

RESEARCH ARTICLE

Relationship of Soil-transmitted Helminth and *Enterobius vermicularis* Infection with Anemic in Students in Aceh Besar

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Abstract

Helminthiasis is a disease caused by parasites in the form of worms, one of which is the type of soil-transmitted helminth (STH), *A. lumbricoides*, *T. trichiura*, *N. americanus*, and *A. duodenale* which infect humans through soil transmission. *Enterobius vermicularis* is the most common intestinal parasite in the whole world. Worms that live in the human intestine can cause malnutrition and anemic. This study aims to determine the relationship STH and *Enterobius vermicularis* infection with anemic of students in several elementary schools in Aceh Besar regency, Aceh province. This study was an analytical study using a cross-sectional study design conducted from May to November 2015. The sample consisted of the total sampling of 736 elementary school students, as well as using the inquiry method of Kato with stool specimens, cellophane tape anal swab, and hemoglobin. The correspondents who suffered from anemia and STH type helminthiasis, namely ancylostomiasis 7/7 students (100%, $p=0.000$); trichuriasis 30/58 students (51.7%, $p=0.000$) and 28 students not anemic (48.3%); and ascariasis 13/22 students (59.9%, $p=0.002$) and 9 students not anemic (41.1%). In enterobiasis infection, anemic students were 46/146 students (31.5%) and nonanemic students were 100 students (68.5%, $p=0.634$). In conclusion, all STH types related to the anemic status of the correspondent, and no correlation between anemic and infection of enterobiasis.

Key words: Anemic, *Enterobius vermicularis*, soil-transmitted helminth

Hubungan Infeksi Soil-Transmitted Helminth dan *Enterobius vermicularis* dengan Anemia pada Siswa di Kabupaten Aceh Besar Provinsi Aceh

Abstrak

Kecacingan adalah penyakit yang disebabkan oleh parasit berupa cacing, salah satunya jenis soil-transmitted helminth (STH), yaitu *A. lumbricoides*, *T. trichiura*, *N. americanus*, dan *A. duodenale* yang menginfeksi manusia melalui transmisi tanah. *Enterobius vermicularis* adalah parasit usus yang paling umum di seluruh dunia. Cacing yang hidup di usus manusia ini dapat menyebabkan kurang gizi dan anemia. Penelitian ini bertujuan mengetahui hubungan infeksi STH dan *Enterobius vermicularis* dengan anemia pada siswa sekolah dasar di Kabupaten Aceh Besar, Provinsi Aceh. Penelitian ini merupakan penelitian analitik menggunakan rancangan *cross-sectional study* yang dilaksanakan dari bulan Mei sampai November 2015. Sampel berupa *total sampling* 736 siswa sekolah dasar, serta menggunakan metode pemeriksaan Kato dengan spesimen feses, *cellophane tape anal swab*, dan hemoglobin. Koresponden yang menderita anemia dan kecacingan jenis STH, yaitu *ancylostomiasis* 7/7 siswa (100%, $p=0,000$); *trichuriasis* 30/58 siswa (51,7%; $p=0,000$) dan 28 siswa tidak anemia (48,3%); serta askariasis 13/22 siswa (59,9%; $p=0,002$) dan 9 siswa tidak anemia (41,1%). Pada infeksi enterobiasis, siswa yang anemia adalah 46/146 siswa (31,5%) dan tidak anemia 100 siswa (68,5%; $p=0,634$). Simpulan, semua kecacingan jenis STH berhubungan erat dengan status anemia pada koresponden, serta tidak terdapat hubungan antara anemia dan infeksi enterobiasis.

Kata kunci: Anemia, *Enterobius vermicularis*, soil-transmitted helminth

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Introduction

World Health Organization (WHO) reported that the case of helminthiasis in the world is still high. In the world, over 1 billion people infected by ascariasis, 795 million by trichuriasis, 500 million by enterobiasis, and 740 million by ancylostomiasis.¹ Helminthiasis is a disease caused by parasites in the form of worms. One of the causes of helminthiasis is soil-transmitted helminth (STH), which is the worm that lives in the intestine that transmitted to humans through soil contaminated feces containing infectious worm eggs.^{2,3} Worms classified as STH were *Ascaris lumbricoides*, *Trichuris trichiura*, *Necator americanus*, *Ancylostoma duodenale*, and *Strongyloides stercoralis*.¹⁻⁵

The STH infection is a chronic infection caused by parasitic worms with a high prevalence and mostly affects children under five and elementary school-age children. The contamination of worm eggs occurs because of soil contamination by feces. It eases the transmission of eggs from the ground to humans through hands contaminated by parasitic worm eggs, and then it goes into the mouth with food.⁶⁻⁸

Worms that live in the human intestine make a substantial contribution to the cases of other diseases. Examples of diseases caused by the worm are malnutrition because of roundworm infestations and anemia caused by hookworms. Roundworm consumes carbohydrates and proteins in the intestine before being absorbed by the body. Hookworms suck blood in the intestine, causing iron deficiency anemia (microcytic hypochromic). The symptom of anemia is pale and lethargic. These worms harm the growth and development of humans.^{7,9-11}

Enterobius vermicularis is the most common intestinal parasite in the whole world. Enterobiasis is also a family disease that is easy to spread its eggs through clothing and other household appliances. Children aged 5–11 years more often experience *E. vermicularis* worms because of the lack of personal hygiene compared to adults who are more able to maintain cleanliness.¹²

In Indonesia, the prevalence of children with helminthiasis in 2008 is around 24.1%. Distribution of the prevalence of helminthiasis caused by ascariasis was 14.5%, trichuriasis was 13.9%, and ancylostomiasis was 3.60%.¹³ The results of a survey conducted by the Research and Development Center for Animal Source Disease Control (*Balai Penelitian dan Pengembangan*

Pengendalian Penyakit Bersumber Binatang) Tanah Bumbu in 2008 in South Kalimantan found that out of 1,964 examined children, 451 children (22.9%) were positive for helminthiasis. The most infection was ascariasis in 192 people (42.5%), trichuriasis found in 167 people (37%), ancylostomiasis (hookworm) in 63 people (13.9%), and enterobiasis in 15 people (7.93%).¹⁴

In the previous research at the Elementary School Gedong Bina Remaja in Semarang city, the result of the examination between helminthiasis and anemic showed that the percentage of respondents with anemia was higher (46.7%) compared to the one without anemia (11.8%).⁹

According to a study in Makassar City, the number of students suffering from severe helminthiasis with anemic was 27 people (27.8%), mild infections, and anemic 63 people (64.9%), non-infected and anemic seven people (7.21%) of the 97 students.¹⁵

Anemia is a public health problem throughout the world, with an estimated prevalence of 24.8%. Anemic can be defined as a condition in which the erythrocyte mass of circulating hemoglobin mass cannot fulfill its function to provide oxygen to body tissues. In Indonesia, the prevalence of anemia in school-aged children reaches 29%.^{16,17} Anemia because chronic bleeding, one of which is due to worm infections, is generally more tolerable because the body will gradually compensate.^{15,18}

Hemoglobin is a protein that is substantial in iron. It has an affinity, combining power, toward oxygen, and it can form oxyhemoglobin in red blood cells. Through this function, oxygen carried from the lungs to the tissues. The hemoglobin also functions to maintain the red blood cells normal shape.¹⁷

This study aims to determine the relationship of STH infection and *E. vermicularis* with anaemic of students in several primary schools in Aceh Besar regency, Aceh province.

Methods

This study was analytical research using a cross-sectional study design. The location of the study was in 10 elementary schools in Aceh Besar regency, Aceh province which conducted from May to November 2015. The sample was all students in the first and second degrees.

Stool specimen collected and anal swab performed. The fecal examination used the Kato method and cellophane tape for anal swab for *Enterobius vermicularis* to determine the

student's worm status. The specimens examine to determine hemoglobin degree to define anemic status.

In this study, the researcher tries to associate between the dependent variable (STH and *Enterobius vermicularis*) with the independent variable (hemoglobin).

The data were analyzed using SPSS version 20 for Windows. The data correlation used a chi-square correlation test with a significance level determined error of $\alpha=5\%$ (0.05).

The study protocol had approved by the Health Research Ethical Committee, Faculty of Medicine, Universitas Sumatera Utara, Medan, with letter number: 503/KOMET/FK USU/2015.

Results

The result of the study found that the mostly respondents from class 1 of elementary school as many as 381 respondents (51.8%). Most of the respondents were female, with a percentage of 52.9%. Respondents suffering from helminthiasis were 233 students (31.7%) of 736 students (Table 1).

The highest number of STH helminthiasis was trichuriasis with 58 respondents (7.9%) and enterobiasis with 146 respondents (19.8%). The other 87 students (11.9%) positively infected by STH and 146 students (19.8%) were positive to enterobiasis (Table 2).

Of the 87 students suffered from STH, 22 infected by ascariasis (3.0%), and 13 of 22 had anemia ($p=0.002$). Students infected by trichuriasis were 58 students (7.9%), 30 of 58 students had anemia ($p=0.000$). Those suffering from ancylostomiasis were 7 students (1.0%), all student suffering from anemia ($p=0.000$). 146 students (19.8%) infected by enterobiasis, 46 of 146 students suffer from anemic ($p=0.634$).

The students non-suffering from helminthiasis were 503 students (68.3%), suffering from anaemic were 124 students (24.7%), and non-suffering from anaemic were 379 students (75.3%, Table 3).

Discussion

From the results of fecal specimens and anal swabs, the prevalence of helminthiasis in elementary school students in Aceh Besar regency was 233 (31.7%). Providing students with albendazole 400 mg of worm medicine twice a year is effective in eradicating helminthiasis.¹⁹

Several factors greatly influence the spread of worm infections including climate—such as rainfall, behavior, household conditions, poverty, and slum environment.²⁰

The number of students suffering from helminthiasis was 87, while the ones with trichuriasis were 58 students (7.9%). Treatment with albendazole 400 mg orally with a single dose is not sufficient. According to the Centers for Disease Control and Prevention (CDC),²¹ patients with *T. trichiura* should be treated with albendazole 400 mg for three consecutive days.

Ascariasis infection found in 22 students (3.0%) and ancylostomiasis infection found in 7 students (1.0%). A patient infected by ascariasis and ancylostomiasis treated with albendazole 400 mg (single dose). According to research by Dewayani et al.¹⁹ in children of Public Elementary School I in the village of Tanjung Anom, Pancur Batu sub-district, Deli Serdang regency, North Sumatra, the success of a single dose of albendazole 400 mg reaches 100% cure rate. However, according to Annisa et al.²² in children in Perokonda village, Southwest Sumba, the effectiveness of a single dose of albendazole for the treatment of ascariasis was only 69%.

Enterobiasis infection from laboratory tests using the anal swab examination method found in 146 students (19.8%) from 736 students. These worms generally infect children whose personal hygiene and live in an unfavorable environment. Bad personal hygiene and sanitation such as rarely changing bedsheets, sleeping in groups, exchanging clothes, and the frequency of changing underwear also speeds up the transmission of enterobiasis.¹² Also, the lack of children's knowledge on the transmission and prevention of helminthiasis causes enterobiasis infection. Enterobiasis can occur through 3 paths, which are from hand to mouth (autoinfection), by

Table 1 Characteristic of Respondents

| Characteristic | n=736 | Percentage |
|------------------|-------|------------|
| Class | | |
| 1 | 381 | 51.8 |
| 2 | 355 | 48.2 |
| Gender | | |
| Male | 347 | 47.1 |
| Female | 389 | 52.9 |
| Worm infestation | | |
| Positive | 233 | 31.7 |
| Negative | 503 | 68.3 |

Table 2 Characteristic of Respondents

| Infection Type | n=233 | Percentage (31.7) | Anemic (n=96) | Nonanemic (n=137) | p Value |
|-----------------|-------|-------------------|---------------|-------------------|---------|
| Ascariasis | 22 | 3.0 | 13 | 9 | 0.002 |
| Trichuriasis | 58 | 7.9 | 30 | 28 | 0.000 |
| Ancylostomiasis | 7 | 1.0 | 7 | 0 | 0.000 |
| Enterobiasis | 146 | 19.8 | 46 | 100 | 0.634 |

breathing air contaminated with *E. vermicularis* eggs infectious, and transmission by retro-infection which is the transmission that occurs in the patient.²³

All respondents who had ancylostomiasis were also anemic (100%). These indicate that there was a close relationship between ancylostomiasis and anemia. Ancylostomiasis can cause anemic hemorrhage (blood loss) because ancylostomiasis sucks blood as much as 0.005–0.1 mL/worm/day.²⁴

Trichuriasis in respondents suffering from anemic were 30 students (52%) out of 58 students (p=0.000), 28 students were not anemia (48%). This worm also sucks the blood of the host as many as 0.005 mL/worm/day so that anemia occurs. This study indicates that there was a significant relationship between trichuriasis as the cause of anemia in children.²³

Respondents with ascariasis were 13 students out of 22 students (p=0.002). This worm sucks the essence of food from the patient's body that the patients were malnourished and consequently experiencing nutritional anemic. From these results, it shows that there is a close relationship between ascariasis and anemic in respondents who are the object of research. According to Ideham and Pusarawati,²⁵ *A. lumbricoides* can cause protein-energy malnutrition (PEM). In children with ascariasis, they can lose 4 grams of protein from a diet containing 35–50 grams of protein/day.

In students with enterobiasis, anemic found in 46 of 146 students, and nonanemic were 100

students (p=0.634). This worm does not cause anemia in patients because this worm does not suck blood from the patient's body. Enterobiasis only causes pruritus perianal, anxiety, loss of appetite, insomnia, and irritability, especially in children with high parasitic infections. This worm also causes children to become lazy and often sleepy because they cannot sleep well at night.¹²

Conclusion

This study concluded that all STH types related to the anemic status of the children and that there is no correlation between anemia and infection of enterobiasis.

Conflict of Interest

There is no conflict of interest at all authors.

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Table 3 Hemoglobin Level of Students with No Helminthiasis

| Category | n=503 | Percentage |
|-----------|-------|------------|
| Anemic | 124 | 24.7 |
| Nonanemic | 379 | 75.3 |

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