

STRONGYLOIDES STERCORALIS INFECTION AND CHRONOLOGICAL CHANGES OF OTHER SOIL-TRANSMITTED HELMINTHIASES IN AN ENDEMIC AREA OF SOUTHERN THAILAND

Malinee T Anantaphruti, Supaporn Nuamtanong, Chatree Muennoo, Surapol Sanguankiat, and Somchit Pubampen

Department of Helminthology, Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand

Abstract. A field survey was conducted in 4 primary schools in Nakhon Si Thammarat Province, southern Thailand. By Sasa modified Harada-Mori cultivation method, 1.8% of the schoolchildren were found to be infected with *Strongyloides stercoralis*, and 25.1% had hookworm infection. By Kato's thick smear method, the overall prevalence of soil-transmitted helminths was 46.8%, being *Trichuris trichiura* 28.5%, hookworm 18.0%, and *Ascaris lumbricoides* 5.7%. Fecal examination, performed by Kato's thick smear and culture method, indicated that the prevalence of hookworm infection was 26.9%. The prevalence in the present study was very much lower than many previous reports in the past decade. This may indicate the partial success of the parasite control project in Thailand by mass treatment, improving the sanitation and personal hygiene of the people in the endemic area.

In light infection with *Trichuris*, albendazole administered at a dosage of 200 mg daily for 3 days showed a 48.7% cure rate. When mebendazole was given at 100 mg twice daily for 3 days, its effectiveness was 88.5%. A lower cure rate was obtained (70.0%) in moderate to heavy infection.

INTRODUCTION

Soil-transmitted helminths are widely distributed in the southern part of Thailand. Many reports of their prevalence have been seen in the literature over more than 20 years, but reports of *Strongyloides stercoralis* infection were little mentioned. In 1980-1981, stool samples from seven provinces in the south of Thailand, including Nakhon Si Thammarat, were examined by Kato's thick smear method and the overall prevalence of soil-transmitted helminths was found to be 84.0%. Hookworm infection was 75.9% while infection caused by *Trichuris trichiura*, *Ascaris lumbricoides* and *Strongyloides stercoralis* were 16.5%, 32.5%, and 0.06% respectively (Preuksaraj *et al*, 1983). In the same year, Yokogawa *et al* (1983) reported 92.9% infection with soil-transmitted helminths in schoolchildren from Nakhon Si Thammarat examined by Kato-Katz's technique, the highest prevalence being hookworm 78.9%, and the lowest being *Ascaris* 32.2% and *Trichuris trichiura* 54.8%.

Muennoo *et al* (1993) reported the result of a survey conducted in schoolchildren in 1990. The infection rate of these soil-transmitted helminths was 81.4% (hookworm 75.5%, *Trichuris* 37.2% and

Ascaris 15.8%) and the following year the infection rate of this group of children increased to 90.4% (hookworm 85.5%, *Trichuris* 34.5%, *Ascaris* 3.7%, pinworm 0.7% and *Strongyloides* 0.3%) (Muennoo *et al*, 1992).

Katz's modified Kato thick smear method is the most common method and widely used to detect the prevalence and intensity of soil-transmitted helminths. However, infection by *Strongyloides stercoralis* was reported by Preuksaraj *et al* (1983) and Muennoo *et al* (1992) with Kato-Katz's method. The best method to detect the prevalence of *Strongyloides stercoralis* infection is the culture method (Sasa *et al*, 1958; Marwi, 1979). The prevalence rate of *Strongyloides stercoralis* infection with this method in the southern part of Thailand has not been reported. This study aimed to ascertain out the actual *Strongyloides stercoralis* infection rate and also other soil-transmitted helminthiasis in schoolchildren in southern Thailand during the economic crisis in 1999.

MATERIALS AND METHODS

The study was performed during January and February 1999 in 4 primary schools, Wat Bode, Tha Rua, Junhoon and Ban Hua Thanon Yai, Muang district, Nakhon Si Thammarat Province, which is

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an endemic area for soil-transmitted helminthiasis in Thailand. Stool bags were distributed to the schoolchildren by their teachers, and fecal samples were collected on the following day. All fecal samples were examined by Kato's cellophane thick smear method. Intensity of infection was classified into 4 categories according to Kobayashi (1980) as very light (1-9 eggs/smear), light (10-99), moderate (100-999) and heavy (1000+). After performing the first method, the feces were cultured by polyethylene tube method (Sasa *et al.*, 1965). On the sixth day after cultivation, the tubes were checked for positive under stereomicroscope, and filariform larvae were identified.

All infected trichuriasis cases with very light (except those egg counts lower than 4 per smear) and light infection were divided into 2 paired-matched groups according to the degree of infection. One group was given mebendazole 100 mg twice daily for 3 consecutive days and the other group was given albendazole 200 mg daily for 3 consecutive days. All moderate and heavy cases were treated with mebendazole in the same regimen as mentioned above.

To determine the cure rate of both anthelmintic drugs in *Trichuris* infection, schoolchildren were asked to submit their stool samples again on day 21 after drug administration. Fecal examination was performed by Kato's thick smear.

RESULTS

Nearly 50% of the schoolchildren were infested with soil-transmitted helminths. The prevalence rate

was rather high at Wat Bode school (56.4%) and Tha Rua school (61.7%). The lower prevalence rates were obtained from Junhoon school (36.1%) and Ban Hua Thanon Yai school (16.7%). *Ascaris*, *Trichuris* and hookworm infection were also higher in the two former schools, but *Strongyloides* infection showed no marked differences among the first three schools, as shown in Table 1. *Trichuris* infection showed the highest infection rate among soil-transmitted helminths. Mixed infections with 2 or 3 kinds of parasites were fewer in number. Most of the *Trichuris* and hookworm cases were classified into very light and light classes. In *Trichuris* infection, very light was 62.5% and 31.8% for the light group, while hookworm infection 66.7% was very light and 32.4% was light infection respectively. *Ascaris* infection was very light (31.4%) and light (51.4%). Only 4.6% and 1.1% of *Trichuris* cases were classified in the moderate and heavy classes and no heavy hookworm infection was shown in this study (Table 2).

As shown in Table 1, the prevalence rate of *Strongyloides stercoralis* was 1.8% by cultivation method. Polyethylene tube cultivation could raise the prevalence rate of hookworm infection from 18.0% in Kato's thick smear to 25.1% and became 26.9% when the results of both methods were pooled (Table 3).

For *Trichuris* infection, mebendazole dosage 100 mg twice daily for 3 days gave a 70.0% cure rate for the moderate and heavy groups and a rather high cure rate (88.5%) for the light infection. In comparison with albendazole 200 mg daily for 3 days, the cure rate was 48.7% for the light intensity group (Table 4).

Table 1
Prevalence of soil-transmitted helminths (STH) among schoolchildren in Nakhon Si Thammarat Province in February 1999 by Kato's thick smear and culture method.

Schools	Number of students			Positive parasites (%)			
	All	Submitted stool sample	STH Prevalence (%)	<i>Ascaris</i>	<i>Trichuris</i>	Hookworm	<i>S. stercoralis</i>
Wat Bode	425	259	146(56.4)	25(9.7)	85(32.8)	49(18.9)	4(1.5)
Tha Rua	200	81	50(61.7)	9(11.1)	43(53.1)	24(29.6)	5(6.5)
Junhoon	260	230	83(36.1)	1(0.4)	43(18.7)	34(14.8)	5(6.5)
Ban Hua Thanon Yai	60	47	10(16.7)	0	5(10.6)	4(8.5)	0
Total	945	617	289(46.8)	35(5.7)	176(28.5)	111(18.0)	14(1.8)

Note: Kato's thick smear method for *Ascaris*, *Trichuris* and hookworm infection.

Culture method for *Strongyloides stercoralis* infection.

Table 2
Intensity of *Ascaris*, *Trichuris* and hookworm infection in schoolchildren examined by Kato's thick smear method.

Schools	<i>Ascaris</i>					<i>Trichuris</i>					Hookworm				
	VL	L	M	H	Total(%)	VL	L	M	H	Total(%)	VL	L	M	H	Total(%)
Wat Bode	8	14	2	1	25(9.7)	50	32	3	0	85(32.8)	29	20	0	0	49(18.9)
Tha Rua	2	4	2	1	9(11.1)	21	15	5	2	43(53.1)	17	7	0	0	24(29.6)
Junhoon	1	0	0	0	1(0.4)	34	9	0	0	43(18.7)	24	9	1	0	34(14.8)
Ban Hua Thanon Yai	0	0	0	0	0	5	0	0	0	5(10.6)	4	0	0	0	4(8.5)
Total	11	18	4	2	35(5.7)	110	56	8	8	176(28.5)	74	36	1	0	111(18.0)
Percentage	31.4	51.4	11.4	5.7	100	62.5	31.8	4.6	1.1	100	66.7	32.4	0.9	0	100

VL - very light infection (1 - 9 eggs/smear) L - light infection (10 - 99 eggs/smear)
M - moderate infection (100 - 999 eggs/smear) H - heavy infection (1000+ eggs/smear)

DISCUSSION

Previous reports showed that the prevalence rate of soil-transmitted helminths in the endemic area was fairly constant over the last 1-2 decades and that the infection rate was very high (81.4% - 92.9%) (Table 5). The Helminthiasis Control Program under the Ministry of Public Health in which the target group emphasized primary schoolchildren was able to reduce the prevalence rate to 46.8% during the economic crisis. The degree of infection was also affected, since many previous reports showed a higher percentage of moderate and heavily infected cases than the one reported in this study (Charanasri *et al*, 1989; Kiattansakul *et al*, 1989; Dulyapiree *et al*, 1990; Preuksaraj *et al*, 1983). *Strongyloides* infection has often been ignored by investigators since a special technique is required for its detection. However, some reports mentioned the prevalence rate based on the Kato's or Kato-Katz's method (Preuksaraj *et al*, 1983; Muennoo *et al*, 1992). By using polyethylene tube cultivation, we could detect 1.8% of *Strongyloides stercoralis* infection in schoolchildren. The result was 6-30 times greater than previous reports and it is possible that the prevalence rate may have been higher if the adult population had been included in the study. According to Pawlowski (1989), Nakhon Si Thammarat Province might be considered an endemic area for *Strongyloides stercoralis* infection because the prevalence rate was between 1-5%.

Trichuris infection is the most prominent nematode in this area (Table 5). Adult *Trichuris* survive longer than 5 years, and within the life span, a female worm can release nearly 20 million eggs to contaminate the environment. Their eggs are highly resistant to physical and chemical factors in the surroundings (Skrjabin *et al*, 1970). In a community where the sanitation and personal hygiene of the villagers are poor, the infection spread widely and continued from generation to generation. Many factors are involved in the failure of the parasite control program, such as human behavior (eating habits, occupation, etc), their beliefs (religion and culture), natural phenomena (climate, rain and yearly flooding in the area) and the most serious problem was the only partial co-operation of the people in mass treatment. Schoolchildren are a good target group because their treatment is in the charge of the local health center and/or teachers, but other risk groups (pre-school age, adult and old age) were incompletely medicated.

Table 3
Difference between hookworm infection rate obtained from Kato's thick smear and culture method.

Schools	Kato thick		Culture		Positive by either Kato or Culture (%)
	Examined	Positive (%)	Examined	Positive (%)	
Wat Bode	259	49 (18.9)	257	70 (27.2)	78 (30.1)
Ta-rhoea	81	24 (29.6)	77	28 (36.4)	28 (34.6)
Junhoon	230	34 (14.8)	224	50 (22.3)	55 (23.9)
Ban Hua Thanon Yai	47	4 (8.5)	47	4 (8.5)	5 (10.6)
Total	617	111 (18.0)	605	152 (25.1)	166 (26.9)

Table 4
Efficacy of mebendazole and albendazole on *Trichuris* infection among schoolchildren in Nakhon Si Thammarat Province.

Drugs	Intensity of infection	Positive cases		Cure rate %
		before treatment	21 days after treatment	
Albendazole (200 mg x 1 x 3)	light	39	20	48.7
Mebendazole (100 mg x 2 x 3)	light	26	3	88.5
	moderate and heavy	10	3	70.0

Table 5
Prevalence of soil-transmitted helminths (STH) in Nakhon Si Thammarat Province by several investigators.

Studied group	Prevalence rate %					Investigators
	STH	Hookworm	<i>Trichuris</i>	<i>Ascaris</i>	<i>S. stercoralis</i>	
Villagers	84	75.9	32.5	16.5	0.06	Preuksaraj <i>et al</i> , 1983
School children	92.9	78.9	54.8	32.2	-	Yokogawa <i>et al</i> , 1983
School children	81.4	75.5	37.2	15.8	-	*Muennoo <i>et al</i> , 1993
School children	87	80	46	3.7	0.3	Muennoo <i>et al</i> , 1992
School children	46.8	18	28.5	5.7	1.8	Present authors

* The survey was conducted in 1990

A higher dose of albendazole (400 mg) seemed to provide a higher cure rate 78.9% single dose (Setasuban *et al*, 1993) and 68.2% and 100% once a day for 3 consecutive days (Anantaphruti *et al*, 1993; Setasuban *et al*, 1993) than the lower dose (200 mg daily for 3 consecutive) 48.7% in the present study. When mebendazole 100 mg twice daily for 3 days was used, a similar result as the previous

studies was obtained (Anantaphruti *et al*, 1993; Waikagul *et al*, 1997).

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