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Impact of health educational programmes on the prevalence of enterobiasis in schoolchildren in Thailand

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Abstract

Enterobiasis is a worldwide prevalent disease particularly in low income areas. The budget needed for the prevention, treatment and eradication of the disease has thus far frustrated the limited budgets of global public health systems. A study was undertaken to determine if education in addition to medical treatment of enterobiasis could make a difference to the rates of infection. A total of 777 children (399 male and 378 female) from 11 elementary schools in five districts of Samut Prakan Province, Thailand were examined between December 2000 and March 2002. In five of the 11 schools studied, medical treatments were applied, followed by a programme of educating the children in the prevention of infection. Children in the remaining six schools received medical treatment only. The study showed a decrease in infections among children who received supplementary education. This decrease was significant in comparison to the decrease shown among children who received medical treatment only. The study therefore showed that educating high risk individuals played a key role in the prevention of enterobiasis.

Introduction

Thailand is undergoing social and economic changes that accompany rapid development. Positive trends include impressive advances in both science and technology, as well as rapidly rising education levels among all segments of the society. Along with rapidly increasing literacy rates, higher education is becoming increasingly available, accompanied by advances in public health. Prevention and control programmes dealing with parasitic diseases have been developed and implemented. However, even with these advances, parasitic diseases still remain a serious concern for the public health system in Thailand. Many factors influence the survival and transmission rates of parasites, as in the case of liver fluke infections in northeast Thailand, where people frequently enjoy eating raw fish. Hookworms and roundworms are more frequently found in southern Thailand where heavy rainfall and temperatures create conditions of high humidity and encourage the survival and development of many parasite species.

The pinworm *Enterobius vermicularis* was chosen as the focus of the present study as this nematode was shown to be common among elementary school children in the Samut Prakan area (Nithikathkul *et al.*, 2001a,b). Perianal itching is the usual symptom of pinworm infections (Cerva *et al.*, 1991) and the invasion of the appendix is also relatively common (Jones, 1988). Pinworms, or their eggs,

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have occasionally been reported from other ectopic sites, such as the liver, lungs (Bever *et al.*, 1973; Little *et al.*, 1973; Daly & Baker, 1984) and female genitalia (Beckman & Holland, 1981; Kogan *et al.*, 1981). Excessively high rates of pinworm infections have been found in communities with a high population density, such as slums (Vajarasthira & Harinasuta, 1960; Tepmongkol *et al.*, 1980; Mameechai *et al.*, 1992), and institutions such as orphanages and schools (Wahah & Ratanaponglakh, 1992; Nithikathkul, 2000). Pinworms are primarily found in children due to their inadequate hygiene practices (Kaewkes *et al.*, 1983). The focus of the present study was to examine methods of lowering the rate of pinworm infections in elementary school-aged children utilizing medical and educational resources.

Enterobius vermicularis is particularly widespread among elementary school-aged children. Studies done in urban slum areas in Bangkok, Thailand showed a rate of infection varying from 53% to 65% (Tepmongkol *et al.*, 1980; Mameechai *et al.*, 1992). Studies of preschool children in Khon Kaen Province in the northeastern region of Thailand indicated a prevalence of around 50.9% (Kaewkes *et al.*, 1983). Research in Nakhon Pathom Province, an urban area adjacent to Bangkok, exhibited a prevalence rate of 38.2% (Wahah & Ratanaponglakh, 1992). A survey of *E. vermicularis* in primary school students in Bang Phli district, Samut Prakan Province, using the transparent tape swab technique, revealed that worms were found in 38.8% of students (Nithikathkul *et al.*, 2001b). In a study carried out at a mobile health clinic of Huachiew Chalermprakiet University the infection rate of *E. vermicularis* in children averaged 21.9% (Nithikathkul *et al.*, 2001a). The population density and personal hygiene were significant factors influencing the prevalence of infection and this explains why higher prevalences are found in overcrowded areas such as slums (Vajarasthira & Harinasuta, 1960; Mameechai *et al.*, 1992), orphanages and schools (Tepmongkol *et al.*, 1980; Nithikathkul, 2000) where large numbers of young children are in close proximity. At present, there is a lack of data concerning educational programmes on the prevention and treatment to decrease the rates of particular infections of *E. vermicularis* in various areas and among different populations. It would be of interest to examine different treatment programmes in these areas and the present study aims to address this.

Materials and methods

Children between six and ten years of age were selected from 11 primary schools in five districts of Samut Prakan Province. The schools were: Wat Phraekasa, Phichaisongkram Kindergarden, Wat Saunsom, Wat Laeam, Suksawad, Wat Bang Phli Yai Nai, Klong Paladpliang, Phra Samut Chedi, Wat Yai, Wat Banrakard and Klong Kanya. Entire classrooms in each school were tested, and a total of 777 students, 399 male and 378 female, was examined. A small number did not fully complete their questionnaires. Therefore, the total number of respondents was more than the total number tested for the following variables: age, number of children in the family, education and occupation of the parents and family income.

Sampling and diagnosis

Stratified random samplings were drawn from five sub-districts (amphoes) in the Samut Prakan Province between December 2000 and March 2002. Eleven primary schools were selected from the five sub-districts to comprise the total sample group. The children in the study comprised around 10% of the total students in each school and selection was determined by group sampling. Data were analysed using the chi-square test, and the variables included parental income and occupation, and the age and sex of the schoolchildren.

Parents of schoolchildren were provided with questionnaires to provide personal data and the socio-economic status for each child. The examination of children took place between 0700 to 1000 h and parents were asked to ensure that the children did not bathe after waking on the morning of the test.

Diagnosis was achieved by the transparent tape technique, where the adhesive side of a transparent tape swab is placed on the perianal skin, pulled off and placed, adhesive side downwards, onto a labelled slide. The slides were collected and examined for the presence of *E. vermicularis* eggs.

Treatment

Children from the following five schools: Wat Bang Phli Yai Nai, Klong Paladpliang, Wat Banrakard, Phichaisongkram Kingdergarden and Suksawad, received treatment with a single dose of 500 mg albendazole. They were directly taught how to prevent the transmission of enterobiasis, supplemented with the use of brochures and videos. Children from the remaining six schools received only medical treatment with albendazole. One year after treatment, the same children were examined for reinfection. Statistical data were analysed using the χ^2 and McNemar tests.

Results

Of 777 schoolchildren examined, 13.5% were infected with *E. vermicularis* after treatment. The majority of parents had an elementary level of education, worked as labourers, and had a family income of less than 5000 baht (125 US dollars) per month (table 1). The infection rates in 11 primary schools are shown in table 2.

Schoolchildren that received medical treatment and prevention education accounted for 9.3% in males and 8.0% in females and those that received medical treatment only accounted for 21.4% in males and 17.5% in females (table 2). Infection in children from schools which received supplementary education was shown to decrease from 18.0% (77/427) to 8.7% (37/427) with a non-reinfection rate of 80.5% (62/77). In students from schools receiving medical treatment only, the infection rate decreased from 21.4% (75/350) to 19.4% (68/350) with a non-reinfection rate of 50.7% (38/75).

Potential factors associated with suppplemental health education such as the sex and age (9–10 years old) of the children, parental occupation (employee) and family income (low) showed significant differences between pre- and post-treatment (table 3).

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Table 1. Demographic information of respondents from 11 elementary schools in five districts of Samut Prakan Province, Thailand from December 2000 to March 2002.

Child sex, age and socio-economic status	Number examined	Proportion (%) of each category
Children		
Sex	777	
Male	399	51.4
Female	378	48.6
Age	764	
6–8 years	590	77.2
9–10 years	174	22.8
Number of children in family	735	
1–3	682	92.8
4–6	44	6.0
7–13	9	1.2
Parent		
Education	746	
Elementary	416	55.8
Secondary	206	27.6
Diploma	49	6.6
Degree	53	7.0
Illiterate	22	2.9
Occupation	748	
Labourer	555	74.2
Business	100	13.4
Government employee	45	6.0
Agriculture	22	2.9
Unemployed	26	3.5
Family income (baht[a]/month)	731	
≤ 5000	342	46.8
5001–10,000	242	33.1
> 10,000	147	20.1

[a] 5000 baht = 125 US dollars.

Discussion

The present study revealed that the overall prevalence of enterobiasis among primary school students in Samut Prakan Province, Thailand was 13.5%. The infection rate for schoolchildren which received health education was shown to decrease from 18.0% (77/427) to 8.7% (37/427) (table 2). The infection rate for those children receiving medical treatment only was shown to decrease from 21.4% (75/350) to 19.4% (68/350). The evidence from this study shows significant differences between the two treatment methods. The potential factors of the sex and age of children, parental occupation and family income had no relationship with the non-infection rate (the rate of children without re-infection) ($P < 0.05$). Health education played a key role in the prevention of infection. The Samut Prakan branch of Thailand's Ministry of Health conducted the first large scale treatment of enterobiasis infections in school students, and this 'population health' approach, targeting high risk individuals, may be a cost-effective way for the Ministry to allocate limited funds. Perhaps this type of approach and a further study on the correlation of symptoms with infection may offer a comprehensive strategy to the enterobiasis dilemma.

The present study found a lower overall prevalence of enterobiasis (13.5%) compared with 50.9% found in earlier studies conducted by Kaewkes *et al.* (1983) in Khon Kaen Province in 1992, and 53.4% found by Teopipiporn *et al.* (1981) in the slum areas of Bangkok in 1980. This discrepancy could be due to the fact that Khon Kaen Province, in the northeastern region of Thailand, lags behind Bangkok and other more developed areas of Thailand economically. However, the present results are closer to the prevalence valve of 38.6% described by Wahah & Ratanaponglakh (1992) in the urban areas of Nakorn Pathom Province in 1992. Both Samut Prakan and Nakorn Pathom are in the greater Bangkok urban area, but are geographically on opposite sides of the city. The prevalence found in the present study is lower than those found in previous studies because nowadays more people pursue advanced and technical education which includes dealing with health issues. The present study focused on 6- to 10-year-old children and found the highest prevalence in 6- to 7-year-olds, whereas Nithikathkul *et al.* (2001b) and Mameechai *et al.* (1992) found the highest prevalence in 8- to 9-year-olds. Social and/or environmental factors could account for the discrepancy between the studies. Children aged 6–7 years are old enough to begin taking responsibility for their own personal hygiene, but are still less responsible than older children. Also, children become more mobile at this age, visiting other children, playing further from home and interacting more with their environment. Further studies should include an investigation of children younger than six years old.

An analysis of the difference between males and females indicated that males exhibited a slightly higher rate of infection, although these results were not statistically significant. Teopipiporn *et al.* (1981) obtained similar results from five locations in differing environments in the Bangkok slums. A study conducted in the Din Daeng slums of Bangkok also found no significant differences between males and females (Teopipiporn *et al.*, 1981). Conversely, Kaewkes *et al.* (1983) found that in Khon Kaen Province, boys showed a higher rate of infection than girls (Kaewkes *et al.*, 1983). Although these differences are not significant, a possible factor influencing these results could be that rural boys tend to spend more time outdoors, whereas boys in urban areas tend to stay indoors playing with computers and video games, and are involved in other sedentary activities.

Socioeconomic data collected from the present study dealt with the parents' incomes and occupational levels. Originally, an inverse relationship between parental income and the rate of infection in children was predicted. However, the study supported the relationship between parental socioeconomic status and the prevalence of *E. vermicularis* infection ($P < 0.05$). Factors influencing the infection rate may include personal hygiene, levels of parental care, social interactions at school, and the teacher's knowledge of and attention to hygiene, e.g. hand washing and bathing.

Factors not evaluated in the present study include a detailed analysis of the physical environment of each child, population density within the grounds of the individual schools, and the extent of the teachers' knowledge of public health and hygiene relating to parasitic infection and transmission. The season of the year may also influence infection rates due to climatic

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Table 2. The prevalence (%) of *Enterobius vermicularis* in schoolchildren before and one year after being given either educational and medical treatment or medical treatment only in Samut Prakan Province, Thailand from December 2000 to March 2002.

		Schoolchildren								
		Male			Female			Total		
Type of treatment	School	Number examined	Pre-treatment (%)	Post-treatment (%)	Number examined	Pre-treatment (%)	Post-treatment (%)	Number examined	Pre-treatment (%)	Post-treatment (%)
Medical and educational	Wat Bangphli Yai Nai	47	21.3	19.2	60	21.7	5	107	21.5	11.2
	Klong Paladpliang	40	12.5	0	36	8.3	8.3	76	10.5	4.0
	Wat Banrakard	42	35.7	16.7	31	29	9.7	73	32.9	13.7
	Phichaisongkram K.	59	5.1	3.4	34	2.9	0	93	4.3	2.2
	Suksawad	38	18.4	7.9	40	27.5	17.5	78	23.1	12.8
	Total	226	17.7	9.3	201	18.4	8	427	18.0	8.7
Medical only	Wat Saunsom	33	15.2	15.2	27	29.6	7.4	60	21.7	11.7
	Phra Samut Chedi	25	24	40	21	19.1	4.8	46	21.7	23.9
	Wat Yai	36	30.6	13.9	43	11.6	20.9	79	20.3	17.7
	Wat Laeam	36	19.4	27.8	34	23.5	29.4	70	21.4	28.6
	Wat Phraekasa	12	25	8.3	16	12.5	6.3	28	17.9	7.1
	Klong Kanya	31	25.8	19.4	36	22.2	22.2	67	23.9	20.9
	Total	173	23.1	21.4	177	19.8	17.5	350	21.4	19.4
Total		399	20.1	14.5	378	19	12.4	777	19.6	13.5

factors such as humidity and temperature. Hopefully, these concerns will be addressed by future research. The facts from this study should provide fundamental information concerning pinworm infection in Samut Prakan Province. In addition, this data can be subsequently utilized to develop programmes for the prevention and control of pinworm infection and thus decrease the prevalence of *Enterobius vermicularis*.

Table 3. Student sex, age and socio-economic status associated with non-reinfection rate of *Enterobius vermicularis* in schoolchildren before and one year after being given either educational and medical treatment or medical treatment only in Samut Prakan Province, Thailand from December 2000 to March 2002.

Sex, age and socio-economic status of schoolchildren	Number examined	Number positive before treatment	Number positive after treatment	*P*-value
Sex				
Male	399	80	58	0.023*
Female	378	72	47	0.003*
Age (years)				
6	80	16	13	0.167
7	291	62	35	0.058
8	220	47	31	0.212
9–10	173	26	20	0.004*
Parental occupation				
Business	100	20	13	0.523
Agriculture	22	5	3	0.625
Government employee	45	4	2	1.000
Labourer	555	121	81	0.000*
Unemployed	26	2	1	0.219
Family income (baht[a]/month)				
≤5000	342	86	56	0.000*
5001–10,000	242	48	35	0.011*
> 10,000	147	15	7	1.000

Statistically significant between pre-treatment and post-treatment (McNemar test).
[a] 5000 baht = 125 US dollars.

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