



The Relation between Hygiene with Soil- transmitted Helminthiasis and Giardiasis on the Elementary School Children in the Slums Area of Bagan Deli, District of Medan Belawan

Adelina Haryani Sinambela*, A.A. Depari, Endang H. Gani

Parasitology Department, Faculty of Medicine, University of Sumatera Utara, Indonesia

Abstract : Soil-transmitted helminthiasis and giardiasis mostly infect elementary school children, especially in tropical and developing countries. Hygiene is the important risk factor in the transmission of these infections. The aim of this research was to determine the correlation between hygiene and soil-transmitted helminthiasis and giardiasis in the elementary school children in slums area. The research was conducted observationally using a cross-sectional study approach from February to April 2014 on 110 children in slums area of Bagan Deli, District of Medan-Belawan, in the Province of North Sumatra. The subjects were selected randomly by sampling. Stool examination was conducted using the formalin-ether concentration technique. Data related to the hygiene level were taken by interview and observation the environment. The results were analyzed using the Chi square test. The level of good hygiene was 52.7% and the poor was 47.3%. The prevalence of intestinal parasites identified was 61.8% of soil-transmitted helminths, 13.6% of *Giardia lamblia*, 6.4% of the mixed infection of soil-transmitted helminths and *Giardia lamblia*, 10% of *Entamoeba coli*, 1.8% of *Iodamoeba butschlii*, and 0.9% of *Hymenolepis nana*. Statistical analysis showed a correlation between age and soil transmitted helminthiasis ($p=0.031$; CI95% 1.120-5436) and giardiasis ($p=0.025$ CI95% 1.178-16.766). However, there was no correlation between sex and soil transmitted helminthiasis and giardiasis. There was a significant correlation between hygiene and soil- transmitted helminthiasis ($p=0.000$; CI95% 2.183-12.243) and giardiasis ($p=0.001$; CI95% 1.993-43.702). Hygiene education in community might decrease these intestinal parasites infection.

Keywords : Giardiasis, hygiene, soil-transmitted helminthiasis, slums area.

Introduction

Intestinal parasite infection is the cause of health problems mostly in developing countries. According to the World Health Organization (WHO) in 1996, it was estimated that a quarter of the world's population faces chronic intestinal parasite infection.¹ In 2002, WHO estimated the amount of infection due to the soil-transmitted helminths worldwide by *Ascaris lumbricoides* as 1.45 billion cases, 1.3 billion cases hookworms and 1,05 billion cases *Trichuris trichiura*.² While giardiasis caused by *Giardia lamblia* (also called *Giardia intestinalis*) reached 200 million cases around the world³ and as the most intestinal protozoan infection in children.^{4,5,6,7,8,9}

In Indonesia, based on the research conducted by the Level One of the Health Department of North Sumatra on elementary school children in 13 districts/towns between 2003 and 2006, the results showed that the

prevalence of *Ascaris lumbricoides* was 39%, *Trichuris trichiura* was 24%, *Ancylostoma duodenale* and *Necator americanus* were 5%.¹⁰ Meanwhile, there has not been much research to report on the prevalence of *Giardia lamblia* in the children of the city of Medan.

Soil transmitted helminthiasis occurs through accidental ingestion of infectious eggs (*Ascaris lumbricoides* and *Trichuris trichiura*) and skin penetration by hookworm infectious larvae.^{11,12,13} In other way, giardiasis occurs through accidental ingestion of cyst of *Giardia lamblia* from the contamination food or water or direct person to person by faecal-oral transmission.^{16,17} The risk factors that influence the transmission of soil-transmitted helminthiasis and giardiasis, especially in children, are hygiene, slums area and crowded housing, socioeconomic factors, education, knowledge, lack of clean water supply and sanitation.^{7,8,11}

According to Health- related Millennium Development Goals, in Indonesia, 12.12% of city populations live in slum areas.¹⁸ In Medan, North Sumatra, slum areas are spread over 15 districts, one of those is Medan Belawan.¹⁹ The aim of this research was to ascertain the hygiene levels of elementary school children and their correlation with soil- transmitted helminthiasis and giardiasis.

Experimental

Data about the slum areas was taken from the Department of Spatial Planning and Housing, the Provincial Government of North Sumatra.¹⁹ The research was conducted observationally using a cross-sectional study approach in four elementary schools in BaganDeli, in Medan Belawan, North Sumatra from February to March 2014. The inclusion criteria was all the children in grades 1-6 and those who wanted to be the subjects of research, as indicated by a completed informed consent being signed by their parents. The criterion of exclusion was all the children who had taken anti helminthics medicine and anti protozoan medicine in the previous one month. Through calculations, a sample of 110 children was obtained by using random sampling in four elementary schools. The data was taken from a questionnaire completed in a direct interview and observation to understand the condition and environment of the research. The questionnaire covering the habits of washing hands with soap and water; defecation; being in contact with soil and the use of footwear; the cleanliness of nails and cleaning raw food with water before eating. The responses to the questions were categorized as good and poor hygiene. The stool examination was conducted by collecting the stool in a plastic pot and examining it using the of formalin-ether concentration technique. The soil-transmitted helminthiasis and giardiasis were marked by the presence of their ova and cysts in stool.^{20,21,22} Statistical analysis was applied to prove the relationship between two qualitative variables by using Chi square test; p value of <0.05 was considered to be statistically significant.

Results

A. Respondents' Characteristic

The respondents in the research were children from four elementary schools located in Bagan Deli, Medan Belawan. The schools were the public schools SD Negeri 060970, SDNegeri 065009, private elementary school Al-Washliyah and private elementary school HKBP Teladan. The research subjects were mostly 6 to 9 years old (53.6%), female (53.6%) (table 1).

Table 1.Responden Characteristic

Characteristic	n	%
Age		
6-9 years	57	51.8
10-13 years	53	48.2
Sex		
Male	51	46.4
Female	59	53.6
School		
SD Negeri 060970	42	38.2
SD Negeri 065009	36	32.7
SD Swasta Al-Washliyah	22	20
SD Swasta HKBP Teladan	10	9.1

B. Intestinal Parasite Prevalence

Table 2 shows the prevalence of intestinal parasite infection among the children. There were 68 subjects (61.8%) were infected by single soil- transmitted helminths, 15 subjects (13.6%) were infected by single *Giardia lamblia* and 7 subjects (6.4%) were infected by mixed soil- transmitted helminths and *Giardia lamblia*. The stool examination also identified other intestinal parasites, which were *Entamoeba coli*(10%), *Iodamoeba butschlii*(1.8%) and *Hymenolepis nana*(0.9%).

Table 2. Intestinal Parasites Prevalence

Type of Parasite	n	%
Soil- transmitted helminths	68	61.8
<i>Giardia lamblia</i>	15	13.6
Soil- transmitted helminths and <i>Giardia lamblia</i>	7	6.4
<i>Entamoeba coli</i>	11	10
<i>Iodamoebabutschlii</i>	2	1.8
<i>Hymenolepis nana</i>	1	0.9

C. Correlation between Respondent Characteristic and Soil- transmitted Helminthiasis

The correlation between respondent characteristic and soil- transmitted helminthiasis are shown in Table 3. Statistic analysis showed as insignificant correlation between age and soil- transmitted helminthiasis (p=0.031 CI95% 1.120-5.436). However, sex had no significant association with soil- transmitted helminthiasis.

Table 3. The Correlation Between Respondent Characteristic and Soil- Transmitted Helminthiasis

Characteristic	Soil- transmitted Helminthiasis						P value	CI95%
	Positive		Negative		Total			
	n	%	n	%	n	%		
Age								
6-9 years	41	60.3	16	38.1	57	51,8	0.031	1.120-5.436
10-13 years	27	39.7	26	61.9	53	48,2		
Sex							0.333	0.683-3.205
Male	29	42.6	22	52.4	51	46,4		
Female	39	57.4	20	47.6	59	53,6		

D. Correlation between Respondent Characteristic and Giardiasis

There was a significant correlation between age and giardiasis (p=0.025 CI95% 1,178-16,766). However, no significant association between sex and giardiasis (Table 4).

Table 4. The Correlation Between Respondent Characteristic and Giardiasis

Characteristic	Giardiasis						P value	CI 95%
	Positive		Negative		Total			
	n	%	n	%	n	%		
Age								
6-9 years	12	80	45	47,4	57	51,8	0,025	1,178-16,766
10-13 years	3	20	50	52,6	53	48,2		
Sex							0,589	0,243-2,156
Male	8	53,3	43	45,3	51	46,4		
Female	7	46,7	52	54,7	59	53,6		

E. Correlation between Hygiene and Soil-transmitted Helminthiasis

Table 5 shows the significant correlation between hygiene and soil-transmittedhelminthiasis. Statistical analysis identified that 42 of 52 (61.8%) children who did notpractice good hygiene suffer from soil-transmitted helminthiasis(p=0.000; CI95% 2.183-12.243).

Table 5.The Correlation Between Hygiene and Soil- Transmitted Helminthiasis

Hygiene	Soil- transmitted Helminthiasis						P value	CI95 %
	Positive		Negative		Total			
	n	%	n	%	n	%		
Good	26	38.2	32	76.2	58	52.7	0.000	2.183-12.243
Poor	42	61.8	10	23.8	52	47.3		
Total	68	100	42	100	110	100		

F. Correlation between Hygiene and Giardiasis

The statistical analysis shows that 13 of 52 (47.3%) children who did not practice good hygiene suffered from giardiasis (p=0,001; CI95% 1,993-43,702) (Table 6)

Table 6.The Correlation Between Hygiene and Giardiasis

Hygiene	Giardiasis						P value	CI 95 %
	Positive		Negative		Total			
	n	%	n	%	n	%		
Good	2	13.3	56	58.9	58	52.7	0.001	1.993-43.702
Poor	13	86.7	39	41.1	52	47.3		
Number	15	100	95	100	110	100		

Discussions

The results of this research identified good levels of hygiene of 52.7% of subjects had good levelsog hygiene and 47.3% with poor levels of hgiene. Soil- transmitted helminths prevalence was 61.8%, 13.6% with *Giardia lamblia* and6.4% with mixed infections of soil- transmitted helminths and *Giardia lamblia*.

According to Albright’s research on elementary school children, good hygiene can reduce the number of intestinal parasite infection cases. The hygiene habits aforementioned consist of: washing hands with soap before eating and after passing feces; passing feces in a toilet which has a septic tank; avoiding direct contact with the soil; using footwear; not putting unwashed hands into the mouth; having clean nails; not eating raw food or drinking unboiled water.²³

In this research, 61.8% subjects contracted single soil-transmitted helminths infection. This was similar with Jiero et al in their observation on elementary school children within the Medan Belawan District, North Sumatra Province which found 65.4% suffered with soil-transmitted helminthiasis.²⁴

Table 3 shows a significant correlation between age and soil-transmitted helminthiasis (p value = 0.031 CI95% 1.120-5.436). This supports the statement of Brooker that the highest soil- transmitted helminths intensity occurs in the age range of 4-10 years.²⁵

Age is an important risk factor for the incidence of intestinal parasite infection. Cook et al in their study found that *Giardia lamblia* infection was higher among the younger children.²⁶The result was in accordance with Yoder’s report that explains the highest giardiasis prevalence is identified in children aged 1-9 years old.²⁷ This is in line with Table 4 that presents the significant correlation between age and giardiasis (p = 0.025 IK95% 1.178 - 16.766).

Table 5 shows a significant correlation between hygiene and soil-transmitted helminthiasis STH. This is consistent with other research which explains that the low level of hygiene marked by the lack of handwashing with soap and water; not using a lavatory when defecating; the habit of having direct contact with the ground and seldom using footwear; the habit of putting fingers into the mouth or biting the nails; the length of the nails; poor hygiene conditions and the lack of the habit of washing raw food before it is consumed, are all connected with the occurrence of soil-transmitted helminthiasis.^{28,28,30,31,32,33}

The significant correlation between hygiene and giardiasis in Table 6, is in line with the research of Gelaw, which reports that the majority of school age children who have a low level of hygiene and are not in the habit of washing their hands with soap and water has a significant association with the occurrence of intestinal parasitic infections.³⁴ Similarly, Bello's research findings report a correlation between nail biting and the risk of giardiasis.³⁵ *Giardia lamblia* cysts can survive for a few weeks or a few months in water or moist environments, in fact, can survive chlorine and ultraviolet radiation,³⁶ however, the practice of cooking food and boiling water can prevent this infection from happening.

Conclusions

The result of this research presents the prevalence of single soil-transmitted helminthiasis, single giardiasis and the mixed of soil-transmitted helminthiasis and giardiasis in elementary school children in slum areas. A significant correlation has been identified among age, hygiene, soil-transmitted helminthiasis and giardiasis. Educate the community on proper hygiene might decrease these intestinal parasites infection.

References

1. Uga S, Hoa NTV, Thuan LK, Noda S, Fujimaki Y., Intestinal parasitic infections in schoolchildren in a suburban area of Hanoi, Vietnam, Southeast Asian Journal of Tropical Medicine and Public Health, Nov 2005, 36,6.
2. World Health Organization. Prevention and control of schistosomiasis and soil-transmitted helminthiasis. 2002. Downloaded from : http://whqlibdoc.who.int/trs/WHO_TRS_912.pdf April 2013
3. Pierce KK, Kirkpatrick BD., Update on human infections caused by intestinal protozoa, Current opinion in Gastroenterology, 2008, 25, 12-17.
4. Sanchez-Vega JT, Tay-Zavala J, Aguilar-Chiu A, Ruiz-Sánchez D, Malagon F, Rodríguez-Covarrubias JA, et al., Cryptosporidiosis and other intestinal protozoan infections in children less than one year of age in Mexico City, Am. J. Trop. Med. Hyg., 2006, 75(6), 1095-8.
5. Wongstitwilairoong B, Srijan A, Serichantalergs O, Fukuda CD, McDaniel P, Bodhidatta L, Mason CJ., Intestinal parasitic infections among pre-school children in Sangkhlaburi, Thailand, Am. J. Trop. Med. Hyg., 2007, 76(2), 345-350.
6. Reither K, Ignatius R, Weitzel T, Seidu-Korkor A, Anyidoho L, Saad E, et al., Acute childhood diarrhea in northern Ghana: epidemiological, clinical and microbiological characteristics. BMC Infectious Diseases, 2007, 7, 104.
7. Mehraj V, Hatcher J, Akhtar S, Rafique G, Beg MA., Prevalence and factors associated with intestinal parasitic infection among children in an Urban Slum of Karachi, PloS ONE, 2008, 3(11).
8. Alyousefi NA, Mahdy MAK, Mahmud R, Lim YAL., Factors associated with high prevalence of intestinal protozoan infections among patients in Sana'a City, PloS One, 2011, 6, 7.
9. Nkrumah B, Nguah SB., *Giardia lamblia*: a major parasitic cause of childhood diarrhoea in patients attending a district hospital in Ghana, Parasites & Vectors, 2011, 4, 163.
10. DinasKesehatanPropinsi Sumatera Utara, Laporanhasilkegiatan program seksi P2ML sub dinas P2P & PL Medan, DinasKesehatanPropinsi Sumatera Utara,2008.
11. Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D, et al., Soil-transmitted helminth infections : ascariasis, trichuriasis, and hookworm, Lancet, 2006, 367, 1521-1532.
12. Brooker S, Clement A, Bundy DAP., Global Epidemiology, Ecology and Control of Soil-transmitted Helminths Infections,AdvParasitol, 2006, 62, 223-65.
13. Mascarini-Serra L., Prevention of soil-transmitted helminth infection, Journal of Global Infectious Diseases, 2011, 3.
14. John DT, Petri WA., Lumen-dwelling protozoa; the intestinal nematodes, Markelland Voge's Medical Parasitology, Ninth edition, Elsevier, 2006, 22-78 & 239-273.

15. Roberts L, Janovy J., Other flagellated protozoa; Nematodes: trichurida and dioctophymatida, enoplean parasites; Nematodes : strongylida, bursateRhabditians; Nematodes : ascaridida, intestinal large roundworm, Gerald D. Schmidt & Larry S. Roberts' Foundations of Parasitology, Seventh edition, McGraw Hill, 2005, 89-106, 397-410, 417-430, 431-444.
16. Hedayati A, Sadraei J, Ghofranipour F., Relationship between the rate of giardiasis and knowledge and practice of prevention in primary school children in South of Tehran, Parasitol Res., 2008, 104, 169-171.
17. Farthing MJG, Cevallos AM, Kelly P., Intestinal protozoa, In: Cook GC, Zumla AI, editors, Manson's Tropical Diseases, Twenty-second edition, Elsevier, 2009, 1375-1406.
18. World Health Organization, Health-related millenium development goals, 2012. Downloaded from : http://www.searo.who.int/entity/health_situation_trends/documents/MDG_Brochure_2012.pdf Juni 2013.
19. Dinas Penataan Ruang dan Pemukiman Bidang Perumahan dan Pemukiman Pemerintah Provinsi Sumatera Utara, Identifikasi & pemuktahiran data perumahan dan pemukiman di Sumatera Utara, Dinas Penataan Ruang dan Pemukiman Bidang Perumahan dan Pemukiman Pemerintah Provinsi Sumatera Utara, 2012.
20. World Health Organization, Basic laboratory methods in medical parasitology, 1991. Downloaded from : http://whqlibdoc.who.int/publications/9241544104_%28part1%29.pdf Februari 2013.
21. Garcia LS, Bruckner DA., Diagnostic Medical Parasitology, 4th ed., Washington, DC ASM Press, 2001.
22. Suwansaksri J, Nithiuthai S, Wiwainitkit V, Soogarun S, Palatho P., The formol-ether concentration technique for intestinal parasite: comparing 0,1 N sodium hydroxide with normal saline preparations, Southeast Asian J Trop Med Public Health, 2002, 33(suppl 3).
23. Albright JW, Hidayati NR, Basaric- Keys J., Behavioral and hygienic characteristics of primary school-children which can be modified to reduce the prevalence of geohelminth infections: a study in Central Java, Indonesia, Southeast Asian Journal of Tropical Medicine and Public Health, 2005, 36,3.
24. Jiero S, Ali M, Pasaribu S, Pasaribu AP. Correlation between Eosinophil Count and Soil- transmitted Helminth Infection in Children. Asian Pasific Journal of Tropical Disease; 5(10); pp. 813-816, 2015
25. Brooker S, Bundy DAP. Soil-transmitted helminthes (geohelminthiasis). In: Cook GC, Zumla AI, editors. Manson's Tropical Diseases. Twenty-second edition. Elsevier. 2009. p. 1515-1548
26. Cook DM, et al. A retrospective analysis of prevalence of gastrointestinal parasites among school children in the Palajunoj Valley of Guatemala. J Health Popul Nutr. 2009; 27(1):31-40
27. Yoder JS, Gargano JW, Wallace RM, et al. Giardiasis Surveillance---United States, 2009-2010. In : Surveillance Summaries, September 7, 2012. MMWR 61 (No. SS 05): 13-23
28. Hohmann H, Panzer S, Phimpachan C, Southivong C, Schelp FP. Relationship of intestinal parasites to the environment and to behavioral factors in children in the Bolikhamxay Province of Lao PDR. Southeast Asian J Trop Med Public Health. 2001; 32: 4-13
29. Hesam Al- Mekhlafi M, Atiya AS, Mohammed Mahdy AK, Ariffin WA, Che Abdullah H, Surin J. Pattern and predictors of soil transmitted helminth reinfection among orang asli (aborigine) schoolchildren in Malaysia. Southeast Asian J Trop Med Public Health. 2008; 39 (1)
30. Ahmed A, Hesam Al- Mekhlafi M, Choy SH, et al. The burden of moderate- to- heavy soil- transmitted helminth infections among rural Malaysian aborigines: an urgent need for an integrated control programme. Parasites & Vectors. 2011; 4: 242
31. Sofiana L, Sumarni S, Ipa M. Fingernail biting increase the risk of soil transmitted helminth (STH) infection in elementary school children. Health Science Indones. 2011; 2:81-6
32. Nasr NA, Al- Mekhlafi HM, Ahmed A, et al. Towards an Effective Control Programme of Soil-transmitted Helminth Infections among Orang Asli in Rural Malaysia. Part 2: Knowledge, Attitude, and Practices. Parasites & Vectors. 2013, 6:28
33. Gyorkos TW, Maheu-Giroux M, Blouin B, Casapia M. Impact of health education on soil- transmitted helminth infections in schoolchildren of the Peruvian Amazon: a cluster randomized controlled trial. PLoS Negl Trop Dis. 2013; 7: e2397
34. Gelaw A, Anagaw B, Nigussie B, Silesh B, Yirga A Prevalence of intestinal parasitic infections and risk factors among schoolchildren at the University of Gondar Community School, Northwest Ethiopia: a cross-sectional study. BMC Public Health. 2013; 13: 304
35. Bello J, Nunez FA, Gonzalez OM, Fernandez R, Almirall, et al. Risk factors for Giardia infection among hospitalized children in Cuba. Annals of Tropical Medicine & Parasitology. 2011; 105(1): 57-64

36. Harhay MO, Horton J, Olliaro PL. Epidemiology and control of human gastrointestinal parasites in children. *Expert Rev. Anti Infect. Ther.* 2010; 219-234
