



National intestinal helminth survey among schoolchildren in Tajikistan: Prevalences, risk factors and perceptions



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ABSTRACT

Solid evidence regarding the epidemiology of intestinal helminth infections in Tajikistan is currently lacking. As such information is essential for the evidence-based design, implementation and evaluation of control interventions, a national intestinal helminth survey was conducted with the following objectives: (i) to assess the prevalence of intestinal helminth infections among school-aged children nationally and stratified by region; (ii) to identify locally relevant risk factors for infection; and (iii) to better understand the children's knowledge and perception of intestinal helminth infections, and assess their haemoglobin status. Standard field and laboratory procedures including the Kato-Katz thick smear and tape test were employed. Complete data was obtained for 1642 children from 33 randomly selected primary schools from different parts of the country. Across the country, prevalences of *E. vermicularis*, *A. lumbricoides*, *H. nana* and *T. trichiura* were 26.5%, 16.9%, 15.5% and 2.7% respectively. The prevalence of common soil-transmitted helminth (*A. lumbricoides* and *T. trichiura*) infections was 19.4%. No hookworm infections were detected, and prevalences of various infections differed significantly between administrative districts (all $P < 0.05$). Hand washing after toilet usage (OR = 0.78; $P = 0.047$) and handling animals (OR = 0.66; $P = 0.009$) were identified as significant protective factors against *E. vermicularis* infections. *H. nana* infection was associated with a 2.85 g/L decrease in haemoglobin levels ($P < 0.001$) despite already low average haemoglobin levels. The proportions of children with knowledge about intestinal helminths and protective hygiene practices varied significantly between regions (both $P < 0.001$). Mass albendazole administration to school-aged children and women of child-bearing age against intestinal helminths has been conducted in Tajikistan in spring 2012, followed by mass albendazole and praziquantel distribution to school-aged children in autumn 2012. In the longer term, an integrated approach including chemotherapy, provision of safe water and proper sanitation as well as targeted health education will be necessary to achieve sustainable control.

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1. Introduction

Tajikistan is a landlocked country with a surface area of 143,100 km² and a continental climate. It is located in Central Asia,

bordering China to the East, Uzbekistan to the West, Afghanistan to the South and Kyrgyzstan to the North. The Pamir and Alay mountains segregate Tajikistan into distinct ecological zones. Half of the country surface is higher than 3000 m above sea level. Being the poorest central Asian country, its economy is mainly driven by remittances from migrant workers, aluminium and cotton production (CIA, 2012). The population of the country is estimated to count over 7 million, with about 40% of them below 14 years old. Around 22% of the population is living in extreme poverty, on less than US\$1.25 per day after adjustment for purchasing power. According to the United Nations Development Program's (UNDP) Human Development Index (HDI) for 2011, Tajikistan was ranked 127 out of 187 countries and classified as having achieved medium human development (UNDP, 2008; UNICEF, 2009).

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Intestinal helminths are transmitted when their eggs, which reached the environment via human faeces, are ingested, or when their larvae penetrate the skin (Bogitsh et al., 2005). The transmission is thus facilitated by conditions associated with poverty, e.g. lack of proper sanitation facilities and safe water, and poor hygiene behaviour. These helminths are most common in rural regions of Sub-Saharan Africa, Asia and Latin America (Hotez et al., 2008) and are estimated to affect about 2 billion people, with the majority of all infections caused by the common soil-transmitted helminths (STHs), namely *Ascaris lumbricoides*, *Trichuris trichiura* and the hookworms (Bethony et al., 2006; Brooker et al., 2006). Besides STHs, the other intestinal helminths of interest in Central Asia are *Enterobius vermicularis* and the cestode *Hymenolepis nana* (Steinmann et al., 2010a, 2012). Infected individuals often harbour several species concurrently (Steinmann et al., 2010b). Intestinal helminth infections are known to cause diarrhoea, abdominal pain, intestinal obstruction, anaemia, malnutrition, itching of the skin and anal area, and impairment in both cognitive development and physical performance (Caldwell, 1982; Chero et al., 2007; Lustigman et al., 2012; Mathers et al., 2007; Nga et al., 2011; Yap et al., 2012). Given its good safety profile, mass administration of albendazole (Keiser and Utzinger, 2008) has been advocated by the World Health Organization (WHO, 2006) for the control of STHs. *E. vermicularis* can also be successfully treated with the same drug (St Georgiev, 2001). For *H. nana* infections, treatment with praziquantel is recommended (WHO, 2006).

Current data on the prevalence of intestinal helminth infections in Tajikistan is scarce. The majority of the published information is in Russian and only one recent peer-reviewed article in English is available (Matthys et al., 2011). The work of Matthys et al. was carried out in the western part of Tajikistan, and identified *H. nana* as the most common helminth (25.8%) while prevalences of *A. lumbricoides*, *E. vermicularis* and hookworm were below 5%. Almost half of the households interviewed in the frame of that study drank water from unimproved sources and their main sanitation facilities were pit latrines. A survey among schoolchildren in neighbouring Kyrgyzstan found higher prevalences of *A. lumbricoides* (23.1%) and *E. vermicularis* (19.3%) but a relatively low prevalence of *H. nana* (4.4%) (Steinmann et al., 2010a).

Considering that solid epidemiological evidence essential for the design, implementation and evaluation of interventions in Tajikistan is currently lacking, a national intestinal helminth survey was conducted among school children in anticipation of a planned national deworming campaign. The objectives of this survey were (i) to assess the prevalence of intestinal helminth infections among school-aged children across the country both as a justification for planned control interventions and to provide baseline information for programme effectiveness evaluation; (ii) to identify locally relevant risk factors for infection; and (iii) to better understand the knowledge and perception of school-aged children regarding intestinal helminth infections.

2. Materials and methods

2.1. Study design and survey site selection

The survey was designed as a clustered cross-sectional study according to WHO recommendations (WHO, 2006). Schools were randomly selected across Tajikistan from all oblasts (highest administrative division), namely Sugd (in the North), Khatlon (in the South), Gorno Badakhshan autonomous oblast (GBAO; in the East), the capital city Dushanbe, and the districts of Republican subordination, which is the area around Dushanbe. From every oblast (i.e. sampling unit), 4–10 schools were randomly selected with a probability of selection proportionate to their population

size. The number of schools to be selected per unit was determined by the fraction of the national population living in the respective unit except in Dushanbe, where fewer schools were selected owing to the assumed higher homogeneity of the population and living conditions. From each of the 33 schools included in the survey, 50 children aged 7–11 years (WHO, 2005) were systematically recruited (target: 1650 participants), usually from 2–3 classes, depending on class size.

2.2. Study setting, field and laboratory procedures

2.2.1. Study setting

Tajikistan has distinct ecological and socio-economic zones. The low-lying lands are found in Khatlon oblast while the other oblasts are generally mountainous, with GBAO having the highest mountains in the country. Khatlon is a relatively populous but poor oblast, while GBAO is the least populated oblast and is even more impoverished. Sugd oblast, the capital Dushanbe and the districts of Republican subordination which is located close to the capital are better developed, with Dushanbe having the best health care infrastructure and services.

2.2.2. Field procedures

All activities were implemented in winter 2011/2012, followed standardized and quality-controlled procedures (Fig. 1) and were performed by trained personnel. Students in the selected classes were invited to participate following the provision of general information about the study. Upon enrolment, each child was given a unique identification number (ID), and participants were requested to submit a single stool sample for parasitological examination and answer a one-page questionnaire. The questionnaire focused on a series of questions pertaining to basic knowledge about helminth infections, hygiene behaviour and access to sanitation facilities and clean water. Following the completion of the questionnaire, the haemoglobin level of the child was measured using the cyanhaemoglobin method. The next morning, stool samples were collected and the Scotch tape test (WHO, 1991) was performed. For the latter, a wooden spatula, covered with a strip of transparent sticky tape, was pressed onto the skin around the anus. The tape was then transferred onto a microscope slide. Stool and Scotch tape test samples were forwarded either to an existing local laboratory (e.g. in a health centre) or to a temporary field laboratory for immediate analysis.

2.2.3. Laboratory procedures

Stool samples were analyzed using the Kato-Katz technique (Katz et al., 1972). The Kato-Katz template, placed on a microscopic slide, was filled with 41.7 milligrams (mg) of sieved faecal

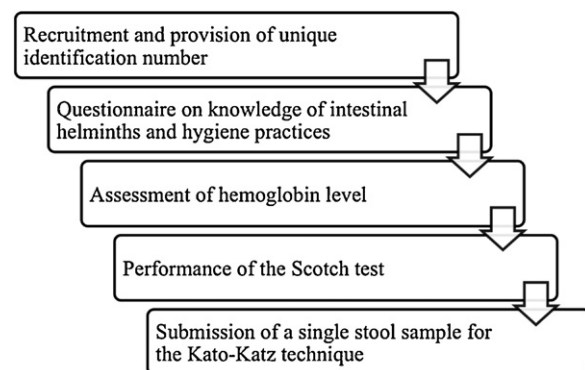


Fig. 1. Workflow of the Tajik national intestinal helminth survey implemented among schoolchildren in 2011/2012.

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