

Risk factors of soil transmitted helminth infection among primary school students

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Abstrak

Latar belakang: Infeksi kronis dari soil transmitted helminth (STH) dapat menyebabkan gangguan gizi, pertumbuhan dan kognitif pada anak. Untuk mengurangi dampak infeksi STH, diperlukan identifikasi faktor risiko. Penelitian ini bertujuan untuk mengidentifikasi faktor risiko yang berhubungan dengan infeksi STH pada siswa sekolah dasar di Desa Seraya Timur, Karangasem, Bali.

Metode: Penelitian ini menggunakan desain potong lintang dengan mengambil total sampel. Penelitian dilaksanakan pada bulan Januari 2020. Data primer mengenai faktor-faktor risiko infeksi STH dikumpulkan dengan menggunakan kuesioner. Diagnosis infeksi STH dilakukan dengan pemeriksaan tinja dengan metode Kato-Katz. Analisis data menggunakan uji chi-square untuk menentukan faktor risiko yang berhubungan dengan infeksi STH.

Hasil: Sebanyak 83 siswa yang berusia 6-12 tahun berpartisipasi dalam penelitian ini. Terdapat 9 siswa (10.84%) yang terinfeksi STH dengan intensitas infeksi ringan. Sebanyak 55.56% terinfeksi *Trichuris trichiura*, 33.33% terinfeksi *Ascaris lumbricoides* dan 11.11% terinfeksi cacing tambang. Terdapat beberapa faktor risiko yang memiliki hubungan bermakna dengan infeksi STH diantaranya adalah sering bermain tanah (OR=6.86; 95%CI 1.326-35.494), bermain tanpa alas kaki (OR=10.5; 95%CI 1.249-88.278) tidak mencuci tangan setelah bermain tanah (OR=9.450; 95%CI 1.809-49.358) dan tidak memotong kuku secara rutin (OR=6.462; 95%CI 1.250-33.388). Pemberian obat cacing setiap enam bulan mampu memberikan efek proteksi terhadap infeksi STH (OR=0.085; 95%CI 0.016-0.449).

Kesimpulan: Kebersihan diri menjadi faktor risiko yang berhubungan dengan infeksi STH. Direkomendasikan untuk meningkatkan promosi kesehatan terkait kebersihan diri disamping pemberian obat cacing setiap enam bulan. (*Health Science Journal of Indonesia 2020;11(2):126-32*)

Kata kunci: Faktor risiko, infeksi STH, anak sekolah dasar

Abstract

Background: Chronic soil transmitted helminth (STH) infection might cause nutritional, growth and cognitive impairment in children. Identifying the risk factors of STH infection is crucially needed to minimize the infection effects. This study aimed to identify risk factors associated with STH infections among primary school students in Seraya Timur Village, Karangasem, Bali.

Methods: This study used a cross-sectional design with a total sampling method. The study was conducted in January 2020. Risk factors data were collected using a questionnaire. The diagnosis of STH infection was done by stool examination with the Kato-Katz method. The chi-square test was used to determine the risk factors associated with STH infection.

Results: 83 students with ages ranging from 6-12 years participated in this study. There were 9 students (10.84%) whose infected with mild infection of STH. 55.56% of students were infected by *Trichuris trichiura*, 33.33% were *Ascaris lumbricoides* infections and 11.11% were hookworm infections. There were several risk factors that significantly associated with STH infection including ground's playing (OR=6.86; 95%CI 1.326-35.494), barefoot (OR=10.5; 95%CI 1.249-88.278), did not wash hands after playing soil (OR=9.450; 95%CI 1.809-49.358) and did not routinely cut their nails (OR=6.462; 95%CI 1.250-33.388). Deworming every six months could provide a protective effect against STH infection (OR=0.085; 95%CI 0.016-0.449).

Conclusion: Personal hygiene is a risk factor associated with STH infection. It is recommended to increase personal hygiene promotion besides dewormed every six months. (*Health Science Journal of Indonesia 2020;11(2):126-32*)

Keywords: Risk factors, STH infection, primary school students

Soil transmitted helminth (STH) infection is an infectious disease caused by worms that require soil as a medium to develop. This infection is associated with poor communities with poor environmental hygiene. The transmission of infection can happen through eggs or larvae that contaminate the soil in poor sanitation areas. Some types of STH that are often found to infect humans include whipworms (*Trichuris trichiura*), roundworms (*Ascaris lumbricoides*), and hookworms (*Necator americanus*, *Ancylostoma duodenale*).¹ STH infections are classified as neglected diseases. This disease is chronic and often without typical clinical symptoms. However, STH infections in children might cause impaired nutrient absorption and growth disorders which have an impact on decreased cognitive development.²

The prevalence of STH infections in Indonesia is still quite high. The Ministry of Health Republic of Indonesia data showed STH infection rates range from 2.5% to 62% in the poor population and poor sanitation.³ STH infections are associated with careless defecation habits, eating or playing with the ground, not washing hands and playing barefoot. Most of those habits are often found in children and make them a vulnerable group. The prevalence of STH infection among school age students in Indonesia between 2002 and 2009 was 31.8%.⁴ Hotez et al also reported that in 2012 there were 16.9 million pre-school age children and 43.5 million school age children infected by STH in Indonesia.⁵ The World Health Organization (WHO) estimated that there were 576 million children worldwide need to be prevented with the total coverage would be 75% in 2018.⁶

In controlling STH infections, WHO recommends doing intervention using Albendazole or Mebendazole tablet once a year to children who live in areas with STH infections rates range from 20%-50% and twice a year in the areas with STH infections rates more than 50%.⁶ The Minister of Health Regulation number 15 year 2017 stated, the intervention of STH infection control are dewormed, health promotion, risk factor control and helminthiasis surveillance accordingly with WHO recommendation. In addition, the target of national STH infection prevalence is below 10% in the year 2017. Program evaluation is needed by doing surveillance and identification of STH risk factors to optimize the control of STH infections.³

The prevalence of STH infection in rural areas in Bali Province is still quite high. Based on several studies between 2017 and 2019 showed that the prevalence

of STH infection among primary school-aged children was around 10.1%-31.7% in three villages in the District of Karangasem.⁷⁻⁹ Those numbers were quite higher than the national target of STH infection prevalence that was set by the Ministry of Health Republic of Indonesia (below 10%). The Seraya Timur Village is one of the villages in the District of Karangasem. The socio-geographical conditions are not much different from other villages in the District of Karangasem, which might also cause the high prevalence of STH infection in Seraya Timur Village. So, identifying the risk factors of STH infections is still needed.

This study aimed to identify risk factors associated with STH infections among primary school students in Seraya Timur Village, District of Karangasem, Bali Province.

METHODS

This research was an observational analytic study with cross sectional design. Sampling was using a total sampling method conducted at the Primary school of SDN 4 Seraya Timur Village, District of Karangasem, Bali Province in January 2020. This research evaluated the risk factors of STH infection as the independent variables by fulfilled the validated questionnaire include gender, frequently playing on soil, hand washing habit, barefoot habit, cut their nails routinely, have a proper toilet at their home, eating while playing on soil habit, nail-biting habit, anthelmintic tablet consumption every six months. The dependent variable was the infection status of STH which was determined by the stool examination.

Before collecting faecal samples, all parents of 1st to 6th grade students were given informed consent of research and signed it as approval to permit their children to participate in this research. All students whose informed consent has been approved by the parent are participating in this study.

The data collection was conducted through stool taken. All students were given 30 mL of faecal containers and a small stick to collect the feces that had been labeled with the student's identity. Stool sampling was taken in the morning before going to school. Stool examination conducted in the Laboratory of Parasitology, Faculty of Medicine, Udayana University used the Kato-Katz method to determine the status and intensity of STH infections. The infection status is defined positive if there are eggs or larvae found in microscopic examination. The intensity of infection is based on the number of worm

eggs per gram of feces (epg). The intensity category of *Trichuris trichiura* infection is mild (1-999 epg), moderate (1.000-9.999 epg) and severe (≥ 10.000 epg). Category of hookworm infection is mild (1-1.999 epg), moderate (2.000-3.999 epg) and severe (≥ 4.000 epg). Category of *Ascaris lumbricoides* infection is mild (1-4.999 epg), moderate (5000-49.999 epg) and severe (≥ 50.000 epg).¹⁰

The collected data then analyzed using SPSS v.23 Software with Chi-Square Test, Odd Ratio (OR) and 95% Confidence Interval (CI) to determine risk factors that were significantly associated with STH infection. The results were considered to be statistically significant for the p-values of < 0.05 .

This research has approved by the Research Ethics Commission of the Faculty of Medicine, Udayana

University/RSUP Sanglah Denpasar with registration number is 29931/UN14.2.2.VII.14/LP/2019.

RESULTS

There were 83 students who participated in this study with a range of ages are 6-12 years. Based on data in table 1, there were 43 (51.8%) male and 40 (48.2%) female students. Stool examination results are depicted in figure 1. There were 9 (10.84%) students infected with STH. The proportion of STH infections was found higher in females (15%) than in male students (7%). Students of 5th grade had the highest proportion of STH infections (55.56%).

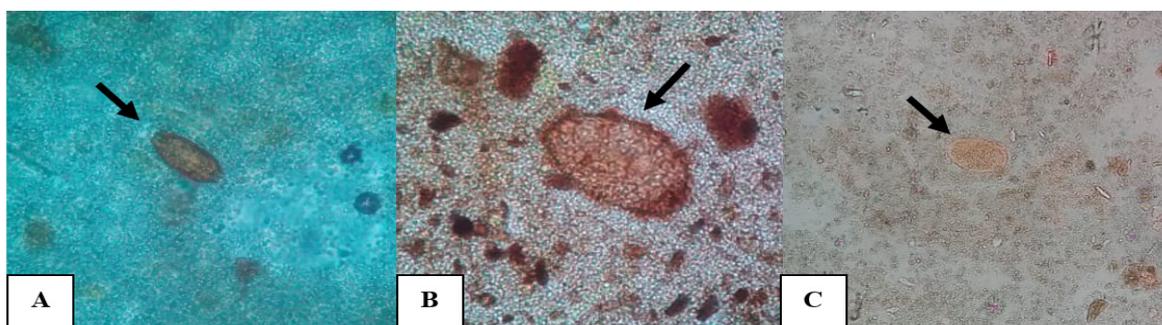


Figure 1. Stool examination results using The Kato-Katz Method (400X Magnification). (A) An egg of *Trichuris trichiura*. (B) An egg of *Ascaris lumbricoides*. (C) An egg of Hookworm.

Table 1. Characteristics of subjects

| Characteristics | STH Infection (n=83) | | |
|---------------------------------------|----------------------|-----------------|--------------|
| | Positive (n=9) | Negative (n=74) | Total (n=83) |
| Median age (min-max), years | 10 (6-11) | 10 (6-12) | 10 (6-12) |
| Gender, n (%) | | | |
| Male | 3 (7) | 40 (93) | 43 (100) |
| Female | 6 (15) | 34 (85) | 40 (100) |
| Grade, n (%) | | | |
| 1 st grade | 1 (16.7) | 5 (83.3) | 6 (100) |
| 2 nd grade | 0 (0) | 4 (100) | 4 (100) |
| 3 rd grade | 1 (25) | 3 (75) | 4 (100) |
| 4 th grade | 1 (4.8) | 20 (95.2) | 21 (100) |
| 5 th grade | 5 (23.8) | 16 (76.2) | 21 (100) |
| 6 th grade | 1 (3.7) | 26 (96.3) | 27 (100) |
| STH infection types, n (%) | | | |
| <i>Trichuris trichiura</i> only | 5 (55.56) | - | 5 (55.56) |
| <i>Ascaris lumbricoides</i> only | 3 (33.33) | - | 3 (33.33) |
| Hookworm only | 1 (11.11) | - | 1 (11.11) |
| STH infection intensity, n (%) | | | |
| Mild | 9 (100) | - | (100) |
| Moderate | - | - | - |
| Severe | - | - | - |

All of STH infection cases in this study were single infection with mild intensity. This study also found that the infection of *Trichuris trichiura* as the major type of STH infection with a proportion of 55.56%. Based on the data in table 2, playing

ground, did not wash hands after playing with the ground, playing barefoot, did not cut nails, and did not take anthelmintic medication every 6 months have become the risk factors of STH infections with playing barefoot as the major risk factor.

Table 2. Risk factors for STH infection

| Variables | Infection status | | p | OR | 95% CI |
|--|------------------|----------------|--------|-------|--------------|
| | Positive n (%) | Negative n (%) | | | |
| Gender | | | | | |
| Male | 3 (7) | 40 (93) | 0.302 | 0.425 | 0.099-1.829 |
| Female | 6 (15) | 34 (85) | | | |
| Frequently playing with or on soil | | | | | |
| Yes | 7 (21.9) | 25 (78.1) | 0.024* | 6.860 | 1.326-35.494 |
| No | 2 (3.9) | 49 (96.1) | | | |
| Unwashed hands after defecation | | | | | |
| Yes | 1 (14.3) | 6 (85.7) | 0.567 | 1.417 | 0.151-13.310 |
| No | 8 (10.5) | 68 (89.5) | | | |
| Unwashed hands after playing with or on soil | | | | | |
| Yes | 7 (25.9) | 20 (74.1) | 0.005* | 9.450 | 1.809-49.358 |
| No | 2 (3.6) | 54 (96.4) | | | |
| Playing barefoot | | | | | |
| Yes | 8 (20) | 32 (80) | 0.013* | 10.5 | 1.249-88.278 |
| No | 1 (2.3) | 42 (97.7) | | | |
| Uncut nails regularly | | | | | |
| Yes | 7 (21.2) | 26 (78.8) | 0.026* | 6.462 | 1.250-33.388 |
| No | 2 (4) | 48 (96) | | | |
| Unavailable of proper toilet at home | | | | | |
| Yes | 4 (19) | 17 (81) | 0.221 | 2.682 | 0.647-11.119 |
| No | 5 (8.1) | 57 (91.9) | | | |
| Eating while playing with soil or objects covered with soil particles | | | | | |
| Yes | 3 (13) | 20 (87) | 0.703 | 1.350 | 0.308-5.918 |
| No | 6 (10) | 54 (90) | | | |
| Nail-biting behavior | | | | | |
| Yes | 2 (15.4) | 11 (84.6) | 0.627 | 1.636 | 0.300-8.930 |
| No | 7 (10) | 63 (90) | | | |
| Anti-helminthic tablet consumption every six months | | | | | |
| Yes | 2 (3.4) | 57 (96.6) | 0.002* | 0.085 | 0.016-0.449 |
| No | 7 (29.2) | 17 (70.8) | | | |

Note: *p<0.05

DISCUSSIONS

STH infection is a disease that is easily found in tropical and sub-tropical regions. Climate can affect soil conditions as a growing medium for STH. All people of all ages are at risk of becoming infected with this disease, but the highest prevalence is found in children. Epidemiologically, the peak occurrence of STH infection at the age of 5-10 years. This is closely related between age and the process of

receiving information. The young children (<10 years old) usually do not care about personal hygiene and lack of knowledge to understand the effects of infection. In addition, young children also tend to be more active playing that allows contact with soil that has been contaminated with STH as a medium of transmission. The increasing age can change children's activity pattern and personal hygiene awareness which might decrease the

infection rates in older age children.^{11,12} The results of this study indicate that the prevalence of STH infections is 10.84% with the highest proportion is a *Trichuris trichiura*. This result is accordingly but lower than the study conducted by Sofiana et al who also found *Trichuris trichiura* as the major type of STH infection with a proportion of 24.6%.¹³ Other research in Karangasem region, Bali showed a varied prevalence of STH infection, namely a study in Gegelang Village found a prevalence of 31.7%, study in Antiga Kelod Village reported a prevalence of 24.8%, while research in Ngis Village depicted the prevalence of 10.1%.⁷⁻⁹

The results of this study indicated that there was a significant relationship between frequently playing on soil with STH infection. Similar results were also found in Dewi's study which showed that STH infections were more common in children who were frequently had contact with soil compare to those who were rarely had contact with soil (OR 6.3).¹ Annida et al reported the majority of children in Dayak Meratus community (80.4%) had the habit of playing in the yard and used soil as the game media were associated with hookworm infections.¹¹ Samad's research also found that 52.5% of the soil contaminated with *Ascaris lumbricoides* eggs in Tembung, Medan was associated with the incidence of STH infections among elementary school students.¹⁴ The STH transmission is easier found among the children who often play or have contact with the ground. The moist soils allow the eggs of *Trichuris trichiura* and *Ascaris lumbricoides* to multiply rapidly. The loose sandy soils in rural areas are well-suited for the growth of hookworm larvae. The transmission can occur due to ingestion of embryonated eggs through contaminated hands, food or drinks, or directly through dust, soil, pets or toy items.¹⁵

Personal hygiene is a person's effort to maintain the degree of health that can be done by maintaining the cleanliness of the skin, hands, feet, nails, oral cavity and other body organs. Washing hands is one of the important points to do with. Hands to be washed with soap in every dirtiness, for example after holding money or animals, before and after eating, after defecation, after playing, especially after playing with the ground. Hands can be a proper transmission medium for STH infection via oral transmission if the hands are contaminated with STH.¹⁶ This study showed that did not wash hands after playing with the ground was one of the risk factors associated with STH infection. This result is supported by the

study of Sofiana et al which showed that children who did not wash their hands had a risk of being infected with STH 2.23 times higher than children who washed their hands.¹³ Sandy et al also reported that children who had bad hands washing habits (using water only) had 3.03 times higher risk to be infected by STH than those who had good hands washing habits (using water and soap).¹⁷

Transmission of STH infections can pass through the skin pores of the feet. Filiform larvae of hookworm can penetrate the skin and enter the blood capillaries and be carried to the heart and lungs until they develop in the small intestine. Hookworms attack all ages with the largest proportion of children due to children's activities which are relatively more unhygienic than adults. One of the STH risk factors is playing barefoot.¹⁶ This study showed that children who were playing barefoot are at risk to develop STH infection 10.5 times higher than children who did not play barefoot. This result is supported by Suryantari's research which showed that elementary school-age children who playing in barefoot tend to have a higher STH infection than those who used footwear while playing (OR 6.5).⁹ Fitri et al also found that students who rarely using footwear when doing their activities had 5.5 times higher to be infected STH than those who always using footwear.¹⁸

Nails can be a medium for the transmission of STH infections. Soil contaminated with STH eggs can be tucked into long nails. Children often unconsciously bite their nails or touch food without washing their hands first which allows the transmission of STH eggs into their mouth. Nail hygiene is also a risk factor for STH infections in children.¹⁹ This study found that children who did not cut their nails routinely had the risk of developing STH infection 6.4 times higher than their counterparts. This result is in line with the study of Wiryadana et al who found that children who did not cut their nails once a week were at risk of developing STH infection 3.3 times higher than children who cut their nails routinely.⁷ Halleyantoro et al also reported that primary school students who had dirty nails tend to have higher STH infection than those who had clean nails (OR 5.3).²⁰

Broad-spectrum worm medicine such as Albendazole and Mebendazole can kill STH in an infected person and be able to prevent transmission to others. The results of this study indicated that the implementation of the deworming program every six months could have a protective effect on primary school students from STH infection (OR 0.02). In line with this

result, Kartini reported that students who did not take anthelmintic tablet every six months had 11 times higher risk to be infected by STH than those who took it.²¹ Suryantari's research also showed that the deworming program was able to prevent STH infections in elementary school children (OR 0.23).⁹ Thus, the deworming program for primary school students is expected to be a proper type of intervention to prevent STH infections in elementary school children.

In conclusion, habits of playing in the ground, playing barefoot, not washing hands after playing with the ground and not cutting nails regularly are risk factors for STH infection. It is recommended to increase personal hygiene and health promotion in addition to the deworming program every six months.

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