ORIGINAL ARTICLE

Soil-Transmitted Helminth Infections and *Schistosomiasis mansoni* in School Children from Chilga District, Northwest Ethiopia

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ABSTRACT

Background: ***Schistosomes and geohelminths are highly prevalent causing serious health problem in the tropics. School children carry the heaviest burden of morbidity due to intestinal helminths and schistosomiasis infections.***
The aim of this study was to determine the prevalence and intensity of the major intestinal helminth parasites of man and the relative appearances of multiparasitism.
Methods*: A cross sectional survey was conducted in seven elementary schools in Chilga District, Northwest Ethiopia. 687 (282 males and 405 females) pupils had their faecal specimens examined for* **schistosomiasis mansoni** *and the major soil-transmitted helminths (***Ascaris lumbricoides, Trichuris trichiura,** *the hook worms(by the Kato thick smear technique.*
Result*: Infection due to* **A. lumbricoides** *was the most prevalent (42.9%, range: 22.9%-68.6%) followed by the hookworms (37.7%, range:28.0%-65.5%***), Schistosoma mansoni** *(19.4%, range:7.0%-64.3%) and* **Trichuris trichiura** *infection (14.8%, range: 12.7%-20.8%). Single double and triple infections were encountered, respectively, in 29.1%, 32.2% and 7.1% of the examined specimens. Most of the double infections were a combination of* **A. lumbricoides** *and the hookworms (20.2%). Overall infection was neither age nor sex related. The intensity of infection was generally higher for* **A. lymbricoides** *and the hookworms. The rate of heavy infection was high for* **A. lumbricoides** *(26.9%) and the hookworms (13.8%). 15.1%, 12.6%, 10.9% and 20.7% of the infected children harboured moderate* **A. lumbricoides, S. mansoni, T. trichiura** *and hookworm infection.*
Conclusion*: The high infection rate observed in this study signals the need for timely intervention measures in the area.*

Key Words: ***Geohelminths, Schistosomes, Hookworms, Helminths, Kato thick smear.***

INTRODUCTION

The public health significance of schistosomes and geohelminths continues because of their high prevalence and their effects on humans, particularly those living in the tropical and subtropical areas.

Human schistosomiasis is a serious health problem of the tropics that affects over 200 million people of which 20 million suffer severe consequences from the disease and 500 to 600 million people are at risk of infection (1). Hookworm infection is a public health problem of great

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magnitude in many African and Asian countries and produces morbidity by blood loss, with consequent iron deficiency anaemia and hypoproteinaemia (2). Ascariasis has an adverse effect on nutrition and also results in serious pathology due to migrations of the worms in the body. *Trichuriasis* is implicated in rectal prolapse and chronic dysentery. In general the geohelminths have detrimental effects, particularly in children. It is widely recognized that school children carry the heaviest burden of morbidity due to intestinal helminths and schistosomiasis infection (3). Apart from the morbidity associated with acute infections, the burden of chronic parasitic infections may affect physical fitness (4) cognitive performance (5) nutritional status and growth (6) and school attendance of school age children (7).

Surveys carried out on schistosomes and the geohelminths in Ethiopia (8-29) have shown the helminthic infections to be major public health problems in many areas. Worms are the main reason (14), or the second one (21), why people seek medical aid in Ethiopia. Although few studies have tried to address the problems encountered by helminths in certain communities in northwester Ethiopia no study, to our knowledge, was conducted in the district of Chilga.

The aim of this study was, therefore, to determine the prevalence and intensity of the major intestinal helminth parasites of man (*Schistosoma mansoni*, *Ascaris lumbricoides*, *Trichuris trichiura*, and the hookworms) and the relative appearances of multiparasitism according to the types of combinations in elementary school children of the Chilga District of northwestern Ethiopia.

MATERIALS AND METHODS

The study was conducted in seven elementary schools (Table 1) found in Chilga District in North Gondar Zone, Northwest Ethiopia. Accessibility by four wheel drive was a factor in the selection of the schools. The District forms part of the northwestern lowlands formed by the foot hills of the Semien mountain ranges extending to the Sudanese border in the west. An all round weather road that joins the towns of Gonder and Metema bisects the district which has an area of approximately 3120 sq km. The area comprises of plateaus, plain and rugged land with the altitude generally ranging from about 1000m to about 2200m above sea level. There are rivers and streams traversing the district and often serving as sources of water for the population. The inhabitants are mainly engaged in farming and trading.

Children attending classes in these seven elementary schools constituted the study population. From the lists of all the children, lists of prospective examinee were drawn from which a total of 687 pupils (282 males and 405 females) were selected, using systematic sampling with a random start, to constitute the sample population. Their ages and sexes were registered.

Stool specimens were obtained from all the 687 children and examined for helminth ova. The standard Kato-Katz cellophane faecal thick smear method (20mg template) was used as the stool examination technique as described earlier (27). The double Kato-Katz slides were examined for hookworm ova soon after the slide preparations following which the slides were kept for at least for one hour prior to examination for *Ascaris*, and *Trichuris* eggs. Positivity for the helminths was established on finding the characteristic eggs on any one of the Kato slides. The number of eggs of each species was recorded and converted into number of eggs per gram of faeces (EPG). The

average number was taken when eggs were found on the two Kato slides.

Children positive *for S. mansoni* were treated on the spot with a single dose of praziquantel at 40 mg/kg body weight. Those pupils positive for the other helminths were notified of the type they had and advised to get treatment form the nearest health institution. Their names along with the parasitological results were also passed to their teachers who were asked to follow their treatment.

The EPG was used to categorize intensity of infection. The intensity of infection was classified as low (when EPG was <200), moderate (EPG = 201-800), and heavy (EPG = >800). In addition to descriptive statistics the Chi-square test was also utilized in the data analysis.

RESULTS

Of the sampled school children, 42.9%, 37.7%, 19.4% and 14.8% of the children had *A. lumbricoides*, the hookworms, *S. mansoni* and *T. trichiura*, respectively (Table 1). The over all prevalence rate for one or multiple parasitic infections in the children was 68.4% (Table 2). Infection with *A. lumbricoides* was registered in all schools with rates ranging from 22.9% in Serako to 68.6% in Chonchok.

Table 1. Prevalence of Helminth Infections in Children Attending Seven Elementary Schools in Chilga District.

School	% Positive for														
	No. Examined			*A. lumbricoides*			*T. trichiura*			Hookworms			*S. mansoni*		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Aykel	46	74	120	43.5	29.7	35.0	17.4	23.0	20.8	28.3	43.23	37.5	0.0	0.0	0.0
Chandeba	47	58	105	59.6	51.7	55.2	14.9	15.5	15.2	27.7	32.8	30.5	48.9	51.7	50.5
Serako	48	70	118	20.8	24.3	22.9	16.7	21.4	19.5	35.4	34.3	34.7	0.0	0.0	0.0
Chonchok	52	66	118	67.3	69.8	68.6	7.7	16.7	12.7	36.5	21.2	28.0	19.2	13.6	16.1
Geledeba	13	29	42	23.1	24.1	23.8	15.4	20.7	19.0	38.5	31.0	33.3	0.0	0.0	0.0
Negadebahr	43	41	84	30.2	24.4	27.4	0.0	0.0	0.0	74.4	56.1	65.5	67.4	61.0	64.3
Seraba	33	67	100	51.5	55.2	54.0	15.2	14.9	15.0	33.3	41.8	39.0	6.1	7.5	7.0
Total	282	405	687	44.7	41.7	42.9	12.1	16.8	14.8	39.0	36.8	37.7	22.7	17.0	19.4

Table 2. Frequency of Multiple Infections and Parasite Combinations in School Children Attending Seven Elementary Schools of Chilga District.

Frequency of isolation	Tot. children examined (%) (n=687)	Infected children (%) (n=470)
Number of infections		
1	29.1	42.6
2	32.2	47.0
3	7.1	10.4
Total positive	68.4	100.0
Total negative	31.6	0.0
Parasite combinations		
S. mansoni, A. lumbricoides, Hookworms	4.1	5.9
A. lumbricoides, T. trichiura, Hookworms	2.0	3.0
S. mansoni, A. lumbricoides, T. trichiura	0.9	1.3
S. mansoni T. trichiura, Hookworms	0.1	0.2
A. lumbricoides, Hooksworms	13.8	20.2
A. lumbricoides, T. trichiura, Hookworms	6.1	8.9
S. mansoni, A. lumbricoides,	5.1	7.4
S. mansoni, T. trichiura, Hookworms	64.8	7.0
T. trichiura, hookworms	2.0	2.8
S. mansoni, T. trichiura	0.4	0.6

Likewise hookworms were recorded in all schools, with comparable prevalence with that of *A. lumbricoides* and ranging form 28.0% in Chonchok to 65.5% in Negadebahr. *S. mansoni* infection was registered from 4 of the 7 schools with prevalence ranging from 7.0% in Seraba school to 64.3% in Negadebahr School. On the other hand *T. trichiura* infection was found in 6 schools with prevalences ranging from 12.7% in Chonchok to 20.8% in Aykel.

Over all there was no significant difference found in infection rates between the sexes for all helminths (Table 1). However infection due to *A. lumbricoides* and the hookwomrs appeared relatively higher in makes than in females in Aykel and Negadebahr, respectively. On the other hand more females than males were affected by *T. trichiura* and the hookwoms in Chonchok and Aykel school children, respectively. Infection was not age related by any one of the helminths.

Of the total examined children 29.1%, 32.2% and 7.1% had single, double and triple infections, respectively (Table 2). From the infected children 42.6%, 47.0% and 10.4% harboured single, double and triple infections. *A lumbricoides* commonly occurred with the other helminths and in the double infections the rate was 20.2%, 8.9% and 7.4% with the hookworms, *T. trichiura*, and *S. mansoni*, respectively, in the infected children. In the triple infections a rate of 5.9% for *A. lumbricoides* was note. Multiplicity of infection was not sex or age related.

The rate of heavy infection was low for *T. trichiura* (1.7%) and *S. mansoni* (1.6%) whereas it was higher for *A. lumbricoides* (26.9%) and the hookworms (13.8%) (Table 3). On the other hand 20.7%, 5.1%, 12.6% and 10.9% of the infected children harboured moderate infection for the hookworms, *A. lumbricoides*, *S. mansoni* and *T. trichiura*, respectively.

Table 3. Categorization of Intensity of Infection Due to *S. Mansoni, A. Lumbricoides, T. Trichiura* and the Hookworms in School Children In Chilga District.

Infection status	A. lumbricoides		S. mansoni		T. trichiura		Hookworms	
Negative	392	57.1	554	80.6	585	85.2	428	62.3
Low	6	0.9	33	4.8	15	2.2	22	3.2
Moderate	104	15.1	89	12.6	75	10.9	142	20.7
Heavy	185	26.9	11	1.6	12	1.7	95	13.8
Total pos.	295	42.9	133	19.4	102	14.8	259	37.7
Overall total	687	100.0	687	100.0	687	100.0	687	100.0

DISCUSSION

The prevalence rates of 42.9% (range 22.9%-68.6%), 37.7% (range 28.0%-65.5%), 19.4% (range 7.0%-64.3%) and 14.8% (range 12.7%-20.8%) obtained for *A. lumbricoides*, the hookworms, *S. mansoni* and *T. trichirua* infections, respectively, are reported for the first time from this study in the Chilga District. These can be compared with other surveys conducted in schoolchildren in Gondar Region and in other parts of Ethiopia.

In a study conducted on intestinal helminth infections in school children in Adarkay District, North West Ethiopia, (27) reported overall prevalence rates of 55.3% (range: 16.7%-88.9%) for *S. mansoni*, 43.0% (range: 27.8%-53.4%) for *A lumbricoides*, 20.2%(range: 5.6%-30.8%) for hookworm and 11.8% (range: 1.8 -22.5%) for *T. trichira* infections. In similar other studies undertaken in school children the same author has recorded infection rates of 41.3% (range 4.4%-70.8%), 35.0% (range:19.5-62.2%), 16.5% (range: 9.2%-31.6%) and 22.8% (range: 2.5%-33.6%) for *A. lumbricoides*, *S. mansoni*, *T. trichiura* and hookworms infections, respectively, in the Dembia Plains (28); and 35.6% (range: 16.0%-60.0%), 17.3% (range:1.0%-54.2%), 8.5% (range:0.8%-35.7%) and 3.3% (range 2.8%-17.1%) for *A. lumbricoides*, S. mansoni, *T. trichiura* and hookworms respectively, in Gondar town and surrounding areas (29).

McConnell et al (10) reported infection rates varying from 3%-100% for *T. trichiura*, 3%-98% for the hookworms, 9%-98% for *A. lumbricoides* and 3%-94% for *S. mansoni* in school children from fifty communities in the Central Plateau of Ethiopia. the study undertaken by Zein et al (30) among farming cooperatives in Gondar Region showed over all prevalence rates of 31.8%, 9.0%, and 5.3% for *A. lumbricoides*, *T. trichiura* and the hookworms, respectively, with the majority of the infection noted below the age of 19 years. In school children of Wonji-Shoa Sugar Estate Tilahun et al. (31) recorded prevalence rates 22.2%, 19.5%, 15.4% and 14.7% for *A. lumbricoides*, *T. trichiura, S mansoni* and the hookworms, respectively.

These findings indicate that helminth infections very considerably in occurrence between districts and regions. The differences in prevalence among the different communities appear to be associated with environmental sanitation, water supply and socioeconomic status of households, although this needs to be verified in more extensive follow up studies. Other factors related to macro-and micro-environment, time of study, method of examination, etc., do also contribute to the differences in the prevalence and distribution of these intestinal helminths. No significant difference was obtained in infection rates and egg counts among the age and sex of schoolchildren under consideration. This denotes a similar

exposure risk to infection by these heminths.

Multiple heminth infection is common in areas where different types of parasites are found. The most common combinations in many areas involve infections by *A. lumbricoides* and *T. tricuiura*. *A. lumbricoides* and the hookworms and *S. mansoni* and hookworms (27-29). Although one expects more frequent mixing between *A. lumbricoides* and *T. trichiura* infections when seen from the point of view of the mode of transmission and development of the two helminths, *A. lumbricoides* was encountered more commonly with the hookworms in this study. This is probably due to the higher prevalence of *A. lumbricoides* (42.9%) and the hookworms (37.7%) in the study communities. 32.2% of the total examined children and 47.0% of the infected harboured two of these helminths, with 3 heminth parasite per child noted in 7.1% and 10.4% of the examined children and 47.0% of the infected harboured two of these heminths, with 3 helminth parasite per child noted in 7.1% and 10.4% of the examined and infected children. Similar findings on the frequency of multi-parasitism were reported from earlier studies (19,32,27-29)
Faecal egg counts obtained by the Kato-Katz stool examination technique and expressed as the mean egg out put of infected and uninfected persons were used to assess the intensity of infection in this study. The method is vulnerable to sampling errors due to a variety of parasite and host factors (33). However, it is still widely used as an indirect measure of intensity of intestinal helminth infections particularly for samples collected from communities. The categorization of the intensity due to *S. mansoni, A. lumbricoides*, *T. trichiura* and the hookworms showed the infection to heavy for *A. lumbricoides* and the hookworms and moderate for the other helminths. The majority of the sampled children were negative or few egg excreters. Similar findings have been reported for schoolchildren in the Dembia Plains by Leykun (28) and Gondar town and the surrounding areas (29) and from a study conducted in the Fincha Sugar Plantation area in Western Ethiopia (34). These suggest a high degree of aggregation of eggs in the infected population and have implication in the contamination of the environment and the control of these helminths. Factors like environmental sanitation, water supply, socio-economic status, immunity and differences in exposure to infection probably play important roles in affecting intensity of infection and helminth distribution in different areas.

The high prevalence rate of *Schistosomiasis mansoni* and the geohelminth infection encountered among schoolchildren of the study area raises a serious concern. It signifies the fact that children are the highest risk groups in the community and serve as sources of infection and transmission. These parasites are well known to be associated with lowered work capacity and productivity both in children and adults and increased susceptibility to other infections. Helminths also impair the mental and physical development of children. Hookworm infection and *schistosomiasis* cause anemia both in adults and children.

The majority of wormy children are not only infected with one species of worm but they also tend to harbour the heaviest burdens. There is a need for community mobilization towards provision of safe and adequate water supply, latrine construction to reduce open field daefecation, and health education aimed at bringing behavioural change in the district. Periodic deworming, particularly of the school-aged children

with long term improvements of sanitation should be exercised.

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