



## Factors Related to Soil Transmitted Helminth Infection on Primary School Children

Liena Sofiana ✉, and Mayang Sumira Jewana Kelen

Faculty of Public Health, Universitas Ahmad Dahlan, Yogyakarta, Indonesia.

### Info Artikel

*Article History:*  
Submitted September 2017  
Accepted January 2018  
Published January 2018

*Keywords:*  
Soil Transmitted  
Helminth (STH) infection;  
risk factor; primary school

### Abstract

Soil Transmitted Helminth (STH) infection is the third ranks of the top 10 common infectious diseases in the world, with an incidence rate about 1.4 billion per year. The incidence of STH in Indonesia is still quite high. Amount 60-80% of STH infection is occurs in primary school students, while 40%-60% infection for all ages. The purpose of this study was to determine factors related to STH infection in primary school children at Moyudan Primary School in Sleman Regency. This research conducted using an analytic observational with the cross-sectional design. The population in this study was all students of grade I, II, and III in Moyudan Primary School. This study took 60 respondents as samples with total sampling technique. Data were analyzed using chi-square test. The results showed that the habit of hand washing before eating ( $p=0.010$ ;  $RP=3.850$ ), the habit of hand washing after defecating ( $p=0.007$ ;  $RP=4.571$ ), nail hygiene ( $p=0.179$ ;  $RP=2.138$ ), the habit of wearing footwear ( $p=0.008$ ;  $RP=3.714$ ), and defecation habits ( $p=0.004$ ;  $RP=4.000$ ). It can be concluded that there STH infection was associated with hand washing before eating, hand washing after defecating, the habit of wearing footwear and defecation habits on Moyudan Primary School the students. It was not associated with nail hygiene.

### Abstrak

*Infeksi Soil Transmitted Helminth (STH) atau kecacingan menempati urutan ketiga dari 10 penyakit menular di dunia, dengan insidensi sekitar 1,4 miliar/tahun. Insidensi STH di Indonesia masih cukup tinggi. Infeksi STH pada siswa di sekolah dasar mencapai 60-80%, sedangkan 40%-60% menginfeksi semua tingkat usia. Penelitian ini untuk mengetahui faktor yang berhubungan dengan infeksi STH pada anak SD. Berupa penelitian observasional analitik dengan rancangan cross sectional. Penelitian menggunakan total sampling yaitu semua siswa kelas I, II, dan III di SD Moyudan Sleman sebanyak 60 responden. Analisis data menggunakan chi-square. Hasil menunjukkan bahwa mencuci tangan sebelum makan ( $p=0,010$ ;  $RP=3,850$ ), mencuci tangan setelah buang air besar ( $p=0,007$ ;  $RP=4,571$ ), kebersihan kuku ( $p=0,179$ ;  $RP=2,138$ ), kebiasaan memakai alas kaki ( $p=0,008$ ;  $RP=3,714$ ), dan perilaku buang air besar ( $p=0,004$ ;  $RP=4,000$ ). Disimpulkan ada hubungan antara mencuci tangan sebelum makan, mencuci tangan setelah BAB, kebiasaan memakai alas kaki, dan perilaku buang air besar dengan infeksi STH. Tetapi, variabel kebersihan kuku tidak memiliki hubungan dengan infeksi STH.*

## INTRODUCTION

Parasitic worm disease is still a public health problem in the world, especially in developing countries. According to a World Health Organization (WHO) report, in 2006 about 300 million people were infected with the worm disease. More than 150,000 died because of worm disease in the world. Worm disease is the third ranks of the top 10 common infectious diseases in the world with an incidence rate of about 1.4 billion per year. It is estimated that more than 2 million people are infected with worm disease in China (WHO, 2008).

Worm infestation is an endemic and chronic disease caused by parasitic worms. That tends not to be lethal but undermine the health of the human body, which result in declining of nutritional conditions and public health. Generally, worm infestation is caused by roundworm (*Ascaris lumbricoides*), and hookworm (*Ancylostoma duodenale* and *Necator americanus*) which grouped as the earthworm or Soil-Transmitted Helminth (STH) due to transmission from one person to another through the soil (WHO, 2008). The high frequency of worm infestation is closely related to personal hygiene and environmental sanitation (Chadajah et al, 2014).

The survey results of worms in primary schools in Indonesia in 2008 showed a prevalence of 41.29%. Worm infestation is mainly caused by worms, that are included in Soil-Transmitted Helminth (STH). The results of the previous study showed the prevalence of worm infestation in urban of 14.81% and in rural of 65.4% (Sayono et al, 2011). Infection of worm infestation in humans is influenced by behavior and environmental factors. Environmental factors that affect the occurrence of worm infestation are the density of the population, the absence of clean water, and latrines that do not meet health requirements. Behavioral factors, namely the habit of defecating everywhere, the habit of not wearing footwear when going out from the house, not washing hands before eating, and not washing hands with soap after defecating (Ginandjar et al, 2017; Sofiana et al, 2011).

Factors related to the incidence of worm infestation in children under five are the presence of sanitation facilities (OR 5.245), defecation habits (OR 4.821), the presence of soil floor (OR 5.342), the habit of hand washing after defecating (OR 4.654), and mother's knowledge of worm infestation (OR 2.425) (Yudhastuti et al, 2012). The habit of hand washing before eating with water and soap has an important role in relation to the prevention of worm infestation infection. Because by washing hands with water and soap, it can more effectively remove dirt, dust, and worm eggs attached to the skin surfa-

ce also nails on both hands (Umar, 2008). As well as the habit of hand washing with soap after defecating, it can remove dirt and worm eggs attached to the fingernails. The highest risk of STH (2.8-fold) occurs among students who have a habit of biting their fingernails (RR 2.80; 95% confidence interval (CI) 1.22-4.04). Subjects who did not wash their hands before eating or did not wash hands with soap after defecating have 2.2 times higher risk of infected with worm infestation (Sofiana et al, 2011).

Based on the preliminary study from Sleman Regency Health Office, the highest worm infestation rate is found in Moyudan Community Health Center. The number of STH infection case in the work area of Moyudan Health Center (*Puskesmas Moyudan*) were 98 children. They consist of age of 18 people were 5-14 years old and 80 people were in age of 1-4 years old. Based on data from Moyudan Health Center, some primary school age children have low weight, so there is a suspicion of worm infestation. The purpose of this study was to determine factors related to STH infection in primary school children at Moyudan Primary School.

## METHODS

The type of research was analytic observational with the cross-sectional design. The independent variables were hand washing before eating, hand washing after defecating, nail hygiene, the habit of wearing footwear, and defecation habits. The dependent variable was STH infection. The study was conducted in the Moyudan Primary School in Sleman Regency, Indonesia.

The population in this study was students of grade 3, 4 and 5 of Moyudan Primary School. The sample size was taken by non-probability sampling. Sampling in this research was performed with total sampling technique. The sample in this study was 60 students. The research instrument to collect data was a questionnaire, which contains the data about the habit of hand washing before eating, the habit of hand washing after defecating, nail hygiene, the habit of wearing footwear, and defecation habits. The data were analyzed using chi-square test.

## RESULTS AND DISCUSSION

Table 1 showed the frequency distribution of respondents. According to the age, the largest age distribution category was 10 years old with the number of 23 students (38.3%) and the smallest age distribution category was the 13 years old with 1 student (1.7%). The tabulation of respondents by sex showed that the highest sex distribution was male with 38 students (63.3%) and the lowest was female with 22

Table 1. Characteristics of Respondents

Characteristics of Respondents	Total (n)	Percentage (%)
Age		
8 years old	8	13.3
9 years old	20	33.3
10 years old	23	38.3
11 years old	6	10.3
12 years old	2	3.3
13 years old	1	1.7
Sex		
Male	38	63.3
Female	22	36.7
Grade		
3	21	35
4	21	35
5	18	
The habit of hand washing before eating		
No	24	35
Yes	36	40
The habit of hand washing after defecating		
No	27	35
Yes	33	40
Nail Hygiene		
No	27	45
Yes	33	55
Defecation habits		
No	20	33.3
Yes	40	66.7
Positive worms		
<i>Trichuris trichiura</i>	4	6.7
Hookworm	11	18.3

students (36.7%). The tabulation of respondents by class showed that the most students were grade 3 and 4 with the number of 21 students (35%); and the least were grade 5 with the number of 18 students (30%). The tabulation of respondents according to the habit of hand washing before eating showed that 35 students (58.3%) had the habit of hand washing before eating and 25 students did not have the habit of washing the hands before eating of (41.7%).

The tabulation of respondents according to the habit of hand washing after defecating, showed that 32 (53.3%) students had the habit of hand washing after defecating and 28 (46.7%) students were categorized as did not have the habit of hand washing after defecating. The tabulation of respondents according to nail hygiene showed that 31 students (51.7%) cut their nails once a week and had clean nails; and 29 students (48.3%) did not cut the nails once a week and had dirty nails. The tabulation of respondents according to the habit of wearing foot-

wear showed that 39 students (65%) had the habit of wearing footwear. The number of respondents who did not have the habit of wearing footwear was 21 (35%). According to the defecation habit, 40 (66.7%) students had good defecation habits and the other 20 (33.3%) had bad defecation habit. According to worm infestation, 4 (6.7%) students were infected by *Trichuris trichiura*, 11 (18.3%) students were infected by Hookworm and 1 (1.7%) student was infected by *Enterobius vermicularis*.

The results of statistical analysis with chi-square test between hand washing before eating and STH infection incidence at Moyudan Primary School presented in Table 2. Table 2 illustrated that the proportion of respondents who did not wash hands before eating and have STH infection was 73.3% and the proportion of respondents who did not wash hands and not infected by STH was 31.1%. The proportion of respondents who washed hands before eating but infected with STH had was 26.7%

Table 2. The Association Between The Habit of Hand Washing Before Eating, The Habit of Hand Washing After Defecating, Nail Hygiene, The Habit of Wearing Footwear, and Defecation Habits in Moyudan Primary School.

Variable	STH Infection				Total		<i>p</i>	RP	CI 95%
	Positive		Negative						
	n	%	n	%	n	%			
The habit of hand washing before eating									
No	11	73.3	14	31.1	25	41.7	0.01	3.85	1.385-10.707
Yes	4	26.7	31	69.9	35	58.3			
The habit of hand washing after defecating									
No	13	80	16	35.6	28	46.7	0.007	4.571	1.424-14.469
Yes	2	20	29	64.4	32	53.3			
Nail hygiene									
No	10	66.7	19	42.2	29	48.3	0.179	2.138	0.83-5.509
Yes	5	33.3	26	57.8	31	51.7			
The habit of wearing footwear									
No	10	66.7	11	24.4	21	35	0.008	3.714	1.461-9.445
Yes	5	33.3	34	75.6	39	65			
Defecation habits									
No	10	66.7	10	22.2	20	33.3	0.004	4.000	1.579-10.135
Yes	5	33.3	35	77.8	20	66.7			

and respondents who washed hands before eating and did not get STH infection was 68.9%. Respondents who did not wash hands before eating were at risk of STH infection of 3.85 times greater than respondents who washed hands before eating. There was a significant association between hand washing before eating and STH infection on the students of Moyudan Primary School (95% CI = 1.384 -10.707;  $p = 0.010$ ). The results of the statistical analysis showed that hand washing before eating is a risk factor, and statistically significant.

The results of statistical analysis with chi-square test between the habit of hand washing after defecating and STH incidence at Moyudan Primary School presented in Table 2. Table 2 showed that respondents who did not wash hands after defecating and had STH infection had a higher percentage of 80% than respondents who did not wash hands after defecating and did not have STH infection had percentage of 35.6%. Respondents who washed hands after defecating but had STH infection with smaller percentage of 20%, than respondents who washed hands before eating and not infected by STH of 64.4%. Respondents who did not wash hands after defecating were at risk of STH infection by 4.571 times greater than respondents who washed hands after defecating. And there was statistically significant association between hand washing after defecating and STH infection on the students of Moyudan Primary School (95% CI = 1.434-14.469;  $p = 0.007$ ). The results of the statistical analysis showed that hand

washing after defecating is a risk factor, and statistically significant.

The results of statistical analysis with chi-square test between nail hygiene and STH incidence at Moyudan Primary School presented in Table 2. Table 2 was illustrates about respondents who did not clean the nails, STH infection had a higher percentage of 66.7% than respondents who did not clean the nails, and did not have STH infection had percentage of 42.2%. Respondents who clean the nails but had STH infection with smaller percentage of 33.3% than respondents who clean the nails and not infected by STH of 57.8%. Respondents who had dirty nails were at risk of STH infection by 2.138 times greater than respondents who had clean nails. There was insignificant correlation between nail hygiene with STH infection on the students of Moyudan Primary School (95% CI = 0.830-5.509;  $p = 0.179$ ). The results of the statistical analysis showed that nail hygiene is a risk factor and insignificant.

The results of analysis data using chi-square test between the habit of wearing footwear and STH incidence at Moyudan Primary School presented in Table 2. It showed that respondents who did not wear the footwear and had STH infection had higher percentage of 66.7% than respondents who did not wear the footwear and did not have STH infection had percentage of 24.4%. Respondents who wore footwear but had STH infection with a smaller percentage of 33.3% than respondents who wore footwear

and not infected by STH of 75.6%. Respondents who did not wear footwear were at risk of STH infection by 4.571 times greater than respondents who wore footwear. And there was the significant correlation between the habit of wearing footwear with STH infection on the students of Moyudan Primary School (95% CI = 1.461-9.445;  $p = 0.008$ ). The results of the statistical analysis showed that the habit of wearing footwear is a risk factor, and statistically significant.

The results of statistical analysis with chi-square test between the defecation habits and STH incident at Moyudan Primary School presented in Table 2. It showed that respondents who did not have a good defecation habits and had STH infection, had higher percentage of 66.7% than respondents who did not have a good defecation habits and did not have STH infection had percentage of 22.2%. The proportion of respondents who had good defecation habits but got STH infection was 33.3%, than respondents who had good defecation habits and not infected by STH of 77.8%. Respondents who did not have good defecation habits at risk of STH infection by 4.000 times greater than respondents who had good defecation habits, and there was the statistically significant correlation between the defecation habits with STH infection on the students of Moyudan Primary School (95% CI = 1.579-10.135;  $p = 0.004$ ). The results of the statistical analysis showed that the defecation habit is a risk factor, and statistically significant.

The results of statistical analysis showed that there was a correlation between hand washing before eating and STH infection on the students of Moyudan Primary School. Respondents who did not wash hands before eating were at risk for STH infection 3.85 times greater than respondents who washed hands before eating, and statistically there was a significant correlation between hand washing before eating and STH infection on the students of Moyudan Primary School (95% CI = 1.384 -10.707;  $p = 0.010$ ).

This indicates that the behavior of not hand washing before eating is a risk factor for STH infection on the students of Moyudan Primary School. The correlation between hand washing before eating and STH infection is caused by the number of respondents who did not wash their hands before eating with water and soap of 73.3% in the positive group STH, and 31.1% in the negative group of STH. Respondents who have poor living habits will be easily infected with STH. Reinfection will occur due to poor living habits.

The results of previous research stated that there was a significant correlation between the habit of hand washing before eating and the incidence of worm infestation. This significant result is due to

the number of respondents who did not wash their hands before eating. The prevalence of respondents who always wash their hands before eating of 7.2%, while those who did not wash their hands before eating of 50% (Gazali, 2008).

The habit of hand washing before eating with water and soap has an important role in relation to the prevention of worm infestation infection. Because by washing hands with water and soap more effectively, to remove the dirt and dust from the surface of the skin also reduce the number of disease-causing microorganisms such as viruses, bacteria, other parasites on both hands. Hand washing using water and soap is more effective in removing dirt and worm eggs which attach to the surface of the skin, nails, and fingers on both hands (Umar, 2008).

The results of statistical analysis showed that there was a correlation between hand washing after defecating and STH infection on the students of Moyudan Primary School. Respondents who did not wash hands after defecating were at risk for STH infection 4.571 times greater than respondents who washed hands after defecating. And there was a significant correlation between hand washing after defecating and STH infection on the students of Moyudan Primary School (95% CI = 1.434-14.469;  $p = 0.007$ ). This indicates that the behavior of not hand washing after defecating is a risk factor for STH infection on the students of Moyudan Primary School.

The correlation between hand washing after defecating and STH infection is caused by the number of respondents, who did not wash their hands after defecating with water and soap, also the unavailability of soap in the toilets. Eighty percents of respondents who did not wash their hands after defecating got STH infection and the rest 35.6% did not get STH infection. Respondents who have poor living habits will be easily infected with STH. Reinfection will occur due to poor living habits.

The results of previous research stated that hand washing factor is the biggest influence of worm infestation infection (Fitri et al, 2012). The habit if not hand washing with soap, will increases STH infection. Transmission of STH infections through dirty hands, nails which tucked with worm eggs are likely to be swallowed at mealtime, it happened if not wash the hands with water and soap after defecating or before eating (Sofiana et al, 2011). The efforts to prevent and eradicate worm infestation can be performed by getting used to washing hands before eating or after defecating with water and soap (Umar, 2008).

The results of statistical analysis showed that there was a correlation between nail hygiene and STH infection on the students of Moyudan Primary School. Respondents who had dirty nails were at risk



for STH infection 2.138 times greater than respondents who had clean nails, and statistically, there was insignificant correlation between nail hygiene and STH infection on the students of Moyudan Primary School (95% CI = 0.830-5.509;  $p = 0.179$ ). There was no statistically significant correlation to this study, which the school supposedly does nail checks every week. Based on interview, more than half of respondents had short and clean nails. It was also suspected that the school had performed nail examination for the students before they filled questionnaires. In addition, the design of this study was also not appropriate enough to see the risk factors for worm infestation, where the observation of nail hygiene and the occurrence of worm infestation performed simultaneously.

There was no correlation between nail hygiene and Soil Transmitted Helminth infection supported by previous studies. Because it usually in primary school students, nail examination is performed every week in the school. Children have been intervened with nail examination every week. This insignificant correlation in this study, it is probably due to the observation of nail hygiene with the incidence of worm infestation, performed simultaneously or once at the same time and measured according to the state or status of time observed (Umar, 2008; Kattula et al, 2014).

Nail hygiene is an activity that performed by pruning and cutting nails once a week, also cleaning the nails every washing hand (Sayono et al, 2011). Long nails can be a place of attachment of various impurities and worm eggs, which can enter the body while consuming food or other actions associated with inserting something into the mouth (Faridan et al, 2013).

The results of statistical analysis showed that there was a correlation between the habit of wearing footwear and STH infection on the students of Moyudan Primary School. Respondents who did not wear the footwear were at risk for STH infection 4.571 times greater than respondents who wore the footwear. And statistically, there was a significant correlation between the habit of wearing footwear and STH infection on the students of Moyudan Primary School (95% CI = 1.461-9.445;  $p = 0.008$ ). This indicates that the behavior of not wearing footwear is a risk factor for STH infection on the students of Moyudan Primary School.

The correlation between the habit of wearing footwear and STH infection is caused by the number of respondents who did not wear the footwear when out of the house or playing on the ground. The habit of respondents who did not wear a footwear when out of the house or remove footwear while playing on the ground, will ease Hookworm larvae enter the

skin of the foot. Results of bivariate analysis showed that 66.7% of respondents who did not wear footwear were getting STH infection and the rest 24.4% were not getting STH infection.

Behavioral changes cannot be achieved directly, so it takes an educational effort to influence a person in changing behavior (Ayu et al, 2016). The results of previous research stated that the behavior of playing on the ground without wearing sandals correlated with the occurrence of worm infestation. This is because there are still many respondents who did not wear footwear while playing and exercising in school (Nmour et al, 2009; Umar, 2008). The same thing is also found in Air Periukan subdistrict of Seluma Regency Bengkulu Province. Which showed that there was a significant relationship between the behavior of wearing footwear with worm infestation. This is because there are still many respondents who did not have a habit of wearing footwear of 26.7%, while the respondents always wear footwear of 5.6%. The process of transmitting worm eggs into the human body can be transmitted through soil media (Amaliah and Azriful, 2016).

The habit of not wearing footwear is a behavior that is directly related to hookworm. The habit of not wearing footwear has the intensity of hookworm infection with transmission patterns commonly occurring near the home. Hookworm infection in humans through penetration of filariform larvae that found in the soil, entering through the skin, and usually occurs when walking without wearing footwear on soil contaminated by hookworm larvae (Gazali, 2008). The results of statistical analysis showed that there was a correlation between defecation habits and STH infection on the students of Moyudan Primary School. Respondents who had bad defecation habits were at risk for STH infection 4.424 times greater than respondents who had good defecation habits. And statistically, there was a significant correlation between the defecation habits and STH infection on the students of Moyudan Primary School (95% CI = 1.597-12.258;  $p = 0.004$ ). This indicates that the bad defecation habit is a risk factor for STH infection on the students of Moyudan Primary School. The correlation between the defecation habits and STH infection is caused by the number of respondents who did not have defecation habits in the place or in healthy latrines. Results of bivariate analysis showed that 73.3% of respondents who had bad defecation habits were getting STH infection and the rest 26.7% were not getting STH infection. Defecation habit in any place is a major source of worm infections transmission, where worm eggs come out through the stool. The worm eggs in the stool will pollute the environment and will infect through dust, hands, and water that contaminated with feces. According to research

of Saputra (2012), there is a positive relationship between student's perceptions and the selection of food snacks.

The results of previous studies suggested that there is a statistically and biologically significant correlation between defecation habit and worm infestation. Children who defecate not in the toilet or defecate in any place will cause contamination of the soil and the environment by the feces which contain the worm eggs. The spread of infestation worm infections depends on the contaminated environment of the stool which contains the worm eggs. Infection in children often occurs due to swallowing the soil contaminated with worm eggs or through hands that contaminated with worm eggs (Umar, 2008; Kattula et al, 2014).

Infection in children often occurs due to swallowing the soil contaminated with worm eggs or through hands that contaminated with worm eggs. Defecation habit in any place can raise the spread of worm infection. Soil that contaminated by worm eggs/stool is the main source of transmission. In addition, the high resistance of worm eggs, humidity and tropical temperatures strongly support the occurrence of continuous infection (Mofid et al, 2011; Kattula et al, 2014).

## CONCLUSION

The factors associated with Soil Transmitted Helminths (STH) infection on the students of Moyudan Primary School were hand washing before eating, hand washing after defecating, the habit of wearing footwear, and defecation habits with occurrence of STH infection on the students of Moyudan Primary School. There was no association between nail hygiene and STH infection on the students of Moyudan Primary School.

## REFERENCES

- Amaliah, A. T. R. & Azriful. 2016. Distribusi Spasial Kasus Kecacingan (*Ascaris lumbricoides*) Terhadap Personal Higiene Anak Balita di Pulau Kodingareng Kecamatan Ujung Tanah Kota Makassar Tahun 2016. *Jurnal Higiene*, 2(2): 74-80
- Ayu, D. S., & Handayani, O. W. K. 2016. Diary Teratas (Terapi Anak Obesitas) Dalam Perubahan Perilaku Gizi Siswa Sekolah Dasar. *Unnes Journal of Public Health*, 5(2): 167-175
- Chadijah, S., Sumolang, P. P. F. & Veridiana, N. N. 2014. Hubungan pengetahuan, perilaku, dan sanitasi lingkungan dengan angka kecacingan pada anak sekolah dasar di kota Palu. *Media Penelitian dan Pengembangan Kesehatan*, 24(1), 50-56.
- Faridan, K., Marlinae, N. & Audhah, N. A. 2013. Faktor-Faktor yang Berhubungan dengan Kejadian Kecacingan Pada Siswa Sekolah Dasar Negeri Cempaka 1 Kota Banjarbaru. *Jurnal BUSKI*, 4(3): 121-127
- Fitri, J., Saam, Z. & Hamidy, M. 2012. Analisis Faktor-Faktor Risiko Infeksi Kecacingan Murid Sekolah Dasar di Kecamatan Angkola Timur Kabupaten Tapanuli Selatan Tahun 2012. *Jurnal Ilmu Lingkungan*, 6(2): 146-161
- Gazali, M. 2008. *Hubungan Higiene Perseorangan Anak Sekolah Dasar dan Kondisi Kesehatan Lingkungan Rumah Dengan Kejadian Kecacingan di Kecamatan Air Periuhan Kabupaten Selum Propinsi Bengkulu*. Tesis. Yogyakarta: Universitas Gajah Mada.
- Ginandjar, P., Saraswati, Lintang D., Martini. 2017. Soil-transmitted Helminth Infection In Elementary School Children: An Integrated Environment and Behavioral Case Study in Bandungan Sub-District, Semarang District. *Advanced Science Letters*, 23(4):3565-3568
- Kattula D., Sarkar R., Ajjampur S.S.R., et al. 2014. Prevalence and Risk Factors for Soil-Transmitted Helminth Infection Among School Children in South India. *Indian Journal of Medical Research*, 139(1):76-82
- Mofid L.S., Bickle Q., Jiang J-Y., Du Z-W. & Patrick E. 2011. Soil-Transmitted Helminthiasis in rural South-West China: Prevalence, Intensity and Risk Factor Analysis. *Southeast Asian Journal of Tropical Medicine and Public Health*, 42(3):513-526.
- Nmour, J.C., Onojafe, J.O. & Omu, B.A. 2009. Anthropogenic Children in Delta State, Southern Nigeria. *Iranian Journal Public Health*, 38:31-38.
- Saputra, A. D. 2012. Hubungan Tingkat Pengetahuan dengan Perilaku Siswa Kelas Sekolah Dasar. *Unnes Journal of Public Health*, 1(1): 1-7.
- Sayono, Endriani, & Mifbakhudin. 2011. Beberapa Faktor yang Berhubungan dengan Kejadian Kecacingan pada Anak Usia 1-4 Tahun. *Jurnal Kesehatan Masyarakat Indonesia*, 7(1): 22-35.
- Sofiana, L., Sumarni, S. & Ipa, M. 2011. Fingernail Biting Increase The Risk of Soil Transmitted Helminth (STH) Infection in Elementary School Children. *Health Science Journal Of Indonesia*, 2(2): 81-85.
- Umar, Z. 2008. Perilaku Cuci Tangan Sebelum Makan dan Kecacingan pada Murid SD Di Kabupaten Pesisir Selatan Sumatera Barat. *Jurnal Kesehatan Masyarakat Nasional*, 2(6): 249-254.
- WHO. 2008. *Soil Transmitted Helminths*. Geneva: World Health Organization
- Yudhastuti, R., Farid, M. & Lusno. 2012. Kebersihan Diri dan Sanitasi Rumah pada Anak Balita dengan Kecacingan, *Jurnal Kesehatan Masyarakat*, 4(6): 173-178.