A CROSS-SECTIONAL STUDY OF INTESTINAL PARASITIC INFECTIONS AMONG SCHOOLCHILDREN IN NAN PROVINCE, NORTHERN THAILAND

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Abstract. A cross-sectional study of the prevalence of intestinal parasitic infections at eight schools in Bo Klau district and four schools in Chalerm Prakiet district, Nan Province, in January and February, 2001. A total of 1,010 fecal samples were examined using the formalin-ether sedimentation technique. Results revealed that the rate of helminthic infection was 60.0%, while protozoa accounted for 36.2% of infections; mixed infections were common, resulting in a total prevalence of both parasites of 68.1%. Helminthic parasites, listed by frequency of infections, were *Ascaris lumbricoides* (21.7%), hookworm (18.5%), *Trichuris trichiura* (16.3%), *Opisthorchis viverrini* (1.7%), *Strongyloides stercoralis* (0.9%) and *Enterobius vermicularis* (0.9%). The protozoal infections were *Entamoeba coli* (25.8%), *Giardia lamblia* (5.3%), *Endolimax nana* (2.5%), *Entamoeba histolytica* (1.4%), *Blastocystis hominis* (0.8%), *Chilomastix mesnili* (0.3%) and *Iodamoeba bütschlii* (0.1%).

This study emphasizes the need for improved environmental hygiene *ie* clean water supplies and enhanced sanitation, in affected communities. Health promotion, by means of a school-based educational approach is recommended; regular check-ups should be implemented, and a continuos program of treatment should be considered.

INTRODUCTION

Parasitic infection still poses a threat to public health in Thailand, particularly in remote communities of low economic status, such as those found in the border areas. Nan Province, in the north of Thailand, is 668 km from Bangkok; it is bordered by Lao PDR to the north and east, by Phayao and Phrae Provinces to the west, and by the province of Uttradit to the south. Chalerm Prakiet and Bo Klua districts are situated in the northeast of Nan Province (Fig 1): the districts have high mountains; the average annual rainfall is 1,120-1,593 mm; the temperature ranges from 2.7 to 41.2ºC, with an average of some 25ºC; the district populations are 9,505 and 16,150 respectively. The majority of the population lives in highland areas, natives of the region, called *Lua*, grow rice on the mountain and rear animals for meat. The Lua have a low income. The most important public health problems in these two districts are those affecting maternal and child health, *ie* stillbirth, low birth weight, malnutrition, and the low body weight of pre- and primary schoolchildren.

Her Royal Highness Princess Maha Chakri Sirindhon's Project for Remote Area Development makes health promotion among schoolchildren one of its main activities. A school lunch program has been widely implemented in order to improve the body weight of schoolchildren; a concurrent deworming program is also helping to promote the health of children. We report, in this paper, on the prevalence of

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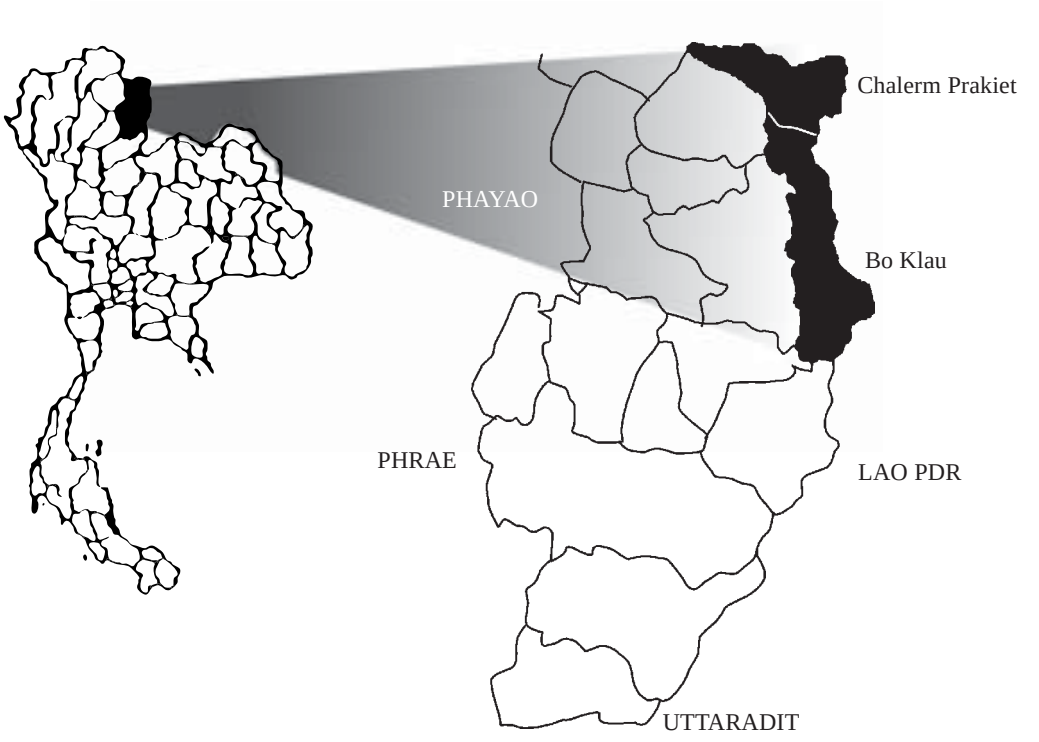

Fig 1–Map of nan Province showing Chalermprakiet and Bo Klau districts.

parasitic infections among children in 12 schools in the Bo Klau and Chalerm Prakiet districts.

MATERIALS AND METHODS

Between the 14th and 17th January and the 11th and 15th February, 2001, stool samples from children in 12 primary schools in Bo Klua and Chalerm Prakiet districts were collected. The schools were Bo Luang, Sob Mang, Ban Hang Thang Laung, Ban Na Bong, Hauy Pong, Swa, Sapan, and Bo Yuag (Bo Klua district); Ban Hauy Phong, Ban Dan, Kew Chan and Mom Chow Charoenjai Jitrpong (Chalerm Prakiet district). A total of 2,171 schoolchildren were studied. The samples were carried in iced boxes to the laboratory of the Bangkok School of Tropical Medicine, where they were immediately processed by the formalin-ether concentration method and examined by microscopy. All the parasites recovered were recorded and descriptively analysed.

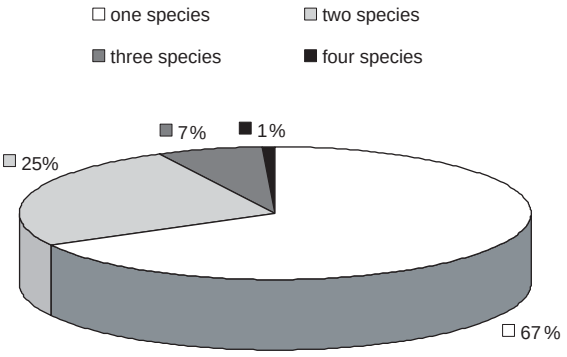

Fig 2–Pattern of parasitic infection in 1,010 schoolchildren in Nan Province.

RESULTS

One thousand and ten fecal samples (46.5%) were submitted from 2,171 children; of these, 688 children (68.1%) were positive for both helminthic and protozoal parasites. The infection pattern (Fig 2) showed that 67.1%

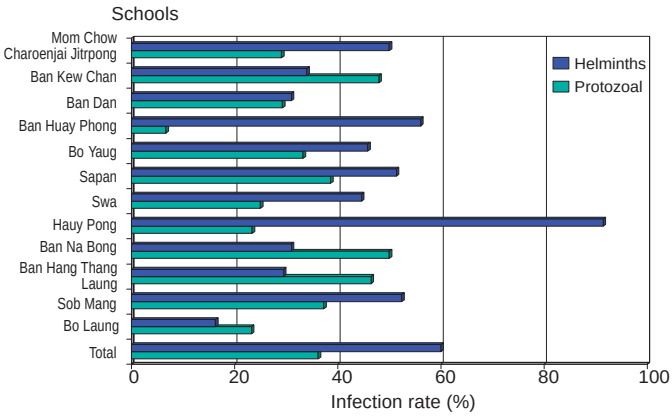

Fig 3–Rates of helminthic and protozoal infections in 12 schools in Bo Klau and Chalerm Prakiet districts, Nan Province, January-February 2001.

Table 1
Rates of helminthic infection among 1,010 children in Nan Province.

Helminths	No.	%
Hookworm	187	18.5
Ascaris lumbricoides	219	21.7
Trichuris trichiura	165	16.3
Strongyloides stercoralis	9	0.9
Enterobius vermicularis	9	0.9
Opisthorchis viverrini	17	1.7
Total	606	60.0

Table 2
Rates of protozoal infection among 1,010 children in Nan Province.

Protozoa	No.	%
Entamoeba histolytica	14	1.4
Entamoeba coli	261	25.8
Endolimax nana	25	2.5
Iodamoeba bütschlii	1	0.1
Blastocystis hominis	8	0.8
Giardia lamblia	54	5.3
Chilomastix mesnili	3	0.3
Total	366	36.2

of the schoolchildren had a single infection, while 1.0% of children were infected by as many as four species. Six hundred and six children (60.0%) were infected with roundworms and liver flukes; 366 children (36.2%) were infected with protozoa of invasive and non-invasive species.

Helminthic infections

Five species of roundworm were found in the schoolchildren; only one species of flatworm, *Opisthorchis viverrini* (1.7%), was recovered. The common species were soil-transmitted helminths: *Ascaris lumbricoides* (21.7%), hookworm (18.5%), *Trichuris trichiura* (16.3%); these species can cause loss of blood as well as nutritional and vitamin deficiencies. The less common species were *Strongyloides stercoralis* (0.9%), which causes diarrhea, and *Enterobius vermicularis* (0.9%), which causes pruritis ani (Table 1). One cyprinid fish, collected from the pond in front of Sob Mang School, Bo Klau district, was examined: large numbers of metacercariae of *Haplorchis taichui* were found encysted in its muscle. *H. taichui* is a trematode that lives in the small intestine of birds and mammals, including humans. The egg of *H. taichui* is morphologically similar to that of the *O. viverrini* liver fluke.

Protozoal infections

Seven species of protozoan were found in the fecal samples, indicating the contamination of drinking water and poor hygiene among the children. The most common species was *Entamoeba coli* (25.8%) a non-pathogenic protozoal. Other non-pathogenic species, listed according to their frequency of occurrence, were: *Endolimax nana* (2.5%), *Chilomastix mesnili* (0.3%) and *Iodamoeba bütschlii* (0.1%). Three pathogenic species were found: *Giardia lamblia* (5.3%), *Entamoeba histolytica* (1.4%), and *Blastocystis hominis* (0.8%), all of which may cause diarrhea (Table 2); moreover *E. histolytica* can invade organs and cause amebic abscesses in the liver and brain.

Parasitic infections in schools

The rates of helminthic and protozoal infections in the 12 schools were compared (Fig 3): the highest rate of helminthic infection was found in Hauy Pong (91.5%); the lowest rate

was in Bo Laung (16.3%.) The protozoal infection rate was highest in Ban Na Bong (50.0%) and lowest in Hauy Phong (6.7%). In total, there were 13 species of parasite in the 12 schools: six helminths and seven protozoa. There were 11 species in Sob Mang: five heminths and six protozoa, the highest number observed. The school which had the lowest number of species was Huay Pong: five in total - three helmiths and two protozoa.

DISCUSSION

The commonest helminths in Thailand are hookworm, *Trichuris trichiura*, *Ascaris lumbricoides*, *Strongyloides stercoralis*, *Enterobius vermicularis* and *Opisthorchis viverrini*. The prevalence of these parasites varies considerably with locality, behavioral factors, and sanitation. In the last national survey of parasitic infections (September, 2001) carried out by Department of Communicable Disease Control, Ministry of Public Health, it was shown that the overall prevalence of helminths, determined by cellophane thick smear stool examination, was 22.3%. The top two infections were hookworm (11.3%) and *O. viverrini* (9.5%); the other parasites were *T. trichiura* (1.6%), *A. lumbricoides* (1.0%), *Echinostoma* spp (0.6%), *S. stercoralis* (0.5%), *Taenia saginata* (0.5%) and *E. vermicularis* (0.1%) (Jongsuksuntigul, 2001). The parasitic infection rate of the 12 schools in this study (60%) was nearly three times higher than that cited in the national report, which considered both children and adults. In the same report, hookworm infections classified by region were: 9.2% (Central), 9.4% (North), 9.1% (Northeast) and 20.0% (South). However, in our study, hookworm infection was 18.5%, more than twice the regional rate. Our study also revealed roundworm infection rates that were much higher than those found at national and regional level.

Ascaris, *Trichuris* and *Enterobius* are most prevalent in children; it was not surprising that the prevalence of these parasites in schoolchildren in the studied area was higher than both the national and regional rates. Although the general pattern of hookworm infection according to age shows a peak of prevalence among adults, the rate of hookworm infection in these schools - much higher than the national level - suggests that hookworm infection in this area would be much higher in adults. The tendency for areas of Nan Province to have higher levels of parasitic infection than urban districts may be attributed to its geography (mostly highland) and the poverty and low living-standards found in its border area. In this study, intensity of infection was not measured; if control strategies are going to be implemented then the intensity of infection could be used as an indicator for evaluating the control program.

The *O. viverrini* infection rate (1.4%) is lower than the national rate as the liver fluke appears more frequently in adults than in children; the infection rate of the liver fluke in adults in this community is likely to be higher than 1.4%. Fish in the study area were infected with *Haplorchis*, an intestinal fluke, suggesting the possibility of human infection. As the differentiation of the eggs of the two flukes is difficult, it is possible that the rate of 1.4% includes both liver and intestinal flukes; this problem may be overcome if worms are collected and identified after treatment. Radomyos *et al* (1998) reported that in the northeast of Thailand the worms recovered from treatment subjects comprised liver flukes (92.2%) and intestinal flukes (67.9%) and that in the north they comprised liver flukes (11.6%) and intestinal flukes (79.8%).

The identification of some species of protozoal is not clear cut. For instance, *Entamoeba histolytica* Schaudinn 1903 and *Entamoeba dispar* Brumpt 1925 are morphologically so similar that they cannot be differentiated by microscopy. If blood and mucus are found in fecal samples or if ingested red blood cells are found, the amebae can be identified as *E. histolytica*. *E. dispar* is non-pathogenic. Regardless of symptoms, only *E. histolytica* elicits serological responses in humans. Differentiation at the species level is possible by isoenzyme electrophoresis, genomic DNA, ribosomal RNA, and antigenic differences

(Jackson and Ravdin, 1996). Using a multiplex PCR method for Cuban patients with amebiasis, Nunez *et al* (2000) found that 75.5% were infected with *E. dispar* and 24.5% had mixed infection with both *E. dispar* and *E. histolytica*. The flagellate formerly identified as *Giardia lamblia*, is divided by enzyme patterns into *G. intestinalis* (human parasite) and *G. duodenalis* (mammal parasite), although these forms cannot be differentiated by microscopy (Mayrhofer *et al*, 1995). In this study, the old names have been retained because our study was concerned only with the microscopic examination of fecal samples; antigen capture tests, isoenzyme electrophoresis, and polymerase chain reaction were not performed.

A seroepidemiological survey of amebiasis was carried out in Phichit Province, north Thailand, and among urban slum dwellers in Bangkok, using indirect hemagglutination antibodies to *E. histolytica*: positive IHA titers were detected in 11% and 20% of sera respectively; *E. histolytica* cysts were found in 2% and 3% stool specimens, respectively. Of 88 subjects with significant levels of IHA, five had *E. histolytica* in their fecal samples, demonstrating that *E. histolytica* is endemic in areas of low socio-economic status (Bunnag *et al*, 1982). *E. histolytica* infection was also found to affect 16.2% of workers and their families at the Khoa Laem hydroelectric dam (Temcharoen *et al*, 1987). Stool examinations of 147 children with diarrhea carried out at Siriraj Hospital, Bangkok, showed that the infection rate of *E. histolytica* was 6.8%, while that of *G. lamblia* was 6.1% (Chavalittamrong and Jirapinyo, 1984). The prevalence of *G. lamblia* in children attending an out-patient department of Siriraj Hospital was 18.6% (children with diarrhea) and 18.2% (children without symptoms) (Chavalittamrong *et al*, 1978). Janoff *et al* (1990) reported enteric protozoal infection in 205 institutionalized orphans (1-61 months of age) in Bangkok. *Cryptosporidium* was found in 8% of the children; *Giardia* was found in 20%; 1% were infected with both species. However, in those children with diarrhea, only 10% were infected with *Giardia*. *G. intestinalis*, the invasive species, was present in half of the cases. It also seems that the prevalence of the two pathogenic species in children in our report was lower than previously reported from both inside and outside Bangkok.

Judging by the rates of parasitic infection in the schools studied, it seems that prevention and control measures should be implemented both in the schools and at the community level. The transmission of nearly all species of parasite is by ingestion of the infective stages that contaminate water, vegetables or hands. Chemotherapy must be given to minimize the intensity of infection and eliminate the parasites. Health promotion by means of health education should aim to promote good personal hygiene in at-risk populations. Improvements in sanitation in order to prevent the transmission of parasites must be implemented and may include the provision of safe drinking water and proper latrines.

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