Tropical Biomedicine 24(2): 83–88 (2007)

Intestinal parasitic infections among school children in Thailand

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Received 7 June 2007; received in revised form 17 July; accepted 20 July 2007

Abstract. A study was conducted to determine the prevalence of intestinal parasites in children from eight schools located in Phuttamonthon District, Nakhon Prathom Province during November 2004 to December 2004. Stool samples were collected from 1920 students; age range from 7 to 12 years old, and examined for intestinal parasites by using formalin-ethyl acetate concentration technique. Of these subjects, 242 (12.6%) were infected with one or more of 10 intestinal parasitic species. In these infected subjects, 214 (11.1%) were single infections whereas 28 (1.5%) were mix infections. The most frequent parasite was *Blastocystis hominis* (6.2%). Other parasites were *Giardia lamblia* (1.7%), *Entamoeba coli* (1.5%), *Endolimax nana* (1.0%), *Entamoeba histolytica* (0.3%), Hookworm (0.3%), *Trichuris trichiura* (<0.1%), *Taenia* spp. (<0.1%), *Strongyloides stercolaris* (<0.1%), and liver fluke or small intestinal fluke (*Opisthorchis* eggs) (<0.1%). Prevalence of protozoan infections was significantly higher than helminth infections ($p<0.05$). Between male and female, there was no significant difference in prevalence of intestinal parasitic infections ($p>0.05$). The results suggest that prevention and control programme for intestinal parasites should be discussed in the design of long term use in this area.

INTRODUCTION

Intestinal parasitic infection is one of the major public health problems in developing countries. Approximately 3.5 billion people are infected by intestinal parasites and around 450 million children are ill due to these infections (WHO, 2000). The parasites affect physical growth, and psychomotor development in the infected children (Oberhelman *et al.*, 1998). The high prevalence in children is attributed to many factors, particularly environmental and personal hygiene (Scolari *et al.*, 2000; Tomono *et al.*, 2003). Although treatment and mass chemotherapy directed at school children in Thailand have been implemented for reducing the occurrence of parasitic infection, the high prevalence of intestinal parasites in school children has been widely reported in many areas (Waikagul *et al.*, 2002; Saksirisampant *et al.*, 2006). For an appropriate control strategy it is necessary to conduct surveys in population in which current status of intestinal parasitic infections are able to be estimated.

Microscopic examinations of stool samples, which are based on morphology, are commonly used for identification of parasites. However, these methods are unable to differentiate closely-related species due to their similar morphology. Various methods have been developed to increase efficiency of parasite identification. For example, *Opisthorchis viverrini* eggs can be distinguished from *Haplorchis taichui* and *Prosthodendrium molenkampi* eggs by using methylene blue staining (Pasuralertsakul *et al.*, 2005). Recently, molecular methods with higher sensitivity and specificity have been suggested for confirmation of morphological identification

in *Opisthorchis* eggs (Ando *et al.*, 2001) and *Taenia* eggs (Anantaphruti *et al.*, 2007).

To commemorate the Sixth Cycle (72nd) Birthday of Her Majesty the Queen of Thailand, surveillance on intestinal parasites in school children at Phuttamonthon District, Nakhon Prathom Province was initiated by Faculty of Medical Technology, Mahidol University. In this study, fecal samples from school children were examined by using formalin-ethyl acetate concentration technique, the prevalence of intestinal parasitic infections among school children and contributing factors to the prevalence such as sex, and age were determined.

MATERIALS AND METHODS

Study area

The study was conducted at eight schools near Mahidol University campus in Phutthamonthon district, Nakhon Prathom Province, which is one of the central provinces of Thailand. The Phutthamonthon district is the east of Nakhon Prathom Province, connecting to the urban area of Bangkok, the capital city of Thailand (Figure 1).

Figure 1. Map of Thailand showing Bangkok and Nakhon Prathom. The study was conducted in Phutthamonthon area (hatched).

Subjects and specimen collection

Surveillance of intestinal parasitic infections was carried out between November and December 2004 in Phuttamonthon district, Nakhon Prathom Province, Thailand. Stool specimens were collected from 1 920 students (7-12 years old). Considering the maximum co-operation from our subjects, all children and their parents enrolled in the study were fully informed through the Principles of schools before specimen collection. For this purpose, the procedure for stool collection was thoroughly explained and clean plastic containers were distributed to each student on the day before specimen collection. All specimens were brought back to the laboratory at Department of Parasitology, Faculty of Medical Technology, Mahidol University and were immediately preserved in 10% formalin.

Fecal examination

Microscopic examination for the occurrence of intestinal parasites was performed by formalin-ethyl acetate concentration technique. The sediments were examined for intestinal protozoa, eggs and larvae of intestinal helminthes under a light microscope.

Data analysis

All data were stratified according to sex and school using EpiInfo 6.2 and analyzed with a chi-square test. A *P*-value was considered statistically significant at $p<0.05$.

RESULTS

The prevalence of intestinal parasites in 1920 school-age children from eight schools located in Phuttamonthon District, Nakhon Prathom Province, Thailand was presented in Table 1. The overall prevalence of intestinal parasites was 12.6% (242/1920). Among eight schools, the highest prevalence (22.8%) was found in School "G" while School "E" had the lowest prevalence (4.7%).

The sex-related prevalence shown in Table 2 revealed that 13.4% (134/1000) male and 11.7% (108/920) female were infected with intestinal parasites. The prevalence of

Table 1. Distribution and prevalence of intestinal parasitic infections in children from eight schools located in Phuttamonthon District, Nakhon Prathom Province, Thailand

Schools	No. examined	No. infected	Percentage of prevalence
A	69	11	15.9
B	82	14	17.1
C	107	18	16.8
D	323	47	14.6
E	698	33	4.7
F	316	55	17.4
G	189	43	22.8
H	136	21	15.4
Total	1920	242	12.6

intestinal parasitic infections among male was higher than female in School A, C, D, E, G, and H. However, the comparative prevalence of intestinal parasitic infections between male and female was not statistically significantly different ($p>0.05$).

The types and occurrence of intestinal parasitic infections in children from eight schools were analyzed according to two categories: single infection and multiple infection (Table 3). There was a predominance of single infection (214 cases, 11.2%) in relation to multiple infection (28 cases, 1.5%). Among the children that presented single infection, 205 cases (10.7%) were infected with protozoa whereas only 9 cases (0.5%) were infected with helminths. The most frequent protozoan and helminth were *Blastocystis hominis* and hookworm, with prevalence of 6.2% and 0.3%, respectively. Others included *Giardia lamblia* (1.7%), *Entamoeba coli* (1.5%), *Endolimax nana* (1.0%), and *Entamoeba histolytica* (0.3%), *Trichuris trichiura* (0.05%), *Taenia* species (0.05%), *Strongyloides stercoralis* (0.05%), and liver fluke or small intestinal fluke (*Opisthorchis* eggs, 0.3%). Among the children who had multiple infection, three cases (0.16%) were infected with helminths and protozoa; (*G. lamblia*, *E. nana*, hookworm), (*T. trichiura*, hookworm, *B. hominis*), and (*G. lamblia*, hookworm, *E. coli*, *B. hominis*). Twenty-five cases (1.3%) were infected with two or more of protozoa species.

DISCUSSION

The overall prevalence of intestinal parasites in this suburban area (Phuttamonthon District, Nakhon Prathom Province) was

Table 2. Sex-related prevalence of intestinal parasitic infections in children from eight schools located in Phuttamonthon District, Nakhon Prathom Province, Thailand

Schools	Male			Female			*P-value*
	N	n	%	N	n	%	
A	34	6	17.6	35	5	14.3	NS
B	55	9	16.4	27	5	18.5	NS
C	55	12	21.8	52	6	11.5	NS
D	168	27	16.1	155	20	12.9	NS
E	348	17	4.9	350	16	4.6	NS
F	163	28	17.2	153	27	17.6	NS
G	96	22	22.9	93	21	22.6	NS
H	81	13	16.0	55	8	14.5	NS
Total	1000	134	13.4	920	108	11.7	NS

N: No. of examined subjects, n: No. of infected subjects, NS: not significance

Table 3. Types and occurrence of intestinal parasitic infections in children from eight schools located in Phuttamonthon District, Nakhon Prathom Province, Thailand

Parasites	No. infected	Percentage of occurrence (n = 1920)
Single Infection	214	11.1
Protozoa	205	10.7
Blastocystis hominis	119	6.2
Giardia lamblia	33	1.7
Entamoeba coli	28	1.5
Endolimax nana	20	1.0
Entamoeba histolytica	5	0.3
Helminth	9	0.5
Hookworm	5	0.3
Trichuris trichiura	1	0.05
Taenia spp.	1	0.05
Strongyloides stercolaris	1	0.05
Liver fluke or small intestinal fluke (*Opisthorchis* egg)	1	0.05
Multiple Infection	28	1.5
G. lamblia, *E. histolytica*	1	0.05
G. lamblia, *B. hominis*	2	0.1
G. lamblia, *E. coli*	1	0.05
E. histolytica, *E. nana*	1	0.05
E. nana, *B hominis*	6	0.3
E. nana, *E. coli*	6	0.3
E. coli, *B. hominis*	4	0.2
G. lamblia, *E. coli*, *B. hominis*	2	0.1
G. lamblia, *E. coli*, *E. nana*	1	0.05
G. lamblia, *E. nana*, hookworm	1	0.05
E. histolytica, *E. coli*, *B. hominis*	1	0.05
T. trichiura, hookworm, *B. hominis*	1	0.05
G. lamblia, hookworm, *E. coli*, *B. hominis*	1	0.05

12.6%, much lower than prevalence in rural areas; "Nan" province (68.0%), the north region of Thailand (Waikagul *et al.*, 2002) and "Nakhon Si Thammarat" province (24.1%), the south region of Thailand (Anantaphruti *et al.*, 2002). The low prevalence of intestinal parasites might be due to the urbanization, the public investments in basic sanitation, and improvement of general living conditions, and the accessibility to health services. Single infections were found in 11.2% of the children; only 1.5% of the children presented multiple infections. Ten parasitic species were reported in our study. It is indicated that various species of intestinal parasites still remained in the study area.

Although there was a tendency of less occurrence of intestinal parasites in female, the prevalence among children in this study was not statistically significantly different between male and female ($p<0.05$),

indicating an equal opportunity for acquiring parasitic infections. At the school "E" the significantly low prevalence (4.7%) of intestinal parasites is thought to be correlated with hygienic condition at school and living place. Since this school was founded under a special project by Office of the National Primary Education Commission, Ministry of Education, Thailand, its high standard and quality in environment and sanitation has been developed.

It is interesting to note that the predominant intestinal parasites in this suburban area were intestinal protozoa while the occurrence of intestinal helminthes was quite low. Our findings reflect the wide distribution of intestinal protozoa, particularly *B. hominis* (6.2%) and *G. lamblia* (1.7%), in this area. Although pathogenesis of *B. hominis* is unclear, previous study observed that *B. hominis* was related to intestinal disturbance (Boreham & Stenzel, 1993). Therefore, a control measure for the prevention of blastocystiasis and giardiasis outbreaks should be emphasized. The most important and simplest way to prevent transmission of these infections is likely to be hand-washing (Early *et al.*, 1998; Guinan *et al.*, 2002; Jumaa, 2005). High standard hygienic conditions at school and living place, and health educations given to the families and school directors should be implemented.

Soil-transmitted helminthes (STH) were detected as the most helminth parasites in our study, which is in agreement with previous reports at various sites of Thailand (Piangjai *et al.*, 2003; Tomono *et al.*, 2003). For the STH infections, WHO recommend treatment of positive cases with prevalence < 50% and percentage of high intensity infections < 10% (Montresor *et al.*, 1998). According to WHO guidelines, Mass treatment may not be suitable for this local area even if intensity of STH infections were not determined in our study.

Our results concerning suburban school children in Phuttamonthon District, Nakhon Prathom Province should not be considered as representative for the whole child population. However, our survey provided essential data for developing control programmes to decrease intestinal parasitic infection in the local area. A longitudinal cohort study will be necessary to determine the efficacy of mass-treatment in this population.

In this study, we applied morphological identification of the species. However, it is quite difficult in some cases to differentiate closely-related species. One example is on *Taenia* eggs. Most recent work from Kanchanaburi, Thailand (Anantaphruti *et al.*, 2007), three human *Taenia* species are sympatrically occurring and a dual infection with *T. solium* and *T. asiatica* has been confirmed using mithcondrial DNA analysis. Therefore, it should be helpful to keep some part of specimens in ethanol and introduce molecular technique for further molecular identification.

Acknowledgements. This work was supported by Faculty of Medical Technology, Mahidol University, Bangkok, Thailand.

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