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Soil Characteristics of Settlements in Sukadono Hamlet, Helvetia District, Deli Serdang Regency

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Abstract. Background: *Soil is where humans can do an abundance of activities. Soil can be contaminated by various factors. Soil is also a medium of development, storage and transmission of several types of worms, commonly referred to as Soil-Transmitted Helminths (STH). Soil Transmitted Helminths are usually found in individuals with poor individual hygiene, low socioeconomics and at risk of infection. Sukadono Hamlet villagers mostly work as pig and chicken breeders.* **Objective:** *The purpose of this study was to find out the characteristics of residential land in the Sukadono Hamlet Helvetia District Deli Serdang.* **Methods:** *The sample in this study was 72 soils taken from the front, back left or right of the house. The soil is measured in temperature, humidity, pH value and is checked using a Digital Soil Analyzer. Then for the STH examination conducted at the Parasitology Laboratory of the Faculty of Medicine, Universitas Sumatera Utara. This research uses research method descriptive - observaional with across sectional approach. Sample was chosen using the technique probability sampling with simple random sampling.* **Results:** *The results showed that most of the soil characteristics in Sukadono Hamlet Helvetia District Deli Serdang were abnormal. The STH examination results also showed that (45.8%) of the 72 soil samples examined positively contained STH. Hookworms were found in (32.9%) soil samples, Ascaris lumbricoides species in (5.3%) soil samples, Strongyloides stercoralis species were found positive in (7.9%) soil samples and a mixture of STH is present in 2 (3.9%) soil samples.* **Conclusion:** *The resident soil in Sukadono Hamlet, Helvetia Ward, Deli Serdang District has been contaminated by Soil Transmitted Helminths.*

Keywords: Contamination. Soil Characteristics, Soil Transmitted Helminth

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1 Introduction

Soil contamination are generalily caused by a group of nematodes referred to as Soil Transmitted Helminth (STH). (1). STH causes infections in humans due to contact with eggs or larvae the are developing in warm and moist soil temperatures that is in tropical and subtropical

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countries. (2) STH consists of Ascaris lumbricoides, Trichuris trichiura, and hookworms (Americanus Necator and Ancylostoma duodenale). (3)

Roundworm diseases is a disease that is caused by Soil Transmitted Helminths and are often suffered by citizens in developing countries and are estimated about more than 60% of the population. STH infection can occur either alone or simultaneously with some other type of worm at once because of low enviroment sanitation quality. (4) Human will most often be exposed to the infective form of STH in an area with poor sanitation quality. (5)

More than 1.5 billion people or 24% of the world's population are infected with worms that transmitted through soil in the whole world. The infection spreads largely tropical and subtropical areas, with the biggest amount of infection happens in Sub-Saharan Africa, America, China and East Asia. More than 267 million preschool-aged children and more than 568 million school-age children live in areas where these parasites are transmitted intensively and need treatment and intervention prevention. (6)

In Jakarta there is other research reported, Ascaris lumbricoides worm infection is as big as (62.2%), and (48%) for Trichuris trichiura and (0.72%) for hookworms. (7). Based on research by Samad in the city of Medan, indicated the presence of eggs STH as much as 52.5% of the 80 soil samples studied whilest the Prevalence of STH Infection in State I-VI elementary students 105296 in the District Percut Sei Mr. Deli Serdang Regency, Sumatera Utara in 2019 is as much as (29.9%). (7)

Soil Transmitted Helminths can cause deficiency in nutrition, anemia, disruption of growth and cognitive development especially on children and are usually referred to as neglected disease due to generally afflicting the poor people in the world and gets less attention compared to other diseases. (8)

Sukadono Hamlet, Helvetia District, Deli Serdang that is used as research is a resident housing area. The enviroment around the area tends to not be cleaned and appears to have a lot of rubbish and livestock feces. The villagers also work as scavengers and pig/chicken ranchers.

Based on the background above, this study aims to find out the characteristics of the soil in the Sukadono Hamlet, Helvetia District, Deli Serdang. The soil characteristics studied are include aspects of temperature, humidity, pH value, presence of STH and types of STH in the residential land of the Sukadono Hamlet Helvetia District, Deli Serdang.

2 Methods

The research type used is descriptive-observational with the cross-sectional method and was held in November 2022. Research is done on the residential soil that is in Sukadono Hamlet,

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Helvetia District, Deli Regency Serdang, Sumatera Utara. The examination of temperature, humidity and pH values is carried out using the Digtial Soil Analyzer tool. The tip of the Digital Soil Anaylzer is stabbed into the ground with a depth of 3cm. Then the button is pressed and released. The results of the temperature, humidity and pH value will be displayed on the Digital Soil Analyzer. The microscopic examination of the soil was done in the Laboratory of Parasitology at the Faculty of Medicine, Univeristas Sumatera Utara, located on Dr. Mansyur Road No 5, USU Campus. The population of this study is residential land of the villlagers in Sukadono Hamlet, Helvetia District, Regency Deli Serdang, Sumatera Utara Province and is obtained by probability sampling with simple random type sampling because of homogenous population. The sampling period in this study was for 1 month.

Soil sample examination is carried out by putting 50 gr soil in a plastic pot that is already cleaned and 50 gr of soil is moved based on the platisc pot to a glass beaker, then add 250 milliliters of aquades & stir until its mixed using a stirrer. Then insert the mixed soil into a 50-size mililiter centrifuge tube using filter paper. Then, centrifuse the tube using a speed of 2,000rpm for two minutes and then the supernatant liquid is removed using a pipette then dissolve 0.5 milliliters of soil deposits using 150 milliters of saturated magnesium sulfate solution in beakers, and stirred until it is mixed. Then pour the solution into a 15 millilers centrifuge tube, then centrifuge the tube using thespeed of 2,500 rpm for five minutes.

In addition, the centrifuged tubes with the centrifuged contents will be placed on a tube rack & a solution of magnesium sulfate is dripped until full or the surface looks like convex but does not spill. The top of the centrifuse tube is closed using cover glass once every 24 hours. Lift the cover glass in an upright and straight position then put in on glass object. Finally, examine the preparations under a microscope using 100x magnification & 400x to identify if there is or the not any Soil Transmitted Helminths.

This method is done to raise eggs / larvae Soil Transmitted Helminths to the surface cover glass to see the presence of STH in the study sample. Ethical Approval obtained from the Medical Ethics Committee of the Faculty of Medicine at the Unversitas Sumatera Utara with Number 159/UN5.2.1.1.2.6/SPB/2022.

3 Results

Results of Digital Soil Analyzer

1. Soil temperature frequency distribution

Table 1.1. Soil temperature frequency distribution

Characteristics	Frequency	Percentage

		(%)
Tempature		
Normal	22	31%
Abnormal	50	69.4%
Total	**72**	**100,0%**

In this study soil samples began with examinations using the Digital Soil Analyzer tool. The findings begin with an examination of the temperature of the soil sample. The normal temperature value of the used soil is 24.9°C -26.6° C and the rest are categorized as abnormal soil temperatures.

2. Average temperature value data

Based on the study of the author, The soil in the Sukadono Hamlet settlement, different temperatures were found recorded. Table 1.2 will show the average value of the temperature of soil sample.

Table 1.2. Table of average temperature values

Tempature	Frequency	Total
33°C	10	330
32°C	17	544
31°C	8	248
30°C	6	180
29°C	2	58
27°C	1	27
26°C	4	104
25°C	9	225
24°C	9	216
23°C	5	115
21°C	1	21
Total	**72**	**2068**

$$\frac{Frequency\ Data}{Total\ Data} = 28{,}7°C = 29°C$$

Based on **Table 1.2,** found a flat value of the average soil temperature is 29 ° C

3. Soil moisture frequency distribution

In this study, soil samples began with examinations using the Digital Soil Analyzer tool. The examination is continued by recording the humidity of the soil sample. Dry soil was found in Sukadono Hamlet. Table 1.3 shows the frequency distribution of soil moisture.

Table 1.3. Soil temperature frequency distribution

Characteristics	Frequency	Percentage (%)
Humidity		
Dry	62	86%
Moist	10	14%
Total	**72**	**100,0**

Based on the results of table **5.3, it** was found that 62 soil samples (86%) were dry, and 10 soil samples (14%) were moist.

In this context, the research uses the Digital Soil Analyzer tool. The pH value of the soil is recorded. Soil pH values are categorized as normal and abnormal. Normal categories include pH values of 6 to 8 whilst abnormal pH values includes values below 6 and above 8. The overall pH value of soil samples is normal. Table 1.4 shows the frequency distribution of soil pH values.

Table 1.4. Frequency distribution of soil pH values

Characteristics	Frequency	Percentage (%)
pH value		
Normal	72	100%
Abnormal	0	0%
Total	**72**	**100,0**

Based on the analysis from Table 1.4, it was found that the pH values of all 72 soil samples (100%) were in normal pH values of 6-8 and were not found in soils where the pH values were abnormal

In this study, the author has found that 2 different soil pH values, 6 and 7 were found in Sukadono Hamlet settlement. Table 1.5 will show the average value of soil pH.

Table 1.5. Data table average value of pH value

pH value	Frequency	Total
6	1	6
7	71	497
Total	**72**	**503**

$$\frac{Jumlah\ Data}{Total\ Data} = 6{,}98 = 7$$

Thefore in **Table 1.5**, the average value of the average soil pH is 7

Results of microscopic examination

4. Presence of STH in soil sample

Microscopic examination in the laboratory is used for the purpose of finding STH in the soil sample. In this study 33 soil samples were found STH and 39 were not found STH. Table 1.6 shows the frequency distribution of STH presence.

Table 1.6. Distribution presence of STH

Absence of STH	Frequency	Percentage (%)
STH found	33	45,8%
STH not found	39	54,2%
Total	**72**	**100,0**

Based on analysis from **Table 1.6**, it is found that on 33 samples (45.8%) found parasites, 39 samples (54.2%) not found STH .

5. The presence of different STH types in soil samples

There are many types of STH that can be found in soil. In this study, the type of STH found were Ascaris lumbricoides, Hookworm, Strongyloides stercoralis, and a mixture of Ascaris

lumbricoides and Hookworm or Strongyloides stercoralis and Hookworm. The common STH found in the soil is Hookworm. Table 1.7 will show the presence of different types of STH in soil samples.

Table 1.7. Presence of different types of STH in soil sample

Types of STH	Frequency	Percentage(%)
Ascaris lumbricoides	4	5,3%
Hookworm	25	32,9%
Strongyloides stercoralis	6	7.9%
Mixture	3	3.9%
Negatif	39	50%
Total	**77**	**100.00%**

Based on the analysis from **Table 1.7**, Ascaris lumbricoides were found in 4 samples (5.3%), Hookworm in 25 samples (32.9%), Strongyloides stercoralis in 6 samples (7.9%), A mixture of STH were 2 in (3.9%) samples, and the latter 39 samples (50%) were found with no STH contamination.

4 Discussion

In this study the temperature of residential soil in the Sukadono Hamlet ,22 (31%) soil samples were found in normal values i.e in between 24.9°C-26.6° C. The results of this study differ from the research conducted by Oyewole and Simon-Oke (9),they recorded the temperature of the soil during the dry season is 35.77 °C and the rainy season is 27.69°C with a total range between 21°C - 41° C. The temperature of the soil in the Sukadono Hamlet Helvetia District Deli Serdang Regency is great for the growth of Soil Transmitted Helminths. Saharman et al and Handayati et al (10, 11) reported that the optimum temperature for growth of larvae and hookworm eggs (Hookworm) is between 23°C- 25°C for Ancylostoma duodenale and 28°C-32° C for Necator Americanus.

Characteristics of the soil that was recorded were dry, sandy, or gulling soil. A total of 62 (86%) of the soil samples studied were dry soil and 10 (14%) of the examined soil were moist soil. The dry and sandy soil is suitable for larval growth of Hookworm which is widely found in the research sites. There is also warm and moist soil that is a perfect enviroment for Ascaris

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lumbricoides (12). Moisture and soil are measured according to the research done by Unaeni (13) i.e by using the Digital Soil Analyzer tool. But the results of this study differ from the results of Unaeni (13) which are shown that moist soils (0,955) are the most affected variables in the presence of STH eggs.The results of the study of soil pH values in the Sukadono Hamlet in total were 72 (100%) soil samples that were in normal pH values of 6 to 8. This result is in accordance with the research done by Oyewole and Simon-Oke (9) ie recorded soil pH ranges from 6.10 to 9.00.

Based on microscopic examination, it was found that in the entirety of the 72 samples, 39 samples were free from parasites, and 33 samples were found parasites. The parasites that was sucessfully identified were Filariform and rhabditiform larvae Hookworm, Ascaris lumbricoides larvae, Filariform larvae and rhabditiform Ascaris lumbricoides, Ascaris lumbricoides egg, Hookworm egg. This is similar with the research done by Natasya (14), where she found as many as 3 (3%) Ascaris lumbricoides eggs, 12 (12%) Hookworm eggs and a mixture of both Ascaris lumbricoides as well as Hookworm in 2 (2%) of the soil samples. The most parasitic finding is the discovery of Hookworm larvae which has been found in 31 (32.9%) soil samples. The results of the study are in line with research conducted by Apriyan & Song in 2018 (3) that uses the method Brine flotation for their research. Research found that Soil Transmitted Helminths in 13 of the total 92 samples discovered about around 90% of the soil sample which is 12 were discovered to be Hookworm larvae. Hookworm found in the whole study were in the larvae form because the samples were not done straight but coveted more first because wanting to wait until all the sample were collected. (3). According to Soedarto's research (15) Hookworm eggs which are released with the stool will grow into their rhabditiform in 2 days up to a week and will develop into their filariform stage.

In the 72 soil samples collected, 4 (5.3%) were found species of eggs and larva of Ascaris lumbricoides. These results differ from studies from Steinbaum et al (12), which took 2107 samples from several places adjacent to nearby houses, 13.0% of the total soil sample was Ascaris lumbricoides. Ascaris lumbricoides found in this study are Ascraris lumbricoides larvae, Ascaris lumbricoides Corticated Infective eggs and Ascaris lumbricodes Corticated Non-Infectif eggs.

No species of Trichuris trichiura (0%) were found in the entire soil sample in this research. Maybe because of unsuitable soil conditions such as clay, the growth of Trichuris trichiura cannot be done. The optimum condition for the development Trichuris trichiura is 30°C with clay type soil. (16) The temperature at the sample site were very optimum for the growth of Trichuris trichiura that is 30° C- 35°C however the type of soil that were found there were sandy and thus does not match with the optimum growth condition for Trichuris trichiura that develops well in more claylike soil.

In this study, filariform and rhabditiform larvae of Strongyloides stercoralis were also found in 6 (7.9%) soil samples. These results are in line with the research of Dr. Invoke and friends (17) who took samples from 797 patients containing those involved with geopha

gy, namely soil consuming activities. The research shows that 1% - 20% of the accumulated soil contains Strongyloides stercoralis. Maybe because the research location is not as dense, prevalancy Strongyloides stercoralis were not much.

5 Conclusion

There are several conclusions obtained from the results of data analysis in this study, including the following:

1. The soil temperature of the residential area in Sukadono Hamlet Helvetia District Deli Serdang Regency was abnormal.
2. The humidity of residential area in Sukadono Hamlet Helvetia District Deli Serdang Regency is dry.
3. The pH value of the residential area in Sukadono Hamlet Helvetia District Deli Serdang Regency is normal.
4. Soil Transmitted Helminth were found in the soil of the residential area in Sukadono Hamlet Helvetia District Deli Serdang Regency
5. Type of Soil Transmitted Helminth in the soil of the residential area in Sukadono Hamlet Helvetia District Deli Serdang Regency is Ascaris lumbricoides, Hookworm and Strongyloides stercoralis

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