



## RISK FACTORS OF REINFECTION OF SOIL TRANSMITTED HELMINTHIASIS IN PRESCHOOL AGE CHILDREN

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### ABSTRACT

**BACKGROUND:** The incidence of reinfection Soil Transmitted helminth (STH) in preschool age greatly influences the growth and development of children. The importance of recognizing risk factors that influence the incidence of reinfection STH in preschool age, thereby reducing the incidence of recurrent infection. **AIM:** To find out the risk factors reinfection STH in preschool age. **METHOD:** A cohort prospective, open trial was conducted in Talawi sub district, North Sumatera Indonesia, from July to December 2018 among . Subjects were children age under five years who met the inclusion and exclusion criteria. The subjects were obtained by consecutive sampling. Demographic data and risk factors for STH reinfection were collected using questionnaire based interviews. Reinfection STH was determined based on the method of kato Katz and logistic regression with value  $p < 0.005$  was significant. **RESULT:** Of the 106 subjects in this study found female sex was dominant 51.90% compare to men. Reinfection prevalence one month after treatment 16.90% and three month after treatment 72.60%. Statistical analysis showing the behavior of children sleeping on floor (PR 0.808;  $p = 0.118$ ) and eating uncook food (PR:0.757;  $p = 0.043$ ) are significant risk factors for STH reinfection in preschool age children. **CONCLUSION:** Children who sleep on the floor 2.82 times are more at risk for reinfection STH in preschool age and children who eat uncook food 4.31 times more at risk for reinfection STH in preschool age.

**KEYWORDS :** Soil Transmitted Helminth, Reinfection, Risk Factors, Preschool Age

### INTRODUCTION

Worm infections are often overlooked, even though this infection causes long-term effects, especially in children, affecting the growth and development of children.<sup>1</sup> In 2009 the World Health Organization (WHO) estimated more than 2 million people were infected with the parasite STH.<sup>2</sup> STH infection can affect all ages, in preschool children, there are around 10-20% of the 3.5 million people who live in endemic STH.<sup>2</sup> However, these infections do not cause a rapid risk of death, but it can impact the health of children. Chronic infections can affect growth, cognitive development, physical activity, and immune responses to children. Data from the Indonesian Ministry of Health in 2015 about the prevalence of helminthiasis around 20-86% with an average of 30%.<sup>3</sup> Based on research in Karo District of North Sumatra in 2004, infected 91.3% of population.<sup>4</sup> The same study in Karo district in 2016 examined for stool in children under five years old, with result 34.4% infected helminthiasis.<sup>5</sup>

A study in Ethiopia in 2015, from 277 children aged 1 to 5 years old found a prevalence of infection at 17.3%.<sup>6</sup> The high risk of reinfection of STH is who had been infected with STH and had received therapy. The reinfection related to geographical location, poor hygiene, and barefoot behavior because it can increase the risk contact with worm eggs or larvae.<sup>1</sup> The study of school-age children in Malaysia showed reinfection of STH after three months of treatment was 48.9%.<sup>7</sup> The researches regarding reinfection in children under five years old or preschool age children are still rare.<sup>1</sup>

### METHODS

#### STUDY DESIGN

This study was a prospective cohort study to determine the risk factors for the incidence of helminthiasis reinfection in children under five years old. The study was conducted in twelve TK / PAUD Schools in Talawi sub-district, Batubara

district, North Sumatra province. The study was started from July to December 2018. The target population in this study was children under five years old. The sample in this study is the population who met inclusion and exclusion criteria obtained by consecutive sampling. Inclusion criteria are children under five years old; parents agree to participate in this study, stay at Talawi sub-district Batubara district North Sumatra province. Exclusion criteria are a history of taken antihelminth drugs under one month, a child who did not give the sample and parents who did not attend when giving an explanation or disagree to join the study. This study was approved by the Ethics Committee of the Faculty of Medicine, University of Sumatera Utara.

### RESULTS

The population of 433 children, only 306 children fulfill the inclusion and exclusion criteria. Total of the 306 children who were stool examination, 110 children (35.9%) were infected then received Albendazole therapy.

**Table 1. Baseline Characteristics**

Characteristics of Subject	
Sex, n (%)	
Male	51(48.10)
Female	55(51.90)
Age (year), mean (SD)	4.75(0.53)
Weight (kg), mean (SD)	15.58(3.63)
Height (cm), mean(SD)	103.30(6.82)
Nutritional status, n (%)	
Normoweight	53(50.00)
Mild malnutrition	44(41.50)
Obese	5(4.70)
Overweight	3(2.80)
Severe malnutrition	1(0.90)
Father's education, n (%)	

Illiterate	5(4.80)
elementary school	24(22.90)
Junior high school	20(19.00)
Senior high school	48(45.70)
University	8(7.60)
Father's occupation n (%)	
Government employee	3(2.90)
Private employee	11(10.50)
Entrepreneur	10(9.50)
Fisherman	78(74.30)
Farmer	2(1.90)
Breeder	1(1.00)
Mother's education, n (%)	
Illiterate	2(1.90)
elementary school	26(24.50)
Junior high school	23(21.70)
Senior high school	45(42.50)
University	10(9.40)
Mother's occupation n (%)	
Government employee	3(2.80)
Private employee	7(6.60)
Entrepreneur	7(6.60)
Farmer	3(2.80)
Breeder	2(1.90)
Housewife	84(79.20)
Total n(%)	106(100)

The prevalence of helminthiasis reinfection based on the type of worm STH found in stool examination (Table 2). The proportion of *A.lumbricoides* infection was most common in initial examination with 79 children (25.8%). Reinfection *T. Trichiura* was most common found on examination after 3 months treatment with 22 children (20.8%). Hookworm infection found only in 1 child (0.3%) and mixed infection between *A.lumbricoides* and *T.trichiura* were mostly found at initial examination with 11 children (3.6%).

**Table 2. Worm distribution at initial examination before taking medication, 1 week after treatment, 1 month after treatment and 3 month after treatment.**

Worms type	Initial examination n (%)	1 week after treatment n (%)	1 month after treatment n (%)	3 month after treatment n (%)
<i>A.lumbricoides</i>	79(25.8)	2(1.8)	7(6.6)	51(48.1)
<i>T.trichiura</i>	19(6.2)	2(1.8)	10(9.4)	22(20.8)
Hookworm	1(0.3)	0(0)	1(0.9)	1(0.9)
Mixed	11(3.6)	0(0)	0(0)	3(2.8)
No worms	196(64.1)	106(96.4)	88(83.0)	29(27.4)

Based on environmental factors, the availability of latrines were found to be significant and related with incidence of STH reinfection (p value 0.022).

**Table 3. Relationship between environmental variables and incidence STH reinfection in preschool children**

Environmental factors	Reinfection		p*	PR	Confidence Interval (CI 95%)
	Positive n (%)	Negative n(%)			
Latrine			0.022	1.385	1.155-1.661
Yes	60(77.9)	28(96.6)			
No	17(22.1)	1(3.4)			
Water source			0.548	0.875	0.668-1.146
Wells	13(16.9)	3(10.3)			
Water suplay company	64(83.1)	26(89.7)			

Relationship between mother / caregiver behavior with

incidence of STH reinfection after 3 months treatment were habit to defecate in latrine and ate uncooked food (p values 0.036 and 0.122).

**Table 4. Relationship between mother / caregiver behavior variables with incidence of STH reinfection in preschool children.**

Mother / caregiver behavior	Reinfection		p*	Prevalence Ratio (PR)	Confidence Interval (CI 95%)
	Positive n (%)	Negative n (%)			
Footwear			0.441	0.885	0.690-1.136
Yes	48(62.3)	15(51.7)			
no	29(37.7)	14(48.3)			
Latrine usage			0.036	1.397	1.168-1.671
Yes	59(76.6)	28(96.6)			
No	18(23.4)	1(3.4)			
Wash hand before eating			0.548	1.143	0.872-1.496
Yes	64(83.1)	26(89.7)			
No	13(16.9)	3(10.3)			
Nail trimming			0.390	1.163	0.899-1.505
Yes	63(81.8)	26(89.7)			
No	14(18.2)	3(10.3)			
Eating uncooked food			0.122	0.801	0.645-0.995
Yes	27(35.1)	5(17.2)			
No	50(64.9)	24(82.8)			

Relationship between children's behavior and incidence of STH reinfection after 3 months treatment found variable sleeping on the floor, nail trimming and eating uncooked food significantly correlated with STH reinfection (p 0.118, p 0.125 and p 0.043).

**Table 5. Relationship between child behavior variables and reinfection events STH in preschoolers**

Child behavior	Reinfection		p*	Prevalence Ratio (PR)	Confidence Interval (CI 95%)
	Positive n (%)	Negative n (%)			
Playing on soil			0.708	0.938	0.659-1.334
Yes	66(85.7)	24(82.8)			
No	11(14.3)	5(17.2)			
Sleeping on the floo			0.118	0.808	0.645-1.013
Yes	36(46.8)	8(27.6)			
no	41(53.2)	21(72.4)			
Hand washing before meal			0.929	1.063	0.793-1.427
Yes	64(83.1)	25(86.2)			
No	13(16.9)	4(13.8)			
Defecate any place			0.664	1.095	0.614-1.952
Yes	4(5.2)	2(6.9)			
No	73(94.8)	27(93.1)			
Hand washing after defecate			1.000	1.037	0.731-1.471
Yes	68(88.3)	26(89.7)			
No	9(11.7)	3(10.3)			
Nail trimming			0.125	1.297	1.053-1.599
Yes	60(77.9)	27(93.1)			
No	17(22.1)	2(6.9)			
Eating uncooked food			0.043	0.757	0.614-0.933
Yes	28(36.4)	4(13.8)			
No	49(63.6)	25(86.2)			

Based on the results of the Chi-Square test, it can be obtained that there are six variables that can be continued to take the multivariate test namely multiple logistic regression. The six variables are behavior mother / caregiver like habit defecate in latrine, availability of latrines, eating uncooking food, the children behavior are sleeping on the floor, nails trimming and eating uncooked food.

Analysis test multivariate logistic regression was done five times with conclusion behavior children sleep on the floor and children eating uncooked food that are significant to helminthiasis reinfection in children under five years old.

## DISCUSSION

Soil-transmitted helminthiasis reinfection is a chronic recurrent infection and still a health issue in the world. In 2012 WHO made preschool age children as one of the population at risk for STH infection.<sup>1,2</sup> Therefore risk factors for STH infection and reinfection in preschool children are important to understanding. The cross-sectional study in China by Wang et al. showed prevalence of STH infection 21.2% in preschool age children.<sup>8</sup> The prevalence of higher STH infections was found in Davis study where the prevalence of STH infection was 40.5% in preschool age and 40.7% in school age.<sup>9</sup> In this study prevalence of STH infection in preschool age children was 35.9%.

Our study reports prevalence of STH reinfection in children under five years old 16.9% (18 children from 106 children) at one month after therapy and 72.6% (77 children from 106 children) at three months after therapy. The prevalence of the incidence of reinfection in children under five years old after three months treatment found 41.6% (87 children from 209 children).<sup>1</sup> Study in Ethiopia in 2015 incidence of STH reinfection in school-age children 36.8%.<sup>10</sup>

Study in Ethiopia in 2014 showed that girls were more infected with STH (56.2%) compared with boys.<sup>11</sup> The same result found in this study which girls were more dominant (51.9%) compared to boys. However, different results found by Masyithah et al in 2016 where children STH infection in boys (54.5%) compared to girls.<sup>12</sup>

The role of mothers for incidence of STH reinfection in preschool children is very important. In this study we found the highest maternal education was in Senior High Schools (42.5%). Different results found in 2014 Ethiopian study, the largest maternal education was non-formal education 37.8%.<sup>11</sup> This study a single dose of albendazole given 200 mg for age 1 until 2 years old and 400 mg over 2 years old. The dosage as same as study in Canada by Carli et al in 2009.<sup>1</sup>

*Ascaris Lumbricoides* is the most common type of worm as a cause of STH reinfection (48.1%). The same results found in Ethiopian study by Zedro et al in 2015 with *A.Lumbricoides* reinfection (36.8%).<sup>10</sup> Different results found in Tanzanian study at 2006 where the most *T.trichiura* infection (15.6%).<sup>13</sup>

Children who live in homes that have ceramic or carpet floors have a lower prevalent STH infection compared to children who live at home with soil or sand floors.<sup>14</sup> In this study, children's sleep behavior 2.82 times higher for STH reinfection. The floor intended in our study is a floor from soil or sand. Different results found in Ethiopian study by Yetemwork et al in 2005 showed that behavior sleeping on the floor was not a risk factor for STH infection.<sup>5</sup>

The results of this study to obtain children's behavior in eating uncooked foods become an important factor for incidence of STH reinfection. Childhood behavior eating uncooked food causes the risk of reinfection of STH 4.31 times higher than children who do not eat uncooked food. Similar results study in China by Wang et al in 2010 where STH infection happen in children who consumed uncooked vegetable 30.3% (114 children from total 367 children) and children who consumed uncooked meat 78.7% (296 children from total 376 children).<sup>15</sup>

In the Ethiopian study in 2014, the habit not nail trimming and washing hands before eating had a risk of the incidence of STH infection in preschool age children. The habit of not nail

trimming causes the risk of STH infection 3.2 times higher than children who nail trimming. The habit of not washing hands before eating is 3 times more risk of STH infection compared to children who wash their.<sup>11</sup> In this study the habit factor of not nail trimming and the habit of not washing hands before eating are not as risk factor for STH reinfection in preschool age children. Soil-transmitted helminthiasis infection can be examined by laboratory test. Study Jiero et al in 2015 found correlation between eosinophil count and STH infection.<sup>16</sup> This study stool examined by Kato-Katz.

In this study, children who live at home with toilet facilities outside the house have a higher prevalence of STH infection compared to children who live in homes with toilet facilities located at home. Most children 76.6% defecated in latrine and 23.4% defecate many place. This study we did not assess latrine locations in the house or outside the house. The child who has received worm treatment but still found eggs on the next stool examination, worm treatment still given again.

## CONCLUSIONS

Sleeping on the floor and eating uncooked food of children are the risk factors for STH reinfection in preschool children.

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