



Research Article

Correlation of soil contamination and incident of soil-transmitted helminths (STH) infection in Sukokerto village Sukowono district Jember regency

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ABSTRACT

The most common worm infections are those caused by soil-transmitted helminths (STH) infection. Soil contamination is one of the causes of helminth transmission to humans. Poor environmental sanitation and personal hygiene facilitate the spread and transmission of STH. Jember is a district where most of the population lives in rural areas with poor sanitation access. This study aims to determine the correlation between soil contamination and incidents of STH infection in Sukokerto Village, Sukowono District, Jember Regency. This cross-sectional analytic observational study was conducted from August 2022 to February 2023. This study's total samples were 44 fecal and soil samples from around the house. The data obtained from the laboratory examination showed that the total fecal positive of STH was 11 or 25%; in soil, it was 13 or 29.5%, and the results of the Chi-Square test analysis obtained $p < 0.05$ ($p = 0.036$, $OR = 4,457$). The results showed a significant relationship between soil contamination and the incidence of STH infection in Sukokerto Village, Sukowo District, Jember Regency.



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INTRODUCTION

The prevalence of worm infection is still high and has become a significant problem for world health. The most common worm infections are those caused by soil-transmitted helminths (STH) infection, worms that require soil for the transmission process. The main species of STH that infect people are *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm (*Ancylostoma duodenale* and *Necator americanus*). More than 1.5 billion people, or 24% of the total world population, are infected by STH (WHO, 2022). A national survey of STH infection reported more than 60 million cases of ascariasis and trichuriasis and 60 million cases of hookworm infection in Indonesia (Lee & Ryu, 2019).

Soil contamination is one of the causes of helminth transmission to humans. Soil contamination by STH can occur due to open defecating habits and other poor environmental hygiene practices. Soil-transmitted helminths (STH) infect their host by accidentally ingesting eggs and hookworm larvae that enter through skin penetration (Sutanto *et al.*, 2017). In daily activities, those who have poor personal hygiene have a high risk of being infected by STH.

Jember is a district where the majority of the population lives in rural areas with poor sanitation access. According to data, the Jember district's sanitation access is 76,2% (Dinas Kesehatan, 2020). Rahmawati (2020), in her research, found STH infection in Widodaren Plantation workers in the Jember Regency. In other research, Syavira (2017) found soil contamination by STH on a plantation and residential land in Klungkung Village, Jember Regency.

Therefore, this research was conducted in this area and aimed to determine the correlation between soil contamination and the incident of

STH infection in Sukokerto Village, Sukowono District, Jember Regency, by identifying the type of STH in the soil microscopically to determine STH transmission through the media.

METHODS

This study is an observational analytic study with a cross-sectional research design conducted from August 2022 to February 2023. This study used a non-probability sampling technique with a purposive sampling method. The Lemeshow formula determined the sample size; the required sample is 44. This study's sample was the Sukokerto Village locals who met the inclusion and exclusion criteria. This study uses primary data obtained from the microscopic examination of samples. The feces sample was collected by giving a pot to subjects; then, samples were taken the next day and taken to the laboratory. Soil samples were taken around the subject's home. The soil used is topsoil (Amoah *et al.*, 2017). Samples are taken with a scope of approximately 5 grams, then put in a bag, stored in a box, and taken to the laboratory. The examination of samples in the laboratory using the floating method. Data were analyzed using chi-square test. This research was approved by the ethical commission from the Faculty of Medicine, University of Jember No.1672/H25.1.11/KE/2022.

The sample criteria are:

a. Inclusion Criteria

- 1) Locals who are willing to give feces and soil around their houses.
- 2) Subjects have not taken antihelmintic drugs in the last three months.
- 3) A house that has a yard.
- 4) The soil around the house is damp and not exposed to sunlight.



- b. Exclusion Criteria
- Soil that cannot be sampled according to the specified procedures.
 - Houses with cement yards.
 - The location of the house is challenging to reach.

RESULTS

The number of subjects who participated in this study was 44, where 23(52.27%) were male and 21(47.73%) were female. Out of 44 subjects, the most infected subjects are men (6 or 13.64%), aged 20-60 years (10 or 22.73%), had low education (6 or 13.64%), and worked as farmers (7 or 15.9%).

The results of the microscopic examination of the fecal and soil are presented in Table 2. The total of positive fecal samples was 11 (25%), and the total of positive soil samples was 13 (29.5%).

The results of identifying STH species in the samples are presented in Table 3. Hookworm is the most common species of STH that infects subjects and contaminates soil.

The results of the Chi-square test analysis between soil contamination and the incidence of STH infection obtained $p < 0.05$ ($p = 0.036$, $OR = 4.457$).

Table 1. Sociodemographic characteristics of subjects (N=44)

Sociodemographic characteristics of subjects	STH Infection				Total	
	Positive	%	Negative	%	N	%
Sex						
Male	6	13.64	17	38.64	23	52.27
Female	5	11.36	16	36.36	21	47.73
Age (year)						
20-60	10	22.73	32	72.73	42	95.45
>60	1	2.27	1	2.27	2	4.55
Education	6	13.64	19	43.18	25	56.80
Lower (No/Elementary school)	5	11.36	13	29.55	18	40.90
Basic (Middle/ High School)						
High (Colleges)	0	0	1	2.27	1	2.30
Occupation						
Farmer	7	15.90	13	29.54	20	45.45
Housewife	4	9.10	13	29.54	17	38.63
Entrepreneur	0	0	4	9.1	4	9.10
Laborer	0	0	3	6.82	3	6.82



Table 2. Number of positive and negative samples (N=44)

Type of sample	Result				Total	
	Positive	%	Negative	%	N	%
Fecal	11	25	33	75	44	100
Soil	13	29.5	31	70.5	44	100

Table 3. Distribution of STH species in fecal and soil samples

Type of sample	STH						Total	
	<i>Ascaris lumbricoides</i>	%	<i>Trichuris trichiura</i>	%	<i>Hookworm</i>	%	N	%
Fecal	0	0	2	18.1	9	81.9	11	100
Soil	0	0	1	7.7	12	92.3	13	100

Table 4. Results of statistical test analysis Chi-square test

Type of sample	STH						Total	
	<i>Ascaris lumbricoides</i>	%	<i>Trichuris trichiura</i>	%	<i>Hookworm</i>	%	N	%
Fecal	0	0	2	18.1	9	81.9	11	100
Soil	0	0	1	7.7	12	92.3	13	100

DISCUSSION

Based on the total proportion of subjects infected by STH, men are the most infected. Other research in the Klungkung district also found that men are the most infected by STH (Apsari et al., 2020). Generally, females have better hygiene practices habits than males. Based on age, most subjects infected by STH were adults (20-60 years). Age affects the activities of people. Adults have more activities outside the home and have more contact with the soil, especially those working in agriculture. In addition, adults are not included in mass antihelminth treatment, which can be a source of infection and a reservoir for STH (Subahar et al., 2017). Based on the education level, subjects with a low level

of education (no school/elementary school) were most infected with STH. A low level of education affects a person’s effectiveness in receiving information and innovation. Based on occupation, farmers are the occupation of subjects who were most infected with STH. Farmers have a higher risk of STH infection due to more frequent contact with the soil and poor hygiene practices (Idayani et al., 2021).

The examination results showed an incidence of STH infection in Sukokerto Village, Sukowono District, Jember Regency. In this study, the incidence of STH infection was 25%, lower than the study conducted in North Sulawesi, which was 50% (Sorisi et al., 2019). The difference in the lower incidence in this study could be due to differences in risk factors in study areas. Environmental sanitation and personal hygiene



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are the main components for controlling and eliminating STH infections (Tekalign et al., 2019). Hookworm infection is the most common in this study. Hookworm infection is found in rural areas, especially in households with low socioeconomic status (Halliday et al., 2019). Hookworm infection is acquired mainly by walking barefoot on contaminated soil; hookworms can also be transmitted by ingesting larvae (CDC, 2019).

The result of the soil examination showed that soil contaminated with STH was 29.5%, and hookworm was the species of STH that most contaminated the soil. The same source of soil contamination of STH has been found in Silo District, Jember Regency, with hookworm being the most significant percentage of STH contaminating the soil (Mahartika et al., 2019). Adult worms of STH live in the intestine, where they produce thousands of eggs. In areas with poor environmental sanitation, these eggs will contaminate the soil. The researcher's observations found that most of the houses in the study area did not have toilets, septic tanks, and livestock pens near the house. In addition to environmental sanitation factors, other factors that play a role in supporting soil contamination by STH are weather, temperature, humidity, and soil conditions. Loose soil conditions allow it to become a place for the growth and breeding of hookworms (Widayati et al., 2020).

The Chi-square analysis test showed a significant relationship between soil contamination and the incidence of STH infection. The Odd Ratio (OR) of 4.457 indicated that the soil contaminated by STH could increase a person's risk of being infected by STH 4,457 times. Soil is the primary reservoir for STH prior to transmission. STH transmission cannot occur without passing through the soil. Poor personal hygiene is one factor of STH transmission that has occurred through the soil. Poor personal

hygiene helps transmit worms from the soil into the human body and causes infection. The habit of washing hands after defecating, washing hands before eating, washing vegetables before consuming, washing/peeling fruit before eating, and washing hands after contact with the ground has a significant relationship with the incidence of STH infection (Zeynudin et al., 2022). Worm infections are generally transmitted through dirty and unwashed hands. Long and untrimmed fingernails will harbor worm eggs (Wikurendra & Crismiati, 2018). The habit of wearing footwear also has a significant relationship with the incidence of STH infection. Worms can penetrate the skin mucosa and enter the body following the blood vessels (Rahmi et al., 2021).

In this study, several results indicated a discrepancy between the results of the examination of fecal samples and soil samples. There were several positive fecal samples, but no STH eggs or larvae were found in the soil samples. That can happen because STH infection is not just transmitted through the soil around the house but can be from other soil areas such as the workplace. In addition, STH transmission can also be transmitted through other media, such as water (Sevfianti et al., 2018). On the other hand, some of the fecal samples were negative. However, an examination of the soil samples found STH eggs or larvae. That can be caused by good personal hygiene and a strong immune system.

There are several limitations in this research. For example, soil samples were taken during the rainy season, which can affect the results of STH identification because STH can be carried away by rainwater flow. Soil samples were taken at only one point in the area around the house, which cannot generalize the presence of STH in the house area.



CONCLUSION

There is a significant relationship between soil contamination and the incidence of STH infection in Sukokerto Village, Sukowono District, Jember Regency. The most common type of STH that infects and contaminates soil is hookworm. STH infections that occurred were dominated by males aged 20-60 years who had low education and worked as farmers. Environmental sanitation and personal hygiene are essential factors in STH infection and soil contamination by STH. As a result, it is necessary to carry out outreach and education regarding maintaining personal and environmental hygiene.

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