International Journal of Public Health Science (IJPHS)
Vol.3, No.1, March 2014, pp. 43~50
ISSN: 2252-8806

Sanitation of House and School, Personal Hygiene and Infection of Soil Transmitted Helminths (STH) among Elementary School Students

Dina Merisa Damanik[1], Soeyoko[2], Adi Heru Husodo[3]
[1] PAMSIMAS Program in Ministry of Health in Klaten, Center of Java Province, Indonesia
[2] Department of Parasitology, Faculty of Medicine, University of Gadjah Mada, Yogyakarta, Indonesia
[3] Postgraduate Programs, Public Health Sciences, Majoring in Environmental Health, Faculty of Medicine, University of Gadjah Mada, Yogyakarta, Indonesia

Article Info

Article history:

Received Jul 20, 2013
Revised Sept 20, 2013
Accepted Jan 26, 2014

Keyword:

Environmental Sanitation
Personal Hygiene
Soil Transmitted Helminths
Elementary School Students

ABSTRACT

Background: In Indonesia, STH infection still as public health problem particularly in the child of elementary school age. The high of that infection was also supported by bad environmental sanitation and bad personal hygiene. STH infection was one of ten great of frequent diseases in Palue Island and in this region still able can be found an adult worm in feces even from regurgitate.
Objectives: To analyze the correlation between house's environmental sanitation, school sanitation, personal hygiene and STH infection.
Methods: This was observational analytic study by cross sectional design. The location of the study was Palue Island, Sikka Regency, East Nusa Tenggara Province. The sample of the study was student of elementary school in grade 1-6, their amont was 100 students from 8 elementary schools. The sampling was done used proportional random sampling approadh. Diagnosis of STH infection was establised based on worm eggs examination in feces used floatation method. Data collecting was performed used questionnaire, check list and observation which then was analyzed in three analysis (univariate, bivariate, multivariate).
Results: There was significant correlation between house's environmental sanitation (p value 0.043), school's environmental sanitation (p value= 0.000), personal hygiene (p value = 0.032) with STH infection. Descriptive analysis showed that the incidence of STH infection in the students of elementary school in Palue Island was 78%. Low level of house's environmental sanitation of the students (84%), low level of school's environmental sanitation (79%) and bad personal hygiene practice (96%) while for multivariate analysis obtained that personal hygiene was the most influence variable to the STH infection in this region.
Conclusions: There was a significant correlation between house's environmental sanitation, school's environmental sanitation and personal hygiene practice to the STH infection among the students of elementary school in Palue Island, Sikka Regency, East Nusa Tenggara Province.

Corresponding Author:

Dina Merisa Damanik

PAMSIMAS Program in Ministry of Health in Klaten,

Center of Java Province, Indonesia

Email: dina.merisa_damanik@yahoo.com

1. INTRODUCTION

Soil transmitted helminthes (STH) is an intestinal worm infection that is transmitted through soil, is a nematode group that need of soil for their infective development and is known as worm infection disease [1]. The species of STH among others is roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), hookworm (*Ancylostoma duodenale* and *Necator americanus*) [2].

Soil transmitted helminthes causes broad health problem, more than one billion people had infected by minimum one species of STH [3]. Generally, it was estimated that the people which infected by roundworm was 807 million people, by whipworm was 604 million people and by hookworm was 576 million people [4].

Several studies in developing countries showed the high prevalence of STH infection among school children that was in Mozambic there was 53.5% school children was infected by STH [5], in China that was in Bulangshan region the worm infection incidence still high that was by *Ascaris lumbricoides* at 68.2%, by *Trichuris trichiura* at 70%, by hookworm at 75.9% and in Pu'er region was also still high that was by *Ascaris lumbricoides* at 9.2%, by *Trichuris trichiura* at 56.5% and by hookworm at 66.9% [6].

The prevalence of STH infection in Indonesia was also still high, and the incidence was still distributed broadly in the rural and urban area, particularly in rural area, worm infection may suffered by more than 60% population that had their feces examined [7], in the rural area of Ambon Island, Maluku, 51.3% of the population that had their feces examined was infected by STH [8]. Worm infection in Indonesia was occurs simultaneously in 60% children [9]. In Semarang Regency, 52% of their child was infected by STH [10]. In South Coast Regency, West Sumatra, 51.4% of their children was infected by STH [11]. In Badung Regency, Bali, there was 33% of elementary school children was infected by STH [12].

The high of this prevalence was caused by tropical climate and high humidity of the air in Indonesia, that is suit environment for the development of the worm as well as bad sanitation and bad hygiene [13]. This was also supported by other study that stated that the access of clean water and latrine ownership had correlation with STH infection incidence [14]-[16].

The prevalence of STH infection was still high in the world, in developing countries, in Indonesia even based on health profile of Sikka Regency, sourced from Sub Office of *P2M-PL* in 2009, worm infection diseases was one of ten most frequent diseases in Sikka Regency, East Nusa Tenggara Province [17]. One of subdistricts in Sikka Regency is Palue Sub District, that call as Palue Island region. Based on health profile from Palue Public Health Center, in 2009 worm infection disease was one of ten most frequent diseases in Palue Island [18]. But this number just the number of public attendance to Public Health Center which desired worm drug because of oftenly it was found some adult worms from their feces or their regurgitation of patiences.

Based on that situation, it was probable that STH infection was still high, so based on the above description it was interested to study on "The sanitation of the houses and school, personal hygiene and soil transmitted helminthes infection in the students of elementary school of Palue Island, East Nusa Tenggara Province.

This study was aimed to analyze the correlation between house's environmental sanitation, school's environmental sanitation and personal hygiene with STH infection in the students of elementary school of Palue Island, Sikka Regency, East Nusa Tenggara Province.

2. RESEARCH METHOD

This study was an observational analytic study used cross sectional design. The study was performed in December 2011 to January 2012. The number of sample was 100 students of elementary school of Palue Island, Sikka Regency, East Nusa Tenggara Province. The dependent variable in this study was soil transmitted helminths (STH) infection and the independent variable was house's environmental sanitation, school's environmental sanitation and personal hygiene.

To knowing the STH infection incidence, thus was performed worm eggs examination in feces used floatation technique. Data collecting was performed used questionnaire, check list and observation and then was analyzed in three analysis (univariate, bivariate, multivariate).

3. RESULTS AND ANALYSIS

3.1. RESULTS

3.1.1 Univariate Analysis

Table 1. Univariate analysis

Variable	Number	%
STH infection (n = 100)		
Positive	78	78
Negative	22	22
Total	100	100
The kind of STH worm eggs (positive=78 students)		
Ascaris lumbricoides	70	89,7
Trichuris trichiura	55	70,5
Hookworm	37	47,4
The kind of STH infection (positive=78 students)		
Ascaris lumbricoides (A.l.)	16	20,5
Trichuris trichiura (T.t.)	2	2,6
Hookworm	2	2,6
A.l + *T.t*	22	28,2
A.l + Hookworm	6	7,7
T.t + Hookworm	4	5,1
A.l + *T.t* + Hookworm	26	33,3
Classification of STH infection		
Single infection	20	25,6
Multiple infection	58	74,4
The availability of clean water in the house (n = 100)		
Not available	19	19
Available	81	81
The availability of latrine in the house (n = 100)		
Not available	57	57
Available	43	43
The availability of waste container in the house (n = 100)		
Not available	81	81
Available	19	19
House's environmental sanitation (n = 100)		
Bad	84	84
Good	16	16
Clean water availability at the school (n = 100)		
Not available	31	31
Available	69	69
Latrine facility availability in the school (n = 100)		
Not available	24	24
Available	76	76
Waste container availability at the school (n = 100)		
Not available	40	40
Available	60	60
Environmental sanitation of the school (n = 100)		
Bad	79	79
Good	21	21
Hand washing habit (n = 100)		
Bad	81	81
Good	19	19
The habit of cutting a fingernail (n = 100)		
Bad	73	73
Good	27	27
The habit of wearing a slipper (n = 100)		
Bad	65	65
Good	35	35
Personal hygiene practice (n = 100)		
Bad	96	96
Good	4	4

Table 1 showed that out of 100 respondents of elementary school students, there were 78% of them was infected by STH. The kind of STH worm eggs that most often infected the students in Palue Island was *Ascaris lumbricoides* (89.7%) and most of them was fertilized eggs that epidemiologically able to transmitt STH infection. There were many students suffered from multiinfection that was infected by more than one kind of worms in their body, their amount was 58%. Base on the availability of clean water, latrine, waste container in their houses and in their school that 84% of their houses environmental sanitation was bad and 79% of their school environmental sanitation was bad. Base on hand washing habit, the habit of cutting a fingernail, the habit of wearing a slipper in the elementary school children then can be concluded that their personal hygiene was bad (96%).

3.1.2. Bivariate Analysis

Table 2. Bivariate analysis

Variable		STH infection				Total		P value
		Positive		Negative				
		n	%	n	%	N	%	
Clean water availability in the house	Not available	14	73,7	5	26,3	19	100	0,759
	Available	64	79,0	17	21,0	81	100	
Latrine availability in the house	Not available	49	86,0	8	14,0	57	100	0,027
	Available	29	67,4	14	32,6	43	100	
Waste container availability in the house	Not available	67	82,7	14	17,3	81	100	0,03
	Available	11	57,9	8	42,1	19	100	
Environmental sanitation of the house	Bad	69	82,1	15	17,9	84	100	0,043
	Good	9	56,3	7	43,8	16	100	
Clean water availability at the school	Not available	28	90,3	3	9,7	31	100	0,046
	Available	50	72,5	19	27,5	69	100	
Latrine availability at the school	Not available	19	79,2	5	20,8	24	100	0,874
	Available	59	77,6	17	22,4	76	100	
Waste container availability at the school	Not available	35	87,5	5	12,5	40	100	0,061
	Available	43	71,7	17	28,3	60	100	
Environmental sanitation of the school	Bad	68	86,1	11	13,9	79	100	0,000
	Good	10	47,6	11	52,4	21	100	
Hand washing habit	Bad	67	82,7	14	17,3	81	100	0,03
	Good	11	57,9	8	42,1	19	100	
The habit of cutting a fingernail	Bad	63	86,3	10	13,7	73	100	0,001
	Good	15	55,6	12	44,4	27	100	
The habit of wearing a slipper	Bad	55	84,6	10	15,4	65	100	0,03
	Good	23	65,7	12	34,3	35	100	
Personal hygiene practice	Bad	77	80,2	19	19,8	96	100	0,032
	Good	1	25,0	3	75,0	4	100	

Table 2 showed the variables which had significant correlation and had no significant correlation to STH infection incidence in Palue Island, Sikka Regency, East Nusa Tenggara Province. The variables with significant correlation was: the availability of latrine in their houses, waste container in their houses, clean water access in their school, environmental sanitation in the house and school, the habit to wash their hand, cutting their fingernail, wearing slipper and personal hygiene.

3.1.3. Multivariate Analysis

Table 3. Multivariate analysis based on house's environmental sanitation, school's environmental sanitation, personal hygiene with STH infection among elementary school students

Variable	*B*	*df*	*Sig*	*Exp B*	*CI Exp B*	
					Lower	*Upper*
Environmental sanitation of the school	2,305	1	0,000	10,026	3,063	32,822
Environmental sanitation of the house	1,452	1	0,034	4,273	1,115	16,374
Personal hygiene	3,292	1	0,008	26,893	2,324	311,207

Logistic regression test obtained that personal hygiene (coefficient value/ Exp B= 26.893) that means that personal hygiene was more dominant to influenced the STH infection incidence in the students of elementary school of Palue Island, Sikka Regency, East Nusa Tenggara Province, Indonesia.

3.2. ANALYSIS

Based on Table 2, the percentage of STH infection in the students of elementary school in Palue Island was 78%, this belongs to high incidence because of this is far above of national number for STH infection that was 40-60% [13]. This number was far higher compared to the number that was obtained in the study by Nurdiana (2005) in Semarang Regency, that was 52%, study by Umar (2007) in Pesisir Selatan Regency, West Sumatra, that was 51.4%, or study by Dewitini (2008) in Badung Regency, Bali, that was 33% [10]-[12]. STH infection actually was the public health problem that generally occurs in elementary school children, this age group was the group in high risk for this illness in many nations in the world particularly in developing worlds [5],[19],[20].

Based on Table 2, there were 64 (79%) of the students had clean water access in their house that was *PAH /penampung air hujan* (water rainfall reservoir) but they were still infected by STH. So in this study, the clean water availability had no significant correlation to STH infection. While in the several previous studies showed there was significant correlation between clean water access with STH infection incidence [14]-[16].

This difference maybe because of they had clean water availability in their house but the quantity was limited, because in Palue Island, the rainfall was low, the rainfall was only occurs in certain season so if in dry season it was very difficult for the people to use water especially to take a bath, wash and latrine. This constrained situations may also made them habituated their thriftily habit in using water even in wet season.

The respondents which had latrine in their houses were only 43%. This showed that latrine ownership was still low, based on this condition maybe the respondents which had no latrine would perform defecation at any place. Several studies showed that no latrine can increased STH infection incidence [15],[16],[21],[22].

Table 2 showed that the respondents which had no waste container was 67 (82.7%) and infected by STH. This study was also supported by study by Ngui et al (2011) that stated that waste container availability had correlation to STH infection incidence [16]. Table 2 showed there was a significant correlation between house's environmental sanitation with STH infection, that was out of 84 respondents with bad house environmental sanitation there was 69 (82.1%) respondents which infected by STH.

Table 2 showed that there was 59 (77%) respondents which their school was already had latrine but the students still infected by STH, this maybe because of the students was not used that school facility but had tendency to performed defecation at any place such as at the forest or their garden and the school's backyard that was probable because of their habit in their house was continued in their school. Other of that maybe because of the student had performed defecation in their house's environment before go to school therefore this was that caused there was no correlation between the availability of latrine in the school with STH infection.

Table 2 showed that there was 43 (71.7%) respondents which their school already had waste container but they still infected by STH. This maybe because of the waste in their school was organic waste of leafs and at 8 elementary schools of study sample it was not found of school canteen so this may cause the waste in their school was not waste that able to triggering the vector such as flies. Thus this was may made there was significant correlation between waste container availability with STH infection in this region.

Based on the result of the study it was obtained that out of 79 respondents which their school's environmental sanitation was bad, there was 68 respondents (86.1%) was infected by STH (Table 2). This study was in line with the study by Ulukanligil & Seyrek (2003) that bad condition of the school's sanitation such as no access for clean water, limited clean water in the school, less of latrine sanitation, there was no soap in the latrine and there was waste pile around the school had significant correlation to STH infection among the students [23].

Table 2 showed that out of 81 respondents which had no habit of washing their hand there was 67 (82.7%) was infected by STH, this was in line with the study by Illechukwu *et al* (2010) that stated that the children which not washing their hand after defecation had tendency to be infected by STH [21]. That was also in line with the study by Umar (2007) that stated that the children which not washing their hand before eating could infected by STH [11]. Those children was infected by STH because their hand that was not clean have correlation with the existence of the germ originated from fecal or dirty soil that contaminated by worm eggs from the soil, as opinioned by Pickering *et al* (2010) [24]. Therefore, tantular and Prasetyo (2011) stated that, if the children have played with the soil or at ground it is advisable to wash their hand after that, not only by clean water but it is advisable to use soap to support cleaning their hand from worm egg that attach on their hand [25]. This opinion was supported by Halder *et al* (2010) that stated that washing a hand

using soap will make a hand cleaner compared to use clean water only, it is advisable to perform it before eating and after defecation [26]. Through the habit of washing a hand we able to prevent STH infection among the elementary school children that was high risk group for STH infection.

STH infection was influenced by the children's habit to play with soil or at a ground that made their fingernail become dirty. This was more severe if their fingernail is long, thus enabling more dirty that attach to their fingernail. Table 2 showed that out of 73 respondents which had no habit of cutting their fingernail there was 63 (86.3%) was infected by STH. This study was in line with the opinion by Onggowalyo (2002) that stated that clean and cared fingernail is reflection of anyone personality, long fingernail and not well cared will be a place for various dirty to attach that contain various material and microorganism among others is bacteria and worm eggs [27]. The transmission of STH infection among others is through dirty hand, dirty nail that probable to contain worm eggs that will be ingested when eating. Therefore according to Gandahusada *et al* (2003), it is advisable that fingernail always be cut to keep short in order to prevent STH infection from hand to mouth [1].

Table 2 showed that out of 65 respondents which had no habit to wearing a slipper there were 55 respondents (84.6%) was infected by STH. This result is in line with the study by Ileshukwu *et al* (2010) and tanner *et al* (2011) that stated that the children which not wearing a slipper regularly when they go out from their houses will had a tendency to be infected by hookworm because of hookworm transmission is by inserting to a skin when the children take a walk by bare foot [21],[22]. Therefore to prevent the contact with the larvae of hookworm it is need to made a habit of wearing a slipper, as opinioned by Haryati (2004) [28].

STH infection is very influenced by personal hygiene. Personal hygiene that has a correlation with STH infection is the custom of washing a hand, cutting a fingernail and wearing a slipper. This is in line with the results of this study that 77 respondents (80.2%) out of 96 respondents which had bad personal hygiene was infected by STH. Considering the personal hygiene practice by the elementary school students, it was probable to occur for STH infection continually or in other words will be able to cause the school children continually get infection. Therefore, Soedarto (2009b) stated that to prevent new infection or re-infection, it is need to improve a personal hygiene practice and environment and need to perform mass and personal treatment by anthelmintic drug [7].

4. CONCLUSION

Based on the results of the study and discussion it can be concluded that "The incidence of *Soil Transmitted Helminths* (STH) infection was still high among the students of elementary schools in Palue Island that was at 78%" with detail as below:

1. There was a significant correlation between environmental sanitation of the house with STH infection among the students of elementary schools in Palue Island. With good environmental sanitation of the house, the lesser the opportunity for STH infection incidence among school children in Palue Island.
2. There was a significant correlation between environmental sanitation of the school with STH infection among the students of the elementary school in Palue Island. With good environmental sanitation of the school the lesser the probability of STH infection incidence among school children in Palue Island.

There was significant correlation between personal hygiene practice with STH infection among the students of elementary school in Palue Island. With good personal hygiene practice the lesser the probability for STH infection incidence among school children in Palue Island.

REFERENCES

[1] Gandahusada, S., Ilahude, D.H., Pribadi, W. *Parasitologi Kedokteran*. Edisi Ketiga. Jakarta: EGC, 2003.
[2] Bethony, J., Brooker, S., Albonico, M., Geiger, S.M., Loukas, A., Diemerl., D., Hotez, P.J. "Soil-Transmitted Helminth Infections: Ascariasis, Trichiuriasis, and Hookworm", *Lancet*, Vol. 367. Pp. 1521-32, 2006
[3] WHO, *Deworming for Health and Developmenth. Report of the Third Global Meeting of the Partners for Parasite Control*. Geneva: World Health Organization, 2005.
[4] Hotez, P.J., Brindley, P.J., Bethony, J.M., King, C.H., Pearce, E.J., Jacobson, J. "Helminth Infections: the Great Neglected Tropical Diseases", *Journal of Clinical Investigation*, Vol. 118. Pp. 1311-21, 2008
[5] Augusto, G., Nala, R., Casmo, V., Sabonete, A., Mapaco, L., Monteiro, J. "Geographic Distribution and Prevalence of Schistosomiasis and Soil-Transmitted Helminths among School Children in Mozambique", *Am.J.Trop.Med.Hyg*, Vol/Issue: 81(5). Pp. 799-803, 2009
[6] Ziegelbauer, K., Steinmann, P., Zhou, H., Du, Z.W., Jiang, J.Y., Furst, T., Jia, T.W., Zhou, X.N., Ulzinger, J. "Self-Rated Quality of Life and School Performance in Relation to Helminth Infections: Case Study from Yunnan, People's Republic of China", *Parasites & Vectors*, Vol. 3. Pp. 61, 2010.
[7] Soedarto, *Penyakit Menular di Indonesia*. *Cacing Protozoa Bakteri Virus Jamur*, Jakarta: Sagung Seto, 2009.

[8] Melianus, S. "Beberapa Aspek Ekoepidemiologi dan Dinamika Populasi Geohelminthes serta Prevalensi dan Distribusinya di Pedesaan Pulau Ambon Maluku", *Disertasi*, Fakultas Kedokteran Universitas Gadjah Mada. Yogyakarta, 2010.
[9] Zulkoni, A. *Parasitologi*, Yogyakarta: Nuha Medika, 2010.
[10] Nurdiana, H. "Pengaruh Tingkat Pengetahuan Pengasuh dari Anak Usia 1-12 Tahun yang Kecacingan terhadap Polusi Tanah di Sekitar Rumah oleh Soil Transmitted Helminths", *Jurnal Ilmu Kesehatan & Kedokteran Keluarga*, Saintika Medika, Vol/Issue: 2(1). Pp. 9-24, 2005.
[11] Umar, Z. "Perilaku Cuci Tangan Sebelum Makan dan Kecacingan pada Murid SD di Kabupaten Pesisir Selatan Sumatera Barat", *Jurnal Kesehatan Masyarakat Nasional*, Kesmas, Vol/Issue: 2(6). Pp. 249-254, 2007.
[12] Dewitini, K., Desi, L.D.N., Sudarmaja, M., Sawitri, A.A. "Faktor-Faktor Risiko Perilaku yang Mempengaruhi Kejadian Infeksi Cacing Usus pada Siswa SD 1 Sobangan Kecamatan Mengwi Badung", *Jurnal Ilmu Kedokteran*, Medicina, Vol/Issue: 39(2). Pp. 227-230, 2008.
[13] Depkes RI, *Pedoman Umum Program Nasional Pemberantasan Cacingan di Era Desentralisasi*, Departemen Kesehatan RI, Jakarta, 2006.
[14] Alemu, A., Atnafu, A., Addis, Z., Shiferaw, Y., Teklu, T., Mathewos, B., Birhan, W., Gebretsadik, S., Gelaw, B. "Soil Transmitted Helminths and *Schistosoma mansoni* Infections among School Children in Zarima Town, Northwest Ethiopia", *BMC Infectious Diseases*, Vol. 11. Pp. 189, 2011.
[15] Kounnavong, S., Vonglokham, M., Houamboun, K., Odermatt, P., Boupha, B. "Soil-Transmitted Helminth Infections and Risk Factors in Preschool Children in Southern Rural Lao People's Democratic Republic", *Transactions of the Royal Sociaty of Tropical Medicine and Hygiene*, Vol. 105. Pp. 160-166, 2011.
[16] Ngui, R., Ishak, S., Chuen, C.S., Mahmud, R., Lim, Y.A.L. "Prevalensi and Risk Factors of Intestinal Parasitism in Rural and Remote West Malaysia", *PLoS Negl Trop Dis*, Vol/Issue: 5(3). Pp. e974, 2011.
[17] Profil Kesehatan Kabupaten Sikka, *Profil Dinas Kesehatan Kabupaten Sikka Tahun 2009*, Dinas Kesehatan Kabupaten Sikka, Maumere, 2009.
[18] Profil Kesehatan Puskesmas Palue, *Profil Kesehatan Puskesmas Palue Tahun 2009*, Puskesmas Palue, Palue, 2009.
[19] Shang, Y., Tang., L.H., Zhou, S.S., Chen, Y.D., Yang, Y.C., Lin, S.X. "Stunting and Soil-Transmitted Helminth Infections among School-Age Pupils in Rural Areas of Southern China", *Parasites & Vectors*, Vol. 3. Pp. 97, 2010.
[20] Speich, B., Knopp, S., Mohammed, K.A., Khamis, S., Rinaldi, L., Cringoli, G., Rollinson, D., Utzinger, J. "Comparative Cost Assessment of The Kato-Katz and FLOTAC Techniques for Soil-Transmitted Helminth Diagnosis in Epidemiological Surveys", *Parasites & Vectors*, Vol. 3. Pp. 71, 2010.
[21] Ilechukwu, G.C., Ilechukwi, C.G.A., Ozumba, A.N., Ojinnaka, N.C., Ibe, B.C., Onwasigwe., C.N. "Some Behavioural Risk Factors for Intestinal Helminthiasis in Nursery and Primary School Children Inenugu South Easthern Nigeria", *Nigerian Journal of Clinical Practice*, Vol/Issue: 13(3). Pp. 288-293, 2010.
[22] Tanner, S., Choque, M.E., Huanca, T., McDade, T.W., Leonard, W.R., Garcia, V.R. "The Effect of Local Medicinal Knowledge and Hygiene on Helminth Infections in an Amazonian Society", *Social Science & Medicine*, Vol. 72. Pp. 701-709, 2011.
[23] Ulukanligil, M. & Seyrek, A. "Demographic and Parasitic Infection Status of School Children and Sanitary Conditions of Schools in Sanliurfa, Turkey", *BMC Public Health*, Vol. 3. Pp. 29, 2003.
[24] Pickering, A.J., Davis, J., Walters, S.P., Horak, H.M., Keymer, D.P., Mushi, D., Strickfaden, R., Chynowath, J.S., Liu, J., Blum, A., Rogers, K., Boehm, A.B. "Hands, Water, and Health: Fecal Contamination in Tanzanian Communities with Improved, Non-Networked Water Supplies", *Environ. Sci. Technol,* 2010.
[25] Tantular, I.S. & Prasetyo, H., *Trikuriasis*. Di dalam Hadidjaja, P. & Margono, S., *Dasar Parasitologi Klinik*. Edisi Pertama, Jakarta: FKUI. Pp. 130-136, 2011.
[26] Halder, A.K., Tronchet, C., Akhter, S., Bhuiya, A., Johnston, R., Luby, S.P. "Observed Hand Cleanlines and Other Measures of Handwashing Behavior in Rural Bangladesh", *BMC Public Health*, Vol. 10. Pp. 545, 2010.
[27] Onggowaluyo, S.J., *Parasitologi Medik I (Helmintologi). Pendekatan Aspek Identifikasi Diagnosis dan Klinik*. Anggota IKAPI, Jakarta: EGC, 2002.
[28] Haryati, S. "Hubungan Antara Pemakaian Alas Kaki dan Pekerjaan Ayah Terhadap Infeksi Cacing Tambang pada Murid SD Sidomukti II Kecamatan Jenawi Kabupaten Karanganyar", *Jurnal Kedokteran YARSI*, Vol/Issue: 12(2). Pp. 55-59, 2004.

BIOGRAPHY OF AUTHORS

	Dina Merisa Damanik, MPH • September – Now = **Klaten Distric Consultant of STBM** (PAMSIMAS Program in Ministry of Health) – at Klaten Distric, Center of Java Province. • January – June 2013 = **Lecture** in Ratu Samban University, Nort Bengkulu, Bengkulu Province. • June – October 2012 = **Lecturer** in School of Health Sciences Wira Husada Yogyakarta. • April – August 2012 = **Health and Hygiene Specialist (Coordinator)** at PAMSIMAS Program (Drinking Water Supply and Community Based

Sanitation) in Rokan Hulu Distric, Riau Province.

- May 2009 – March 2010 = **Health and Hygiene Facilitator** at PAMSIMAS Program in Bengkalis Distric, Riau Province.
- September 2008 – February 2009 = **Lecture Assistant** in Hang Tuah Midwifery Academy, Pekanbaru City, Riau Province.