Factors Related to Soil Transmitted Helminth Infection in Vegetable Farmers

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Received: June 8, 2021
Revised: September 6, 2021
Accepted: September 22, 2021
Published: October 30, 2021

DOI: 10.33086/ijmlst.v3i2.2145

Abstract

Soil Transmitted Helminth (STH) infection can occur at all ages, from children to the elderly. Farmers are at risk of contracting STH infection because of their daily work which is in direct contact with the soil. The risk of STH infection is due to poor personal hygiene and environmental sanitation. The study aims to determine observe the factors associated with STH infection in vegetable farmers, using a cross-sectional approach. The research subjects were vegetable farmers in Batur Wetan Hamlet, Getasan, Semarang Regency. Data were collected using a questionnaire to determine the personal hygiene and sanitation hygiene of farmers when working in the garden. Worm identification used (reference,) based on the worm performance using the floating method. Worm identification were done by examining the stool using the floating method. The results of the study were processed using SPSS version 20. Data analysis using Chi-Square (α = 5%), found 3 positive study subjects infected with STH, consisting of 1 egg of Ascaris lubricoides and 2 eggs of Trichuris trichiura. Positive STH respondents, have a washing by water and soap habits before eating and defecating, without wearing gloves. There was a relationship between hand washing by water and soap habits before eating to worm infection, but no relationship between this habit after defecating and no wearing gloves to worm infection. Vegetable farmers are advised to change the daily habits and maintain personal hygiene after working. use personal protective equipment when working and maintain personal hygiene.

Keywords

Flotation Method, Soil Transmitted Helminth, Vegetable Farmer.
INTRODUCTION

Worms infection caused by worm parasites, with some species of worm known as Soil Transmitted Helminth (STH) (1). STH is a worm that in its life cycle requires suitable soil to develop into an infective form. Common STH species are roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*) and hookworm (*Ancylostoma duodenale, Necator americanus*) (2). STH infections occur worldwide. This infection is widespread in tropical and subtropical regions, where about one-third of the world's population are infected by at least one STH species. Estimation globally Globally, it is estimated that *Ascaris lumbricoides* infect 820 million people, *Trichuris trichiura* infect 460 million people, and hookworms infect 440 million people (1). The highest prevalence occurs in Asia, sub-Saharan Africa and Latin America (3). Worms infection occurs in Southeast Asia, including Indonesia.

Indonesia as a tropical country with a warm and humid climate provides an ideal environment for the survival of the eggs or larvae of the STH parasite. The prevalence of worms in Indonesia varies from 2.5% to 62%. Worms infection enable attack all ages from children to adults (2). The prevalence of worms was related to the low social-economic conditions of the community, poor environmental sanitation and poor personal hygiene.

STH infection rarely causes death but causes diarrhea, abdominal pain and a drop-in hemoglobin level. As a result, the long-term effects of this infection lead to decreased cognitive, intellectual abilities and low work productivity (4). Because the symptoms are generally not specific, STH infection is considered a normal condition by the affected individual, or as a symptom of another disease that occurs more often in certain conditions so that this disease is considered not a dangerous disease (4,5).

Worms transmission occurs due to soil contamination by STH’s species eggs or larvae. In warm tropical environments, parasite eggs are excreted in the feces of infected individuals and contaminate the soil. Humans become infected through ingestion of eggs or larvae that are excreted in the feces of an infected person. In addition, hookworm eggs hatch in the soil, releasing larvae that mature into a form that can actively penetrate the skin (1). Community behavior contributes to the incidence of worms, for example, lack of personal hygiene and poor environmental sanitation. Work related to or using the land has a high risk of contracting worms, one of the jobs is farmers (6). Based on the research of Ali (7), as many as 70% of farmers in Maharatu Village, Pekanbaru suffer from STH infection. Vegetable farmers have 9 times the risk of getting a worm infection. The risk of STH infection in farmers is caused by poor sanitation hygiene, and not
using personal protective equipment (PPE) (7). Studies by Adeola (8) showed that the habit of not wearing shoes and not washing hands before eating was found to be associated with an increased likelihood of STH infection.

Based on preliminary study farmers in Batur Wetan Getasan Hamlet, work without using proper personal protective equipment, for example using shoes or footwear, wearing gloves, or even not using both. The floor of the houses in Batur Wetan Hamlet, mostly are still on land. This situation enables the farmers by the worms that are transmitted through the soil. This study aims to determine the factors associated with worm infection in vegetable farmers in Batur Wetan Hamlet, Getasan Regency, Semarang-Indonesia.

MATERIALS AND METHODS

Study Area

The type of study is observational (non-experimental), with cross-sectional. This study was conducted in June until August 2019. Dusun Batur Wetan, one of part of Batur Village is located at an altitude of 1,200 m above sea level with a slope-shaped topography and an average temperature of 30°C (Figure 1). The soil conditions are quite fertile so it is very suitable for agriculture, especially horticulture with an average rainfall of 2,500 mm/year. Irrigation and watering system using soil water. The sensus done at 55 vegetable farmers population, in Batur Wetan Getasan Hamlet, Central Java Province.

Figure 1. Location of Batur Wetan Getasan Hamlet

Inclusion and Exclusion Criteria

Inclusion criteria for vegetable farmers were aged 17-55 years with minimum 1 year working period. Exclusion criteria for vegetable growers who were sick. Data collection used a structured questionnaire to
collect the sociodemographic data (including gender, age). The given questioner consisted of the using of gloves when working, the latrine outside the house, washing hands with water and soap after defecating, washing hands with soap and water before eating, consumption of uncooked, cut nails once a week, using toilet facilities in place work, drinking water from wells. After the interview, respondents collect feces in a stool container. This study did not use a control group, because the respondents did not receive any intervention or treatment.

**Ethics Statement**

This study was approved by the Health Research Ethics Committee of Ministry of Health Polytechnic Semarang with No. 168/EA/KEPK/2019.

**Data collection**

Each respondent was given a plastic dry screw-top container, applicator wand, toilet paper, and given appropriate instructions on how to obtain and carry a fresh stool sample. Stool samples were collected, labeled, and transported to the Health Analyst Parasitology Laboratory, Campus 3 of the Health Polytechnic of the Ministry of Health, Semarang.

Microscopic examination (Olympus) of infection with worm eggs STH in fecal specimens using the flotation method. Briefly, emulsify 1 g of feces with 3-4 mL of saturated salt solution in a test tube, then stir until homogeneous, add the saturated salt solution to the brim. Place the coverslip on it, leave it for 10-60 minutes, then remove the coverslip, observed for the presence of eggs/larvae (9).

**Statistical Analysis**

The data obtained from the study were analyzed by SPSS Statistics for Windows version 20, both univariate and bivariate analyzes. Univariate analysis was conducted to obtain a description of each variable were calculated using descriptive statistics, while bivariate analysis to determine the relationship between independent variables to the dependent variable, using Chi Square analysis with a 95% confidence degree. If result shows p-value <0.05, it means that statistically or indicate has a significantly relationship between variables, and vice versa.

**RESULTS**

Based on field observations, irrigation and watering systems use ground water, fertilizer comes from animal waste, and there are no toilets available in the workplace. The STH Infection of respondents by gender and age, showed in Table 1.

**Table 1. STH infection of the respondent**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>STH Infection</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2</td>
<td>3,6</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td>2,3</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-39</td>
<td>2</td>
<td>3,6</td>
</tr>
<tr>
<td>40-59</td>
<td>1</td>
<td>2,5</td>
</tr>
</tbody>
</table>
The respondent’s population were 55 people, consist of 31 (56%) men and 24 (44%) women. The infected with worms of respondent population consist of 2 women and a man. The incidence of STH infection is most prevalent in the age of 20-39 years (3.6%) and age 40-59 years (2.5%).

Table 2. Frequency distribution of stool examination

<table>
<thead>
<tr>
<th>Result STH</th>
<th>F</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infected</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td>No infected</td>
<td>52</td>
<td>94.9</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100</td>
</tr>
</tbody>
</table>

Tabel 2 showed there are 3 (5.1%) vegetable farmers infected with STH. Based of the identification of STH positive stool samples found A. lumbricoides eggs (Figure 2) and T. trichiura eggs (Figure 3).

Figure 2. Ascaris lumbricoides eggs stool examination magnification 40x (black arrow)

There were 3 respondents who were infected with STH (Table 3). The relationship between using of gloves while working with the incidence of helminth infections is not significant (p = 0.214). The relationship between the location of the latrine outside the house and the incidence of worms is not significant (p = 0.347). The washing hands with soap and water after defecating habits was not significant (p = 0.233).

Figure 3. Trichuris trichiura eggs stool examination magnification 40x (black arrow)

Regarding the relationship between the consumption of uncooked food and cutting nails once a week with the incidence of worms is significant (p = 0.911) (0.711). However, the relationship between the washing hands with water and soap before eating habits with helminth infections showed a significant relationship (p = 0.000). All of 55 respondents has been used toilet facilities at work, source of clean water from wells, uses footwear when working.

DISCUSSION

Worms are found in areas with high humidity, moist soil conditions. The nature of clay and high humidity and tropical climate is very suitable for the growth of the eggs of Ascaris lumbricoides and Trichuris trichiura (10,11). In warm tropical environments
where TSH is widespread, parasite eggs are excreted in the feces of infected individuals and contaminate the soil (12).

Worm infections mostly attack workers whose activities are more related to soil. Vegetable farmers are a group of workers who are at risk of infection with helminthiasis because their activities are directly related to the soil. STH infection is higher in male farmers than female farmers. It is not in line with statement of Ross (13), that women are more at risk of STH infection than men, but it’s in line to Aribodor (14) statement, that there are varying levels of infectivity associated sexes differ according to socio-economic and cultural factors. The incidence of STH infection can affect all gender, ages, from children to adults, depending on the good and bad of personal hygiene and environmental sanitation (15).

**Table 3. Statistic analysis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>STH Infection</th>
<th>Total n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wearing gloves when working</td>
<td>Yes</td>
<td>38 (69)</td>
<td>0.214</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>14 (31)</td>
<td></td>
</tr>
<tr>
<td>Location of latrine outside the house</td>
<td>Yes</td>
<td>43 (78)</td>
<td>0.347</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>9 (12)</td>
<td></td>
</tr>
<tr>
<td>Washing hands with water and soap after defecating</td>
<td>Yes</td>
<td>38 (69)</td>
<td>0.233</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>17 (31)</td>
<td></td>
</tr>
<tr>
<td>Washing hand with water and soap before eating</td>
<td>Yes</td>
<td>54 (98)</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td>Comsumption of uncooked food</td>
<td>Yes</td>
<td>54 (98)</td>
<td>0.911</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td>Cutting nails once a week</td>
<td>Yes</td>
<td>23 (44)</td>
<td>0.711</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>29 (56)</td>
<td></td>
</tr>
<tr>
<td>Use the toilet facilities at the workplace</td>
<td>Yes</td>
<td>55 (100)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Source of clean water from wells</td>
<td>Yes</td>
<td>52 (100)</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Wearing footwear for work</td>
<td>Yes</td>
<td>55 (100)</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

a = no data computed because result constant

This study used flotation method, because this method produces a clean preparation for microscopic examination need with minimal residual dirt that interfere. This method increases the likelihood of detecting parasitic organisms when the amount is small, fairly easy to do and inexpensive (16). The result showed 2 types of worm eggs, namely *Ascaris lumbricoides* and *Trichuris trichiura*. These eggs are a types of worms eggs that are commonly found in Indonesia. This result is in line with Apsari (17), which found eggs of *A. lumbricoides* and *T. trichiura*. *A.
lumbricoides and of T. trichiura. Boko, Taiwo and Aribodor (12,14,18), reported that A. lumbricoides and T. trichiura were the most dominant and important among STH, as well as intestinal parasites.

The relationship of using gloves when working with the incidence of worm infections, is not significant. This result is in line with research Imansyah (19) showing that stated no significant relationship between the use of PPE (gloves or shoes) and STH infection. This indicates that the STH infection does not originate in the workplace but may originate elsewhere. However, these findings is not in line with by Baidowi (20) which showed workers who did not wear gloves were 8.8 times more likely to be infected with STH than workers who wore gloves while working. Gloves are one of the personal protective equipment. Personal protective equipment aims to protect all parts of the hand, prevent direct contact to the soil, cut the chain of transmission of STH infection, and prevent entering eggs of A. lumbricoides and T. trichiura from nails or sticking to the hands (20,21).

A latrine facility is very important for life. The latrine is used as a place to defecate and urinate. The use of latrines must meet health requirements, toilets must be clean, clean water and soap are provided for washing hands (2,22). The use of clean latrines is one of the ways to live clean and healthy. An unsanitary latrine can cause the spread of disease due to human waste (23).

Hands are the main transmission body organ of germs and diseases. Hand hygiene is important to avoid transmission of germs, dangerous diseases and prevent infection (24). Efforts to control the risk factors for worms can be done by washing hands before eating or after defecating with water and soap (25). The results of washing hands with soap are in line with Ali’s research (7) on the habit of washing hands with soap in vegetable farmers in Maharatu Village, Marpoyan Damai District, Pekanbaru City, which is related to the incidence of worms. The same results were also shown by research Alamsyah on Vegetable Farmers in Lingga Village, Sungai Ambawang District, Kubu Raya Regency, which showed that the habit of washing hands with soap was related to the incidence of worms (26). The habit of washing hands with water is not enough to reduce the number of disease-causing microorganisms that stick to the hands. The Indonesian Ministry of Health stated that washing hands properly is using soap and water (27). Washing hands with water and soap are more effective at removing dirt and dust and reducing the number of disease-causing microorganisms such as viruses, bacteria, other parasites that stick to the surface of the skin, nails and fingers on both hands such as worm eggs (25). It can be stated that it is very possible that the
handwashing behavior of vegetable farmers in Batur Wetan Hamlet is carried out inappropriately and correctly so that it is one of the factors causing worm infection.

The soil condition of Batur Wetan Hamlet is quite fertile so it is suitable for agriculture, especially horticulture (28). Vegetable planting land can be a source of transmission of STH worms because moist soil is a good growth medium for the development of worms (29,30). The moist soil is very suitable for fertile eggs of *A. lumbricoides* and *T. trichiura* worms to develop into infective stage (31). The optimum growth temperature for *A. lumbricoides* eggs is approximately 25°C, and for *T. trichiura* eggs at 30°C (2). Farmers' habit of using manure also has the potential to contaminate STH to vegetables. Animal waste possibly transmits these worms (29). In addition to local suitable soil and environmental conditions, is also influenced by the number of infective eggs and entering the host. The more eggs found in the source of contamination (soil, dust, vegetables, etc.), the higher the endemicity in an area (2).

The result of consumption of uncooked food in this research, this is different from the results of Yavari (32) which states that there is a relationship between raw food consumption and the incidence of worm infection. Consumption of fresh vegetables plays an important role in the transmission of parasites in humans, if vegetables are not washed properly (33). Parasites that have been linked to foodborne infections include worm eggs (34). When vegetables contaminated with worm eggs are eaten by humans, the person will become infected with worms.

Personal hygiene is a person's efforts to maintain health, one of which can be done by maintaining nail hygiene. Transmission of worm infection to humans can occur in several ways, namely direct transmission through worm eggs attached to nails that have been contaminated by soil contaminated with STH. To prevent the transmission of intestinal worms, nails should always be cut short, and clean, uneven nail surface (there are wounds on the nails), color is not clear, the skin under the nails the length of the nails exceeds the fingertips (2).

Efforts to control helminthic risk factors can be carried out through personal hygiene efforts or environmental hygiene. Personal hygiene is carried out, including the use of clean water for bathing purposes, consumption and washing hands with soap using clean water (2). Availability of latrines is needed on agricultural land where work is carried out as a means of standardised disposing of feces for disease prevention and control. For disease prevention, workers must use personal protective equipment such as gloves and footwear (35). Footwear can protect feet from the entering of worm larvae into the skin (12). Footwear that is used for
personal protective equipment, such as use boots to protect the foot.

CONCLUSIONS

The study showed that the relationship between washing hands with water and soap before eating to worm infections in vegetable farmers in Batur Wetan Hamlet is significant. It is necessary to educate vegetable farmers about the importance of personal hygiene, using complete PPE while working.

AUTHOR CONTRIBUTIONS


ACKNOWLEDGMENT

Thank you to the Director of the Health Polytechnic of the Ministry of Health in Semarang, who have provided research funding.

CONFLICT OF INTEREST

This research has no conflict of interest.

REFERENCES

11. Rosmini, Nurwidayati A. Tingkat infeksi soil-transmitted helmint pada anak sekolah dasar di Dataran Tinggi Bada , Kecamatan Lore Barat , Kabupaten Poso , Sulawesi Tengah Tahun 2016. [The soil-transmitted helminth infection among...


30. Wijaya RP. Prevalensi infeksi cacing usus yang ditularkan melalui tanah pada petani di Kelurahan Ranowangko Kecamatan Tondano Timur Kabupaten Minahasa (Prevalence of soil-transmitted intestinal worm infection among...


