GEO-HELMINTH INFECTIONS IN A RURAL AREA OF SRI LANKA

SD Fernando[1], H Goonethilleke[1], KH Weerasena[1], ND Kuruppuarachchi[2], D Tilakaratne[2], D de Silva[3], AR Wickremasinghe[4]

[1]Department of Parasitology, Faculty of Medicine, Colombo, Sri Lanka; [2]Department of Parasitology, Faculty of Medical Sciences, University of Sri Jayawardenepura, Nugegoda; [3]Department of Psychological Medicine, Faculty of Medicine, Colombo; [4]Department of Community Medicine and Family Medicine, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka

Abstract. School children carry the heaviest burden of morbidity due to intestinal helminth infection. The objective of this investigation was to study geo-helminth infections in 349 school children aged 6 to 13 years living in a rural area of Sri Lanka. Stool samples were examined by direct saline smear in an initial survey to determine the prevalence of intestinal parasitic infections and thereafter the children were followed up over a two year period with cross sectional surveys of stool samples being carried out at yearly intervals. Following collection of a stool sample, all the subjects were treated with mebendazole 500 mg as a single dose. Weights and heights were measured using standardized procedures. 2 ml of venous blood were collected from each subject under aseptic conditions to determine hematological indices. The prevalence of geo-helminth infections was low, and the prevalence declined during the two-year period from 5.4% in 1997 to 2.2% in 1998 and 2.0% in 1999 following yearly mass anti-helminth treatment. The incidence density was 0.021 cases per child year. The reduction in the prevalence from the baseline to the second survey is probably due to the reduction of the reservoir of infection among children as a result of mass treatment at baseline. The prevalence of infection during the second and third surveys were almost the same probably due to infections originating from other segments of the untreated population.

INTRODUCTION

The World Health Organization estimates that more than one billion of the world's population is chronically infected with soil transmitted helminths and these infections are associated with poverty and poor living conditions (WHO, 1998). It is widely recognized that school children carry the heaviest burden of morbidity due to intestinal helminthiasis and schistosomiasis infection (WHO, 1998). Apart from the morbidity associated with acute infections, the burden of chronic parasitic infections may affect physical fitness (Stephenson, 1990), cognitive performance (Connolly and Kvalsvig, 1992), nutritional status and growth (Stephenson, 1994), and school attendance (Nokes and Bundy, 1993) of school age children. Other studies conducted throughout Sri Lanka have shown that prevalence rates of intestinal parasitoses vary widely with time and location because they are influenced by environmental, social and cultural factors and the economic conditions in a given community. Atukorale and Lanerolle (1999) have reported the prevalence of geo-helminth infections in adolescent schoolgirls to be 2.2% in a rural area of Sri Lanka and 16.7% in an urban area. In another study conducted in the plantation sector of Sri Lanka, 89.7% of the children aged 3-12 years of age were infected with at least one type of soil transmitted nematodes (Sorenson *et al*, 1994). The objective of our investigation was to study the prevalence of geo-helminth infections in a rural area of Sri Lanka.

MATERIALS AND METHODS

The study population comprised 349

children in the age group 6 to 13 years attending four schools in the Moneragala district situated in the dry zone of Sri Lanka. The first survey on the prevalence of infections was carried out in September 1997 and thereafter the children were followed up over a two-year period with cross sectional surveys being carried out at yearly intervals. Stool samples of the study population were examined by direct saline smear to identify helminth eggs. Following collection of a stool sample, all subjects were treated with mebendazole 500mg as a single dose. The parents or guardians of the children were interviewed using a direct structured questionnaire to determine the socio-economic status of the family. Weights of children were measured using electronic scales with an accuracy of ± 0.1kg. Heights were measured to the nearest 0.1 cm using a stadiometer. Z-scores for weight for age, height for age and weight for height based on the median NCHS standard were calculated for males <11.5 years and females <10 years using the EPIINFO statistical package. Two milliliters of venous blood was collected from each subject under aseptic conditions to determine the hemoglobin, mean corpuscular volume (MCV) and the mean corpuscular hemoglobin (MCH) level. Iron deficiency anemia was classified as a child having a hemoglobin level less than 12 g/dl, MCH <27 pg and MCV <76 fl (Prematilleke, 1997). The houses were classified into three groups. If the house had a tiled roof and plastered brick walls it was classified as a "good" house. If the house had a tiled or asbestos roof and unplastered brick walls the house was classified as "medium" and if the house had a thatched roof and mud walls it was classified as "poor". Statistical significance between the groups was assessed using the chi square test, Student's *t*-test and ANOVA.

RESULTS

A total of 349 children in the age group of 6 to 13 years were followed over a 2-year period. More than 50% of the mothers of the children had an education above grade 5 while 4.3% had not attended school. Fifty-eight percent of the fathers had an education above grade 5 while 6.6% had not attended school. More than 55% of the households had a monthly family income less than Sri Lankan Rs 3000 (approximately US$ 42) and almost 70% of the families were living in poorly constructed houses. Forty-two percent of the houses had sanitary latrines indicating the rural poor socio-economic background of this population.

Over the two year follow up period 15 new cases of geo-helminth infections were detected in the population (Table 1). The incidence density *ie*, number of new cases per child per year observed, was 0.021 infections per child year. The prevalence of geo-helminth infections declined during the two year period from 5.4% in 1997 to 2.2% in 1998 and 2.0% in 1999 following mass anthelminth treatment. Of the 15 new cases of helminth infections, 9 cases were hookworm infections. None of the children positive for geo-helminth infections were found to be positive at subsequent examinations after a single dose treatment with mebendazole 500 mg. In addition to the geo-helminths, pathogenic protozoa (*Entameoba histolytica* and *Giardia intestinalis*) and non-pathogenic protozoa (*E. coli, Iodamoeba butschlii* and *Blastocystis hominis*) were also detected.

The nutritional status of the infected children, at the time the infection was detected, was better than the uninfected population. The hemoglobin level of the infected population was lower than the uninfected group. The prevalence of anemia in the population was 61% (213 children) and the prevalence of iron deficiency anemia in the population was only 5.2% (18 children) (Table 2).

DISCUSSION

A number of studies on the prevalence of geo-helminth infections have been carried out in Sri Lanka. However, most of the studies have focused on the estate sector and urban slums. It has been documented that geo-helminth infection in rural areas of Sri Lanka is low. Compared to other studies done in rural areas of Sri Lanka, the prevalence of geo-helminth infections in this population is similar. The incidence of infections was low in the 2 year follow up period. The decrease in the prevalence from the first to the second survey was greater than the decrease from the second to the third surveys. The impact of geo-helminth infections on the nutritional and hemoglobin status of the children was inconsequential in this study as compared to reports of other studies.

The reduction in the prevalence of geo-helminth infections from the first to the second survey was probably due to the reduction of the reservoir of infection among children as a result of mass treatment at the time the initial survey was done. The prevalence of infection during the second and third surveys were almost the same probably due to infections originating from other segments of the untreated population. To evaluate the exact extent of geo-helminth infections in the community, other segments of the population including adults and pre-school children should be studied. The extent of infection in such groups of population has to be considered in designing and implementing a control program.

Table 1
Intestinal parasite infections detected.

Variable	Number of children		
	1997	1998	1999
Geohelminth eggs isolated in the stools			
Roundworm	5	3	1
Hookwork	14	3	6
Whipworm	0	2	0
Other pathogens			
E. histolytica	4	8	3
Giardia	19	5	9

Table 2
Anthropometry and hemoglobin status of infected and uninfected children.

Variable	Infected children	Uninfected children	*t*-value[a]	p-value
Weight for age (z-scores)				
Mean	-1.800	-2.053	1.361	0.171
SD[b]	0.429	0.637		
n[c]	12	257		
Height for age (z-scores)				
Mean	-1.267	-1.301	0.127	0.892
SD[b]	0.512	0.920		
n[c]	12	257		
Weight for height (z-scores)				
Mean	-1.442	-1.957	2.099	0.034
SD[b]	0.894	0.828		
n[c]	12	257		
Hemoglobin status				
Mean	11.44	14.42	0.732	0.528
SD[b]	0.941	15.704		
n[c]	15	333		

[a]*t*-value is the *t*-statistic
[b]Standard deviation
[c]Number of children

Our results may be an underestimate of the true prevalence as only saline smears were used for detection of geo-helminth eggs. However, given the results of other studies and follow up of this population over a 3 year period, these results provide supportive evidence of the low infection rate in this population.

Another more plausible reason for the low prevalence of infections at the initial survey may be the availability and widespread use of cheap and effective anthelmintic drugs by the community. These are non-prescription drugs and are used on a regular basis by the community, sometimes as frequently as every 3 months. Although 61% of the children were anemic, the results of this study confirm that hookworm infection is not a major cause of anemia in this population. In fact, iron deficiency anemia was present in only 18 (5.2%) children.

The low prevalence of geo-helminth infections in this population is striking given the socio-economic background of this community. As seventy percent of the houses were of the poor construction type and only 42% had sanitary latrines, the low prevalence of geo-helminth infection is probably due to the widespread use of anthelmintic medication, which are freely available in the market.

The low prevalence of geo-helminths augurs well for control efforts. It is probably opportune at this point in time to embark on a large scale program to eliminate geo-helminth infections based on widespread controlled use of anthelmintic drugs over a short period of time. The approach should be based on mass treatment targeting all segments of the population.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the University of Colombo for financial support (Grant number: AP/3/2/98/M/25).

REFERENCES

Atukorale TM, Lanerolle P. Soil transmitted helminthic infection and its effect on nutritional status of adolescent schoolgirls of low socioeconomic status in Sri Lanka. *J Trop Paediatr* 1999; 45: 18-22.

Connolly KJ, Kvalsvig JD. Infection, nutrition and cognitive performance in children. *Parasitol Today* 1992; 104: S187-S200.

Nokes C, Bundy DAP. Compliance and absenteeism in school children: implications for helminth control. *Trans R Soc Trop Med Hyg* 1993; 87: 148-52.

Prematilleke N. The basics of haematology- Anaemia. Colombo: Guneratne Offset, 1997.

Sorensen E, Mahroof I, Amarasinghe DKC, Hettiarachchi I, Dassenaieke TSC. The effect of the availability of latrines on soil-transmitted nematode infections in the plantation sector in Sri Lanka. *Am J Trop Med Hyg* 1994; 51: 36-9.

Stephenson LS. Helminth infections; a major factor in malnutrition. *World Health Forum* 1994;15: 169-72.

Stephenson LS, Lantham MC, Kinoti SN, Kurz KM, Brigham H. Improvement of physical fitness of Kenyan schoolboys infected with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides* following a single dose of albendazole. *Trans R Soc Trop Med Hyg* 1990; 84: 277-82.

WHO, 1998. A global strategy for the control of soil-transmitted nematodes in high risk groups. TAG Meeting. 9th to 11th March, 1998.