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Prevalence and Risk Factors of *Trichuris trichiura* Infection among Elementary School Students in Palipi District, Samosir Regency, North Sumatera, Indonesia

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ABSTRACT

Background: Infection with *Trichuris trichiura* continues to affect populations in tropical and subtropical regions, particularly school-aged children living in environments with inadequate sanitation. This study was conducted to estimate the prevalence of *T. trichiura* infection and to identify associated risk factors among elementary school students in Palipi District, Samosir Regency, North Sumatra, Indonesia.
Methods: This cross-sectional study was conducted from January to March 2025 in five elementary schools in Palipi District, Samosir Regency. A total of 109 students who met the inclusion and exclusion criteria and agreed to participate were recruited through school-based screening. Stool samples were examined using the Kato–Katz method at the Parasitology Laboratory, Universitas Sumatera Utara. Data on handwashing habits, diarrhea history, stunting status, and nail hygiene were collected using structured assessments. Anthropometric measurements and hematological parameters were also recorded. The data analysis involved descriptive statistical methods and chi-square testing, with statistical significance set at $p < 0.05$.
Result: The prevalence of *trichuris trichiura* infection was 14.7%. Diarrhea was significantly associated with infection ($p = 0.010$), while stunting, handwashing with soap, and nail hygiene were not significantly associated ($p > 0.05$). Infected children showed slightly lower mean height, BMI, and hemoglobin levels; however, these differences were not statistically significant..
Conclusion : *Trichuris trichiura* infection remains a public health concern among elementary school students in Palipi District. Diarrhea was significantly associated with infection. Strengthening hygiene promotion and sanitation programs at the school and community levels may help reduce transmission.

Keywords: *trichuris trichiura*; prevalence; risk factors; soil-transmitted helminths

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Introduction

Whip worm infection *Trichuris trichiura (T. trichiura)* is one of the Soil Transmitted Helminthiasis (STH) are globally significant, especially in tropical and subtropical areas with poor sanitation and hygiene.[1] These nematode parasites infect the human colon, causing a wide range of health problems ranging from mild asymptomatic infections to significant morbidity in severe infections, especially in children. Clinical manifestations of infection *T. trichiura* can be abdominal pain, diarrhea, loss of appetite, weight loss, anemia and even rectal prolapse in severe cases of infection.[2]

Based on global estimates, hundreds of millions of individuals are infected with T. trichiura, with school aged children in low-resource settings bearing the greatest burden. In certain disadvantaged communities, infection rates remain extremely high, particularly among children. Recent evidence from a systematic review and meta-analysis (2010–2023) confirms that *T. trichiura* infection remains widely prevalent globally, particularly among children living in tropical and subtropical settings.[3] Prevalence of infection *T. trichiura* remain high in many developing countries, including Indonesia, where low socioeconomic conditions and limited access to adequate sanitation are major predisposing factors. The public health impact of these infections cannot be ignored, especially on children's physical and cognitive growth, which can ultimately affect the quality of life and socioeconomic potential of individuals as well as society as a whole.[4]

Infection control efforts *T. trichiura* often it has not achieved optimal results due to the complexity of interrelated factors. Poor sanitation and hygiene are the root of the main problem. The practice of open defecation is still common, causing soil contamination by worm eggs. On the other hand, limited access to clean water and lack of public awareness of the importance of hand and food hygiene exacerbate the spread of infections,[5] and previous research indicates that strengthening water access, sanitation facilities, and hygiene practices plays an important role in lowering the transmission of soil-transmitted helminths.[6] Although mass treatment programs have been rolled out with antihelmintic drugs such as Albendazole and Mebendazole, suboptimal coverage and high post-treatment reinfection rates continue to be serious challenges. This problem is exacerbated by the limited resources for education and the provision of adequate sanitation facilities. In addition, infections that are often asymptomatic make sufferers unaware of their status, thus continuing to contribute to the cycle of transmission. Therefore, a comprehensive approach that integrates sanitation improvement, continuous health education, and effective treatment strategies is crucial to achieving control *T. trichiura* the maximum.[7]

Palipi District, located in Samosir Regency, North Sumatera, is a rural area where environmental and sanitation conditions may support the transmission of soil-transmitted helminths. Several communities rely on untreated water sources such as lakes and rivers, and sanitation infrastructure in schools and households remains limited in certain areas. In addition, the humid tropical climate around the Lake Toba region may facilitate the survival of *T. trichiura* eggs in the soil. However, local epidemiological data regarding the prevalence of *T. trichiura* infection and its associated factors among elementary school children in Palipi District are still scarce. Therefore, this study provides important baseline evidence to support targeted prevention and control strategies in this setting.

The aim of this study was to determine the prevalence of *Trichuris trichiura* infection and its associated factors among elementary school students in Palipi District, Samosir Regency, North Sumatera, Indonesia. This research is expected to provide a scientific basis for a deeper understanding of the infection, as well as support the formulation of more targeted and sustainable control strategies in the future.

Methods

The research was designed as an analytical cross-sectional study carried out between January and March 2025. Sampling was carried out in five elementary schools located in Palipi District, Samosir Regency, namely SDN 10 Sigaol Simbolon, SDN 19 Palipi, SDN 21 Simbolon Purba, SDN 20 Simbolon Purba, and SDN 4 Suhut Nihuta.

The target population consisted of all students enrolled in grades 3 to 6 in the selected schools during the study period. A total of eligible students were invited to participate through school-based screening. Active case finding was conducted by distributing informed consent forms to parents or guardians, followed by stool sample collection from students who met the inclusion criteria and agreed to participate. After applying the eligibility criteria and verifying data completeness, 109 students were retained for statistical analysis.

To estimate the minimum number of participants, a single population proportion approach was applied, using an anticipated prevalence of 15%, a 95% confidence level, and a 7% precision margin. The computation indicated that approximately 100 individuals were necessary for adequate statistical power.

Stool samples were analyzed using the Kato-Katz technique at the Parasitology Laboratory of the Faculty of Medicine, Universitas Sumatera Utara

Inclusion criteria were students enrolled in grades 3–6 who provided stool samples and whose parents or guardians gave written informed consent. Exclusion criteria included students who had received anthelmintic treatment within the previous three months, had chronic systemic diseases, or were absent during data collection.

The independent variables in this study were handwashing with soap, history of diarrhea, stunting status, and nail hygiene. The dependent variable was the presence of *Trichuris trichiura* infection confirmed by microscopic examination.

Diarrhea was defined as the occurrence of three or more loose or watery stools within a 24-hour period during the previous seven days prior to data collection, based on participant self-report obtained through a structured questionnaire. Linear growth was evaluated using height-for-age Z-scores derived from the WHO Child Growth Standards. Participants with scores below −2 standard deviations were considered stunted. Nail hygiene was assessed through direct observation by the research team at the time of examination. Nails were categorized as “healthy” if they were short, clean, and free from visible dirt, and as “unhealthy” if they were long and/or contained visible dirt under the nails.

Measurements of body weight and stature were carried out according to established procedures, and BMI was calculated based on these values. Blood examination results, including hemoglobin concentration, total leukocyte count, and the proportions of neutrophils and lymphocytes, were included in the analysis.

Descriptive statistical analysis was conducted to summarize participant characteristics. To evaluate the relationship between categorical variables and T. trichiura infection, bivariate analysis was conducted. The chi-square test was primarily used, with statistical significance determined at a p-value below 0.05. If the minimum expected frequency assumption was violated, Fisher’s exact test was performed instead. For numerical variables, normality was assessed, and comparisons between infected and non-infected groups when the distribution met normality assumptions, the independent t-test was used to compare groups. In contrast, variables that were not normally distributed were evaluated using the Mann–Whitney U test.

The research protocol was reviewed and approved by the Universitas Sumatera Utara Health Research Ethics Commission (Approval No. 1429/KEPK/USU/2024) prior to data collection.

Result

Fecal examination was performed to determine if respondents were infected with T. trichiura. The method used is Kato katz. According to Table 1, a study conducted in five elementary schools within the Pallipi District, utilizing fecal examination via the

Kato-Katz method, revealed a prevalence of *T. trichiura* infection of 14.7%, as evidenced by thedetectiong of *T. trichiura* eggs in fecal samples.

The following table presents the results of an analysis examining the association between several risk variables and the incidence of *T. trichiura* infection among elementary school students in Palipi District. The analysis was carried out on 109 respondents by comparing the proportion of positive and negative infection cases against four variables, namely diarrhea, stunting status, handwashing habits with soap, and nail health conditions. The relationship between each factor and T. trichiura infection was analyzed through chi-square testing, while the corresponding odds ratios (OR) were computed to estimate effect size.

Table 1. Percentage of respondents infected with *T. trichiura*

Intestinal Parasite Infections	n	%
Positive	16	14.7
Negative	93	85.3

Based on table 2, the variable that had a significant association with *T. trichiura* infection was diarrhea (p=0.010). Meanwhile, the variables of stunting, handwashing with soap, and nail hygiene conditions did not show a statistically significant association with *T. trichiura* infection (p>0.05).

Table 2. Characteristics of respondents based on categorical variables

Variable	*T. trichiura* infection				Total		*p-value*	POR
	Positive		Negative					
	n	%	n	%	n	%		
Diarrhea								
Yes	5	45.5	6	54.5	11	100	0.010	6.591
No	11	11.2	87	88.8	98	100		(1.722-25.230)
Total	16	14.7	93	85.3	109	100		
Stunting								
Yes	2	6.9	27	93.1	29	100	0.227	0.349
No	14	17.5	66	82.5	80	100		(0.074-1.642)
Total	16	14.7	93	85.3	109	100		
Handwashing with soap								
Yes	5	10	45	90	50	100	0.279	0.494
No	11	18.6	48	81.4	59	100		(0.166-1.472)
Total	16	14.7	93	85.3	109	100		
Healthy nails								
Healthy	6	10.5	51	89.5	57	100	0.279	0.485
Unhealthy	10	19.2	42	80.8	52	100		(0.156-1.505)
Total	16	14.7	93	85.3	109	100		

Table 3 presents the comparison of numerical characteristics between students with and without *T. trichiura* infection. The mean age of infected children was 9.87 ± 1.84 years, slightly higher than that of non-infected children (9.42 ± 1.53 years), although the difference was not statistically significant (p = 0.299). The mean body weight was similar between infected (27.31 ± 4.82 kg) and non-infected students (27.09 ± 6.14 kg), with no significant difference (p = 0.891). Likewise, the mean height of infected children (127.54 ± 10.42 cm) was lower than that of non-infected

children (138.15 ± 12.45), but this difference was not statistically significant (p = 0.735).

The mean BMI was also lower among infected children (15.78 ± 3.96) compared to non-infected children (16.78 ± 2.57); however, the difference was not statistically significant (p = 0.348). Regarding hematological parameters, infected children showed slightly higher mean neutrophil percentages (63.44 ± 7.23%) compared to non-infected children (61.81 ± 4.32%), and slightly lower mean lymphocyte percentages (27.13 ± 6.45% vs. 28.23 ± 4.32%), but these differences were not statistically significant (p = 0.215 and p = 0.368, respectively).

Similarly, the mean white blood cell count (8.68 ± 1.52 vs. 8.43 ± 2.10; p = 0.655) and hemoglobin level (12.81 ± 0.81 g/dL vs. 12.87 ± 0.70 g/dL; p = 0.772) did not differ significantly between infected and non-infected groups. Overall, no statistically significant differences were observed in any of the numerical variables between children with and without *T. trichiura* infection (all p > 0.05).

Table 3. Characteristics of respondents based on numerical variables

Characteristics	Trichuriasis	N	Mean	Std.Deviation	*p-value*
Age of	Positive	16	9.869	1.8434	0.299
respondents	Negative	93	9.424	1.5258	
Weight	Positive	16	27.313	4.8231	0.891
	Negative	93	27.091	6.1357	
Height	Positive	16	127.538	10.4229	0.735
	Negative	93	138.145	12.4585	
BMI	Positive	16	15.775	3.9585	0.348
	Negative	93	16.775	2.5667	
Segment	Positive	16	63.44	7.229	0.215
Netrophile	Negative	93	61.81	4.322	
Lymphocytes	Positive	16	27.13	6.449	0.368
	Negative	93	28.23	4.322	
WBC	Positive	16	8.675	1.5210	0.655
	Negative	93	8.429	2.1027	
Hb	Positive	16	12.813	0.8148	0.772
	Negative	93	12.869	0.7006	

Discussion

Among 109 elementary school students examined across five schools in Palipi District, 16 children were identified as infected, corresponding to a prevalence of 14.7%. This prevalence should be interpreted cautiously and compared with studies conducted in similar populations and settings rather than directly with global aggregate estimates. While previous reports have described substantial global burdens of infection, differences in study design, age groups, geographic context, and measurement methods may influence comparability.[3] Therefore, the prevalence observed in this study indicates that *T. trichiura* infection remains present among school-aged children in this rural setting and warrants continued attention. The relatively high prevalence in this rural area may be influenced by environmental and sanitation-related conditions. Although factors such as unsafe water sources, proximity of livestock pens, limited sanitation facilities, open defecation practices, and inadequate waste disposal were observed during field activities, these variables were not formally measured in this study. Therefore, they should be interpreted as contextual observations rather than

statistically tested determinants. Future studies incorporating these environmental variables into quantitative analysis would provide a more comprehensive understanding of transmission dynamics.

Diarrhea in this study was shown to be significantly associated with *T. trichiura* infection. These findings are in line with a study in Ethiopia that reported that infections *T. trichiura* are often accompanied by diarrhea.[8] In contrast, previous findings have reported Conversely, earlier investigations were unable to establish a significant relationship connecting Soil Transmitted Helminth infection with diarrheal symptoms.[9] The significant relationship between diarrhea and intestinal parasitic infections in Palipi District may reflect contextual conditions, particularly restricted availability of safe water and adequate sanitation facilities. Previous systematic reviews have indicated that poor water, sanitation, and hygiene (WASH) environments contribute to a higher risk of soil-transmitted helminth infections, supporting the biological plausibility of this association.[10] The significant relationship between diarrhea and intestinal parasitic infections in Palipi District may be influenced by several contextual factors, including limited access to clean water and sanitation. However, because these environmental variables were not quantitatively assessed, their contribution cannot be confirmed within the present analysis.

In theory, infection with *T. trichiura* may damage the intestinal mucosa, interfere with nutrient absorption, and trigger diarrhea, which over time could contribute to chronic malnutrition and impaired growth.[9] Previous studies have indicated that poor water, sanitation, and hygiene (WASH) environments contribute to a higher likelihood of soil-transmitted helminth infections, thereby strengthening the biological rationale for this relationship.[11] However, this study did not identify a statistically meaningful relationship linking T. trichiura infection to stunting among elementary school students in Palipi District. Although the mean height and BMI were lower in infected children, these differences were not statistically significant. The absence of statistical significance may be influenced by the relatively small number of infected participants (n = 16) and variability within the data. Therefore, the findings do not support a definitive association between infection and impaired growth in this population. These findings are in line with similar studies conducted in Papuaa.[12] In contrast, research in East Nusa Tenggara identified a statistically meaningful association linking Soil Transmitted Helminth infection to stunting.[13]

Hand washing with soap is recognized as an effective preventive measure against STH infection because it can remove parasite eggs adhering to the hands after contact with contaminated soil, food, water, or objects.[8] Recommended times for washing hands with soap include prior to eating, before preparing or serving meals, after defecation, and following contact with animals.[14] The analysis did not demonstrate a statistically significant association between handwashing with soap and T. trichiura infection in this population. This result aligns with research carried out at SD Negeri 11 Kesiman Denpasar, Bali (2023), which also reported no statistically meaningful association between CTPS behavior and helminth infection.[15] However, other studies have reported significant associations.[8]

Although infection rates were numerically higher among children who did not practice hand washing with soap, the difference did not reach statistical significance. Therefore, the present findings should be interpreted cautiously and do not provide sufficient evidence to establish hand washing behavior as a significant associated factor in this study population. Long and dirty nails are theoretically associated with an increased risk of *T. trichiura* infection due to the potential accumulation of parasite eggs. However, bivariate analysis in this study did not demonstrate a statistically significant association between nail hygiene and infection. These findings are in line with a study in East Java (2021), which reported that regular nail cutting may reduce worm infection.[16] In contrast, research conducted in Sibolga found a significant association between nail hygiene and STH infection.[17]

In addition, the diagnostic method used in this study, the Kato–Katz technique, is recommended for STH detection; however, its sensitivity may be reduced in light-intensity infections and when only a single stool sample is examined. Previous methodological studies have highlighted that repeated sampling or multiple slides may improve diagnostic accuracy.[18] Although biological mechanisms suggest that poor nail hygiene may facilitate transmission, the absence of statistical significance in this study may be related to the limited number of infected cases and potential measurement limitations. Therefore, interpretations regarding the protective effect of hygiene programs should be made cautiously, and future studies using larger sample sizes and multivariable analyses are recommended to clarify these relationships.

Conclusions

In conclusion, the prevalence of *T. trichiura* infection among elementary school students in Palipi District, Samosir Regency, was 14.7%, indicating that trichuriasis remains a public health concern in this rural setting. Diarrhea was significantly associated with *T. trichiura* infection, while handwashing with soap habits, nail hygiene, and stunting status were not significantly associated. Although hygiene-related factors were not statistically significant in this study, strengthening sanitation and health education remains important as part of broader soil-transmitted helminth prevention strategies. Further studies with larger sample sizes and multivariable analysis are recommended to better clarify associated factors in this population.

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References

1. Lydia Lestari D. Infeksi Soil Transmitted Helminths pada Anak. Scientific Journal. 2022 Nov 30;1(6):423–33.
2. WHO. Soil Transmitted helminth Infections. WHO [Internet]. 2023 [cited 2025 May 8]; Available from: https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections
3. Behniafar H, Sepidarkish M, Tadi MJ, Valizadeh S, Gholamrezaei M, Hamidi F, et al. The global prevalence of Trichuris trichiura infection in humans (2010-2023): A systematic review and meta-analysis. J Infect Public Health. 2024 May;17(5):800–9.
4. Jodjana E, Majawati ES. Gambaran infeksi cacing Trichuris trichiura pada anak di SDN 01 PG Jakarta Barat. Jurnal Kedokteran Meditek [Internet]. 2017 [cited 2025 Jun 8]; Available from: https://files01.core.ac.uk/download/pdf/326447058.pdf
5. CDC. Trichuriasis. CDC [Internet]. 2024 [cited 2025 Jun 8]; Available from: https://www.cdc.gov/dpdx/trichuriasis/index.html
6. Strunz EC, Addiss DG, Stocks ME, Ogden S, Utzinger J, Freeman MC. Water, Sanitation, Hygiene, and Soil-Transmitted Helminth Infection: A Systematic Review and Meta-Analysis. PLoS Med. 2014 Mar 25;11(3):e1001620.
7. Kementerian kesehatan RI. Peraturan Menteri Kesehatan Nomor 15 Tahun 2017 tentang Penanggulangan Cacingan. Kementerian kesehatan RI. 2017;
8. Mahmud MA, Spigt M, Bezabih AM, Dinant GJ, Velasco RB. Associations between intestinal parasitic infections, anaemia, and diarrhoea among school aged children, and the impact of hand-washing and nail clipping. BMC Res Notes. 2020 Dec 2;13(1):1.
9. Ramlal PS, Stenström TA, Munien S, Amoah ID, Buckley CA, Sershen. Relationships between shared sanitation facilities and diarrhoeal and soil-

transmitted helminth infections: an analytical review. Journal of Water, Sanitation and Hygiene for Development. 2019 Jun 1;9(2):198–209.
10. Ziegelbauer K, Speich B, Mäusezahl D, Bos R, Keiser J, Utzinger J. Effect of Sanitation on Soil-Transmitted Helminth Infection: Systematic Review and Meta-Analysis. PLoS Med. 2012 Jan 24;9(1):e1001162.
11. Djuardi Y, Lazarus G, Stefanie D, Fahmida U, Ariawan I, Supali T. Soil-transmitted helminth infection, anemia, and malnutrition among preschool-age children in Nangapanda subdistrict, Indonesia. PLoS Negl Trop Dis. 2021;15(6):e0009506.
12. Zukhaila Salma F, Rossyanti L, Salle S, Pasulu B, Ranuh IGMRG, Husada D, et al. Soil-transmitted helminthes infection and nutritional status of elementary school children in Sorong District, West Papua, Indonesia. Indonesian Journal of Tropical and Infectious Disease. 2021;9(2):85–93.
13. Paun R, Bia MB, Shagti I, Gunawan YES, Krisyudhanti E, Dafroyati Y, et al. The Relationship between Intestinal Worm Infection and Stunting in Elementary School Childien in South Central Timor Regency, East Nusa Tenggara. In: The International Conference on Public Health Proceeding. 2021. p. 328–33.
14. Kementerian kesehatan RI. Permenkes No 3 Tahun 2014. Kementerian kesehatan RI [Internet]. 2014 [cited 2025 Jun 8]; Available from: https://peraturan.bpk.go.id/Details/116706/permenkes-no-3-tahun-2014
15. Bagus B, Mardiah A, Nurwidya A. Hubungan Perilaku Cuci Tangan Pakai Sabun Dengan Kejadian Kecacingan Pada Siswa Sekolah Dasar Negeri 11 Cakranegara. In: Musyawarah Nasional Asosiasi Fakultas Kedokteran Swasta Indonesia 2022. Universitas Islam Al-Azhar Mataram; 2022. p. 432–41.
16. Novitasari NA, Fatah MZ. Systematic Review Of Risk Factor Of Intestinal Parasite Infection. Media Gizi Kesmas. 2021 Jun 1;10(1):165.
17. Pane R, Nurmaini, Sri Andayani L. Relationship between the Cleanliness of Nails and the Usage of Footwear with the Incidence of Helminths Infections on Elementary Student in Sibolga of 2019. Britain International of Exact Sciences (BIoEx) Journal. 2020 Jan 3;2(1):45–52.
18. Bärenbold O, Raso G, Coulibaly JT, N'Goran EK, Utzinger J, Vounatsou P. Estimating sensitivity of the Kato-Katz technique for the diagnosis of Schistosoma mansoni and hookworm in relation to infection intensity. PLoS Negl Trop Dis. 2017 Oct 4;11(10):e0005953.