

The Relation between Environmental Sanitation and Worm Infestation on Elementary Student in Kalilangkap Village, Bumiayu District, Brebes Regency, Centre Java of Indonesia

¹Faisal Amri, ²Azis Nur Bambang, ³Azrul Azwar, ²Henna Rya Sunoko

¹Doctoral Program on Environmental Science Study, Postgraduate Program on University of Diponegoro, Semarang, Centre Java of Indonesia

²Lecturer on Environmental Science Study, Postgraduate Program on University of Diponegoro, Semarang, Centre Java of Indonesia

³Lecturer on Faculty of Medical, University of Indonesia, Jakarta, Indonesia

ABSTRACT

Prevalence of worming on elementary student in Indonesia is still high enough such as about 60-80%. One of the causing factors of the higher worming prevalensi is the condition of environmental sanitation is not feasible. This research intended to know how far the relation between environmental sanitation (condition of restroom, type of house floor, the availability of clean water, and the facility of garbage exile) and worm infestation on elementary student in Kalilangkap village, Bumiayu district, Brebes Regency. This research was as analytical obseration with the design of sectional crosss and it conducted on August-September 2013. Population in this research consisted of the whole students in State-02 Elementary School in Kalilangkap village and all of them were as the samples. Number of them were 100 students and they were determined based on the criteria of inclusion and exlusion. The data were obtained from the laboratorium test, interview, and observation by using questionnaire. Analysis of relation used statistical test of chi square with the significant level (α) of 0.05. Result showed that the proportion of worm infestation on elementary student in Kalilangkap village was 14% which included 35.71% of *Ascaris lumbricoides* and *Ancylostoma duodenale* with the same amount, 21.43% of *Trichuris trichura*, and 7.14% of *Oxyuris vermicularis*. There was no significant relation between the condition of restroom (p-value of 0.869), type of house floor (p-value of 0.077), the availability of clean water (p-value of 0.618), and the facility of garbage exile (p-value of 0.612) with worm infestation on elementary student in Kalilangkap village. Based on the result, it could be concluded that there was no significant relation between environmental sanitation and worm infestation on elementary student in Kalilangkap village. However, it was suggested that the clean and health life style had to be continously increased for preventing and controlling the worm distribution on the elementary school.

KEYWORDS: environmental sanitation, worm infestation, elementary student

INTRODUCTION

Worming is one of the environmental based aches which still becomes as a problem of society healthy in Indonesia until now, because the prevalence of warming in Indonesia is still high mainly the worming which is caused by an amount of stomach worm that is the infection through soil or it is mentioned as Soil Transmitted Helminthes (STH). Soil Transmitted Helminthes (STH) is as the group of intestine Nematode which is needed soil in its development to become as infective form. STH with the habitat is human intestine, includes *Ascaris lumbricoides*, *Hookworm (Necator americanus)*, and *Ancylostoma duodenale*, *Strongiloides stercoralis*, *Trichuris trichiura*. The important worm among them is *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Necator americanus*, and *Trichuris trichiura* [1]. Worm is one of parasites on human and animal that has a characteristic to injure which human is as hospes for any kind of worm that is included in intestine Nematode. Most of the Nematode is still as healthy problem in Indonesia. Among the intestine Nematodes, there are a number of species which the infection through the soil (*Soil Transmitted Helminths*) and the most repeatedly is *Ascaris lumbricoides*, *Necator americanus*, *Ancylostoma duodenale*, and *Trichuris trichiura* [2].

Worming ache is as a wealthy problem in Indonesia mainly in the villages. There are some factors that effect it such as the environmental sanitation has not been feasible, personal hygiene, education level, low economic social, the attitude of health life has not been feasible [3]. Indonesia is as a country which has any problems of healthy included still higher of prevalence on the infection ache mainly that is related with environmental sanitation and hygiene attitude that has not been good. One of the aches that the frequency is still high is worming infection which is as one of sanitation based and bad hygiene ach [4]

Worm infection is as a society healthy problem especially in under developed and developed country and it places the highest ranking of aching number which is caused on school age children. Infection depends neither only on ecological environmental condition of a region nor economic social standard of local society [5].

*Corresponding Author: Faisal Amri, Doctoral Program on Environmental Science Study, Postgraduate Program on University of Diponegoro, Semarang, Centre Java, Indonesia. Email: dr.faisal_amri@yahoo.com

In further, worming can give the negative impact for children growth and development because it can decrease the productivity and in the end it can influence children quality next time. Generally, the factors that effect worming are climate that is suitable with its growth, environmental sanitation condition and bad personal hygiene, economic social condition, and low education level [[6]. Condition of environmental sanitation is very related with worm infestation on elementary student because there are no feasible environmental sanitation that can be as the source of worm infection in human body [7]. This research intended to investigate the relationship between environmental sanitation and worming infestation on elementary students in Kalilangkap village, Bumiayu District, Brebes Regency.

MATERIALS AND METHODS

Human is as a definitive hospes of *Ascaris lumbricoides* worm. Size of male worm is 10-30 cm, but for female worm is 22-35 cm. However, on mature stadium, the worm lives in the hollow of small intestine. Female worm can produce until 100,000 – 200,000 eggs per-day, it includes impregnated and non impregnated egg. In land that is as a suitable environment, impregnated egg grows as the infective form in the duration more than 3 weeks. If this infective form is swallowed by human, it will hatch into larva in small intestine. This larva perforates the intestine wall towards the blood vessels or limfoid channel and then it is flowed to the heart and follows the blood flow to the lung. For the next, the larva enters to the alveolus hollow through the alveolus wall, then rises up to the trachea through the bronchiolus and broncus. From trachea, the larva goes towards the faring, so it causes cough stimulation, and then it is swallowed entering to esofogus to go towards small intestine and growing up become mature worm. The process needs time less than 2 months since it is swallowed until become as mature worm [2]. The detail process is presented as in Figure 1.

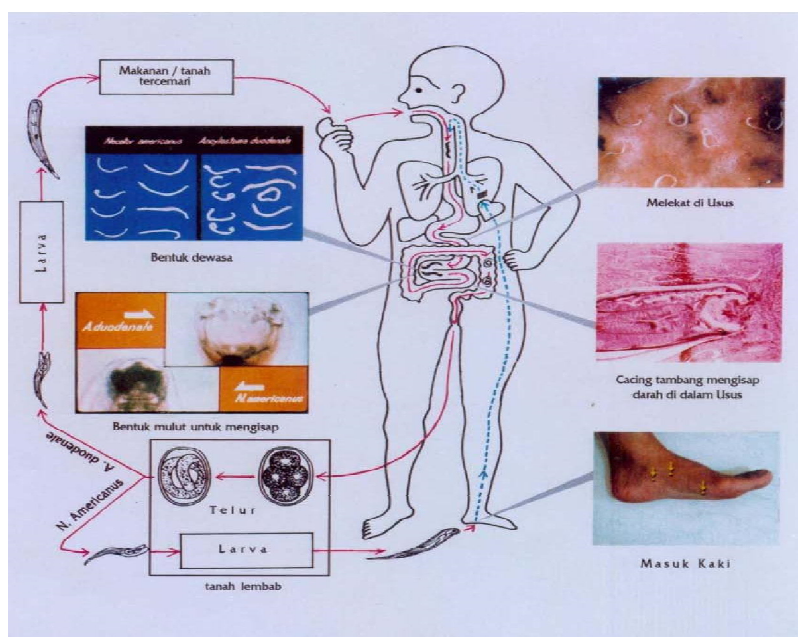


Figure 1 Life cycle of *Ascaris Lumbricoides* [1]

Necator americanus and *Ancylostoma duodenale* are two species of hook worm which is mature in human body. The habitat is in the hollow of small intestine. Female worm produces 9,000 – 10,000 eggs per-day. The female worm has the length about 1 cm, however male worm is approximate to 0.8 cm. Mature worm has the shape as the letter of S or C, and there is a pair of teeth in the mouth. Life cycle of hook worm is as follow: worm egg will go out together with feaces, after 1-1.5 day in soil, the egg hatches becoming as rabbitiform larva. In the duration of about 3 days, the larva grow up as filariform larva that can perforate the skin and can hold the life of 7-8 weeks in soil. The hook worm egg with the size about of 60 x 40 micron is formed of length wise and has thick wall and there are some cells such as *larva rabbitiform* with the length as about 250 micron, however, fliriform larva has the length about less than 600 micron. After it perforates the skin, the larva follows blood flow towards heart and then to the lung. In the lung, the larva perforates blood flow into bronchus and then to the trachea and laring. From laring, the larva is also hatched and enters to the small intestine and becomes as mature worm. Infection is happened if the filariform larva perforates skin or being hatched together with food [1]. The detail process is presented as in Figure 2.

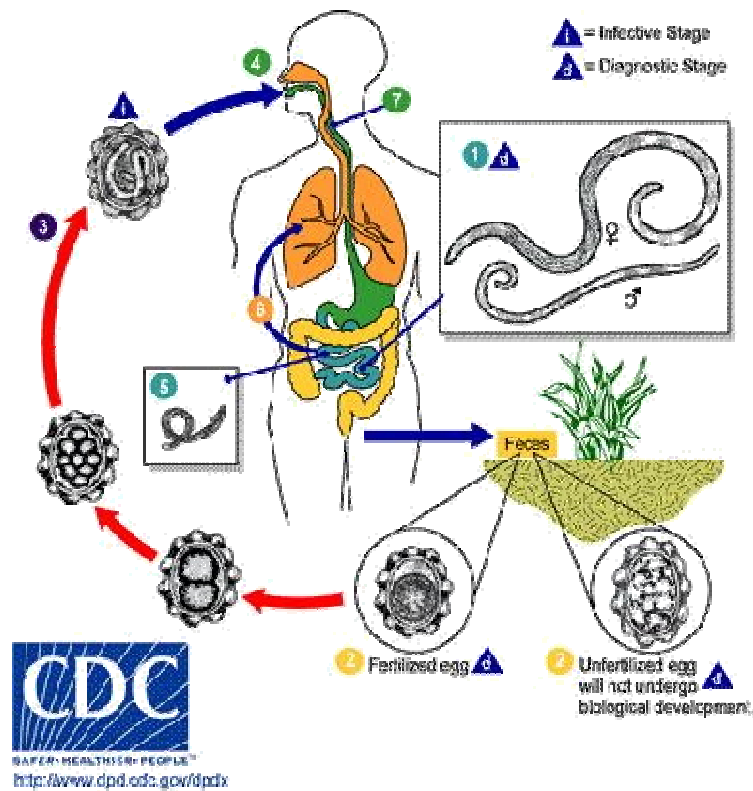


Figure 2 Life cycle of *Necator americanus* and *Ancylostoma duodenale* [1]

Female *Trichuris trichiura* has the length approximate to 5 cm and the male one has about 4 cm. It is life in colon ascenders with the anterior part enters to mucosa of intestine. A female worm is predicted can produce 3,000-5,000 eggs per-day. Egg with the size of 50-54 micron x 32 micron has the shape like large earthen with a kind of a clear hump on the both of poles. The outside part of egg skin has yellowish colour and inside is clear. Impregnated egg is taken it out from the hospes together with faeces; the egg is ripe on 3-6 weeks in moist and calm soil. Ripe egg is as an egg that contains of larva and as the shape of infective. Direct infective method is happened if the ripe egg is perforated by human (hospes), then the larva will go out from egg wall and enters to small intestine. After becoming mature, the worm goes down to the distal of intestine and enters to colon ascenders and cecum. The growth period begins to be perforated until becomes as female mature worm and ready to be pegged at about 30-90 days [2]. This process is described as in Figure 3.

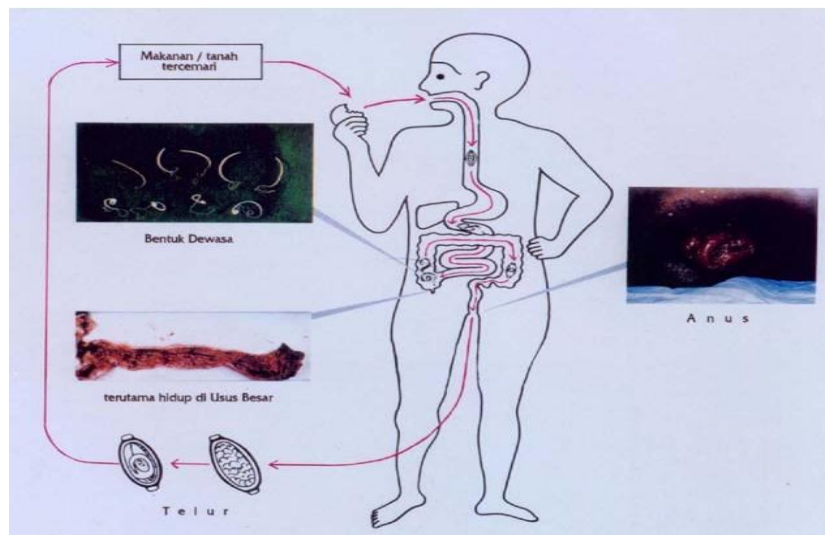


Figure 3 Life cycle of *Trichuris trichiura* [1]

Based on the survey, there was found that on elementary student age, the prevalence of worming is high enough such as in the range of 60-80% [1]. The higher number of worming on student age is caused by that they often play or contact with soil where is as the growth and developing place of stomach worms. Although the number of worming is high, but the prevention and destroying of the infection has not been maximally carried out. It is due to that the worm infection generally gets less attention mainly from parents because the worm infection can not directly be seen [6]

Worming ache can be attached anyone without knowing the age. Generally, worming infection consists of two types as follow: [8]

1. To urinate in anywhere – faeces that contents of worm egg will pollutes the soil – the egg sticks in hand or nail when they are playing – when they will eat or drink, the worm egg enters to the mouth – to be perforated – then they will worming etc.
2. To urinate in anywhere - faeces that contents of worm egg will pollutes the soil – it is swarmed by fly – fly settles in food or drink – food or drink that contents of worm egg enters through mouth – to be perforated – and then they will worming etc.

De Silva *et.al* [9] presented that the risk factors which could affect the worm infection which the infection was through soil was as follow:

1. Environment:
Worming infection is usually happened in dirty environment mainly in city or edge region [9]. According to Phiri [9] that the prevalence number of *Ascaris lumbricoides* was more found in the city. However, according to Albonico [9], the highest prevalence number was found in edge region or village which the society was in poverty. The imbalanced population growth with the residence area caused the problem of faeces drainage was increasing too. The function of faeces in infection is very high. Faeces can contaminate food, drink, water, soil, and goods so it can cause ache for the other person. Dirty water will cause the healthy trouble like worming infection and stomach ache. Worming infection is as one of the infections that based on environment.
2. Soil
Worming infection can be through soil that is contaminated by faeces which contents of *Trichuris trichiura* egg, egg grows in moist clay soil and soil with the optimal temperature of $\pm 30^{\circ}\text{C}$ [1]. Clay soil with high moisture and temperature in the range of 25°C - 30°C is very good for the developing of *Ascaris lumbricoides* egg until becomes as infective form [2]. However, for the larva growth of *Necator americanus* such as needing the optimum temperature of 28°C - 32°C and loose soil like sandy or humus, and for *Ancylostoma duodenale* is lower such as 23°C - 25°C but in general it is stronger [2].
3. Climate
The infection of *Ascaris lumbricoides* and *Trichuris trichiura* is in tropic region because the moisture level is high enough. However for *Necator americanus* and *Ancylostoma duodenale*, the most infection is in hot and moist region. The suitable environment as the habitat with high temperature and moisture is mainly in the region of plantation and mining [10]. Tropic climate and high air moisture in Indonesia as well as sanitation and non-hygiene condition which is as the healthy condition as well as economic social and education have not been fitted, are as a good environment for development of worm [11].
4. Attitude
Attitude influences the happening of worm infection such as it is infected through soil [9]. Children are often infected by worm infection because their fingers are usually entered to the mouth or eating rice without washing hand [12]. Attitude can also be reflected by the usual of using foot underlayer, washing hand, cutting nail, and eating.
5. Economic social
According to Jalaluddin [13], economic social influences the happening of worm such as bad sanitation factor that is related with low economic social. The economic social conditions which are still low is supported by the suitable climate for the growth and development of worming. These some factors are as the cause of higher prevalence on intestine worm infection which is infected in Indonesia [14].
6. Status of nutrient
Worming can influence the intake, digestif, absorbtion, and foof metabolism. In wholly, worming infection can cause the lack of nutrient such as kalori and it can cause the lack of protein and blood loosing. Beside it can pursue the physical development, anaemia, intelligence, work productivity, and it

also causes big influence to decrease the body defence so it will be easy to be infected the other ache [1].

Kalilangkap village is about 1.5 km in eastern of Bumiayu city. The village has beautiful nature condition, green hill, irrigated rice area that stretches in almost all of the village area. Result of observation showed that there is no data of worming number on elementary student in Kalilangkap village because the survey about worming in the village has not been carried out.

Sanitation condition in Kalilangkap village was still not feasible which is the ownership of healthy restroom still reaches 57.6% or 288 families (KK) of 500 families (KK). However, for clean water access in house is still 9% or 45 families (KK). Beside it, number of family which has garbage place and health house is still 56% or 280 families (KK) of 500 families (KK) and 88% or 440 families (KK) of 500 families (KK). This condition is as the cause factor of worming infection on children.

The reason as above stimulated to know the relationship between environmental sanitation and worming infestation on elementary students in Kalilangkap village, Bumiayu District, Brebes Regency with the specific aims were as follow:

1. To give information about the availability of worming infestation on elementary students and the factors that affect it so the society can make effort to prevent the worming.
2. As a base in policy making for the related institution to make effort of prevention to the worming on elementary students in Kalilangkap village, Bumiayu District, Brebes Regency.
3. This research is as an worthy experience for the researcher because it can increase the knowledge and insight about worming which will be very helpful for carrying out the work that is related with environmental healthy.

METHOD

This research was as an analytical observation by using Cross Sectional Design. This research was conducted in Kalilangkap village, Bumiayu District, Brebes Regency on August-September 2013. Populations in this research are all elementary students of State Elementary 02 with total population of 100 students. The samples were selected with the criteria of inclusion and exclusion as follow:

- a. Criteria of inclusion:
 - He/ She is registered as the elementary students of the schools in Kalilangkap village, Bumiayu District, Brebes Regency
 - He/ She was in location when the research was conducting
 - He/ She was prepared as the respondents
- b. Criteria of exclusion
 - Students that stayed in Kalilangkap village, Bumiayu District, Brebes Regency during the last 6 months.
 - Students that did not consume worm medicine for the last 6 months.

Based on the criteria of inclusion and exclusion as above, number of observed samples was 100 elementary students.

Variable of research

- Independent variable such as environmental sanitation which consists of restroom condition, type of house floor, the availability of clean water, facility of garbage exile
- Dependent variable such as worm infestation

Definition of operational

- Environmental sanitation is as a house environment that is related with worming infestation based on the indicator of restroom, type of house floor, the availability of clean water, facility of garbage exile
- Worming infestation is as there is found one or more stomach worm egg such as *Ascaris lumbricoides*, *Ancylostoma duodenale*, and *Trichuris trichura* on elementary students through faeces evaluation microscopically with positive and negative indicator.
- Restroom condition is a condition of restroom that is used by the respondent every urinating with the indicator of feasible or not feasible
- Type of house floor is as the availability of house floor that is belonged to the respondent with the indicator of soil or board or plaster or ceramic
- The availability of clean water is as the availability of water to fulfil the daily demand with the indicator enough or not enough
- Facility of garbage exile is as the place that is used for exiling and storing garbage temporary with the indicator of feasible or not feasible.

Technique of selecting data

Selecting data was carried out by observation and interview, and then to conduct it by using laboratory test and evaluation.

Data analysis

Analysis of data was carried out by using Statistical Product and Service Solution (SPSS) version 16.0. Data analysis used Chi Square test and the decision making was due to the level of significant (α) 0.05 as follow: 1) hypothesis is accepted if $p\text{-value} < \alpha$ (0.05); and 2) hypothesis is rejected if $p\text{-value} > \alpha$ (0.05)

RESULTS AND DISCUSSION

This research was conducted in Kalilangkap village, Bumiayu district, Brebes regency on elementary student in this village such as the student of State Elementary 02. Samples that were used in this research was 100 students which was selected based on the criteria of inclusion.

A. Proportion of worm infestation

Based on the test of laboratory test to the faeces of respondent, it showed that 14 students (14%) of 100 respondents was indicated to be positively worming infected, however, the other 86 respondents (86%) were expressed negative. The proportion of worm infestation on elementary students in Kalilangkap village, Bumiayu district, Brebes regency was presented as in Figure 1.



Figure 1 Proportion of worm infestation on elementary students in Kalilangkap village, Bumiayu district, Brebes regency

B. Proportion of worm infestation based on type

Based on the evaluation of positive worm infestation samples, it indicated that 14 elementary students in Kalilangkap village, Bumiayu district, Brebes regency. Each of 5 students (35.71%) was infected by the infestation of *Ascaris lumbricoides* and *Ancylostoma duodenale*. This number was higher than the infestation of *Trichuris trichura* and *Oxyuris vermicularis* such as each of 3 students (21.43%) and 1 student (7,15%). The proportion of worm infestation based on type on elementary student in Kalilangkap village, Bumiayu district, Brebes regency was presented as in Figure 2.

A. Proporsi Infestasi Cacing Berdasarkan Jenisnya

Berdasarkan hasil pemeriksaan pada sampel yang positif terinfestasi cacing diketahui bahwa dari 14 murid sekolah dasar di Desa Kalilangkap Kecamatan Bumiayu Kabupaten BREBES yang positif cacingan, terdapat infestasi *Ascaris lumbricoides* dan *Ancylostoma duodenale* dengan jumlah yang sama, yakni 5 orang (35.71%). Angka ini lebih tinggi dibandingkan infestasi *Trichuris trichura* dan *Oxyuris vermicularis* dengan jumlah masing-masing 3 orang (21.43%) dan 1 orang (7,15%). Proporsi infestasi cacing berdasarkan jenisnya pada murid sekolah dasar di Desa Kalilangkap Kecamatan Bumiayu Kabupaten Brebes dapat dilihat pada Gambar 2.

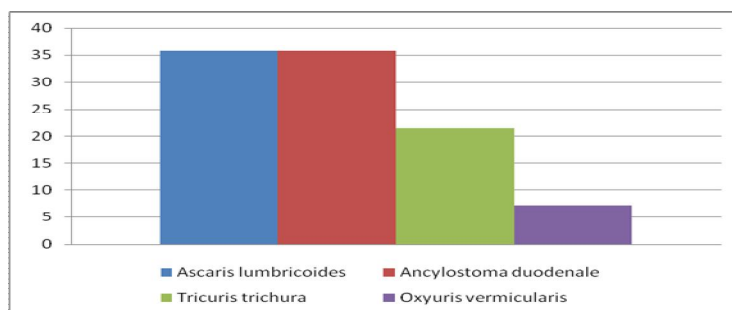


Figure 2 Proportion of worm infestation based on type on elementary students in Kalilangkap village, Bumiayu district, Brebes regency

The relationship between environmental sanitation and worm infestation

Condition of respondents environmental sanitation was measured based on the observation and interview result by using questionnaire to the indicator of restroom condition, type of house floor, the availability of clean water and the facility of garbage exile. The measuring was based on objective criteria of each indicator. Based on the data analysis, it showed that there was no significant relationship between environmental sanitation and worm infestation on elementary student in Kalilangkap village, Bumiayu district, Brebes regency. Detail of analysis was presented as in Table 1 which indicated that indicator of restroom (p-value = 0.869), type of house floor (p-value = 0.077), the availability of clean water (p-value = 0.618), and the facility of garbage exile (p-value = 0.612) had the probability value (p-value) more than level of significant (α) 0.05.

Table 1 The relationship between environmental sanitation and worm infestation on elementary student in Kalilangkap village, Bumiayu district, Brebes regency

Environmental sanitation	Worm infestation				n	%	p
	Positive	%	Negative	%			
Condition of restroom							
Non feasible	6	14.3	36	85.7	42	100	0.869
Feasible	8	13.8	50	86.2	58	100	.
Type of house floor							
Soil	10	22.2	35	77.8	45	100	0.077
Board/ plaster/ ceramic	4	7.3	51	92.7	55	100	
Availability of clean water							
Enough	4	10.0	36	90.0	40	100	0.618
Not enough	10	16.7	50	83.3	60	100	
Facility of garbage exile							
Feasible	11	13.1	73	86.9	84	100	0.612
Non feasible	3	18.8	13	81.2	16	100	

Result of faeces observation on 100 samples of elementary students in Kalilangkap village, Bumiayu district, Brebes regency indicated that the proportion of elementary students which were positively worming was 14% and negatively one was 86%. This number was lower than the research result of Ginting [15] on under developed elementary students in Pangururan district, Samosir regency which showed that 114 students (56.40%) were worming infected. High and low frequency of worming on each research was very related with environmental sanitation and private hygiene that was as the infection source [16].

The worming number on 14% of elementary students in Kalilangkap village, Bumiayu district, Brebes regency indicated that effort of worming prevention and destroying in this region has not been maximally carried out because the ache was as neglected diseases and less monitored by healthy official [17]. It was due that the impact of this diseases can not directly seen or as silent diseases and chronically happened. This condition causes someone can not realize that he/ she is worm infected. Diagnose of worming on someone can be carried out by finding egg and mature worm in faeces [18].

Based on the evaluation of positive worm test, it indicated that *Ascaris* and *Ancylostoma* had the same proportion of 35.71%, however *Trichuris* and *Oxyuris* had the proportion each of 21.43% and 7.14%. *Oxyuris vermicularis* was as a worm that was not together with the group of *soil transmitted helminths* because the infection was not through soil but through dusty. The finding of *Oxyuris vermicularis* egg in faeces test could be caused by worm egg that was in outside of perinial area and together with faeces when child urinated every day.

Based on the research result, it indicated that the probability value (p-value) of each indicator as follow: restroom condition (p-value = 0.869), type of house floor (p-value = 0.077), the availability of clean water (p-value = 0.618), the facility of garbage exile (p-value = 0.612), those all were more than level of significant (α) 0.05. Therefore, it could be concluded that generally, the environmental sanitation and worm infestation did not have significant relation on elementary student in Kalilangkap village, Bumiayu district, Brebes regency. Although statistically there was not found the relation between the two variables, it could not be meaned that the environmental sanitation did not influence worm infestation on elementary students because worming was as one of diseases with environmental base and it was due to the bad environmental condition. The less of feasible sanitation causes the environment was polluted by faeces that contents worm egg.

Unhealthy faeces exile causes the worm egg can be easily infected in environment. Therefore, it is needed an effort of clean and health environment (sanitation) which can prevent the growth and infection of the worm on human. It is carried out so the worm is not easily to enter human body and cuases ache. Efforts of clean and health environment (sanitation) that can be carried out to preent the growth and infection of worm egg are as follow: by urinating in health restroom, having type of house floor that does not become as grow and

development place for worm egg, having the availability of clean water that is enough for maintaining self and environmental cleanliness. There is also necessary to make attention the facility of garbage exile so it is always closed for preventing the vector development that can take and distribute worm egg on human. Therefore, it can be said that environmental sanitation influences the happening of worm infestation on human mainly on children which often contact with soil.

No significant relation between environmental sanitation and worm infestation on elementary student in Kalilangkap village, Bumiayu district, Brebes regency is caused by the other factor such as self hygiene that has more probability of influence to the respondent than the environmental sanitation. It is due to that the entering of worm egg can be happened through some media such as by entering hand or goods which is contaminated by worm egg into mouth, less using foot underlayer when walking in soil which is contaminated by faeces (entering way of hook worm to human body), consuming food and drink which is contaminated by worm egg. Based on the conditions as above, it is shown that beside environmental sanitation, self cleanliness factor (self hygiene) like the behaviour of washing hand, eating, taking a bath, using foot underlayer, and cutting nail also influence the worm infestation on human.

Based on the initial observation that was conducted in Kalilangkap village, Bumiayu district, Brebes regency, it was found that most of students mainly elementary students did not use foot underlayer when they were playing in soil and had long and dirty nail. This condition indicated that child self hygiene mainly for elementary students were still less, so it could influence the happeninf of worm infestation. Therefore, to prevent the happenning of worm infestation on elementary student in Kalilangkap village, it could not only be payed attention on environmental sanitation. However, it was also necessary to pay attention the student self hygiene.

CONCLUSION

Based on the result as above, it can concluded that there is no strong relation between environmental sanitation (restroom condition, type of house floor, the availability of clean water, and the facility of garbage exile) and worm infestation on elementary students in Kalilangkap village, Bumiayu district, Brebes regency.

SUGGESTION

However, the suggestions are as follow:

1. There is needed to build School Health Unit (UKS) that can facilitate the implementation of healthy activity in school like jeakthy education about worming and the influenced factors.
2. There is needed to apply and increase the clean and health life style every day through the effor of environmental cleanliness (sanitation) and self cleanliness (self hygiene) for preventing the worm infestation on children by urinating in health restroom, exiling garbage in garbage place, washing hand before eating and after urinating with soap, taking a bath every day hygienely, using foot underlayer (sandals/shoes), consuming health and riped food and drink, and cutting nail.
3. There is needed the cooperation and active function of school headmaster, teacher, and parant in giving the guidance and education to children about the importance of self hygiene and environmental sanitation in preventing the worming.
4. There is needed the further research about worm infestation with the more sample number and it is added with the other factors that influence the worm infestation

REFERENCES

1. Depkes RI, 2006. *Surat Keputusan Menteri Kesehatan Nomor 424/MENKES /SK/VI/2006 tentang Pedoman Pengendalian Cacingan*. (Online). Diambil dari [http://www.hukor.Depkes.go.id/up_prod_kepmenkes/KMK% 20 No. % 20424% 20t tg%20Pedoman%20Pengendalian%20 Cacingan](http://www.hukor.Depkes.go.id/up_prod_kepmenkes/KMK%20No.%20424%20t%20Pedoman%20Pengendalian%20Cacingan).
2. Gandahusada S., 2000. *Parasitologi Kedokteran*. Jakarta : Fakultas Kedokteran Universitas Indonesia.
3. Rampengan, 1997. *Penyakit Infeksi Tropik pada Anak*. Jakarta : EGC
4. Depkes RI. 1999. *Rencana Pembangunan Kesehatan Menuju Indonesia Sehat 2010*. Jakarta : Depkes, RI.
5. Bethony, J., Brooker, S., Albanico, M., Geiger, S.M. and et al. 2006. Soil-transmitted Helminth Infections : Ascariasis, Trichuriasis, and Hookworm. *The Lancet*. 367 : 1521-32
6. Dachi, RA. 2005. *Hubungan Perilaku Anak Sekolah Dasar terhadap Infeksi Cacing Perut di Kecamatan Palipi Kabupaten Samosir*. Diambil dari [http ://repository.usu.ac.id/bitstream/123456789/15363/1/mki-des2005-%20%285%29.pdf](http://repository.usu.ac.id/bitstream/123456789/15363/1/mki-des2005-%20%285%29.pdf). Diakses 2013

7. Mardiana dan Djarismawati. 2008. *Prevalensi Cacing Usus pada Murid Sekolah Dasar Wajib Belajar Pelayanan Gerakan Terpadu Pengetasan Kemiskinan Daerah Kumuh di Wilayah DKI Jakarta*
8. Ali, Arsad Rahim, 2009. *Prevalensi Kecacingan Anak SD di Polewali Mandar Kembali Tinggi*. Diambil dari <http://arali2008.wordpress.com/2009/08/18/prevalensi-kecacingan-anak-sd-di-polewali-mandar-kembali-tinggi>
9. De SilvaR., Brooker S., Hotez P., Montresor A., Engles D. and Savioli L., 2003. "Soil-transmitted helminth infections: Updating the global picture". *Trends Parasitol.* 19 : 547–51.
10. Onggowaluyo, J.S, 2002. *Parasitologi Medik I*. Jakarta : Penerbit Buku Kedokteran EGC.
11. Ginting, S. Alemina, 2002. *Hubungan antara Status Sosial Ekonomi dengan Kejadian Kecacingan pada Anak Usia Sekolah Dasar di Desa Suka Kecamatan Tiga Panah Kabupaten Karo Provinsi Sumatera Utara*. Sumatera Utara : Fakultas Kedokteran Universitas Sumatera Utara.
12. Oswari, E., 1991. *Penyakit dan Penanggulangannya*. Jakarta : PT. Gramedia Pustaka Utama
13. Jalaluddin, 2009. *Pengaruh Sanitasi Lingkungan, Personal Hygiene, dan Karakteristik Anak terhadap Infeksi Kecacingan pada Murid Sekolah Dasar di Kecamatan Blang Mangat Kota Lhokseumawe*. Medan : Universitas Sumatera Utara
14. Pipit, Festi. *Hubungan antara Penyakit Cacingan dengan Status Gizi pada Anak Sekolah Dasar*. Diambil dari <http://www.fik.umsurabaya.ac.id/jurnal/HUBUNGAN-ANTARA - PENYAKIT - CACINGAN - DENGAN - STATUS - GIZI - PADA - ANAK - SEKOLAH - DASAR - SD - DISEKOLAH - DASAR - AL - MUSTOFA - SURABAYA.pdf>, 2013.
15. Ginting, 2009. *Faktor-faktor yang Berhubungan dengan Kejadian Kecacingan pada Anak Sekolah Dasar di Desa Tertinggal Kecamatan Pangururan Kabupaten Samosir Tahun 2008*. Skripsi. Fakultas Kesehatan Masyarakat Universitas Sumatera Utara. (Online).
16. Mardiana dan Djarismawati. 2008. *Prevalensi Cacing Usus pada Murid Sekolah Dasar Wajib Belajar Pelayanan Gerakan Terpadu Pengetasan Kemiskinan Daerah Kumuh di Wilayah DKI Jakarta*
17. Sumanto, D. 2010. *Tesis: Faktor Resiko Infeksi Cacing Tambang pada Anak Sekolah*. Program Studi Magister Epidemiologi Pasca Sarjana Universitas Diponero. Diambil dari http://eprints.undip.ac.id/23985/1/DIDIK_SUMANTO.pdf.
18. Supali, T., Margono, S.S. dan Abidin A.S.N. 2008. *Nematoda Usus*, dalam Susanto, I., Ismid, I.S., Sjarifuddin, P.K. dan Sungkar, S. (Editor), *Buku Ajar Parasitologi Kedokteran*. Jakarta : Buku Kedokteran ECG