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Article

Prevalence and associated risk factors of *Strongyloides stercoralis* infection in urban slum community of Dhaka, Bangladesh

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Abstract: The present study was designed to investigate *Strongyloides stercoralis* infestation in four selected slum areas of Dhaka city. Harada-Mori culture was applied for detection. The average prevalence of *S. stercoralis* infection was 13.42%; 11.77% in male and 13.85% in female. The highest prevalence was found (40%) among the slum dwellers aged 50-59 years old following the age group 10-19 years (16.66%). In summer, the prevalence was the lowest (2.50%) and the peak was in rainy season (33.33%). The infestation was significant ($p<0.05$) depending on the educational status, economic condition and sense of hygiene among the slum residents. Noticeable prevalence was observed among the dwellers living in mud floored house (40.91%), performing irregular nail trim (50%), day laborer (31.58%) and bare footers (24.24%). Positive history of diarrhoea showed higher prevalence (18.52%) of *S. stercoralis.* The results of the present study suggest that, in the urban slum community, changes in the household environment, promulgation of proper hygiene knowledge amongst the slum dwellers would lessen the transmission of *S. stercoralis* infection.

Keywords: *Strongyloides stercoralis*; harada-mori; prevalence; risk factors

1. Introduction

Strongyloides stercoralis is a soil-transmitted nematode estimated to infect 30-100 million people globally (Olsen *et al*., 2009). Warm moist tropical conditions and poor sanitation resulting in fecal contamination of the soil are optimal for survival of *S. stercoralis* (Gamboa *et al*., 2009). The free-living stage of the parasite lives in humid soil. When the microenvironment changes to unfavorable circumstances, rhabditiform larvae transform to infective filariform larvae and penetrates the human skin (Grove, 1996). Risk factors which increase the chance of contact to infective larval stages depend both on the level of disease endemicity in the community and survival of the parasite in the environment.

Autoinfection is the major characteristic of *S. stercoralis*. Patients with immunosuppressive states viz. AIDS, malignancy, steroid therapy are prone to develop massive strongyloidiasis called hyperinfective syndrome which may be life threatening. Severe diarrhoea, malabsorption, paralytic ileus, peritonitis, meningitis, brain abscess may occur in hyperinfective condition. The mortality rate of disseminated infections has been estimated to be as high as 87% (Siddiqui and Berk, 2001). Two studies in Bangladesh performed over 15 years ago have identified several environmental issues along with some health-related behavior as risk factors for *S. stercoralis* infestation based on stool examination (Hall *et al.*, 1994; Conway *et al.*, 1995). In Dhaka city, a significantly higher ($p < 0{\cdot}001$) prevalence was found among slum dwellers compared to socio-economically better-off city dwellers (Sultana *et al.*, 2012).

The Harada-Mori culture method (Harada and Mori, 1955) is successfully established in Southeast Asia which is used in the present study for *S. stercoralis* detection. The technique seems to be simple and one of the most

cost-effective methods for proper identification (Rai *et al*., 1997). There are limited data on strongyloidiasis epidemiology from the developing world especially in tropical countries (Glinz *et al*., 2010); only a little detail from East Asia and Thailand (Steinmann *et al*., 2007). Considering the facts, the aim of the current study was to determine the prevalence of *S. stercoralis* infection and to identify individual risk factors among the slum dwellers in Dhaka, Bangladesh.

2. Materials and Methods

It was a cross sectional study conducted among urban slum residents (Railway Colony, Ananda azar, Suhrawardy Udyan and Kamrangirchar area of Dhaka city) aged 1-79 years old. The study was carried out from April 2015 to April 2016.

2.1. Laboratory screening

A total of 82 fecal samples were tested in the Parasitology laboratory, Department of Zoology, University of Dhaka. Fresh samples (stool) were ideal for testing applying direct smear technique (Cheesbrough 1987) and then Harada-Mori culture technique was applied for *S. stercoralis* detection.

2.1.1. Harada-Mori Culture

A filter paper was smeared with the stool sample and inserted into a 15-ml conical centrifuge tube containing 3-4 ml of warm distilled water. The tube was covered by a cotton plug and maintained upright in a rack at 25-28°C, and kept for 10 days. The tube was checked daily by withdrawing a small amount of fluid from the bottom of the tube and examined microscopically. Diagnostic criteria for *S. stercoralis* larvae detection by microscopy: First stage larva (L1), 200-300 µm x 16- 20 µm with short buccal cavity, rhabditiform oesophagus (1/3 body length) and prominent genital primordium (Gracia, 2009).

2.2. Statistical analysis

Statistical package, SPSS version 16 was used to compare the prevalence of infection between groups using X^2 statistics. Values of $p<0.05$ were considered statistically significant.

3. Results and Discussion

3.1. Sex wise prevalence

In the present study, the prevalence of *S. stercoralis* was 13.42%; higher in female (13.85%) than in male (11.77%) (t=1.57, p=0.36) (Figure 1) which is supported by Hossain *et al.* (2016). Sultana *et al*. (2015) conducted a coproanalysis among the slum dwellers of Dhaka and found higher prevalence of *S. stercoralis* in male (16.66%) than in female (11.32%).

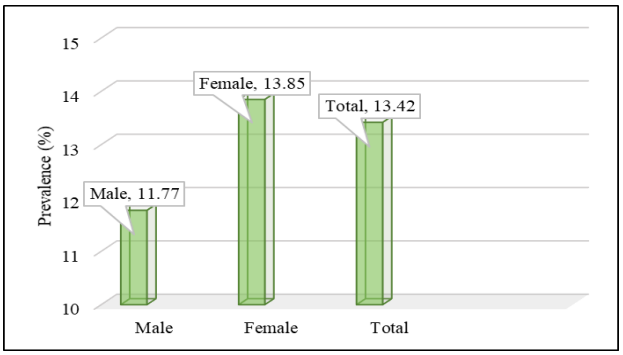

Figure 1. Prevalence of *S. stercoralis* according to gender.

3.2. Age wise prevalence

The highest prevalence was found (40%) among the slum dwellers aged 50-59 years following the age group 10-19 years (16.66%) (t=3.15, p=0.007) in the present study (Table 1). The elderly people had higher prevalence which is supported by another study conducted in Cambodia (Khieu *et al*., 2014). Wang *et al*. (2013) found the most positive cases of *S. stercoralis* among the people aged 60 years old and older. Kaminsky *et al*. (2016) found 60% of *S. stercoralis* infected patients were 21 years old or older. According to the study by Widjana and Sutisna (2000), *S. stercoralis* infection rate was high among the people aged above 18 years old.

3.3. Seasonal prevalence

The maximum prevalence was observed in the rainy season (33.33%) following the winter (14.29%). The lowest was observed in the summer (2.50%) (t=2.079, p=0.173) (Table 2) which is supported by another work (Ali-Shtayeh *et al.*, 1989). A study conducted among the inhabitants of tea garden, Sylhet disclosed the winter season comprising the highest percentage of infection whereas rainy stood second; summer showed the lowest infection and researchers assumed that the variation of infection might be due to the environmental factors stimulating development of the parasitic larvae (Hossain *et al.*, 2016).

3.4. Diarrhoeal history and higher prevalence of *S. stercoralis*

In the present study, the prevalence was higher (18.51%) among the dwellers suffering from diarrhoea (t=1.153, p=0.368). The prevalence was also higher (14.55%) among the dwellers whose one or more family members were suffering from diarrhoea at the time of sample collection (t=1.22, p=0.437) (Table 3). Khieu *et al.* (2013) documented clinical manifestations of *S. stercoralis* infected 21 patients from a community in rural Cambodia. Out of 21 patients, 18 (85.7%) reported frequent diarrhoea. Politis *et al.* (2017) observed a 69 years old Caucasian male who was suffering from watery diarrhea for six months without bleeding or weight loss. The pathology report from duodenal biopsies revealed the presence of chronic inflammatory infiltrate as well as cross-sections of *S. stercoralis.*

3.5. Household factors influencing high prevalence

In the present study, no infection was found among the dwellers having secondary or above level of education. Illiterate dwellers displayed 16.22% prevalence (t=1.571, p=0.177). Mekonnen *et al.* (2014) found that two thirds (67.1%) of the participants of his study had no adequate information about intestinal parasites earlier and they were more prone to infection. Housewives were less infected with *S. stercoralis* (4.76%) than the day laborer (31.58%) (t=2.976, p=0.025) (Table 4) in the present study.

Sultana *et al.* (2015) reported in her study that participants who had a latrine at home were significantly less frequently infected (5.26%) with *S. stercoralis* than those who used community latrines (20.77%). In the present study, toilet types did not show any marked differences though dwellers using sanitary toilet were less infected (9.09%) than non-sanitary toilet users (14.9%) (t=1.279, p=0.291). Dwellers living in mud floor were more susceptible to infection (40.91%) than the brick floored residents (3.33%) ($p < 0.05$) (Table 4) which is agreed by another study conducted in Dhaka, Bangladesh (Hall *et al*., 1994). Several factors such as respondent's use of a community latrine rather than a private latrine, living in a house with an earth floor rather than a cement floor were found to be significantly associated with *S. stercoralis* infection.

In the present study, bare footers were more prone to *S. stercoralis* infection (24.24%) than the shoe users (6.12%) (p=0.272). Similar reports were recorded by Sultana *et al.* (2015). The prevalence of *S. stercoralis* was 50% among the dwellers who did not trim their nails regularly ($p < 0.05$) in the present study. Washing hands without soap displayed higher prevalence of *S. stercoralis* (14.52%). Sultana *et al.* (2012) found that those participants who were not trimming nails regularly, not washing their hands after defecation and not wearing shoes were more likely to be infected with *S. stercoralis* ($p < 0.05$). Filtered water drinkers were less frequently infected (12.33%) than the raw water drinkers (22.22%) (p=0.093) in the present study (Table 4). Sultana *et al.* (2015) found higher rate of *S. stercoralis* infection (15.84%) among the inhabitants who used to drink unboiled supply water. Odikamnoro *et al.* (2016) analyzed 200 water samples in Ebonyi state, south-eastern Nigeria. *S. stercoralis* larvae was found in 105 water samples.

Table 1. Prevalence of *S. stercoralis* according to age groups.

Age group (years)	Total samples examined	No. of infected	Prevalence (%)
0-9	15	2	13.33
10-19	12	2	16.67
20-29	13	2	15.38
30-39	9	0	0
40-49	15	1	6.67
50-59	10	4	40
60-69	5	0	0
70-79	3	0	0

Table 2. Seasonal prevalence of *S. stercoralis.*

Season	No. of observation	No. of infected	Prevalence (%)
Summer	40	1	2.50
Winter	21	3	14.29
Rainy	21	7	33.33

Table 3. Prevalence of *S. stercoralis* in relation to diarrhoea.

Type	No. of observation	No. of infected	Prevalence (%)
History of diarrhoea in subject			
Present	54	10	18.52
Absent	28	1	3.57
History of diarrhoea in family members			
Present	55	8	14.55
Absent	27	3	11.11

Table 4. Risk factors of *S. stercoralis* infection.

Factors	No. of samples examined	No. of infected	Prevalence (%)
Educational status			
Illiterate	37	6	16.22
Primary education	34	5	14.71
Secondary and above	11	0	0
Occupation			
Housewife	42	2	4.76
Student	10	1	10
Day laborer	19	6	31.58
Unemployed	11	2	18.18
Type of house			
Mud floor	22	9	40.91
Brick floor	60	2	3.33
Types of toilet			
Non-sanitary	71	10	14.9
Sanitary	11	1	9.09
Use of shoes			
Bare footed	33	8	24.24
Wear shoes	49	3	6.12
Hand wash			
With soap	20	2	10
Without soap	62	9	14.52
Trimming nails			
Regularly	64	2	3.12
Irregularly	18	9	50
Water			
Raw	9	2	22.22
Filtered	73	9	12.33

4. Conclusions

The significance of *S. stercoralis* infection, as a public health problem, needs to be assessed accurately for community control. Unless severely infected, the clinical signs and symptoms of *S. stercoralis* infection are usually nonspecific. Early diagnosis and proper therapy will reduce the morbidity and mortality as well.

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