

Screening for Soil Transmitted Helminths (STHs) Eggs and Hemoglobin (Hb) Levels on Aggregat Community of Garbage Collectors

Asmuji¹, Ali Usman²

^{1,2} Faculty of Health Science, University Muhammadiyah of Jember

E-mail address: asmuji@unmuhjember.ac.id

ABSTRACT

Introduction

Soil-Transmitted Helminths (STHs) infection becomes a problem world widely especially in the area with inadequate hygiene and sanitation. One of the prone population is garbage collectors. Contamination of a disease (egg worms) on part of body allows the occurrence of oral- fecal transmission that causes STHs infection. The presence of STHs worm in the intestine suck the host's blood thus it causes the decreasing of hemoglobin (Hb) level which may cause severe anemia and death.

Methods

This research was an analytical observational through laboratory approach. Sample in this research was 35 respondents taken by simple random method. Laboratory analysis is used to determine the presence of STHs worm eggs and Hb levels. Spearman's rank correlation test with $\alpha = 0.05$ was used to know if there was a correlation between the existence of STHs worm eggs in fingernails sample and hemoglobin levels.

Results

The presence of STHs worm eggs in nails sample categorized has strong correlation with Hb levels on garbage collector community (p value= 0.000; $\alpha = 0.05$; $r = -0.930$). It was discovered that nine respondents with egg STHs worms in their fingernails sample had Hb level less than 13 g/dl.

Conclusions

Personal hygiene including maintenance of nail hygiene is one way to prevent the transmission of fecal- oral STHs worm infections.

Keywords

Screening; Soil-Transmitted Helminths Eggs; Hemoglobin; Garbage Collectors

BACKGROUND

Soil-Transmitted Helminths (STHs) infections are a world problem (Vermeire et al., 2012) that was found occurs in tropical developing countries such as Indonesia (Blair et al., 2015; Noviasuti, 2015, Ratag et al., 2011). STHs infections are distributed in many people who live in susceptible communities with poor infrastructures access, lack of availability clean water (Dewi et al., 2017; Mara et al., 2010), poor sanitation facilities, and inadequate health care facilities

(Chimbari, 2012; Midzi et al., 2014; WHO, 2013; Yajima et al., 2012; Chimbari, 2012) stated that more than one billion people in the world are infected with STHs infections. WHO (2013) estimated the number of *Ascaris lumbricoides* infections were 1.2 billion, *Trichuris trichiura* infections were 795 million and sufferers of *hookworm* infections were 740 million. Even, Blair et al. (2015) stated that more than two billion people in the world were infected intestinal worm infections.

Susceptible communities with low socio economic conditions, one of them were the aggregate of garbage collectors. Unhygienic living habits (washing hands and feet that are less clean after work) (Burhanudin et al., 2008; Mulasari et al., 2013) and they are not using protective equipment while working, then the garbage collectors' low level of education and knowledge (Ottay, 2010) further, the incidence of intestinal worms more occurred in this community. Enforcement of the worm disease diagnosis is through fecal examination in the laboratory.

However, as a first step before ensuring the presence of worms in intestine through fecal examination, can examine the presence of worm eggs in area of individual nails. With the ideas that if in the individual nails found worm eggs, it can be estimated egg worms were swallowed or enter the skin pores and eventually live and survive in the intestine. Further examination to ensure the presence of worms in the body after worm eggs are found on the nails by checking the Hb level of infected patients. Palgunadi (2008) stated that decreases in the Hb level of worm infected patients are caused by worms in the intestine sucking blood from the host.

METHODS

This research was an analytical observational through laboratory approach with 35 respondents as sample from aggregate community of garbage collectors that is taken by simple random sampling. Laboratory analytical technique is used to identify the existence of worm eggs on respondents by using fingernail sample and doing a test to measure Hb levels. Univariate analysis and bivariate analysis are used in this research. Univariate analysis is shown in the form of distribution frequency table, while bivariate analysis used Spearman's rank correlation test with $\alpha = 0.05$ which it has purposes to know there was a correlation between the existence of worm eggs and Hb levels on community of garbage collectors.

RESULT

The Presence of Worm Eggs on Nails Sample of Aggregate Community of Garbage Collectors

Table 1. The Frequency Distribution of Worm Eggs Count on Finger nails Sample Aggregate Community of Garbage Collectors (n= 35)

Worm Eggs	Frequency	Percentage
Positive	9	25,7%
Negative	26	74,3%
Total	35	100

Table 1 showed that from 35 respondents who their fingernails were checked 25.7% was positive that egg worms have been found.

Table 2. The Frequency Distribution of Worm Eggs Count on Fingernail Sample on Aggregate Community of Garbage Collectors(n= 35)

Worm Types	Frequency	Percentage
<i>Ascaris lumbricoides</i>	5	55,6%
<i>Trichuris trichuira</i>	2	22,2
<i>Hookworm</i>	2	22,2%
Total	9	100%

Table 2 showed that from 9 respondents who positive that egg worms have been found on their fingernails 5 (55.6%) respondents were found *Ascaris lumbricoides*, 2 (22.2%) respondent were found *Trichuris trichuira*, and 2 (22.2%) respondents were found *Hookworm*.

Hemoglobin (Hb) levels

Hb levels on aggregate community of garbage collectors were between 9.5 g/dl – 16.5 g/dl. Based on that data there was found low Hb level or the value lower than Department of Health in 2011, between 13 - 18 g/dl.

Correlation Between The Presence of Worm Eggs on Fingernails Sample And Hemoglobin Levels

Based on the statistical test result of Spearman's rho was obtained that the presence of worm eggs on nails sample categorized has strong correlation with Hb levels on aggregate community of garbage collector (pvalue= 0.000; α = 0.05; r = -0.930). Negative value at coefficient correlation means that if there are no worm eggs found in the nails sample, then the value of Hb level increase or higher.

DISCUSSION

The Presence of Worm Eggs on Nails Sample on Aggregate Community of Garbage Collectors

Garbage collector is a job which full of risks. Besides being able to get an accident (Auler et al., 2014; Ferraz et al., 2012) because of sharp garbage which is collected (Lazzari et al., 2011), garbage collector also susceptible to get disease because of work related with garbage. Garbage has many types and characteristics, such as drying garbage and wet garbage, solid waste and liquid waste, organic and inorganic garbage, and also infectious and non-infectious garbage. Garbage characteristic that is heterogeneous present a greater risks of health problems for the garbage collector community.

Garbage is material or goods are no used again and it as always been a by- product of human activity. If the materials that is no wanted again, it will be thrown. Throwing unused materials anywhere and it often has direct contact with soil which makes possibility where the soil will be contaminated with various diseases (Adeyeba, 2002) including parasitic worms.

Many types of worms or parasitic worms can be found in a variety of habitats and place of its developments in soil, such as *Ascaris lumbricoides*, *Trichuris trichiura*, dan *Hookworm*. This species are well known as STHs caused STHs infections (Mara et al., 2010). Vermeire et al., (2012) stated that STHs infection are world problems that until now it has not been resolved properly.

The incidence of STHs infections can be caused by garbage collectors activities in finishing their work often or even not using appropriate personal protective equipment, such as waterproof shoes, waterproof gloves and masks. Furthermore, according to (Dewi et al., 2017; Mara et al., 2010) stated that thus worms above are intestinal worms which are often found in individual whose lack of personal hygiene, lack of clean water access, and lack of knowledge about health and low socio- economic communities.

Diagnosis enforcement in order to ensure individual has STHs infections, such as by examining worms with fecal sample, because STHs worms which enter the body through digestion or skin pores then eventually live and develop in the intestine. As a first step to determine the presence of worms in the body through examination of STHs eggs in nails sample.

The nail is part of hands and feet, it is the first organ that touches with whatever we hold and touch directly. Nail structure and shape in such way is very possible once dirt or other objects are tucked and stored. The result of observation on respondents' nails showed that 60% looks dirty black because of dirt that is tucked in the nail. Further, the results of worm eggs examination at respondents' nails sample are found 9 (25.7%) has positive worm eggs. From 9 positive respondents, 5 (55.6%) has positive *Ascaris lumbricoides*, 2 (22.2%) has positive *Trichuris trichiura*, dan 2 (22.2%) has positive *Hookworm*.

Seeing thus condition that exist, garbage collectors habits who give less attention to their personal hygiene are very susceptible to worm infections. The garbage collectors habit that never wash their hands and feet properly after work or working while smoking when the condition of the hand is very dirty, it is very possible for worm eggs enter the body. If worm eggs enter the body, so they can grow and reproduce in the intestines.

Garbage collectors' behavior that reluctant to use personal protective equipment properly and complete is also becomes the factors where worm eggs get into part of the body, such as mouth, hands (fingernails), and feet. *Ascaris lumbricoides* and *Trichuris trichiura* can infect the garbage collectors because swallow egg worms in their hands because they are not use waterproof rubber gloves. Hookworms larvae infect the garbage collectors by penetrate to the skin pores because they are not using proper self-personal protective equipment (Islami et al., 2014; Pullan et al., 2014).

Rianda (2014) stated that hand hygiene (nails) and feet (nail) are an important indicator in keeping and maintaining personal hygiene. Many kinds of diseases or germs get into the body through nails. Therefore, nails must always be kept in order to get clean and health. Umar (2008) added that clean and healthy living behavior such hands washing use soap with running water has important role in preventing STHs infections. Because hands washing use running water and soap is more effective to clean dirt, dust, and egg worms that stick on the skin surface.

Besides that, nails should be cut frequently. Short nails will clean easily (<https://doktersehat.com>). So that, it can prevent the occurrences of disease transmission through nail intermediaries.

Hemoglobin (Hb) Level of Garbage Collectors

Hemoglobin is a molecule which has basic function for oxygen (O₂) transport in blood (Andersen et al., 2012) and carbon dioxide (CO₂). Hb contain from globin (four polypeptide chains which is consisting of two unit alpha and two units beta) and heme (containing iron atom and porphyrin ring: a red pigment). Iron pigment of Hb joins with oxygen. Hb which carries blood oxygen (in artery) has light red color then Hb which lack of oxygen (in vena) has dark red color. One gram of Hb carries 1.34ml oxygen. This transport capacity is related to the Hb levels not the number of red blood cells (Kemenkes R.I, 2011).

As the important components in human living, Hb becomes crucial thing that must be kept in normal range condition. Kemenkes R.I. (2011) stated that normal value of Hb between male and female has different range. The normal range for Hb is: for men 13 - 18 g/dl and for women 12 - 16 g/dl in general levels. However, the normal range of Hb generally is 12 g/dl. If the value of Hb levels less than 12 g/dl is well known as anemia.

Based on the Hb examination at garbage collectors there was found the variation value between one and others. The range of Hb is obtained between 9.5 g/dl – 16.5 g/dl. From 35 respondents,

14 (40%) respondents have range of Hb level between 9.5 – 12.9 g/dl. Thus value if it is compared with normal range, means that the respondent has low Hb level. But if seen from statement of Kemenkes R.I. (2011) that the normal range for Hb level generally is 12 g/dl, so there was 8 respondents who have low Hb levels.

Low of Hb level is well known as anemia. Anemia is often associated with oxygen delivery disruption that caused intolerance activities and can reduce quality of live for adults. Some sources stated that low Hb concentration is often associated with increasing of mortalities (Martinsson et al., 2014). The effect of low Hb levels is very dangerous for human living, hence this is needs to be prevented so that cases do not occur and increased incidence of anemia. Including prevent soil transmitted helminth (STHs) infections caused by *Ascaris lumbricoides*, *Trichuris trichiura*, or *Hookworm*.

Correlation Between The Presence of STHs Worm Eggs on Fingernails Sample And Hemoglobin (Hb) Level

Nail is an organ that has important role in human life, such as 1) Protect fingertips that are full of nerves and sensitive veins under the nails 2) Give touching stimuli sensitivity. Because in fingertips there are many receptors that have function to deliver touch stimulus when we touch an object, so we can feel touching with object that we are touched 3) as balancing power when fingertips touch an object. This condition will increase fingers sensitivity although on nails without nerve endings 4) Epidemis at the base of the nail has function to protect from dirt. 5) Help processing to prevent or grip objects that is done by fingers; 6) On the feet, nails give a balancing pressure on the toes to help balancing and spatial awareness; 7) abnormal nail appearance and shape or un usual can be used as a an indicator for health workers in further examination; 8) nails can also be used as parts of the body that increase attractiveness for the owner (<https://www.galena.co.id/q/>).

Nails position on fingertips gives an effect on nails can direct touch or indirect with other parts of the body. Even in terms of eating, nails become parts that often come into contact with food that enter a person's mouth. Strategic nails' position can give advantages for human life sustainability. But, according to Cointreau (2006); Eassa et al. (2016) stated that when nails in dirt condition, contaminated by many kinds of diseases, including STHs egg worms (parasite) that can infect the human digestive system through fecal- oral route, it is very dangerous for human living.

The presence of egg worms in nails examination through laboratory test is needed to get serious attention. Nails have been a major part of the end of hand organ can become a media for STHs egg worms to enter the body. If egg worms enter the body, they will hatch, grow, and develop in the digestive channel and it will threat that individual life.

Diagnosis enforcements of the presence STHs worms in digestive channel are by doing fecal testing laboratories (Kemenkes R.I., 2011). It also can try doing Hb testing in positive someone

who found egg worms in his nails' sample. Hypothesis that there was a correlation between the presence of egg worms on nails and the value of Hb level of garbage collectors have been answered with p value= 0.000; α = 0.05; r = -0.930. Where, garbage collectors whose nailssample is found STHs egg worms has lower Hb level if compared to someone who did not found in similar worms eggs.

When worms are entering the intestinal mucosa, then the intestinal mucosa will be irritated (Gandahusada et al., 2004; Muller, 2000; Sutanto et al., 2008). So, the intestinal worms' infections, especially *Hookworm* infections and *Trichuris trichiura* had been proved that they have relationship with anemia (Drake et al., 1994; Friedman et al., 2005; Hotez et al., 2004; Ndomugyenyei et al., 2002; Yatich, 2008). One of a predictor that caused anemia because of *Hookworm* infections and other worms types (Kinung'hi et al., 2014). Decreasing of Hb level on infected person who has *Hookworm* infections because worms in the intestine also suck the hospes' blood (Neva et al., 1994; Palgunadi, 2008), so that person loses much intestinal blood (Hotez et al., 2004; Yatich, 2008). But if the worm types in the intestine is *Trichuris trichiura*, although it also suck the blood as part of their food, the biggest blood loss that causes anemia because of dysentery and damaging on the cecum mucous layer.

CONCLUSION

Soil Transmitted Helminthiasis (STHs) infections are problem that caused multi problems in human life. STHs infections can cause a person result in anemia and malnutrition and other health problems. Maintain personal hygiene by always washing hands after touching various media that allow intestinal worms and use appropriate personal protective equipment properly is highly suggested.

REFERENCES

- [1] Adeyeba, O. A., and J. A. A. (2002). Pathogenic intestinal parasites and bacterial agents in solid wastes. *East African Medical Journal*, 79, 604–610.
- [2] Andersen, C. B. F., Torvund-Jensen, M., Nielsen, M. J., de Oliveira, C. L. P., & Hersleth, H.-P. (2012). Structure of the haptoglobin-haemoglobin complex. *Nature; London*, 489(7416), 456–9.
- [3] Apa fungsi kuku pada tubuh manusia? (n.d.). Retrieved from <https://www.galena.co.id/q/>
- [4] Auler, F., Nakashima, A. T., & Cuman, R. K. (2014). Health Conditions of Recyclable Waste Pickers. *Journal of Community Health; New York*, 39(1), 17–22. <https://doi.org/10.1007/s10900-013-9734-5>
- [5] Blair, P., & Diemert, D. (2015). Update on Prevention and Treatment of Intestinal Helminth Infections. *Dordrecht*, 17(3), 1–8. <https://doi.org/DOI:10.1007/s11908-015-0465-x>

- [6] Burhanudin, Budiyo, & Mulasari. (2008). Faktor- faktor yang berhubungan dengan kelainan kulit pada petugas pengangkut sampah di Kota Yogyakarta. *Jurnal Kesmas*, 2(1), 43–53.
- [7] Chimbari, M. J. (2012). Enhancing schistosomiasis control strategy for Zimbabwe: building on past experience. *J Parasitol Res*. 2012. <https://doi.org/10.1155/2012/353768>
- [8] Cointreau, S. (2006). Occupational and environmental health issues of solid waste management: Special emphasis on middle- and lowerincome countries. *Jurnal Kesmas. Volume 2(1). Hal. 43-53.*, 2(1), 43–53.
- [9] Dewi, N. L. G. D., & Laksmi, D. A. A. S. (2017). Hubungan perilaku higienitas diri dan sanitasi sekolah dengan infeksi soil transmitted helminths pada siswa kelas III-VI Sekolah Dasar Negeri no. 5 Delod Peken Tabanan tahun 2014. *E-Jurnal Medika*, 6(5), 1–4.
- [10] Drake, L., Korchev, Y., Bashford, L., Djamgoz, M., Wakelin, D., Ashall, F., & Bundy, D. (1994). The major secreted product of the whipworm, *Trichuris*, is a pore-forming protein. *Philos Trans R Soc Lond B Biol Sci*, 257, 255–61.
- [11] Eassa, S. M., El-Wahab, E. W. A., Lotfi, S. E., El Masry, S. A., & Shatat, H. Z. (2016). Risk factors associated with parasitic infection among municipality solid-waste workers in an Egyptian Community. *The Journal of Parasitology; Lawrence*, 102(2), 214–221. <https://doi.org/10.1645/15-782>
- [12] Ferraz, L., Gomes, M. H. A., & Busato, M. A. (2012). O catador de materiais recicláveis: Um agente ambiental [The collector of recyclable materials: An environmental agent]. *Cadernos EBAPE.BR*, 10(3), 763–768.
- [13] Friedman, J. F., Kanzaria, H. K., & McGarvey, S. T. (2005). Human schistosomiasis and anemia: the relationship and potential mechanisms. *Trends Parasitol*, 21(8), 386–392.
- [14] Gandahusada, S., Hahude, H. D., & Pribadi, W. (2004). *Parasitologi kedokteran* (3rd ed.). Jakarta: Balai penerbit FKUI.
- [15] Hotez, P. J., Brooker, S., & Bethony, J. M. (2004). Current concepts: Hookworm infection. *N Engl J Med*, 351(8), 799–808.
- [16] Islami, L. N., Sulastrianah, & AsfiahUdu, W. O. S. (2014). Perbedaan kejadian infeksi cacing antara petugas pengangkut sampah yang menggunakan alat pelindung diri dengan petugas pengangkut sampah yang tidak menggunakan alat pelindung diri. *Medula*, 2(1), 108–111.
- [17] Kemenkes, R. I. (2011). *Pedoman interpretasi data klinik*. Jakarta: Kemenkes R. I.
- [18] Kinung'hi, S. M., Magnussen, P., Kaatano, Godfrey M. Coleman, K., & Vennervald, B. J. (2014). Malaria and Helminth Co-Infections in School and Preschool Children: A Cross-Sectional Study in Magu District, North-Western Tanzania. *PLoS One; San Francisco*, 9(1). <https://doi.org/10.1371/journal.pone.0086510>
- [19] Lazzari, M. A., & Reis, C. B. (2011). The perception of urban garbage collectors of Dourados, in the state of Mato Grosso do Sul, regarding the biological risks involved in their work routine. *Ciência & Saúde Coletiva; Rio de Janeiro*, 16(8), 3437–3442.

- <https://doi.org/10.1590/S1413-81232011000900011>
- [20] Manfaat rutin memotong kuku. (n.d.). Retrieved from <https://doktersehat.com/>
 - [21] Mara, D., Lane, J., Scott, B., & Trouba, D. (2010). Sanitation and health. *PLoS Medicine*, 2010; 7(11)., 7(11).
 - [22] Martinsson, A., Andersson, C., Andell, P., Koul, S., & Engström, G. (2014). Anemia in the general population: prevalence, clinical correlates and prognostic impact. *European Journal of Epidemiology; Dordrecht*, 29(7), 489–98. <https://doi.org/10.1007/s10654-014-9929-9>
 - [23] Midzi, N., Chimbari, M. J., Tshuma, C., Charimari, L., & Mhlanga, G. (2014). Distribution of schistosomiasis and soil transmitted helminthiasis in Zimbabwe: towards a national plan of action for control and elimination: e3014. *PLoS Neglected Tropical Diseases; San Francisco*, 8(8), 10.1371/journal.pntd.0003014.
 - [24] Mulasari, S. A., & Maani, D. (2013). Relationship between habits to use personal protective equipment and personal hygiene with occurrence of helminths infection on garbage workers in Yogyakarta City. *Jurnal Ekologi Kesehatan*, 12(2), 161 – 170.
 - [25] Muller, R. (2000). *Worms and Human Diseases*. (2nd editio). CABI publishing International.
 - [26] Ndomugenyi, R., Kabatereine, N., Olsen, A., & Magnusses, P. (2002). Malaria and hookworm infections in relation to heamoglobin and serum ferritin levels in pregnancy in Masindi district, Western Uganda. *Transactins of the Royal Society of Tropical Medicine and Hygiene* 102.:, 102, 130–36.
 - [27] Neva, A., & Brown, H. W. (1994). *Basic clinical parasitology* (6th ed.). Prentice-Hall Intenational Inc.
 - [28] Noviasuti, A. R. (2015). Infeksi soil transmitted helminths. *Majority*, 4(8), 107–115.
 - [29] Ottay, R. I. (2010). Hubungan antara perilaku pemulung dengan kejadian penyakit cacangan di Tempat Pembuangan Akhir Sampah Sumompo Kota Manado. *Jurnal Biomedik*, 2(1), 38–43.
 - [30] Palgunadi, B. U. (2008). *Faktor-faktor yang mempengaruhi kejadian kecacangan yang disebabkan oleh soil tranmitted helminths di Indonesia*. Surabaya: FK Wijaya Kusuma.
 - [31] Pullan, R. L., Smith, J. L., Jasrasaria, R., & Brooker, S. J. (2014). Global Number of infection and disease burder of soil transmitted helminth infection in 2010. *Parasit Vectors*, 7(37).
 - [32] Ratag, B. T., Maramis, F. R. R., & Dareda, K. (2011). Hubungan antara higiene perorangan dengan infestasi cacing usus pada siswa Sekolah Dasar Negeri 119 Manado. *Buletin IDI Manado.*, 19–25.
 - [33] Rianda, D. P. (2014). Pengetahuan dan tindakan personal hygiene pemulung sampah di TPA Ganet Tanjungpinang. *Jurnal Kesehatan*, V(2), 162–166.
 - [34] Sutanto, I., Ismid, I. S., Sjarifudin, P. K., & Sungkar, S. (2008). *Buku Ajar Parasitologi Kedokteran*. Jakarta: Balai Penerbit FKUI.
 - [35] Umar, Z. (2008). Perilaku cuci tangan sebelum makan dan kecacangan pada murid SD di

- Kabupaten Pesisir Selatan Sumatera Barat. *Jurnal Kesehatan Masyarakat*, 2(6), 249–54.
- [36] Vermeire, J. J., Lantz, L. D., & Caffrey, C. R. (2012). Cure of hookworm infection with a cysteine protease inhibitor. *PLoS Neglected Tropical Diseases; San Francisco*, 6(7). <https://doi.org/10.1371/journal.pntd.0001680>
- [37] WHO. (2013). *Schistosomiasis Progress report 20001–2011 and strategic plan 2012 – 2020*.
- [38] Yajima, A., Mikhailov, A., Mbabazi, P. S., Gabrielli, A. F., & Minchiotti, S. (2012). Preventive Chemotherapy and Transmission Control (TCT) databank: a tool for planning implementation and monitoring of intergrated preventive chemotherapy for control of neglected tropical diseases. *Trans. R. Soc. Trop. Med. Hyg*, 106, 215 – 222.
- [39] Yatch, N. J. (2008). *The effect of malaria and intestinal helminth coinfection on birth outcomes in Ghana*. ProQuest Dissertations Publishing.