

## Soil – transmitted helminthes – a glimpse into the eastern horizon of India

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**Abstract:** *Introduction:* The soil-transmitted helminthiases (STH) are important neglected tropical diseases (NTD) as they are often ignored for their chronic disease outcome. However, they continue to be diseases of public health importance globally. *Aim & Objectives:* To analyze the epidemiology and distribution trend of STH infections from stool samples received in a tertiary care hospital in eastern India in the last decade. *Material & Methods:* A retrospective observational cross-sectional study was conducted based on stool examination findings from patients attending Calcutta School of Tropical Medicine which is a referral centre of excellence for HIV-AIDS between January 2012 and July 2022. These samples were subjected to direct microscopic examination following formol-ether concentration method, modified Ziehl-Neelsen and Trichrome staining techniques and were subsequently followed by culture by Harada-Mori technique. The data collected were subsequently analysed. *Results:* Out of 5821 stool samples, 736 (12.64%) revealed at least one STH and the most common STH detected was *Trichuris trichiura* (289 samples). The annual distribution revealed that 220 out of 811 (27.13%) samples obtained in 2012 had STH, while in 2021, 18 out of 1358 (1.33%) samples had STH, thereby reflecting a declining trend over the last decade. *Conclusion:* *Trichuris trichiura* was the most common STH infection in our study. There has been a sharp decline in STH infections in eastern India in the past decade, thereby reflecting successful therapeutic and preventive interventions. However, strict vigil through intensive laboratory diagnosis is needed to keep the prevalence of STH, a disease of public health importance, under control.

**Keywords:** Soil-transmitted helminths, Neglected tropical Diseases, *Trichuris trichiura*, Harada-Mori technique

### Introduction

The soil-transmitted helminths (STH), also known as geohelminths, are a group of helminths which undergo a free-living phase of development in soil before becoming infective to human. The most prevalent STH are *Ascaris lumbricoides*, hookworms (*Ancylostoma duodenale* and *Necator americanus*), and *Trichuris trichiura* [1].

Other STH include *Strongyloides*, *Trichostrongylus* and *Capillaria*. STH infections are widespread in tropical and subtropical regions, mainly in low and middle income countries. These helminths are predominantly

transmitted when faeces containing eggs are deposited into the environment, develop to an infective stage and are transmitted by ingestion or by penetration through the skin (e.g. in case of hookworm). Thus prevalence is highest in overcrowded, unhygienic areas with poor safe water supply, sanitation facilities and insufficient health care services. Despite their high prevalence, specially in underdeveloped countries, these infections are often ignored because of their chronic smoldering nature, and also the lack of awareness regarding their effect on the economic and educational burden, making them some of the most important neglected tropical diseases (NTD) [2-3].

Globally, more than a billion people are infected with one or other STH [3-4]. Asia contributes 67% of the global prevalence of STH. Within this continent, the highest prevalence of STH is observed in India (21%) followed by China (18%) [5-6]. STH infections rarely cause mortality, the immediate outcomes being malnutrition, anemia due to diarrhea, malabsorption. However, the long term effects of these infections are far more sinister and include reduced cognitive abilities, intellectual capacity and lower work productivity [4]. These infections are among the most common infections worldwide, resulting in considerable morbidity in low-resource settings [5]. A high prevalence of STH, along with poor hygiene and malnutrition, indicates future problems for the country, and emphasizes the urgent need to eradicate STH worldwide [6].

Periodic surveillance for improvement of drinking water supply, sanitation and health care facilities along with anthelmintic treatment for the control of intestinal parasitic infection, is highly effective and inexpensive. However careful study of epidemiology of STH is needed for improvement of the overall scenario [7]. Though numerous studies have been done on STH in India, there is a dearth of data regarding the prevalence of STH and the trends of STH infections in the recent years from the eastern part of the subcontinent which the present study attempts to address.

**Aim & objectives:** To analyze the distribution trends of STH in stool samples received in a tertiary care hospital in eastern India in the last decade.

**Material and Methods**

A retrospective observational cross-sectional study was conducted based on results obtained from examination of stool samples of clinically suspected patients attending Calcutta School of Tropical Medicine (CSTM), Kolkata (NRL & Centre for excellence for HIV-AIDS between January 2012 and July 2022. All the faecal samples from clinically suspected STH cases, not having received anti-parasitic medications in the last six months, received at the Helminthology Unit of the Microbiology Laboratory of CSTM were included in the study.

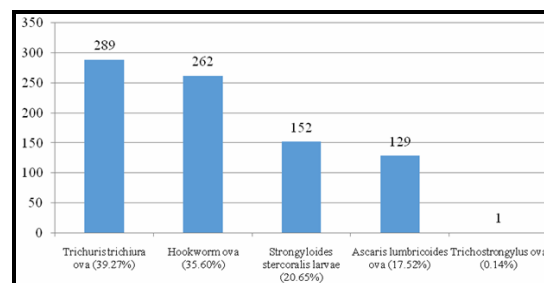
The samples were subjected to direct microscopic smear examination by normal saline and iodine preparation followed by microscopic examination after formol-ether concentration method. Additionally smears prepared from the samples were subjected to microscopy following modified Ziehl-Neelsen and Trichrome techniques. The positive samples were also observed after subjecting them to culture by the Harada-Mori technique. The findings were noted and data were analysed subsequently as discussed below.

**Results**

Out of 5821 stool samples, 736 samples revealed at least one STH infection, indicating an overall prevalence of 12.64% of STH infections among clinically suspected patients over the last decade. Out of these 736 positive samples, 432 (58.7%) belonged to males and the rest were females, indicated a slight male preponderance (1.42:1) among the infected cases. Age-wise, the highest preponderance was found among the 21-30 age group with 304/736 cases (41.3%). Among the 736 STH infections, 458 cases (62.2%) and 278 cases (37.8%) belonged to the immunocompetent and immunocompromised category respectively.

The most commonly isolated parasite in our study was *Trichuris trichiura* with 289/736 cases (39.27%). Hookworm (*Ancylostoma duodenale* and *Necator americanus*) was the next with 262/736 cases (35.60%). 152/736 cases (20.65%) of *Strongyloides stercoralis* larvae were isolated, followed by 129/736 cases (17.52%) of *Ascaris lumbricoides* and 1/736 case (0.14%) of *Trichostrongylus spp.* (Fig-1).

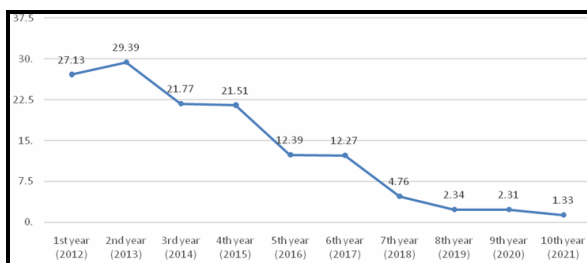
**Fig-1:** Column diagram showing the distribution of individual STH infections among positive samples (n=736)



There were samples revealing mixed STH infections with dual infections in 114/736 (15.49%) positive samples and triple infections in 9/736 (1.23%) positive samples. The most common dual infection involved *Trichuris trichiura* and hookworm with 30/736 samples (4.1%) while the most common triple infections involved hookworm, *Ascaris lumbricoides* and *Trichuris trichiura* and hookworm, *Trichuris trichiura* and *Strongyloides stercoralis* with 2/736 samples each (0.27%).

A year wise distribution of the STH infections revealed 220 out of 811 (27.13%) samples obtained in 2012 with STH, while in 2021, 18 out of 1358 (1.33%) samples showed the presence of STH. There has been a drastic, noticeable decline in the STH positivity in the 10-year period between 2012 and 2021 (Fig-2).

**Fig-2:** Line diagram showing the percentage of STH-positive stool samples for every year between 2012 and 2021



## Discussion

In our study, out of 5821 stool samples, 736 samples revealed at least one STH infection, indicating an overall prevalence of 12.64% of STH infections among clinically suspected patients over the last decade.

Our study revealed the highest age group to be involved was 21-30 years age group. Higher rates of infection in the young adult age group (21-30) is a cause of great concern since this results in immense morbidity in the most economically active age group of the country. The male preponderance found in our study can probably be attributed to the higher outdoor activities and occupational exposure of men.

When we look at similar studies around India, we find that Pullan et al, have reported the three most common STH worldwide, in descending order of

prevalence, are *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm [8]. A study conducted in Vizianagaram revealed the overall STH prevalence to be 55.6% STH, which is quite high compared to our findings [9]. The most common soil-transmitted helminth is hookworm (8.7%), and the most commonly affected age group was reported to be 8–10 years. [10]. A Vellore-based survey revealed a similar prevalence rate for hookworm (8.4%) [11]. In a study done in Karaikal region of Puducherry, the overall prevalence of stool parasites has been found to be 30%, of which 35% has been attributed to hookworm [12]. The overall prevalence of parasitic diseases in Puducherry in 1998 was 67% in slum children aged 1–10 years [13]. Hookworm infections, as revealed by our study are also predominant STH in eastern India. Another hospital-based study conducted in Puducherry revealed an overall parasitic prevalence of 16%, which reveals a similar picture as our findings, of which 68%, had helminthic infections; the most common STH was found to be hookworm (86%) followed by *Strongyloides stercoralis* (6.3%) and *A. lumbricoides* (2.8%) [14].

Unlike most of the studies elsewhere in India, the most common parasite isolated from our study was *Trichuris trichiura*, prompting a greater need for further evaluation of its epidemiology in future studies in Eastern India. This is in contrast to *Ascaris lumbricoides* as per the findings of most India-based studies e.g. those of Parija et al [3], Greenland et al [15] and Ganguly et al [16], though hookworm infections are consistently grabbing the limelight.

STH prevalence is greater in rural areas than that in urban areas. A Lucknow-based community-centric study found that the STH infection rate was 20% in rural areas compared to 5% in urban areas [17]. Meta-analysis done in India revealed a higher prevalence of STH in rural areas compared to urban areas as a result of lack of awareness, poor sanitary measures and a lack of continuous water supply [18].

Geohelminthes tend to be more widespread in people inhabiting poorly sanitized areas, and

their effect on morbidity and mortality is more severe in populations suffering from malnutrition [19]. The soil-transmitted helminthes are capable of living for years in the human gastrointestinal tract once they attain the adult form [20]. The risk of acquiring STH infection and the higher prevalence of these parasites tend to be multifactorial. As per studies in tropical countries they can be attributed to various social, biological, behavioral and environmental factors like poverty, low standards of living and lack of personal hygiene, both at the community and the individual levels [21-22].

In contrast to the venues of most of the above studies, Calcutta School of Tropical Medicine, the place of our study, has been the National Reference Laboratory for the diagnosis of HIV, and is a well-known apex institution and referral centre for the diagnosis and treatment of HIV infections. This is probably one of the reasons for the high percentage of *Strongyloides stercoralis* larvae among the stool samples unlike most other studies, as strongyloidiasis is one of the important opportunistic infections associated with HIV-

positive individuals. The prevalence of dual and triple infections among positive STH cases is a stark reminder of the lack of sanitation and hygiene conditions in the eastern part of the country.

### Conclusion

As depicted from our study, there has been a drastic and noticeable decline in STH infections in eastern India in the past decade, thereby demonstrating the success of the national and state level measures to curb STH infections. However, it must be emphasized that STH infections in general continue to remain an important public health hazard, thereby stressing the need for prompt and complete laboratory diagnosis of such suspected cases and initiate appropriate therapeutic and preventive measures. More such demographic studies are needed for proper estimation of STH infestation burden in Eastern India to frame more robust national policies in treatment and prevention of such infections.

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