

Fingernail biting increase the risk of soil transmitted helminth (STH) infection in elementary school children

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Abstrak

Latar belakang: Infeksi cacing usus yang ditularkan melalui tanah (Soil Transmitted Helminth-STH) merupakan infeksi tersering dan terbanyak di antara infeksi-infeksi parasit. Kunci pemberantasan kecacingan adalah memperbaiki higiene perorangan dan sanitasi lingkungan. Tujuan penelitian ini adalah untuk Mengidentifikasi faktor risiko yang meningkatkan infeksi STH pada anak sekolah dasar (SD).

Metode: Penelitian ini menggunakan desain potong lintang dengan sampel purposif. Penelitian ini dilakukan di suatu SD di wilayah kerja Puskesmas di Yogyakarta pada bulan Oktober sampai Desember 2009. Pengumpulan data dilakukan dengan survei tinja dan wawancara. Pemeriksaan tinja menggunakan metode Kato Katz dan wawancara menggunakan kuesioner.

Hasil: Di antara 211 subjek, 52 (24,6%) murid mengidap cacingan dan yang terbanyak adalah *Trichuris trichiura*, sedangkan cacingan *Ascaris lumbricoides*, sedangkan infeksi campuran *Trichuris trichiura* dan Hookworm sangat jarang. Risiko tertinggi (2,8 kali lipat) terjadi di antara murid yang mempunyai kebiasaan menggigit kuku jari dibandingkan dengan yang tidak mempunyai kebiasaan ini [risiko relatif suaian (RRa) = 2,80; 95% interval kepercayaan (CI) = 1,22-4,04]. Subjek yang tidak mencuci tangan sebelum makan atau tidak mencuci tangan dengan sabun setelah buang air besar mempunyai risiko 2,2 kali terhadap terinfeksi cacingan.

Kesimpulan: Kebiasaan menggigit kuku jari, tidak mencuci tangan sebelum makan dan tidak mencuci tangan dengan sabun setelah buang air besar mempertinggi risiko infeksi cacingan. (*Health Science Indones 2011;2:81-6*)

Kata kunci: cacingan, kebiasaan menggigit kuku jari, cuci tangan

Abstract

Background: Intestinal worm infections transmitted through the soil are the most common infection among parasitic infections. The key to worm eradication is to improve personal hygiene and environmental sanitation. This study aimed to identify several risk factors related to occurrence of Soil Transmitted Helminth (STH) infections in elementary school.

Methods: A cross sectional study with purposive sampling method was carried out in a primary school children in a area of a Yogyakarta health Center from October to December 2009. Stool was examined by using the Kato Katz method and pupils were interviewed by questionnaires.

Results: Two hundred and eleven subjects participated in this study, and 52 subjects (24.6%) had STH infection. The most frequent STH infection was *Trichuris trichiura*, and the least was mixed infection (*Ascaris lumbricoides*, *Trichuris trichiura* and Hookworm). The highest risk (2.8-fold) occurred among those with a habit of fingernail biting compared to those who did not bite fingernails [adjusted relative risk (RRa) = 2.80; 95% confidence interval (CI) = 1.22-4.04]. No hand washing before meals as well as no hand washing with soap after passing stool also increased the risk of STH infection by 2.2-fold.

Conclusion: Fingernail biting and no hand washing before meals as well as no hand washing with soap after passing stool increased the risk of STH infections. (*Health Science Indones 2011;2:81-6*)

Key words: soil transmitted helminth, fingernail biting, hand-washing

Soil Transmitted Helminth (STH) infections are the most common among parasitic infections. These intestinal worms, such as roundworms (*Ascaris lumbricoides*), whip worms (*Trichuris trichiura*), and hookworms (*Necator americanus*), usually infect children. They are transmitted through the soil and into the human body and more than one billion people worldwide suffer from worm infestation.¹

In Indonesia, the number of STH cases, especially in children, is also quite high, although it is not considered a serious public health problem yet. Even though STH does not cause death, but the impact is very severe, since it can affect the intelligence and mental development of children. This is especially true during the growth and development of the children. Therefore worm infestations still pose a threat to the future of the children, even though it has been largely ignored by the community. A report from one district in the province of Yogyakarta found the prevalence of worm infection in 2008 to be 9.8%, while in an area served by another health center, the prevalence was 7.8%.²

Several risk factors suspected to be related to the high incidence of STH are, among others, inadequate sanitation, poor personal hygiene, low level of education and poor socio-economic level, poor knowledge, attitude, and health behavior, and also geographic conditions suitable for breeding of the worms.³

The purpose of this study was to identify the association of personal hygiene and the other factors to STH infections in elementary school children in the area of a primary health center in Yogyakarta.

METHODS

A cross sectional study with purposive sampling method was carried out in a primary school. The primary school was located in the area of *Kulonprogo* in Yogyakarta health center. The subjects were first grade primary school children. The number of primary schools in the Kokap I health center area is 25, consisting of 15 state primary schools (SDN) and 10 private primary schools. The study lasted 3 months from October to December 2009. All the children were asked for fecal samples and then interviewed.

The fecal samples were collected in cooperation with the classroom teachers. The teachers instructed the children to collect their stool in a pot that has been

provided. The children were asked to pass stool in the morning before going to school, promptly collected the stool sample and come to the school as soon as possible.

The stool collected was examined by Kato-Katz method. A sample the size of a green bean was taken with a stick and placed on waxed paper (which is water impermeable) and filtered through a fine steel mesh (screen ware) approximately 3x4 cm. Stool that had been filtered was taken with a stick and then pressed with perforated cardboard (Kato cardboard) on a coded slide. The stool sample was then covered with cellophane tape (22 x 30 mm) which had been soaked in a solution of green Gliserynmalachiet for 24 hours. The stool preparation was thinned and flattened out. Excess fluid on the edges of the cellophane tape was drained by placing the preparations upside down on tissue paper.⁴

The preparations were labeled (name of student, school, and date of execution) and then examined under a compound microscope.

Data of personal hygiene and sanitation were obtained through questionnaires filled out by the respondents.

There were eight aspects for personal hygiene. These were hand washing before meals, using the toilet, hand washing with soap after passing stool, trimming fingernails, fingernail biting, using sandals/shoes, bathing twice a day with soap, and using clean water for bathing & drinking.⁵ There were ten aspects for sanitation of home environment clean water, toilet, soap, distance of toilet to water source/well, water storage, types of flooring, yard, wastebasket, drinking water, and kitchen.⁶

Cox regression analysis with constant time using STATA 9.0 software was done to determine the risk factors for STH infections. A risk factor was considered to be a potential confounder if the univariate test it had a *P*-value of <0.25 , and considered as a candidate for multivariate model along with all known risk factors for STH infections. Ninety-five percent confidence intervals were based on the standard error of coefficient estimates. Relative risks (RR) were estimated by the maximum likelihood.

This survey was conducted with approval by the Ethics Committee of Medicine and Health Research, Faculty of Medicine, Universitas Gadjah Mada, Yogyakarta.

RESULTS

A number of 211 subjects participated in this study, and 52 subjects (24.6%) had STH infection. The STH infections were not only single infection (one type of worm

only) but also mixed type infections with 2 or 3 types of worms. Table 1 showed that the STH infection with the highest frequency was single infection of *Trichuris trichiura* and the lowest frequency was mixed infection of *Ascaris lumbricoides*, *Trichuris trichiura*, and Hookworm.

Table 1. Results of stool examination for Soil Transmitted Helminths infection

Species of worms	Frequency	Percentage (%)
<i>Ascaris lumbricoides</i>	8	15.4
<i>Trichuris trichiura</i>	25	48.1
<i>A. lumbricoides</i> & <i>T. trichiura</i>	15	28.8
<i>T. trichiura</i> & Hookworm	3	5.8
<i>A. lumbricoides</i> , <i>T. trichiura</i> & Hookworm	1	1.9
Total	52	100.0

Table 2 showed that subjects with positive and negative STH infections were similarly distributed with respect to trimming of fingernails, using clean water for bathing & drinking, and using soap for bathing. On the other hand, subjects who did not wear sandals or shoes, or did not use the toilet were more likely to have STH infection compared to the reference group.

Table 3 revealed four dominant risk factors that increased the risk STH infections. Those with a habit of biting their fingernails had the highest risk (2.8-fold) of STH infections compared to those who did not. No hand washing before meals as well as no hand washing with soap after defecation also increased the risk for STH infection. Those who did not wash their hands before meals had a 2.2-fold increased risk for STH infections. The same increased risk for STH infection (2.2-fold) was found among those who did not wash their hand with soap after defecation.

Table 2. Several personal hygiene characteristics and the risk of Soil Transmitted Helminth infections

	STH infection				Crude Relative Risk	95% Confidence Interval	P
	Negative (n=149)		Positive (n=52)				
	n	%	n	%			
Trimming fingernails							
Yes	92	73.6	33	26.4	1.00	Reference	0.850
No	57	75.0	19	25.0	0.95	0.54-1.66	
Using clean water for bathing & drinking							
Yes	142	74.7	48	25.3	1.00	Reference	0.484
No	7	63.6	4	36.4	1.44	0.52-3.99	
Using soap for bathing							
Yes	141	74.2	49	25.8	1.00	Reference	0.925
No	8	72.7	3	27.3	1.06	0.33-3.39	
Using toilet							
Yes	142	75.9	45	24.1	1.00	Reference	0.072
No	7	50.0	7	50.0	2.08	0.94-4.60	
Using sandals/shoes							
Yes	139	76.8	42	23.2	1.00	Reference	0.029
No	10	50.0	10	50.0	2.15	1.08-4.29	

Table 3. Fingernails biting and several personal hygiene and risk of Soil Transmitted Helminth infections

	STH infection				Adjusted Relative Risk	95% Confidence Interval	P
	Negative (n=149)		Positive (n=52)				
	n		n				
Fingernails biting							
Yes	140	76.9	42	23.1	1.00	Reference	0.019
No	9	47.4	10	52.6	2.80	1.14-4.55	
Hand washing before meals							
Yes	93	88.6	12	11.4	1.00	Reference	0.009
No	56	58.3	40	41.7	2.23	1.22-4.04	
Hand washing with soap after defecation							
Yes	98	88.3	13	11.7	1.00	Reference	0.009
No	51	56.7	39	43.3	2.16	1.21-3.85	
House sanitation							
Good	123	81.5	28	18.5	1.00	Reference	0.000
	26	52.0	24	48.0			

DISCUSSION

Soil Transmitted Helminth infection is a disease typical of tropical and sub-tropical regions, especially in rural areas, urban slums and densely populated areas. Although all ages can be infected with worms, the highest prevalence can be found in children. STH infections in children can be only a single infection (one type of worm only) or they can be mixed infections involving 2 or 3 types of worms. Mixed infections usually indicate recurrent infections in these children.

The results showed that poor house sanitation was a risk factor for STH infections. This result was similar to a study in the *Karanganyar* district.³ The high prevalence of STH was probably due to geographic and environmental sanitation of the area which were favorable for the proliferation of the worms. The poor environmental sanitation surrounding the houses made it possible for the occurrence of continuous reinfection, since *Ascaris lumbricoides* can be present up to more than 1 year, whereas *Trichuris trichiura* and Hookworms for 5-10 years. This condition will produce an accumulation of larvae in the body.⁷

Reinfection of *Ascaris lumbricoides* and *Trichuris trichiura* in humans (self reinfection) are possible through food contaminated by infective eggs. These ingested eggs will hatch in the duodenum where the

larvae will stick to the intestinal villi and move to the proximal colon or eventually to the entire colon. Adult worms will burrow into the anterior part of the intestinal mucosa and begin to produce eggs. The eggs will exit the body along with the feces. Outside the body the eggs will mature and ready to reinfect again for the same person or another person (another host). Reinfection of Hookworms in humans is through penetration of the skin. After entering through the skin, the larvae will be taken by venous blood flow to the lungs. The larvae will then enter the alveoli, trachea, and pharynx to be swallowed and passed to the small intestines. The worms then produce eggs which will pass to the outside world along with feces to reinfect the person or other persons.⁸

Poor personal hygiene was also found to be a risk factor for STH infections in primary school children in Kokap I health center, *Kulon Progo*, Yogyakarta. This result was similar to a study in Malaysia that showed hygiene as a risk factor for the occurrence of Soil Transmitted Helminths.⁹ Poor personal hygiene will facilitate the occurrence of STH infections by continuous reinfection. The occurrence of reinfection in children often resulted from direct contact with soil containing infective eggs. In a village reinfection of *ascariasis* in children under 10 years was found to be lower than in children the age of 10 years and over.

This was probably caused by the spread of infection elsewhere outside the village Sentanan.¹⁰

Humans are infected with *Ascaris lumbricoides* and *Trichuris trichiura* through swallowing mature eggs from contaminated soil, whereas infection by hookworm larvae are through penetration of the filariform in the soil into the skin.⁷ This was supported by the poor environmental sanitation of the houses state where most of the houses have floors of beaten earth which facilitated the occurrence of STH infections. The transmission of *Ascaris lumbricoides*, both new infection and reinfection, after treatment was slow. This was probably the result of the dry sandy soil conditions which was unfavorable for the growth of *Ascaris* eggs.¹⁰ The results of this study differed from the results of a study conducted in *Mataram*, which showed that there was no significant correlation between personal hygiene and the prevalence of worm infections, and substantial infection of *A. lumbricoides* and hookworms in elementary school students.

Since poor personal hygiene is one of the factors that play a role in the STH infections, poor people with unsanitary behavior have a greater possibility to be infected by all types of worms.¹¹ This proved that the occurrence of STH infections is determined by man himself.

One aspect of personal hygiene which has a greater influence on STH infections was hand washing before meals. This finding was similar to other studies.¹² Hand washing before meals using soap and water played an important role in the prevention of STH infections, because washing with soap can mechanically remove dirt along with parasites from the hands.¹³

In children, frequent infections directly via hands contaminated by soil containing infective eggs, the children most frequently diseased worms because usually their fingers inserted into the mouth or eating rice without washing hands, but the occasional person stomach also contained adult worms, worms are commonly encountered roundworms, hookworms, thread worms, tapeworms and pinworms. This is consistent with the theory that humans infected with *Ascaris lumbricoides* and *Trichuris trichiura* by swallowing infective eggs contaminate food, drinks and cutlery.¹⁴

In this study fingernails biting was found to increase risk factor for STH infection. This result was similar to a study in Southern Nigeria, licking/biting of fingers

were significantly higher risk for *A. lumbricoides* and *T. trichiura* infection.¹⁵ Fingernails biting behavior is bad behavior and have a significant association of STH infection.⁵

Fingernail which dirty and infected the soil is containing infective eggs are medium in STH infection transmission. Fingernails are usually to be the place of transmission of worm eggs from soil into the body. Fingernails always be cut in two days and short to avoid the transmission of worms from hand to mouth.¹⁴

STH transmission them through dirty hands, fingernails tucked worm eggs are likely to be swallowed when eating, this is compounded if they are not accustomed to hand washing before meal using soap.¹⁶

In conclusion, fingernails biting and no hand washing before meals, as well as no hand washing with soap after passing stool increased the risk of STH infection.

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