Abstract:

Soil-transmitted helminth (STH) prevalence is high worldwide. School-aged children are at risk of infection due to poor self-hygiene and contaminated soil and water. Anemia is caused by infection in children, and it affects cognitive development, physical development, and school performance. To ascertain the relationship and distribution of STH and anemia in elementary school students, as the cross-sectional objectives. Students from SDN 96 and 97 Palembang participated in the study. Using stratified random sampling, 84 students from grades 4, 5, and 6 were chosen at random. Anemia is diagnosed through a test using the Quick Check hemoglobin method. They discovered that 40.5 percent of students had intestinal worms, 15.5 percent were anemic, and 11.8 percent were both anemic and worm-infected. A p-value of 0.438 was obtained from the chi-square bivariate analysis. There is no link between STH and anemia.

Keywords:
low haemoglobin; intestinal worms; child development; South Sumatra

I. Introduction

Anemia is caused by a poor diet, a lack of micronutrients, inflammation, genetics, and parasitic infections (Righetti et al., 2012). Serum 25(OH)D levels correlated with hemoglobin levels in children with iron-deficient anemia (Niknamian, 2019). Intestinal parasitic diseases are caused by intestinal worms, namely soil-transmitted helminth (STH). STH is a parasitic disease spread to humans by nematode worms infected soil. They are Trichuris trichiura (TT), Necator americanus (NA), Ancylostoma duodenale (AD) and Ascaris lumbricoides (AA). AA is the most common worm in vulnerable pregnant women due to poor behavioral aspects (Aswita, Siregar, & Nurmaini, 2020). School-aged children are particularly vulnerable to STH infection due to their rapid growth and frequent exposure to contaminated soil and water (Tefera, Belay, Mekonnen, Zeynudin, & Belachew, 2017). More than 2 billion people are infected with STH, with children from Southeast Asia accounting for 42% of those infected. 64% are Indian, 15% are Indonesian, and 13% are Bangladeshi (WHO, 2011). Preschoolers and school-aged children require deworming in Indonesia.

The Ministry of Health defines anemia in schoolchildren aged 6 to 12 as Hb 12.0 g/dL (Departement Republik Indonesia, 2012). Anemia affects both developed and developing countries around the world. Anemia affects 1.62 billion people worldwide, accounting for 24.8 percent of the global population. Asia has the highest prevalence of anemia among school-aged children (315 billion) (WHO, 2015). 26.4 percent of Indonesian children aged 5-14 were anemic in 2013 (Kemenkes RI., 2018). Anemia was discovered in 25% of children aged 6 to
12 in ten Palembang City elementary schools (SD) (Desti Handayani, Rismarini, Kesuma, Purnamasari, & Husin, 2016). Impact anemia harms children’s cognitive, physical, and academic development. This study aims to find a link between intestinal worm infection and anemia in Palembang City students in SDN 96 and 97. Seberang Ulu II District has the lowest sanitation level number 4 in Palembang City, and preliminary observations show that many children still play barefooted.

II. Review of Literatures

2.1. Soil-Transmitted Helminths

One or more STHs affect about 1.7 billion people globally (Parija, Chidambaram, & Mandal, 2017). According to a 2010 research by Pullan et al., the prevalence rate of AA was 819 million, while the prevalence rate of TT was 464 million and the prevalence rate of hookworm was 439 million, with more than half of all cases occurring in South Asia and Sub-Saharan Africa (Pullan, Smith, Jasrasaria, & Brooker, 2014).

STH transmission levels are influenced by urbanization, settlement patterns, and economic growth. In 2010, 77 percent of the world's population resided in regions where chronic transmission was a concern. Due to these constraints, an STH risk distribution must change rapidly, emphasizing the links between urbanization, sanitation, and infection. The global burden of STH infection may be estimated to target individuals with preventive chemotherapy, improved water and sanitation infrastructure, and health education (Pullan & Brooker, 2012). Significant social and economic changes have occurred globally in recent decades. In a global parasite update, STH infections remain the most prevalent. Infection rates are unlikely to decrease until the global economy improves substantially (de Silva, N.R., Brooker, S., Hotez, P.J., Montresso, A., Engeles, D., and Savioli, 2003).

Efforts to deworm individuals have been unsuccessful. Contrary to expectations, STH infection has persisted in Central Java. Integrated sanitation and hygiene practices prevent STH. WASH and health education are not prioritized, and chemotherapy is seldom administered as recommended. Poverty, a lack of knowledge about STH causes and prevention, poor hygiene and sanitation, and ideal environmental circumstances for STH transmission may persist (Kurscheid et al., 2020). In western Kenya, a pit latrine with a plastic slab and drop hole cover, a plastic child toilet, and a metal scoop were examined to determine whether STH eggs in the soil outside rural homes were reduced. The features of homes, toilets and adjacent areas linked with STH eggs in soil were also studied. Cleaner homes did not decrease the presence or concentration of STH eggs in household soil samples. The ability of financing partners and political and financial logistics and infrastructure may have an enormous impact on STH transmission rates (Steinbaum et al., 2019).

2.2 Anemia

Anemia is defined as a reduction in the number of red blood cells, hemoglobin, and packed red blood cells per 100 milliliters of blood (World Health Organization, 2011). The Ministry of Health Indonesia (MoH) defines anemia in children aged 6 to 12 as Hb 12.0 g/dL (Departement Republik Indonesia, 2012). Anemia was found in 52.5% of the South and Southeast Asian (SSEA) population, ranging from 22.7% in Timor-Leste to 63.5% in the Maldives.
According to multiple logistic regression, anemia is more likely to occur in women in reproductive-aged (WRA) 15–24 years, women with primary or no education, women from the poorest wealth quintile, women without access to toilets or improved water sources, women who are underweight, and women who have had more than one child in the last five years. Fighting anemia requires evidence-based, multidisciplinary policies and initiatives to improve mothers’ health, nutrition, education, and socioeconomic position. It is critical to provide nutrition-sensitive and tailored services for people from low-income families (Sunuwar et al., 2020).

Anemia is a widespread and severe global health issue that has received insufficient attention, particularly in low-and middle-income countries (LMICs), where progress has been sluggish and uneven. Even though iron deficiency (ID) remains the most frequent cause of anemia in most nations, recent research shows that the etiology of anemia is complex and environment-dependent. In order to accurately assess anemia in clinical settings and populations, it will be necessary to incorporate biochemical measurements of micronutrient status (particularly iron and vitamin A concentrations) and indicators of infection into the assessment process in addition to hematological indicators. (Chaparro & Suchdev, 2019).

**III. Research Methods**

An observational method is used in this cross-sectional study conducted in October 2020. In Palembang, the investigation was conducted at SDN 96 and 97. From fourth to sixth grades at Palembang City Elementary School. We chose 84 students who met the inclusion and exclusion criteria using stratified random sampling.

The researcher explained the sampling method to elementary school students who received the pot the day before and collected it the next day in class. In the Faculty of Medicine, the laboratory used the Kato-Katz method to test the stools. Finding Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale, or Necator americanus eggs makes it detected. Hemoglobin measurement and reading tool At a Glance Hb Anemia is defined as hemoglobin less than 12 g/dL.

An analysis of the data using the Chi-Square test was carried out. The p-value is related to anemia in elementary school kids (0.05). There is no statistically significant link between intestinal worm infection and anemia in elementary school children (p-value >0.05).

**IV. Discussion**

**4.1 Socio-Demographic Data of Respondents**

Thirty-four of the 84 respondents (40.5%) had STH. In 2015, five people (6.8%) were infected at SDN 169 Gandus Village in Palembang City, and 27 students (6.8%) were infected in 2018 at Madrasah Ib tidaiyah (29.3%) (Dwi Handayani, Ramdja, & Nurdianthi, 2015). Intestinal worms benefit from soil and water contamination, as well as poor sanitation practices. Dangerous habits and natural conditions lead to the growth of intestinal worms. Without a doubt, a good education helps parents understand the importance of clean and healthy living (Sanya, Nkurunungi, Andia Biraro, Mpairwe, & Elliott, 2017). The family patriarch's education, financial state, and attitude impact open defecation (Syarifah Syarifah, Yustina, & Lumongga Lubis, 2020). Belief in human excrement interment, thus environmental and personal hygiene problems have grown less critical in West Sumba, especially Taramamu Village. Youngsters defecate in public places (bushes, forests, or behind their homes), and not wearing shoes guarantees the STH's life cycle is completed (Suharmiati & Rochmansyah,
In Palembang's Gandus district, the co-occurrence of Ascaris lumbricoides (88.90%), Trichuris trichiura (7.4%), and Ancylostoma duodenale (1%) were discovered (Dwi Handayani et al., 2015).

The study discovered that 13 of the 84 students (15.5%) tested positive for anemia. Anemia affected 25% of children aged 6 to 12 in ten Palembang schools. Anemia affects 34 of the 225 students at Kokap I Health Center Kulonprogo (Fatimah, Sumarni, & Juffrie, 2012). The lower anemia response rate was supported by normal-weight students (64 versus two skinny and ten thin) (less than the previous study). There was no history of anemia-related bleeding or bleeding. (Kemenkes RI., 2018).

Table 1. Characteristics of Respondents, Based on Age, Gender, Nutritional Status, Co-Morbidities, Parents' job and education (n=84)

| Characteristics | N   | Percentage (%) |
|-----------------|-----|----------------|
| **Age (Years)** |     |                |
| 8-9             | 30  | 35.7           |
| 10-11           | 51  | 60.7           |
| 12-13           | 3   | 3.6            |
| **Total**       | 84  | 100            |
| **Gender**      |     |                |
| Man             | 45  | 53.5           |
| Woman           | 39  | 46.4           |
| **Total**       | 84  | 100            |
| **Nutritional status** |     |                |
| Very thin       | 2   | 2.4            |
| Thin            | 10  | 11.9           |
| Normal          | 64  | 76.2           |
| Fat             | 7   | 8.3            |
| Obesity         | 1   | 1.2            |
| **Total**       | 84  | 100            |
| **co-morbidities, thalassemia, diarrhea, hemophilia, acute bleeding** |     |                |
| Yes             | 0   | 0              |
| Not             | 84  | 100            |
| **Total**       | 84  | 100            |
| **Parental Education** |     |                |
| SD              | 12  | 14.3           |
| Junior High School | 21  | 25             |
| Senior High School | 42  | 50             |
| Bachelor        | 9   | 10.7           |
| **Total**       | 84  | 100            |
| **Parents' job** |     |                |
| Laborer         | 36  | 42.9           |
| Service         | 18  | 21.4           |
| Private         | 12  | 14.3           |
| Military        | 6   | 7.1            |
| Etc             | 12  | 14.3           |
Four of the 34 students (11.8%) with STH had anemia (82.2%). This study also discovered that 62 students had STH, 32 (51.6%) had intestinal worms and anemia, and 30 (48.4%) did not. Consuming iron-inhibiting foods such as tea can cause a low heme intake, aggravated anemia (Rahayu & Indarto, 2020). It is also lower than the results of the SD 060925 Medan City study. 48.27% had STH infection and anemia, while 51.72% did not (Sandy, Sumarni, & Soeyoko, 2015).

Table 2. Distribution of Anemia (n=84)

| Anemia  | Frequency | Percentage (%) |
|---------|-----------|----------------|
| Yes     | 13        | 15.5           |
| Not     | 71        | 84.5           |
| Total   | 84        | 100            |

Table 3. Distribution of STH (n=84)

| Soil Transmitted Helminth Infection | Frequency | Percentage (%) |
|-------------------------------------|-----------|----------------|
| Positive                            | 34        | 40.5           |
| Negative                            | 50        | 59.5           |
| Total                               | 84        | 100            |

Table 4. Species Distribution of STH Eggs

| Species of STH       | Frequency | Percentage (%) |
|----------------------|-----------|----------------|
| Ascaris lumbricoides | 34        | 100            |
| Trichuris trichiura  | 0         | 0              |
| Hookworm             | 0         | 0              |
| Total                | 34        | 100            |

Table 5. Distribution of Anemia in Elementary School Students 96 and 97 Infected with STH

| Anemia | Frequency | Percentage (%) |
|--------|-----------|----------------|
| Yes    | 4         | 11.8           |
| Not    | 30        | 88.2           |
| Total  | 34        | 100            |

4.2. Relationship of STH and Anemia in School Children

Four students were suffered from STH infection and anemia. In a bivariate Chi-square test, anemia and STH are not related (p-value>0.05). There is no link between STH infection and nutritional status or anemia at Kokap I Health Center Kulonprogo (Fatimah et al., 2012). STH infection, however, is associated with low hemoglobin levels in Medan (Arraysid, Sinambela, Tala, Darlan, & Warli, 2017). The severity and duration of the infection and diet and iron stores play a role in this anemia. Symptoms of chronic or severe hookworm infections Ancylostoma duodenale caused injury to the mucosa of the small intestine with
cutting plates/teeth (Ghodeif AO & Jain H, 2021; Pearson, 2012). In chronic infections, Trichuris trichiura causes diarrhea, dysentery syndrome, anemia, and weight loss. Trichuris trichiura causes anemia for every thousand eggs in 1 g of feces (Gyorkos, Gilbert, Larocque, Casapia, & Montresor, 2012). Ascaris lumbricoides infection caused poor absorption, thus malabsorption by interfering with iron absorption through the duodenum and jejunum walls. The Ascaris lumbricoides parasite consumes 2.8 grams of carbohydrates and 0.7 grams of protein per day (CDC, 2020). Poverty and malnutrition were also factors in the development of anemia (Arrasyid et al., 2017; Rahman, Mushfiquee, Masud, & Howlader, 2019). Risk of intestinal worm infection, personal hygiene takes precedence over nutritional statuses, such as not wearing shoes (Oliveira et al., 2015).

Table 6. Relationship of STH and Anemia

| Soil-Transmitted Helminth | Anemia | Amount | p-value |
|---------------------------|--------|--------|---------|
|                           | yes N | %     | Not N | %     | N | %    |
| Positive                  | 4     | 4.8   | 30    | 35.7  | 34 | 40.5 |
| Negative                  | 9     | 10.7  | 41    | 48.8  | 50 | 59.5 |
| Total                     | 13    | 15.5  | 71    | 84.5  | 84 | 100  |

V. Conclusions

Anemia was 15.5 percent among 84 respondents in SD Negeri 96 and 97 Seberang Ulu II District, Palembang City, while the STH infection was 40.5 percent. Thirty-four respondents were infected with Ascaris lumbricoides worms. This study found no link between intestinal worm infection and anemia.

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