

Studi Literatur Infeksi *Soil-Transmitted Helminths* (STH) pada Anak: Pemeriksaan Laboratorium dan Risiko Kematian

Literature Study of Soil-Transmitted Helminths (STH) Infections in Children: Laboratory Examination and Mortality Risk

Agnes Cecilia^{1*}, Ahmad Abid Syarif², Arya Jagad Mulawarwan², Herciella Bernadetha², Joice Earlene Nathaniella Taffy², Rezjita Asti Pratiwi²

^{1,2}Program Studi Teknologi Laboratorium Medis, Fakultas kedokteran, Universitas Palangka Raya. Jl. Yos Sudarso, Kota Palangka Raya, Kalimantan Tengah, Indonesia. *e-mail: agnescecilia1207@gmail.com

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ABSTRAK

Abstrak. Infeksi *Soil-Transmitted Helminths* (STH) menjadi masalah kesehatan global dengan beban tinggi pada anak-anak akibat sanitasi yang buruk. Kajian literatur ini bertujuan menganalisis pemeriksaan laboratorium pada infeksi STH pada anak dan kaitannya dengan risiko kematian. Kajian ini menggunakan metode *Systematic Literature Review* melalui pencarian di *PubMed*, *ScienceDirect*, dan *Google Scholar* dengan kata kunci relevan, dibatasi publikasi sepuluh tahun terakhir. Hasil menunjukkan *Ascaris lumbricoides* sering menimbulkan komplikasi akut asfiksia mekanik dan obstruksi usus yang dapat menyebabkan kematian bila tidak segera ditangani. Infeksi *Trichuris trichiura* dapat menimbulkan komplikasi kronis seperti sindrom disentri, anemia berat, stunting, dan malnutrisi yang meningkatkan resiko kematian pada anak. Sementara itu, infeksi cacing tambang dapat menyebabkan anemia berat dan hipalbuminemia pada anak. Pemeriksaan laboratorium mikroskopis tinja, histopatologi, radiologi, dan ultrasonografi penting untuk dilakukan untuk menegakkan diagnosis, menilai tingkat keparahan, dan menentukan terapi. Kesimpulannya, deteksi dini infeksi STH melalui pemeriksaan laboratorium berperan dalam mencegah komplikasi serius dan menurunkan risiko kematian pada anak sehingga diperlukan strategi yang tidak hanya fokus pada pemberian obat cacing tetapi juga perbaikan gizi dan pengelolaan penyakit penyerta.

Kata kunci: *Soil Transmitted Helminths*, anak-anak, infeksi, pemeriksaan laboratorium, risiko kematian

ABSTRACT

Abstract. *Soil-Transmitted Helminth* (STH) infections represent a global health problem, imposing a substantial burden on children due to poor sanitation. This literature review aims to analyze laboratory examinations in STH infections among children and their association with mortality risk. The study employed a *Systematic Literature Review* method through searches in *PubMed*, *ScienceDirect*, and *Google Scholar* using relevant keywords, restricted to publications from the past ten years. The findings indicate that *Ascaris lumbricoides* frequently causes acute complications such as mechanical asphyxia and intestinal obstruction, which may lead to death if not promptly managed. *Trichuris trichiura* infection can result in chronic complications including dysentery syndrome, severe anemia, stunting, and malnutrition, all of which increase the risk of mortality in children. Meanwhile, hookworm infection may lead to severe anemia and hypoalbuminemia in children. Laboratory examinations such as stool microscopy, histopathology, radiology, and ultrasonography are essential for establishing diagnosis, assessing disease severity, and guiding therapy. In conclusion, early detection of STH infections through laboratory investigations plays a critical role in preventing serious complications and reducing mortality risk in children, underscoring the need for strategies that extend beyond deworming programs to include nutritional improvement and the management of comorbid conditions.

Keywords: *Soil-Transmitted Helminths*, children, infection, laboratory examination, mortality risk

INTRODUCTION

Soil-Transmitted Helminths (STH) infections are a global health problem with 642 million cases and more

than 1.3 million in 2020 (Chen et al., 2024). Children are a vulnerable group because they are often exposed to environments with poor sanitation conditions (Aulia, 2025). In Indonesia, the prevalence of soil-transmitted



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helminths (STH) in school-age children is a significant national health problem. The prevalence rate is reported to reach 30–40%, especially in endemic areas (Djuardi et al., 2021). Severe infections in children can cause fatal complications, so laboratory tests are necessary to prevent death.

Early diagnosis through laboratory examination plays a crucial role in efforts to control soil-transmitted helminth (STH) infections in children, because rapid detection can reduce the risk of serious complications (Suraini & Oktavianti, 2019). This diagnostic procedure functions not only to determine the species of helminths responsible for the infection but also to evaluate the intensity of the disease, thereby enabling the formulation of more targeted and effective treatment strategies (Rajagukguk & Aritonang, 2022). Undiagnosed or untreated STH infections are at risk of developing into persistent infections that cause serious complications such as gastrointestinal dysfunction and mechanical intestinal obstruction (Chen et al., 2024). This complication is a phase that can be a direct link to the risk of death, but it still rarely gets the attention (Samuel et al., 2017).

According to Lebu et al. (2023), based on a critical review of the existing literature, there remain substantial gaps and limitations in the evidence linking soil-transmitted helminth infections to direct morbidity. Martins-Melo et al. (2017) showed that although the mortality rate from STH has decreased, more than 800 cases still occur in children and vulnerable groups in Brazil. A case of sudden death due to intestinal

obstruction due to *A. lumbricoides* infestation was also reported by Yadav et al. (2023) in New Delhi, India, which confirmed that acute complications of STH can be fatal. Delays in diagnosis and treatment can lead to life-threatening acute complications of STH. This literature review focuses on analyzing laboratory tests for STH infections in children and the risk of death.

METHOD

This study uses a systematic literature review approach to examine the literature related to soil-transmitted helminth (STH) infections in children, with a focus on laboratory examinations and the risk of death. Literature searches were conducted through scientific databases such as PubMed, ScienceDirect, and Google Scholar, using relevant keywords, including “soil-transmitted helminths,” “children,” “infection,” “laboratory examination,” and “mortality risk”. Publication limits are set within the last ten years to ensure that the data used is up-to-date and relevant. The selection process is carried out in three stages: reviewing the title, abstract, and full content of the article to ensure suitability with the focus of the study. Articles that met the criteria were then analyzed descriptively to identify the most frequently found types of STH, the laboratory examination methods used, and the relationship between infection and the risk of death in children. The research will be guided by the PRISMA Flowchart shown in Figure 1.

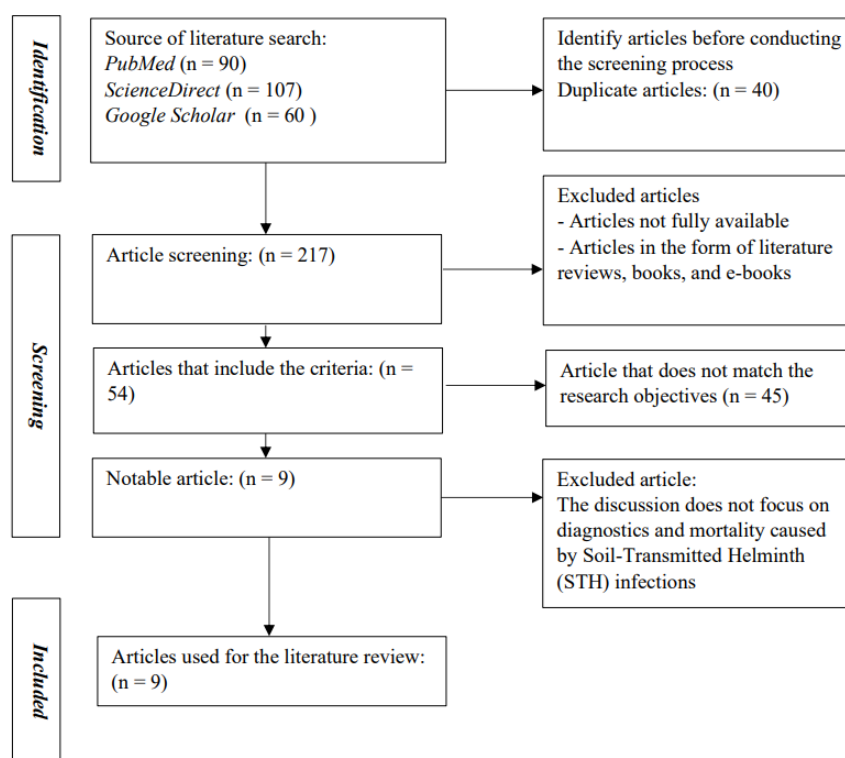


Figure 1. PRISMA Flowchart of Literature Selection Process on Soil-Transmitted Helminths (STH) Infections in Children Related to Laboratory Examination and Mortality Risk

RESULT DAN DISCUSSION

Based on the results of a literature search through the PubMed (n = 90), ScienceDirect (n = 107), and Google Scholar (n = 60) databases, a total of 257 articles were obtained. After initial identification, 40 articles were excluded due to duplication, leaving 217 articles for the screening stage. During the screening stage, 163 articles were eliminated because they were not available in full or in the form of literature reviews, books, and e-books. Of the 54 articles that met the criteria, 45 were again excluded because they did not match the research objectives. Furthermore, of the 9 articles that passed, all met the eligibility criteria. Thus, 9 articles were obtained for use in the literature review regarding laboratory examinations and the risk of death due to Soil-Transmitted Helminths (STH) infections.

Table 1. Results of Literature Study on Soil-Transmitted Helminths (STH) Infections in Children: Laboratory Examination and Mortality Risk

No.	Author, Year of Publication, Title	Research	Examination	Result
1.	(Herbstein et al., 2020) Death by asphyxiation caused by <i>Ascaris lumbricoides</i> case report	This study focuses on deaths due to asphyxia caused by <i>A. lumbricoides</i> infestation. The case involved a 4-year-old girl who died from respiratory obstruction caused by the worm.	The examination used in this study was a direct macroscopic examination during autopsy to evaluate the cause of death. During the autopsy, the study observed the presence of parasites in areas such as the pharynx, larynx, and upper esophagus, as well as examining other organs to determine the general health of the animals.	An autopsy revealed the presence of 15-20 cm <i>A. lumbricoides</i> worms in the respiratory tract, as well as congestion in the trachea and lungs. The cause of death was determined to be mechanical asphyxia due to obstruction of the respiratory tract by the parasite. These findings highlight the serious dangers of <i>Ascaris</i> infestation, which can cause death.
2.	(Saraf et al., 2021) Sudden death in a 2-year-old child: Role of <i>Ascaris</i> infestation and other possibilities	This study reports a case of sudden death in a two-year-old child suspected to be related to an <i>A. lumbricoides</i> worm infestation. A single worm was found in the epiglottis, possibly causing airway obstruction, although it could not be confirmed as the primary cause of death.	The study used the case report method. Examinations were conducted through complete autopsies, including neck dissection, internal organ examination, pulmonary histopathology examination, microscopic examination of stomach and intestinal contents to detect <i>Ascaris</i> eggs, and toxicology screening.	An autopsy revealed a male <i>A. lumbricoides</i> worm (11.8 cm) in the epiglottis, causing mucosal inflammation and edema. No eggs or larvae were found in the intestines or lungs. Lung histopathology showed mild lymphocytic infiltration. The exact cause of death is uncertain, but is suspected to be related to airway obstruction and chronic malnutrition.

3.	(Paparau et al., 2018) Mechanical Asphyxia with <i>Ascaris lumbricoides</i> -A Forensic Case Report	This study reports a forensic case of a two-year-old child who died from mechanical asphyxia due to airway obstruction by <i>Ascaris lumbricoides</i> , with autopsy, histopathology, and toxicology examinations to establish the cause of death.	Histopathological examination of the lungs using hematoxylin-eosin staining revealed bronchial lumen dilation, epithelial sloughing, atelectasis, and ruptured alveolar septa due to airway obstruction. Toxicology tests did not detect the presence of alcohol, drugs, or anesthetics.	An autopsy of a child weighing 11.5 kg and 82 cm tall revealed growth retardation without signs of trauma. Adult worms were found protruding from the mouth and nose, as well as worms in the esophagus and trachea, with one obstructing a major bronchus. Approximately 250 g of worms, each >20 cm long, were collected from the digestive and respiratory tracts. Other lesions included gastric mucosal erosion, hepatic steatosis, and worms in the ampulla of Vater of the gallbladder.
4.	(Liyew et al., 2025) Small bowel obstruction due to ascariasis in a child from southern Ethiopia: a case report	This study reports a case of small bowel obstruction in an eight-year-old child caused by <i>A. lumbricoides</i> infestation. The diagnosis was made through ultrasonography, which showed a blockage caused by a mass of worms, followed by laparotomy and enterotomy to remove the worms. After receiving anthelmintic and antibiotic therapy, the patient recovered with normal bowel function one month postoperatively.	Clinical examination revealed signs of small bowel obstruction, including vomiting, abdominal pain, abdominal distension, and inability to pass stool or gas. Abdominal ultrasonography confirmed a small bowel obstruction caused by a mass of <i>Ascaris lumbricoides</i> . Laparotomy and enterotomy were performed to remove the worms, serving both as a diagnostic confirmation and treatment.	Examination results showed an obstruction of the small intestine by a mass of <i>A. lumbricoides</i> , as seen on ultrasonography. During laparotomy and enterotomy, several worms were successfully removed from the intestinal lumen. After administration of albendazole and antibiotics, the patient recovered with normal intestinal function within one month postoperatively.
5.	(Supangat et al., 2025) Intestinal obstruction due to <i>Ascaris lumbricoides</i> in child: a case report	This study reports a case of intestinal obstruction in a three-year-old child caused by <i>Ascaris lumbricoides</i> infection.	The examination conducted included a clinical examination and laboratory tests showing anemia and leukocytosis, as well as an abdominal radiograph showing meteorism and intestinal obstruction with an air-fluid level. During surgery, worm extraction was performed using ileotomy and milking procedures, and the worms were then sent to parasitology for identification as <i>A. lumbricoides</i> .	Laboratory tests revealed anemia and leukocytosis, while abdominal radiography revealed meteorism with whirlpool features and air-fluid levels, suggesting intestinal obstruction. Three obstructions were identified, from the jejunum to the ileum, caused by a collection of <i>A. lumbricoides</i> . After an ileotomy and milking procedure to remove the worms, the patient's condition improved, and she was then given antiparasitic therapy with pyrantel pamoate and albendazole.

6.	(Wardani et al., 2022) <i>Trichuris</i> dysentery syndrome, the neglected tropical disease: a case series	This study reports three cases of <i>Trichuris</i> dysentery Syndrome in male children aged 4, 7, and 11 years in West Papua. All three patients experienced chronic bloody diarrhea, severe anemia, marasmic malnutrition, stunting, and rectal prolapse.	The examination is conducted through anamnesis and a complete physical examination, routine blood tests (including peripheral blood tests), microscopic stool examination to detect <i>Trichuris trichiura</i> eggs, as well as monitoring of clinical symptoms and follow-up after anthelmintic therapy.	The three patients had severe anemia (Hb as low as 1.8 g/dL), marasmic malnutrition with stunting, chronic bloody diarrhea, and rectal prolapse in two patients. Stool examination revealed numerous eggs and adult <i>Trichuris trichiura</i> worms. After receiving blood transfusions, nutritional therapy, and albendazole or mebendazole, their clinical condition improved with weight gain and negative stool results at follow-up.
7.	(Rajagukguk & Aritonang, 2022) Identification of <i>Trichuris trichiura</i> Worm Eggs in 6–8 Years Old Elementary School Children at GKPS Private Elementary School, Saribudolok, Simalikuta, Simalungun	This cross-sectional study identified <i>Trichuris trichiura</i> eggs in stool samples of 30 children aged 6–8 years at GKPS Private Elementary School, Saribudolok, Silimakuta District, Simalungun Regency, Indonesia.	Stool samples were examined using the direct smear method with 2% eosin staining. Microscopic observations were performed at 10× and 40× magnification to detect <i>Trichuris trichiura</i> eggs as well as other intestinal parasites, particularly <i>A. lumbricoides</i> . This method was selected due to its simplicity, rapid execution, and common use in routine parasitological examinations.	Out of 30 stool samples examined, 5 children (17%) were positive for <i>Trichuris trichiura</i> eggs. In addition, <i>A. lumbricoides</i> infection was detected in 14 children (46%), while 16 children (54%) showed negative results for intestinal helminth eggs. These findings indicate that Soil-Transmitted Helminths (STH) infections remain present among elementary school children, which may be associated with poor personal hygiene, lack of handwashing practices before eating, and the consumption of uncovered snacks in the school environment.
8.	(Kendre et al., 2019) Unusual Case of Recurrent Severe Anaemia and Hypoalbuminemia in an Infant	This study uses a case study of hookworm infection in infants, supported by a literature review related to the prevalence, transmission, diagnosis, and treatment of hookworm infection in children.	The examinations used consist of peripheral blood smears, stool examination for <i>Ancylostoma duodenale</i> eggs, and urine examination for albumin to confirm the diagnosis of worm infection and severe anemia.	Test results revealed microcytic hypochromic anemia, low serum iron levels, and the presence of <i>Ancylostoma duodenale</i> eggs in the stool. After treatment, the worm eggs disappeared and the child's clinical condition improved.
9.	(Singh et al., 2023) A Case of Hookworm Infection in a Child Causing Severe Anemia Diagnosed by Endoscopy: A Neglected Tropical Disease	This study reports on a 3-year-old child in northern India who suffered from severe anemia due to hookworm infection. The diagnosis was confirmed through endoscopy and microscopic examination. After treatment, the child's condition improved, and he made a full recovery.	The examination includes clinical and laboratory examinations in the form of physical examination, hemogram examination, reticulocyte, serum sodium, potassium, calcium, iron, serum, ferritin, TIBC, transferrin saturation, upper gastrointestinal endoscopy, microscopy, and DPDx mount.	A 3-year-old child in northern India suffered from severe anemia due to hookworm infection (<i>N. americanus</i> and <i>A. duodenale</i>), diagnosed by endoscopy and confirmed by microscopic examination of hookworm eggs. After treatment with blood transfusion and albendazole, the child showed significant clinical improvement and made a full recovery, emphasizing the importance of early detection and

Laboratory examinations have an essential role in establishing the diagnosis of STH infections in children. Various case reports indicate the use of varying methods according to clinical manifestations. Macroscopic examination at autopsy is used to identify the presence of worms directly in the respiratory and digestive (Herbstein et al., 2020; Saraf et al., 2021). Meanwhile, histopathological examination of the lungs with hematoxylin-eosin staining is able to describe tissue changes due to obstruction (Paparau et al., 2018). In cases of intestinal obstruction, ultrasonography has been shown to provide visualization of *Ascaris lumbricoides* clumps in the intestinal lumen (Liyew et al., 2025), while Supangat et al. (2025) added laboratory examination and abdominal radiography with the typical appearance of the whirlpool sign. In *Trichuris trichiura* infections, microscopic examination of feces is a consistent method used to detect eggs and adult worms (Kaminsky et al., 2015; Wardani et al., 2022).

The ability to immediately visualize worm clusters makes ultrasonography superior to techniques like abdominal radiography, histology, and stool inspection (Liyew et al., 2025). The diagnosis still involves an enterotomy or laparotomy, which also acts as treatment. The ability to determine the severity of infection by counting the number of eggs per gram of feces has also demonstrated the importance of fecal inspection (Kaminsky et al., 2015). In general, fecal examination is regarded as the best diagnostic approach and is utilized as an initial screening to find problems. Delays in diagnosis have been found to raise the risk of death in children with STH, thus efforts to establish a diagnosis are crucial.

The laboratory methods used have advantages and limitations. Stool microscopy examination using the Kato-Katz method is the gold standard in assessing infection intensity because it is able to provide quantitative egg counts (Barda et al., 2020). However, this method is most effective in moderate to high-intensity infections and may underestimate prevalence in low-transmission settings (Grau-Pujol et al., 2021). The sensitivity of the Kato-Katz test decreases in cases with low infection, so false-negative results may occur (Chieng et al., 2021). Stool examination is the most consistently used method, showing that this simple test is still the main reference in the diagnosis of STH. Stool examination remains relevant, although in severe cases it requires supporting methods (Kasirga, 2019).

Regarding the risk of death, *Ascaris lumbricoides* infection often causes acute complications that can be fatal. Herbstein et al. (2020) reported a case of a 4-year-old child who died from mechanical asphyxia with a 15–20 cm worm in the respiratory tract. Paparau et al. (2018) found a similar case of main bronchial obstruction. In addition, intestinal obstruction due to *Ascaris* has also been found in children in Ethiopia and Indonesia (Liyew et al., 2025; Supangat et al., 2025). This confirms that gastrointestinal

complications due to worms can be a major cause of death if not treated promptly.

In addition to acute complications, chronic infection significantly contributes to the risk of death in children. Severe *Trichuris trichiura* infection has been reported to cause chronic dysentery syndrome, severe anemia, stunting, malnutrition, and rectal prolapse (Wardani et al., 2022). Evidence from a school-based study in Indonesia showed that *Trichuris trichiura* eggs were detected in 17% of children aged 6–8 years, indicating that STH infections persist among elementary school children and may occur alongside other helminth infections such as *Ascaris lumbricoides* (Rajagukguk & Aritonang, 2022). Although this study did not directly assess mortality, the presence of chronic STH infection in children reflects ongoing exposure that can contribute to long-term nutritional deficiencies and hematological disorders, which may worsen prognosis and increase susceptibility to other infectious diseases that can potentially lead to death.

Cases of severe anemia in children due to hookworm infection have been reported with findings of microcytic hypochromic anemia, low serum iron levels, and the presence of *Ancylostoma duodenale* eggs in the infant's stool, which improved after treatment (Kendre et al., 2019). Another report describes a 3-year-old child in northern India with severe anemia due to *Necator americanus* and *A. duodenale*, diagnosed by endoscopy, microscopy, and laboratory examination, who showed significant clinical improvement after receiving a blood transfusion and albendazole (Singh et al., 2023). These two reports emphasize the importance of early detection and appropriate therapy to prevent serious complications of hookworm infection in children.

The case of Raya, a toddler from Sukabumi, provides a clear example of STH infection in clinical practice. Initially, it was suspected that she died from intestinal worms, but tests showed that the main cause was sepsis due to malnutrition, stunting, and tuberculous meningitis, even though worms were also found in her body (Gustati, 2025). STH infection acts as a triggering factor that exacerbates the child's condition, not the sole cause. This situation shows that helminthiasis can worsen prognosis when interacting with other infectious diseases or poor nutritional status. Management of STH in children requires a comprehensive strategy that not only focuses on worm control but also on improving nutritional status and managing complications.

CONCLUSION

Laboratory tests, particularly stool analysis, histopathology, radiology, and ultrasonography, are diagnostic methods for STH infections in children and can help determine the severity of the disease due to delayed diagnosis. STH infections in children have been shown to be closely associated with various serious

complications, including gastrointestinal obstruction, respiratory distress, and malnutrition, which can worsen clinical conditions and increase the risk of death.

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