

Soil Transmitted Helminth Infections among Ethnic Minority Primary Schoolchildren in an Phu Ward Gia Lai Province in 2026

Tran Thi Thu Suong [1], Phan Van Trong [2], Dinh Huu Hung [3], Nguyen Thi Le Quyen [4], Dang Dinh Thanh [5*]
[1] Gia Lai General Hospital, 132 Ton That Tung Street, Pleiku City, Gia Lai Province, Vietnam
[2-4] Tay Nguyen University, 567 Le Duan Street, Ea Kao Ward, Buon Ma Thuot City, Dak Lak Province, Vietnam
[5] Buon Ma Thuot Medical University, 298 Ha Huy Tap Street, Tan An Ward, Buon Ma Thuot City, Dak Lak Province, Vietnam

* Corresponding Author: **Dang Dinh Thanh**

Article Info

ISSN (online): 2582-8940
Volume: 07
Issue: 04
Received: 10-08-2026
Accepted: 09-09-2026
Published: 07-10-2026
Page No: 46-50

Abstract
Objective: To determine the prevalence of soil-transmitted helminth (STH) infection and associated factors among ethnic minority primary schoolchildren in An Phu ward, Gia Lai province, in 2026.
Methods: A cross-sectional study was conducted among 354 ethnic minority students in grades 1–5 at Le Lai Primary School. Stool specimens were examined using the Kato thick-smear technique. Demographic characteristics, household conditions, and hygiene behaviors were collected using a questionnaire. Data were analyzed in Stata 17.0; associations were expressed as odds ratios (ORs), 95% confidence intervals (CIs), and p values.
Results: Twenty-six of 354 students (7.34%) had STH infection. Hookworm eggs were detected in all positive samples; no Ascaris lumbricoides or Trichuris trichiura eggs were detected. Prevalence was 15.22% among Bahnar students and 2.33% among J'Rai students (OR = 7.54; $p < 0.001$). In univariable analyses, infection was associated with a father's education at primary level or below (OR = 4.25), eating raw vegetables (OR = 11.12), drinking unboiled water (OR = 4.75), not washing hands after defecation (OR = 4.58), and defecating on soil (OR = 2.84); all p values were < 0.05.
Conclusion: The prevalence of STH infection was 7.34%, and hookworms were the only helminth group detected. Ethnicity, paternal education, and several hygiene behaviors were associated with infection in unadjusted analyses. The findings support culturally appropriate hygiene education and improved sanitation.

DOI: https://doi.org/10.54660/IJMBHR.2026.7.4.46-50

Keywords: soil-transmitted helminths; primary schoolchildren; ethnic minorities; Gia Lai

1. Introduction

Soil-transmitted helminths are intestinal parasites commonly surveyed and include Ascaris lumbricoides, Trichuris trichiura, and hookworms. Their infective stages develop in soil contaminated with feces. A. lumbricoides and T. trichiura are transmitted through ingestion of embryonated eggs, whereas hookworms are primarily transmitted through skin penetration by larvae. STH infections can affect digestion, anemia, and nutritional status in children [1].

Although periodic deworming programs and improvements in sanitation have reduced the disease burden in many settings, STH infection remains unevenly distributed across regions and population groups. A systematic review of ethnic minority communities in Southeast Asia and the Western Pacific found that STH infection remains a public health concern; sanitation, living practices, and access to healthcare may contribute to differences between communities [2].

In Vietnam, studies in the Central Highlands have reported varying prevalence across locations. A study among Ede schoolchildren in Dak Lak found an overall prevalence of 25% [3]. A study in Ea Po commune, Dak Nong province, reported a

prevalence of 17.5% among primary schoolchildren [4], while a study at Kim Dong Primary School in Chu Se district, Gia Lai province, also showed that STH infection remained endemic locally [5].

An Phu ward, Gia Lai province, is home to diverse ethnic groups, including J'Rai, Bahnar, Kinh, Tay, and Nung communities. The area has a long history of agriculture and vegetable cultivation. Agricultural activities and household sanitation conditions may produce different levels of exposure. However, data on STH infection among ethnic minority primary schoolchildren in this area are limited. This study therefore aimed to determine the prevalence of STH infection and associated factors among ethnic minority primary schoolchildren in An Phu ward in 2026.

2. Materials and Methods

2.1 Study Population, Setting, and Period

The study population consisted of ethnic minority students in grades 1–5 attending Le Lai Primary School, An Phu ward, Gia Lai province. The study was conducted from January to October 2026.

Inclusion criteria: Ethnic minority students in grades 1–5 enrolled at the school and present during the study period, whose parent or guardian consented to participation and who provided an adequate stool specimen.

Exclusion criteria: Students unable to communicate during the interview, those dewormed within the preceding 3 months, and those whose stool specimens did not meet laboratory requirements because of insufficient volume, contamination, or improper storage.

2.2 Study Design, Sample Size, and Sampling

A cross-sectional design was used. The minimum sample size was calculated using the formula for estimating a single proportion:

$$n = Z^2_{1-\frac{\alpha}{2}} \frac{p(1-p)}{d^2}$$

The type I error was α = 0.05, giving Z(1−α/2) = 1.96; the expected prevalence was p = 29.84%, based on the 2025 study by Do Thien Thi *et al*. among Ede people in Dak Lak [6]; and the absolute precision was d = 0.05. The minimum calculated sample was 322. Allowing 10% for inadequate specimens, missing information, or withdrawal yielded a target of 354 students.

Stratified random sampling by grade was used. Lists of ethnic minority students were compiled for the five grades; the sample was allocated proportionally to the number of eligible students in each grade, and students were selected by computer-generated simple random sampling within each stratum.

2.3 Data Collection and Stool Examination

Information on age, sex, ethnicity, grade, parental education and occupation, water source, latrine facilities, and hygiene behaviors was collected by face-to-face interview using a structured questionnaire.

Stool specimens were collected in clean, coded containers and examined using the Kato thick-smear technique to detect A. lumbricoides, T. trichiura, and hookworm eggs. Hookworm findings were reported as a group; species were not identified from egg morphology. Smears were cleared with glycerin and examined microscopically for helminth eggs. Infection intensity was not assessed.

2.4 Data Analysis

Data were entered in Excel and analyzed using Stata 17.0. Categorical variables were summarized as frequencies and percentages. Overall prevalence was reported with a Wilson 95% CI. Univariable analyses used crude ORs with the reference group specified in each table; 95% CIs were estimated using the conditional exact method. Two-sided Fisher's exact tests were used for each 2 × 2 comparison; $p < 0.05$ was considered statistically significant.

2.5 Research Ethics

The study was reviewed and approved by the Scientific Council of Tay Nguyen University. Students and their parents or guardians were informed about the study objectives, procedures, and voluntary participation. Information was coded to protect confidentiality; test results were communicated and counseling provided according to the study protocol.

3. Results

3.1 Characteristics of the Study Population

Of the 354 students, 53.11% were female. J'Rai and Bahnar students accounted for 60.73% and 38.98%, respectively. Grade 1 students represented the largest proportion (28.25%), while grade 5 students accounted for 11.86% (Table 1).

Table 1: Characteristics of the study population

Characteristic		Number	Percentage (%)
Age (years)	7	95	26.84
	8	83	23.45
	9	54	15.25
	10	76	21.47
	11	46	12.99
Grade	Grade 1	100	28.25
	Grade 2	83	23.45
	Grade 3	51	14.41
	Grade 4	78	22.03
	Grade 5	42	11.86
Sex	Male	166	46.89
	Female	188	53.11
Ethnicity	Jrai	215	60.73
	Bahnar	138	38.98
	Other	1	0.28

3.2 Prevalence of STH Infection

Overall, 26 of 354 students had STH infection, giving a prevalence of 7.34% (95% CI: 5.06–10.54%). Hookworm eggs were detected in all positive samples; no A. lumbricoides or T. trichiura eggs were detected using the examination method employed (Table 2).

Table 2: Prevalence of STH infection at the study site

Characteristic		Positive samples	Percentage (%)
STH infection	Positive	26	7.34
	Negative	328	92.66
Helminth group	*Ascaris lumbricoides*	0	0.00
	Trichuris trichiura	0	0.00
	Hookworm	26	7.34

3.3 Factors Associated with STH Infection

Prevalence was 15.22% among Bahnar students compared with 2.33% among J'Rai students (crude OR = 7.54; p < 0.001). There was no evidence of an association with sex or with individual grades compared with grade 1 (p > 0.05). An OR was not estimated for the other ethnicity category because it contained only one student (Table 3).

Table 3: Association between STH infection and selected participant characteristics

Characteristic		n	Infected, n	Infected, %	OR	95% CI	p
Sex	Male	166	9	5.42	1.73	0.71 - 4.54	0.23
	Female	188	17	9.04			
Ethnicity	J'Rai	215	5	2.33	1		
	Bahnar	138	21	15.22	7.54	2.66 - 26.12	< 0.001
	Other	1	0	0	-	-	-
Grade	1	100	4	4.00	1		
	2	83	5	6.02	1.54	0.32 - 8.01	0.73
	3	51	6	11.76	3.20	0.71 - 16.07	0.09
	4	78	7	8.97	2.37	0.57 - 11.40	0.22
	5	42	4	9.52	2.53	0.44 - 14.20	0.24

Table 4: Association between STH infection and parental education and occupation

Characteristic		n	Infected, n	Infected, %	OR	95% CI	p
Father's education	≥ Lower secondary	120	3	2.50	4.25	1.24 - 22.51	0.02
	≤ Primary	234	23	9.83			
Mother's education	≥ Lower secondary	146	7	4.79	2.00	0.78 - 5.77	0.12
	≤ Primary	208	19	9.13			
Father's occupation	Farming	327	24	7.34	1.01	0.11 - 4.48	1.00
	Other occupation	27	2	7.41			
Mother's occupation	Farming	330	25	7.58	1.89	0.28 - 80.71	1.00
	Other occupation	24	1	4.17			

Prevalence was 9.83% among students whose fathers had primary education or less, compared with 2.50% among those whose fathers had at least lower secondary education (crude OR = 4.25; p < 0.05). No statistical evidence of an association was found for maternal education or either parent's occupation (Table 4).

Table 5: Association between STH infection and selected student behaviors

Characteristic		n	Infected, n	Infected, %	OR	95% CI	p
Eating raw vegetables	Yes	252	25	9.92	11.12	1.76 - 461.06	0.003
	No	102	1	0.98			
Drinking unboiled water	Yes	259	24	9.27	4.75	1.14 - 42.14	0.02
	No	95	2	2.11			
Handwashing before eating	Yes	338	24	7.10	1.87	0.19 - 8.90	0.33
	No	16	2	12.50			
Handwashing after defecation	Yes	311	17	5.47	4.58	1.65 - 11.82	< 0.001
	No	43	9	20.93			
Handwashing after soil contact	Yes	337	23	6.82	2.93	0.50 - 11.56	0.12
	No	17	3	17.65			
Nail biting or putting toys in the mouth	Yes	175	16	9.14	1.70	0.70 - 4.32	0.23
	No	179	10	5.59			
Defecation on soil	Yes	163	18	11.04	2.84	1.13 - 7.75	0.023
	No	191	8	4.19			
Regular deworming (every 6 months)	Yes	281	24	8.54	3.32	0.79 - 29.54	0.13
	No	73	2	2.74			

In univariable analyses, infection was associated with eating raw vegetables (OR = 11.12), drinking unboiled water (OR = 4.75), not washing hands after defecation (OR = 4.58), and defecating on soil (OR = 2.84), all with p < 0.05. The remaining behaviors in Table 5 were not significantly associated with infection.

4. Discussion

4.1 Prevalence of Soil-Transmitted Helminth Infection

The prevalence of STH infection among ethnic minority primary schoolchildren at the study site was 7.34% (Table 2). This was lower than that reported in several studies in the Central Highlands. Bui Khac Hung *et al*. found a prevalence of 25% among Ede schoolchildren in Krong Pac, Dak Lak [3], and Tran Van Thuy *et al*. reported 17.5% in Cu Jut district, Dak Nong [4]. Internationally, Andargie *et al*. reported 18.2% among schoolchildren in Mekan Eyesus, Ethiopia [7], and Rahimi *et al*. reported an overall prevalence of 22.7% among rural children in Daman district, Afghanistan [8]. These comparisons are descriptive because populations, study periods, and diagnostic methods differed.

Hookworm eggs were detected in all positive specimens. This finding indicates the contribution of hookworms to infections detected at the surveyed school, but does not establish that A. lumbricoides and T. trichiura are absent from the area. Detection may be affected by the diagnostic technique and the number of specimens and slides examined.

4.2 Factors Associated with STH Infection

Several individual and household characteristics and daily practices were associated with STH infection among students.

Regarding ethnicity, Bahnar students had 7.54 times the odds of infection observed among J'Rai students ($p < 0.05$). Similarly, Bach Cong Ai Thuy (2019) reported significant differences between ethnic groups: prevalence was highest among Dao participants (56.0%), followed by Tay (41.38%) and Kinh (23.16%), with no infections recorded among Ede participants [9]. Direct comparison of the magnitude of differences is difficult because the populations and settings differed. In the present study, differences may reflect socioeconomic conditions, environmental sanitation, access to safe water, latrine conditions, and community practices. Ethnicity may represent multiple social and environmental factors and should not itself be interpreted as a direct cause of infection.

Students whose fathers had primary education or less had 4.25 times the odds of infection compared with those whose fathers had at least lower secondary education (95% CI: 1.24–22.51; $p < 0.05$). This is consistent in direction with Andargie *et al*. (2024), who reported higher odds among children whose fathers were illiterate than among those whose fathers were literate (adjusted OR = 2.29; 95% CI: 1.18–4.44; $p = 0.01$) [7]. Tran Van Thuy *et al*. (2023), however, found higher prevalence among students whose fathers had primary education or less (23.6% versus 15.1%), although the difference was not statistically significant [4]. Differences may relate to sample size, educational categories, living conditions, and fathers' roles in childcare. Paternal education may also be related to access to health information and household hygiene. The wide CI in this study indicates limited precision; a difference in statistical significance between studies does not by itself establish a difference in the underlying associations.

STH prevalence was higher among students who ate raw vegetables than among those who did not (9.92% versus 0.98%; $p < 0.05$). Ojja *et al*. (2018) similarly reported 1.9 times higher odds among children who ate raw or undercooked vegetables than among those who ate cooked vegetables (95% CI: 1.3–2.7) [11]. Ho Vy Nu Thuc Trinh (2019) observed a similar trend, although it was not statistically significant [10]. Differences may reflect vegetable sources, soil and irrigation-water contamination, preparation, and frequency of consumption. Vegetables grown in soil or exposed to fecally contaminated water may carry helminth eggs, which may be ingested if washing does not remove them. Given that many local households farm and use well water, further assessment of water quality and vegetable preparation is needed.

Students who drank unboiled water had 4.75 times the odds of infection compared with those who did not (95% CI: 1.14–42.14; $p < 0.05$). Ho Vy Nu Thuc Trinh (2019) reported a similar association (OR = 2.39; 95% CI: 1.05–5.44) [10]. A meta-analysis by Strunz *et al*. (2014) found that use of treated water, such as filtered or boiled water, was associated with lower odds of STH infection (OR = 0.46; 95% CI: 0.36–0.60) [12]. These findings suggest that water sources or storage containers may contribute to exposure when contaminated. However, the very wide CI in the present study requires caution in interpreting the magnitude. Drinking unboiled water may also coexist with other adverse sanitation conditions and cannot be considered an independent cause without adjusted analysis.

Students who did not wash their hands after defecation had 4.58 times the odds of infection compared with those who did (95% CI: 1.65–11.82; $p < 0.05$). The direction is consistent with studies by Nguyen Thi Van (2019), Tran Van Thuy *et al*. (2023), and Ojja *et al*. (2018), although the magnitude varied [4, 5, 11]. Andargie *et al*. (2024) also found an association between handwashing after defecation and lower odds of infection (association estimate = 0.43; 95% CI: 0.21–0.88) [7]. Differences may arise from how handwashing was assessed, including frequency, timing, soap use, and availability of safe water. Hands may contact helminth eggs in contaminated soil or on surfaces, allowing hand-to-mouth transfer if not washed. Handwashing with soap after defecation should therefore be emphasized in school hygiene education.

Students who defecated on soil had 2.84 times the odds of infection compared with those who did not (95% CI: 1.13–7.75; $p < 0.05$). Rahimi *et al*. (2022) similarly reported an association between open defecation and STH infection in Daman district, Afghanistan (adjusted OR = 1.4; 95% CI: 1.1–2.0; $p = 0.023$) [8]. In contrast, Do Thien Thi (2025) observed a nonsignificant trend toward higher infection among those defecating on soil around the home, with a CI that included 1 [6]. Differences may reflect population characteristics, sanitation, environmental contamination, and analytical methods. Human feces deposited on soil can introduce helminth eggs into the environment; after development to infective stages under suitable conditions, transmission may occur by ingestion or skin penetration, depending on the species. Sanitary latrine use and reduced open defecation may therefore help decrease exposure in households and communities.

Overall, the findings suggest associations between STH infection and both household conditions and hygiene practices. These factors may be interrelated, and multivariable analysis should be considered if the data permit. The cross-sectional design supports interpretation as associations and does not establish causality.

5. Conclusion

Among 354 ethnic minority students at Le Lai Primary School, STH prevalence was 7.34%; hookworm eggs were

detected in all positive specimens. No A. lumbricoides or T. trichiura eggs were detected using the technique employed. Bahnar ethnicity compared with J'Rai ethnicity, paternal education at primary level or below, eating raw vegetables, drinking unboiled water, not washing hands after defecation, and defecating on soil were associated with infection in unadjusted analyses. Further assessment of potential confounders and environmental conditions is needed to guide prevention measures at the surveyed school.

References

1. World Health Organization. Soil-transmitted helminth infections. Available at: https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections (accessed 7 February 2026).
2. Gilmour B., Alene K.A., Clements A.C.A. The prevalence of soil-transmitted helminth infections in minority indigenous populations of South-East Asia and the Western Pacific Region: A systematic review and meta-analysis. PLoS Neglected Tropical Diseases. 2021;15(11):e0009890.
3. Hung B.K., De N.V., Duyet L.V., *et al*. Prevalence of soil-transmitted helminths and molecular clarification of hookworm species in ethnic Ede primary schoolchildren in Dak Lak Province, Southern Vietnam. The Korean Journal of Parasitology. 2016;54(4):471-476.
4. Tran Van Thuy T., Hoang Thi Minh T., Ngo Van P., *et al*. Soil-transmitted helminth infections and associated factors among primary school students in Ea Po Commune, Cu Jut District, Dak Nong Province. JMP. 2023:114-120.
5. Nguyen Thi Van. Prevalence of soil-transmitted helminth infections and associated factors among students at Kim Dong Primary School, Bar Maih Commune, Chu Se District, Gia Lai Province, in 2018 [Master's thesis]. Tay Nguyen University, Dak Lak, Vietnam; 2019.
6. Do Thien Thi, Dang Dinh Thanh, Phan Van Trong, *et al*. Prevalence, intensity, and associated factors of soil-transmitted helminth infections among the Ede people in Ea Phe Commune, Krong Pac District, Dak Lak Province, Vietnam, 2025. 2025.
7. Andargie Y., Alelign A., Tekeste Z. Prevalence and associated risk factors of soil-transmitted helminth infections among schoolchildren in Mekan Eyesus town, northwestern Ethiopia. Parasite Epidemiology and Control. 2024;27:e00379.
8. Rahimi B.A., Mahboobi B.A., Wafa M.H., *et al*. Prevalence and associated risk factors of soil-transmitted helminth infections in Kandahar, Afghanistan. BMC Infectious Diseases. 2022;22:361.
9. Bach Cong Ai Thuy. Prevalence of soil-transmitted helminth infections and associated factors among residents of Quang Hiep Commune, Cu M'gar District, Dak Lak Province, in 2018 [Master's thesis in Biomedical Sciences]. Tay Nguyen University, Dak Lak, Vietnam; 2019.
10. Ho Vy Nu Thuc Trinh. Prevalence of soil-transmitted helminth infections and associated factors among Ede residents of Cu Sue Commune, Cu M'gar District, Dak Lak Province, in 2018 [Master's thesis in Biomedical Sciences]. Tay Nguyen University, Dak Lak, Vietnam; 2018.
11. Ojja S., Kisaka S., Ediau M., *et al*. Prevalence, intensity and factors associated with soil-transmitted helminth infections among preschool-age children in Hoima District, rural western Uganda. BMC Infectious Diseases. 2018;18:408.
12. Strunz E.C., Addiss D.G., Stocks M.E., *et al*. Water, sanitation, hygiene, and soil-transmitted helminth infection: A systematic review and meta-analysis. PLoS Medicine. 2014;11(3):e1001620.

How to Cite This Article

Suong TTT, Van Trong P, Hung DH, Le Quyen NT, Thanh DD. Soil transmitted helminth infections among ethnic minority primary schoolchildren in an Phu ward Gia Lai province in 2026. International Journal of Medical and All Body Health Research. 2026;7(4):46-50. doi:10.54660/IJMBHR.2026.7.4.46-50.

Copyright and License

© 2026 The Author(s). Authors retain the copyright of their published articles. This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution Non Commercial-Share A like 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.