

Factors associated with the transmission of soil-transmitted helminthiasis among schoolchildren

Isra Firmansyah, MD; Sri Alemina Ginting, MD; Munar Lubis, MD; Iskandar Z Lubis, MD; Syahril Pasaribu, MD; Chairuddin P Lubis, MD

ABSTRACT

Background Soil-transmitted helminthiasis (STH) is an important public health problem in Indonesia.

Objective To find out factors influencing the transmission of STH in two different communities in North Sumatera, Indonesia.

Methods A cross sectional study was done on 96 primary school children in Suka village (located on a mountain area) and 96 primary school children in Pantai Cermin village (a coastal area). Subjects were recruited by simple random sampling. Kato Katz and centrifuge floatation methods were used for stool and soil examinations, respectively. Data were collected by interviewing parents of children using a questionnaire and were analyzed using chi-square test by SPSS program version 11.0.

Results There was no difference in the prevalence of STH in both villages ($p > 0.05$). Parents' knowledge and economic status had significant relationships with the prevalence of STH in Suka village ($p < 0.05$), but not in Pantai Cermin ($p > 0.05$). In both villages, parents' education did not have a significant relation with STH, while there were significant relations between STH and hygiene, environment, or soil contamination by worm eggs ($p < 0.05$).

Conclusion There were significant relationships between hygiene, environment, or soil contamination and the prevalence of STH in the two villages. [Paediatr Indones 2004;43:127-132].

Keywords: soil-transmitted helminthiasis, parents'

Soil-transmitted helminthiasis (STH) is a common affliction in the tropics causing serious public health problems in developing countries.¹ According to the World Health Organization, there are 800–1000 million cases of ascariasis, 700–900 million of hook worm infection, and 500 million of trichuriasis.^{1,2} In Indonesia, STH is still an important public health problem and its

prevalence is still high. There are three main soil-transmitted helminths, namely *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms. Surveys in several areas indicated that the prevalence rate of STH is about 40–60%.²⁻⁵ Factors influencing the prevalence rate of STH are hygiene, sanitation, socioeconomic level, knowledge, educational level, and ecosystem differences.^{1,4,5} In North Sumatera in 1995, the prevalence of STH was about 57–90%.¹ In villages, even though the pattern of STH transmission is generally the same, different characteristics of living cause different intensity of helminthiasis transmission. This was proved by the different prevalence between areas.^{1,5} Suka village is located on a mountain area and Pantai Cermin village on a coastal area. The aim of this study was to find factors influencing the transmission of soil-transmitted helminthiasis among primary school children in two different communities.

Methods

A cross sectional study was conducted at two different villages i.e., Suka village and Pantai Cermin village,

From the Department of Child Health, Medical School, University of Sumatera Utara, Adam Malik Hospital, Medan, Indonesia.

Reprint requests to: Isra Firmansyah, MD, Department of Child Health, Medical School, University of Sumatera Utara, Adam Malik Hospital, Medan, Indonesia. Tel/Fax. 62-61-8361721.

North Sumatera province, from March to April 2002. Subjects were primary school students. Based on the sample size formula, 96 students were recruited from each village. Kato Katz and magnesium sulphate centrifuge floatation methods were used for stool and soil examinations.

Parents were interviewed using a questionnaire which comprises the characteristics of the respondents, economic status, parents' education, parents' knowledge, hygiene, and environment. Economic status was classified as pre welfare family, welfare family I, welfare family II, welfare family III, and welfare family III plus, based on the criteria of the National Coordination Board on Family Planning (BKKBN). Parents' knowledge level was classified as good (score 9-12), moderate (score 5-8), and bad (score below 5). Hygiene and environment were classified as good (score 15-21), moderate (score 8-14), and bad (score below

8). Statistical analysis was done by chi-square test using the SPSS program version 11.0.

Results

Subjects were mostly children aged 6 to 9 years, 54% in Suka village and 62% in Pantai Cermin village. Sex distribution in Suka village were 55% boys and 45% girls, while in Pantai Cermin, the distribution was equal. Chi-square test (χ^2) showed that there were no significant differences in age and gender between the two villages ($p < 0.05$).

Table 1 shows the characteristics of parents in the two villages. Most of them were mothers (85% and 90%) who did not finish primary school. Fathers' education in the two villages was comparable. Meanwhile, mothers' education and parents' occupation

TABLE 1. SUBJECTS' CHARACTERISTICS IN SUKA VILLAGE AND PANTAI CERMIN VILLAGE

Characteristics	Suka village		Pantai Cermin village		p
	n (96)	[%]	n (96)	[%]	
Sex					
Male	14	15	10	10	0.383
Female	82	85	86	90	
Father's education					
Primary	44	46	48	50	0.872
Elementary	27	28	22	23	
High school	24	25	25	26	
Academy	-	-	-	-	
University	1	1	1	1	
Mother's education					
Primary	41	43	63	66	0.001*
Elementary	26	27	22	23	
High school	27	28	8	8	
Academy	2	2	1	1	
University	-	-	2	2	
Father's occupation					
Farmer	76	79	20	21	0.001*
Entrepreneur	16	17	44	46	
Employee	3	3	13	13	
Others	1	1	19	20	
Mother's occupation					
Farmer	77	80	19	20	0.000*
Entrepreneur	15	15	42	44	
Employee	3	3	10	10	
Others	1	1	25	26	
Economic status					
Pre Welfare	9	9	32	33	0.000*
Welfare I	24	25	33	34	
Welfare II	37	38	20	21	
Welfare III	26	27	11	11	
Welfare III +	0	0	0	0	
Total	96	100	96	100	

TABLE 2. ASSOCIATION BETWEEN PARENTS' EDUCATION, PARENTS KNOWLEDGE, ECONOMIC STATUS, HYGIENE, ENVIRONMENT AND SOIL-TRANSMITTED HELMINTHIASIS IN SUKA VILLAGE

Variables	STH in Suka Village			p
	Negative n	AL n	AL, TT, HW n [%]	
Father's education				
Primary	20	2	22 39	0.071
Elementary	10	1	16 29	
High School	6	1	17 30	
Academy	0	0	0 0	
University	0	0	1 2	
Mother's education				
Primary	5	2	24 43	0.265
Elementary	15	1	10 18	
High school	6	1	20 36	
Academy	0	0	2 4	
University	0	0	0 0	
Knowledge				
Good	10	0	2 4	0.001*
Moderate	17	1	20 36	
Bad	9	3	34 61	
Economic status.				
Pre Welfare	1	3	5 9	0.001
Welfare I	2	1	21 37	
Welfare II	9	0	28 50	
Welfare III	24	0	2 4	
Welfare III+	0	0	0 0	
Hygiene				
Good	0	0	0 0	0.001*
Moderate	19	0	2 4	
Bad	17	4	54 96	
Environment				
Good	5	0	0 0	0.019*
Moderate	14	1	15 27	
Bad	17	3	41 73	

AL= *Ascaris Lumbricoides*, TT= *Trichuris trichiuria*, HW= hookworm

were significantly different ($p < 0.05$). The economic status of parents in Suka village were mostly of welfare family II and III (38% and 27%), while in Pantai Cermin, most were pre welfare family and welfare family I (33% and 34%), showing a significant difference between the two villages ($p < 0.05$).

From 96 children observed in Suka village, 60 children (62%) were infected by STH, while in Pantai Cermin, there were 51 (53%). Comparison between the two villages showed no significant difference in the percentage of children infected by STH.

Children in the two villages were mostly infected by the combination of *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms, accounted for 93% of children in Suka village and 92% of children in Pantai Cermin. There were 4 children in Suka village and 4 children in Pantai Cermin who were infected by *As-*

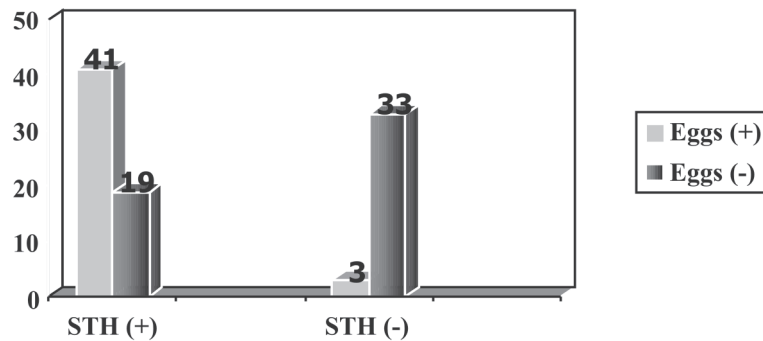
caris lumbricoides only. Statistical analysis showed that there was no significant difference in the type of STH between the two villages ($p > 0.05$).

The relationships between either parents' education, parents' knowledge, economic status, hygiene, or environment and the prevalence of STH in Suka village are shown in **Table 2**. There were significant relationships between either parents' knowledge, economic status, hygiene, or environment and the prevalence of STH in Suka village ($p < 0.05$), but no relation with parents' education ($p > 0.05$). The relationships between either parents' education, parents' knowledge, economic status, hygiene, or environment and the prevalence of STH in Pantai Cermin are presented in **Table 3**, showing no significant relation ($p > 0.05$), except for hygiene and environment ($p < 0.05$).

TABLE 3. ASSOCIATION BETWEEN PARENTS' EDUCATION, PARENTS' KNOWLEDGE, ECONOMIC STATUS, HYGIENE, ENVIRONMENT AND SOIL-TRANSMITTED HELMINTHIASIS IN PANTAI CERMIN VILLAGE

Variables	STH in Pantai Cermin Village				p
	Negative n [%]	AL n	AL, TT, HW n [%]		
Father's education					
Primary	31 69	1	12 25	0.740	
Elementary	6 13	2	14 30		
High School	8 18	1	20 43		
Academy	0 0	0	1 2		
University	0 0	0	0 0		
Mother's education					
Primary	23 51	3	23 49	0.952	
Elementary	16 36	1	15 32		
High School	6 13	0	6 13		
Academy	0 0	0	1 2		
University	0 0	0	2 4		
Knowledge					
Good	8 18	0	2 2	0.956	
Moderate	15 33	2	26 55		
Bad	24 53	2	19 40		
Economic status.					
Pre Welfare	15 33	2	15 32	0.133	
Welfare I	15 33	1	17 36		
Welfare II	8 18	1	11 23		
Welfare III	7 16	0	4 8		
Welfare III+	0 0	0	0 0		
Hygiene					
Good	9 20	0	4 8	0.030*	
Moderate	21 47	1	3 6		
Bad	15 33	3	40 85		
Environment					
Good	23 51	0	3 5	0.012*	
Moderate	12 27	2	24 42		
Bad	10 22	2	30 53		

AL= *Ascaris lumbricoides*, TT= *Trichuris trichiuria*, HW= hookworm

**Figure 1.** Association between soil contamination by worm eggs and STH in Suka village

Soil contamination by worm eggs in Suka village is shown in **Figure 1**. Forty-one (68%) infected children's houses had their backyards contaminated while only 3 non-infected children's houses were contaminated. There was a significant relation between

soil contamination by worm eggs and the prevalence of STH ($p < 0.05$).

Figure 2 shows soil contamination by worm eggs in Pantai Cermin village. There were 36 (71%) infected children's houses contaminated while only 1

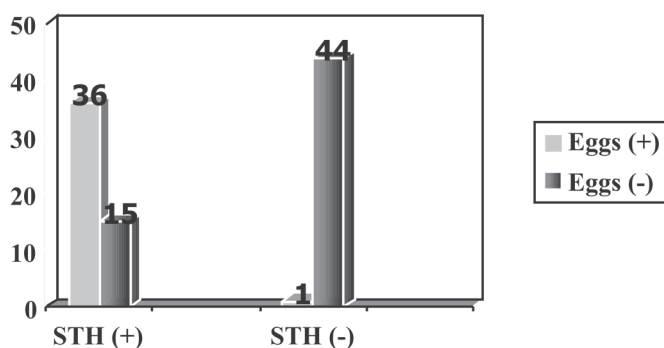


Figure 2. Association between soil contamination by worm eggs and STH in Pantai Cermin village

non-infected child's house was contaminated. Soil contamination by worm eggs was related with the prevalence of STH ($p < 0.05$).

Discussion

The epidemic of STH is influenced by human and soil factors. In Suka and Pantai Cermin village, children were commonly infected by the combination of *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms. We could not find any single infection by *Trichuris trichiura* or hookworms. This was the same with the study of Sayogo *et al* in Tangerang. From 96 children in Suka village, 60 (62%) were infected, while in Pantai Cermin village, from 96 children there were 51 (53%) infected. The results were in accordance with the data of infection rate in Sumatera Utara and the prevalence of STH in Indonesia (50%-90%) which most commonly were mixed infection (55.8%).⁴

Ismid and Margono in their observation on students of Madrasah Ibtidaiyah Al Wathoniyah (an elementary school) in Cilungkup area, East Jakarta, found that 66.6% of children were infected by *Ascaris lumbricoides*, 14.7% by hookworms, and 39.9% by *Trichuris trichiura*. They also found a large prevalence of *Ascaris lumbricoides* infection (95%) in Jembatan Besi, a dirty area with bad sanitation and population around 63,573 person/km².⁵

In our observation, we did not find a significant difference in STH prevalence between Suka village and Pantai Cermin village. Even though the ecosystems of these two villages differed, there were other

factors such as high housing density and the unavailability of family lavatory that made transmission by contaminated soil was easier. Fecal disposal facilities in the two villages were not much different which mostly consisted of rivers and open lavatories. As we know, the use of water closet is the most important factor in preventing worm infection.^{5,6-11}

In this study, we did not find any significant relation between either parents' education or economic status and the prevalence of STH in the two villages. This was the same with Silva's opinion that there is no relation between STH and parents' education or economic status, instead STH is related to hygiene and clean environment.⁸ Kosin and Ismid *et al* said that high worm infection is caused by the attitude of humans who have little attention to environment and hygiene.⁵

The characteristic of soil has big influences on egg growth and worm larva survival.¹² We found that the backyards of children's houses in Suka and Pantai Cermin village were contaminated with *Ascaris lumbricoides* and *Trichuris trichiura* eggs. This matter was also reported by Arrasyid in Samosir island, where over 95% of soil on the island was contaminated by *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms.¹³ In Pantai Cermin Village, there was a possibility that its above-sea location influenced the temperature and soil in a way that they promote the growth of worms. Usually, *Ascaris lumbricoides* and *Trichuris trichiura* live and reproduce in clay, which can easily absorb water, contain little air, and in wet condition, its particles bond to each other. It is easier for worms to live in wet or moist soil and be shielded

from sunray.^{4,13} That might be the reason why the soil in Suka village was contaminated more than that in Pantai Cermin. The Sorensen's observation on children who lived in farm areas in Srilanka, found that there was a difference in STH prevalence between high and low areas.

We could not find any significant relation between parents' education and the prevalence of worm infection. Silva reported that the mother's education had more role than father's education in preventing worm infections.⁸ In Malaysia, the educational level of parents had role in the prevention of worm infection in primary school children.¹⁵ Savioli and Norhayati reported that the high transmission of worm infection from soil to human depended on socioeconomic factors, such as population, bad sanitation, and habits connected to society culture.^{14,15}

We concluded that the prevalence of STH in Suka village and Pantai Cermin village was not significantly different. We also did not find any relation between parents' education and STH in both villages. We found significant relations between either parents' knowledge or socioeconomic status and STH in Suka village, but not in Pantai Cermin. Significant relation was found between hygiene, environment, or soil contamination by worms egg and STH in both villages.

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