Medical Laboratory Science Journal (MedLab)
Vol. 2, No. 1, 2026, pp. 20-26

Identification of soil-transmitted helminth eggs in students' fingernails using the flotation method

Jennifer Putri Sumanti[1], Sri Idayani[2*], Nyoman Sudarma[3]
[1,2,3]Medical Laboratory Technology Study Program, STIKES Wira Medika Bali, Denpasar, Indonesia
*Corresponding Author: sriidayani@stikeswiramedika.ac.id

Article Info

Article history:
Received April 14, 2026
Revised April 21, 2026
Accepted Mei 1, 2026

Keywords: soil-transmitted helminth infection, fingernails, elementary school students, personal hygiene, flotation method

Abstract

Soil-transmitted helminth infection remains a persistent public health concern, particularly among school-aged children who are frequently exposed to contaminated environments and may have suboptimal personal hygiene practices. This study aimed to identify the presence of soil-transmitted helminth eggs in students' fingernails at an elementary school in Bali, Indonesia. A descriptive cross-sectional design was employed, involving 30 students selected through purposive sampling. Fingernail samples were collected and examined using the flotation method with saturated sodium chloride solution, followed by microscopic observation. The data were analyzed using descriptive statistics to determine the distribution of positive and negative findings. The results showed that a small proportion of samples were positive for helminth eggs, with only Ascaris lumbricoides identified, while the majority of samples were negative. These findings suggest that although fingernails can serve as a potential medium for helminth transmission, the level of contamination in this population appears relatively low. Nevertheless, the presence of positive cases indicates the continued importance of maintaining proper personal hygiene, particularly handwashing and regular nail care. This study highlights the relevance of simple preventive measures and supports the role of school-based hygiene education in reducing the risk of helminth infection among children.

How to cite:
Sumanti, J. P., Idayani, S., & Sudarma, N. (2026). Identification of soil-transmitted helminth eggs in students' fingernails using the flotation method. *Medical Laboratory Science Journal (MedLab), 2*(1), 20–26.

1. Introduction

Soil-transmitted helminth (STH) infections remain a major global health issue. To date, an estimated 1.5 billion people worldwide are infected, equivalent to nearly a quarter of the global population (Chen et al., 2024). In many tropical and subtropical regions, limited access to clean water, adequate sanitation, and suboptimal hygiene practices create ideal conditions for the transmission of these parasites. Regions such as sub-Saharan Africa, Asia, and South America have a relatively high disease burden.

Children are the population most vulnerable to this disease. Globally, approximately 267 million preschool-aged children and 568 million school-aged children live in areas at risk of STH transmission (Agrawal et al., 2024). In Indonesia, particularly in Bali, the situation is also significant. Data indicate that the prevalence of intestinal parasitic infections can reach 20–40% (Dinas Kesehatan Provinsi Bali, 2020; Lee et al., 2023). Interestingly, the distribution of cases in Bali tends to be higher in areas with humid environmental conditions, such as highland regions. In such conditions, a significant proportion of cases involve the species Ascaris lumbricoides, Trichuris trichiura, and hookworms (Devi et al., 2018).

STH infections can be caused by several types of intestinal nematodes, including Ascaris lumbricoides, Trichuris trichiura, Necator americanus, Ancylostoma duodenale, and Strongyloides stercoralis (Widodo & Ikawati, 2019). The presence of these parasites in the human body is not merely a mild infection. In many cases, the infection can disrupt the digestive process and nutrient absorption, thereby contributing to the loss of protein, carbohydrates, vitamins, and even a certain amount of blood (Suraini & Oktavianti, 2019). In the long term, this condition has the potential to affect children's nutritional status and development. However, behavioral aspects play an equally important role. Children are often exposed to high-risk environments, such as when playing in the dirt, interacting with unclean surroundings, or when proper handwashing habits have not yet been established. Long, dirty fingernails can serve as a vector for worm eggs to enter the body. Simple habits such as not washing hands before eating or after playing outdoors also increase the risk of infection (Irawati & Sartini, 2021).

Previous studies have begun to highlight the importance of fingernails as a potential transmission vector. Situmorang et al. (2023) demonstrated that Ascaris lumbricoides eggs are frequently found under the fingernails of schoolchildren, a finding closely linked to soil exposure and inadequate hygiene practices. Fitri (2020) also emphasized that personal hygiene practices, including nail and hand hygiene and the habit of washing hands with soap, are factors contributing to the incidence of helminthiasis. Nevertheless, studies on the identification of worm eggs on fingernails, particularly at the local level, such as in elementary school settings, remain relatively limited. Most studies have focused on stool examinations as the standard for diagnosis, while the potential of fingernails as an indicator of exposure has not been explored in depth.

Elementary School No. 4 Taman, Badung Regency, Bali, is a school environment with characteristics relevant to this study. Based on initial observations, some students were found not to be practicing optimal personal hygiene, such as failing to trim their nails regularly or wash their hands with soap after activities. If left unaddressed, this situation has the potential to serve as a pathway for infectious agents, including STH eggs. Therefore, this study aims to identify the presence of soil-transmitted helminth eggs on the fingernails of elementary school students using the flotation method. This approach is expected to provide an initial assessment of potential contamination and contribute to strengthening behavior-based and personal hygiene prevention strategies within the school environment.

2. Method

2.1 Research Design and Participants

This study employed a quantitative descriptive design with a cross-sectional approach, aiming to identify the presence of soil-transmitted helminth (STH) eggs under the fingernails of students during a specific time period. Sampling was conducted at Elementary School No. 4 Taman, located in Banjar Ketogan, Taman Village, Abiansemal Subdistrict, Badung Regency, Bali, while laboratory testing was performed at the Parasitology Laboratory of STIKES Wira Medika Bali in Denpasar. The study population comprised all 84 students enrolled at Elementary School No. 4 Taman. From this population, 30 students were selected as the sample using purposive sampling (Subhaktiyasa, 2024). Inclusion criteria included students who were willing to participate, had fingernails suitable for sampling, and were present at the time of sampling. Meanwhile, students who refused to participate or did not meet the conditions for sample collection were excluded from the study.

2.2 Instruments and Data Collection

The primary instrument in this study consisted of samples of students' fingernail clippings collected directly, which were then analyzed using the flotation method. This method was chosen because it can separate worm eggs based on differences in specific gravity, allowing the eggs to rise to the surface of the solution and be more easily observed under a microscope. The examination procedure was conducted in stages. The collected nail clippings were placed in a beaker, and then a saturated NaCl solution was added until the entire sample was submerged. After that, the mixture was gently stirred and allowed to stand for approximately 30 minutes to allow dirt adhering to the nails to dissolve. The resulting supernatant was then transferred into a test tube until full, then covered with a cover slip. This mixture is allowed to stand for another 30 minutes to allow the worm eggs to rise to the surface. Next, the cover glass is carefully transferred onto a clean, dry slide and examined under a microscope at 10× magnification, followed by 40× magnification. The test result is considered positive if STH worm eggs are found, and negative if no worm eggs are found. Data collection was conducted directly by the researchers while adhering to standard laboratory procedures. Before sample collection, students were given a simple explanation of the research

objectives, and consent for participation was obtained through permission from the school and teacher supervision.

2.3 Data Analysis

The data obtained were analyzed using a descriptive statistical approach (Subhaktiyasa et al., 2025). This analysis was chosen because it aligns with the study's objective, which focuses on identifying and mapping the distribution of findings. The examination results were categorized into two main groups: positive and negative for the presence of STH eggs. The data were then presented in the form of frequency distribution tables and percentages to provide an overview of the proportion of occurrences in the studied sample. The entire analysis process was conducted manually with the aid of basic data processing software to ensure the accuracy of the percentage calculations.

2.4 Ethical Considerations

This study involved children as a vulnerable group; therefore, special attention was given to participant protection. Before data collection began, the researcher first obtained permission from the school. In addition, information regarding the study's objectives, procedures, and benefits was clearly communicated to the students with teacher supervision. Participation in this study was voluntary, and students were free to decline without any consequences. Respondent confidentiality was maintained by not including names or personal information in the data recording or reporting process. All data collected was used solely for research purposes and reported in aggregate form.

3. Results and Discussion

3.1 Results

This section presents the characteristics of the respondents and the main findings regarding the presence of soil-transmitted helminth (STH) eggs in the students' nail samples. The characteristics of the respondents are shown in Table 1, and the results of the soil-transmitted helminth egg examinations are presented in Table 2.

Table 1. Characteristics of the study respondents

Variable	Category	Total (n)	Percentage (%)
Age (years)	7	4	13.4
	8	4	13.4
	9	7	23.3
	10	7	23.3
	11	7	23.3
	12	1	3.3
Grade	1	4	13.4
	2	4	13,4
	3	9	30.0
	4	5	16.6
	5	7	23.3
	6	1	3.3
Gender	Male	20	66.7
	Female	10	33.3

Table 1 illustrates that most respondents were in the 9- to 11-year-old age group, with relatively even proportions across all three age groups. The distribution by grade level shows a predominance of third-grade students, followed by fifth-grade students, while the smallest number of respondents came from sixth grade. In terms of gender, male students made up the majority of respondents, with a higher proportion than female students.

Table 2. Results of soil-transmitted helminth egg examinations on students' fingernails

Variable	Category	Total (n)	Percentage (%)
STH Type	Ascaris lumbricoides	2	6.7
	Trichuris trichiura	0	0
	Hookworm	0	0
	Strongyloides stercoralis	0	0
	Negative	28	93.3
Gender	Male (positive)	2	6.7
	Male (negative)	18	60.0
	Female (positive)	0	0
	Male (negative)	10	33.3
Grade	1–3 (positive)	2	6,7
	1–3 (negative)	13	43.3
	4–6 (positive)	0	0
	4–6 (negative)	15	50.0
Age (years)	7–10 tahun (positive)	2	6,7
	7–10 tahun (negative)	20	66.6
	11–12 tahun (positive)	0	0
	11–12 tahun (negative)	8	26.7

Table 2 indicates that most samples did not contain soil-transmitted helminth (STH) eggs, with a significantly higher proportion of negative results compared to positive findings. Positive cases were found only in a small proportion of respondents, with the identified egg type limited to Ascaris lumbricoides. No other STH species were detected in any of the samples examined. When analyzed by respondent characteristics, all positive findings were from the group of male students. Furthermore, positive findings were only found in the lower grade groups (grades 1–3) and among younger age groups, while no positive cases were found in older age groups or among female students.

3.2 Discussion

The findings indicate that the prevalence of soil-transmitted helminth (STH) eggs on students' fingernails is relatively low. Only a small proportion of samples tested positive. These results provide an initial indication that fingernail contamination as a transmission route does exist, although it is not the dominant mode of transmission in the studied population. Interestingly, all positive findings were limited to male students aged 8 and 9 years, who, in the context of daily behavior, may have a higher level of environmental exposure.

When linked to individual conditions, the two samples identified as positive came from students with suboptimal personal hygiene habits, particularly regarding nail care. It suggests that personal hygiene acts as a protective factor against infection. Personal hygiene refers to an individual's efforts to maintain bodily cleanliness and health to achieve physical and psychological well-being (Bista, 2023; Danyati, 2018; Putri & Subhaktiyasa, 2018; Tinungki & Purnawinadi, 2023). One aspect that is often overlooked is nail hygiene, even though nails can be a site for the accumulation of dirt, including soil and food debris that may contain worm eggs (Genet et al., 2021; Tadege et al., 2022).

Dirt trapped under the fingernails can serve as a route for worm eggs to enter the body, especially when handwashing habits are not practiced properly. This process seems simple, but it has significant implications for parasite transmission. Worm eggs attached to fingernails can easily be ingested when a person eats without washing their hands thoroughly (Aemiro et al., 2022; Gurmassa et al., 2024; Tadege et al., 2022). In fact, recommended nail hygiene standards indicate that nail length should not exceed 2 mm from the fingertip to minimize dirt accumulation (Speth, 2023).

These research findings also align with previous studies emphasizing the importance of personal hygiene in preventing helminth infections. Rahmawati et al. (2023) revealed a relationship between the level of personal hygiene knowledge and the incidence of infection among elementary school students. The better the understanding and practice of personal hygiene, the lower the likelihood of infection. These findings reinforce that behavioral aspects play a role that cannot be ignored in STH epidemiology. On the other hand, children's age characteristics also appear to contribute to the patterns observed in this study. Children in the elementary school age range tend to have habits of playing in high-risk environments, such

as dirt or unclean areas, and have not yet fully developed an awareness of the importance of personal hygiene (Bokicho et al., 2023; Eyayu et al., 2022; Genet et al., 2021). Habits such as not washing hands before eating, not wearing footwear, or not maintaining nail hygiene regularly can increase the likelihood of exposure to worm eggs from the surrounding environment.

Several previous studies have also confirmed that poor hygiene is a major factor in the occurrence of parasitic worm infections. (Simple practices such as washing hands with soap before eating and after defecation, as well as maintaining foot and nail hygiene, have a significant impact on reducing the risk of infection (Amare & Lindtjørn, 2021; Gupta et al., 2022; Khan et al., 2021). The research results indicate that the predominance of negative samples may suggest that most students have relatively good hygiene practices, although these are not yet uniform. Nevertheless, these findings do not necessarily indicate that the risk of infection has been fully controlled. Interview results indicate that there are still some students who are inconsistent in maintaining personal hygiene, particularly regarding the habit of regularly trimming their nails. This situation highlights a gap between knowledge and practice, which, in the long term, may continue to leave the door open for infections.

The study's findings have implications, particularly within the context of behavior-based prevention. The school environment plays a strategic role in shaping clean and healthy living habits, both through education and supervision. Simple measures such as instilling the habit of washing hands with soap and maintaining regular nail hygiene can serve as effective preventive steps in reducing the risk of STH infection. The findings confirm that fingernails can serve as a potential medium for the transmission of soil-transmitted helminth eggs, although their prevalence was relatively low in the studied population. These findings also underscore the importance of strengthening personal hygiene practices as part of a strategy to prevent helminth infections. However, there are several limitations to this study. The relatively small sample size and the descriptive nature of the study design limit the ability to generalize the results to a broader population. Additionally, identification was performed only on nail samples without confirmation through stool examinations, so it cannot fully and comprehensively describe an individual's infection status.

4. Conclusion

This study demonstrates that the presence of soil-transmitted helminth (STH) eggs on the fingernails of elementary school students at Elementary School No. 4 Taman is relatively low. A small proportion of samples tested positive for the species Ascaris lumbricoides. These findings suggest that fingernails may serve as a potential medium for the transmission of worm eggs, although they are not the primary route of transmission in the studied population. These results underscore the importance of maintaining personal hygiene, particularly nail hygiene and handwashing habits, as simple yet relevant preventive measures in efforts to control helminth infections in school settings. This study provides an initial contribution toward expanding approaches to identify STH contamination beyond stool examinations by utilizing nail samples as an indicator of environmental exposure. However, the study has limitations, such as a relatively small sample size and the absence of confirmation through stool examinations. Therefore, future research is recommended to use a more comprehensive design with a larger sample size, as well as to combine different laboratory examination methods to obtain a more accurate picture of the dynamics of soil-transmitted helminth infections.

Conflict of Interest

The authors confirm that there are no conflicts of interest.

References

Aemiro, A., Menkir, S., Tegen, D., & Tola, G. (2022). Prevalence of Soil-Transmitted Helminthes and Associated Risk Factors Among People of Ethiopia: A Systematic Review and Meta-Analysis. *Infectious Diseases*, *15*. https://doi.org/10.1177/11786337211055437

Agrawal, R., Pattnaik, S., Kshatri, J., Kanungo, S., Mandal, N., Palo, S., & Pati, S. (2024). Prevalence and correlates of soil-transmitted helminths in schoolchildren aged 5 to 18 years in low- and middle-income countries: a systematic review and meta-analysis. *Frontiers in Public Health*, *12*. https://doi.org/10.3389/fpubh.2024.1283054

Amare, H., & Lindtjørn, B. (2021). Risk factors for scabies, tungiasis, and tinea infections among schoolchildren in southern Ethiopia: A cross-sectional Bayesian multilevel model. *PLoS Neglected Tropical Diseases*, *15*. https://doi.org/10.1371/journal.pntd.0009816

Bista, C. B. (2023). Knowledge, Attitudes, and Practices of Hygiene in Hindu Society of Chunikhel, Lalitpur. *Historical Journal*. https://doi.org/10.3126/hj.v14i2.59045

Bokicho, B., Hailu, D., Eshetu, B., Matie, M., & Tadele, T. (2023). Soil-transmitted helminthiases among school-age children and their association with water, sanitation, and hygiene, Hawassa City, Southern Ethiopia. *PLOS Neglected Tropical Diseases*, *17*. https://doi.org/10.1371/journal.pntd.0011484

Chen, J., Gong, Y., Chen, Q., Li, S., & Zhou, Y. (2024). Global burden of soil-transmitted helminth infections, 1990–2021. *Infectious Diseases of Poverty*, *13*. https://doi.org/10.1186/s40249-024-01238-9

Danyati, N. P. N. T. (2018). *Gambaran asuhan keperawatan penerapan TAK stimulasi persepsi defisit perawatan diri untuk mengatasi defisit perawatan diri pada pasien skizofrenia tahun 2018* [Poltekkes Kemenkes Denpasar]. https://repository.poltekkes-denpasar.ac.id/678/

Devi, N. P. A., Sudarmaja, I. M., & Swastika, K. (2018). Prevalensi infeksi soil transmitted helmith di Sekolah Dasar Negeri 1 Padangbulia Kecamatan Sukasada. *Intisari Sains Medis*, *9*(3), 59–61. https://doi.org/10.1556/ism.v9i3.315

Dinas Kesehatan Provinsi Bali. (2020). Profil Kesehatan Provinsi Bali Tahun 2019. In *Dinas Kesehatan Provinsi Bali*. https://www.diskes.baliprov.go.id/download/profil-kesehatan-2019/

Eyayu, T., Yimer, G., Workineh, L., Tiruneh, T., Sema, M., Legese, B., Almaw, A., Solomon, Y., Malkamu, B., Chanie, E., Feleke, D., Jimma, M., Hassen, S., & Tesfaw, A. (2022). Prevalence, intensity of infection and associated risk factors of soil-transmitted helminth infections among school children at Tachgayint woreda, Northcentral Ethiopia. *PLoS ONE*, *17*. https://doi.org/10.1371/journal.pone.0266333

Fitri, M. (2020). Analisis telur cacing soil transmitted helminthes pada kuku siswa sekolah dasar. *Jurnal 'Aisyiyah Medika*, *5*(1), 131–141. https://doi.org/10.36729/jam.v5i1.319

Genet, A., Motbainor, A., Samuel, T., & Azage, M. (2021). Prevalence and associated factors of soil transmitted helminthiasis among school-age children in wetland and non-wetland areas of Blue Nile Basins, northwest Ethiopia: A community-based comparative study. *SAGE Open Medicine*, *9*. https://doi.org/10.1177/20503121211063354

Gupta, S., Das, D., Chakraborty, A., & Banerjee, R. (2022). Factors predicting proper handwashing practice amidst the COVID-19 pandemic in India: a field-based cross-sectional study. *Journal of Water and Health*, *20 10*, 1534–1542. https://doi.org/10.2166/wh.2022.103

Gurmassa, B. K., Gari, S., Solomon, E. T., Goodson, M., Walsh, C., Dessie, B., & Alemu, B. (2024). Prevalence and risk factors of soil transmitted helminths among vegetable farmers of Akaki river bank, Addis Ababa, Ethiopia. *BMC Infectious Diseases*, *24*. https://doi.org/10.1186/s12879-024-09704-3

Irawati, O., & Sartini, I. F. (2021). Infeksi cacing nematoda usus pada anak kelas 1 dan 2 sekolah dasar. *Jurnal Biologi Inovasi*, *3*(1), 1–7. https://doi.org/10.31289/jibioma.v3i1.538

Khan, K., Chakraborty, R., Brown, S., Sultana, R., Colón, A., Toor, D., Upreti, P., & Sen, B. (2021). Association between Handwashing Behavior and Infectious Diseases among Low-Income Community Children in Urban New Delhi, India: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*, *18*. https://doi.org/10.3390/ijerph182312535

Lee, P., Kurscheid, J., Laksono, B., Park, M., Clements, A., Lowe, C., Stewart, D., & Gray, D. (2023). Model validation for a knowledge and practices survey towards prevention of soil-transmitted helminth infections in rural villages in Indonesia. *Scientific Reports*, *13*. https://doi.org/10.1038/s41598-023-27781-3

Putri, P. H. J., & Subhaktiyasa, P. G. (2018). Hubungan Pengetahuan dengan Sikap Personal Hygiene Pemulung di Tempat Pembuangan Akhir Suwung Denpasar Selatan. *Bali Medika Jurnal*, *5*(2), 292–297. https://doi.org/10.36376/bmj.v5i2.45

Rahmawati, Y., Harlita, T. D., & Yusran, D. I. (2023). Hubungan pengetahuan personal hygiene dengan correlation between knowledge of personal hygiene. *Journal Health and Sciences*, *8*(1), 34–42. https://doi.org/10.35971/gojhes.v8i1.21725

Situmorang, P. R., Sihombing, R. A. K., & Hutabarat, Y. B. (2023). Identifikasi morfologi cacing STH (Soil Transmitted Helminth) pada kuku anak SD Yayasan Betania tahun 2023. *Jurnal Kesehatan Tambusai*, *4*(3), 3152–3158. https://doi.org/10.31004/jkt.v4i3.17284

Speth, J. (2023). Guidelines in Practice: Hand Hygiene. *AORN Journal*, *118 2*, 101–108. https://doi.org/10.1002/aorn.13964

Subhaktiyasa, P. G. (2024). Menentukan Populasi dan Sampel : Pendekatan Metodologi Penelitian Kuantitatif dan Kualitatif. *Jurnal Ilmiah Profesi Pendidikan*, *9*(4), 2721–2731. https://doi.org/10.29303/jipp.v9i4.2657

Subhaktiyasa, P. G., Candrawati, S. A. K., Sumaryani, N. P., Sunita, N. W., & Syakur, A. (2025). Penerapan Statistik Deskriptif: Perspektif Kuantitatif dan Kualitatif. *Emasains: Jurnal Edukasi Matematika Dan Sains*, *14*(1), 96–104. https://doi.org/10.59672/emasains.v14i1.4450

Suraini, S., & Oktavianti, V. (2019). Pemeriksaan Telur Cacing Soil Transmitted Helminths Pada Anak Usia 2-5 Tahun Di Nagari Batu Bajanjang Lembang Jaya Solok. *Prosiding Seminar Kesehatan Perintis*, *2*(1), 117–122. https://jurnal.upertis.ac.id/index.php/PSKP/article/view/383

Tadege, B., Mekonnen, Z., Dana, D., Tiruneh, A., Sharew, B., Dereje, E., Loha, E., Ayana, M., & Levecke, B. (2022). Assessment of the nail contamination with soil-transmitted helminths in schoolchildren in Jimma Town, Ethiopia. *PLoS ONE*, *17*. https://doi.org/10.1371/journal.pone.0268792

Tinungki, N. N., & Purnawinadi, G. (2023). Hubungan Kebersihan Diri dan Keluhan Gangguan Kulit Pada Petani. *Nutrix Journal*. https://doi.org/10.37771/nj.v7i2.1022

Widodo, A., & Ikawati, K. (2019). Pemeriksaan telur soil transmitted helminths pada kotoran kuku pemulung di tempat pembuangan akhir (TPA) sampah. *Majalah Kesehatan Masyarakat Aceh (MaKMA)*, *2*(2), 133–141. https://doi.org/10.32672/makma.v2i2.1303