean EPG of A. *lumbricoides* was found to be highest. Mean EPG of other intestinal helminths was not different among the different age groups except for *A. lumbricoides* (p < 05) (Table 6).

Risk Factors Associated with Helminthiasis: Children who utilized water for drinking and cooking from river were more infected by intestinal helminths than those depending on piped water (AOR 2.701; 95% CI1.403- 5.200, P= 003). Similarly, the absence of latrine was significantly associated with intestinal helminths infection. (AOR 1.056; 95%CI 0.447- 2.494, p = 0.001). Moreover, children who are living at close vicinity of irrigation canals were more frequently infected by intestinal helminths than those living in non- irrigated areas (AOR 2.144; 95%CI; 1.094-4.199, P=0.026). On the other hand, factors including gender, exposures to soil, educational standards and hand washing before meal were not significantly associated with intestinal helminthic infection (Table 7).

DISCUSSION

The present study identified six intestinal helminths including *S. mansoni, A. lumbricoides, T. trichiura, E. vermicularis, H. nana* and *Taenia* species. The overall prevalence of helminths was 12.22%. This finding was lower than the reports from different corners of Ethiopia [5, 8-10, 19, 20].

Table 5: Prevalence of intestinal helminth infections according to age and sex of primary school children in Were Abaye sub district, Southern Tigray, Ethiopia, 2013

	Sex				Age in years				
	Female n= 207	Male n=235	Total 442		5-9 n=173	10-14 n=245	15+ n=24	Total 442	
Helminths detected	n (%)		Total	P-value		n%		Total	p-value
Al	9(4.32)	13(5.6)	22(10)	0.568	14(8.1)	8(3.3)	0	22(11.4)	0.042
Tt	5(2.4)	2(0.85)	7(3.25)	0.189	0	6(2.5)	1(4.2)	7(6.7)	0.083
Ev	6(2.9)	3(1.28)	9(4.18)	0.596	4(2.3)	5(2.0)	0(0)	9(4.3)	0.675
Hn	2(0.96)	7(3)	9(3.96)	0.212	3(1.7)	5(2.0)	0(0)	9(3.4)	0.770
Tae	3(1.44)	2(0.85)	5(2.29)	0.553	2(1.2)	3(1.2)	0(0)	5(2.4)	0.863
Sm	1(0.5)	1(0.4)	2(0.9)	0.928	1(0.6)	1(0.4)	0(0)	2(1)	0.914

Note: Al = *Ascaris lumbricoides*; Tt = *Trichuris trichiura*; Hn = *Hymenolepis nana*; Ev = *Enterobius vermicularis;* Tae = *Taenia* species; Sm= *Schistosoma mansoni*

Table 6: Intensity of intestinal helminths among the different age groups of children in the study Schools Were Abaye, Raya Azebo District of Southern Tigray, Ethiopia, 2013

	Schools							
	Latie primary school				Hujira primary school			
	Mean EPG ±SE among ages (in years)							
Helminths Detected	5-9 n= 100	10-14 n = 133	15+ n= 17	Total n= 250	5-9 n= 74	10-14 n = 111	15+ n= 7	Total 192
Al*	65.1±20.9	8.3±4	00±00	73.4±24.9	0	3±1.96	0	3±1.96
Tt	0	3.4±1.6	5.6±5.6	9±7.2	0	0.65±0.65	0	0.65±65
Ev	1.9±1.1	0.54±0.4	0	2.4±1.5	0.65±0.65	1.73±1.1	0	2.38±1.7
Hn	6.7±4.7	3.97±2.29	0	10.67±6.99	0.65±0.65	1.5±0.88	0	2.15±1.53
Tae	2.2±1.5	1.8±1.2	0	4±2.7	0	0	0	0

*Significant difference was observed in intensity of infection with *Ascaris lumbricoides*

Note: Al = *Ascaris lumbricoides*; Tt = *Trichuris trichiura*; Hn = *Hymenolepis nana*; Ev = *Enterobius vermicularis;* Tae = *Taenia* species

Table 7: Logistic regression analysis with Adjusted Odds Ratio for factors potentially associated with intestinal helminthic infection in School children of Were Abaye sub district, Southern Tigray, Ethiopia

		Intestinal Helminths			
Risk factors		No. of examined	No. of positive (%)	AOR (CI, 95%)	P value
Water source	River	250	41(16.4)	2.701(1.403- 5.200)	0.003
	Pipe	192	13(6.8)		
Latrine	Absent	243	38(15.6)	1.056 (0.447- 2.494)	0.001
	Present	199	16(8.04)		
Irrigation	Longstanding	250	41(16.4)	2.144(1.094- 4.199)	0.026
	No irrigation	192	13(6.7)		

AOR = Adjusted odds ratio, CI = Confidence interval

The variation in the prevalence of intestinal helminths among different studies might be due to differences in climate and geographical locations of the areas. Moreover, socio-economy as well as environmental and personal hygiene plays a pivotal role for the variation in infection prevalence [12].

From the overall prevalence of intestinal helminths identified in this study, relatively *A. lumbricoides* comprised the highest proportion. The high existences of this parasite among the school children may be due to the resistant nature of the eggs against various environmental conditions. This finding is in agreement with the report of Amare *et al.* [21] and lowers than the observation reported by Asrat *et al.* [12].

The prevalence of *S. mansoni* was less than 1%. This finding seems similar to the work of Tadesse and Beyene [11] with the survey done in Gerjelle, Soouthern Tigray, which is 30km south of the present study area with similar altitude and environmental conditions. The low prevalence rate of *S. mansoni* in the present study area should not be undermined as it may be due to recent introduction of the parasite into the area.

Taenia species recorded in the present work was ten times lower than the finding reported in the study conducted in Southeast of lake Langano, Ethiopia [8].

Significant difference in infection prevalence of intestinal helminths was observed between the primary schools surveyed. Infection prevalence of *H. nana* was different among the hamlets assessed ($p < 0.05$). The difference in prevalence intestinal helminths in between the schools among the hamlets might be attributed to the difference in sanitary conditions.

In the present study gender of the study subjects didn't have effect on infection prevalence of intestinal helminths ($p > 0.05$). This might be due to the fact that both male and female children are equally exposed for risk factors. Similar finding was reported by Teklu *et al.* [13]. Age of the study subjects had effect on *A. lumbricoides* with highest prevalence in children aged 5-9 years ($p < 0.05$). This might be due to the fact that younger children cannot properly keep their personal hygiene and their habit of crawling on contaminated soil. This finding was in line with Nmor *et al.* [5].

The intensity of intestinal helminths infection in terms of the mean eggs per gram of stool (EPG) was examined among different age groups of school-children and showed that age did not have significant effect on mean EPG for most helminths species. However, age had significant effect on mean EPG of A. *lumbricoides.*

The findings of this study also showed that source of water from the river for drinking and other activities in the home was one of the risk factors for intestinal helminthic infections. This might be due to the fact that the contamination of river water by environmental pollutants mainly from human excreta introduced in to the river. This was in agreement to the report of Asrat *et al.* [12] northern Ethiopia. Similarly, the present study revealed that the presence of longstanding irrigation near the residence had the risk of association for intestinal helminths infection. This might be due to the contamination of working canals through open field defecation and using of untreated sewage for cultivation of vegetables. In line with this view, Zewdneh and Dawit [23] found that pre-harvest vegetables associated with the use of wastewater, raw manure or sewage for vegetable production was associated risk factors for intestinal parasitic infection. Similar finding was also reported by Tadesse and Beyene [11]. Intestinal helminths infections were also associated with the absence of latrine and infections were commonly observed among children who defecate in the open field than those users of latrines.

CONCLUSION

The findings reported in the present study showed that infections of intestinal helminths were prevalent and important health problem in the school children in the study area. Intestinal helminthic infection identified in this study were *A. lumbricoides, T. trichiura, E. vermicularis, H. nana, S. mansoni and Taenia* species. Both the prevalence and intensity of *A. lumbricoides* infections were higher in age groups ranged in 5-9 and followed by 10-14. Source of water for household consumption, absence of latrine and presence of longstanding irrigation nearby villages were among the risk factors identified for intestinal helminths infections. The finding of the present study also highlights the present study area could be a new transmission foci for intestinal schistosomiasis

Recommendation: The present study revealed prevalence of intestinal helminths in the study area and highlighted the study area as potential foci for schistosomiasis mansoni. We suggest implementation of proper control and prevention strategies such as deworming in the study area. Moreover, future work is required to establish the epidemiology of schistosomiasis mansoni in the study area.

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