JOURNAL OF COMMUNITY EMPOWERMENT FOR HEALTH

JCOEMPH

Vol 3 (3) 2020, 157-164 | Original article
DOI: 10.22146/jcoemph.54417

# Knowledge and behaviour of elementary school children concerning soil transmitted helminth infections

Annisa Aarts,[1,*] Ari Budi Himawan,[2] Marloes A van Bokhoven,[3] Job FM Metsemakers[3] and Tri Nur Kristina[4]

[1]*Faculty of Health, Medicine, and Life Sciences, Maastricht University, Maastricht, The Netherlands*
[2]*Faculty of Public Health, Diponegoro University, Semarang, Indonesia*
[3]*Public Health Research Institute (CAPHRI), Department of Family Medicine, Maastricht University, Maastricht, The Netherlands*
[4]*Clinical Microbiology Department, Faculty of Medicine, Diponegoro University, Semarang, Indonesia*

SUBMITTED: 4 April 2020 REVISED: 26 April 2020 ACCEPTED: 16 June 2020

KEYWORDS
Health behaviour
Elementary school children
Health knowledge
Soil transmitted helminth infections

ABSTRACT Soil transmitted helminth infections (STHI) are prevalent among elementary school children in Indonesia. The nutritional impairments that an infection can cause have their consequences for the children's development and health. This study aimed to determine children's knowledge and behaviour in relation to the prevalence of STHI among elementary school children in Jepara, a rural regency in Indonesia. The study intended to evaluate the effectiveness of the current elimination program for STHI in this area. A cross-sectional study was conducted among 132 children from eight elementary schools in Mlonggo, Jepara. The research population consisted of children aged eight to ten years old. During September and October 2018, the research population was obtained by consecutive sampling. Information about the children's knowledge and behaviour regarding STHI was collected using a questionnaire. Stool samples were collected to determine STHI prevalence. Analysis was done using chi-squared and Spearman's rho tests. Out of 132 children examined, no children had STHI. Scores on STHI knowledge were most often low (51.5%), while scores on behaviour were mostly average (67.4%). Statistical analysis showed that residence was significantly associated with the level of knowledge about STHI ($P$ = 0.007). Additionally, gender ($P$ = 0.002) and a previous STHI ($P$ = 0.041) were significantly associated with the children's behaviour concerning STHI. This study revealed inadequate knowledge and behaviour concerning STHI in elementary school children in Mlonggo, Jepara. Even though the prevalence of STHI was 0% in the study population, a proper health education program to teach children about STHI is still necessary.



## 1. Introduction

Soil transmitted helminth infections (STHI) are most prevalent in school-aged children from deprived communities in the (sub)tropics.[1] STHI can cause nutritional impairments that in turn, have their consequences for the children's development and health. Therefore, it is important for close communities, in rural areas in particular, that all community members take adequate prevention measures.[1,2]

Humans can get infected by roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichiura*) and hookworms (*Necator americanus* and *Ancylostoma duodenale*). Transmission takes place by eggs present in the feces of infected individuals. Contaminated soil can be ingested, or as with hookworms, their larvae can penetrate the skin directly.[1,2]

Children at-risk for STHI are supposed to receive periodic treatment consisting of anti-helminth drugs and education on health and hygiene conforming to the World Health Organization (WHO) eradication program.[1] However, there are still children infected. This implies that the interventions are not focused on the proper problems or the implementation is inadequate. Indonesia belongs to the countries where there is a high disease burden concerning STHI. This means that it is required to deworm twice a year in order to achieve the targets of WHO's global deworming program. In 2009, 15% of children in Indonesia were still in need of treatment.[3]

*Correspondence: annisa.aarts@alumni.maastrichtuniversity.nl
Maastricht University, Dept. Family Medicine c/o M.A. van Bokhoven PO Box 616 6200 MD Maastricht

A recent pilot study on STHI was conducted south of Semarang, Central Java. At baseline, 20% of the children had STHI. The intervention village received health education and latrines were installed. In both villages, the infected children received therapy with albendazole. Follow-up showed a much lower incidence of STHI in the intervention village (4.0% vs. 20.4%).[4] This pilot study shows the importance of health education and good sanitation to prevent (re-) infection with STHI, in addition to the anti-helminth treatment.

In a study conducted in Central Java, the prevalence of STHI in children from five different schools was determined. There was a marked variation in the prevalence of STHI (8.7% to 76.1%). The results suggest that education in avoiding high-risk behaviour and maintaining good personal hygiene are the most effective ways to reduce STHI infection.[5]

Recent research among elementary school children in Semarang, Central Java, showed a STHI prevalence of 11.3%. Good behaviour in personal hygiene was seen in 54% of the children, whilst 93% showed unhealthy environmental sanitation conditions.[6] These numbers are lower in a similar study conducted in Semarang. Here, the prevalence was only 10.7% and poor hygiene was seen in only 7.1%.[7]

A study on the knowledge level regarding STHI of students in Indonesia, showed a poor result in 77.3% to 88.8%, a fair result in 9.1% to 19.6% and a good result in 2.1% to 3.1% of the students.[8] These findings support the necessity of health education concerning STHI.

The previous research in Central Java showed overall STHI prevalence numbers among children ranging from 8.7% to 76.1%.[4-8] It appears that the implementation of the WHO eradication program still has room for improvement. Previous research showed high-risk behaviour and a lack of personal hygiene in school children were probably due to a lack of knowledge. This shows that anti-helminth treatment in itself is not sufficient, and health education is essential.

The purpose of this study was to explore the knowledge and behaviour concerning STHI in elementary school children in Jepara, Central Java. In addition, it has the goal to determine the current prevalence of STHI among them. Furthermore, relations between children's knowledge and behaviour with its prevalence can be explored. This study will reveal if a lack of knowledge and/or the presence of high-risk behaviour are possible causes of the high prevalences, and if the prevalence is indeed as high as stated in the literature. Since there are no data available on the prevalence of STHI in elementary school children in Jepara, it was our intention to make an estimate of the prevalence in this area, and to determine the position of our research population in the wide range of prevalence. Information about their knowledge, attitude and the resulting practices will reveal certain risk factors for STHI, for example, misconceptions and misunderstandings. By exploring school children's knowledge and behaviour concerning STHI, the focus for the elimination of STHI can be adjusted to their knowledge.

## 2. Method

In this cross-sectional study, the relation between the knowledge and behaviour of elementary school children on STHI and its prevalence among them was explored using a questionnaire and stool examination. With this information, the study intended to evaluate whether the current WHO eradication program for STHI in this area is focused on the proper problems. Data were obtained during September and October 2018.

The subjects included are all elementary school children aged eight to ten years old, in grades three and four of eight randomly selected elementary schools in Mlonggo (a district of the rural regency Jepara in Central Java, Indonesia). All included schools were under the supervision of Puskesmas Mlonggo (the community health centre). Each head of the school was personally invited to participate in the research by two of the researchers. A letter describing the goals and implementation of the research was handed over to support the spoken explanation. Additional questions were answered. Children that did not hand in a stool sample and/or did not give consent themselves as well as their parents, were excluded. Consent from the children themselves was important to secure their best

motivation to complete the questionnaire. The age of the included children was determined based on the prevalence of STHI and the ability to fill in the questionnaire. Studies show that the prevalence of STHI diminishes below the age of five and above the age of ten.[9,10] Also, children at this age are still learning the basics of personal hygiene. Based on an estimated STHI prevalence of 10.7%[7], a power of 80% and an alpha of 0.05, we calculated a sample size of 132 individuals. The sample size was achieved by consecutive sampling.

The children and teachers received verbal information and instructions on the research. First, we raised awareness of the existence of the disease in their country. By providing information on the consequences for their health, it was our intention to motivate the children to participate. We explained that it is our goal to explore their knowledge and behaviour concerning STHI in this area, by collecting stool samples and taking questionnaires to gather information. Afterwards, written information and informed consent forms for the parents and children were distributed. Also, coded stool containers and written instructions on how to collect the stool sample were distributed. On the following day, informed consent forms and stool samples were gathered and the latter were brought to the lab for examination. This process also took place on the third day, as well as taking the questionnaires.

The questionnaire was designed to obtain information about living circumstances, experiences with STHI, and knowledge and behaviour concerning STHI. It is an adjusted version of the questionnaire of the Ministry of Health of the Republic of Indonesia.[11] Living circumstances of interest concern residence, amount of household members, parental occupations, source(s) of drinking water and type(s) of latrine at home. Information on these variables, as well as on experiences with STHI, was gathered to explore influences on STHI knowledge and behaviour. Questions were added to gather additional information on STHI knowledge and behaviour. The questionnaire was provided in Bahasa Indonesia. Therefore, the researcher instructed a local colleague student to take the questionnaire. In groups of 7 to 15 children, the questionnaire was taken. The questions were shown in a PowerPoint presentation and read out loud by a local colleague student, one by one. Some questions were supported by pictures for a better understanding. The last question was an open question to obtain additional information on what else the children knew about STHI and from whom they received their knowledge. The children had to write down their answers on the questionnaire form. Before gathering all the filled-in forms, they were checked by the investigator on completeness. At the same time, the fingernails of the children were assessed. Any nail longer than approximately 1 mm and/or any nail with visible dirt was assessed as long and/or dirty. In case all nails were shorter than approximately 1 mm and without visible dirt, it was assessed as short and clean. Finally, key information about the prevention of STHI was given verbally and an educative poster was handed over.

The subject knowledge consists of five questions about STHI: cause, symptoms, consequences, treatment and prevention. For every right answer on the subject knowledge, one point could be obtained. Children were scored low (0-1 point), average (2-3 points) or good (4-5 points). A total of five points could be obtained on this subject. The same principle was used to score behaviour. One point could be obtained for each of the following: washing hands with soap before eating, washing hands with soap after defecation, showering with soap at least two times per day, clipping nails at least one time per week, always wearing shoes or sandals on soil, and having clean and short fingernails. A total of six points could be obtained on this subject. Children were scored low (1-3 points), average (4-5 points) or good (6 points).

A verbal instruction on how to collect the stool sample was given to support the written instructions. A spoon secured to the lid of the stool container could be used to gather the stool sample. Stool samples had a two hours conservation time, meaning that the sample had to be collected in the morning. The containers did not contain a fixative. Samples had to be stored at room temperature. A stool amount of 5-10 ml was required for examination.

All stool samples were examined for the presence of helminth ova. The stool examinations were performed by Puskesmas Mlonggo and an

external lab from a diagnostic centre to handle the capacity. Random samples stained with eosin were used for the preparation of the slides. A stool sample was considered positive when at least one helminth ova was observed using a microscope at 400x magnification.

SPSS version 25 was used for the statistical examination. The prevalence of STHI was based on the amount of positive stool samples. Knowledge and behaviour were measured by a scoring based on the questionnaire. Data analysis consisted of STHI prevalence, knowledge and behaviour with different background variables of influence. Substantive data analysis concerned further exploration.

Data were presented as means, percentages and standard deviations (SD). Bivariate analysis using chi-squared tests was used to assess relations between knowledge and behaviour with the independent variables. Correlations between knowledge and behaviour with numerical variables were obtained using Spearman's rho. A 95% confidence interval (CI) was used, and $p$-value < 0.05 was considered significant.

The research was approved with Ethical Clearance by the Commission on Health Research Ethics of the Faculty of Medicine Diponegoro University and Dr. Kariadi Hospital Semarang.

## 3. Result

From the 322 children in grades three and four of eight schools in Jepara, 132 children were included. The subjects had a mean age of 8.92 years, with the youngest subject being eight years old and the oldest being ten years old. With 51.5%, girls were the majority of the research population. Most of the children were in the third grade. Sinanggul was the most common residence with 51.5%. All 132 children had their feces examined by the lab and filled in the questionnaire. The remaining 190 children had problems gathering the stool sample in the morning (5%) and the majority did not receive consent from their parents to participate in the research (95%). Baseline characteristics of the included subjects are shown in Table 1.

All 132 stool samples turned out negative for the presence of helminth ova. Therefore, the prevalence of STHI in the research population was 0%.

**Table 1.** Baseline characteristics of research population

| | |
|---|---|
| Age (year), mean (SD) | 8.92 (0.7) |
| Gender, n (%) | |
| Male | 64 (48.5) |
| Female | 68 (51.5) |
| Grade, n (%) | |
| 3 | 67 (50.8) |
| 4 | 65 (49.2) |
| Residence, n (%) | |
| Jambu | 4 (3.0) |
| Karanggondang | 8 (6.1) |
| Mororejo | 23 (17.4) |
| Sekuro | 29 (22.0) |
| Sinanggul | 68 (51.5) |
| Amount of household members, mean (SD) | 4.82 (1.3) |
| Parental occupations, n (%) | |
| Both employed | 73 (55.3) |
| One employed | 57 (43.2) |
| None employed | 2 (1.5) |
| Total, n (%) | 132 (100) |

On the subject knowledge, the children scored most often low (51.5%), followed by average (42.4%) and good (6.1%). A great number of children were not aware of the causes (78.0%), symptoms (61.4%), consequences (90.9%), treatment (68.2%) and prevention (47.7%) of STHI. Misconceptions about symptoms were present in 12 children; they thought STHI causes fever, headache and joint pain. Another seven children thought STHI requires the lifelong need for medication, while antibiotics seemed the right treatment for 14 children. Misconceptions about prevention were made by 27 children; they thought that a healthy diet or a vaccine prevents infection.

Variables that might be of influence on the children's knowledge of STHI are shown in Table 2. The results show that their residence was significantly associated with the level of knowledge about STHI ($X^2$ (8) = 21.190, $p$ = 0.007). Other variables were not significantly associated with knowledge about STHI.

The scores on the subjects' behaviour were mostly average (67.4%), followed by good (17.4%) and low (15.2%). The results show that 25.0% of the children do not always wash their hands before eating. While 8.3% of the children do not always wash their hands after defecation. All children showered at least two times a day and clipped their nails at

**Table 2.** Variables influencing STHI knowledge in elementary school children

| Variables | | STHI knowledge, n (%) | | | $X^2$ | *P* |
|---|---|---|---|---|---|---|
| | | Low | Average | Good | | |
| Age (y) | 8 | 20 (15.2) | 14 (10.6) | 4 (3.0) | 4.671 | 0.323 |
| | 9 | 36 (27.3) | 27 (20.5) | 4 (3.0) | | |
| | 10 | 12 (9.1) | 15 (11.4) | 0 (0.0) | | |
| Gender | Male | 28 (21.2) | 31 (23.5) | 5 (3.8) | 3.142 | 0.208 |
| | Female | 40 (30.3) | 25 (18.9) | 3 (2.3) | | |
| Grade | 3 | 36 (27.3) | 25 (18.9) | 6 (4.5) | 2.849 | 0.241 |
| | 4 | 32 (24.2) | 31 (23.5) | 2 (1.5) | | |
| Residence | Jambu | 1 (0.8) | 2 (1.5) | 1 (0.8) | 21.190 | 0.007 |
| | Karang-gondang | 0 (0.0) | 6 (4.5) | 2 (1.5) | | |
| | Mororejo | 9 (6.8) | 11 (8.3) | 3 (2.3) | | |
| | Sekuro | 17 (12.9) | 12 (9.1) | 0 (0.0) | | |
| | Sinanggul | 41 (31.1) | 25 (18.9) | 2 (1.5) | | |
| Previous STHI | Yes | 42 (31.8) | 31 (23.5) | 6 (4.5) | 1.338 | 0.512 |
| | No | 26 (19.7) | 25 (18.9) | 2 (1.5) | | |
| STHI behaviour | Low | 11 (8.3) | 7 (5.3) | 2 (1.5) | 1.024 | 0.906 |
| | Average | 45 (34.1) | 39 (29.5) | 5 (3.8) | | |
| | Good | 12 (9.1) | 10 (7.6) | 1 (0.8) | | |

**Table 3.** Variables influencing STHI behaviour in elementary school children

| Variables | | STHI behaviour, n (%) | | | $X^2$ | *P* |
|---|---|---|---|---|---|---|
| | | Low | Average | Good | | |
| Age (y) | 8 | 2 (1.5) | 29 (22.0) | 7 (5.3) | 7.443 | 0.114 |
| | 9 | 15 (11.4) | 43 (32.6) | 9 (6.8) | | |
| | 10 | 3 (2.3) | 17 (12.9) | 7 (5.3) | | |
| Gender | Male | 15 (11.4) | 44 (33.3) | 5 (3.8) | 12.249 | 0.002 |
| | Female | 5 (3.8) | 45 (34.1) | 18 (13.6) | | |
| Grade | 3 | 7 (5.3) | 48 (36.4) | 12 (9.1) | 2.364 | 0.307 |
| | 4 | 13 (9.8) | 41 (31.1) | 11 (8.3) | | |
| Residence | Jambu | 0 (0.0) | 3 (2.3) | 1 (0.8) | 13.737 | 0.089 |
| | Karang-gondang | 1 (0.8) | 5 (3.8) | 2 (1.5) | | |
| | Mororejo | 7 (5.3) | 14 (10.6) | 2 (1.5) | | |
| | Sekuro | 3 (2.3) | 25 (18.9) | 1 (0.8) | | |
| | Sinanggul | 9 (6.8) | 42 (31.8) | 17 (12.9) | | |
| Previous STHI | Yes | 7 (5.3) | 56 (42.4) | 16 (12.1) | 6.392 | 0.041 |
| | No | 13 (9.8) | 33 (25.0) | 7 (5.3) | | |
| STHI knowledge | Low | 11 (8.3) | 45 (34.1) | 12 (9.1) | 1.024 | 0.906 |
| | Average | 7 (5.3) | 39 (29.5) | 10 (7.6) | | |
| | Good | 2 (1.5) | 5 (3.8) | 1 (0.8) | | |

least once a week. When playing outside in soil, only 51.5% of the children always wear shoes or sandals. Dirty and/or long fingernails were seen in 63.6% of the children.

Variables that might be of influence on the children's behaviour concerning the prevention of STHI are shown in Table 3. Gender was significantly associated with the children's behaviour ($X^2$ (2) = 12.249, $p$ = 0.002). The table indicates that boys show behaviour that is more likely to get infected with STH compared to girls. Also, a previous STHI was significantly associated with the children's behaviour ($X^2$ (2) = 6.392, $p$ = 0.041). Children that had a previous STHI were less likely to show risky behaviour.

**Table 4.** Correlations between numerical variables and their influence on STHI knowledge and behavior in elementary school children

| | | STHI knowledge | STHI behavior |
|---|---|---|---|
| Age | rs | -0.016 | -0.096 |
| | *P* | 0.856 | 0.272 |
| Grade | rs | 0.032 | -0.126 |
| | *P* | 0.714 | 0.151 |

Analysis using Spearman's rho showed there are no significant correlations between the numerical variables age and grade with STHI knowledge and behaviour. Results are shown in table 4

Other results showed that children with a history of STHI were more likely to have household members that had a previous STHI, compared to children that did not have a STHI before (PR: 2.735, CI: 1.664 – 4.495). The association between gender and behaviour was supported by the findings that boys were in comparison to girls less likely to wear shoes or sandals when walking on soil ($X^2$ (2) = 9.860, $p$ = 0.007), and boys tended to have dirty and/or long fingernails more often than girls (PR: 1.563, CI: 1.192 – 2.048).

Finally, none of the children knew any additional information about STHI. A few children responded that the information they knew was received from their parents.

## 4. Discussion

Previous studies on STHI in Central Java showed a prevalence ranging from 8.7% to 76.1%.[4-7] However, in this research STHI were not found. This finding can be supported by the fact that two months prior to the research, all children received their anti-helminth treatment according to the deworming program of Puskesmas Mlonggo. Bias in the process of gathering the stool sample to examining the stool sample in the lab could be another explanation. Delivering fresh stool samples was a difficult task for the children. Therefore, it is not clear whether the gathering of stool samples went as required. Examination of the stool samples was done in either of two different laboratories. Both used the same eosin staining technique, which was considered the easiest and cheapest way to detect helminth ova. However, this was not according to WHO guidelines and, therefore, a potential source of bias. Since the prevalence was zero, it was not possible to explore whether knowledge and/or behaviour were related to prevalence.

The children's knowledge about STHI turned out to be very poor. Only a few children were aware of the consequences, while just under half of the study population knew how to prevent STHI. Also, there were children with misconceptions about STHI. Residence was the only variable that was significantly associated with the level of knowledge about STHI. Especially children from the residence in Sinanggul showed the lowest results, and this might be due to the significantly higher number of children from this village. It assumes that some villages have better knowledge than others, and in some villages, there are still misconceptions circulating. Since the research took place in small rural villages, this assumption is reasonable. It is also supported by the fact that children responded that they received their STHI knowledge from their parents. These findings support the findings from a previous study in Indonesia, where poor knowledge was found in 77.3% to 88.8% of subjects.[8]

A vast majority of the children showed average behaviour when it comes to the prevention of STHI. However, there were still children that did not wash their hands every time before eating or after defecation. Less than half of the children did not always wear shoes or sandals when they were walking on soil, while more than half of the children had dirty and/or long fingernails. These results are worrisome, since these activities belong to basic personal hygiene and are moreover important risk factors for STHI. The results showed that boys are more likely to show risky behaviour, which is likely since boys tend to play outside more often and usually spend less time on personal care than girls. A history of STHI was also associated with the children's behaviour. This leads to the assumption that children learn from their previous STHI. Perhaps they gather information actively or receive information when receiving treatment. Previous research on children's behaviour to prevent STHI showed similar results, meaning most often had good or average behaviour in personal hygiene.[6,7]

Children that had a previous STHI were more likely to have family members with a previous STHI. This finding can be explained by their shared living environment, assuming that little knowledge and risky behaviour is spread within the family, and bad living circumstances are shared. This also might relate with the finding that knowledge is associated with residence.

In contrast to the literature, the prevalence of STHI in this study turned out to be 0%. However, as hypothesized, elementary school children have poor knowledge about all aspects of STHI and this in turn leads to risky behaviour when it comes to the prevention of STHI. The fact that misconceptions about STHI are still present in a certain number of children supports the lack of knowledge among them. Therefore, it is necessary to provide proper health education as a part of the WHO eradication program. This recommendation for Puskesmas Mlonggo is supported by the finding that the children only named their parents as a source of information. Here, the Puskesmas and schools can improve their important role as sources of health education.

The goal of health education is to increase knowledge and improve behaviour. To accomplish these goals, a few conditions have to be met. First of all, it is important to teach children in their own language. Even then, a simple word like 'stool' can be misunderstood if the children only speak in a dialect. Another requirement of being understandable is adapting to the level of the audience. Keeping explanations simple and using illustrations to support the spoken word are necessary. To make sure that information is not only heard, but also remembered, it is useful to apply an interactive way of teaching. For example, by letting the children participate in a dialogue, or asking them for their knowledge and experiences. Another way to activate the children is to make use of a playful way of teaching, by organizing a quiz and letting them compete for a small reward. The best way of learning, however, is by teaching someone else. Therefore, it is important to explain the relevance of the problem and the important role of the community. By emphasizing that the children can use their new knowledge to make a change, hopefully they feel the responsibility of transferring this information by teaching their family.

Health education is necessary to prevent re-infection. Multiple studies have proven its effectiveness. In China, animated cartoons increased STHI knowledge and changed the children's behaviour. These can be adapted to local cultural beliefs.[12] Another example of health promotion on an entertainment-based level was done using traditional Javanese shadow puppetry. A pilot study was conducted in Central Java to improve sanitation and hygiene in the prevention of STHI. The results showed significant improvements in both knowledge and behaviour.[13]

This study has a few limitations. The first one concerns the circumstances during the gathering of data. In the first school, it was difficult to keep the children completely separated from each other. Sharing answers was prevented by researchers and teachers walking around the classroom. Therefore, all the following schools were chosen based on their smaller classes. There was no bias suspected considering contact between (children from) different schools. None of the heads of the schools nor the children knew about the research. The children signed an informed consent form stating not to share information about the research to anyone. In a few schools, it was not possible to use a PowerPoint presentation due to the lack of a projector. However, taking the questionnaire verbally did not seem to influence the children's ability to answer the questions. Data obtained from questionnaires might have been biased by the children providing desired answers. This is supported by the fact that all children said that they clipped their nails at least once a week. However, 63.6% of the children had dirty and/or long nails. Data obtained from examining stool samples might have been biased by a recent anti-helminth treatment and/or an inadequate gathering of the stool samples. It is not sure whether all the stool samples were gathered the same morning. For future research, it is suggested to interview the children individually. This way, researchers can ask additional questions in case a given answer seems questionable. In addition, it is recommended to check in advance when the children had their last anti-helminth treatment. The gathering of stool samples can be optimized by picking up stool samples more frequently. Another option is for the parents to directly bring the stool samples to the lab themselves. The examination in the lab can be optimized by additionally examining

the stool samples with another technique such as Kato-Katz, the most common method for counting helminth eggs.[14,15]

## 5. Conclusion

Elementary school children in Mlonggo, Jepara have inadequate knowledge and show risky behaviour concerning STHI. This is a problem given the consequences STHI can have for their health. Therefore, it is necessary to provide proper health education as a part of the WHO eradication program. Here, the Puskesmas and schools can improve their important roles as sources of health education.

## Acknowledgments

The authors want to thank the children, heads of the schools, teachers, staff of Puskesmas Mlonggo, and staff and students of Diponegoro University for their valuable participation in this study. This study did not receive specific grants from funding agencies in the public sector, commercial, or non-profit section.

## References

1. World Health Organization. Factsheet Soil-Transmitted Helminth Infections. February 2018. Accessed on: 05-09-2018.
2. Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert A, et al. Soil-transmitted helminth infections: *Ascariasis*, *Trichuriasis*, and hookworm. Lancet 2006; 367(9521): 1521-1532.
3. World Health Organization. Eliminating Soil-Transmitted Helminthiases as a Public Health Problem in Children: Progress Report 2001–2010 and Strategic Plan 2011–2020. 2012. Accessed on: 13-11-2019.
4. Park MJ, Laksono B, Clements A, Sadler R, Stewart D. Worm-free children: an integrated approach to reduction of soil-transmitted helminth infections in Central Java. Rev Environ Health 2016; 31(1): 111-3.
5. Albright JW, Hidayati NR, Basaric-Keys J. Behavioural and hygienic characteristics of primary schoolchildren which can be modified to reduce the prevalence of geohelminth infections: a study in Central Java, Indonesia. Southeast Asian J Trop Med Public Health 2005; 36(3): 629-40.
6. Islamudin RA, Suwandono A, Saraswati LD, Putri RK. The association between Soil transmitted helminth infections with nutritional status in children: a cross sectional study in elementary school, Candi Village, Semarang District, Central Java Province, Indonesia. The 2nd International Meeting of Public Health 2016 with theme "Public Health Perspective of Sustainable Development Goals: The Challenges and Opportunities in Asia-Pacific Region", KnE Life Sciences, pages 288–295.
7. Texanto AH, Hendratno S. The Correlation of Personal Hygiene Status with Prevalence of Soil Transmitted Helminthes Infection at SDN 03 Pringapus, Regency of Semarang, Jawa Tengah. Diponegoro University Semarang, 2008. Accessed on: 25-09-2018.
8. Astrella C, Sungkar S. The Association Between Knowledge Level on Soil Transmitted Helminth Life Cycle and Education Level among Tsanawiyah and Aliyah Students in Pacet Village, Cianjur. 2014. University of Indonesia. Accessed on: 25-09-2018.
9. Ojja S, Kisaka S, Ediau M, Tuhebwe D, Kisakye AN, Halage AA, Mugambe RK, Mutyoba JN. Prevalence, intensity and factors associated with soil-transmitted helminths infections among preschool-age children in Hoima district, rural western Uganda. BMC Infect Dis. 2018 Aug 17;18(1):408.
10. Pasaribu AP, Alam A, Sembiring K, Pasaribu S, Setiabudi D. Prevalence and risk factors of soil-transmitted helminthiasis among school children living in an agricultural area of North Sumatera, Indonesia. BMC Public Health. 2019 Aug 7;19(1):1066.
11. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan No. 15 Tahun 2017 Tentang Penanggulangan Cacingan. No. 438, 2017. Accessed on: 07-09-2018.
12. McManus DP, Bieri FA, Li YS, Williams GM, Yuan LP, Henglin Y, et al. Health education and the control of intestinal worm infections in China: a new vision. Parasit Vectors 2014; **7**:344.
13. Kurscheid J, Bendrups D, Susilo J, Williams C, Amaral S, Laksono B, et al. Shadow puppets

and neglected diseases: evaluating a health promotion performance in rural Indonesia. Int J Environ Res Public Health 2018; 15(9).

14. Khurana S, Sethi S. Laboratory diagnosis of soil transmitted helminthiasis. Trop Parasitol 2017; **7**(2): 86–91.
15. Mbong Ngwese M, Prince Manouana G, Nguema Moure PA, Ramharter M, Esen M, Adégnika AA. Diagnostic techniques of soil-transmitted helminths: impact on control measures. Trop Med Infect Dis. 2020;5(2):93.