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Research Report

PREVALENCE, INTENSITY AND RISK FACTORS OF SOIL TRANSMITTED HELMINTHS INFECTIONS AMONG ELEMENTARY SCHOOL STUDENTS IN NGIS VILLAGE, KARANGASEM DISTRICT, BALI

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ABSTRACT

*Soil Transmitted Helminths (STH) infection is one of health issues in Indonesia based on social and environment problems. It is classified as neglected disease. The Indonesian government already has STH eradication program, but it is not supported by evaluation and monitoring program. The purpose of this study is to determine the prevalence and relation of each risk factors related to STH infections in elementary school in Ngis village, Karangasem regency, Bali. The study was done by analytical description using cross sectional study. Samples were selected from population based on inclusion and exclusion criteria. Primary data about suspected risk factors were collected using questionnaire. Diagnosis was established using Kato-Katz modification method. Data were analyzed using chi-square with confidence interval 95% or p value ≤ 0.05 categorized as significant. 138 students was enrolled in this study, the median age is 9 (6-13) years. The prevalence of STH infections is 10.1% with 78.6% is single infection of *Trichuris trichiura* and 21.4% mixed infections. The proportion of STH infections in males (64,3%) is higher than female (35,7%) but it is statistically non significantly different. STH infections have significant relationship with some risk factors such as unwashed hand after defecation, unwashed hand after playing with soil, barefoot, uncut nails and dewormed. The highest risk factor of STH infections in Ngis village is not having available and proper latrine. (OR=33.9; 95%CI=5.749-199.769). The prevalence of STH infection is quite high with mild to moderate intensity and risk factors namely low hygiene and limited latrines. The implementation of monitoring and evaluation can be an effort to control risk factors and stop the STH transmission chain.*

Keywords: Elementary School, Intensity, Kato-Katz Modification, Risk Factors, Soil Transmitted Helminths (STH).

ABSTRAK

*Soil Transmitted Helminths (STH) adalah salah satu masalah kesehatan di Indonesia berdasarkan aspek sosial dan lingkungan yang digolongkan sebagai penyakit terabaikan (neglected disease). Pemerintah saat ini telah melaksanakan program eradikasi, namun tidak didukung dengan tahap evaluasi dan monitoring (monev). Penelitian ini bertujuan untuk menentukan prevalensi dan hubungan antara faktor risiko dengan kejadian infeksi STH pada siswa sekolah dasar di Desa Ngis, Karangasem, Bali. Penelitian ini dilakukan dengan metode deskriptif analitik menggunakan studi cross-sectional. Sampel dipilih dari populasi berdasarkan kriteria inklusi dan eksklusi. Data primer mengenai faktor-faktor risiko yang dicurigai dikumpulkan dengan menggunakan kuesioner tervalidasi. Diagnosis ditegakkan menggunakan metode Kato-Katz modifikasi. Analisis data menggunakan chi-square dengan tingkat kepercayaan 95% atau dikategorikan sebagai signifikan apabila nilai $p \leq 0,05$. Sebanyak 138 siswa berpartisipasi dengan median usia 9 (6-13) tahun. Prevalensi kejadian infeksi STH yakni 10,1%, dengan 78,6% infeksi *Trichuris trichiura* dan 21,4% infeksi campuran. Infeksi STH dominan terjadi pada laki-laki (64,3%) daripada perempuan (35,7%) tetapi secara statistik tidak bermakna. Kejadian infeksi STH memiliki hubungan yang signifikan dengan faktor risiko seperti; tidak mencuci tangan setelah buang air besar, tidak mencuci tangan setelah bermain tanah, tidak memakai alas kaki, tidak memotong kuku dan minum obat cacing secara rutin. Faktor risiko tertinggi kejadian infeksi STH pada*

siswa di Desa Ngis adalah tidak adanya ketersediaan jamban ($OR=33,9$; $IK\%95=5,749-199,769$). Prevalensi infeksi STH tergolong cukup tinggi dengan intensitas ringan – sedang dan faktor risiko yaitu rendahnya higienitas dan keterbatasan jamban. Pelaksanaan monev dapat menjadi upaya untuk mengontrol faktor risiko dan menghentikan rantai transmisi STH.

Kata kunci: Faktor Risiko, Infeksi STH, Intensitas, Kato-Katz Modifikasi, Sekolah Dasar.

INTRODUCTION

Soil Transmitted Helminths (STH) infection is one of the health issues in Indonesia that has environment and social basis.¹ Inadequate sanitation, poor economic conditions, and suitable climatic conditions for worm growth support the high prevalence of helminthiasis in Indonesia. STH infection is classified as neglected disease which is defined as an infection that is rarely noticed and chronic without causing obvious clinical symptoms. The impact of the infection is usually noticeable in long term such as malnutrition, growth and developmental disorder, and cognitive impairment in children.²

More than two billion of the world's population is estimated to be infected with STH. Approximately 300 million of them are people with severe infections with 150 thousand cases of death due to STH infection occur every year. Most infections were caused by *Ascaris lumbricoides* of 1.2 billion, *Trichuris trichiura* of 795 million, and *Necator americanus* and *Ancylostoma duodenale* as many as 740 million cases.³

The prevalence of STH infection, especially in Indonesia, is still high with most infections caused by *Ascaris lumbricoides*.⁴ As many as 60% to 80% of Indonesia's population is infected by STH,¹ the prevalence is even higher in certain regions.^{1,3,5} Primary school age is a high-risk group to be infected with STH.⁵ This is due to poor immunity and lack of awareness to live clean and healthily.⁶ Especially in Bali, the prevalence of STH infections in rural areas is still high. In the village of Telaga, the prevalence of intestinal worm infections was reached 68.41% of 93 public elementary school students of Telaga I and 83.87% of 72 elementary school students in Telaga II. The most prevalent infection was *Ascaris lumbricoides* (49.65%).⁷

Factors which cause high STH infection are poor sanitation, such as the habit of unwashed hand before eating and after defecation (defecation), uncut nails, snacking in unhygienic places, not having a decent toilet and difficult to access clean water.¹⁻³

The impact of STH infection is quite serious, therefore an effective and efficient control strategy is needed. The World Health Organization (WHO)⁸ was recommended routine deworming as a major morbidity control strategy in countries with a high prevalence of helminthiasis.⁸ The program has already been implemented in Indonesia, especially in the province of Bali which still has a high prevalence of STH infection. Some areas in Karangasem

Regency still have a high incidence of STH infection even though the government has implemented a worm eradication program in the form of routine deworming in every elementary school. Therefore, to increase the effectiveness of helminthiasis, valid data is needed regarding the incidence of helminthiasis, and education on the prevention of intestinal worm infections and administration of helminthic drugs to infected students is necessary.⁵⁻⁸

Based on the exposition above, this study is to find out the prevalence and risk factors which contribute to the incidence of STH infection in elementary school children in Ngis Village, Karangasem District, Bali.

MATERIAL AND METHODS

This research is a descriptive analysis study with cross-sectional study design. This research was conducted in three elementary schools in Ngis Village, Manggis Subdistrict, Karangasem Regency, Bali, namely SDN 1 Ngis, SDN 2 Ngis, and SDN 3 Ngis. The study was conducted on July 28 to August 27, 2017. The target population of this study is school-age children (6-12 years). Reachable population of this study were all elementary school students in Ngis Village totaling 157 people. Reachable populations are selected in the period of July 2017. The sampling process was not done randomly (non probability sampling) with total sampling technique. Samples were selected from the population based on the inclusion criteria and exclusion criteria as follows. Inclusion criteria were students who were willing to become respondents, aged 6 to 12 years, filled out validated questionnaires and collected feces. Exclusion criteria were students who moved school or did not approve inform consents.

Research Instrument

Research instruments in the form of tools and materials used in the study are distilled water, glycerin solution, 3% malachite green solution, physiological NaCl or 2% eosin, object glass, Kato-Katz modification kit, 10-15 ml plastic pot (faecal pot), filter wire, toothpicks, plastic sticks, cellophane tape, wipes, waterproof markers, scissors, rubber gloves, microscopes, and questionnaires.

Kato-Katz Modification Method

Stool pots are distributed a day before feces collection. Before being given stool pots, students were given a

validated questionnaire regarding worm disease risk factors. Personal data on validated questionnaires were adjusted according to data on faecal pots. The amount of stool that is put into a pot is about 100 mg (as big as a marble or thumb).

The procedure used in this research is the Kato-Katz modification method (see Figure 1). This method is used to assess the degree of infection. The degree of infection established by WHO is defined as the number of worm eggs per gram of feces (epg). The degree category of *Ascaris lumbricoides* infection is mild (1-4,999 epg), moderate (5000-49,999 epg) and severe (> 50,000 epg). Category of degree of *Trichuris trichiura* infection is mild (1-999 epg), moderate (1000-9.999 epg) and severe (> 10,000 epg).⁸

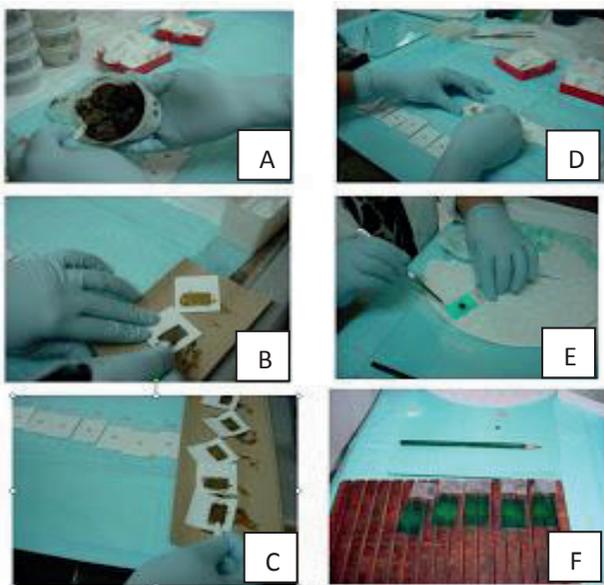


Figure 1. Kato-Katz modification method.⁹

A) Label the glass slide with the sample number and take the faecal sample from container B) Place a small amount of the faecal sample on a paper C) Press the faecal with wirenet to filter the debris D) Place a hollow carton on slide glass then fill with faecal E) Replace the cartoon with cellophane which has been soaked overnight in methylene blue glycerol solution and press the top slide firmly to spread the stool F) let the slide dries about 20-30 minutes before reading on microscope.

Data analysis techniques were carried out using SPSS software. The data that has been obtained is analyzed descriptively and analytically. First, univariate analysis is carried out, it shows data in proportion in the form of respondent characteristics presented in tables and graphs. Second, continued bivariate analysis was carried out to determine the relationship between STH-infected students and risk factors analyzed using chi-square test in crosstab. Odd ratio (OR) analysis was carried out to determine risk factors that affect the occurrence of STH infection in elementary students in Ngis Village with a confidence interval (CI) of 95%. The results of bivariate analysis are presented through tables and graphs.

RESULT AND DISCUSSION

Based on the data obtained (Table 1), there were 138 students who participated in this study with 14 people (10.1%) having STH infection. Male students (64.3%) have a higher proportion of infections compared to female students (35.7%). Third grade students (19%) and five (13.8%) had the highest proportion of students who had STH infection. There were eleven students experiencing a single type of *Trichuris trichiura* infection (78.6%) and the other three experienced mixed infections with *Ascaris lumbricoides* and *Trichuris trichiura* (21.4%). Of the eleven students who had a single *Trichuris trichiura* infection, ten students had a mild infection (90.9%) and one student had a moderate infection (9.1%). Of the three people who had mixed infections with *Ascaris lumbricoides* and *Trichuris trichiura*, two students had a mild infection (66.7%) and one person had a moderate infection (33.3%). Of all students who were infected with STH, there were no students who had severe infections.

Table 1. The Characteristics of Respondents.

Characteristics	STH Infection (n=138)		
	Positive (n=14)	Negative (n=124)	Total (n=138)
Age (Median)	9 (6-13)	9 (6-13)	138
Gender, n (%)			
Male	9 (12,5)	63 (87,5)	72 (100,0)
Female	5 (7,6)	61 (92,4)	66 (100,0)
Grade Level, n (%)			
Grade 1	1 (5,0)	19 (95,0)	20 (100,0)
Grade 2	2 (9,1)	20 (90,9)	22 (100,0)
Grade 3	4 (19,0)	17 (81,0)	21 (100,0)
Grade 4	2 (9,1)	20 (90,9)	22 (100,0)
Grade 5	4 (13,8)	25 (86,2)	29 (100,0)
Grade 6	1 (4,2)	23 (95,8)	24 (100,0)
Type of Infection, n (%)			
Single Infection <i>T. trichiura</i>	11 (78,6)	-	
Mixed Infections <i>A. lumbricoides</i> and <i>T. trichiura</i>	3 (21,4)	-	
STH Infection Intensity, n (%)			
Single Infection <i>Trichuris trichiura</i>			
- mild	10 (90,9)	-	
- moderate	1 (9,1)	-	
- severe	-	-	
Mixed Infections <i>Ascaris lumbricoides</i> and <i>Trichuris trichiura</i>			
- mild	2 (66,7)	-	
- moderate	1 (33,3)	-	
- severe	-	-	

Children are one of the groups that is vulnerable to infection due to poor self-protection efforts, both in terms of the body's immunity and adequate knowledge about hygiene.¹⁰ Village children in Bali often spend their time playing with the soil and this causes them to be easily infected by bacteria or parasites.¹¹⁻¹⁴ The incidence of STH infection in children has brought the attention of the government. The Indonesian government program currently wants to reduce the incidence of helminthiasis in children, both through counseling and deworming for six months on a regular basis, targeting primary school children in remote villages.

In this study, researchers were found the prevalence of STH infection in elementary school children is 10.1%. This result is lower than the results obtained by Siregar¹¹ which is 25.7% and Damayanti¹² in Baturiti, Tabanan is 38.57%. In 2017, the nation-wide prevalence is in the range of 28.9%. This difference is caused by several factors such as time of study, geographical location, culture, social and economic conditions.^{11,14-16}

Based on the data in Table 2, the results of statistical tests found that the proportion of male sex is higher than

that of women experiencing STH infection. Gender has no risk for the incidence of STH infection. There was a low proportion of elementary school students who were infected with STH with frequent playing behavior (8.1%). Students who often play with soil are not at risk for the incidence of STH infection. There were 66.7% of students with STH infection who did not wash their hands after defecation. Unwashed hands after defecation has a significant relationship to the incidence of STH infection ($p < 0.05$). Furthermore, unwashed hands after defecation can increase the risk of STH infection by twenty times with a confidence interval of 1,730-242,98. It was also found that the proportion of students infected with STH who did not wash their hands after playing with soil was 42.6%. Unwashed hands after playing the soil can cause STH infection ($p < 0.05$). This can put the student at risk for by twelve times higher. STH infection is also caused by being barefoot. The proportion of students who are barefoot with the incidence of STH infection is greater than those who have are not barefoot. This is supported by a significant relationship between being barefoot with the incidence of STH infection ($p < 0.05$). Students who are barefoot is

Table 2. STH Infection Risk Factors in Elementary students in Ngis Village, Karangasem, Bali.

STH Infection	Positive n (%)	Negative n (%)	p	PR	95% CI
Gender					
Male	9 (12,5)	63 (87,5)	0,339	0,57	0,182-1,809
Female	5 (7,6)	61 (92,4)			
Often Playing with Soil					
Yes	3 (8,1)	34 (91,9)	0,631	1,38	0,364-5,270
No	11 (10,9)	90 (89,1)			
Dewormed					
Yes	9 (7,6)	110 (92,4)	0,012*	0,23	0,067-0,781
No	5 (26,3)	14 (73,7)			
Unwashed Hands after defecation					
Yes	2 (66,7)	1 (33,3)	0,001**	20,50	1,730-242,98
No	12 (8,9)	123 (91,1)			
Unwashed Hands after Playing with Soil					
Yes	6 (42,6)	7 (53,8)	0,000**	12,54	3,401-46,210
No	8 (6,4)	117 (93,6)			
Barefoot					
Yes	3 (37,5)	5 (62,5)	0,008**	6,491	1,365-30,856
No	11 (8,5)	119 (91,5)			
Uncut Nails Regularly					
Yes	3 (17,6)	14 (82,4)	0,274	2,143	0,538-8,625
No	11 (9,1)	110 (90,1)			
Unavailable Latrine					
Yes	5 (71,4)	2 (28,6)	0,000**	33,89	5,749-199,77
No	9 (6,9)	122 (93,1)			

Explanation: * $p < 0,05$, ** $p < 0,01$

at risk of STH infection by six times. The proportion of students infected with STH by uncut nails is greater than those that cut nails regularly. Uncut nails is not a risk factor that affects the incidence of STH infection in elementary students in Ngis Village. There were 5 (71.4%) students who were infected with STH with unavailable latrine. The availability of toilet is one of the efforts made to protect against STH infection. This is proven through the research results which states the absence of latrines can put students at risk of STH infection by 33 times higher. A significant relationship between STH infection and unavailable latrines in elementary students in Ngis Village ($p < 0.05$) was also found. There was a low proportion of STH infected elementary school students who took deworming drugs regularly. Dewormed regularly is a protective effort against the occurrence of STH infection. This is proven by a significant relationship between taking deworming drugs regularly with no STH infection ($p < 0.05$).

Based on some of these risk factors, there are risk factors that influence the incidence of STH infection in students in Ngis Village, including unwashed their hands after defecation, unwashed their hands after playing with soil, being barefoot, unavailable latrines, and dewormed regularly.

In this study, researchers were found that elementary school children had previously gone through dewormed as part of government program in eradicating the incidence of STH infection in the area. This was conveyed by the Head of Community Health Center (Puskesmas) II Manggis during the interview session, who stated the administration of deworming drugs was implemented as a district government program to eradicate the incidence of STH infection in elementary school children. As for the program implementation, the administration of worm medicine (Albendasol dose 1x400mg) once in six months was done as an effort to eradicate or reduce the incidence of STH infection in children. The administration of these drugs is carried out routinely and is carried out directly, meaning the administration of deworming drugs was done in the classroom to avoid students who do not take deworming drugs (program in 2016). This program has been carried out twice in December 2016 and in July 2017. However, the implementation of this program only provides deworming drugs directly to children, without educating them on basic health hygiene practices, such as washing hands with soap after playing.

In addition, there is a limitation to this program, namely the lack of monitoring and evaluation during program implementation. It also becomes an obstacle in determining whether the program is implemented properly or not. Based on the results of our study, it was found that only 10.1% of children infected with STH. It is below the nation-wide prevalence of STH infection in Indonesia by 25.7%, thus this program had an effect on decreasing the incidence of STH infection in children.^{17,18} Furthermore, the intensity or degree of infection of children who have STH infection is mild to moderate according to the results of calculations

with the Kato-Katz modification method.¹⁵ This program can be continued to reduce the incidence of STH infection in children especially in Karangasem district, Bali.

In this study, it was found that children who had STH infection lacks knowledge about self hygiene. It was proven that the hygiene of children from the habit of hand washing and playing outside the house was known to be significant in causing the incidence of STH infection. Another risk factor which caused the occurrence of STH infection is hygiene after defecation, because children often forget to wash their hands after defecation. Infection is transmitted through dirty hand nails which mediate the entry of worm eggs into the body. In addition, the habit of unwashed hands after defecation can be a strong risk factor in children having STH infection.

It was found that playing with soil often is not a risk factor for STH infection in elementary students in Ngis Village. These results are differ from the research results by Samad who found contamination of *Ascaris lumbricoides* eggs in children who enjoy playing with soil.¹⁹ It is also inversely proportional to Juhairiyah's findings which was stated that the habit of playing with soil will increase the risk of STH infection.²⁰ These results may be influenced by children who no longer play with soil as often. It was also found that the proportion of students infected with STH who did not wash their hands after playing the soil was 42.6%. Not washing hands after playing the soil can increase risk of being infected with STH by twelve times in elementary students. These results are in line with the research results obtained by Wiryadana et al.¹⁴ In addition, which researcher also was found that children who are barefoot when they are outside the house was also significantly associated with the incidence of STH infection. Being barefoot can cause the occurrence of *Ascaris lumbricoides* infection. In line with Kartini's²¹ research which was stated that is a relationship between children who were barefoot against STH infection, but in Wiryadana et al.¹⁴ study, no significant results were found.^{14,21}

Researcher was also found that children who did not have latrines had a significant association with the incidence of STH infection. However researcher was found the protective value of children who have latrines. Supported by the research results of Wiryadana et al.,¹⁴ children who have latrines are not infected with STH due to the inability of worms to develop in the latrine whereas on the ground it can develop and re-infect.¹⁴ This study was found that there were still children who did not have latrines at home. This is the biggest risk factor for the incidence of STH infection. Countermeasures are needed in the form of latrines for families who do not have latrines as an effort to reduce the incidence of STH infection.^{14,20,21,22}

In this study, researchers were also found that elementary school children had been dewormed before. Researchers were found that taking deworming drugs had a protective relationship to STH infection. This is supported by the results of research conducted by the researcher, which found that dewormed regularly can prevent students from

getting STH infection.¹⁴ Therefore, regular administration of deworming drugs can be a prophylactic effort to prevent children from having STH infection. However, there were some children who had mild STH infection even though they had been dewormed. It is also part of the WHO program to eradicate STH infections.²¹

The STH eradication program should be implemented as the government's priority program. The development of this program will be good if proper monitoring and evaluation can be carried out. In eradicating STH infection, information and health education is needed for both parents and children as well as all components of society. Collaboration and good performance in this program will make the target of eradicating STH a success.^{14,20-22}

The limitations of this study are the distance between the location of the research and the examination laboratory. Due to the unavailability of the epidemiological data from Bali and Indonesia, this study was conducted with a cross-sectional design. At present, it is not possible to carry out studies with a more comprehensive design. Thus, this study was used a cross-sectional design which could not assess the risk factors but limited only to the incidence of STH. Furthermore, the researchers collect only one specimen in each child which may be different from the worm egg count in that child later on.

CONCLUSION

Based on the results of the study and the discussion above, it can be concluded that the prevalence of STH infection in elementary students in Ngis Village is 10.1%. Intensity of STH infection occurs with mild to moderate. Risk factors that cause the incidence of STH infection in students in Ngis Village are unwashed hands after defecation, unwashed hands after playing with soil, being barefoot, unavailable latrines, and not dewormed regularly. Researcher was found a decrease in the prevalence of STH infection compared to the national prevalence rate. The knowledge in prevention and attitude of elementary school students are fairly good but efforts are needed to improve hygiene in order to prevent the onset of infection. Monitoring and evaluation efforts from the Community Health Center (Puskesmas) are also needed to maximize the efforts to eradicate STH infection.

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