Prevalence and risk factors associated with the presence of Soil-Transmitted Helminths in children studying in Municipal Corporation of Delhi Schools of Delhi, India

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Abstract To determine the type, prevalence, intensity and the potential risk factors for helminths infection harboured by primary school aged children from selected schools of Delhi, India. Stool samples collected from 347 boys and girls studying in grades I–IV (aged 5–15 years) were examined by the semi-quantitative Kato-Katz method for presence of eggs of soil-transmitted helminths. Questionnaire data on the potential risk factors, associated variables and consequences of infection were categorized as individual, household, hygiene/sanitation related and behavioural factors. Associations between infection and these factors were assessed by multiple logistic regressions. The overall prevalence of infection with any of the helminths was 29.7 %. The prevalence of single infection with *Ascaris lumbricoides* was 8.1 % while that of hookworm and *Trichuris trichiura* was 3.7 % each. Strongest predictors for the helminths presence were never deworming (OR = 1.76; 95 % CI: 1.05, 2.95), no facility for defection (OR = 4.31; 95 % CI: 1.22, 15.22), using left hand for cleaning anal region (OR = 2.01; 95 % CI: 1.18, 3.43) and not reporting pain in stomach (OR = 1.93; 95 % CI: 1.14, 3.26). Though the infection intensities were low, we highlighted some of the potential risk factors that increase the susceptibility to these infections. Periodic deworming along with improvement in hygiene and sanitation practices through concerted efforts, not only from the school infrastructure but also the community at large, will help prevent helminths transmission and reinfection.

Keywords *Ascaris lumbricoides* · *Trichuris trichiura* · Hookworm · Soil-transmitted helminths · Risk factors · Kato-Katz technique

Introduction

Soil-transmitted helminths (STHs) are a major contributor to the malnutrition-infection cycle that adversely affects physical and cognitive development, thwart educational achievement thereby hindering economic growth. Although termed as neglected tropical diseases (NTDs), these ubiquitous problems affect individuals especially in the period of intense physical and intellectual development. Among the numerous species, *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), and the blood-feeding *Ancylostoma duodenale* or *Necator americanus* (hookworms) are the major species of intestinal nematodes that affect humans. Globally, about 48 % of the 5 billion or so people living in the developing world are infected with at least one worm species, while 10 % with at
least two species; and that *A. lumbricoides* infects 1.221 billion people (26 %), *T. trichiura* 795 million (17 %), and hookworms 740 million (15 %) (de Silva et al. 2003; Hall et al. 2008). Earlier estimate of the Disability Adjusted Life Years (DALY’s) lost for these nematodes was a whooping 39.0 million life-years (Chan 1997).

Chemotherapy is the most cost-effective and easy to implement strategy. However, to prevent re-infection and development of drug resistance, non-chemotherapeutic-based options (like health education, improved sanitation and living conditions) must be adopted along with chemotherapy (WHO 1996; Geerts and Gryseels 2001).

Determining the prevalence and intensity of infection at baseline is fundamental to initiate parasitic control. In this cross-sectional study, we determine the prevalence, intensity and the type of helminths infection harboured by the school children. We also examine the relationship between STHs infection and their potential risk factors, associated variables and consequences.

### Materials and Methods

#### Study area

The Municipal Corporation of Delhi (MCD) divides Delhi, the capital of India, into 12 zones and each zone into several wards. For this study, Civil Lines Zone was purposively short-listed. Among its ten wards, three schools within a distance of 5 km namely Guru Teg Bahadur, Hakikat Nagar and Gopalpur Village M.C. Primary Schools from the Timarpur and GTB Nagar wards were randomly selected. Necessary permissions from the Education Department and the school principals were obtained.

#### Design

Class-wise interactive discussions highlighting the causes, consequences and control of helminths were carried out wherein awareness about the helminths’ eggs being invisible to the naked eyes but detectable by sophisticated instruments was also generated. Appropriate method of stool sample collection was demonstrated and necessary instructions given. Each child (aged 5–15 years) present on the days designated to the classes I–IV was given a stool sample collection vial containing 10 % formalin (an all-purpose fixative) and a wooden spatula. Each vial was labelled with a unique code, child’s name, class and date. Children who brought their stool samples the following day were enrolled in the study while those reporting loss or breakage were given a fresh vial. The faecal samples were transported to laboratory at the National Institute of Communicable Diseases for further processing and examination.

Using the questionnaire, data on socio-demographic profile, potential risk factors, associated variables or consequences of helminth infection were gathered. Anthropometric measurements (weight and height) were taken employing standardized procedures. Weight-for-age (WAZ), Height-for-age (HAZ) and Body Mass Index-for-Age (BAZ) z-scores were then computed using the WHO AnthroPlus software version 1.0.2 that compares their distribution with the WHO Reference 2007 for 5–19 year olds (WHO 2009).

#### Sampling statistics

A sample size of 200–250 individuals is adequate to evaluate prevalence and intensity of STHs for each ecologically homogeneous area (Lwanga and Lemeshow 1991). Keeping this in mind, single faecal samples were collected from 347 children over a period of 3 months between November and January. In total, 167 boys and 180 girls participated in the study.

#### Parasitological examination

Faecal samples were examined for the eggs of *A. lumbricoides, T. trichiura* and hookworms using the semi-quantitative Kato-Katz technique (Martin and Beaver 1968; WHO 1993). The presence of single and multiple helminths were noted and their intensities of infection were measured as eggs per gram of faeces (epg). Presence of eggs of other species, if any, were noted without their egg counts.

#### Ethical consideration

The study was approved by the Institutional Ethics Committee, Institute of Home Economics, University of Delhi. After explaining the study procedure, verbal assent either from the subject or their parental permission was obtained. All the infected subjects were given a single dose of albendazole by the School Health Scheme ensuring that the tablets were properly chewed and swallowed.

#### Statistical analysis

A coding design formulated for each response was used for data entry into Microsoft Excel which was manually crosschecked. Statistical analysis was carried out using SPSS 11.5 (SPSS, Chicago, IL) and STATA 9.0 (College Station, Texas, USA) and the *p* values less than 0.05 were considered statistically significant.

The prevalence of infection with each parasitic species, the cumulative (prevalence of infection with at least one STH) and the multiple infection prevalence were computed. Subjects were categorized as having light, moderate or heavy STH’s infections on the basis of threshold.
concentrations of their faecal worm eggs load (WHO 1987, 2002). For *A. lumbricoides* infection, the presence of 1–4,999 epg (eggs per gram) was considered as light infection, between 5,000 and 49,999 epg as moderate and ≥50,000 epg as heavy infection. In case of Hookworm (*A. duodenale* and *N. americanus*), 1–1,999 epg was regarded as light, between 2,000 and 3,999 as moderate and ≥4,000 as heavy infection while for *T. trichiura*, 1–999 epg was categorized as light, between 1,000 and 9,999 epg as moderate and ≥10,000 epg as heavy infection.

All the potential risk factors, associated variables and consequences of STH infection explored were categorized under four factors. The variables studied within each were:

- **Individual factors:** Age, Gender, Height, Weight, HAZ Scores, WAZ Scores, BAZ scores, History of excreting worms, Action taken on seeing worms, Anthelmintic usage.
- **Household factors:** Area, Family Size, No of rooms in the house, Place of defecation.
- **Hygiene/sanitation related factors:** Wash hands before eating, Wash hand before eating with, Hand used for cleaning anal region, Wash hands after defecation, Wash hands after defecation with, Nail biting habit.
- **Behavioural factors:** Pica behaviour, Stomach ache, Appetite, Participation in extracurricular activities, Peri-anal irritation, Footwear usage.

Number of subjects infected with a particular helminth being relatively small, the risk of infection with either was evaluated. Associations between parasitic infection and the variables within each factors were studied using Chi-square test and the potential factors associated with infection by multiple logistic regression. Factors significant at *p* < 0.10 in the bivariate analysis were considered in the multiple logistic regressions. The results are reported as OR (95 % CI). For analysis of the variables—age, height and weight, values below or above their means for the total sample have been used.

**Results**

**Study population**

Of the 544 children present on the day of vial distribution, 347 children providing their stool samples for examination were enrolled. Reasons for non-participation (36.2 %) were either self or parent’s restrain. Mean age of the subjects computed from date-of-birth was 8.1 ± 1.8 years (5.1–15.6). 55.0 % of the subjects belonged to medium sized families with 6–8 members, 40.6 % to small families (3–5 members) while the rest had large families (9–12 members). Nearly 80 % of them lived in households with one room accommodation, 17.9 % in two while a meagre in three rooms’ accommodation.

| Type of infection | Total (N = 347) |
|-------------------|----------------|
| *Ascaris lumbricoides* | 28 (8.1) |
| *Trichuris trichiura* | 13 (3.7) |
| Hookworm | 13 (3.7) |
| *Enterobius vermicularis* | 8 (2.3) |
| *Hymenolepis nana* | 18 (5.2) |
| Any infection | **103 (29.7)** |
| Single infection | 80 (23.1) |
| Double infection | 21 (6.1) |
| Triple infection | 2 (0.6) |

*N* = Total number of study participants

Figures in parenthesis indicate percentages

**Prevalence and intensity of infection**

Stool examination revealed the presence of eggs of *A. lumbricoides*, *T. trichiura*, Hookworm, *Enterobius vermicularis* and *Hymenolepis nana* (Table 1). The overall prevalence of infection with any of the helminths was 29.7 %; single infection with *Ascaris* was 8.1 % while that of hookworm and *T. trichiura* (3.7 % each). Prevalence of infection (alone or co-infection) with *Ascaris* was 12.4 %, with hookworm or *T. trichiura* 6.3 % while with *E. vermicularis* and *H. nana* 4.0 % and 7.2 %, respectively. None harboured heavy infection, majority had light infections except few with moderate *A. lumbricoides* (2.3 %) and *T. trichiura* (0.6 %) infections.

**Risk factors associated with infection**

Bivariate logistic regression analysis of all the variables studied was carried out and only those significant at 0.10 level in the bivariate analysis were considered in the multivariate analysis.

**Potential individual factors**

Children aged 8 years or less (5–<8 years) had 1.63 times higher odds (95 % CI: 1.03, 2.59; *p* = 0.039) of being infected as compared to those aged between 9 and 13 years. Also, never dewormed children had 1.75 times higher odds (95 % CI: 1.08, 2.82; *p* = 0.023) of being infected as compared to previously dewormed ones (Table 2).

**Potential household factors**

Children from peri-urban areas had 1.53 times higher odds (95 % CI: 0.96, 2.4; *p* = 0.073) of being infected as compared to those from urban area. Compared to those using own flush toilets, children with no facility for
defecation/those defecating in the open had 5.66 times higher odds (95 % CI: 1.71, 18.71; \( p = 0.005 \)) of being infected. Though statistically insignificant, children using shared or public flush toilets had nearly 1.68–1.73 times higher odds of being infected as compared to those using own flush toilet (Table 2).

### Potential hygiene/sanitation related factors

The study indicate that children using left hand for cleaning their anal region had 1.88 times higher odds (95 % CI: 1.15, 3.06; \( p = 0.012 \)) of being infected. Hand washing after defecation with soap and water had 0.72 (0.23, 2.26; \( p = 0.786 \)) times lower odds of being infected as compared to those who used water/mud water.

### Potential individual factors

| Risk factors                          | Unadjusted OR (95 % CI) | \( p \) Value |
|---------------------------------------|-------------------------|---------------|
| Age (years)                           |                         |               |
| >8                                    | 1.0                     |               |
| \( \leq 8 \)                           | 1.63 (1.03, 2.59)        | 0.039*        |
| Gender                                |                         |               |
| Female                                | 1.0                     |               |
| Male                                  | 1.02 (0.65, 1.62)        | 0.920         |
| Height (cms)                          |                         |               |
| \( \geq 120 \)                         | 1.0                     |               |
| \( <120 \)                            | 1.19 (0.75, 1.88)        | 0.465         |
| Weight (kgs)                          |                         |               |
| \( \geq 20 \)                         | 1.0                     |               |
| \( <20 \)                             | 1.26 (0.79, 1.99)        | 0.334         |
| HAZ Scores                            |                         |               |
| \( < -2 \) SD                         | 1.0                     |               |
| \( \geq -2 \) SD                      | 1.07 (0.58, 1.95)        | 0.831         |
| WAZ Scores                            |                         |               |
| \( < -2 \) SD                         | 1.0                     |               |
| \( \geq -2 \) SD                      | 1.08 (0.65, 1.82)        | 0.762         |
| BAZ Scores                            |                         |               |
| \( < -2 \) SD                         | 1.0                     |               |
| \( \geq -2 \) SD                      | 1.38 (0.82, 2.34)        | 0.225         |
| History of excreting worms            |                         |               |
| No                                    | 1.0                     |               |
| Yes                                   | 0.68 (0.41, 1.12)        | 0.131         |
| Action taken on passing worms         |                         |               |
| Doctor’s consultation                 | 1.0                     |               |
| No action                             | 1.39 (0.79, 2.49)        | 0.255         |
| Anthelmintic usage                    |                         |               |
| Dewormed                              | 1.0                     |               |
| Never dewormed                        | 1.75 (1.08, 2.82)        | 0.023*        |

### Table 2 continued

| Risk factors                          | Unadjusted OR (95 % CI) | \( p \) Value |
|---------------------------------------|-------------------------|---------------|
| Potential hygiene/sanitation related factors |                         |               |
| Wash hand before eating with          |                         |               |
| Soap and water                        | 1.0                     |               |
| Only water/no washing                 | 0.90 (0.51, 1.59)        | 0.719         |
| Hand used for cleaning anal region    |                         |               |
| Right hand                            | 1.0                     |               |
| Left hand                             | 1.88 (1.15, 3.06)        | 0.012*        |
| Wash hand after defection             |                         |               |
| Soap and water                        | 1.0                     |               |
| Only water/mud water                  | 0.72 (0.23, 2.26)        | 0.786         |
| Habit of nail biting                  |                         |               |
| No                                    | 1.0                     |               |
| Yes                                   | 0.69 (0.35, 1.39)        | 0.300         |

### Potential behavioural factors

| Risk factors                          | Unadjusted OR (95 % CI) | \( p \) Value |
|---------------------------------------|-------------------------|---------------|
| Eat mud                               | 1.0                     |               |
| Reported stomach ache                 |                         |               |
| Yes (often/sometimes)                 | 1.0                     |               |
| No                                    | 1.86 (1.14, 3.01)        | 0.012*        |
| Appetite                              |                         |               |
| Feels hungry often                    | 1.0                     |               |
| Doesn’t feel hungry                   | 1.24 (0.78, 1.96)        | 0.368         |
| Participate in extracurricular activities |                     |               |
| Participates                          | 1.0                     |               |
| Doesn’t participate                   | 1.77 (0.89, 3.50)        | 0.103         |
| Experience peri-anal irritation       |                         |               |
| No                                    | 1.0                     |               |
| Yes                                   | 0.88 (0.56, 1.41)        | 0.605         |
| Footwear                              |                         |               |
| Wear footwear’s when outdoors         | 1.0                     |               |
| Barefoot when outdoors                | 1.27 (0.57, 2.84)        | 0.555         |

\( * \) \( p \) < 0.05

defecation/those defecating in the open had 5.66 times higher odds (95 % CI: 1.71, 18.71; \( p = 0.005 \)) of being infected. Though statistically insignificant, children using shared or public flush toilets had nearly 1.68–1.73 times higher odds of being infected as compared to those using own flush toilet (Table 2).
1.15, 3.06; \( p = 0.012 \)) of being infected as compared to those using right hand for the same (Table 2). Surprisingly, subjects reporting pica behaviour of consuming mud had 64% (\( p = 0.065 \)) less chance of being infected as compared to their counterparts.

**Potential behavioural factors**

Compared to those who reported stomach ache, children who did not report experiencing pain in stomach had 1.86 times higher odds (95% CI: 1.05, 3.01; \( p = 0.012 \)) of being infected (Table 2).

Potential risk factors independently associated with infection

The independent predictors of infection identified from multiple logistic regression analysis are shown in Table 3.

**Table 3 Multivariate analysis of independent risk factors for infection**

| Risk factors                        | Adjusted OR (95% CI) | \( p \) Value |
|-------------------------------------|----------------------|---------------|
| **Potential individual factors**    |                      |               |
| Age (years)                         |                      |               |
| \( \geq 8 \)                        | 1.0                  |               |
| \( \leq 8 \)                        | 1.60 (0.96, 2.68)    | 0.071         |
| Anthelmintic usage                  |                      |               |
| Dewormed                            | 1.0                  |               |
| Never dewormed                      | 1.76 (1.05, 2.95)    | 0.033*        |
| **Potential household factors**     |                      |               |
| Area                                |                      |               |
| Urban                               | 1.0                  |               |
| Peri-urban                          | 1.41 (0.79, 2.50)    | 0.242         |
| Place of defecation                 |                      |               |
| Own flush toilet                    | 1.0                  |               |
| Shared flush toilet                 | 1.06 (0.33, 3.47)    | 0.917         |
| Public flush toilet                 | 1.61 (0.56, 4.65)    | 0.375         |
| No facility/bush/field/drain        | 4.31 (1.22, 15.22)   | 0.023*        |
| **Potential hygiene/sanitation related factors** |   |               |
| Hand used for cleaning anal region   |                      |               |
| Right hand                          | 1.0                  |               |
| Left hand                           | 2.01 (1.18, 3.43)    | 0.010*        |
| **Potential behavioural factors**   |                      |               |
| Eat mud                             |                      |               |
| No                                  | 1.0                  |               |
| Yes                                 | 0.73 (0.44, 1.20)    | 0.216         |
| Reported pain in stomach            |                      |               |
| Yes (often/sometimes)               | 1.0                  |               |
| No                                  | 1.93 (1.14, 3.26)    | 0.014*        |

\* \( p < 0.05 \)

Anthelmintic usage, place of defecation, hand used for cleaning anal region and reported pain in stomach remained the significant independent predictors. Compared to those who were previously dewormed, never dewormed ones had 1.76 times higher odds (95% CI: 1.05, 2.95; \( p = 0.033 \)) of being infected. Subjects with no facility for defecation/those defecating in the open had 4.31 times higher odds (95% CI: 1.22, 15.22; \( p = 0.023 \)) of being infected as compared to those using own flush toilets. Subjects using left hand for cleaning anal region had 2.01 times higher odds (95% CI: 1.18, 3.43; \( p = 0.010 \)) of being infected as compared to those using right hand for the same. Further, subjects who did not report experiencing pain in stomach had 1.93 times higher odds (95% CI: 1.14, 3.26; \( p = 0.014 \)) of being infected as compared to their counterparts.

**Discussion**

To our knowledge, this study is first to determine the prevalence along with potential risk factors of STH infection among children from the selected MCD schools of Delhi. Based on 2001 population census, the prevalence of Ascariasis in India was estimated as 14% while of hookworm and Trichuriasis as 7% each (de Silva et al. 2003). Although our sample represents only a small part of Delhi and not India, the slightly lower prevalence of infection in our sample could perhaps be by chance or may be due to improved hygiene/sanitation practices and access to health services to a certain extent.

Our study provides evidence for public health measures to counteract STH infection; however, the results must be interpreted in the light of certain limitations. Information on potential risk factors, associated variables and consequences of infection were based on the child’s response and not validated by parents, possibly leading to recall and information bias. Infection with individual STHs being relatively small, risk of infection with either had to be evaluated which might have further diluted the true findings. Among the factors investigated, the present study highlighted anthelmintic usage, place of defecation; hand used for cleaning anal region and reported pain in stomach as important independent predictors of infection.

Although statistically insignificant in the multivariate analysis, our subjects aged 5–8 years had higher risk of being infected as compared to their elder counterparts presumably due to their greater participation in soil contact activities and lower personal hygiene. It has also been reported that *A. lumbricoides* and *T. trichiura* infections reach maximum prevalence and intensity in school-age years and then decline in adulthood (Asaolu et al. 1992; Bundy 1995).

We observed no gender differences for the risk of infection. However, studies show that men are more prone...
Ascaris while females have higher levels of infection owing to gender differences in exposure to contaminated soil (Holland et al. 1989; Kightlinger et al. 1998; Knopp et al. 2010). Growth deficits in children have been attributed to Ascaris while deficit in height to intense T. trichiura infections (Bundy and Cooper 1989; Hlaing et al. 1998). Although heaviest infections have most pronounced effects on growth, light infections also contribute to growth deficits if the nutritional status is compromised (Stephenson et al. 2000; Crompton and Nesheim 2002). We did not find any specific trend in the anthropometric parameters and indices studied. Perhaps, data on duration of infection would have given a better insight.

Children with a history of excreting worms and not being treated are more likely to be infected or re-infected. Child’s recall bias could have lead to our non-conclusive result. However, our never dewormed subjects had higher chances of being infected as compared to previously dewormed ones. Periodic deworming is by far the most cost-effective strategy for reducing the worm burden and transmission over time. Anthelmintics usage at least once every 3 years could significantly reduce the prevalence of A. lumbricoides 1.9 times (95 % CI: 1.2, 3.1; \( p = 0.015 \)) and hookworms 1.8 times (95 % CI: 1.1, 2.9; \( p = 0.018 \)), but had no effect on T. trichiura prevalence (Traub et al. 2004).

Although not a true classification, to account for their slight differences in geographical distribution, subjects enrolled from Guru Teg Bahadur and Hakikat Nagar M.C. Primary Schools were considered as urban slum dwellers while from Gopalpur Village M.C. Primary School as peri-urban slum dwellers. Possibly due to poor community services that increase the likelihood of infections, our peri-urban slum dwellers had higher chances of being infected as compared to their urban counterparts. While living in rural area is significantly associated with highest infections (Escobedo et al. 2008), poor living conditions and improper personal hygiene practices even in the urban areas have resulted in increased A. lumbricoides and T. trichiura infections (Atukorala and Lanerolle 1999).

Household crowding (number of co-residents per room) is a significant determinant of both the prevalence and intensity of STHs (Haswell-Elkins et al. 1989; Narain et al. 2000; Olsen et al. 2001). Unlike our findings, individuals living in households with more than six members had higher intensities of infection with all the three STHs and were 2.0 times more likely to be infected with A. lumbricoides, 1.6 times with T. Trichiura and 1.7 times with hookworms than individuals living in households with six or fewer members (Traub et al. 2004). Others too have highlighted that households not owning a toilet or the children not always using it had a higher percentage of infected members (Holland et al. 1988; Yajima et al. 2009). Promiscuous defecation too increases faecal pollution and the risk of geohelminth infection (Haswell-Elkins et al. 1989).

Non-use of soap is a predictor of Ascaris infection and that households without soap had 2.6 times higher risk of being infected than their counterparts (Olsen et al. 2001). Washing hands after defecation is protective against T. trichiura infection (OR = 0.06; 95 % CI: 0.01, 0.26) (Knopp et al. 2010) and that relative to daily use, infrequent (at least once a week) and less frequent (less than once a week) use of soap has been associated with increased risk of infection (OR = 1.40, 1.66 respectively; \( p \) for trend = 0.018) (Belyhun et al. 2010). Although it remains unclear as to why we could not see the same correlation, one possible reason could be the child’s recall bias. While it is logical to check on the habit of biting nails to prevent auto- and cross-infection, we observed no significant trend.

Due to faecal-oral route of transmission, use of right hand both for eating and cleaning the anal region (post defecation) could increase the risk of helminths infection. Subjects being rather young were asked to raise their hands used for each. Since washing hands with soap after defecation was universally reported, we couldn’t observe this association. For better understanding, data should have been gathered for hand mostly used for eating.

Although pica behaviour, particularly geophagy, is a risk factor for helminths infection (Geissler et al. 1998; Saathoff et al. 2002), we couldn’t find this because we studied the association between present infection and retrospective pica behaviour rather than their present behaviour.

Children reporting abdominal pain are 4 times (OR = 4.05; 95 % CI: 1.11, 13.18) more likely to have STHs infections and that T. trichiura infected subjects, in particular, have increased risk of stomach ache (OR = 3.31; 95 % CI: 1.05, 10.43) (Escobedo et al. 2008; Knopp et al. 2010). Absence of such correlation in our sample could be because majority had light infection which may be asymptomatic and the reported ache could be due to other underlying problems. Because helminth infection causes and/or aggravates malnutrition through several mechanisms, reduced food intake being one of them (Hall et al. 2008), we gathered data on their appetite. Conclusions could not be arrived at probably because this data was not supplemented by parental response.

Although non-significant, our study pointed that children not participating in extracurricular activities, perhaps due to lethargy and lack of vigour, had 1.77 times higher odds (95 % CI: 0.89, 3.50; \( p = 0.103 \)) of being infected as compared to their counterparts. Iron deficiency among infected children can explain this association.
Cutaneous penetration of larvae explains the association between walking barefoot while outdoors with hookworm but the reason for Trichuris infection remains unclear (Traub et al. 2004). Though insignificant, our subjects who reported being barefoot when outdoors too had 1.27 times higher odds (95% CI: 0.57, 2.84; p = 0.555) of being infected as compared to those wearing footwear’s. Migration of female Enterobius vermicularis worms before egg deposition leads to peri-anal sepsis in children (Mahomed et al. 2003). However, owing to its low prevalence; peri-anal irritation did not emerge as a consequence in our sample.

Conclusions

The consequences of STH’s infection may not be alarmingly detrimental as other infectious diseases but due attention is required in view of its potential to affect young children and enormity. School children being a captive population, the school system offers a unique set-up for its successful treatment. Therefore, the STH control programme should be integrated and developed as an entry point for providing more comprehensive school health services. Further, the school curriculum should lay ample emphasis on intestinal parasites, their prevention and control so that by improved awareness, positive change in personal hygiene and environmental sanitation related habits as well as avoidance of certain behaviours aggravating infection can be achieved. The preventive and promotive behaviours learnt and adopted by these children (health messengers) can further be passed on to their parents, households and community at large.

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