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Factors Related to Soil Transmitted Helminth Infection in Vegetable Farmers

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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 with out used 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 cause 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.

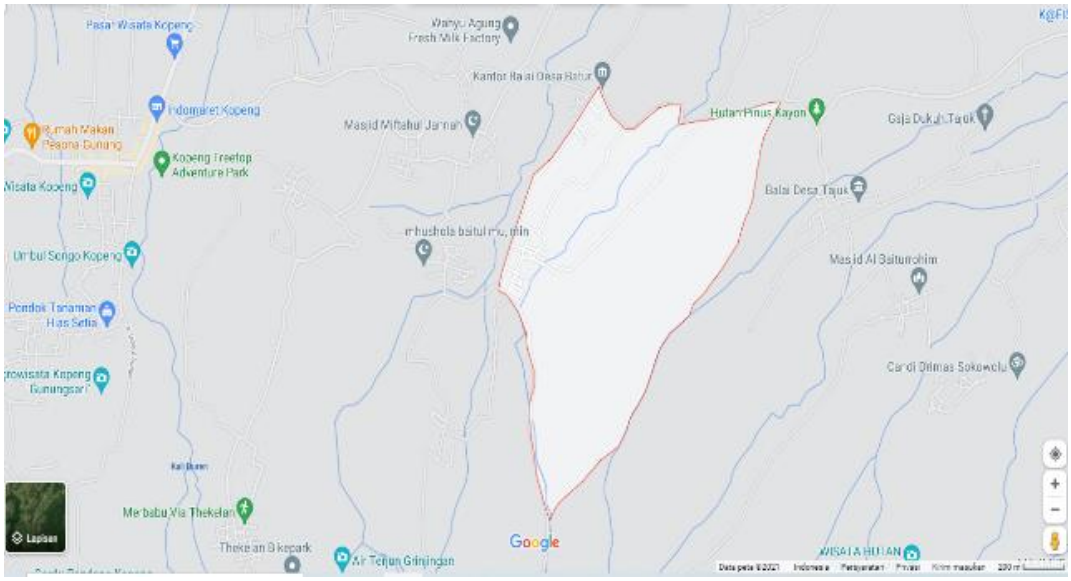

Figure 1. Location of Batur Wetan Getasan Hamlet

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

Characteristic	STH Infection				Total	
	Yes		No			
	n	%	n	%	n	%
Gender						
Male	2	3,6	29	51,4	31	55
Female	1	2,3	23	42,7	24	45
Age (years)						
20-39	2	3,6	17	30,9	19	34,5
40-59	1	2,5	35	63	36	65,5

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

Result STH	F	%
Infected	3	5,1
No infected	52	94,9
Total	55	100

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 infectios 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

Variable		STH Infection		Total	p-value
		Yes	No	n (%)	
Wearing gloves when working	Yes	-	38	38 (69)	0,214
	No	3	14	17 (31)	
Location of latrine outside the house	Yes	-	43	43 (78)	0,347
	No	3	9	12 (22)	
Washing hands with water and soap after defecating	Yes	3	35	38 (69)	0,233
	No	-	17	17 (31)	
Washing hand with water and soap before eating	Yes	2	52	54 (98)	0,00
	No	1	-	1 (2)	
Comsumption of uncooked food	Yes	2	52	54 (98)	0,911
	No	1	-	1 (2)	
Cutting nails once a week	Yes	1	23	24 (44)	0,711
	No	2	29	31 (56)	
Use the toilet facilities at the workplace	Yes	3	52	55 (100)	
	No	-	-	-	
Source of clean water from wells	Yes	3	52	55 (100)	a
	No	-	-	-	
Wearing footwear for work	Yes	3	52	55 (100)	a
	No	-	-	-	

a = no data computed because result constan

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 develops into infective stage (31). The optimum growth temperature for *A. lumbricoides* eggs is approximately 25^0C, and for *T. trichiura* eggs at 30^0 C (2). Farmers' habit of using manure also has the potential to contaminate STH to vegetables. Animal waste posibly transmits these worms (29). In addition to local suitable soil and environmental conditions, is also influenced by the number of infective eggs and intering 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. is necessary to educate vegetable farmers about the importance of personal hygiene, using complete PPE while working.

AUTHOR CONTRIBUTIONS

Ririh Jatmi Wikandari: conceptualization, methodology, writing–original. Lilik Setyowatiningsih: supervision, conceptualization. Masrifan Djamil: supervision, conceptualization. Surati: supervision, conceptualization, validation. Fitriani Kahar: supervision, reviewing and validation.

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CONFLICT OF INTEREST

This research has no conflict of interest.

REFERENCES

1. WHO. Guideline: Preventive chemotherapy to control soil-transmitted helminths infections in at risk population groups. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO. WHO Press. 2017. 1–87 p.
2. Kemenkes RI. Permenkes RI tentang penanggulangan cacingan. [The minister of health of the republic of Indonesia concerning the prevention of worms]. Jakarta: Kementerian Kesehatan RI; 2017. p. 1–78.
3. Moser W, Schindler C, Keiser J. Efficacy of recommended drugs against soil transmitted helminths: Systematic review and network meta-analysis. BMJ. 2017;358:1–10.
4. Salam N, Azam S. Prevalence and distribution of soil-transmitted helminth infections in India. BMC Public Health. 2017;17(1).
5. Hairani B, Indriyati L. Prevalensi *Trichuriasis* pada anak di sekolah dasar negeri harapan maju : studi kasus di Kabupaten Tanah Bumbu Provinsi Kalimantan Selatan. [Prevalence of *Trichuriasis* in children in harapan maju Public Elementary School]. J Vektor Penyakit. 2016;10(1):25–32.
6. Aritonang BNRS. Hubungan personal higiene dengan penyakit cacing (soil transmitted helminth) Pada petani sayur kartama kota Pekanbaru. [Relationship of personal hygiene with worm disease (soil transmitted helminth) in kartama vegetable farmers in Pekanbaru city]. J Sains Dan Teknol Lab Med. 2019;4(2):39–43.
7. Ulfa Ali R, Zulkarnaini Z, Affandi D. Hubungan personal hygiene dan sanitasi lingkungan dengan angka kejadian kecacingan pada petani sayur di kelurahan maharatu kecamatan marpoyan damai kota pekanbaru. [Relationship of personal hygiene and environmental sanitation with the incidence of STH]. Din Lingkung Indones. 2016;3(1):24.
8. Adeola A, Olugbemiga A, Funmi O, James B. Prevalence of geo-helminths and preventive practices among farmers in a local government area of North Central Zone Nigeria. Eur J Pharm Med Res. 2017;4(8):634–42.
9. World Health Organization. Assesing the epidemiology of STH during TAS. in: assesing the epidemiology of STH during TAS. Geneva: World Health Organization; 2015. p. 1–44.
10. WHO. A contribution to the control of soil-transmitted helminth infections in Latin America and the Caribbean. Washington; 2015. 70 p.
11. Rosmini, Nurwidayati A. Tingkat infeksi soil-transmitted helminth pada anak sekolah dasar di Dataran Tinggi Bada , Kecamatan Lore Barat , Kabupaten Poso , Sulawesi Tengah Tahun 2016. [The soil-tranmitted helminth infection among

school children in Bada Plateau , West Lore Distric]. Spirakel. 2017;9(1):19–26.

12. Akinsanya, Taiwo A, Adedamola M, Okonofua. An investigation on the epidemiology and risk factors associated with soil-transmitted helminth infections in Ijebu East local government area, Ogun State, Nigeria. Sci African [Internet]. 2021;12:e00757. Available from: https://doi.org/10.1016/j.sciaf.2021.e00757
13. Ross AGP, Olveda RM, McManus DP, Harn DA, Chy D, Li Y, et al. Risk factors for human helminthiases in rural Philippines. Int J Infect Dis [Internet]. 2017;54:150–5. Available from: http://dx.doi.org/10.1016/j.ijid.2016.09.025
14. Aribodor DN, Bassey SA, Yoonuan T, Sam-Wobo SO, Aribodor OB, Ugwuanyi IK. Analysis of Schistosomiasis and soil-transmitted helminths mixed infections among pupils in Enugu State, Nigeria: Implications for control. Infect Dis Heal [Internet]. 2019;24(2):98–106. Available from: https://doi.org/10.1016/j.idh.2018.12.003
15. Ali, R.U; Zulkarnaini; Dedi A. Hubungan Personal hygiene dan sanitasi lingkungan dengan angka kejadian kecacingan (Soil Transmitted Helminth) pada petani sayur di kelurahan maharatu kecamatan marpoyan damai kota pekanbaru. [Relationship of personal hygiene and environmental sanitation]. Din Lingkung Indones. 2016;3(1):24–33.
16. Demelash K, Abebaw M, Negash A, Alene B, Zemene M, Tilahun M. A review on diagnostic techniques in veterinary helminthlogy. Nat Sci 2016;14(7). 2016;14(7):109–18.
17. Apsari PIB, Arwati H, Dachlan YP. Correlation of eosinofil and basophil count with intensity of soil transmitted helminth infection among farmers in Bali. IOP Conf Ser Mater Sci Eng. 2018;434(1).
18. Boko PM, Ibikounle M, Onzo-Aboki A, Tougoue JJ, Sissinto Y, Batcho W, et al. Schistosomiasisand soil transmitted helminths distribution in Benin: A baseline prevalence survey in 30 districts. PLoS One. 2016;11(9):1–17.
19. Imansyah Putra TR, Loesnihari R, Panggabean M. Soil-transmitted helminth infection and eosinophil levels among waste collectors in banda aceh. Indones J Trop Infect Dis. 2018;7(2):27.
20. Baidowi II, Armiyanti Y, Febianti Z, Nurdian Y, Hermansyah B. Hubungan penggunaan alat pelindung diri dengan status infeksi soil-transmitted helminthspada pekerja kebun di Perkebunan Kaliputih Kabupaten Jember. [The correlation between the use of personal protective equipment (ppe) and soil- transmitted helminths]. Inf. J Agromedicine Med Sci. 2019;5(2):8.
21. Trisnawati E, Rochmawati. Risiko infeksi kecacingan pada pekerja peternakan ayam di sungai Ambawang kabupaten Kubu Raya. [Worm Infection risk among poultry farming workers in Sungai Ambawang Kabupaten Kubu Raya]. Appl Phys A. 2016;73:1–21.
22. Prayitno H, Hanafi AS, Sholihah Q. Factors associated with helminthiasis among vegetable in Barito Kuala district. Asian J Epidemiol. 2017;10(3):108–15.
23. Suharmiati S, Rochmansyah R. Mengungkap kejadian infeksi kecacingan pada anak sekolah dasar (Studi etnografi di Desa Taramanu Kabupaten Sumba Barat). [Revealing the event of helminthic infection in primary school children (ethnographic study in taramanu village of West Sumba regency)]. Bul Penelit Sist Kesehat. 2018;21(3):211–7.
24. World Health Organization. Hand Hygiene: Why, how & when? [Internet]. World Health Organization (WHO). 2017. p. 1–7. Available from: https://www.who.int/gpsc/5may/Hand_Hygiene_Why_How_and_When_Brochure.pdf
25. Sofiana L, Kelen MSJ. Factors Related to soil transmitted helminth infection on primary school children. Unnes J Public Heal. 2018;7(1):55–61.
26. Alamsyah D, Saleh I, Nurijah. Faktor yang berhubungan dengan kejadian infeksi s*oil transmitted helminths* (STH) pada petani sayur di Desa Lingga Kecamatan Sungai Ambawang Kabupaten Kubu Raya Tahun 2017. [Factors associated with the incidence of soil transmitted helminths (STH) infection. J Mhs Dan Penelit Kesehat [Internet]. 2017;4(2):1–10. Available from: http://openjurnal.unmuhpnk.ac.id/index.php/JJUM/article/download/858/680%0Ahttp://repository.unmuhpnk.ac.id/609/2/BAB I-6.pdf
27. Kementerian Kesehatan RI. Panduan cuci tangan pakai sabun (CTPS). [Hand Washing guide with soap]. Jakarta; 2020. p. 1–34.
28. Pemda Kab Semarang. Desa Batur [Internet]. Pemda Kab Semarang. 2021 [cited 2021 Jul 14]. p. 1. Available from: https://getasan.semarangkab.go.id/desa-batur/
29. Adrianto H. Kontaminasi telur cacing pada sayur dan upaya pencegahannya. [Helminth eggs contamination in vegetables and prevention efforts hebert]. Balaba J Litbang Pengendali Penyakit Bersumber Binatang Banjarnegara. 2017;13(2):105–14.
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

farmers in Ranowangko Village, East Tondano Distric. J Kedokt Komunitas Dan Trop. 2019;6(2):310–3.

31. Nur A, Srikandi Y, Risti, Nelfita, Tolistiawaty I, Anastasi H. Infeksi soil transmitted helminths di dataran tinggi bada kecamatan Lore Barat kabupaten Poso Sulawesi Tengah tahun 2018. [Soil transmitted helminths infection in the Bada Plateau, West Lore District, Poso Regency, Central Sulawesi in 2018]. Seminar Nasional Pendidikan Biologi dan Saintek (SNPBS) ke-V 2020 2020 p. 672–8.
32. Yavari MR, Mirzaei F, Shahcheraghi SH, Bafghi AF. Parasitic contamination on fresh raw vegetables consumed in Yazd City, Iran, In during 2017-2018. Chinese J Med Res. 2019;2(4):70–3.
33. Padmanandan A, Singh S, Gaind R. Parasitic contamination in commonly consumed raw vegetables: A review study. Epidemiol Int [Internet]. 2016;1(1):27–30. Available from: https://www.researchgate.net/profile/Rajni_Gaind/publication/298712874_Parasitic_Contamination_in_Commonly_Consumed_Raw_Vegetables_A_Review_Study/links/56ea6eec08ae25ede8313e0b.pdf
34. Rahimi Esboei B, Sharif M, Daryani A, Hosseini F, Pagheh A sattar, Rahimi M, et al. Parasitic contamination in commonly- consumed vegetables in mazandaran province, Northern Iran. J Human, Environ Heal Promot. 2017;2(2):89–95.
35. Kemenkes RI. Pedoman pembinaan perilaku hidup bersih dan sehat (PHSB). [Guidelines for guidance on clean and healthy living behavior]. Kementerian Kesehatan RI. Jakarta; 2011. 1–97 p.