Soil transmitted helminth infections among school going age children of slums from Bhubaneswar, Odisha

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**Abstract**

**Objective:** The objective is to determine prevalence and risk factors for soil-transmitted helminth (STH) infection among school-going age children from slums of Bhubaneswar.

**Design:** Cross-sectional observational study.

**Setting:** Microbiology laboratory of a tertiary care hospital, Bhubaneswar, during May 1–October 30, 2015 (6 months) including 360 children of 3–15 years from two populated slums of Bhubaneswar, assuming STH prevalence - 50%, confidence interval 95% and 10% relative precision. Purposively sampling by house to house visit was adopted to collect stool samples along with risk factors through questionnaires from each child after written informed consent of parents/guardians.

**Materials and Methods:** Direct saline mount and egg counting by Kato-Katz (KK) method for STH-positive samples was done.

**Results:** STH prevalence was 13.3%, more in males (68.8%), and significantly high (62.5%. \(P < 0.05\)) in school-going children between 6 and 12 years of age. Predominant STH was *Ancylostoma duodenale* (56.2%), 15% of parents were illiterate, 80% of houses had toilets, 70% were washing hand with soap and using footwear. STH infection was much less (12.5%) in those practicing handwashing with soap. Fifty percent of children had STH infection even after receiving deworming within the past 6 months. More egg counts - 216 eggs/gram of feces were found in 29 cases by KK method. *Entamoeba histolytica* (56.5%) was predominant among non-STH infections.

**Conclusion:** STH prevalence of Bhubaneswar slums was minimum (13.3%), school-going children of 6–12 years were more affected and handwashing habit with soap was the key factor to prevent STH infection. The proportion of participants having toilet facility and using footwear regularly had no role in STH prevention.

**Keywords:** Bhubaneswar, slum children, soil-transmitted helminth

**INTRODUCTION**

The soil-transmitted helminths (STHs) are so-called as they require appropriate soil to develop into the infective form and transmit primarily through contaminated soil.[1] More than 1.5 billion people (24% of the world’s population) are infected with STH. They are widely distributed in tropical and subtropical areas and affect the poorest and most deprived communities. STH are transmitted by eggs present in human feces that contaminate soil in areas of poor...
sanitation. Over 267 million preschool-age children and over 568 million school-age children live in such areas and are in need of treatment and preventive intervention. The species infecting humans are *Ascaris lumbricoides*, *Trichuris trichiura*, *Necator americanus*, and *Ancylostoma duodenale*. STH infection impairs the nutritional status of the host in multiple ways - increase malabsorption of nutrients, loss of iron, protein and blood as they feed on host tissues, leading to chronic intestinal blood loss and anemia. Some STH also causes loss of appetite and, therefore, a reduction of nutritional intake and physical fitness. In particular, *T. trichiura* can cause diarrhea and dysentery. The global target is to eliminate morbidity due to soil-transmitted helminthiases in children by 2020. In India, the reported prevalence of STH ranges from 4.8% to 66%, with varying prevalence rates for individual parasites. In recent years, a number of steps have been initiated in India to decrease the morbidity of the STH by mass drug administration program involving the school-going children and building sanitary latrines in urban as well as rural areas. Studies for STH prevalence are reported from different parts of India but no study has been reported from a middle income and backward state like Odisha. As the urban slums lack all types of basic amenities and the residents are many a times deprived of the medical facilities due to lack of involvement or lack of awareness; the present study was conceived to determine the prevalence and pattern of common STH among school-going children in slum areas of Bhubaneswar and to assess risk factors associated with STH infection in them.

**MATERIALS AND METHODS**

Odisha is bounded by the bay in the east, West Bengal in the north-east, Bihar in the north, Madhya Pradesh in the west and Andhra Pradesh in the south. The territory may be divided into four distinct geographical regions: The Eastern Plateau, the Central River Basin, the Eastern Hill Region, and the Coastal Belt. The entire territory lies in the tropical zone. The state of Odisha is the least developed state of India. There are 30 districts, 314 blocks and 42 million population, out of which 35 million people reside in rural area. All the essential drugs are being supplied free to the patients at all the government health facilities of the state by the state Government.

**Ethics**

After getting institutional ethical approval, the present study was conducted among randomly selected school-going age children (3–15 years) in Bhubaneswar among two purposively selected most populated slum areas named SaliaSahi and Dumudumbasthi. Assuming the prevalence of the STH as 50% and 95% confidence level and 10% relative precision, the sample size determined was 384. Stool samples were collected from each child after getting written informed consent from their parents/guardians. As it was difficult to get the population details in the slum area, we adopted the purposively sampling for the study population selection by house-to-house visit, half of the calculated samples were from each slum area. Demographic information such as age, sex, toilet facility, parent’s education, occupation, footwear habits, deworming medication intake, and personal hygiene were collected in a pretested semi-structured questionnaire. Each child/parent was provided with the properly labeled container and instructions for collection of stool samples at the time of the first visit. The samples were transferred to the microbiology laboratory in icebox within 6 hours of collection.

**Statistics**

Collected data and examination findings were entered into excel sheet and analyzed by statistical analysis - Chi-square test; the level of significance of each test was set at $P < 0.05$.

**Laboratory procedures**

Direct microscopy was done with saline mount for the presence of egg/larva/any other finding (iodine mount if cyst) under ×10 and confirmed under ×40 magnification. All positive samples for STH were re-examined by a different observer for confirmation. Kato-Katz (KK) technique was used to quantify the number of eggs per gram of feces.

**Kato-Katz technique**

A glass slide labeled with the sample number was taken and a plastic template with a hole at the center was placed on it. A small amount of feces was put on a newspaper and with the help of a nylon screen on top feces was sieved using a spatula. Some of the sieved feces were scraped up and put in the template to fill the hole (approximately holding 41.7 mg) avoiding air bubbles. Then, the template was lifted off carefully to leave the feces on the slide. One piece of cellophane strip of the size of a coverslip was cut and immersed in glycerol malachite green (1 ml of 3% aqueous malachite green added to 100 ml glycerol and 100 ml water) and soaked for 24 h before use. The soaked cellophane was placed over fecal sample. Then, the slide was inverted and the fecal matter was firmly pressed over the cellophane to evenly spread the feces between the slide and cellophane. Then, the slide was removed carefully without lifting off the cellophane. Excess fecal matter was cleaned, then slide was allowed to dry and placed under
microscope with cellophane upwards and examined in a systematic manner and the number of eggs of each species was reported. Finally, the number of eggs was multiplied by the appropriate number (24 for 41.7 mg template) to give the number of eggs per gram.\textsuperscript{[9,11]}

RESULTS

Among the 360 slum children studied, 95% were going to school, 70% in the primary school, 15% of the parents were illiterate, 80% of the houses had toilets, 70% children were using soap for hand wash, and the same proportion was regularly using footwear during a toilet visit. The overall positivity rate for parasites was found to be 117 (32.5%), STH was positive in 13.3% (48/360) and parasites other than STH was found in 19.16% (69/360). Among the 48 STH positive, 33 (68.8%) were males and 15 (31.3%) were females and A. duodenale was found in 27 (56.2%) cases followed by A. lumbricoides 6 (12.5%) and rest were mixed infections [Table 1]. School-going children (6–12 years) were affected more (62.5%) in comparison to smaller children and the difference was found to be statistically significant [Table 2]. History of receiving deworming medication in the last 6 months was found in 24 (50%) among STH positive and 144 (46.2%) among STH-negative study participants but the association of STH-negative participants and deworming treatment was not statistically significant. All the participants used to eat from roadside vendors and all of them were from low socioeconomic status. Parent’s education status had no role in relation to STH positivity. The number of participants having toilets at home and regularly using footwear had a higher proportion of STH infection (62.5%) among regular footwear users in comparison to nonusers-37.5% [Table 2]. STH infection was positive in 6 (12.5%) participants using soap for handwashing after visit to toilet. Of the 48 STH positive, saline mount detected egg counts of 1–2, 2–4 and 4–9/coverslip area in 28, 14, and 6 cases, respectively. In contrast, KK method detected 1–2, 2–4, and 4–9 eggs/coverslip area or 48, 96 and 216 eggs/gram of feces in 6, 13, and 29 cases respectively [Table 3]. Entamoeba histolytica (39/69–56.5%), Giardia lamblia – (27/69–39%), and Hymenolepis nana (3/69–4.3%) were found among the participants having infections other than STH.

DISCUSSION

In our study, the STH prevalence was found to be 13.3% which closely resembles to the study carried out by Kattula et al. where the prevalence in rural areas was 5.9%–12.1%.\textsuperscript{[6]} However, several other studies have shown higher prevalence rates ranging from 30%–70%.\textsuperscript{[12–16]} Ganguli et al. reported still higher prevalence of 75.6% (95% confidence interval: 71.2–79.5) STH infection in the state of Uttar Pradesh.\textsuperscript{[17]} A recent review have reported the prevalence of STH infections from 19 different states of India and more than 50% prevalence was reported from six states including Tamil Nadu, Andhra Pradesh, Bihar, Assam, and West Bengal. Less than 20% prevalence was reported from Delhi, Himachal Pradesh, Chandigarh, Madhya Pradesh, Rajasthan, Gujarat, and Karnataka. However, states such as Chhattisgarh, Telangana, and Odisha though contribute a large section of people living below poverty line, STH prevalence in these regions could not be included in the above review due to the absence of any published reports.\textsuperscript{[18]} STH positivity was more in males 33 (68.8%) and School going children (6–12 years) were affected more (62.5%) as compared to Avhad and Hiware and Greenland et al. where they have reported in 33.9% and 42.5% in the same age group, respectively.\textsuperscript{[19,20]} The most common helminths found was A. duodenale (56.25%) followed by A. lumbricoides (20.83%). Mixed infection of A. duodenale + A. lumbricoides was seen in 22.91% of children. Many studies reported A. lumbricoides as the most prevalent parasite and nearly 90% have more than one parasite species in the same sample population.\textsuperscript{[13,18,21]} However, Odinaka et al. (94.2%) had reported a higher prevalence of A. duodenale.\textsuperscript{[13]} The possibility of getting more hookworm infection may be attributed to poor personal hygiene, walking barefoot or the male children playing outdoors. T. trichiura infection was not detected at all in our study. The prevalence of T. trichiura was 4.6% in a study from North India.\textsuperscript{[17]} More than 50% prevalence for T. trichiura was reported from Assam and Andhra Pradesh. Jalaripet in Andhra Pradesh was a unique location from where a high prevalence of all three parasites - A. lumbricoides (91.12%), T. trichiura (71.5%), and hookworm (50.2%) were reported.\textsuperscript{[18]} Open defecation practices, poor handwashing and footwear use, low literacy rate, and poor socioeconomic status were significant predictors of the prevalence of STH infections in most of the above studies. In the present study, the awareness regarding personal hygiene and sanitation habits was satisfactory among the study children which was reflected by the higher percentage practicing handwashing with soap and using toilets and foot ware while defecation [Table 2]. However, the proportion of STH infection was more among the children having toilet

### Table 1: Distribution of helminths among soil transmitted helminth positive children (n=48)

| Name of STHs | n (%) |
|--------------|-------|
| A. duodenale | 27 (56.25) |
| A. lumbricoides | 10 (20.83) |
| A. duodenale + A. lumbricoides | 11 (22.9) |
| Total | 48 (100) |

STHs: Soil transmitted helminths, A. duodenale: Ancylostoma duodenale, A. lumbricoides: Ascaris lumbricoides
facility at home and using the footwear regularly. Kalipan et al. had also reported that poor usage of footwear does not significantly increase the risk of STH infection.\[^{14}\] However, the STH infection was much lower (12.5%) here in participants using soap for handwashing after visit to toilet and the difference was statically significant. Although the deworming medication is provided regularly in the government schools but in our study half of the children had not received the medication in the past 6 months and there was no significant difference in STH positivity from those who received deworming medication. The literacy status of parents also did not play any significant role in preventing STH infection here [Table 2].

### CONCLUSION

STH prevalence in urban slum of Bhubaneswar city is much less in comparison to earlier reported studies as well as recent reviews. The common age group affected was school-going (6–12 years) and handwashing habit with soap was the key factor detected to prevent STH infection in the community. KK is a simple and rapid method which can be used routinely to detect egg burden and monitor therapy.

The limitation of this study was a limited sample size as it was difficult to convince for consent as well as specimen collection and transportation within the stipulated time. However, larger sample study in future can be planned to strengthen the present findings. Deworming intervention should be carefully monitored and documented for better coverage and compliance. This study will definitely add data of STH prevalence from Odisha state which was lacking in several review articles of India. Further such studies will increase the awareness of healthy sanitary

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### Table 3: The detection of worm burden in saline mount and per gram of feces by Kato-Katz technique (n=48)

| Number of eggs/cover slip area | Saline mount (n) | Kato-Katz count/gram of feces (multiplying factor=24) (n) |
|-------------------------------|-----------------|----------------------------------------------------------|
| 1-2                           | 28              | 2x24=48 (6)                                               |
| 2-4                           | 14              | 4x24=96 (13)                                              |
| 4-9                           | 6               | 9x24=216 (29)                                             |

eggs) where there is a chance of missing detection of STH. The efficacy of KK method was also reported by many investigators.\[^{12,17,20}\]
habits among children and improve the sanitation levels in rural areas.

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Conflicts of interest
There are no conflicts of interest.

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