Original article

Intestinal helminth infections in school children in Adarkay District, Northwest Ethiopia, with special reference to Schistosomiasis mansoni

Leykun Jemaneh[1]

Abstract: In a survey carried out in five schools of five rural towns in Adarkay district in Northwest Ethiopia, 519 children had their stool specimens examined for *Schistosoma mansoni* and other intestinal helminth infections of man by the Kato thick smear technique. Infection due to *S. mansoni* was the most prevalent (54.3%), ranging from 16.7% in Deb Bahir to 55.3% in Adarkay and Buya, 67.4% in Kerenejan and as high as 88.9% in Zarema, followed by *Ascaris lumbricoides* (43.0%) and hookworm spp (23.3%). The least prevalent was *Trichuris trichiura* infection (11.8%). Triple, double, and single infections were found in 49 (9.4%), 180 (34.7%) and 172 (33.1%) specimens respectively. Most of the double infections were a combination of *S. mansoni* and *A. lumbricoides* (90=17.3%). The highest prevalence for a single infection was recovered for *S. mansoni* (103=19.8%). Age specific analysis of prevalence due to *S. mansoni*, the hookworms and *A. lumbricoides* showed the presence of infection in all ages under consideration, but with no significant difference among the age groups. Neither was there any significant difference in infection rates between the sexes. The average egg counts were generally higher for *S. mansoni* and *A. lumbricoides*. Younger age groups appear to have higher average egg counts, particularly for the hookworms. Sex was not related to egg output. The high infection rate of intestinal helminth infestation observed in this study among school children signifies the need for prompt intervention measures. [*Ethiop. J. Health Dev.* 1997;11(3):289-294]

Introduction

Infections due to intestinal helminths are most common in the developing world, particularly in tropical regions where the environment, socio-economic status, human behaviour and cultural practices favour transmission. Knowledge of the distribution and extent of helminthic diseases in these areas is essential for prevention and control programmes.

In Ethiopia, intestinal helminthic infection is of major public health concern (1). Schistosomiasis mansoni is endemic in many localities (2,3). The major soil-transmitted helminths, *Trichuris trichiura*, *Ascaris lumbricoides*, and the hookworms are also frequently encountered in surveys (2-6).

There are well known causes of disease and contribute, among others, to the high proportion of childhood morbidity (4).

Health strategy for the attainment of effective parasitic diseases control programmes demand knowledge of the prevalence and distribution of the diseases and their changes in the course of time as related to ecological, cultural, behavioural and other factors.

The present study is aimed at providing epidemiological information on schistosomiasis mansoni

[1] From the Department of Microbiology and Parasitology, Faculty of Medicine, P.O. Box 9086, Addis Ababa, Ethiopia

and other major intestinal helminthic parasites with respect to prevalence, species distribution and

intensity of infection among elementary schoolchildren in Adarkay Woreda (District) in Northwest Ethiopia. It is anticipated that the information generated through this study will serve as a baseline data for future health programme in the region.

Methods

This study was undertaken in five randomly selected elementary schools (Deb Bahir, Zarema, Adarkay, Kerenejan, Buya) out of the total of sixteen found in Adarkay Woreda (District), North Gonder, Ethiopia, in 1995. Accessibility by a fourwheel drive was a factor in the selection of the schools. The District has a population of approximately two hundred thousand people who are mainly static and engaged in subsistence mixed agriculture. The altitude ranges from 1,000 to 2,400m above sea level. The topography shows hills and plain land with springs, streams and rivers, which are often the sources of water for domestic and other uses for the population. The meteorology, soil types and other geographical features of the area are dealt with in detail by various authors (7-11). In the rural areas and in most parts in the towns, defecation is mainly in open fields and in ditches.

The study population constituted children attending grades five and six in these five schools. Children in these grades were assumed to show age of peak infection rate and hence expected to indicate the situation of helminthiasis in the area. From the lists of children in these grades, lists of prospective examinees (those who lived in the area for three or more years and had no treatment for any intestinal ailment during the last one month) were drawn. Based on earlier reported prevalence rates of 30-50% (4,12) for Gondar region and a confidence interval of 95% using appropriate statistical formulae, 519 pupils were selected, using systematic sampling with a random start, to constitute the sample populaton. The compliance rate was 100%. Their ages and sexes were registered.

For the parasitological diagnosis of intestinal helminths, stool samples were obtained from all 519 pupils and the Kato-Katz cellophane faecal thick smear technique (13) was employed using a 50 mg template. Double Kato-Katz slides were prepared for each specimen. Examination for hookworm ova under the microscope was performed immediately after the double Kato-Katz slide preparations following which the slides were kept for at least one hour at ambient temperature to clear the faecal material prior to examination for *Ascaris*, *Trichuris*, and *Schistosoma* eggs. Stool specimens were considered positive when the characterstic eggs of *S. mansoni*, *A. lumbricoides*, *T. trichiura*, and hookworms were noted in any one of the double Kato-Katz slides. The number of eggs of each species was recorded and converted into the number of eggs per gram of faeces (EPG) in order to analyze intensity of infection. The average number was taken when eggs were found on the two Kato slides. Individuals positive for *S. mansoni* were treated on the spot with a single dose of praziquantel at 40 mg/kg body weight. Children positive for the other helminths were informed of the type of parasite they harboured and advised to get treatment from the nearest health institution. Their names along with the parasitological results were also communicated to respective home room teachers who were requested to follow-up their treatment.

Results

In these five schools infection due to *Schistosoma mansoni* was the most prevalent (54.3%). The least prevalent was *Trichuris trichiura* infection (11.8%) (Table 1).

Table 1: **Prevalence (%) and intensity (average EPG) of intestinal helminth infections in children attending five elementary schools in Adarkay district Northwest Ethiopia, in 1995. Values in parenthesis are average egg count per gram per positive individual (EPG)**

School	No. Examined	*S. mansoni*		*A. lumbricoides*		Hook worms		*T. trichiura*	
		#	%	#	%	#	%	#	%
Adarkay	114	63	55.3	49	43.0	23	20.2	2	18
		(507.14)		(1579.59)		(563.04)		(200.00)	
Buya	103	57	55.3	55	53.4	31	30.1	19	18.4
		(584.21)		(1718.18)		(1319.35)		(621.05)	
Deb Bahir	120	20	16.7	62	51.7	37	30.8	27	22.5
		(862.50)		(1179.84)		(687.84)		(618.52)	
Kerenejan	92	62	67.4	32	34.8	25	27.2	13	14.1
		(857.26)							
Zarema	90	80	88.9	25	27.8	5	5.6	0	0.0
		(926.25)		(1787.50)		(1808.00)		(773.08)	

Of the four parasites studied, infection due to *Schistosoma mansoni* is more pronounced in all communities except in Deb Bahir. The prevalence ranged from 16.7% in Deb Bahir to as high as 88.9% in Zarema. The prevalence of *A. lumbricoides* infection was highest in Buya (53.4%). Hookworm infection prevalence was highest in Deb Bahir (30.8%) and Buya (30.1%). No *T. trichiura* infection was registered in Zarema while the prevalence in others ranged from 1.8% in Adarkay to 22.5% in Deb Bahir.

Table 2: **Prevalence (%) and intensity (average EPG) of intestinal helminth infection by age group in children attending five elementary schools in Adarkay District, Northwest Ethiopia, in 1995. Values in parenthesis are average egg count per gram per positive individual (EPG).**

Age Group (yrs)	No examined	*S. mansoni*		*A. lumbricoides*		Hookworms		*T. trichiura*	
		#	%	#	%	#	%	#	%
5 - 9	82	47	57.3	34	41.5	24	29.3	12	14.6
		(784.04)		(1576.47)		(1181.25)		(729.17)	
10-14	361	203	56.2	158	43.8	83	23.0	42	11.4
		(790.89)		(1559.18)		(1095.78)		(632.93)	
15-19	76	32	42.1	31	40.8	14	18.4	8	10.5
		(696.88)		(1343.55)		(628.57)		(531.25)	
Total	519	282	54.3	223	43.0	121	23.3	62	11.8
		(779.08)		(1531.84)		(1058.68)		(638.52)	

prevalence due to each of the four parasites showed the presence of infection in all ages with no significant difference among the age groups. Nevertheless, in all but *A. lumbricoides*, a gradual decline was noted in occurrence with increasing age (Table 2). Similarly no significant difference was seen in infection rates of these intestinal helminths between the sexes (Table 3).

The average EPG due to *S. mansoni* was highest in Zarema, Deb Bahir and Kerenejan. With hookworms and *T. trichiura*, the EPG tended to be higher in Buya and Kerenejan (Table 1). Younger age groups appear to have higher average egg counts for the intestinal helminths, particularly for the hookworms, but the difference is not significant (Table 2). Considering the sex, no significant difference was observed in the intensity of infection among all helminths (Table 3).

Triple, double and single infections were found in 49 (9.4%), 180 (34.7%) and 172 (33.1%) specimens, respectively as can be seen in Table 4. In addition, in two children there had quadruple infections. Most of the double infections were a combination of *S. mansoni* and *A. lumbricoides*

(90=17.3%). The highest prevalence for a single infection was recorded for *S. mansoni* (103=19.8%).

Discussion

The outcome factors of interest in this study were positivity for the major intestinal helminths, intensity and multiplicity of infection. The results of the study confirm the high prevalence of *S. mansoni* and the soil-transmitted helminths.

In this study *S. mansoni* was present in 54.3% of the examined children with the prevalence reaching close to 90% in Zarema. Although previous reports on *S. mansoni* are lacking for Buya, Deb Bahir and Kerenejan, two decades ago McConnell and Armstrong (2), using the merthiolateiodine-formaline concentration technique (14) in Zarema and the merthiolate-iodine-formaline direct smear method (15) in Adarkay, have reported the prevalence of *S. mansoni* to be 94% and 24% for Zarema and Adarkay primary schoolchildren, respectively. It is vividly

Table 3: **Prevalence (%) and intensity (MEPG) of intestinal helminth infection by sex in children attending five elementary schools in Adarkay District, Northwest Ethiopia, in 1995.**

Parasites	Male N = 272			Female N = 247			Both sexes N = 519		
	No	%	MEPG**	No.		MEPG	No.	%	MEPG
S. mansoni	163	59.9	775.7	119	48.2	783.6	282	54.3	889.1
A. lumbricoides	118	43.4	1420.6	105	42.5	1656.7	223	43.0	1531.8
Hookworms	69	25.4	1073.2	52	21.1	1039.4	121	23.3	1058.7
T. trichiura	*28*	*10.3*	*698.2*	*33*	*13.4*	*587.8*	*61*	*11.8*	*638.5*

Table 4: **Multiple intestinal helminthic infection in children attending five elementary school in Adarkay District, northwest Ethiopia, in 1995.**

Multiplicity of infections	Males		Females		Both sexes	
	No.	%	No.	%	No.	%
Specimens with 4 helminth parasites						
SM, HW, AL and TT	2	0.7	0	0.0	2	0.4
Specimens with 3 helminth parasites						
SM, AL and HW	14	5.1	7	2.8	21	4.0
SM. AL, and TT	7	2.6	11	4.4	18	3.5
SM, TT a nd HW	5	1.8	1	0.4	6	1.2
AL, TT and HW	1	0.4	3	1.3	4	0.8
Specimens with 2 helminth parasites						
SM and AL	53	19.5	37	15.0	90	17.3
AL and HW	20	7.3	15.0	6.1	35	6.7
SM and HW	16	5.9	15	6.1	31	6.0
SM and TT	6	2.2	5	2.0	11	2.1
TT and HW	3	1.1	1	0.4	4	0.8
AL and TT	1	0.4	8	3.2	9	1.7
Specimens with 1 helminth parasite						
SM	60	22.1	43	17.4	103	19.8
AL	20	7.3	24	9.7	44	8.5
HW	8	2.9	10	4.0	18	3.5

TT	3	1.1	4	1.6	7	1.3
Total number positive	219	80.5	184	74.5	403	77.6
Total number negative	53	19.5	63	25.5	116	22.4
Total number examined	272	100.0	247	100.0	519	100.0

0SM = *S. mansoni* HW = *Hookworm*

AL = *A. lumbricoides* TT = *T. trichiura* evident that when one compares the outcomes of the present study and that of McConnell and Armstrong (2) the situation of *S. mansoni* has not changed in Zarema. On the other hand *S. mansoni* prevalence has more than doubled in Adarkay. This increase can be explained by, among many other factors, a more sensitive stool examination technique used in this study over the merthiolateiodine-formalin direct smear technique on the one hand, and by sampling variation on the other. Moreover a finding of 55.3% prevalence for *S. mansoni* in Buya, an area well-removed from the main highway, and 16.7% in Deb Bahir has been noted. These high prevalence figures of *S. mansoni* infections registered in the different localities of the district are alarming.

The prevalence of the three soil-transmitted helminthic infections in this study can be compared with a variety of other surveys carried out in schoolchildren or in communities in Gondar and other parts of Ethiopia. Prevalence rates ranging from as low as 14% to as high as 85% for Gondar region (2,12, 16-17) and from 4% to 72 % for other parts of Ethiopia (3-5) have been reported for *A. lumbricoides*. Leykun Jemaneh and Shibru Tedla (18) found an overall hookworm infection rate of 18.1% among schoolchildren in Gondar region. Trichuriasis, with infection rates ranging from 3% to 100%, has also been reported from various localities (2,3).

There are a couple of published information that deal with the situation of these geo-helminths in the study localities. Two decades ago McConnel and Armstrong (2) indicated prevalence rates of 82% and 52% for *A. lumbricoides*, 77% and 20% for hookworms and 47% and 0% for *T. trichiura*, respectively, in schoolchildren for Zarema and Adarkay. On the other hand, in 1984 Leykun Jemaneh and Shibru Tedla (18) noted hookworm prevalence rates of 32.4%, 39.2% and 21.4% for Zarema, Adarkay, and Deb Bahir, respectively. The infection prevalence rates of *A. lumbricoides, T. trichiura*, and the hookworms registered for the study localities in this study concur to the outcomes of the previous investigations, while a much lower prevalence rate was obtained for *A. lumbricoides* (27.8%), the hookworms (5.6%), and *T. trichiura* (0.0%) in Zarema. These differences in prevalence rates may be due to differences, among others, in the method of examination used, on the one hand, and to environmental factors on the other.

The intensity of helminthic infection in this study has been assessed indirectly by egg counts in faeces. This method, although susceptible to errors of sampling due to periodicity of egg production by female worms which may lead to uneven distribution of eggs in faeces (19) and density-dependent constraints on fecundity that may mask the number of worms present (20), is still widely used as a measure of intensity of intestinal helminthic infections. In this study, although the reported prevalence of the geo-helminths is high, the intensity of infection as measured by eggs per gram of faeces is low. It is comparable with the findings of a study carried out in a small farming village, near Lake Tana, Gondar Region, Ethiopia (21). On the other hand, the intensity of *S. mansoni* infection was found to be much higher than that reported for schoolchildren of Zeghie Junior Secondary School in Lake Tana, an area endemic for *S. mansoni* (22). Such patterns of high prevalence of infection along with low intensity of infestation and vice versa, have been observed elsewhere (23,24). Disparate exposure to infection probably plays an important role in affecting intensity of infestation and helminth distribution in different communities.

In localities where numerous kinds of intestinal helminths are found multi-parasitism is frequently encountered. The most common combinations in some regions are infections which involve *A. lumbricoides, T. trichiura*, and hookworms (3,25). Although a similar phenomenon is noted in the present study, *S. mansoni* tended to appear more with *A. lumbricoides*. This is probably due to the high prevalence of the two helminths in the area.

In conclusion, the high prevalence rate of intestinal infestation established in this study among school children indicates the need for timely control measures. In many communities, as is the case in this study, the majority of children aged between 5 and 15 years are not only infected with at least one species of worm but they also tend to harbour the heaviest burdens (25). These helminth parasites are identified with malnutrition as causes of compromised growth (26) and reduced physical and mental fitness (27) that in turn affect the educational achievements of school children (28). Periodic treatment measures targeted at school-aged children may be implemented within the capability of the local health care system. Targeted chemotherapy with long term improvements of sanitation and incorporation of health education in the schooling system should be exercised. Safe, low cost, single dose drugs are now available to treat parasitic worms and the fact that many children aged 5 to 15 years assemble in schools provides ample apportunity in which periodic treatments could be delivered.

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