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Prevalence of intestinal parasitic infections in northern Vietnam

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Summary We surveyed the prevalence of parasitic infections in the mountainous province of Hoa Binh, north-west Vietnam, involving 526 households of six ethnic groups: Muong, Kinh, Dao, Thai, Tay and Hmong. Eggs or cysts of at least one parasite species were detected in 88% of stool samples ($n = 2522$). Prevalences of nematodes were high among all ethnic groups: hookworm (52%), *Trichuris trichiura* (50%) and *Ascaris lumbricoides* (45%). *Ascaris* infection appeared to be lower in households owning a latrine, was highest among children and decreased with age. Prevalence of hookworm rose during childhood, remained high until old age, was highest among adult women, but was not linked to anaemia. Eggs of *Chlonorchis* spp. were found in 126 (5%) individuals (of the Muong, Kinh or Thai groups only). Chlonorchiasis increased with age and was highest among adult men. *Taenia* eggs were found in three individuals (0.1%). *Giardia lamblia* was found in all districts and among all groups and the prevalence of infection was estimated at 3%.

keywords intestinal parasites, Vietnam

Introduction

In the mountainous provinces of northern Vietnam malaria is considered the most important parasitic infection, but after a comprehensive control programme, malaria transmission diminished considerably in the 1990s (Verle *et al.* 1998). Several other human parasites such as nematodes, tapeworms, flukes and protozoa are also prevalent. People are poor (GDP < 300 $US per year) and have habits facilitating transmission of these parasites. Night soil is routinely used as fertilizer for crops or deposited in fishponds. From a certain age onwards, the majority of the population spends considerable time in muddy rice fields. Eating fresh salads and stir-fried or raw fish and meat are popular. High humidity and a temperate climate are other favourable factors for transmission.

However, in contrast to malaria, little information is available on the prevalence of these other parasitic infections. Possibilities for diagnosis are limited: stool examination, the main diagnostic tool for most parasitic infections, is rarely part of the routine examinations in a district hospital, which is the lowest level of the health system using a microscope. Previous studies focused on one parasite only, in one or in a few selected communities at the most (De *et al.* 2003). We report the results of a survey on the prevalence of parasitic infections in the mountainous province of Hoa Binh in the north-west of Vietnam.

Materials and methods

The province of Hoa Binh, with a population of around 750 000, is divided into 10 districts. We selected 50 villages, five in each district. The number of villages per ethnic group within the five per district was based on the relative importance of ethnic groups. The hamlets were then selected randomly within each group, and 10 households chosen randomly in each. After informed consent, all individuals belonging to these households were included in the survey conducted in June 1999. If there were fewer than 50 selected individuals in a hamlet, more households were included.

A stool and a blood sample were taken from all subjects. Stool samples were examined using the formalin–ether concentration technique (World Health Organization 1991). An experienced technician entirely examined one smear per sample. Of each blood sample a thick blood film was prepared and haemoglobin was measured using the Lovibond Comparator method (Woodliff *et al.* 1966). All subjects were clinically examined and standardized questionnaires were filled in. Data were analysed using Epi Info 6. Overall estimates of prevalence were adjusted to the exact ethnic composition of the province, using the data of the population census of 1999 (General Statistical Office 2001). Risk ratios (RR) were calculated with 95% confidence intervals. All subjects participating in the survey

were treated systematically with albendazole (400 mg in a single dose except for pregnant women and children <2 years old). Praziquantel was given under supervision to all individuals found positive for *Chlonorchis* spp. (75 mg/kg) and *Taenia* spp. (20 mg/kg).

Results and discussion

Data were obtained from 526 households of the following ethnic groups: Muong (64%), Kinh (11%), Dao (10%), Thai (6%), Tay (5%), Hmong (4%). Of the 2997 individuals belonging to these households, individual interviews were obtained from 2686 (90%), blood samples from 2673 (89%), and stool samples from 2522 persons (84%).

Not a single slide was found positive for malaria, confirming the success of the malaria control programme in recent years (Verle *et al.* 1998). High compliance with preventive measures for malaria was observed: of the 526 households, only two did not have any bed net at all. Household leaders (59%) reported impregnation of their bednets within the last 6 months.

In 88% of the stool samples, eggs or cysts of at least one parasite species were detected. Evidence of infection by parasites, transmitted by faeco-oral contact (*Ascaris lumbricoides, Trichuris trichiura* and protozoa), by ingestion of raw or undercooked food (*Chlonorchis* and *Taenia* spp.), or by penetration through the skin (hookworm), was found.

Hookworm proved to be the most commonly detected parasite (adjusted prevalence 52.4%) followed by *T. trichiura* (adjusted prevalence 49.6%) and *A. lumbricoides* (adjusted prevalence 45.4%). Prevalence of nematode infections was high in all ethnic groups (Table 1). *Trichuris* infection was more prevalent in adult men (54%) than in women (48%) ($\chi^2 = 4.87$, $P = 0.027$ and RR $1.01 < 1.09 < 1.18$). Prevalence of hookworm infection was higher in adult women (67%) than in adult men (60%) ($\chi^2 = 8.40$, $P = 0.0037$ and RR $1.01 < 1.09 < 1.16$), which may be explained by the fact that women spend more time in muddy rice fields. We could not identify the species of hookworm, but previous studies in northern Vietnam reported *Necator americanus* in more than 95% of the hookworm larvae identified in coprocultures (De 1995). The high prevalence of hookworm infection was not linked to anaemia. Only 14 of 2673 subjects who were blood sampled had a haemoglobin concentration of <10 g/100 ml; and only six of these had hookworm infection.

An adjusted overall prevalence of 5.3% for *Chlonorchis* spp. infection was found among individuals belonging to three ethnic groups. Infections with *C. sinensis* have previously been described in seven provinces of the Red River Delta with prevalences as high as 37% in selected Kinh villages (De *et al.* 1998; Kino *et al.* 1998), but not in mountainous areas such as Hoa Binh province. Prevalence in adult men (7.1%) was higher than in adult women (2.3%) ($\chi^2 = 34$, $P < 0.0001$ and RR $2.08 < 3.09 < 4.60$), which is consistent with findings in the Red River Delta (Kino *et al.* 1998). Individuals who reported eating raw fish were more often infected ($\chi^2 = 120.7$, $P < 0.0001$ and RR $4.62 < 6.61 < 9.46$). The species could not be identified.

Taenia eggs were found in three subjects only (0.1%), living in three different districts. This is in contrast to other areas of northern Vietnam, where infection prevalences of up to 7.2% have been reported (De *et al.* 2001). Only 2.5% and 4.5% of the individuals questioned admitted eating raw pork or raw beef, respectively. Clinical examination of all individuals revealed only one person with subcutaneous nodules that were diagnosed as cysticercosis by biopsy. No liver flukes were detected in this survey

Table 1 Prevalence of most common intestinal helminth infections among different ethnic groups in Hoa Binh province, Vietnam

Ethnic group	Population† (*n*)	Survey (*n*)	*Ascaris lumbricoides* [*n* (%)]	Hookworm [*n* (%)]	*Trichuris trichiura* [*n* (%)]	*Chlonorchis* spp. [*n* (%)]
Kinh	209 852	261	106 (41)	149 (57)	141 (54)	6 (2)
Muong	479 197	1612	722 (45)	791 (49)	752 (47)	119 (7)
Dao	13 128	249	138 (55)	179 (72)	122 (49)	0 (0)
Hmong	3962	95	80 (84)	53 (56)	45 (47)	0 (0)
Thai	29 438	155	99 (64)	107 (69)	84 (54)	1 (1)
Tay	20 537	147	101 (69)	66 (45)	99 (67)	0 (0)
Others	599	3	0	2	2	0
Total population	756 713	2522	1246 (45*)	1347 (52*)	1245 (50*)	126 (5*)

* Prevalence adjusted to proportion of different ethnic groups in the overall population.
† General Statistical Office (2001).

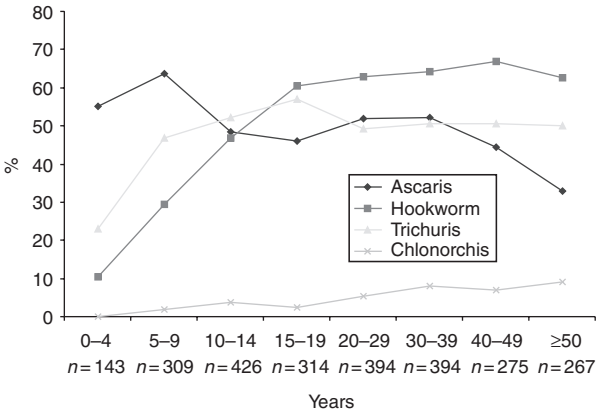

Figure 1 Age distribution of most prevalent helminth infections diagnosed by stool examination in the population of Hoa Binh province, Vietnam.

although prevalences of infection with liver flukes such as *Fasciola gigantica* and *F. hepatica* of over 30% have been reported in cattle and buffaloes of the region (Thu & Linh 1996; Khuong *et al.* 2001).

Cysts of *Giardia lamblia* were found in 103 (4.1%) subjects, in all districts and among all ethnic groups. The adjusted prevalence was calculated at 3.2%. Other cysts were detected in 597 individuals (24%) but we could not differentiate between species.

The prevalence according to age for the three nematode infections and for *Clonorchis* spp. is shown in Figure 1. Only for *A. lumbricoides*, prevalence was highest among children and decreased with age. Prevalence of hookworm and *Trichuris* infection rose during childhood and adolescence, and remained high until old age. Prevalence of *Clonorchis* infection increased with age. The age dependent prevalence patterns for *A. lumbricoides* and *T. trichiura* infection are quite different from those described in a study in a community in a neighbouring province, where prevalences exceeded 75% in all age groups (Needham *et al.* 1998). Hookworm, *Ascaris* and *Trichuris* infections were significantly related ($\chi^2 > 26$ and $P < 0.0001$ for all combinations): the same individuals seemed to be most at risk of these three most prevalent helminth infections.

A total of 383 households had latrines (73%): 341 were single pit latrines (89%) and 14 double pit latrines (4%). Both types allow faeces to be used as fertilizer, which was reported by 93 owners (24%). Prevalence of *Ascaris* infection was significantly lower in subjects of households with a latrine ($\chi^2 = 51.8$, $P < 0.0001$ and RR $0.66 < 0.71 < 0.77$). This was not the case for any of the other parasitic infections. In the 1980s, the Vietnamese government promoted double pit latrines lined with concrete in order to make the utilization of faeces safer. When the first pit is filled, it is sealed off and only emptied when the second pit is full as well. This delay would allow the degeneration of eggs and cysts. The apparent limited success is explained by higher costs (87% of the single pit latrines are not lined with concrete).

Means for control of parasites other than malaria are limited in northern Vietnam. Stool examinations can only be performed in district capitals. Treatment of clonorchiasis can rarely be obtained in the public health sector and is expensive in private pharmacies. Albendazole and mebendazole are available at community level. Although 203 individuals (7.6%) claimed to have been treated for helminth infection in the previous 6 months, the prevalance was lower only for hookworm among the treated (41%) than the non-treated (54%) ($\chi^2 = 12.39$ and $P < 0.001$). But the clinical importance of most common parasitic infections is unclear. Clonorchiasis might deserve special attention because of its serious complications.

Vietnam's health policy for the next decade focuses on improving quality of health services and accessibility for the poor, a strategy which is supported by the donor community (Government of Vietnam 2002). Funds for parasitic infection control programmes other than malaria are expected to be limited. Therefore priorities will have to be chosen but adequate treatment should be assured for patients detected trough the curative health services.

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