RISK FACTORS OF HELMINTHIASES AMONG SCHOOLCHILDREN IN SOUTHERN THAILAND

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Abstract. School-age children are particularly at risk of soil-transmitted helminthiasis (STH), which affects their growth and development. Hence, school-based helminthiasis control has been discussed and conducted as one of cost-effective ways in developing countries. A parasite control program is to be planned and conducted in an evidence based way as one of practical medical fields. However, a prevalence is likely to be influenced by various factors such as local environment and residents' behavior and so on. As few reports mentioning the relation of the prevalence and children's behavior and practice have been published, we conducted a survey to investigate such relation by asking children directly. Two hundred and eighty pupils in grade 3 to grade 5 were enrolled, who were in the two schools in Nakhon Si Thammarat Province, southern Thailand. A cross-sectional study was conducted in February and in November 2001, on the relationship between helminthiasis and children's knowledge and practice by using Kato-Katz method and a questionnaire, respectively. Hookworm (Hw) was the most predominant helminth followed by *Trichuris*. Boys had more intensive Hw infection than girls ($p = 0.022$), and wore shoes less frequently than girls ($p < 0.001$). The pupils who nearly acquired Hw infection after the first stool examination had lower levels of the knowledge of STH comparing to those who did not ($p = 0.011$). This study suggests that a prior survey can identify unique local factors as a part of diagnostic process, the results of which are useful for teachers to understand some points of health education at schools and can be applied as indicators for monitoring and evaluation.

INTRODUCTION

Soil-transmitted helminthiasis (STH) is considered as silent epidemic. School-age children are particularly at risk from this infection. Furthermore more intensive infections are likely to be observed among those age group rather than others, affecting their growth and development. School-based helminthiasis control has been discussed and conducted as a cost-effective way in many developing countries (World Bank, 1993; Partnership for Child Development, 1999; Margono *et al*, 2001). The nutritional status (Beasley *et al*, 1999; Stephenson *et al*, 1993) and the cognitive ability of infected children (Drake *et al*, 2000) can be improved by treatment.

A parasite control program is to be planed and conducted in an evidence based way as one of practical medical fields. However the prevalence of each helminth is not always equally worldwide. It is likely to be influenced by various factors such as the local environment and the behavior of the local residents and so on. It would make implementation plans more fruitful to consider these unique local risk factors based on a prior survey.

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Few reports mentioning epidemiological data both of prevalence and with KAP survey of children have been published. Here we conducted a survey to investigate the state of parasite infections and the relevant risk factors by asking children directly KAP questionnaire, the result of which is to be used for further school-based helminthiasis control program.

MATERIALS AND METHODS

Study site

The project site was located in Nakhon Si Thammarat Province in southern Thailand, with the climate of tropical forest. Two primary schools [Wat Thangphoon (WTP) School and Wat Krou Chou (WKC) School] were enrolled in this study. It was a 90 km distance apart from each other. Stool examination and questionnaire were conducted among the students in grade 3-5 (Table 1). In total, 280 pupils were enrolled.

Stool examination

A cross-sectional study was conducted in February and November 2001 for the relationship between helminth infections and children's relevant risk factors. Stool specimens of both schools were examined in February; additionally those of WTP School were examined in November again. Two hundred and thirty-three specimens were collected. Kato-Katz method was used for qualitative and semi-quantitative investigations for three helminth infections: *Ascaris lumbricoides* (Al), *Trichuris trichiura* (Tt), and hookworm (Hw). Examined pupils were categorized as having light, moderate, or heavy infections based on WHO criteria (WHO, 1987).

Questionnaire administration

A questionnaire consisted of two parts, asking the knowledge of STH and their behavior concerning STH infection. The questionnaire also included demographic information and their environment. The questionnaire sheets were filled by pupils under teachers' guide in both schools in November. The questionnaire consisted of twelve questions to be scored. A correct answer got one point and a wrong answer got zero point, and then total points were summed up to be a score of a schoolchild.

The aim of the study was explained to teachers, parents, and pupils but written form of agreement was not obtained, because stool examination and health education in schools were a part of the national policy of Thailand. After the data were obtained all infected children received a treatment with a single 400 mg dose of albendazole by health staff.

Statistical analysis

Epi Info Version 6.0 and Microsoft Excel were used to analyze frequency, prevalence, intensity and associations. The score of the student knowledge was compared with *t*-test. Chi-square or Fisher's exact test was used to assess the association of the variables with helminth infections.

RESULTS

Stool examination

The result of the stool survey in both schools in February is shown in Table 2. There was no Al infection. Hw was the most predominant parasite in both schools (46 cases, 19.7%) followed by Tt (13 cases, 5.6%). Six boys had moderate infection, while eighteen boys and twenty-two girls had light infection. There was no significant difference between the two schools in the infection rate of Hw infection ($p = 0.652$). However, Tt infection cases were observed in WTP School more than in WCS School (12 cases *vs* 1 case; $p = 0.024$).

The relation between stool examination and questionnaire in both schools

The prevalence of Hw infection in February was compared to the results of the questionnaire. There was no significant relation between sex and the prevalence of Hw infection ($p = 0.601$). The intensity of Hw infection was related to the sex ($p = 0.022$) (Fig 1). Six moderate cases were only boys. After the continuity correction, p value of Pearson's chi-square test for the infection rate of Hw and shoe wearing habit ($p = 0.048$) was adjusted to 0.078. Quite significant difference was observed in shoe wearing among different sex groups. Boys wore shoes less frequently than girls ($p < 0.001$) (Fig 2). The prevalence of Tt was related to using wells as a water resource ($p = 0.004$), but no other risk factors were observed.

Table 1
The grade and sex of the pupils.

Schools		Grade 3	Grade 4	Grade 5	Total
Wat Thangphoon School	Boy	34	21	30	85
	Girl	29	30	34	93
	Total	63	51	64	178
Wat Krou Chou School	Boy	22	19	16	57
	Girl	14	14	17	45
	Total	36	33	33	102
Total	Boy	56	40	46	142
	Girl	43	44	51	138
	Total	99	84	97	280

Table 2
Prevalence of soil-transmitted helminthes in two schools.

	Wat Thangphoon %	Wat Krou Chou %	Total
A. lumbricoides	0.0	0.0	0.0
T. trichiura	8.8	1.0	5.6
Hookworm	18.4	21.6	19.7
Total	23.5	22.7	23.2

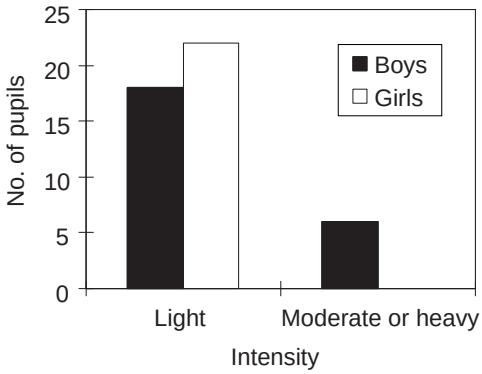

Fig 1–The intensity of hookworm infection in both sexes.

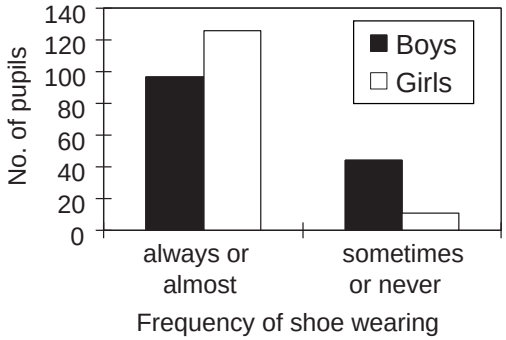

Fig 2–Shoe wearing habit and sex.

The knowledge and re-infection

One hundred and eleven children showed negative results for Hw in WTP School in February. When, out of them, ninety specimens were re-examined in November, fourteen children turned to positive although seventy-six remained negative. The only detected difference between the two groups was their knowledge of STH ($p = 0.011$).

DISCUSSION

In this study, three main facts were revealed; firstly the predominant helminth in this region was Hw, followed by Tt; secondly the children with less knowledge are likely to get Hw infection; and thirdly boys, who were unlikely to wear shoes, had higher intensity of Hw infection than girls.

The prevalence of Hw infection in NST is consistent with the results of the national survey of helminthiases in Thailand (Jongsuksuntigul *et al*, 1997). The prevalence has been declined gradually due to the national policy with modified Mass Drug Administration (MDA) and health education to the communities. However the results of the national survey did not show that the prevalence had reached zero. In our study, 15.5%

of the children had got Hw infections in eight months after the first stool examination in February 2001, who had less knowledge of STH compared to those who did not get infections in the same period. This result can advocate the importance of health education for STH prevention. In fact health education is one of the important factors of the helminthiases control of WHO (Montresor *et al*, 1998). Although health education has got a huge attention (Albonico *et al*, 1999), there has been argument that its cost might be over that of the MDA. Mascie-Taylor *et al* (1999) reported that one MDA without any health education was the most cost effective to reduce the prevalence and intensity of STH. However if the existing education system and facilities had been used, the cost can be reduced in great amount with much reduction of the prevalence and intensity.

When a helminth control project terminated without eradication even with low intensity by any reason, the parasites would re-emerge and the intensity would increase immediately as far as the environment and the residents' behavior did not improved enough (Muennoo e*t al*, 1998). The re-infection rate of Hw infection in this study could be estimated almost 0.22/child/year. Without any effective intervention, the prevalence would be almost 50% in 3 years. Hence once a project started, it should be continued until the parasite is eradicated in the area. Furthermore, continual MDA might induce a drug resistant strain. There were reports about the drug resistant Hw to antihelminthics listed in the WHO's essential drugs (De Clercq *et al*, 1997; Reynoldson *et al*, 1997; Geerts and Gryseels, 2000). Although the risk is still small, it should be kept in the minds of the policy makers.

A parasite control program is to be planed and conducted in an evidence based way as one of practical medical fields. STH prevalence is likely to be influenced by local factors (Jongsuksuntigul *et al*, 1997). Our health education plan for helminth prevention and control is to be based on the prior epidemiological information in the target area, not only of parasitological data, but also of the environmental condition, personal hygiene practice, and so on as a part of diagnostic process (Spasoff, 1999). In fact some of such kinds of data in this study were different from those of other reports. Boys, who were less likely to wear shoes, had higher intensity of Hw infection than girls, which was unique and different from previous reports (Anderson *et al*, 1993; Bakta *et al*, 1993; Stoltzfus *et al*, 1997; Labiano-Abello *et al*, 1999; Gandhi *et al*, 2001). On the other hand, although the relation between Hw infection and absence of latrine in houses has been reported and discussed in several reports (Chongsuvivatwong *et al*, 1996), any relation of them was not observed here. Neither was observed here the relations with nail trimming, washing hands and so on. Provided such local information, the target groups and the contents of the education would be clearer. The priorities among topics for health education of STH prevention should be set up based on such an evidence based way, which can contribute to saving limited resource of personnel, materials and time in many developing countries.

Nowadays, cheap anti-helmintics are available in markets in various regions. In fact some pupils here had taken it in the previous year. A report from Africa mentioned that parents were eager to purchase medicine for their children (Brooker *et al*, 2001). Therefore our task here for STH control may not be providing medicine to vulnerable people, but encouraging them to save themselves by showing cheap and effective preventive methods by using proper health education.

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