



Effective Prophylactic measures to Ameliorate health of mankind with special reference to Worms

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ABSTRACT

Helminthes or parasites, often called "worms", are widespread throughout the world. It is estimated that half of the world's population is infected with at least one helminthes [8]. There are over 340 species of helminthes; most are rare in humans but may infect animals that can serve as a reservoir for infection and cause diseases. These worms are often called "soil-transmitted helminthes" (STH) which refers to their mode of transmission. Ingestion of contaminated feces through soil, water or food is a main mode of transmission. There are three main types of parasitic worms that can grow inside the human digestive tract: roundworm, pork tapeworm and beef tapeworm. The steps needed to control helminthes infections are improving the quality of the water supply, sanitation, and hygiene (WASH). Education to ensure the safe and hygienic handling of human feces is needed for the general public. Sanitation is the key to eliminating helminthes infections. Soil transmitted helminthes are common among school-aged children, with an estimated 50% of children, five to nine years of age, infected with helminthes in developing countries. Improvements to WASH are essential for achieving sustained control of helminthes in the medium and long-term. Diagnosis of helminthes diseases in humans usually requires a medical history and physical examination, a laboratory analysis of stools, and sometimes other tests. WHO recommends preventive doses of antihelminthic medication, treatment, and mass treatment depending on the prevalence of helminthes.

Key words: worms, infection, sanitation, sustained control

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INTRODUCTION

The word "helminth" is derived from the Greek "helmins" (worm). Helminths are large, worm-like parasites. They can usually be seen by the naked eye when they are adults. As adults, helminths are not able to multiply in humans. Most helminths can live in the gastrointestinal tract of humans. But some can also be found in the blood, lymphatic system or under the skin. A person can get these worm-like parasites by swallowing their eggs. This may happen after a person touches contaminated soil. The eggs can be swallowed when they are transferred from the person's hands to the mouth. Some helminths can also enter the body by entering through the skin. A person may walk barefoot through soil contaminated with parasite larvae. The larvae can enter the skin, travel through the bloodstream and end up in different parts of the body. Food or water may be contaminated by coming into contact with urine or feces. Raw or undercooked meat can also contain parasitic worms. In some cases, helminths can also spread if a mosquito or other insect bites an infected person. The next person the insect bites can become infected. Helminths can cause many different parasitic diseases. These small worms are usually barely visible to the naked eye, but the discomfort level and illnesses caused are varied in intensity and seriousness. An untreated worm infestation can even result in the host's death. Symptoms that may indicate the presence of worms are common to other health problems, but people who suspect they might have picked up a parasite can look for certain signs that often accompany the presence of parasitic worms. The three main types of common intestinal worms that infect humans are large intestinal roundworm (*Ascaris lumbricoides*), hookworm (*Ancylostoma duodenale* and *Necator americanus*) and whipworm (*Trichuris trichiura*) (WHO, 2013) are commonly associated with malnutrition, including anemia, and disease in children. These worms are often called "soil-transmitted helminths" which refers to their mode of transmission. Globally, more than 3.5 billion people are infected with intestinal worms. Of them, 1.47

billion have roundworm; 1.3 billion are infected with hookworm and 1.05 billion with whipworm [1]. The highest rates of roundworm, hookworm and whipworm infections are often in children between age 5 and 15. It is estimated that about 400 million school-age children are infected with these three types of worms. The preventive measures, leading to a clean living environment, is necessary for the proper development and well being of mankind.

COMMON INTESTINAL WORMS AND THE PROBLEMS THEY CAUSE

Roundworm: Roundworms hatch and live in the intestines. The eggs usually enter the body through contaminated water or food or on fingers placed in the mouth after the hands have touched a contaminated object. Symptoms of their presence include fatigue, weight loss, irritability, poor appetite, abdominal pain and diarrhea. Treatment with medication results in a cure in about a week. Without treatment, anemia and malnutrition can develop.

Pinworm: Also called seatworms and threadworms, pinworms hatch and live primarily in the intestines. The eggs usually enter the body through the anus, through the nose or mouth via inhaled air, or through the mouth on fingers that have touched a contaminated object. Symptoms of their presence include anal itching and sometimes pale skin and stomach discomfort. Pinworms do not cause serious complications. Treatment with medication results in a cure within days.

Trichina spiralis: This worm lives in the intestines and causes a serious illness known as trichinosis. The eggs usually enter the body via raw or undercooked pork, sausage or bear meat. Early symptoms include vomiting, diarrhea, and abdominal cramps. In time, a high fever, puffiness of the face and muscle pain develop. Eventually the worms can penetrate the muscles, the heart and the brain and can cause death. Treatment with an anti-worm drug such as thiabendazole, as well as bed rest and a physician's care, can cure trichinosis. Recovery may take several months. Diagnosis of trichinosis sometimes requires analysis of a tissue sample (biopsy) taken from muscle.

Tapeworm: Tapeworms live in the intestines. The eggs usually enter the body via raw or uncooked beef. Symptoms of their presence are usually absent. However, some patients experience abdominal pain, fatigue, weight loss, and diarrhea. Treatment with medication results in a cure within days.

Fluke: Flukes live in different locations in the body, including the intestines, bladder, rectum, liver, spleen, lungs and veins. Flukes first mature inside freshwater snails. After leaving the snails, they can enter the body of humans by penetrating the skin of persons swimming, bathing or washing in water where flukes are active. Infected persons can re-contaminate the water by urinating or defecating in it. Most infected persons experience no symptoms. However, some infected persons may experience rash, itching, muscle aches, coughing, chills and fever. Flukes pass out of the body, but persons can become infected again and again. In time, the repeated infections can damage the liver, bladder, intestines and lungs. In rare cases, flukes can invade the spinal cord or brain and cause seizures and paralysis. Fluke-caused illnesses are classified as schistosomiasis (also called bilharziasis) and are mainly confined to Africa parts of South America and the Caribbean, and parts of the Middle East, China and the Philippines.

SIGNS AND SYMPTOMS OF HOOKWORM INFECTION

Hookworm infection is generally considered to be asymptomatic, but as Norman Stoll described in 1962, hookworm infection is an extremely dangerous infection because its damage is "silent and insidious" [11]. There are general symptoms that an individual may experience soon after infection. Ground-itch, which is an allergic reaction at the site of parasitic penetration and entry, is common in patients infected with *N. americanus*. Additionally, cough and pneumonitis may result as the larvae begin to break into the alveoli and travel up the trachea. Then once the larvae reach the small intestine of the host and begin to mature, the infected individual will suffer from diarrhea and other gastrointestinal discomfort. However, the "silent and insidious" symptoms referred to by Stoll are related to chronic, heavy-intensity hookworm infections. Major morbidity associated with hookworm infection is caused by intestinal blood loss, iron deficiency anemia, and protein malnutrition. They result mainly from adult hookworms in the small intestine ingesting blood, rupturing erythrocytes, and degrading hemoglobin in the host. Recently, more attention has been given to other important outcomes of hookworm infection that play a large role in public health. It is now widely accepted that children who suffer from chronic hookworm infection can suffer from growth retardation as well as intellectual and cognitive impairments.

SOIL-TRANSMITTED HELMINTH (STH) INFECTIONS = TRANSMISSION

India has the highest burden of soil-transmitted helminths in the world, with 241 million children at risk of parasitic worm infections. Soil-transmitted helminths interfere with nutrient uptake in children; can lead to anemia, malnourishment and impaired mental and physical development. Rigorous research has shown that they also pose a serious threat to children's education, and productivity later in life [7].

Soil-transmitted helminthes are most common infections worldwide and affect the poorest and most deprived communities. They are transmitted by eggs that are passed in the feces 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. 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 feces, because eggs passed in feces need about 3 weeks to mature in the soil before they become infective. Since these worms do not multiply in the human host, re-infection occurs only as a result of contact with infective stages in the environment.

Global distribution and prevalence

More than 1.5 billion people, or 24% of the world's population, are infected with soil-transmitted helminth infections worldwide. Infections are widely distributed in tropical and subtropical areas, with the greatest numbers occurring in sub-Saharan Africa, the Americas, China and East Asia.

CONTROL AND PREVENTION

Water, sanitation and hygiene

UNICEF's water, sanitation and hygiene (WASH) team works in over 100 countries worldwide to improve water and sanitation services, as well as basic hygiene practices [2]. UNICEF Annual Report 2014 outlines: UNICEF's ongoing efforts to realize the rights of every child, especially the most disadvantaged, and break the intergenerational cycle of inequity and poverty. In 2014, UNICEF programmes helped millions of children to be nourished and healthy, and to learn to be protected and safe. Throughout the year, UNICEF worked to advance the global conversation on children and equity. Looking back on 25 years of water, sanitation and hygiene monitoring, the report provides a comprehensive assessment of progress since 1990 (UNICEF progress on sanitation and drinking water, 2015). In 2015, 663 million people still lack improved drinking water sources, 2.4 billion lack improved sanitation facilities and 946 million still practice open defecation.

Complementary interventions

Long-term solutions to controlling helminth infections are improving the quality of the water supply, sanitation, and hygiene (WASH). Education to ensure the safe and hygienic handling of human feces and wearing shoes in areas designated for defecation are effective measures in controlling transmission. Sanitation is the key to the elimination of helminth infections. Much of this burden is due to poor sanitation and open defecation. Improvements to WASH are essential for achieving sustained control of helminths in the medium- and long-terms.

Awareness raising

Awareness raising for the importance of WASH is regularly carried out by various organizations on some special days of the year, as it is easier to obtain media coverage on those days. These United Nations international observance days include: World Water Day (22 March), Global Handwashing Day (15 October), and World Toilet Day (26 November).

Swachh Bharat Abhiyan

Swachh Bharat Mission - A model for social empowerment envisions covering the entire community for saturated outcomes with the aim of creating 'Clean India' with specific emphasis on 'eliminating open defecation' by 2019 [6]. Over 50 percent of India's population practices open defecation which put them at risk of diseases like cholera, diarrhoea, typhoid etc. Lack of toilets also expose one-third of the country's women to the risk/fear of sexual abuse/assault (TERI and Ministry of Water Resources, 20-22 April, 2016).

According to Census 2011, India's urban population is 377 million or 31% of the total population. These numbers are expected to increase to 600 million by 2031. Weak sanitation has significant health costs and untreated sewage from cities is the single biggest source of water resource pollution in India. The Swachh Bharat Mission (SBM) emanates from the vision of the Government articulated in the address of The President of India in his address to the Joint Session of Parliament on 9th June 2014: "We must not tolerate the indignity of homes without toilets and public spaces littered with garbage. For ensuring hygiene, waste management and sanitation across the nation, a "Swachh Bharat Mission" will be launched. This will be our tribute to Mahatma Gandhi on his 150th birth anniversary to be celebrated in the year 2019" SBM is being implemented by the Ministry of Urban Development (M/o UD) and by the Ministry of Drinking Water and Sanitation (M/o DWS) for urban and rural areas respectively.

Global Atlas of Helminth Infections (GAHI)

Identifying who is in need of treatment can be somewhat difficult. Conducting parasitological surveys is costly and time-consuming. The Global Atlas of Helminth Infections (GAHI) is an online open-access information resource on the distribution of STH, schistosomiasis and lymphatic filariasis [5]. GAHI aims

to provide reliable and updated maps of helminth infection distribution that are essential to target treatment to populations in greatest need. For India, GAHI maps data from 127 surveys conducted over the period 1999 to 2007. Although some parts of India are too hot or dry to permit transmission of STH, the combined prevalence rates reported in many of these surveys are well over the 20% threshold recommended by the WHO for introduction of preventive chemotherapy programmes.

WHO strategy for control

In 2001, delegates at the World Health Assembly unanimously endorsed a resolution (WHA54.19) urging endemic countries to start seriously tackling worms, specifically schistosomiasis and soil-transmitted helminthes [9].

The strategy for control of soil-transmitted helminth infections is to control morbidity through the periodic treatment of at-risk people living in endemic areas. People at risk are: preschool children, school-age children, women of childbearing age (including pregnant women in the second and third trimesters and breastfeeding women) and adults in certain high-risk occupations such as tea-pickers or miners [4].

WHO recommends periodic medicinal treatment (deworming) without previous individual diagnosis to all at-risk people living in endemic areas. Treatment should be given once a year when the prevalence of soil-transmitted helminth infections in the community is over 20%, and twice a year when the prevalence of soil-transmitted helminth infections in the community is over 50%. This intervention reduces morbidity by reducing the worm burden. Schools provide a particularly good entry point for deworming activities, as they allow the easy provision of the health and hygiene education component, such as promotion of hand washing and improved sanitation.

Global target

The global target is to eliminate morbidity due to soil-transmitted helminthiases in children by 2020 [10]. This will be obtained by regularly treating at least 75% of the children in endemic areas (an estimated 873 million). In 2010, de-worming programmes coordinated by the World Health Organization (WHO) covered a total of 328 million pre-school and school age children in treatment campaigns worldwide corresponding to 31% of the global target.

Statistics published in the recent edition of the Weekly Epidemiological Record, 2012, show that more than 50% of all children in need of treatment worldwide live in 5 countries - Bangladesh, China, India, Indonesia and Nigeria.

National Deworming Day

With an aim to intensify efforts towards STH control among children in India, the Ministry of Health & Family Welfare, Government of India (GoI) has decided to observe National Deworming Day (NDD) on 10th February 2016 across all 36 States/UTs. The National Deworming Day will be followed by a Mop-Up Day (MUD) on 15th February 2016 with the intent of deworming children who missed the dose on February 10th. All Government and Government aided schools and anganwadi centers will be the sites for implementation of National Deworming Day across the country.

Prevention of Reinfection

The things should be done until your child and family members are free of infection. Start when the medicine is first given and continue for about one week. Continue to practice good hand washing and good housekeeping even after the pinworms are gone. Hand washing is very important. Have your child and all family members wash their hands in the morning, before meals and after using the toilet. This is a good habit all the time. Make sure children wear shoes when they are outside. This will keep them from carrying into the house any worms or eggs that live in the soil.

Challenges

Although access to sanitation has in general been improving over the past decades, the World Health Organization estimates that even still, "2.5 billion people – more one third of the global population – live without basic sanitation facilities. Part of the reason for slow progress in sanitation may be due to the "urbanization of poverty," as poverty is increasingly concentrated in urban areas. Migration to urban areas, resulting in denser clusters of poverty, poses a challenge for sanitation infrastructures that were not originally designed to serve so many households, if they existed at all.

CONCLUSION

In countries of high endemicity of the soil-transmitted helminth parasites *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm, preventive chemotherapy (i.e., repeated administration of anthelmintic drugs to at-risk populations) is the main strategy to control morbidity. However, rapid reinfection of humans occurs after successful deworming, and therefore effective preventive measures are required to achieve public health goals with optimal efficiency and sustainability.

Improved living conditions almost inevitably lead to declining prevalence of STH infections. These are basically transmitted through the contamination of surface soil with human feces. WHO recommends

preventive chemotherapy as a primary means of controlling STH infections when prevalence rates are high [3]. In the case of STH infections, the targets set in the Roadmap are that by 2015, 50 per cent of pre-school and school-aged children in need of treatment are regularly treated and 100 per cent of endemic countries have a plan of action for the control programmes; and by 2020, 75 per cent of pre-school and school-aged children in need of treatment are regularly treated, with at least 75 per cent coverage in all endemic countries.

Evidence Action provides technical assistance to governments around the world to rapidly scale up national school-based deworming programs. The organization is a principal technical assistance provider to the governments of Kenya and Ethiopia for their national deworming programs, and works with state governments in Delhi, Bihar, Rajasthan, and more recently Madhya Pradesh, on deworming 30 million children annually in India alone.

India's ambitious national school-based deworming program is funded by the Government of India and State Departments of Health, Education, and Women and Child Development. Additional support for Evidence Action's technical assistance for deworming in India has been provided by the Children's Investment Fund Foundation (CIFF), Dubai Cares, the United States Agency for International Development, the Michael & Susan Dell Foundation, the END Fund, the Douglas B. Marshall Jr. Family Foundation, and by individual donors to Evidence Action.

At the end of the International Drinking Water Supply and Sanitation decade (1981-1990), WHO and UNICEF established a Joint Monitoring Programme for Water Supply and Sanitation (JMP).

The overall aim of the JMP is to report globally on the status of water supply and sanitation sector, and to support countries in improving their monitoring performance to enable better planning and management at the country level. Health education, therefore, must address preventive measures in ways that are both feasible and sustainable in the context of resource-limited settings.

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