Soil transmitted helminthiasis in Kathmandu, Nepal

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ABSTRACT

A total of 200 soil samples taken from different sites and 1,504 stool samples collected from school children (n=188) and patients (n=1,316) visiting the health care centres in Kathmandu Valley were included in this study. Soil samples were investigated for the presence of parasitic eggs using sucrose flotation technique. Stool samples were examined by formal-ether concentration and direct smear techniques. The contamination rate of soil with parasitic eggs and larvae was found to be 28.5% (57/200). The overall parasitic infection rates in school children and patients were 42.5% and 2.8%, respectively. Four types of parasites were detected from soil samples, of which *Ascaris* was the most common. *Trichuris* was most common among school children whereas *Ascaris* in patients. Females in both study groups had higher prevalence compared with male counterparts with significantly low rate in health care centre visiting patients ($p<0.05$).

Keywords: Soil transmitted helminthes, school children, patients, Kathmandu Valley.

INTRODUCTION

Intestinal parasitosis constitutes one of the important public health problems in developing countries. About 3.5 billion people in the world are affected and 450 million are ill as a result of parasitic infection alone.[1] It is estimated that soil transmitted helminthes (STH) alone infect over one billion people in the world.[2] Many of them were infected by more than one species of STH.[3] It has been estimated that 65,000 deaths occur due to *Ascaris lumbricoides*, 60,000 due to hookworms and 70,000 due to *Trichuris trichiura* each year and STH mainly affect children leading to their poor growth, reduced physical activity, impaired cognitive function and learning ability.[1]

In Nepal, STH infection has remained as one of the significant health problems. The prevalence rate approaches nearly one hundred percent in some areas[4] and been associated with anaemia and malnutrition.[5] Even now intestinal helminth infection ranks fourth in top-ten diseases in Nepal.[6] The reported soil contamination rate with STH in Kathmandu Valley range from 2.5%[7] to nearly hundred percent.[8] Relatively recent report showed the soil contamination rate in and outside the valley is 36.9% and 35.3%, respectively.[9] This paper presents the present status of soil contamination with STH and helminth parasite infection in man (school children and patients) in Kathmandu Valley, Nepal.

MATERIALS AND METHODS

The study was conducted during August 2005 to July 2006. Soil samples were collected from different parts of Kathmandu Valley (n=200) in both wet (June-October) and dry (November-May) seasons. Sucrose flotation technique was used to detect the eggs of parasites from the soil.[10] About 200 gm of soil samples were collected from a depth of about 2 cm using a shovel from an area not exposed to direct sun light. Soil samples were dried overnight in room temperature and sieved through the 150 µm mesh sieve. About 2 gm soil powder was taken in a test tube and suspended in approximately 8.0 ml of Tween-20 (0.05%) and centrifuged at 1000 rpm for 5 minutes and the supernatant was discarded. Again the tube was filled with sucrose solution (sp. gr. 1.200), shaken vigorously and centrifuged at 2000 rpm for 10 minutes. The surface solution was taken out with the loop and placed on the slide and covered with the slip and observed under the microscope.

Stool samples collected from school children (n=188) in rural region of valley and patients (n=1,316) attending the health care centres in Kathmandu Valley were included in this study. Stool samples collected in the wide mouthed, clean, dry, screwed capped plastic containers were examined for the presence of parasites both macroscopically and microscopically. Direct smear techniques and formal-ether sedimentation technique were used to detect the parasites in stool samples. Statistical significance was analyzed by using Chi-Square (χ^2) test.

RESULTS

Of a total 200 soil samples, 57 (28.5%) were positive for helminthes parasite eggs and larvae. The contamination rates in dry and wet seasons were 25.3% and 30.0%, respectively ($p>0.05$) (Table-1). Out of 57 positive samples, 56.1% were contaminated with *Ascaris* eggs, 17.5% with *Trichuris* eggs, 15.8% with hookworm and 10.5% with *Strongyloides* larvae (Table-2).

Overall, 42.5% school children had some kind of helminth parasite infections. Girls had marginally higher (44.8%) prevalence compared with boys (40.6%) ($p>0.05$) (Table-3). On the other hand, among the patients, 2.8% had some kind of parasitic infections. As in case of school children, female patients had significantly higher (4.2%) positive rate than male patients (2.0%) ($p<0.05$) (Table-3).

Over two-third of the school children had single type of helminthes while remaining had mixed helminthes. In hospital patients, all the infected subjects had single type of infection (Table-4). Among the school children, *T. trichiura* was the most common followed by *A. lumbricoides* and others (Table-5). However, among the patients, *A. lumbricoides* was the commonest followed by hookworm and others.

DISCUSSION

Soil contamination rate found in this study was lower than that reported earlier.[9] and much lower than that reported three decade earlier.[8] These differences might be due to the time and may reflect the improvement in the living standards, literacy rate, health awareness, use of toilet and else.

Ascaris eggs found as the commonest soil contaminant was in agreement with previous reports from Nepal [7-9] and other Asian countries.[11,12] This might be due to the survival of *Ascaris* eggs in adverse environmental conditions. It might also be due to the over dispersion of *Ascaris* eggs in the environment as a single female *Ascaris* lay relatively large number of eggs. This has been reflected by the static year-to-year incidence of *Ascaris* among hospital visiting population.[13] Lower rate of soil contamination with *Trichuris* eggs observed was in agreement with the earlier reports from Nepal [8,9] and elsewhere.[11,12] This might be due to their minimal dispersion as a single female *Trichuris* liberates relatively less numbers eggs and also due to easy destruction of embryonated eggs by dessication[14] One interesting finding in this study was the detection of larvae of hookworm and *Strongyloides*. These were not reported earlier from Nepal [7-9] but elsewhere.[11,12] As reported earlier, the positive rate was marginally higher in wet season than in dry season and appeared to be due to the relative high humidity in the valley.[9] *Toxocara* eggs could not be found in this study despite of stray dogs in the city area for which we have explanation. Parasitic eggs of other animal origin were not detected in this study. It might be due to the decrease in animal husbandry in the valley during recent years.

Helminth infection rate among school children (42.5%) and patients attending health care centre (2.8%) was not in agreement with previous findings from Nepal.[15,16] It might be due to the use of only direct smear technique to detect the parasites and partly, regular deworming program conducted during recent years. Earlier, Uga *et al* have reported 42.2% positive rate in hospital population (mainly police personnel and their families) using concentration technique.[16]

Among the school children, girls had marginally higher parasitic infections compared with boys. This was in agreement with some of the previous reports from Nepal [17,18] and elsewhere.[19] However, other reports from Nepal have shown higher positive rate in boys.[15,20,21] These findings indicated that both boys and girls are equal chances for infections. However, among the patients, females had significantly higher positive rate compared with their male counterparts. This appeared to be due to relatively lower educational status and their involvement in child care as well as other household works. Though not significantly, other workers have also reported higher prevalence in females.[16] All infected patients and about two-third of infected children had single type of helminth infection. Earlier, single parasite infections have been reported in half [20] and more than half [21] of the school children and elderly population.[22] However, higher rate of multiple infections has also been reported from remote areas.[18]

Five species of helminthes were detected from children. Of them, *T. trichiura* was most common. This was in agreement with previous reports from Nepal [15,16,21,23] and elsewhere.[19] This might be partly due to the incomplete removal of parasite with single dose of anthelminthic drug particularly in heavy infections.[5] Low prevalence of *Ascaris* in children was in contrast to its high prevalence in soil. This might be due to the removal of *Ascaris* during deworming program run in conjunction with Vitamin A Program and its relatively short life-span. However, in patients, *Ascaris* was the commonest as has been reported among general population [18,24] and patients in Nepal.[13]

Prevalence of hookworm observed in both school children and hospital patients were lower than the year-to-year incidence (ranging from 3.8% to 10.7%) reported earlier.[25] This appears to be due to the use of shoes/slippers by school children even in rural areas, which prevent skin penetration by larvae. However, the higher prevalence has also been reported in Southern Nepal.[17] The low prevalence of *H.*

nana detected among the school children and patients were in agreement with previous reports from Nepal.[15,17,26] A single case of *H. diminuta* observed in this study may be accidental.

Though present study showed a decreasing trend of STH in the valley (both in soil and children as well as patients), control measures including creating awareness among common people is advocated.

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Table-1: Soil contamination in different seasons in Kathmandu Valley

Seasons	n	Pos n	%	p-value
Dry	67	17	25.3	
Wet	133	40	30.0	p>0.05
Total	**200**	**57**	**28.5**	

Table-2: Prevalence and frequency of parasites in two different seasons (dry n=67; wet n=133)

Parasites detected	Dry season n (%)	Wet season n (%)	Total n (%)
A. lumbricoides	10 (58.8)	22 (55.0)	32 (56.1)
T. trichiura	2 (11.8)	8 (20.0)	10 (17.5)
Hookworm	3 (17.6)	6 (15.0)	9 (15.8)
S. stercoralis	2 (11.8)	4 (10.0)	6 (10.5)
Total	**17 (100.0)**	**40 (100.0)**	**57 (100.0)**

Table-3: Gender wise distribution of parasitic infections in school children and patients

School children					Patients				
Sex	**n**	**Pos n**	**%**	**p-value**	**Sex**	**n**	**Pos n**	**%**	**p-value**
Boys	101	41	40.6	p>0.05	M	817	17	2.0	p<0.05
Girls	87	39	44.8		F	499	21	4.2	
Total	**188**	**80**	**42.5**		**Total**	**1,316**	**38**	**2.8**	

Table-4: Types helminthes infections in different study groups

Helminthes infections	School children		Patients	
	n	%	n	%
Single infection	52	65.0	38	100.0
Mixed infection	28	35.5	-	-
Total	**80**	**100.0**	**38**	**100.0**

Table-5: Types of helminthes detected from different study groups

Types of parasites	School children (Total n=188)		Patients (Total n=1,316)	
	Pos n	%	Pos n	%
T. trichiura	66	35.1	4	0.3
A. lumbricoides	37	19.9	15	1.1
Hookworm	2	1.6	11	0.8
H. nana	1	0.5	8	0.6
H. diminuta	1	0.5	-	-
Total	**107**	**56.9**	**38**	**2.8**

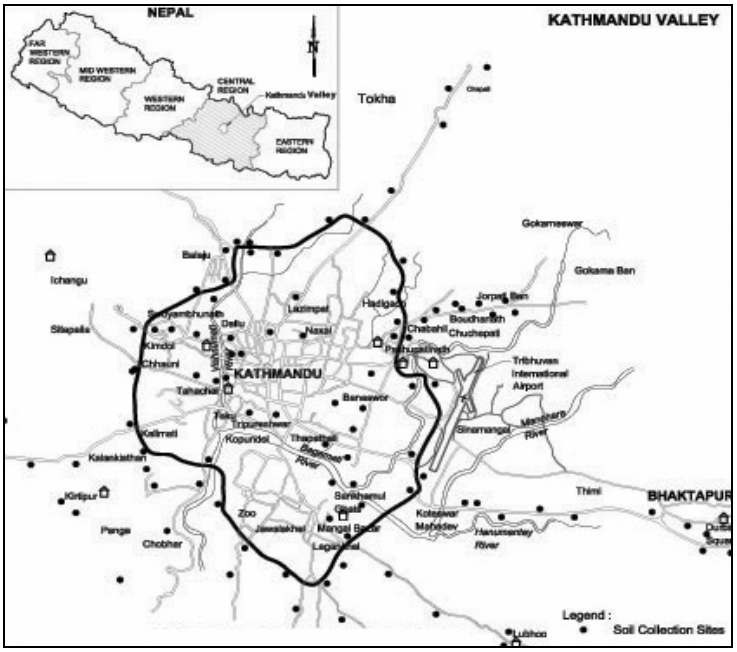

Fig. 1: Sample collection sites in Kathmandu Valley (Map of Nepal is shown in inset)