Helminth parasites, a major factor in malnutrition

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The author discusses the significance of helminth and schistosome infections in exacerbating nutritional problems in many countries, and advocates population-wide treatment where there is clear evidence that this would yield substantial gains in the quality of life.

Infections with hookworm, roundworm and/or whipworm are particularly significant if they cause or aggravate protein-energy malnutrition, iron-deficiency anaemia, vitamin-A deficiency, or goiter (*1*). Some 500 million children are affected by the first of these conditions, among whom about 10 million die every year; low weight and height for age or stunted growth occur in children aged two years and more. Iron-deficiency anaemia affects 800–900 million persons. Helminths and malnutrition usually occur in the same geographical areas, and often in the same persons.

Hookworm

The growth-stunting potential of hookworm has long been known (*2*). Nutritional status is altered through a decline in food intake and/or an increase in nutrient wastage through blood loss, vomiting or diarrhoea. These effects can lead to or aggravate protein-energy malnutrition, anaemia and other manifestations of nutrient deficiency. The general social and economic consequences include:

- decreased work capacity and productivity in both children and adults;
- increased maternal and fetal morbidity and mortality, premature delivery and low birth weight;
- reduced rate of cognitive development, poor performance at school, and increased absenteeism in schoolchildren;
- increased susceptibility to infection.

These factors in turn decrease the ability of individuals and families to grow food or earn sufficient money to buy it and other essentials. Although the extent to which hookworm diminishes growth and the capacity to work is not known precisely, it seems clear that hundreds of millions of people would benefit significantly from treatment against this parasite.

Roundworm

Roundworm infection or ascariasis is present in up to 90% of children in some areas of the tropics. In 1987 there were probably over 100 000 deaths caused by complications of infection with *Ascaris lumbricoides*, such as intestinal obstruction. This parasite also has important nutritional effects; treatment can improve food intake and growth in infected children. The utilization of protein declines in *Ascaris*-infected children, an important phenomenon where there is severe protein-energy malnutrition or in children on low-protein diets. The absorption of fat decreases,

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and this may exacerbate protein-energy malnutrition and vitamin-A deficiency. Lactase activity in the small intestine is reduced, and lactose and milk intolerance develops in children.

Whipworm

Trichuriasis, or infection with the whipworm (*Trichuris trichiura*), can cause prolapse of the rectum and nutritional problems; the treatment of children can lead to increased haematocrit, improved growth rates and anthropometry, increased serum albumin, decreased diarrhoea, and a reduction in bacterial and protozoan infections in the gut.

Schistosomiasis

Many of the nutritional effects of schistosomiasis, caused by *Schistosoma haematobium*, *S. mansoni* and *S. japonicum*, are very like those of the intestinal worms. Urinary schistosomiasis causes blood loss in the urine of school-age children.

Societal significance

Children and adults feel better, are healthier, and can be more physically and mentally active and productive after treatment for helminth infections and/or anaemia (*3–6*). Recent studies in Kenya and elsewhere, combined with precise holistic descriptions of worm-infested persons in the earlier literature, provide insights into the mechanisms by which helminth infections and anaemia are likely to influence growth and physical and cognitive abilities. Worm infections appear to depress growth, physical fitness, physical activity and cognitive ability via two pathways, for both of which a central feature is depressed appetite (see figure). One mechanism involves iron-deficiency anaemia and the poor appetite, poor growth and decreased activity that result from it. The other involves cytokines (endogenous factors) produced by the body in response to parasitic infestation; they act directly on the brain, depress the appetite, increase the metabolic rate, decrease activity, and cause wasting and the breakdown of fats and proteins.

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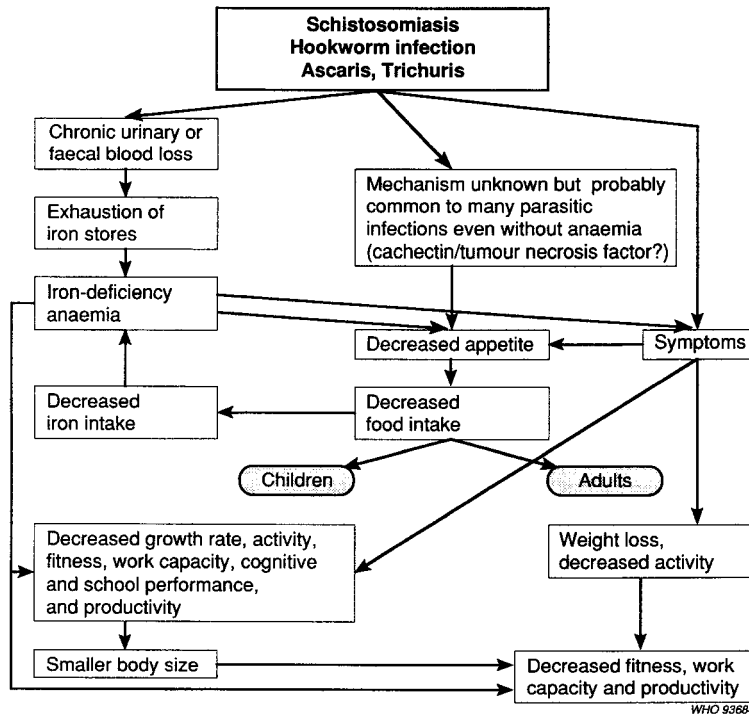
Decreased appetite leads to a reduction in food intake, which in turn diminishes growth rate, physical fitness, physical activity and cognitive performance. Eventually, the adult population shows decreased fitness and productivity, partly because of reduced body size. This chain of events is clearly undesirable, particularly in developing countries where heavy manual labour frequently has to be performed.

Recent studies in Kenya have demonstrated a significant improvement in appetite accompanying improved growth and fitness in school-age children four months after a single treatment against intestinal worm infections (*4*). In the prevention and control of malnutrition it is often just as important to improve the desire of children to eat as it is to augment the ability of parents to produce or buy food. Clearly, people who consume too little food can only achieve energy balance and avoid becoming severely undernourished by decreasing their physical activity.

Cost-effectiveness

In studies in Kenya during 1986, primary school children were treated with a single oral dose of metrifonate or praziquantel against

Pathways whereby helminth and schistosome infections depress growth, physical fitness, physical activity and cognitive ability.



S. haematobium (*7*), a single oral dose of albendazole against hookworm, *Trichuris* and *Ascaris* (*8*), or daily with ferrous sulfate for iron-deficiency anaemia (*6*); and in 1989–90 boys were treated for intestinal worms with albendazole (*4*). Comparisons with previous studies in East Africa (*9, 10*) indicated that treating children for worms or anaemia improved weight gains per month at least as much as and usually much more than school feeding programmes, which may be much more labour-intensive, complicated and expensive.

Countries at risk

In areas where the prevalence of mild to moderate underweight exceeds 25% and where parasites are widespread, high priority should be given to deworming programmes (*11*). Data on access to safe water, an indicator for the risk of contracting worm infections, and on the prevalence of moderate to severe stunting in children aged 24–59 months (*12*), suggest that many countries with very high mortality rates in this age category would benefit from such programmes. Among these countries are Bangladesh, Bhutan, Bolivia, Burundi, Cameroon, Ethiopia, Laos, Madagascar, Malawi, Mali, Mauritania, Niger, Pakistan, Rwanda, Senegal, Sudan, Togo, Uganda, and Yemen.

The treatment of helminth infections on a wide scale in most developing tropical countries could significantly decrease malnutrition and improve the overall health and well-being of the people. ■

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Leprosy need not mean deformity

Most leprosy patients do ***not*** *have disabilities or deformities when the disease first appears, and develop them later. Even when patients develop disabilities and deformities, they are mild and reversible to begin with and become severe and permanent only later on. Indeed, many conditions leading to disability and deformity can be cured if action is taken at an early stage, and the development of disabilities and deformities can be prevented. ... Disability prevention requires active collaboration between health care personnel on the one hand and patients and their families on the other.*

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