

Prevalence and Risk Factors of Soil Transmitted Helminthic Infections in School Going Children Population in Uttar Pradesh: Review

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Abstract

Soil-transmitted helminth (STH) infections are highly prevalent in many developing countries, affecting the poorest and most deprived communities. Most of the STH infections were of light intensity. Our review focus on STH infections which is common among the school going children. The national programs should be strengthen among these population. The impact of deworming programs must be monitored and routine surveillance should be carried out. Lower socio-economic groups are more affected. The reason for this might be poor socio economic condition and unhygienic living conditions. The main species involved are roundworm (AL, *Ascaris lumbricoides*), whipworm (TT, *Trichuris trichiura*), and hookworms (HW, *Ancylostoma duodenale* and *Necator americanus*). This review aims to intensity STH infections and focus more among school-aged children.

Keywords: School children; poor hygiene; national deworming programs; autoinfection

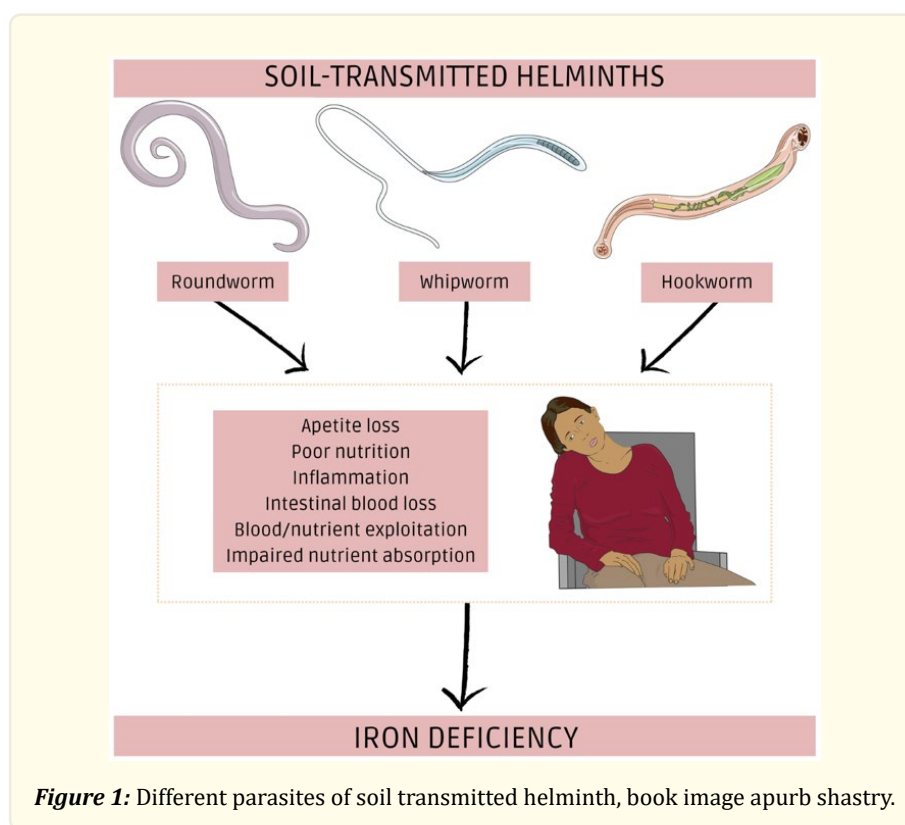
Introduction

Protozoans and soil-transmitted helminths are the two main groups that cause intestinal parasitic infections (IPI) in humans and are a major public health concern in low-and middle income-countries [1]. Adult worms live in the intestine and produce thousands of eggs every day. STH infections are transmitted by eggs and larvae present in human faeces that contaminate soil in areas with poor sanitation. School going children live in areas with increased transmission of these infections and thus are in need of preventive measures as well as treatment [2]. Soil-transmitted helminths (STH) comprise *Ascaris lumbricoides*, *Necator americanus*, *Ancylostoma duodenale*, and *Trichuris trichura*. Globally more people are affected by this parasites, this causes them to renew programs on national deworming to relieve parasitic symptoms [3]. As per World Health Organization, preschool children, school going children, adolescent and reproductive age group women are at greater risk of STH infection [4]. Intestinal helminth infections generally caused by the food intake and improper digestion leads to iron depletion anemia [5]. This anemia is characterised by microcytic hypochromic anemia. Contaminated soil are the major source of infection. Bare foot walking causes these worms larva to penetrate causing soil transmitted helminth infection. These infections are widely distributed in tropical and subtropical regions due to a combination of factors, such as living conditions and climatic influences. Warm and humid climates provide favourable conditions for the survival of STH parasites [6], Southeast Asia and sub-Saharan Africa have shown the highest burden of this infection. Eggs of parasite are found in soil and are the major source of transmission of infection. Two modes of transmission of this parasites are found by active skin penetration of larvae and bare foot walking for hookworm and *S. stercoralis*. Secondly, through ingestion of eggs in contaminated food or water for A.

lumbricoides and *T. trichiura* [7]. Autoinfection by these is also the cause. School-based deworming programs are considered as simple, safe, cost-effective, and scalable [8, 9].

Types of species

The main species which infect population are the roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*) and hookworms (*Necator americanus* and *Ancylostoma duodenale*). These STH species are collectively called parasite causing infection. These require generally similar diagnostic procedures. Their treatment and medications are also the same [10]. *Strongyloides stercoralis* is an intestinal helminth which is frequently missed due to its peculiar characteristics: different diagnostic methods is employed this is why it is frequently missed [11]. In addition, the treatment of this parasite is different. It is not sensitive to albendazole or mebendazole and therefore not cured by large-scale preventive treatment campaigns targeting other soil-transmitted helminthiasis. Figure 1. Different programs and treatment modalities are required.



Transmission

Infected people pass eggs as well as adult worms. These worms produce thousands of eggs each day [10]. In areas which lack adequate sanitation, proper disinfection and poor hygiene maintenance these eggs are generally found contaminating the soil. This can happen in several ways:

- Eggs that are found on vegetables are ingested if these are not properly cooked, washed or peeled;
- Eggs can be ingested from contaminated water sources
- Eggs are generally ingested by children who play in the contaminated soil.
- The infection in children is more severe as they put their hand in mouth without proper hand washing.

- In addition, hookworm eggs hatch in the soil, releasing their larvae into a form that can actively penetrate the skin.
- People become infected with hookworm when they walk barefoot on the contaminated soil.

There is no direct human to human transmission, or infection from fresh faeces, because eggs passed in faeces need about three weeks to mature in the soil before they become infective.

A. lumbricoides, *T. trichiura* and hookworms do not multiply in the human host; re-infection occurs only as a result of contact with infective stages in the environment.

Collection Transport and Processing of Stool Sample

Early morning single stool samples are selected and collected from children. The transportation is carried out in ice-packs or cool boxes to the laboratory if delayed from 3-4 hours of sample collection. In the laboratory, samples are stored in cool boxes with ice packs until they are processed. One gram of the stool sample which is collected is prepared using sodium-acetate-acetic acid-formalin (SAF) ether concentration technique to increase the sensitivity of STH ova detection [12]. The best concentration method employed is sodium ether method. In this layers formed are ether, formalin, debris and sediment. Samples were emulsified in 10mL of SAF solution and transported in ice packs to the parasitology laboratory. The sample should be ideally transported within two hours of collection. In the laboratory, sample bottles are vigorously agitated so that stool samples are efficiently suspended in the solution. Stool suspension are further strained through a 13-mm sieve into a centrifuge tube, and the filtrate are centrifuged at 2000 rpm for 5 minute. The resulting supernatant was discarded; then 7 mL of normal saline and 3 mL of petroleum ether were added to the sediment. The resulting mixture was shaken vigorously and centrifuged for 5 minute at 2000 rpm. The first three layers of the suspension observed after centrifuging were discarded leaving the last layer of sediment. Sediment was pipette onto clean, oil-free glass slide and examined for the ova of gastro- intestinal helminths under $\times 10$ objective lens [12]. It is observed carefully so that no finding is missed. Generally for better observation slide is scanned under 40X objective lens. The stool sample received in lab are made two mount iodine mount and saline mount. Generally iodine mount shows better nucleus and chromatoid bodies and saline mount shows better motility. The liquid stool sample should be processed within 30 minutes of receiving in the lab. The stool samples are stored for long duration with addition of formalin at room temperature.

Treatment

The WHO recommended medicines are albendazole (400 mg) and mebendazole (500 mg). These drugs are found effective, inexpensive and can be easily administered by non-medical personnel and staffs also. These drugs are safe with minimal side effects and effective actions are found in single dose of administration only. Both these drugs are donated to national ministries of health through WHO. All endemic countries are especially covered through this programs. Generic ivermectin for the control of *S. stercoralis* has been available at affordable price since 2021. For *S.stercoralis* along with albendazole we add ivermectin for broad coverage and prophylaxis. WHO generally employs massive programs for deworming including mass drug administration. Therefore proper disinfection and hygiene practices should be carried out for prevention of worm infestation and infection.

Nutritional effects

Soil-transmitted helminths impair the nutritional status of the people they infect in multiple ways.

1. Loss of iron and protein is reported in case of worm infestations.
2. Anaemia and intestinal malabsorption is reported in these soil transmitted helminths parasitic infections.
3. Vitamin A deficiency is reported in case of roundworm infection.
4. Diarrhoea and dysentery is reported in case of *T.trichiura* infection.
5. Hyper-infection and dissemination syndromes is associated with *S.stercoralis* infection.

WHO responses

There are six WHO 2030 global targets for soil-transmitted helminthiasis:

1. Soil transmitted helminth infection should be eliminated.
2. Number of tablets needed in preventive chemotherapy should be removed for STH.
3. Preventive chemotherapy for soil transmitted helminth should be employed.
4. STH control programme in adolescent, pregnant and lactating women should be established.
5. Efficient strongyloidiasis control programme in school age children should be established.
6. Basic sanitation and hygiene by 2030 in STH-endemic areas should be incorporated.

Discussion

According to systematic review published in 2017 in India, the prevalence of STH among school going children was reported as high as 50% [13]. It is essential to break the chain of transmission to eliminate the morbidity of STH in preschool and school children by 2030. To ensure proper eradication or deworming of parasites guidelines should be followed strictly. Deworming of the parasites should be done six monthly so that autoinfection and recurrent infection rate can be decreased. Sanitation and hygiene practices with preventive strategies can help in decreasing the rate of this infection. WHO implemented biannual deworming with 400 mg of albendazole to all high-risk groups including school going children and pregnant women [14]. Possible reasons for the high rate could be the differences in the method of diagnosis and poor living, environmental conditions and lack of awareness regarding the parasitic infections. In Uttar Pradesh the rate of helminthic infection is high due to overpopulation and overcrowding of people. Overall, there has been an improvement in adopting good practices over last few decades and it is possible that the above factors may not play a major role in the STH transmission. STH infections commonly lead to disease with relatively mild symptoms. Only few vague symptoms present are nausea, loss of appetite, fatigue etc. However, the severity of the infection and associated complications can vary depending on the intensity and severity of the disease. In addition to mild symptoms, more severe forms of the infection can occur, resulting in various clinical manifestations and long-term sequelae. These include general malaise, fatigue, intestinal manifestations (diarrhoea and abdominal pain), anaemia, growth impairment, intellectual retardation, and cognitive and educational deficits [15], moderate prevalence of STH infections, with *T. trichiura* and *A. lumbricoides* being the most prevalent. The risk of being infected with *A. lumbricoides* decreases in adulthood because adults care better about hygiene than children [16]. WHO recommendation for STH control consists of the mass drug administration of albendazole among school children. Decreased risk of *A. lumbricoides* infection with age, while the risk of *T. trichiura* infection was similar in different age groups. This could probably be due to infection with *T. trichiura* could occur in childhood already in our community. This is efficiently controlled by the benzimidazole (ABZ and mebendazole) used for either the treatment of STH infection cases or in the frame of MDA campaigns. The absence of heavy infection intensity in our community could be explained by frequent deworming of children by their parents, which is a common practice in the country, particularly when the child presents helminth-like symptoms and thus in cases of heavy infection intensity three monthly deworming should be done [17]. The Government of India is constantly making efforts to scale up STH control activities to meet the WHO global commitment to overcome the impact of neglected tropical diseases [18]. The current study observed a higher STH burden in women with anemia. The common iron-deficiency anemia is observed among population infected with soil transmitted helminth. The symptoms present in this population include fatigue, malaise and abdominal discomfort. The long term results in malabsorption, weakness and perforation. Pregnancy may complicate the intestinal symptoms. Similar findings were observed in a study among pregnant women in southern India [19]. *A. lumbricoides* was found to be more prevalent, followed by Hookworm and *T. trichuria*, respectively. However, some studies reported higher prevalence of hookworm [20]. Apart from this, studies have showed that in developing countries, young children crawl and play in areas where they may come into contact with soil that is contaminated with human and animal feces [21]. Proper hygiene practices and sanitation measures are important to curtail the spread of helminthic infection. Health and hygiene education among general population reduces transmission. Reinfection can be reduced among general population by encouraging healthy behaviours and practices. Provision of adequate sanitation is also important but its follow-up in resource-poor settings is not

always followed. Pilot interventions should be done to evaluate the impact of programs. WHO recommends to endemic countries to measure the success of their programmes through epidemiological assessments after 5 to 6 years of PC implementation with effective treatment coverage of $\geq 75\%$ and to adjust their treatment frequency [22].

Conclusion

The soil transmitted helminth infection is more prevalent in school going children and pregnant women. Water, sanitation and hygiene (WASH) measures should be help to interrupt the transmission and reinfection in the community, thereby reducing the burden further. Periodic assessment of prevalence of STH in school going children is recommended and this will help in deciding the deworming strategies in the national programs. STHs are prevalent among the study population, hence some considerations should be given to children with respect to deworming programs. This can be through production of less stronger drugs than can be administered to them during mass deworming programmes.

Conflict of Interest

Authors have no conflict of interest.

Author Contribution

All authors contributed equally in drafting and designing manuscript.

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