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DOI: [10.31965/infokes.Vol20Iss2.932](https://doi.org/10.31965/infokes.Vol20Iss2.932)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Personal Hygiene and Soil Transmitted Helminth Incidence in Elementary School Students Amanuban Barat District, South Central Timor****Michael Bhadi Bia^{1,2a*}, Ni Made Susilawati^{1b}, Agnes Rantesalu^{1c}, Karol Octrisdey^{1d}, Winioliski L.O. Rohi Bire^{1e}**¹ Department of Medical Laboratory Technology, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia² Center of Excellence, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia^a Email address: michaelbia07@gmail.com^b Email address: madeanalis@yahoo.co.id^c Email address: agnesransh@gmail.com^d Email address: octrisdeykarol@gmail.com^e Email address: winioliski@gmail.com

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Abstract

Soil-transmitted helminth infection remained a significant public health problem in many developing countries. Elementary school-age children dominated the cases in Indonesia due to poor personal hygiene. South Central Timor had the top three poverty and the highest stunting rates in East Nusa Tenggara. Research to examine the relationship between personal hygiene and the incidence of Soil-Transmitted Helminth infection had never been conducted in South Central Timor. The study population consisted of 279 elementary school students selected from Inpres Nulle Elementary School, Inpres Neonmat Elementary School, and GMIT Nulle Elementary School through the Multistage Random Sampling technique. It was obtained 160 children as the study samples. The study found that 46 children (29.0%) were positive for STH, and 114 (71.0%) were negative for STH. Furthermore, 30 (65.2%) were positive for hookworm, 14 (30.4%) were positive for *Ascaris lumbricoides*, and 2 (4.4%) children had mixed infections. Multiple Logistic Regression Tests showed a significant effect of washing hands with soap after defecating with $p = 0.031$ and $OR = 7.158$. Thus, if a child did not wash his hands with soap after defecating, he had a risk of STH infection by 7.158 times. Furthermore, the effect of eating habits obtained a $p = 0.038$ and an OR value = 0.133 with the possibility of eating habits that did not protect against STH infection. In addition, the effect of dirty nails obtained a $p=0.064$ and an $OR=5.264$, which indicated the risk of contracting STH by 5.264 times. The effect of snacking habit obtained a $p = 0.005$ and an $OR=0.121$. It can be concluded that the incidence of STH was simultaneously influenced by the habit of defecating on the ground, washing hands without soap after defecation, eating raw food, having dirty nails, and having poor snacking habits.

Keywords: Effect, Personal Hygiene, Soil Transmitted Helminth.***Corresponding Author:**

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1. INTRODUCTION

Soil-transmitted helminth infection remains a major problem in developing countries. More than 1.5 billion people are infected, or 24% of the world's population. The infection is widespread in tropical and subtropical regions, with the highest prevalence in sub-Saharan Africa, the Americas, China, and East Asia (WHO, 2022). A survey conducted in Indonesia reported a Soil Transmitted Helminth (STH) prevalence of 61%. The case was dominated by primary school-age children due to poor personal hygiene (Lee & Ryu, 2019), (Ali, Zulkarnaini, & Affandi, (2016). Helminth species that are of global concern and are often found are *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), and hookworm (*Necator americanus* and *Ancylostoma* spp., including *A. duodenale* and *A. ceylanicum*). Such infection is often found in areas with warm and humid climates, especially those with poor sanitation and personal hygiene (Parija, Meenachi Chidambaram, 2017). One of the important risk factors for hookworm transmission is using human feces as fertilizer and the habit of defecating on the ground. *Ascaris lumbricoides* generally infects people with poor access to environmental sanitation and personal hygiene and uses human feces as plant fertilizer. *Trichuris trichiura* is often found among patients who live in areas where human waste is used as fertilizer and people who like to defecate on the ground (Center for Disease Control and Prevention, 2022)

Several studies on STH reported that Ascariasis dominated the number of cases. A study conducted by Lee & Ryu, (2019) reported that Kalena Rongo Village, the poorest village in Southwest Sumba had a higher prevalence of STH: *A. lumbricoides* by 65.8% (279/424), *T. trichiura* by 60.4% (256/424), and hookworm by 53.5% (227/424). Furthermore, a study conducted in Southwest Sumba District found the highest prevalence of *A. lumbricoides* infection by 28.5%, followed by *T. trichiura* infection by 5.9% and mixed infection by 65.6%. A study conducted in Central Sumba showed *A. lumbricoides* infection by 30.0%, *T. trichiura* infection by 17.1% and mixed infection by 46.8%. A study on STH risk factors conducted by Rahmawati et al., (2020) proved that personal hygiene had a significant effect on the incidence of *Ascaris lumbricoides* and Hookworm infections among garden workers in Jember District. Furthermore, Dahal et al., (2019) reported that clean water supply, personal hygiene, environmental sanitation had an effect on the incidence of STH in Dad in Kowa Nigeria. Different findings were reported by Kurscheid et al (2020) that the behavior of washing hands with soap after defecation did not affect the incidence of STH transmission. However, the traveling activities of the population to the fields significantly affected the incidence of STH transmission. The impact of STH infection was reported by Paun et al., (2019) in Southwest Sumba which showed that there was an effect of STH worm infection on anaemia among elementary school-age children. Feces examination among 105 children found *Ascaris lumbricoides* by 31.0%, *Trichuris trichiura* by 21.4%, *Ancylostoma duodenale* by 2.4%, *Necator americanus* by 7.1%, mixed infections of *A. lumbricoides* and *T. trichiura* by 38.1%.

South Central Timor is the area with the third largest poverty rate in East Nusa Tenggara by 26.64% (Badan Pusat Statistik Provinsi Nusa Tenggara Timur, 2022). In addition, South Central Timor also contributed to the highest stunting rate in East Nusa Tenggara by 48.3% (Kementerian Kesehatan Republik Indonesia, 2021). Previous study conducted by Paun et al (2021) among 160 elementary school-age children in Amanuban Barat Sub-District found that 14 (8.75%) children were infected with *A. lumbricoides*, 30 (18.75%) children were infected with Hookworm, and 2 (1.25%) children experienced mixed infections of the two species. In addition, 84 children suffered from stunting. The analysis concluded that worm infection increased the risk of stunting among elementary school-age children in Amanuban Barat, South Central Timor. However, none of the previous studies determined risk factors for STH

transmission. Therefore, researchers are interested to determine the factors regarding personal hygiene that increase the incidence of STH infection transmission among elementary school-age children in Amanuban Barat Sub-District, South Central Timor.

2. RESEARCH METHOD

This study applied a cross sectional design. This study was conducted in elementary schools in Amanuban Barat Sub-District, South Central Timor District from May to October 2021. The study samples consisted of 160 elementary school-age children who were selected using Multistage Random Sampling. The dependent variable was the incidence of STH infection obtained from the results of children's feces examination at the Parasitology Laboratory of Kupang Health Polytechnic, while the independent variable was personal hygiene obtained through interviews (defecation habit, use of footwear, washing hands with soap before eating, washing hands with soap after defecation, eating habit, drinking water habit, play on the ground habit, cutting nails habit, cleaning the house, food storage, snacking habit). Data were analyzed using multiple logistic regressions. The study had obtained approval from the school management, parents as well as the students involved, maintained confidentiality, anonymously and obtained the approval letter issued by the ethical committee of Kupang Health Polytechnic number: LB.02.03/1/0052/2021.

3. RESULTS AND DISCUSSION

This study was conducted in three elementary schools in *Amanuban Barat* Sub-District, South Central Timor District, namely the Nulle Inpres Elementary School and the GMIT Nulle Elementary School located in Tublopo Village and the Neonmat Inpres Elementary School located in Nulle village.

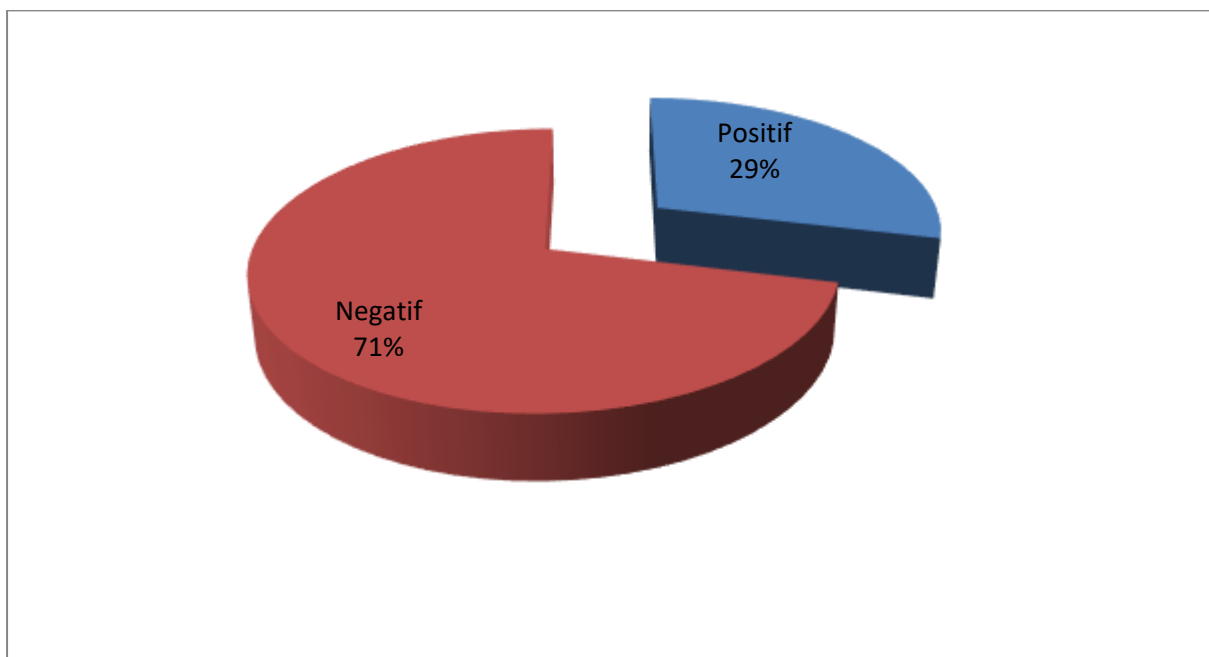


Figure 1. Laboratory Tests Results.

Figure 1 presents the results of laboratory tests. It was found that out of 160 elementary school-age children, there were 46 children (29.0%) were positive for STH infection and 71.0% were negative for STH infection. Types of worms based on the results of the examination are presented in the following figure:

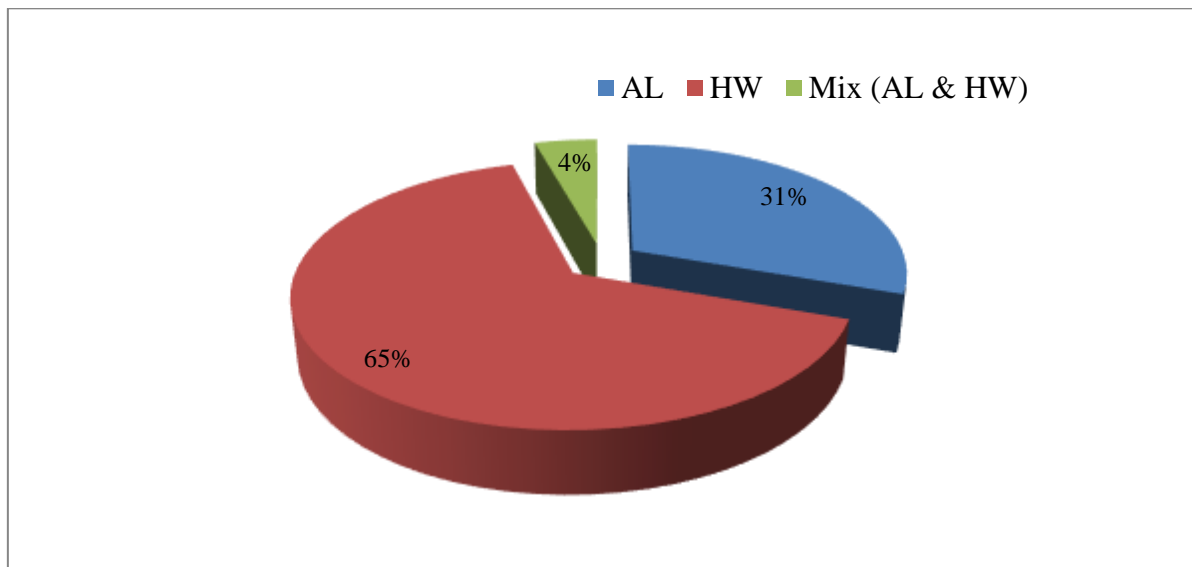


Figure 2. Types of Worms.

Figure 2 revealed that the most common type of worm was Hookworm (HW) by 65%, *A. lumbricoides* (AL) was found in 31.0% of cases and a mixture of HW and AL was found in 4.0% of cases. Description of STH infection among school-age children at three elementary schools is presented in the following figure:

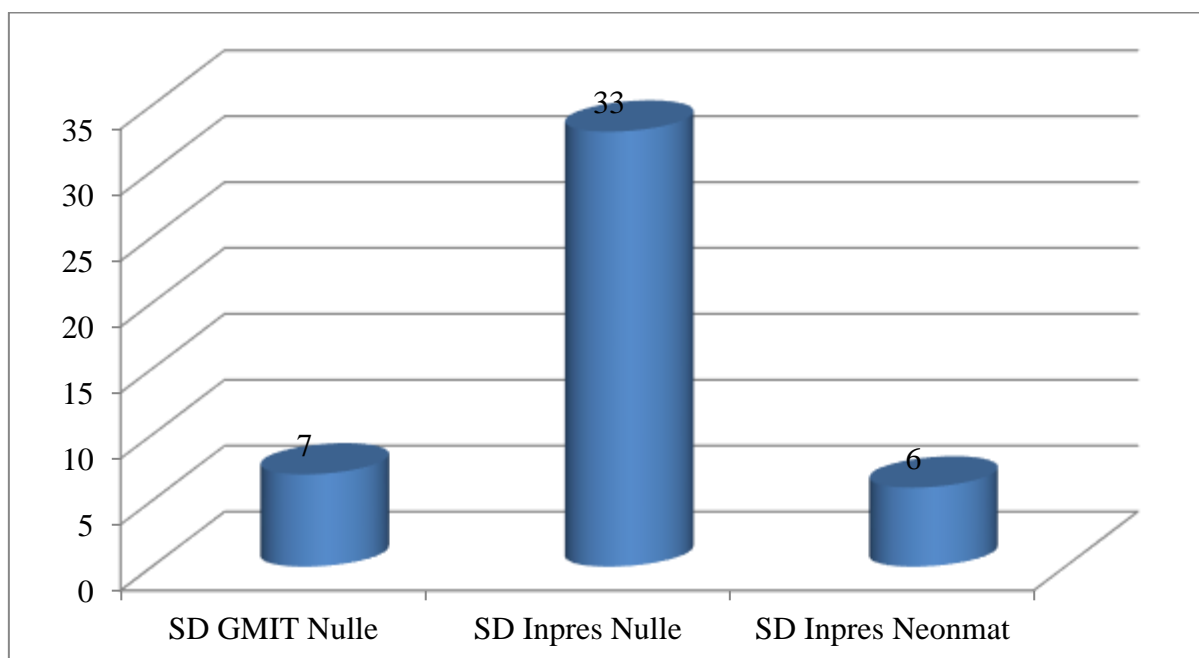


Figure 3. STH Infection by Elementary School.

Figure 3 Revealed that most of STH infection was found among 33 children (45.5%) at Inpres Nulle, Elementary School, among 7 children (22.6%) at GMIT Nulle Elementary School and among 6 children (10.3%) at Inpres Neonmat Elementary School.

Effect of Personal Hygiene on the Incidence of Soil Transmitted Helminth Infection. Data regarding personal hygiene was obtained through interviews with 160 children about

defecation habit, use of footwear, washing hands with soap after defecation, washing hands with soap before eating, eating habit, drinking water habit, playing on the ground, cutting nails, condition nails habit, food storage, and snacking habit. The effect of personal hygiene on the incidence of Soil Transmitted Helminths infection was analysed as presented in table 1 below:

Table 1. Effect of Personal Hygiene on STH Infection.

Personal Hygiene	STH Infection		Total	p-value	PR
	Positive	Negative			
Defecation habit					
On the ground	.28 (73,7%)	10 (26.3%)	38 (100%)	0.000	0.34
Latrine	18 (14.8%)	104 (85.2%)	122 (100%)		
Use of footwear					
No/Seldom	29 (50.0%)	29 (50.0%)	58 (100%)	0.000	0.57
Yes	17 (16.7%)	85 (83.3%)	102 (100%)		
Wash hands with soap before eating					
No/Seldom	31 (41.3%)	44 (58.7%)	75 (100%)	0.001	0,88
Yes	15 (17.6%)	70 (82.4%)	85 (100%)		
Washing hands with soap after defecation					
No/Seldom	31 (47.7%)	34 (52.3%)	65 (100%)	0.000	0.68
Yes	15 (15.8)	80 (84.2%)	95 (100%)		
Eating habit					
Uncooked/Raw	24 (92.3%)	2 (7,7%)	26 (100%)	0.000	0.19
Cooked	22 (16.4%)	112 (83.6%)	134 (100%)		
Water drinking habit					
Unboiled/Raw	27(96.4%)	1 (3.6%)	28 (100%)	0.000	0,212
Boiled/ gallon	19 (14.4%)	113 (85.6%)	132 (100%)		
Playing on the ground					
Yes	43 (37.1%)	73 (62.9%)	116 (100%)	0.000	2.64
No/Seldom	3 (6,8%)	41 (93.2%)	44 (100%)		
Cutting nails habit					
No/Seldom	39 (43.3%)	51 (56.7%)	90 (100%)	0.000	1.29
Yes	7 (10.0%)	63 (90.0%)	70 (100%)		
Nails condition					
Long/dirty	36 (41.4%)	51 (58.6%)	87 (100%)	0.000	1.21
Short/clean	10 (13.7%)	63 (86.3%)	73 (100%)		
Clean the house					
No/Seldom	33 (41.3%)	47 (58.8%)	80 (100%)	0.000	1.00
Yes	13 (16,3%)	67 (83.3%)	80 (100%)		
Food storage					
Open	27 (60.0%)	18 (40.0%)	45(100%)	0.000	0.39
Closed/Cupboard	19 (16.5%)	96 (83.5%)	115(100%)		
Snacking habit					
Yes	42 (42.9%)	56 (57.1%)	98 (100%)	0.000	1.60
No/Seldom	4 (6.5%)	58 (93.5%)	62 (100%)		

Table 1 revealed that there were still many children who defecated on the ground, had the habit of not using footwear when leaving the house, the habit of not washing hands with

soap before eating, the habit of not washing hands with soap after defecation, the habit of eating uncooked food, drinking raw water, habit of playing on the ground, rarely cutting nails, having long and dirty nails, rarely cleaning the house, having open food storage and there were still many children who often bought snacks around school. These habits were dominated by children with STH infection and had a significant effect on STH transmission. This was proven by the Chi-Square test with a p value of $<\alpha$ 0.05.

The Chi-Square test results showed that some of the habits of that may protect children from STH transmission were defecation, using footwear, washing hands with soap before eating, the habit of washing hands with soap after defecation, eating raw food, the drinking boiled water, the habit of covering food/stored in a cupboard. This was proven from the PR value <1.00 . Meanwhile, the habit of children who are at risk of causing STH transmission are the habit of playing on the ground, not/infrequently cutting their nails, long and dirty nails and eating habit. This was proven by the PR value of >1.00 . The variables mentioned above can be further tested further using multiple logistic regression which can be seen in table 2 below.

Table 2. STH Infection Incidence Model.

Variable	B	p-value	OR	95% CI	
				Low	Upper
Defecation habit	-4.434	0.000	0.012	0.002	0.083
Washing hands with soap after defecation	1.968	0.031	7.158	1.201	42.673
Eating habit	-2.017	0.038	0.133	0.020	0.893
Nails condition	1.661	0.064	5.264	0.911	30.428
Snacking Habit	-2.211	0.005	0.121	0.028	0.269

Table 2 describes the results of the multiple logistic regression test which presented the effect of defecation habit, washing hands with soap after defecation, eating habit, and snacking habit on STH infection among elementary school-age children. Habits that may be protective against the transmission of STH infection are proper defecation, eating cooked food, and not eating any snacks. Furthermore, children who were at risk of contracting STH infections did not wash hands with soap after defecation as well as long and had dirty fingernails.

The probability of STH infection among elementary school-age children in *Amanuban Barat* Sub-District simultaneously influenced by defecation habit, washing hands with soap after defecation, eating habit, condition of fingernails and snacking habit. Soil-transmitted helminth infections are common in areas with a warm, humid climate and poor sanitation and hygiene (WHO, 2012). Worm eggs excreted with human feces can contaminate the soil and live in warm, moist soil. These will develop into infectious eggs, which can then infect humans through contamination of food, drink, cutlery and drinking (Center for Disease Control and Prevention, 2022)

The results of this study showed that 46 (29.0%) of 160 elementary school-age children were positive for STH. The dominant worm species was Hookworm by 65%, *A. lumbricoides* by 30.4% and a mixture of Hookworm and *A. lumbricoides* by 4.3%. The results of other different study found that Ascariasis was a dominant type found. Furthermore, a study conducted by Paun et al., (2019) in Southwest Sumba District among 105 elementary school-age children showed that the most common types of worms found were *A. lumbricoides* among 13 children (31.0%), *T. trichiura* among 9 children (21.4%), *Ancylostoma duodenale* in 1 child (2.4%), *Necator americanus* among 3 children (7.1%), and a mixture of *A. lumbricoides* and *T. trichiura* among 16 children (38.1%). A study conducted by Mau, & Mulatsih, (2017) in West Sumba and Central Sumba showed that 568 elementary school-age children (91.0%)

experienced helminth infection. In a study conducted in West Sumba District showed that the highest prevalence was *A. Lumbricoides* infection by 28.5%, followed by *T. Trichiura* infection by 5.9% and mixed infection by 65.6%. In addition, a study conducted in Central Sumba District showed that the highest prevalence was *A. lumbricoides* infection by 30.0%, followed by *T. Trichiura* infection by 17.1% and mixed infection by 46.8%. A study in Kupang District conducted by [Susilawati & Smaut, \(2017\)](#) in Batakte Kota Kupang found that out of 59 respondents, 7 children were positive for *A. lumbricoides*. A study conducted by [Bria et al \(2021\)](#) in children in Manusak Village, Kupang District found Ascariasis infection by 38.46% (50/80). [Sinaga et al., \(2014\)](#) found that there were 38% of Ascariasis infection among children in the Liliba subdistrict, Kupang City. [Bia, \(2019\)](#), reported high worm cases in Noelbaki Village, Kupang District, namely ascariasis by 5.06% and Enterobiasis by 30.04%. A study conducted in Timor Leste in Manufahi by [Campbell et al., \(2017\)](#) found that there was 24% of Ascariasis infection among preschool age children. The prevalence of ascariasis from the mainland of Flores, namely in Nangapanda Ende District was 58.8% ([Djuardi et al., 2021](#)). A study conducted by [Lee & Ryu in \(2019\)](#) reported *Ascaris lumbricoides* infection by 65.8%, *T.trichiura* infection by 60.4%, and Hookworm infection by 53.5%.

According to psychological theory proposed by Skinner in [Notoatmodjo \(2012\)](#), behaviour is a person's response or reaction to external stimuli (stimulus). Meanwhile, health behaviour is all activities of a person both observable and non-observable related to health and illness in maintaining and improving health. The habit of washing hands is one of the eight important indicators in the clean and healthy behaviour launched by the government ([Kementerian Kesehatan Republik Indonesia, 2011](#)). Children who rarely paid attention to hand hygiene were at a high risk of being infected with behaviour- and sanitation-based diseases such as helminthiasis.

This study found that the habit of defecating, washing hands with soap after defecation, eating habit, condition of nails and snacking habit had a simultaneous effect on the incidence of STH infection. Almost the same thing was also found by [Avokpaho et al., \(2021\)](#) that the habit of defecation on the ground was closely related to cases of ascariasis and Hookworm infection. Furthermore, a study conducted by [Rahayu et al, \(2020\)](#) in South Kalimantan found that the behavior of washing hands with soap before eating and after defecation had a significant relationship with the incidence of ascariasis and enterobiasis infections. A study conducted by [Dhaka et al, \(2019\)](#) in Haryana found that the habits of washing hands and washing fruit or vegetables were very influential for the incidence of STH infection. [Pasaribu et al, \(2019\)](#) emphasized that washing hands with soap and taking deworming medicine 2 times a year had a significant effect on reducing cases of helminthiasis among elementary school-age children in plantation areas in North Sumatra. He also found that the habit of washing hands and wearing footwear were very closely related to the incidence of STH infection among children under 12 years of age. Different finding was shown in the study conducted by [Kurscheid et al, \(2020\)](#) which showed that the influential factors were employment status, ground floor condition, and goat ownership.

Another study among elementary school-age children in Ethiopia revealed that personal hygiene affected the incidence of hookworm infection (20%). The influential factors were the habit of using footwear, washing hands before eating and dirty fingernails ([Tiruneh et al., 2020](#)). A study conducted in Malaysia by [Nisha et al., \(2020\)](#) found a relationship between hand washing habit and the habit of using footwears very closely with the incidence of STH infection among children under 12 years of age. Different finding was presented by a study conducted by [Kurscheid et al, \(2020\)](#) and [Bisara and Mardiana, \(2010\)](#) which showed that the influential factors were employment status, ground floor condition, goat ownership, and personal hygiene.

The findings of this study emphasize the need for sustainable STH eradication together with other steps such as increasing the knowledge of elementary school-age children and elementary school teachers about the dangers of STH infectious diseases, carrying out a movement to wash hands with soap before eating and after defecating, eating food, eating washed fruits, cleaning nails and cutting fingernails and also teaching how to choose healthy and safe snacks. It is necessary to identify worm eggs on fingernails, snacks around elementary school, vegetables eaten raw, fruits that are usually consumed by elementary school-age children. Mass and routine administration of deworming drugs is required by the South Central Timor District Health Office.

4. CONCLUSION

This study revealed that elementary school-age children were very vulnerable to Ascariasis and hookworm infections. The probability of STH infection among elementary school-age children in Amanuban Barat Sub-District was simultaneously influenced by defecation habit, washing hands with soap after defecation, eating habit, condition of fingernails and snacking habit.

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