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Prevalence and Knowledge of Soil-Transmitted Helminth Infections in Mandailing Natal, North Sumatera, Indonesia

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Abstract

BACKGROUND: Soil-transmitted helminth (STH) infection remains of public health importance, particularly in developing countries. North Sumatra province of Indonesia has reported high prevalences of STH in many of its districts.

AIM: In this study, we aimed to determine the prevalence of STH and evaluated STH knowledge and risk behaviours of school children in Mandailing Natal district.

METHODS: We conducted a cross-sectional study in two primary schools in Mandailing Natal district, North Sumatera province, Indonesia. Data were collected directly from the subjects using a questionnaire after receiving consent from their parents. A stool sample was also collected to determine the STH status of each subject. Samples were then transported to the parasitology laboratory at Universitas Sumatera Utara in Medan to be analysed by a trained analyst. Kato-Katz method was used to prepare the slides (World Health Organization, 2002). The intensity of infection is classified into light, moderate and heavy infection.

RESULTS: Prevalences of STH infections were 76.8% and 87.2% in Singkuand and Sikapas primary schools, respectively. The majority of infections were *Ascaris lumbricoides* and *Trichuris trichiura* at a light intensity. Only small numbers of children in the two schools used soap before eating, used soap after defecating, and wear sandal/shoes when walking outdoor. Less than 50% of children also knew the route of transmission of STH. Poorer knowledge and behaviours were shown in children from Sikapas than in Singkuang.

CONCLUSION: High prevalence and poor hygiene behaviours found in this study reinforce the need to identify the correct intervention to address this STH problem in the region.

Introduction

Soil-transmitted helminth (STH) infections (*Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm) are widespread through tropical and subtropical regions with the highest prevalence in developing countries. According to the WHO, the burden of STH infection worldwide was estimated to be 1.5 billion people in February 2018, or have reached 24% of the world's population with the highest prevalence in sub-Saharan Africa, America, China and East Asia. This infection occurs in more than 267 million people in pre-school children, and more than 568 million in school-aged children [1].

In Indonesia, STH infection is one of the main public health problems with prevalences ranging from 45% to 65%. In areas with poor sanitation, the prevalence can reach as high as 80% [2]. In different districts in North Sumatra province, the prevalence of helminthiasis in suburban and rural areas have been reported from 87% in 2004, 84.6% in 2005, 64.3% in 2012 to 84.66% in 2015 [3], [4], [5], [6], [7], [8], [9]. Helminthiasis affects the nutritional status and cognitive function of the children, and in the long-term may interfere with their growth [10].

Factors associated with a high prevalence of helminthiasis in children including low personal hygiene such as handwashing behaviour before a meal and after going to the bathroom, nail cleanliness, defecation habit, availability of freshwater and soil contamination with helminth eggs. To prevent helminth infection and to reduce the prevalences, public education on family and personal hygiene, as

well as deworming programmes, are important [11].

This study aims to determine the prevalence and primary schoolchildren's knowledge of soil-transmitted helminth infection.

Material and Methods

We conducted a cross-sectional study in two primary schools in Mandailing Natal district, North Sumatera province, Indonesia. The study was done in March 2019. Subjects were children attending two primary schools in the district, namely Singkuang and Sikapas Primary School. Data were collected directly from the subjects using a questionnaire after receiving consent from their parents. The questions comprised of demographic data and knowledge on the potential STH risk factor and STH transmission. Teachers and research assistants assisted children in grade 1 and 2 to fill in the questionnaire. A stool sample was also collected to determine the STH status of each subject. Samples were then transported to the parasitology laboratory at Universitas Sumatera Utara in Medan to be analysed by a trained analyst. Kato-Katz method was used to prepare the slides [12]. The intensity of infection is classified into light, moderate and heavy infection (Table 1).

Table 1: Intensity of STH infection (World Health Organization, 2002)

Classification	*Ascaris lumbricoides*	*Trichuris trichiura*	Hookworm
Light	1-4,999 epg	1-999 epg	1-1,999 epg
Moderate	5,000-49,999 epg	1,000-9,999 epg	2,000-3,999 epg
Heavy	≥ 50,000 epg	≥ 10,000 epg	≥ 4,000 epg

Data were analysed using STATA SC/IC Version 15 (STATA Corporation, TX, USA). Chi-square analysis was used to determine significance. The level of significance was set at $P < 0.05$.

The study was approved by the Ethics Committee of Faculty of Medicine Universitas Sumatera Utara, Indonesia.

Results

During the study period, a total of 426 primary school children completed the questionnaires. Two hundred and twenty-nine (53.8%) were male and 197 (46.2%) were female. Of those, only 54.9% have a private toilet inside their house, while the remaining used the public facility or defecate in the sea. The majority of children (71.3%) also admitted of helminth infection in the past (Table 2).

Table 2: Baseline characteristics

Characteristics	*n*	%
Grade		
1	81	19.0
2	102	23.9
3	81	19.0
4	89	20.9
5	73	17.1
Gender		
Male	229	53.8
Female	197	46.2
Sanitation facility		
Private toilet	234	54.9
Public toilet	41	9.6
Outdoor toilet	93	21.8
Not available	54	12.7
History of helminthiasis	305	71.3

Table 3 shows the hygiene behaviour of children in both schools. The use of soap for handwashing and after defecation was more likely among children in Singkuang primary school ($P < 0.001$), as well as the use of sandals or shoes when walking outdoor ($P = 0.04$). However, the proportion of children who used a toilet for defecating was similar in both schools ($P = 0.98$). During the study, we also inspected the cleanliness of the hand nails. Of 188 children at Singkuang primary school, 116 (61.7%) had dirty hand nails. Similar proportion ($n = 153$, 64.2%) at Sikapas primary school also had dirty nails.

Table 3: Hygiene behaviour among enrolled students

Behaviour	Singkuang ($n = 188$)	Sikapas ($n = 238$)
Use of soap for handwashing	77 (40.9)	40 (16.8)
Use of soap after defecation	63 (33.5)	44 (18.5)
Use of sandals or shoes when walking outside	40 (21.3)	33 (13.9)
Defecating in a toilet	121 (64.4)	169 (71.0)

We further collected data on the children's knowledge on STH transmission (Table 4), and only 4 (2.1%) of children in Singkuang did not know any route of STH transmission, while a more significant number (n = 84, 35.3%) of primary school children in Sikapas did not know about the route of transmission. As the route of transmission of each parasite is different, the most commonly known routes in Singkuang children were via the anus (93.1%) and skin (92.0%), as well as in Sikapas (62.6% and 63.9%).

Table 4: Knowledge of STH transmission

Knowledge on the cause of transmission	Singkuang ($n = 188$)	Sikapas ($n = 238$)
Dirty hand when eating (%)	86 (45.7)	135 (56.7)
Uncooked water (%)	129 (68.6)	133 (55.9)
Uncooked meal (%)	143 (76.1)	147 (61.8)
Via anus (%)	175 (93.1)	149 (62.6)
Via skin (%)	173 (92.0)	152 (63.9)
Via barefoot (%)	98 (52.1)	132 (55.5)

Of all enrolled children, only a third of children ($n = 56$, 29.7%) in Singkuang provided a stool sample for examination. While all children in Sikapas presented their stool. The prevalence of any STH infection (Table 5) were 76.8% and 87.2% for Singkuang and Sikapas, respectively. The most common infections were *A. lumbricoides* and *T. trichiura*. While hookworm infection only occurred in

one child in Singkuang, but more common in Sikapas (19.4%). The majority of infection intensity was light infection for both *A. lumbricoides* and *T. trichiura.* Although in Sikapas, more proportion of children had a moderate infection than in Singkuang ($P > 0.05$). Furthermore, the proportion of mixed infection was significantly more common in children in Sikapas than in Singkuang (72.0% vs 53.5%, $P = 0.01$).

Table 5: Prevalence and intensity of infection

Prevalence	Singkuang (*n* = 56)	Sikapas (*n* = 242)
Ascaris lumbricoide	33 (58.9)	169 (69.8)
Mean intensity	2011.4 (2426.4)	2780.8 (3270.6)
Light intensity	28 (84.9)	129 (76.3)
Moderate intensity	5 (15.2)	40 (23.7)
Trichuris trichiura	32 (57.1)	189 (78.1)
Mean intensity	514.1 (454.9)	633.4 (602.7)
Light intensity	29 (90.6)	144 (76.2)
Moderate intensity	3 (9.4)	45 (23.8)
Hookworm	1 (1.8)	47 (19.4)
Mean intensity	432 (0)	303.6 (191.7)
Light intensity	1 (100)	47 (100)
Any STH infection	43 (76.8)	211 (87.2)
Two mixed infections	23 (41.1)	110 (45.5)
Three mixed infecctions	0 (0)	42 (17.4)

Discussion

This present study reported the prevalence and basic knowledge of STH infection and transmission among school children in Mandailing Natal district, North Sumatra province. Further, we also assessed the hygiene behaviour in those children. Similar to our earlier studies in other districts in North Sumatra province, the prevalence of STH infections remains high [3], [4], [5], [6], [7], [8], [9], [13], despite existing health promotion and education to reduce STH burden.

Therefore, in this study, we complemented our data with the information regarding basic knowledge of STH infection, how they transmit and STH risk behaviours. This is part of a prospective study to evaluate the impact of hygiene education on children's knowledge and habit. In the two primary schools in the studied district, we revealed that the children had poor hygiene behaviour. However, children in Sikapas were less likely to use soap before eating or after defecating, and also less likely to wear sandals/shoes when walking outside to those in Singkuang. This is similar to a previous study [14]. When they were asked of how STH transmit, children in Singkuang also had better knowledge than children in Sikapas. This is by the higher prevalence of STH seen in Sikapas than in Singkuang. Although we did not perform analysis on individual risk, we are unable to determine a definite relationship between the risk behaviour and high prevalence.

This result also strengthens the importance of implementing other strategies to improve children's knowledge which lead to better health hygiene behaviour. The current deworming programme recommended by the government, as also recommended by the WHO [12], has not been successful in reducing the STH infections in this region, although efficacy studies in this province still demonstrated high efficacy of both albendazole and mebendazole for *A. lumbricoides* and *T. trichiura* infections [7], [15], [8], [13]. Therefore, anthelminthic resistance is not yet an issue. However, the routine deworming programme has been shown to have an impact on the infection intensity than in the prevalence which can be used as an indicator of improved health [16].

In this study, we have shown that the majority of children were infected with light intensity for either *A. lumbricoides* or *T. trichiura* infection. A WHO model evaluated the correlation between the species prevalence with the possibility of moderate to heavy infection, where prevalences of 58.9% and 69.8% as determined in this study correlated with a proportion of moderate infection of 17.8% and 29.3%, respectively. While *T. trichiura* prevalences at 57.1% and 78.1% correlated with the proportion of moderate infection at 10.8% and 21.4%, respectively. These estimations are by our results, and supports the continual use of periodic anthelminthic to reduce morbidity especially in individuals with moderate to heavy infections [16].

Our study has several limitations; first not all children returned their stool for STH examinations; therefore, the prevalence reported here may not reflect the true burden of STH in these communities. Second, we also did not correlate the STH results with individual data due to high numbers of missing STH status. Therefore, the association between high prevalence and children's behaviours and knowledge were only made based on assumption.

However, this study added more information on STH burden and risk behaviour in children. These data can be used to assess the changes in their knowledge and habits following our prospective health education intervention study.

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