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Research Note

Soil-transmitted helminths and haemoglobin status among Afghan children in World Food Programme assisted schools

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Abstract

In recent years there have been major socio-economic changes within Afghanistan such that the present public health burden of soil-transmitted helminths (STH), especially that within school-aged children, remains to be determined. A baseline parasitological survey was therefore carried out in four defined areas of Afghanistan to better assess the distribution, prevalence and intensity of STH infections prior to a nationwide de-worming campaign beginning within World Food Programme assisted schools. A cross-sectional examination of 1001 children aged between 8 and 15 years old revealed that approximately half (47.2%) were infected with at least one STH. Infections with *Ascaris lumbricoides* were most widespread (40.9%) and elevated prevalences were detected in urban environments; for example, schoolchildren in Kabul were more likely to be infected (OR = 2.2, 95% CI 1.6–3.0) than elsewhere and these infections were often of higher intensity (OR = 7.6, 95% CI 4.9–11.8). *Trichuris trichiura* (9.9%) and hookworms (0.7%), previously unknown from Afghanistan, were encountered. The blood haemoglobin concentration of surveyed children was also assessed: 4% resulted to be anaemic (Hb $< 11\,g\,dl^{-1}$), and 0.4% to be severely anaemic (Hb $< 7\,g\,dl^{-1}$).

Soil-transmitted helminths (STH) continue to be a major public health burden throughout many countries of the world where both sanitation and hygiene are poor and access to anthelmintics is limited (Savioli *et al.* 2002). Soil-transmitted helminth infections cause a spectrum of pathologies (Awasthi *et al.*, 2003) and their detrimental effects are often most keenly felt within school-aged children where anaemia, retarded growth and impairment of cognitive development occur (Crompton, 1992, 1999; Oberhelman *et al.*, 1998; Crompton & Nesheim, 2002). At the public health level, regular administration of single-dose chemotherapy (albendazole 400 mg or mebendazole 500 mg) has proven to be a cost-effective method of control (Savioli

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et al., 2002; Urbani & Albonico, 2003) and remains a foundation of control in conjunction with the desirable improvements of sanitation and hygiene (WHO, 2002).

After decades of civil disruption and recent conflict, the health sector status within The Islamic Republic of Afghanistan is only now beginning to improve. The total population of this landlocked country is close to 29 million with only a minority having access to suitable sanitation and safe water. There are approximately 4 million people surrounding the urbanized areas of Kabul (World Food Programme (WFP) estimates, July 2004). The present status and public health burden of STH within school-children remains poorly known with previous literature now out of date, for example, conducted nearly 30 years ago (Buck *et al.*, 1978). At that time only *Ascaris lumbricoides* was reported and was then assumed to be widespread. As part of a school health initiative, an inter-sectorial collaboration between the Afghan Ministries of Health and Education, the WFP and World Health Organization (WHO), established a platform to implement a de-worming campaign in Afghanistan. Prior to this general intervention we report on a parasitological survey at intervention baseline to estimate the distribution and extent of STHs in schools assisted by the WFP.

The survey was carried out in February and March 2003 in each of the four ecologically homogeneous areas (eco-zones) in which the country can be divided (fig. 1). The eco-zones are: (i) urban: inclusive of the capital Kabul and the main cities, namely, Herat, Kandahar, Mazar-e-Sharif and Ghazni; (ii) central highlands: covering the central region being an extension of the Himalayan mountain chain, and including the Hindu-Kush; (iii) north-western plains: the major agricultural area extending along the Afghan north-western border from Iran in the west to Tajikistan in the east; and (iv) south-western plateau: desert and semi-desert landscape covering the southern third of the country, including the Rīgestan desert.

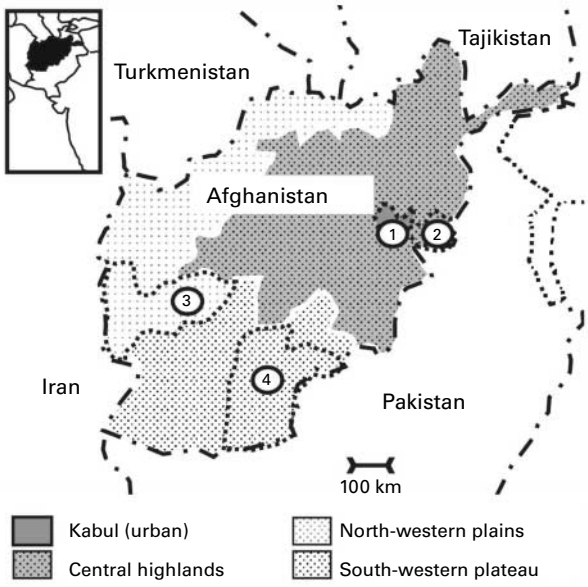

Fig. 1. Schematic map of Afghanistan showing eco-zones suveyed. Numbers refer to provinces where the survey was carried out: (1) Kabul; (2) Nangarhar; (3) Farah and (4) Kandahar.

In each of the four eco-zones, one province was randomly selected: Kabul (urban); Nangarhar (central highlands); Farah (north-western plains); Kandahar (south-western plateau) and for each one of the identified four provinces, one district was randomly chosen among those officially declared accessible for United Nations staff. Five primary schools were randomly selected within each district for a total of 20 schools across the four eco-zones. Approximately 50 children per school were randomly selected and enrolled in the survey following WHO guidelines (WHO, 2002). Parasitological examination was performed on a single, thick Kato-Katz (41.7 mg) smear from the stool of each child and viewed microscopically at × 100 magnification for helminth eggs (WHO, 1991). Informed consent was obtained, to determine the prevalence of haemoglobin concentration assessed upon examination of fingerprick blood using a digital haemoglobinometer (HemoCue AB, Angelholm, Sweden). Following the WHO ethical guidelines of 'no survey without service', all children enrolled in the survey received one tablet of albendazole 400 mg (anthelmintic drug).

A total of 1001 children were enrolled in the survey (55.3% male sex): 239 in Kabul, 256 in Nangarhar, 249 in Farah and 257 in Kandahar. The age range of the children was between 8 and 15 years, the bulk of the sample consisting of 9- to 12-year-olds. Prevalence and intensity of STH infections in each of the provinces included in the survey are shown in table 1. About half (47.2%) of the schoolchildren population under study were infected with at least one STH. *Ascaris lumbricoides* was the most widespread, affecting 40.9% of the population under study, followed by *Trichuris trichiura* (9.9%). Hookworm infection was detected in Nangarhar province only, where its prevalence of infection was low (2.7%). Neither of the latter two infections was reported in the 1978 survey (Buck *et al.*, 1978). 9.7% of the sample presented infection with moderate-to-heavy intensity, the major determinant of severity of morbidity (Awasthi *et al.*, 2003). Among the subjects with any moderate-to-heavy intensity infection, 97% were infected with *A. lumbricoides*, while only 5% were infected with *T. trichiura.* No moderate-to-heavy intensity infection due to hookworms was recorded.

Overall, Kabul province appears to possess the most severe STH burden, both in terms of prevalence and intensity of infection (cumulative prevalence of STH infection = 61.9%; cumulative prevalence of moderate-to-heavy intensity STH infection = 26.4%). In the three other provinces, cumulative prevalence of STH infection ranged from 34.8% in Nangarhar to 42.8% in Kandahar to 50.2% in Farah, and cumulative prevalence of moderate-to-heavy intensity STH infection was well below the 10% threshold (Nangarhar: 3.1%; Kandahar: 3.1%; Farah: 7.2%). The overall prevalence of poly-parasitism (co-occurrence of more than one STH infection in the same individual) was 4.3%. All poly-parasitic infections were double infections due to *A. lumbricoides*–*T. trichiura* co-infection, except a single *A. lumbricoides*–hookworm co-infection. Only 0.2% of the sample presented with moderate-to-heavy intensity poly-

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Table 1. Prevalence (%) and intensity category of soil-transmitted helminth (STH) infections across eco-zones in Afghanistan.

	Province				
	Kabul	Nangarhar	Farah	Kandahar	Total
Ascaris lumbricoides					
Prevalence of infection	57.3	27	43	37.4	40.9
Prevalence of moderate-to-heavy intensity infection	25.9	3.1	6.4	3.1	9.4
Trichuris trichiura					
Prevalence of infection	13	6.3	12.9	7.8	9.9
Prevalence of moderate-to-heavy intensity infection	0.8	0.4	0.8	0	0.5
Hookworms					
Prevalence of infection	0	2.7	0	0	0.7
Prevalence of moderate-to-heavy intensity infection	0	0	0	0	0
Any STH					
Prevalence of infection	61.9	34.8	50.2	42.8	47.2
Prevalence of moderate-to-heavy intensity infection	26.4	3.1	7.2	3.1	9.7
Prevalence of poly-parasitic infection	8.4	1.2	5.6	2.3	4.3
Prevalence of moderate-to-heavy intensity poly-parasitic infection	0.4	0.4	0	0	0.2

parasitic STH infections. In both cases they were due to *A. lumbricoides* and *T. trichiura*, in which only *A. lumbricoides* intensity was moderate-to-heavy.

Only 40 children (4%) were found to be anaemic (haemoglobin concentration $<11\,g\,dl^{-1}$); of these four children (0.4%) all boys, were severely anaemic (haemoglobin concentration $<7\,g\,dl^{-1}$). However, it should be noted that an iron-fortified bread/biscuit distribution system targeting schoolchildren was started in Kabul and Kandahar provinces during 2002, and was in place at the time of the survey. On the contrary, no iron supplementation programmes were ongoing in Farah and Nangarhar at the time of the survey or in the period preceding it. The average altitude of the schools where the survey was carried out was 1790 m (Kabul), 600 m (Nangarhar), 730 m (Farah), and 1010 m (Kandahar). Within this altitudinal range, it may well be that a small additional confounding effect upon the child's haemoglobin level could have occurred and in the absence of appropriate local standardization, assessing its relative contribution(s) on general haemoglobin levels remains elusive.

Since the last documented survey of STH in Afghanistan (Buck *et al.*, 1978), clearly *A. lumbricoides* still appears to be widespread and *T. trichiura* and hookworm infections are now documented for the first time. No doubt as a result of overcrowding and poor sanitation and hygiene, the urban environment appears to offer a particularly conducive environment for STH transmission. Schoolchildren surveyed in Kabul were more likely than the others to be infected with at least one STH (OR = 2.2; 95% CI 1.6–3.0) and to have a moderate-to-heavy intensity STH infection (OR = 7.6; 95% CI 4.9–11.8) in line with the observations of Phiri *et al.* (2000) for STHs in Malawi. Poly-parasitism in Afghanistan appears to be less common than observed in other countries (Booth *et al.*, 1998; Tchuem Tchuente *et al.*, 2003) and the levels of presently observable anaemia associated with infection were not particularly severe. Mass drug administration of anthelmintics would therefore be best focused upon schools within a predominantly urban setting.

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