



## Correlation Between Soil Transmitted Helminth Infection and Incidence of Anemia at Public Primary School 060925

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**Abstract :** Soil transmitted helminth infection (STH) is one of most prevalent worldwide infection, especially in environments with poor sanitation. Based on WHO data, more than 1.5 billion, or 24% of the world population infected with soil transmitted helminth. In Indonesia, the prevalence of worm infection is quite high, ranging from 10%-85.9%. The objective of this study was to determine the correlation between soil transmitted helminth infection with hemoglobin status on primary school children, as well as to determine the prevalence of worm infection and anemia, infection intensity and the type of worm that infects the most of them. This study was analytical observational with cross-sectional method. The sampling technique was total sampling; total samples obtained were 72 people. The study took place in Public Primary School 060925, Village Harjosari I, district of Medan Amplas throughout March to December 2015. Statistical analysis was performed bivariate analysis to find the correlation between soil transmitted helminth infection with anemia through Chi-square ( $\chi^2$ ). The results showed that the prevalence of worm infection and anemia were 40.3% and 33.3%. Type of worm that infects most was *Ascaris lumbricoides* (26.5%). Also, there is a significant correlation between soil-transmitted helminth infection and hemoglobin levels with p Value 0.027 and the risk factor of STH infection have positive relationship towards anemia with Odds Ratio (OR) 3.08 (CI 95: 0.026 – 0.041).

**Keyword :** soil-transmitted helminthiases, anemia, primary students.

### Introduction

Soil transmitted helminth (STH) infection is the most common infection in the whole world, especially in an environment with bad sanitation. This kind of infection is transferrable through worm eggs that contaminate the surrounding ground that created by a bad sanitation in the environment. Infections with STHs affect more than one billion people, particularly the rural are of developing world. Approximately one third of the world's population infected with at least one specie of STH, with *Ascaris lumbricoides* infecting 800 million people, *Trichuristrichiura* 600 million people, hookworm 600 million people, *Strongyloides stercoralis* 100 million people and resulting in up to 135,000 deaths annually. This infection is widely spread in both tropic and subtropic countries, with the most infections occurred in Saharan Africa, America, China, and East Asia. More than 270 million of pre-school children about 600 million students lived in those areas with high level of infection.<sup>1</sup> School age children are at high risk for STH infections because of their habit of playing in the dirt, which may be contaminated with infective stages of STH eggs/larvae and their lack of good personal hygiene. In East Asia, almost 50% of all the school age children are anemic. The burden of STH infection is correlated with anemia and micronutrient deficiencies such as Iron and Folate.<sup>2</sup>

Intestinal worms could decrease the health, nutrition, intelligence and productivity of the patients, which later could cause economic losses such as: loss of carbohydrate, protein, and blood. At the end this will decrease the human resource quality. In chronic bleeding cases caused by parasites like hookworms, whipworms, and roundworms, they cause an increasing need of iron. Those worms would stock on the bowel's wall and consume blood. Blood lost varies from 2-100 cc per day, depending on the level of infection. Some of the iron in blood that is flown by the worms in the stomach would be reabsorbed in the lower tract of gastrointestinal, while the rest would be wasted through feces.<sup>3</sup>

In Indonesia, according to Directorate General of Diseases Prevention and Control (Dirjen P2P) Ministry of Health of the Government of Indonesia, intestinal worm prevalence is relatively very high. It varies from 10% to 85.9%, especially among the citizens with low income and bad sanitation. This intestinal worm prevalence report was resulted based on surveys conducted in 10 sentinel provinces in year 2005 with primary school students as the target varies from 1.37% up to 77.14%. The highest infected areas found in Banten province and the lowest in South Kalimantan province. The type of worms that cause intestinal worm mostly are *T.trichiura* with percentage of 16.52%, followed by *A.lumbricoides* with 12.38%, and the lowest is *Ancylostoma duodenale* with 1.38%.<sup>4</sup> Worm infection proportion in an elementary school named as SD GMIM Buha Manado students was examined, the results showed that 17.5% (14/80) children were and 82.5% (66/80) were not infected.<sup>5</sup> In the 14 infected children, there were 9 of them had a normal hemoglobin ( $\geq 11.5$  g/dl) while 5 of children had abnormal hemoglobin it was 9.5 g/dl.<sup>5</sup> Low Hb prevalence on primary school students grade IV, V and VI in Makassar coastal areas year 2013 was 38% out of 57% got infected. Worms' species prevalence that infected primary school students of grade IV, V and VI in Makassar coastal areas was 34% for single infection *A.lumbricoides* and 14% for double infection *A.lumbricoides* and *T.trichiura*.<sup>6</sup> They were few reports on the prevalence of *S.stercoralis*; Widjana et al., 2001 reported a prevalence of *S.stercoralis* of 1.6% among the people of Bali<sup>7</sup> and 10.6% of larvae *S.stercoralis* positive reported from stool specimen of patient at Parasitology Laboratory of FMUI.<sup>8</sup>

Iron deficiency anemia (IDA) affects 20% to 50% of the world's population. It is common in young children and prevalence has been reported to be as high as 22% among East-Asian school children.<sup>9</sup> In developing countries, hookworm and trichuriasis can lead IDA. Among the low income groups beside poor dietary consumption, soil-transmitted helminth infection also can cause to the high anemia prevalence in children. Trichuriasis can cause colitis leading to dysentery and chronic fecal blood loss. Hookworm infection results in intestinal bleeding at site of attachment causing in chronic intestinal bleeding. In the severe form, these infections also lead to malnutrition and hypoalbuminaemia in children.<sup>10</sup>

Based on the study above, we conducted a research on the correlation between soil transmitted helminth infection and incidence of anemia among Primary School age. The main goal is to know the correlation between soil transmitted helminth infection with the anemia occurrence on the students of Public Primary School 060925 of Medan.

## Materials and Methods

An analytic observational cross sectional study was undertaken to evaluate the prevalence of STH and anemia in Public Primary School 060925, Harjo Sari, Amplas, Medan, North Sumatera (Figure 1). Children included in the study were enrolled in primary school between March and November 2015. Samples were selected through total sampling following inclusion and exclusion criteria. The inclusion criteria were: subjects must be student grade III and IV with soft or watery stool, or had a record of soft/watery stool for the last three months, were willing to bring feces. The exclusion criteria were who did not get approval from the parents, had not been consuming anthelmintic medications in the past 6 months, and was not sick or being in a medication.

Stool samples were preserved in 10% formalin for transportation. Direct examination and Kato-Katz method were used to detect helminth ova or larvae.<sup>11</sup> Hemoglobin (Hb) levels were measured using an automatic portable hemoglobin meter Easy Touch GCHb Function monitoring. Data were analyzed using the statistical Package for the Social Sciences (SPSS) v20 for Mac. Frequencies were used to describe variable distributions. Chi-Square test was used in bivariate analyses of prevalence STH infection and anemia.



Figure 1. Map of North Sumatera; red point: Amplas district (location of the study)

## Results & Discussion

Total subjects were 114 students grade 3 and 4 from Public Primary School 060925, but only 72 samples met the study criteria. The following details were 22/72 (30.6%) students from class 3A, 20/72 (27.8%) students from class 3B, 16/72 (22.2%) students from class 4A, and 14/72 (19.4%) students from class 4B (Table 1). Most of the subjects were male 40/72 (55.6%) students and female 32/72 (44.4%) students. The most frequent age in this study was 8 years old 60/72 (50%) students (Table 2).

Table 1. Frequency Distribution of Students at Public School 060925 who Collecting Stool & Measured Hb Based Classroom

Classroom	Total Students	Feses	Hb	Feses + Hb	Percentage (%)
3A	31	23	27	22	30,6
3B	28	24	22	20	27,8
4A	27	18	24	16	22,2
4B	28	15	24	14	19,4
<b>Total</b>	<b>114</b>	<b>80</b>	<b>97</b>	<b>72</b>	<b>100</b>

Table 2. Frequency of Gender & Age among Students at SDN 060 925-student district of Medan Amplas

	Frequency (n)	Percentage (%)
<b>Gender</b>		
Boy	40	55,6
Girl	32	44,4
<b>Age</b>		
7 years	3	4,2
8 years	36	50,0
9 years	24	33,3
10 years	9	12,5

**Table 3. Soil-Transmitted Infection Prevalence Helminths and type of STH on Students at Public Primary School 060925 Medan District Amplas**

STH Infection	Frequency (n)	Percentage (%)
<b>Positif</b>	29	40,3
<i>A.lumbricoides</i>	19	26,5
<i>Hookworm</i>	0	0
<i>T.trichiura</i>	5	6,9
<i>Mixed</i> ( <i>A. lumbricoides</i> dan <i>T. trichiura</i> )	5	6,9
<b>Negative</b>	43	59,7
<b>Total</b>	<b>72</b>	<b>100,0</b>

**Table 4. Prevalence of Anemia in Students Public Primary School 060925 Medan District Amplas**

The Prevalence of Anemia	Frequency (n)	Percentage (%)
Hb < 11,5 g/dl	24	33,3
Hb ≥ 11,5 g/dl	48	66,7
<b>Total</b>	<b>72</b>	<b>100,0</b>

**Table 5. Cross tabulation STH with the Prevalence of Infection Anemia in Students in Public Primary School 060925 Medan District Amplas**

Infection STH	The Prevalence of Anemia				Total	%
	Positif (+)	%	Negatif (-)	%		
Positif	14	58,3	15	31,3	29	40,3
Negatif	10	41,7	33	68,8	43	59,7
<b>Total</b>	<b>24</b>	<b>100</b>	<b>48</b>	<b>100</b>	<b>72</b>	<b>100,0</b>

$p = CI\ 95\%$      $p < \alpha = 0,05$      $p = 0,027$

We found 40.3% (29/72) students were positive STH infection; the following details were 26.5% (19/72) single *Ascaris lumbricoides* infection, 6.9% (5/72) single *Trichuris trichiura* infection, 6.9% (5/72) mixed *A.lumbricoides* and *Trichuris trichiura*. None of the students was infected by Hookworm (Table 3). The overall prevalence of anemia (Hb level <11.5 g/dL) and non anemia was 33.3% (24/72) and 66.7% (48/72) respectively (table 4).

In the cross tabulation, subjects that positive STH infections were 58.3% (14/24) students suffering anemia and 31.3% (15/48) not suffering anemia. The statistical analysis with Chi-Square ( $X^2$ ) test showed association between STH infection with anemia on students Public Primary School 060925 ( $p=0.027$ ,  $p<0.05$ , OR Value = 3.08 (CI 95%: 0.026 – 0.041) (Table 5).

Soil transmitted helminth infections and anemia coexist among low-income population. Their correlations are complex and super-infection between various groups of organisms is commonly seen in the population. In this study showed 40.3% students were positive STH infection. This result showed higher than previous reports of STH infection in South India, where the prevalence of STH infection was 9%<sup>12</sup> and 21.2%.<sup>13</sup> However this result was still relatively lower compared to study conducted in Malaysia that reported a prevalence of STH infection was 60.5%.<sup>14</sup>

In this study, it was shown that the positive subjects infected with soil-transmitted helminth were 58.3% (14/24) students suffering anemia and 31.3% (15/48) students not suffering anemia. The risk of having anemia among individuals with STH infection compared to individuals with no STH infection was within the following odds ratio (OR): 3.08 (95% CI: 0.026-0.041), with a P-value of 0.027. This indicated that risk factor of

individuals with STH infection has a positive relation towards anemia, and statistically significant ( $P < 0.05$ ). This result is similar with previous study in Malaysia where the odds ratio (OR): 2.9 (95% CI: 1.54 – 5.45), with  $P < 0.05$ .<sup>14</sup> However this result was differ with previous study in Kulanprogo, Indonesia which this study was no correlation between STH infection with anemia ( $P > 0.05$ ).<sup>15</sup>

The positive correlation between anemia and STH infection observed among these students could be attributed to the intensity of infection and the long synergism with other causative factors such as poverty and poor dietary intake. As a limitation, the present study did not measure the daily iron intake. STH infection can cause the loss of protein, carbohydrate, fat, vitamin and blood in a large amount; it could also create immune response disturbance, decrease Insulin like Growth Factor (IGF-1) plasma, increase Tumor Necrosis Factor  $\alpha$  (TNF) serum rate, and decrease hemoglobin average concentration.<sup>16</sup>

## Conclusion & Suggestion

Soil transmitted helminth infection prevalence on the students of Public Primary School 060925 Kelurahan Harjosari I, Kecamatan Medan Amplas is 40,3%; the highest prevalence was caused by *Ascaris lumbricoides* (26,5%). Soil transmitted helminth infection prevalence based on gender and age are dominated by male (69%) and age group of 9 years old (19,4%) out of total subjects with intestinal worms. Anemia occurrence prevalence on those students is 33,3%; anemia occurrence frequency based on gender and age is dominated by male (58,3%) age of 8 years old (16,7%) out of total subjects with anemia. There is significant correlation between soil transmitted helminth infection with anemia occurrence on students of Public Primary School 060925 Kelurahan Harjosari I, Kecamatan Medan Amplas.

A suggestion for all components of school, to pay attention to personal hygiene and environment sanitation. Toilet, clean water, playground, garbage disposal and foods or snacks sold needs to be watched carefully. This can start with school teaching the students to do not litter, always wash their hands with soap and running water before eating, consume healthy and clean snacks, clip their nails regularly, wear shoes or sandals while playing outside, and an active role from the parents in preventing, early detecting and also treating intestinal parasites infection on children.

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