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Research Article

Prevalence and risk factors of soil transmitted helminths from rural field practice area of a tertiary care center from northern India

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ABSTRACT

Background: Soil-transmitted helminths (STH) are a major public health problem in our country, affecting the physical growth and cognitive development. STH infections are considered a leading cause of sickness, absenteeism and disability adjusted life years lost. Aim of the study was to assess the prevalence and risk factors of soil transmitted helminths (STH) in Farrukhabad district, India.
Methods: A total of 1203 study subjects from 602 eligible households fulfilling the eligibilty criteria. Thus equal number of children and adults were recruited from rural and urban areas. In each household, one child participant of the age 1-15 years and one adult, older than 15 years, and willing to participate, were eligible to participate in this study. All enrolled subjects were provided with a screw- capped plastic container to collect their stool sample. The following day, a field worker visited the subject's home to collect the container. Saline and iodine wet preparations were examined for the presence of nematode ova. All positive stool samples were re-examined by the McMaster egg counting technique to quantify the number of eggs per gram of stool.
Results: Overall prevalence of STH was 14.3% (95% CI 4.4-19.2) among study subjects. Hookworm was the predominant STH identified with a prevalence of 11.3% (95% CI 1.1-17.4), followed by *Ascaris lumbricoides* with a prevalence of 4.5% (95% CI 0.5-7.6). Prevalence of STH was observed to be 13.2% (95% CI 8.7-17.2) and 7.6% (95% CI 4.4-10.7) in rural and urban areas respectively. Age category, residing in a field-hut, presence of cat at home, presence of untrimmed nails, open air defaecation, habitually eating food that has fallen on the ground, not washing hands with soap and water after defaecation, and consumption of deworming tablet turned out to be independent risk factors for acquiring STH infection in our study.
Conclusions: Identification of at-risk groups along with Strategic planning and health education, awareness campaigns along with mass drug administration could reduce the burden of STH significantly.

Key words: Prevalence, Risk factors, Soil transmitted helminths

INTRODUCTION

Soil-transmitted helminths (STH), namely roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichiura*), hookworms (*Necator americanus* and *Ancylostoma duodenale*), are among the most common gastrointestinal worm infestations among humans in the world including India. A number of studies have suggested that even a moderate intensity of infection may result in delayed physical growth and impaired cognitive development, particularly among children of school-going age, and STH infections are considered a leading cause of sickness, absenteeism and disability adjusted life years (DALYs) lost.[1,2] According to the World Health Organization (WHO) estimates, over 1 billion people are infected with roundworm, 740 million with hookworm and 795 million with whipworm.[3] In 2001, the World Health Assembly of the WHO resolved to achieve a target of 75% coverage of preventive chemotherapy for pre-school and school-aged children by the year 2010 in all its regions, but globally only 31% has been achieved, with 38% in India.[4,5]

Lack of resources in terms of health infrastructure, manpower, drugs, political will, traditional beliefs and customs are some of the common barriers to achieving the target. Non-availability of accurate information on the prevalence or burden of disease in the community is another major obstacle to the timely implementation of preventive strategies. The reported prevalence of STH ranges from 12.5-66%, with varying prevalence rates for individual parasites.[6,7] The risk of acquiring STH infection and higher prevalence cannot be attributed to just one factor, but interplay of various biological, social, behavioural and environmental factors like poverty, substandard living conditions and lack of personal hygiene, both at the individual and the community level.[8] Such factors may vary from place to place depending on geographic terrain, demographic structure and socio-cultural milieu. According to best of our knowledge burden and risk factors of STH infections have not been closely investigated by the community experts in western Uttar Pradesh. The present study was therefore conducted to assess the prevalence and risk factors of soil transmitted helminths (STH) in Farrukhabad district.

METHODS

The present cross sectional survey was conducted among residents of the rural and urban field practice area of the Department of Community Medicine in collaboration with Department of Microbiology, Major S.D. Singh Medical College and Hospital, Fatehgarh, Uttar Pradesh, India during June to December 2015. Study subjects were recruited from the two villages, located within a distance of 3 kilometers from the Rural Health Training Centre (RHTC) and an urban slum falling in the vicinity of Urban Health Training centre (UHTC) under the Department Community Medicine of a tertiary care center located in western Uttar Pradesh, India. Major S.D. Singh Medical College is a state of art tertiary care centre which is located in rural outskirt of Farrukhabad district. Preventive, promotive, rehabilitative health services are offered to its adopted population in catchment area apart from curative services in rural as well as in urban areas. Thus this tertiary care health center provided us a perfect base to study such objective. In each household, one child participant of the age 1–15 years and one adult, older than 15 years, and willing to participate, were eligible to participate in this study. A total of 1203 study subjects from 602 eligible households fulfilling the eligibility criteria. Thus equal number of children and adults were recruited from rural and urban areas. Probability proportional to size (PPS) sampling technique was used to select subjects from 2 villages out of sample to be obtained from rural area. All enrolled subjects were provided with a screw- capped plastic container to collect their stool sample. The following day, a field worker visited the subject's home to collect the container. All stool samples were transferred to the laboratory at the MSDS Medical College within 4 hours of collection. Saline and iodine wet preparations were examined for the presence of nematode ova. All positive stool samples were re-examined by the McMaster egg counting technique to quantify the number of eggs per gram of stool.[9] Risk factors for STH infection were assessed. Any case with an egg count of >150 eggs per gram faeces (EPG) was considered as positive for helminthic eggs in their stool. Cut-off of >150 EPG was fixed as recommended in the anthelminthic resistance guidelines of World Association for Advancement of Veterinary Parasitology.[10] Ethical committee approved the study. Informed consent was obtained from the study participants. After compilation of collected data, analysis was done using Epi-Info 2002 (CDC, Atlanta, GA) and STATA 10.0 (STATA Corp. TX, USA) software. Results were expressed using appropriate statistical methods. The overall and individual prevalence rates of STH were calculated and compared between rural and urban areas using $\chi 2$ tests. Logistic regression analysis was performed to assess the risk factors for acquisition of STH infection. At first, the effect of each exposure variable on the outcome was assessed using univariate logistic regression analysis. The variables were then considered for the multivariate analysis using a backward step-wise model.

RESULTS

Prevalence of soil- transmitted helminths

Overall prevalence of soil- transmitted helminths (STH) was observed to be 14.3% (95% CI 4.4-19.2) among study subjects. Hookworm was the predominant STH identified with a prevalence of 11.3% (95% CI 1.1-17.4), followed by *Ascaris lumbricoides* with a prevalence of 4.5% (95% CI 0.5-7.6), and followed by *Trichuris trichiura* with a prevalence of 1.2% (95% CI 0.03-4.9). Four (2.9%) people had mixed infections with both hookworm and Ascaris.

Table 1: Rural and urban differences in prevalence rates of total and individual soil- transmitted helminths (STH) in study area

Parasite	Rural		Urban		P value
	Prevalence	95% CI	Prevalence	95% CI	
STH	13.2	8.7-19.2	7.6	4.4-10.7	0.04
Hookworm	11.9	6.8-17.4	2.7	1.1-3.3	0.02
Ascaris lumbricoides	1.6	0.5-2.3	5.8	3.2-7.6	0.05
Trichuris trichiura	0.9	0.03-2.1	3.2	1.8-4.9	0.004

Table 2: Risk factors of soil-transmitted helminths (STH)

Variable	Univariate OR (95% CI)	Significant	Multivariate OR (95% CI)	Significant
Age Category				
Children	(Reference)		(Reference)	
Adults	2.12 (1.51-2.64)	0.006	2.47 (1.73-2.98)	<0.001
Socio-economic status				
High	(Reference)		(Reference)	
Low	0.94 (0.68-1.17)	0.54	0.81 (0.74-1.05)	0.38
Overcrowding				
5 or fewer members	(Reference)		(Reference)	
Six or more members	1.16 (0.76-1.45)	0.32	1.12 (0.70-1.35)	0.15
Location of house				
Non field location	(Reference)		(Reference)	
Field hut	2.05 (1.47-2.34)	0.09	2.31 (1.62-2.85)	0.04
Pig rearing				
Not rearing	(Reference)		(Reference)	
Rearing	0.90 (0.82-1.27)	0.15	0.77 (0.64-1.08)	0.11
Presence of cat at home				
No	(Reference)		(Reference)	
Yes	1.26 (0.96-2.03)	0.04	1.32 (1.03-2.11)	0.02
Habitually eating food fallen on ground				
No			(Reference)	
Yes	0.95 (0.67-1.42)	0.03	0.62 (0.23-1.05)	0.04
Peeling vegetables before cooking				
Yes	(Reference)		(Reference)	
No	2.55 (0.68-6.15)	0.07	1.52 (0.39-3.35)	0.06
Presence of untrimmed nails				
No	(Reference)		(Reference)	
Yes	0.83 (0.56-1.35)	0.05	0.79 (0.48-1.24)	<0.001
Foot wear usage during various activities				
Proper usage	(Reference)		(Reference)	
Improper usage	1.15 (0.66-1.73)	0.64	0.96 (0.51-1.58)	0.36
Using designated area for defaecation				
Open air defecation	(Reference)		(Reference)	
Regular usage	0.89 (0.48-1.42)	0.27	0.42 (0.17-0.84)	<0.001
Washing hands with soap and water after defaecation				
Yes	(Reference)		(Reference)	
No	1.56 (0.74-2.33)	0.06	1.80 (1.12-2.75)	0.005
Consuming deworming tablet				
No	(Reference)		(Reference)	
Yes	1.24 (0.81-2.42)	0.07	1.64 (1.03-2.40)	0.03

Significant, p<0.05; Highly significant, p<0.001

Rural and urban differences in prevalence of soil-transmitted helminths

Great variation was observed in the prevalence of soil-transmitted helminths with respect to rural and urban areas. Prevalence of soil- transmitted helminths was observed to be 13.2% (95% CI 8.7-17.2) and 7.6% (95% CI 4.4-10.7) in rural and urban areas respectively. This difference was found to be statistically significant (p<0.05) (Table 1).

Risk factors for acquiring soil transmitted helminths (STH) infection

Various risk factors associated with soil-transmitted helminths were accessed using regression analysis. In the univariate analysis, adults, presence of cat at home and presence of untrimmed nails were found to be significant risk factors.

On the multivariate analysis, age category, residing in a field-hut, presence of cat at home, presence of untrimmed nails, open air defaecation, habitually eating food that has fallen on the ground, not washing hands with soap and water after defaecation, and consumption of deworming tablet turned out to be independent risk factors for acquiring STH infection (Table 2).

DISCUSSION

In this study, overall prevalence of soil- transmitted helminths was estimated to be 14.3% among study subjects. Hookworm was the predominant STH identified with a prevalence of 11.3%, followed by *Ascaris lumbricoides* with a prevalence of 4.5%, followed by *Trichuris trichiura* with a prevalence of 1.2%. An earlier study from south India found 22.8 per cent of all stool samples positive for hookworm and 0.8 per cent positive for Ascaris.[11] Another study on children aged 9-10 year, conducted in the same region, reported a prevalence of 60 per cent.[12] Prevalence estimated from the current study was much lower as compared with these studies. This difference could be due to different geographical area of study.

As a general dictum, soil-transmitted helminths infect people who live in poverty with poor sanitary conditions and lack of adequate safe water.[13] Socioeconomic status and socio-cultural factors are significantly associated with STH infections.[14] Data comparing STH in urban and rural settings are very few.

We observed statistically significant rural-urban difference in the prevalence of STH. Ascaris and Trichuris were more prevalent in urban set up whereas hookworm infestation was more common in rural areas. Higher prevalence of Ascaris and Trichuris in urban area could be due to overcrowding, lack of adequate water and improper sanitary conditions.

Another study by Kattula D et al is also in concordance with our observations.[15] Another study from Ethiopia hypothesized that the differences in prevalence among different communities might be associated with environmental sanitation, water supply, and the socio-economic status of the households.[16]

Age category, residing in a field-hut, presence of cat at home, presence of untrimmed nails, open air defaecation, habitually eating food that has fallen on the ground, not washing hands with soap and water after defaecation, and consumption of deworming tablet turned out to be independent risk factors for acquiring STH infection in our study. In rural south India, people residing in huts in the fields, far away from the main village are socio-economically deprived, and children walk barefoot through "faecal fields" that surround the village because open air defaecation is a common practice.[17] Ostan et al concluded in his study that children living in shanty areas had a higher risk of STH infection than those living in towns.[2] Another study from Egypt observed that children living in villages near a river or desert, considered to have low levels of services such as sewage, garbage disposal and water supply, were at greater risk of infection than town residents.[18] Another study from Vietnam also concluded that intestinal parasites spread through poor hygienic practices, evidenced by contaminated finger nails and unclean hands.[19]

This study has several strengths. First, to our knowledge, burden and risk factors of STH infections has not been investigated in western Uttar Pradesh. Very few similar studies are available in the literature. Second, we used PPS sampling method to select the study subjects which provide protection against selection bias apart from selection of representative sample. Third, we followed standardized procedures and guidelines.

The study has some limitations as well. First, some may argue that these markers may not be applicable to other areas of the country. I agree because baseline data like income, literacy, gender distribution and other socio-demographic-cultural factors tend to vary in different geographical areas. Second, multiple stool sample examinations are better in finding the true prevalence of STH infections thus the actual prevalence of STH infection may be higher than reported here.[12]

CONCLUSION

Identification of locally relevant risk factors such as long/untrimmed nails, habit of picking up and eat food from the ground including consuming raw vegetables directly from fields without thorough washing should be searched along with general risk factors. Identification of at-risk groups along with Strategic planning and health education, awareness campaigns along with mass drug administration could reduce the burden of STH significantly.

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