

# Soil-Transmitted Helminth Infections

## Key facts

- Soil-transmitted helminth infections are caused by different species of parasitic worms.
- They are transmitted by eggs present in human faeces, which contaminate the soil in areas where sanitation is poor.
- Approximately 1.5 billion people are infected with soil-transmitted helminths worldwide.
- Infected children are nutritionally and physically impaired.
- Control is based on periodical deworming to eliminate infecting worms, health education to prevent re-infection, and improved sanitation to reduce soil contamination with infective eggs.
- Safe and effective medicines are available to control infection

## What are intestinal worms (soil transmitted helminthiasis)?

Soil-transmitted helminth infections are among the most common infections worldwide and affect the poorest and most deprived communities. They are transmitted by eggs present in human faeces which in turn contaminate soil in areas where sanitation is poor.

The main species that infect people are the roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*) and hookworms (*Necator americanus* and *Ancylostoma duodenale*). These STH species are normally addressed as a group because they need similar diagnostic procedures and respond to the same medicines.

*Strongyloides stercoralis* is an intestinal helminth with peculiar characteristics: the parasite requires different diagnostic methods than other soil-transmitted helminthiasis, and for this reason is frequently not identified. In addition, the parasite is not sensitive to albendazole or mebendazole and therefore not impacted by large-scale preventive treatment campaigns targeting other soil-transmitted helminthiasis.

# Transmission

Soil-transmitted helminths are transmitted by eggs that are passed in the faeces of infected people. Adult worms live in the intestine where they produce thousands of eggs each day. In areas that lack adequate sanitation, these eggs contaminate the soil. This can happen in several ways:

- eggs that are attached to vegetables are ingested when the vegetables are not carefully cooked, washed or peeled;
- eggs are ingested from contaminated water sources;
- eggs are ingested by children who play in the contaminated soil and then put their hands in their mouths without washing them.

In addition, hookworm eggs hatch in the soil, releasing larvae that mature into a form that can actively penetrate the skin. People become infected with hookworm primarily by walking barefoot on the contaminated soil.

There is no direct person-to-person transmission, or infection from fresh faeces, because eggs passed in faeces need about 3 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. *S. stercoralis* can reproduce in the host and in immunocompromised individuals, its uncontrolled multiplication can be fatal.

## Nutritional effects

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

- The worms feed on host tissues, including blood, which leads to a loss of iron and protein.
- Hookworms in addition cause chronic intestinal blood loss that can result in anaemia.
- The worms increase malabsorption of nutrients. In addition, roundworm may possibly compete for vitamin A in the intestine.

- Some soil-transmitted helminths also cause loss of appetite and, therefore, a reduction of nutritional intake and physical fitness. In particular, *T. trichiura* can cause diarrhoea and dysentery

## Types

### Ascariasis

Ascariasis of STH is caused by the large roundworm *A. lumbricoides*. It is estimated to be the most widespread STH, affecting approximately 1 billion people. The victims constitute about half of the populations in tropical and subtropical areas. Most conditions are mild and often show little or no symptoms. Heavy infections however are debilitating, causing severe intestinal blockage and impair growth in children. Children, compounded with malnutrition, are most infected, with the most common age group being 3 to 8 year olds, with an annual death of about 20,000. Children are more susceptible due to their frequent exposure to contaminated environment such as during playing, eating raw vegetables and fruits, and drinking wastewater.

### Hookworm disease

Hookworm infection of STH is caused by *N. americanus* and *A. duodenale*. Mild infections produce diarrhoea and abdominal pain. More severe infections can create serious health problems for newborns, children, pregnant women, and malnourished adults. In fact it is the leading cause of anaemia and protein deficiency in developing nations, affected an estimated 740 million people. *N. americanus* is the more common hookworm, while *A. duodenale* is more geographically restricted. Unlike other STHs, in which school-age children are most affected, high-intensity hookworm infections are more frequent in adults, specifically women. Roughly, 44 million pregnant women are estimated to be infected. The disease causes severe adverse effects in both the mother and infant, such as low birth weight, impaired milk production, and increased risk of mortality

## **Trichuriasis**

Whipworm (*Trichuris trichiura*) is the third most common STH-causing nematode in humans. According to current estimate, nearly 800 million people are infected, and majority of the victims are children. Heavy infections could lead to acute symptoms such as diarrhoea and anaemia, and chronic symptoms such as growth retardation and impaired cognitive development. Medical conditions are more often serious since coinfection with protozoan parasites such as *Giardia* and *Entamoeba histolytica*, and with other nematodes is common. Predominantly a tropical disease of developing countries, trichuriasis is quite common in the United States

### **Diagnosis**

For basic diagnosis, specific helminths can be generally identified from the faeces, and their eggs microscopically examined and enumerated using fecal egg count method. However, there are certain limitations such as the inability to identify mixed infections, and on clinical practice, the technique is inaccurate and unreliable. A novel effective method for egg analysis is the Kato-Katz technique. It is a highly accurate and rapid method for *A. lumbricoides* and *T. trichiura*; however not so much for hookworm, which could be due to fast degeneration of the rather delicate hookworm eggs.