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RISK FACTORS OF SOIL TRANSMITTED HELMINTHS AMONG ELEMENTARY SCHOOL STUDENTS IN CENTRAL SUMBA – WEST NUSA TENGGARA

FAKTOR RISIKO INFEKSI SOIL TRANSMITTED HELMINTHS PADA ANAK USIA SEKOLAH DI KABUPATEN SUMBA TENGAH PROVINSI NUSA TENGGARA TIMUR (NTT)

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Research Report
Penelitian

A B S T R A C T

Background: *Soil Transmitted Helminhs (STH) infection is one of health issues in Indonesia. Helmintiasis is a disease commonly found among elementary school.* ***Purpose:*** *To identify risk factor related to the transmission of infection STH in Central Sumba Regency, East Nusa Tenggara Province.* ***Method:*** *The research was done by analytical description based on cross-sectional study. Primary data on risk factors were colleted by which qustionnaire for students fourth to sixth grade, age ranged 8-15 years old. Diagnosis was established using Kato Katz modification method. The data were is analyzed using by cross-sectional of Chi-square test with confidence interval 95% or p-value <0.05 categorized as significant.* ***Result:*** *The proportion of infection in male was 47.1% and in females was 50.9%. The proportion of STH infections was 83.3%, mostly found in fifth grade children (36.6%) and aged 8-11 years (66.6%). The most common type of worm egg infection found in feces was mixed infection of Ascaris lumbricoides and Trichuris trichiura (35.6%), followed by a single infection with T. trichiura (32.8%) and the least number was A. lumbricoides (14. 9%). STH infections have significant related to some risk factors such as defecating not in the latrine, not washing hand with water and soap before eating and after defecated, not practicing hand washing properly, biting nails, sucking fingers, not cutting nails once a week, and barefood. The highest risk factor of STH infection in Central Sumba was defecating not in the latrine (PR=135.500; CI 95% (34.062 - 539.020)).* ***Conclusion:*** *The proportion of STH infections is still quite high due to low personal hygiene and open defecation.*

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A B S T R A K

Latar belakang: *Soil Transmitted Helminth*s (STH) adalah salah satu masalah kesehatan di Indonesia yang banyak menyerang anak terutama anak sekolah dasar. **Tujuan:** Mengidentifikasi faktor risiko terkait penularan cacing STH di Kabupaten Sumba Tengah Provinsi Nusa Tenggara Timur. **Metode:** Telah dilakukan penelitian deskriptif analitik menggunakan desain *cross-sectional study*. Data faktor risiko dikumpulkan dari rentang usia 8-15 tahun pada anak kelas 4-6 menggunakan kuesioner tervalidasi. Diagnosis menggunakan teknik *Kato Katz* sedikit modifikasi. Data dianalisis menggunakan uji *Chi-square* secara *crosstab*. Data dikategorikan signifikan apabila nilai *p-value*<0,05 atau tingkat kepercayaan 95%. **Hasil:** Proporsi anak laki-laki 47,1%, atau lebih sedikit dibandingkan anak perempuan 50,9%. Proporsi infeksi STH ditemukan sebanyak 83,3%, terbanyak pada anak kelas lima (36,6%) pada kisaran umur 8-11 tahun (66,6%). Jenis infeksi telur cacing yang ditemukan dalam fases terbanyak adalah infeksi campur antara *Ascaris lumbricoides* dan *Trichuris trichiura* sebanyak (35,6%) diikuti oleh infeksi tunggal jenis *T. trichiura* (32,8%) dan paling sedikit ditemukan pada jenis *A. lumbricoides* sebanyak 14,9%. Kejadian infeksi STH memiliki hubungan signifikan dengan faktor risiko seperti Buang Air Besar (BAB) tidak di jamban, tidak cuci tangan menggunakan air dan sabun sebelum makan dan setelah BAB, tidak melakukan praktek cuci tangan dengan baik dan benar, mengigit kuku, mengisap jari, tidak menggunting kuku sekali dalam seminggu, tidak menggunakan alas kaki. Faktor risiko tertinggi adalah BAB tidak di jamban (PR=135,500; CI 95% (34,062-539,020)). **Kesimpulan:** Proporsi infeksi STH masih cukup tinggi disebabkan masih rendahnya kebersihan diri serta BAB tidak di jamban.

Kata kunci:
Kabupaten Sumba Tengah, Sekolah dasar, Faktor risiko, Infeksi *Soil Transmitted Helminhs (STH)*

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INTRODUCTION

Soil Transmitted Helminth (STH) worms are a disease caused by worm infections in the human body that are transmitted through soil (Juhairiyah *et al*., 2020). This infectious disease is still a health problem because it spreads in most regions of the world, including Indonesia (Suryantari, 2019). STH worm infections are generally very high, especially among the less fortunate (Sihombing, 2021), with poor sanitation (Khan and Ishaq, 2018). The most common type of STH worms found infecting children of school age is *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm) *Ancylostoma duodenale*, and *Necator americanus* (hookworm) (Sastrawan *et al*., 2020; Kamila *et al*., 2018).

The prevalence of worms in Indonesia was found to vary in each district/city at all ages, with the national rate between 2.5%-62% (Regulation of the Minister of Health, 2017). The prevalence of infection in school-age children aged 1-12 years is 30-90% (Prasetyo and Prasetyo, 2018). Central Sumba data survey found the prevalence of worms in school-age children as much as 82.40% in West Sumba Regency as much as 100% (Mau and Mulatsih, 2017) while in Southwest Sumba Regency, it was reported as much as 40% (Paun *et al*., 2019). According to the World Health Organization, 568 million school-age children live in areas with high transmission of STH (WHO, 2023). Children are the group of people who suffer from intestinal worms the most (Rahmawati *et al*., 2014), especially elementary school-aged children because they often play or come into contact with the soil, which is a place for the worms to grow and develop (Suharmiati and Rochmansyah, 2018). Risk factors for STH worm transmission are due to exposure to soil contaminated with STH worm eggs and other supporting factors such as low levels of knowledge, poor environmental sanitation, and lack of personal hygiene (Setyowatiningsih *et al*., 2020). This study aims to identify risk factors for STH worm infection in elementary school-age children in Central Sumba District, East Nusa Tenggara Province.

MATERIAL AND METHOD

This research is descriptive with cross-sectional design. The research was conducted from September 2020 to January 2021. The location of this research was in Central Sumba Regency, East Nusa Tenggara Province (NTT).

Methods of data collection

The research was conducted by examining stool samples in elementary school children or islamic elementary schools, which were collected using the two-stage cluster sampling method. The first stage was to collect a list of the number of elementary schools in Central Sumba Regency, followed by a random selection of 30 cluster/ elementary schools. The second stage is the random selection of seven SD/MI children at the school so that the total sample is 210. The number of samples can be increased by using a design effect (deff) from three to seven so that the number of samples can be 315 (if deff = 3), 420 (if deff = 4), and so on. The stool samples successfully collected in this activity were as many as 323 elementary school children whose class representatives were selected from grades 4, 5, and 6, boys and girls aged between 8 and 15. Data collection used two instruments, namely questionnaires and stool samples.

The *Kato Kattz* method

The *Kato Katz* technique is a method that can detect worm eggs and can count the number of worm eggs quantitatively in infected patients' stool samples. The stool collection technique begins with knowledge and behavior interviews followed by the distribution of stool pots labeled with unique code numbers, so they are not confused, to obtain fresh feces (within 24 hours of being produced and collected by the sampled school children).

How to make a stool specimen: 1) Slide the label using the sample listed on the stool pot, 2) Take 100 g of feces (the size of a green bean seed). Place it in a filter, take the filtered feces, and then place it in the mold, 3) Remove the feces mold and cover the feces using cellophane 4) Store the stool specimen for 20-30 minutes, 5) Read the specimen using a microscope at 10x, 40x, and 100x magnification. Identification of worm eggs was carried out using the *Kato Kattz* method (Suryantari *et al*, 2019).

Stool specimens are taken on a microscope slide and the number of worm eggs can be counted under a light microscope, and the species of each worm egg recorded separately. With this examination, the intensity and prevalence of worm infection can be determined (mild, moderate, or severe). This technique can also identify infections with soil-transmitted helminth worms such as *Ascaris lumbricoides*, *Trichuris trichiura*, hookworms, or *Taenia spp*. Other species can be recovered from fecal samples.

Data analysis

Risk factor analysis data used SPSS software. First, univariate analysis was used to display proportional data on the characteristics of the respondents and presented in tabular form. Second, a bivariate analysis was performed to determine the relationship between students infected with STH and risk factors were analyzed using the *Chi-square* crosstab test. Prevalent Ratio Analysis (PR) was carried out to determine the risk factors that influence the occurrence of STH infection in elementary school students in Central Sumba Regency with a Confidence Interval (CI) of 95%.

RESULT

The characteristics of the respondents (Table 1) show that the number of elementary school students who participated was 323 people, with a proportion of 49.1% male and less than 50.9% female. The proportion of STH infections in school children was 83.3%. Most infections were found in fifth graders, while STH infections in children aged 8-11 years were 84.2%. The results of a fecal examination of elementary school children found positive for two species of worm eggs (mixed infection) between *A. lumbricoides* and *T. trichiura* (35.6%), a single infection of *T. trichiura* species (32.8%) and species *A. lumbricoides* (14.9%).

Analysis of the relationship between the sex of respondents and STH infection found that as many as 49.1% of men were infected with STH, while as many as 50.9% of women were infected with STH. The statistical analysis results obtained *p-value*=0.14, so there is a difference in the proportion of STH infections between men and women and there was no significant relationship between gender and STH infection.

The relationship between age and STH infection analysis found that as much as 84.2% of the 8-11 year old group was infected with STH while the 12-15 year old group was infected with STH as much (as 81.5%). The results of statistical analysis obtained a *p-value*= 0.64, so it can be concluded that there is a difference in the proportion of STH infections between the age group 8-11 years and the age group 12-15 years, and there was no significant relationship between the age group and STH infection.

Table 1. Distribution of the frequency characteristics of elementary school students in Central Sumba Regency in 2020-2021

Respondents characteristics	Diagnostic results		PR (95% CI)	*p-value*
	Positive (n=269)	Negative (n=54)		
Age (years)				
8-11	181 (84.2)	34 (15.8)	1.033 (0.928 - 1.150)	0.64
12-15	88 (81.5)	20 (18.5)		
Gender				
Male	132 (49.1)	20 (37.0)	1.084 (0.984 - 1.194)	0.14
Female	137 (50.9)	34 (62.9)		
Class				
4	87 (82.1)	19 (17.9)		
5	98 (83.1)	20 (16.9)		
6	84 (84.8)	15 (15.2)		
Type of infection				
A. lumbricoides	48 (14.9)			
T. trichiura	106 (32.8)			
Mixed infection	115 (35.6)			
STH prevalence	83.3%			

Table 2 shows a statistical analysis of several factors at risk for STH transmission in elementary school children in Central Sumba Regency. Statistical analysis of the relationship between the place of excretion (BAB) and STH infection found that as many as 99.3% of children who had defecation in any area, such as in the garden/house yard/in the forest/shrubs were infected with STH with a *p-value*=0.00 (<0.05), which shows that there is a significant relationship between the place of defecation and STH infection. Statistical analysis obtained a PR value = 135.500, meaning that children who defecate openly have a 135.500 times chance of being infected with STH than those who defecate in the lavatory or toilet.

Based on the factor of washing hands before eating, it was found that 99.5% of children with the behavior of not washing their hands were infected with STH or more than children who washed their hands before eating, which was 48.0%. The factor of washing hands using water alone shows that 100% are infected with STH and this has a 100% risk of being infected with STH, compared to the factor of washing using water and soap before eating, which is as much as 51.8%. The results of the statistical test showed a *p-value*=0.00 (<0.05), which showed a significant relationship between STH infection and the factor of washing hands with water and soap, with a PR value = 1.930 which means that children who wash their hands only with water are 1.930 times more likely to be infected with STH compared to children who wash their hands with soap and water.

Table 2. The relationship between risk factors and STH infection in elementary school children in Central Sumba Regency in 2020

Variable	ISTH worm infection				PR (95 % CI)	*p-value*
	Positive		Negative			
	N	%	N	%		
Defecate place						
Private/public WC/latrine	0	0	52	100	135.500 (34.062-539.020)	0.00
Defacate (Garden/yard)	269	99.3%	2	0.7		
Washing hands before eating using						
Yes	49	48.0	53	52.1	0.483 (0.394-0.591)	0.00
No	220	99.5	1	0.5		
Washing hands using						
Just water	11	100	0	0	1.930 (1.612-2.311)	0.00
Water and soap before eating	57	51.8	53	48.2		
Washing hands after defecation						
Yes	54	50.5	53	49.5	0.507 (0.420-0.612)	0.00
No	215	99.5	1	0.5		
Washing hands after defecation						
Just water	11	100	0	0	1.883 (1.584-2.240)	0.00
Water and soap	60	53.1	53	46.9		
Implementing WHO's hand washing practices						
Yes	4	6.9	54	93.1	0.069 (0.027-0.178)	0.00
No	265	100	0	0		
Playing in the dirt						
Yes	240	81.6	54	18.4	0.816 (0.773-0.862)	0.02
No	29	100	0	0		
Washing hands after playing in the dirt						
Yes	19	26.4	53	73.6	0.265 (0.180-0.390)	0.00
No	231	99.6	1	0.4		
Cutting nails once a week						
Yes	37	41.1	53	58.9	0.413 (0.322-0.529)	0.00
No	232	99.6	1	0.4		
Biting nails habit						
Yes	240	83.3	2	0.8	0.361 (0.270-0.483)	0.00
No	29	35.8	52	64.2		
Finger sucking habit						
Yes	252	99.2	2	0.8	0.248 (0.248-0.164)	0.00
No	17	24.6	52	75.4		
Eating with a spoon						
Yes	2	3.6	54	96.4	0.036 (0.009-0.139)	0.00
No	267	100	0	0		
Using footwear when playing						
Yes	3	5.3	54	94.7	0.053 (0.017-0.158)	0.00
No	266	100	0	0		
Knowledge						
Lack	267	83.2	54	16.8	0.832 (0.792-0.874)	1.00
Good	0	0	2	100		

As many as 81.6% of children who had a habit of playing using soil media were found to be infected with STH. Based on the results of the analysis (Table 2), it was obtained that the *p-value* = 0.00 (<0.05) indicated that there was a significant relationship between playing with soil media and STH infection. The PR value = 0.816 from the statistical analysis shows that children who play using soil media are 0.816 times more likely to be infected with STH than children who play without using soil. The proportion of STH infections with the habit of clipping nails once (1x) a week was 41.1%, while those who did not cut their nails were 99.6%. The results of the statistical test showed that the *p-value*=0.00 and the PR value = 0.413. This means that those who cut their nails once a week have a 0.413 times chance of being infected with STH.

Children who had a habit of biting their nails were found to be infected with STH in 83.3%, while those who did not bite their nails were also infected with STH in 35.8%. Statistically, there is a significant relationship between nail biting and STH infection with a *p-value*=0.00 (<0.05). They were compared to children who frequently bite their nails. School children who had the habit of finger sucking had a proportion of STH infections of 99.2% or higher compared to children who did not suck their fingers, which was 24.6%. The finger-sucking factor is significantly related to STH infection with a *p-value*=0.00 (<0.05) and a PR value = 0.248, which indicates that children who do not suck their fingers have a 0.248 times chance of not being infected with STH compared to children who suck their fingers.

The habit of eating without using a spoon is at risk of being infected with STH as much, that is, 100% compared to children who eat using a spoon. Likewise, children who do not use footwear when playing have a 100% risk of STH infection compared to children who wear footwear. This factor significantly affects the risk of STH transmission because the *p-value*=0.00 (<0.05). From the analysis results, the PR value = 0.053 indicates that children who eat using a spoon are 0.053 times less at risk of STH infection than children who eat without using a spoon.

The knowledge variable shows that elementary school children with less knowledge about STH are at a higher risk of STH infection, with a proportion of 83.2% compared to children with good knowledge about STH. However, this level is insignificant for STH infection because a *p-value*=1.00 is obtained. At the same time, the PR value = 0.832 shows that children with a low level of knowledge about STH have a 0.832 times chance of being infected with STH compared to children with a good level of knowledge about STH.

DISCUSSION

The survey results show that children aged 8-11 years are at risk of infection with STH. Similar was findings were was found in a study conducted in Semarang which reported that children aged 8-10 years were at risk of infection (Prabandari *et al*., 2020) and among 7-11 years, the majority were infected with STH (Prasetyo and Prasetyo, 2018). The same thing was also found in Denpasar and it was reported that at school age, children's awareness of clean living is still low (Krishnandita *et al*., 2019).

This survey found that the proportion of children infected with STH had a Poor, Clean, and Healthy Lifestyle (PHBS). Children often defecate in any place, for example in bushes or forests. One of the essential facilities for disposing of feces is the latrine because feces are a source of disease. Every house must have a healthy lavatory. This is one of the indicators for a healthy family and is included in the 12 indicators of the Healthy Indonesia Program with a Family Approach (PIS-PK) (Regulation of the Minister of Health, 2016). However, having a restroom does not guarantee the habit of defecating in a latrine. This was revealed in research conducted in West Sumba District, which reported that the practice of not defecating in the toilets had not been taught by parents in the past. It is believed that the ancestors did not allow to bury feces, so the local people practiced defecation in bushes or forests (Suharmiati and Rochmansyah, 2018).

Another potential that arises from the habit of defecating will significantly support the survival of STH worms and is at risk of transmission because these intestinal worms will ripen the eggs to become infective in soil media (Suryan *et al*., 2016). Worm eggs will become infective and survive in moist soil (Ruba *et al*., 2021). This has been proven by research conducted in Tanah Bumbu Regency, South Kalimantan Province, where the results of tests on soil samples around residential areas with high STH infection rates were positively contaminated with STH worm eggs (Juhairiyah *et al*., 2020).

The analysis results show that children infected with STH in Central Sumba Regency have a habit of not washing their hands properly and properly using water and soap before eating and after defecating (Anjani *et al*., 2019; Fitri *et al*., 2012). This infection occurs due to dirty hands contaminated with worm eggs entering the body with food (Unud, 2021). This is in line with research findings that worm eggs enter the mouth with food and go to the intestines (Juhairiyah *et al*., 2020). This event is also reinforced

by children eating without a spoon (Prabandari *et al*., 2020). The habit of washing hands properly is related to the transmission of STH. Research results in Central Java evidence that brick artisans who wash their hands properly have lower STH infections (Setyowatiningsih *et al*., 2020).

Personal hygiene factors closely related to STH infection are the habit of not using footwear, not cutting nails at least once a week, eating without using a spoon with dirty hands, and not washing with water and soap. This is in line with research conducted on school children in Banda Aceh, where children with poor personal hygiene have the potential to transmit STH (Rahma *et al*., 2020; Halleyantoro *et al*., 2019). The personal hygiene problem is closely related to the level of knowledge about STH. This study found that 83.2% of STH-infected children had insufficient knowledge of STH-infected worms. This is similar to research on brick artisans in Central Java (Setyowatiningsih *et al*., 2020; Permatasari, 2020).

CONCLUSION

Based on the results of the research and discussion above regarding the risk factors for STH infection in elementary school children in Central Sumba Regency, NTT, it can be concluded that the risk factors for STH infection in the study area are related to personal hygiene issues such as not washing hands properly and using soap and water, before eating and fafter defecation, after playing with the ground, the habit of eating with the hands or without using a spoon, the habit of not using footwear, sucking fingers, biting nails, and not cutting nails once a week. The riskiest factor is the habit of defecating not in the latrine.

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