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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

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Abstract: Soil-transmitted helminth (STH) infections affect over 1.5 billion people globally, primarily in impoverished areas with poor sanitation. These infections cause significant morbidity, including malnutrition, developmental delays, and anemia, particularly in vulnerable groups like children and pregnant women. Objectives: To determine the prevalence and intensity of STH infections and identify associated factors among the Ede people in Ea Phe commune, Krong Pac district, Dak Lak province in 2025. A cross-sectional study used the Kato-Katz thick smear technique for STH diagnosis and a Knowledge-Attitude-Practice (KAP) survey to assess related factors. A total of 305 individuals participated in this study. The results showed that the overall prevalence of STH infections among the Ede people in the study area was 29.84% (95% CI = 24.75–35.31). Among these, 25.90% were infected with hookworms, 3.61% with *A.lumbricoides*, and 2.62% with *T.trichiura*. The groups more likely to be infected included individuals aged 15 and above (PR = 1.50; 95% CI = 0.98–2.30; p = 0.04), farmers (PR = 1.94; 95% CI = 1.28–2.93; p = 0.0008), those unaware of STH prevention methods (PR = 2.08; 95% CI = 1.23–3.51; p = 0.01), individuals not using personal protective equipment during farming (PR = 2.10; 95% CI = 1.23–3.60; p = 0.02), and those not deworming every six months (PR = 2.27; 95% CI = 1.37–3.77; p = 0.003). This study highlights a strong link between STH infection prevalence and age, occupation, preventive knowledge, protective gear use, and regular anthelmintic treatment. These findings are crucial for targeted STH control interventions in this population.

Keywords: Soil-transmitted helminths (STH), *Ascaris lumbricoides*, *Trichuris trichiura*, Ede people, Vietnam.

INTRODUCTION

Soil-transmitted helminths (STHs) are intestinal parasites with a crucial soil-dependent developmental stage, making them non-infective immediately after excretion. According to a WHO report (2023), over 1.5 billion people worldwide are infected with STHs, making it one of the most common diseases globally (Organization, W. H. 2023). In Southeast Asia, reported average prevalences in 2018 were 18.0% for *A. lumbricoides*, 14.0% for *T. trichiura*, and 12.0% for hookworms. Vietnam, however, shows significantly higher rates: 36%, 52%, and 29%, respectively (Silver, Z. A. *et al.*, 2018). Among ethnic minority populations, Beth Gilmour et al. (2021) reported an overall STH prevalence of 61.4% in Southeast Asia and the Western Pacific Region, with 30.3% in Southeast Asia and 66.3% in the Western Pacific (Gilmour, B. *et al.*, 2021). In Ecuador, the Philippines, and Malaysia, the prevalence prevalence were 46.9% (Romero-Sandoval, N. *et al.*, 2017), 71.3% (De Guia, J. J., & Flores, M. J. 2019) and 95.5% (Khir N. *et al.*, 2020) respectively.

In Dak Lak province, which has a hot and humid climate, underdeveloped socio-economic conditions, low education levels, poor environmental sanitation, and outdated agricultural practices - especially among ethnic minorities – STH infections remain a significant health concern. Research by Quang TT (2009) showed that the prevalence of infection with STHs in the Ede people in Dak Lak was 75.1% , by (Anh, PTL. 2015) was 36.83%, and by (Trinh, HVNT 2019). Alarmingly, over 95% of the population carries these pathogens, often with co-infections of multiple species. Despite treatment, reinfection rates are high (51–68%) due to environmental contamination, highlighting the urgent need for robust prevention strategies. STHs profoundly impact host nutrition, causing iron and protein loss, anemia (especially hookworms), nutrient malabsorption, anorexia and physical decline, especially *T. trichiura* can cause diarrhea and dysentery (Organization, W. H. 2023).

Given this situation, and with the aim of contributing to the national program for helminth disease control and finding truly effective prevention methods for the Ede community, we conducted the study: ***"Prevalence, intensity of soil-transmitted helminth infections and related factors among the Ede people in Ea Phe commune, Krong Pac district, Dak Lak province, Vietnam 2025"*** with the following two specific objectives:

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- *To determine the prevalence and intensity of STH infections among the Ede people in Ea Phe commune, Krong Pac district, Dak Lak province in 2025.*
- *To describe factors related to STH infections in this population.*

SUBJECTS AND METHODS

Location: Ea Phe commune, Krong Pac, Dak Lak province,Vietnam..

Duration: From April 2025 to October 2025.

Subjects: Ede people residing in the research site.

Study design

Design: Cross-sectional study.

*Sample size:*The sample size will be calculated using the following formula:

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

With the STH infection prevalence based on data from the Dak Lak Center for Disease Control (25.12%), a 95% confidence interval (CI), and a margin of error (d) of 0.05, the sample size was determined to be 290. Considering a 5% data loss prevalence, the final sample size included in the study was 305 individuals.

Sampling method

Four hamlets within Ea Phe commune, Krong Pac district, Dak Lak province were selected.

Households were chosen using systematic cluster random sampling.

Inclusion and exclusion criteria for stool sample collection:

Inclusion criteria: Ede individuals aged 2 years and older who agreed to participate in the study.

Exclusion criteria: Individuals who had received anthelmintic treatment for STH infections within the past 30 days prior to the survey; stool samples that were insufficient in quantity or contaminated with soil or sand were excluded.

Inclusion and exclusion criteria for interview participants: Each household selected one representative aged 15 years or older for the interview.

Inclusion criteria: Voluntarily agreed to participate in the interview.

Exclusion criteria: Individuals with mental disorders (e.g., epilepsy, schizophrenia, intellectual disabilities), those who are mute, deaf, or otherwise unable to communicate effectively.

Parasitological examination technique: The Kato-Katz thick smear technique was used for stool sample analysis.

Interview technique

Data were collected from participants through face-to-face interviews using a pre-designed questionnaire.

Completed questionnaires were reviewed during data processing. Invalid or incomplete responses were excluded.

Data processing and analysis

All collected data were entered into EpiData version 3.1 and statistically analyzed using Stata version 17.0.

Descriptive Statistics: Frequency, percentage (%), and 95% confidence intervals (CI) were used to describe sample characteristics and infection prevalence.

Analytical Statistics: The Chi-square test was used to compare infection prevalence between groups. Associations between exposure factors and STH infections were assessed using the Prevalence Ratio (PR), 95% CI, with statistical significance set at $p < 0.05$. When any cell in the frequency distribution had an expected value < 1 or if ≥ 20% of cells had expected values < 5, Fisher's exact test was used as an alternative to the Chi-square test.

Potential errors and mitigation strategies

As a cross-sectional study, the data collected only represent a snapshot in time. Due to limited resources, the study included only 305 participants, so the findings may not be representative of the entire Krong Pac district.

Potential errors could also occur during the KAP interviews. To minimize these errors, local health workers or community officials assisted with the interviews and acted as interpreters when necessary.

Ethical considerations in research

The study was conducted with approval from the Research Proposal Review Board at Tay Nguyen University. Confidentiality and voluntary participation were strictly respected. In addition to data collection, participants who tested positive for any STH species were provided with anthelmintic medication.

RESEARCH RESULTS

Prevalence and intensity of STH infections in Ea Phe commune, Krong Pac district, Dak Lak province

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Table 1. General prevalence of STH infections at the study site (n = 305)

Variables		**Infected with STHs**		**95% CI**
		Number	**Percentage (%)**	
Infected with STHs	Negative	214	70.16	64.68–75.24
	Positive	91	29.84	24.75–35.31
Parasites identified	*A. lumbricoides*	11	3.61	1.81–6.36
	T. trichiura	8	2.62	1.13–5.10
	Hookworm	79	25.90	21.07–31.20
Types of infections	Single infection	85	27.87	22.90–33.26
	Multiple infections	6	1.97	0.72–4.23

Of the 305 people tested for feces using the Kato-Katz technique, 91 people were infected with at least one species of STH, accounting for 29.84% (95% CI = 24.75%–35.31%). The infection prevalence of hookworm, *A. lumbricoides* and *T. trichiura* decreased to 25.90% (95% CI = 21.07%–31.20%), 3.61% (95% CI = 1.81%–6.36%) and 2.62% (95% CI = 1.13%–5.10%), respectively. The majority of STH infections were single infection (27.87%–33.26%), with a low prevalence of multiple infections (1.97%–4.23%).

Table 2. Intensity of STH infections (n = 305)

Parasites identified	**Infection Intensity (95% CI)**	**Intensity Level**
A. lumbricoides	4.98 epg (1.78–8.17)	Light
T. trichiura	1.90 epg (0.40–3.39)	Light
Hookworm	56.32 epg (39.89–72.76)	Light

Hookworm infection intensity was highest at 56.32 (95% CI = 39.89–72.76) epg. 100% of STH infections were at low infection intensity.

Association between selected factors and STH infections at the study site

Table 3. Association between STH prevalence and demographic characteristics (n = 305)

Factor		**Infected with STHs (n=305)**		**PR (95% CI)**	**p**
		Positive (%)	**Negative (%)**		
Gender	Female	41 (25.63)	119 (74.375)	1.34 (0.95–1.90)	0.09
	Male	50 (34.48)	95 (65.52)		
Age groups	< 15	21 (22.11)	74 (77.89)	1.50 (0.98–2.30)	**0.04**
	≥ 15	70 (33.33)	140 (66.67)		
Education	High school and above	11 (29.73)	26 (70.27)	1	
	Junior High School	31 (30.10)	72 (69.9)	1.01 (0.56–1.80)	0.96
	Elementary	23 (25.84)	66 (74.16)	0.86 (0.47–1.59)	0.65
	Not/not yet in school	26 (34.21)	50 (65.79)	1.15 (0.64–2.06)	0.63
Occupation	Other jobs	23 (19.01)	98 (80.99)	1.94 (1.28–2.93)	**<0.001**
	Farming	68 (36.96)	116 (63.04)		

While men had a slightly higher prevalence than women (1.34 times), this difference wasn't statistically significant ($p > 0.05$). However, age played a significant role: individuals aged 15 and older were 1.50 times more likely to be infected than those under 15 ($p < 0.05$).

Education level showed no significant impact, with those having less schooling exhibiting only slightly higher, non-significant prevalences. Similarly, schoolchildren had a slightly higher, non-significant prevalence compared to other occupations.

In stark contrast, farmers were significantly more likely to be infected, with a 1.94 times higher prevalence than individuals in other occupations ($p < 0.05$).

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Table 4. Association between STH infection prevalence and knowledge (n = 102)

Factor		**Infected with STHs (n=102)**		**PR (95% CI)**	**p**
		Positive (%)	**Negative (%)**		
Heard/aware of information about soil-transmitted helminthiasis	Yes	27 (30.34)	62 (69.66)	1.77 (0.98–3.21)	0.09
	No	7 (53.85)	6 (46.15)		
Heard/aware of causes of soil-transmitted helminthiasis	Yes	26 (30.23)	60 (69.77)	1.65 (0.92–2.97)	0.12
	No	8 (50.00)	8 (50.00)		
Heard/aware of causes of environmental contamination with worm eggs	Yes	24 (30.00)	56 (70.00)	1.51 (0.85–2.67)	0.17
	No	10 (45.45)	12 (54.55)		
Heard/aware of the harmful effects of STHs	Yes	27 (38.03)	44 (61.97)	0.59 (0.29–1.21)	0.12
	No	7 (22.58)	24 (77.42)		
Heard/aware of how to prevent soil-transmitted helminthiasis	Yes	24 (28.24)	61 (71.76)	2.08 (1.23–3.51)	**0.01**
	No	10 (58.82)	7 (41.18)		

Among 102 representatives of each household selected for interview, Table 3.9 shows that the rates of those who had not heard or were unaware of information about soil-transmitted helminthiasis, its causes, and the causes of environmental contamination with worm eggs were 1.77 times (95% CI = 0.98–3.21), 1.65 times (95% CI = 0.92–2.97) and 1.51 times (95% CI = 0.85–2.67) higher compared to the respective reference groups. However these differences were not statistically significant ($p > 0.05$). The prevalence of STH infection in the group of people who had not heard of or were unaware of prevention methods for the disease was 2.08 times higher (95% CI = 1.23–3.51) than in the group who had such knowledge, and this difference was statistically significant ($p < 0.05$).

Table 5. Association between STH infection prevalence and behavior (n = 102)

Factor		**Infected with STHs (n=102)**		**PR (95% CI)**	**p**
		Positive (%)	**Negative (%)**		
Habit of drinking plain water	Yes	28 (33.73)	55 (66.27)	0.93 (0.45–1.93)	0.85
	No	6 (31.58)	13 (68.42)		
Habit of eating raw vegetables	Yes	11 (31.43)	24 (68.57)	1.09 (0.60–1.97)	0.76
	No	23 (34.33)	44 (65.67)		
Habit of washing hands before eating	Yes	27 (30.34)	62 (69.66)	1.77 (0.98–3.21)	0.09
	No	7 (53.85)	6 (46.15)		
Habit of washing hands after going to the toilet	Yes	28 (31.11)	62 (68.89)	1.60 (0.84–3.05)	0.19
	No	6 (50.00)	6 (50.00)		
Frequent contact with soil	No	10 (32.26)	21 (67.74)	1.04 (0.57–1.91)	0.87
	Yes	24 (33.8)	47 (66.2)		
Use of labor protection	Yes	26 (29.21)	63 (70.79)	2.10 (1.23–3.60)	**0.02**
	No	8 (61.54)	5 (38.46)		
Sanitary toilet	Yes	14 (26.42)	39 (73.58)	1.54 (0.88–2.70)	0.12
	No	20 (40.82)	29 (59.18)		
Defecation on the ground around the house	No	28 (32.18)	59 (67.82)	1.24 (0.62–2.47)	0.55
	Yes	6 (40.00)	9 (60.00)		
Use fresh manure to fertilize crops	No	29 (31.87)	62 (68.13)	1.42 (0.69–2.91)	0.36
	Yes	5 (45.45)	6 (54.55)		
Take deworming medicine every 6 months	Yes	20 (25.64)	58 (74.36)	2.27 (1.37–3.77)	**0.003**
	No	14 (58.33)	10 (41.67)		

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In an analysis of 102 households, several behavioral and environmental factors were associated with higher STH infection prevalence, though most did not reach statistical significance ($p > 0.05$). These included eating raw vegetables (1.09 times higher prevalence; 95% CI = 0.60–1.97), not washing hands before meals (1.77 times; 95% CI = 0.98–3.21), not washing hands after using the toilet (1.60x; 95% CI = 0.84–3.05), frequent soil contact (1.04x; 95% CI = 0.57–1.91), lack of hygienic toilets (1.54 times; 95% CI = 0.88–2.70), open defecation around the house (1.24 times; 95% CI = 0.62–2.47), and using fresh manure for crops (1.42x; 95% CI = 0.69–2.91).

However, two factors showed a statistically significant association with increased STH infection:

Not using labor protection during farming led to a 2.10 times higher prevalence (95% CI = 1.23–3.60, $p < 0.05$) compared to those who used protection.

Not taking deworming medication every 6 months resulted in a 2.27 times higher prevalence (95% CI = 1.37–3.77, $p < 0.05$) than for those who adhered to the deworming schedule.

DISCUSSION

Prevalence and intensity of STH infections at the study site

The results in Table 1 show that through the Kato-Katz stool test for 305 Ede people participating in the study, 91/214 people were found to be infected with at least 1 species of STH, accounting for 29.84%. Compared with previous studies in the country, on the same group of Ede people, our STH infection prevalence is lower than the research results of (Quang, T. T. 2009) in Hoa Xuan commune, Buon Ma Thuot city and Ea Tieu commune, Cu Kuin district (75.1%). (Anh, PTL. 2015) in Ea Bar commune, Buon Don district (36.83%) and Trinh HVNT (2019) in Cu Sue commune, Cu M'gar district (33.67%). Our results are also lower than studies in Southeast Asia on ethnic minorities such as N. (Mohd-Shaharuddin, N. *et al.*, 2018). Jessica Joyce R. de Guia et al. (2019) in the Philippines (71.3%) (De Guia, J. J., & Flores, M. J. 2019); Khir N. et al. (2020) in Malaysia (95.5%) (Khir N. *et al.*, 2020) in Malaysia (71.6%) (Nisha, M. *et al.*, 2020); in Laos (74.84%) and the Philippines (73.34%) in the pooled analysis of Beth (Gilmour, B. *et al.*, 2021). The prevalence of STH infections in our study site was lower than these studies, a result that may be attributed to differences in sample size in the studies, study design, age of study subjects, and differences in environmental and climatic factors between previous and current study areas, especially for studies conducted in Southeast Asia. Furthermore, the differences may come from different levels of awareness of disease transmission among communities. Secondly, besides households that are in extremely difficult circumstances such as living in stilt houses, dilapidated level-four houses, rocky ground, etc., after our field survey, the majority of people's material lives have also improved significantly. Finally, deworming in the community has been well implemented in recent years. Every year, people are dewormed every 6 months (early January and June 1). At our study site, people were dewormed in early January. This emphasizes the role of preventive measures in controlling and reducing the prevalence of STH infections in the community.

An interesting thing that we have found is that there is a surprising similarity between our results and those in the Tay ethnic group in the study of Pham Thi Lan (Anh, PTL. 2015) in Tan Hoa commune, Buon Don district (28.81%). showing an interesting intersection in the epidemiological context of earthworm infection between different ethnic communities and possibly in different locations in Dak Lak province. Our results are also similar to the results of studies in other provinces by (Thuy, B. C. A. 2019). in Quang Hiep commune, Cu M'gar district (29.11%). (Cuong, N. V. 2019) in Buon Triet commune, Lak district (34.30%). (Nam, D. H. 2020) in Dak Lieng commune, Lak district (28.43%) and (Lien, N. T. 2023) in Ea Ngai commune, Krong Buk district (27.84%).

Regarding species composition, our study results show that among the common STHs, the highest infection prevalence is hookworm (25.90%), followed by *A. lumbricoides* (3.61%) and the lowest is *T. trichiura* (2.62%). This phenomenon raises profound thoughts about the environmental, ecological and living habits factors of this land, which may be creating a "golden environment" that is particularly favorable for the strong development and spread of hookworm. This suggests that, despite control efforts, local conditions continue to favor their survival and development, which requires further in-depth studies to identify and address the etiological factors. This finding is similar to the results of

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many domestic and foreign authors, for example the results of (Trinh, HVNT 2019) in Cu Sue commune, Cu M'gar district (hookworm 32.91%; *A. lumbricoides* 2.55%; *T. trichiura* 0%), (Thuy, B. C. A. 2019) in Quang Hiep commune, Cu M'gar district (hookworm 28.35%; *A. lumbricoides* 2.28%; *T. trichiura* 0%), (Nam, D. H. 2020) in Dak Lieng commune, Lak district (hookworm 24.31%; *A. lumbricoides* 6.47%; *T. trichiura* 2.16%). (Lien, N. T. 2023). in Ea Ngai commune, Krong Buk district (hookworm 26.99%; *A. lumbricoides* 5.97%; *T. trichiura* 1.70%) and (Okafor, N. M. *et al.,* 2023) in Nigeria (hookworm 42.9%; *A. lumbricoides* 36.6%; *T. trichiura* 10.7%).

The results of Table 1 also show that the single infection prevalence is the majority (27.87%), but it is still necessary to note the multiple infections (1.97%), reflecting a common picture of the general helminth infection situation in Vietnam, where infection with a single parasite is more common than coinfection with multiple parasites. However, the existence of multiple infections, although accounting for a much smaller proportion, still shows the complexity in the context of parasitic infections and poses specific public health challenges. Our results are similar to the majority of domestic authors such as (Quang, T. T. 2020) (single infection 73.1%; multiple infections 26.9%). Trinh HVNT (single infection 31.89%; multiple infections 1.79%) (Trinh, HVNT 2019), (Nam, D. H. 2020) (single infection 23.92%; multiple infections 4.51%). (Lien, N. T. 2023) (single infection 21.02%; multiple infections 6.82%). (Cuong, N. V. 2019) and in Guinea in 2023 in the study of Meñe GR et al. (single infection 57.8%; multiple infections 42.2%) (Meñe, G. R, *et al.,* 2023).

However, our results differ from the studies of which recorded a significantly higher prevalence of multiple infections (79.7%) than monoinfection (20.3%) (Khir N. *et al.,* 2020); while the study of Jessica Joyce R. De Guia et al. (2019) showed an almost equal distribution between monoinfection (49.7%) and multiple infections (50.3%) (De Guia, J. J., & Flores, M. J. 2019); in addition, the study of (Meñe, G. R, *et al.,* 2023) also showed that the prevalence of multiple infections (42.2%) was still significantly higher than monoinfection (57.8%). The difference from these studies may stem from differences in geographical and climatic conditions and levels of environmental pollution.

The results of Table 2 show that 100% of study participants infected with STHs had mild infection intensity according to WHO classification, with hookworm having the highest average intensity (56.32 epg), followed by *A. lumbricoides* (4.98 epg), the lowest was *T. trichiura* (1.90 epg) and there was no moderate or severe infection intensity in all 3 species of *A. lumbricoides*, *T. trichiura* and hookworm. Our results are similar to many studies conducted in and outside the country such as (Quang TT . 2009). (Anh, PTL. 2015) , (Trinh, HVNT 2019) , (Cuong, N. V. 2019), (Nisha, M. *et al.,* 2020). (Le, B. *et al.,* 2022) the authors noted that all cases of infection were at a low infection intensity level.

Association between some factors and the prevalence of STH infections

Gender differences play an important role in the epidemiology of STH infections. The results of univariate logistic regression analysis in Table 3 show that the prevalence of STH infection in men is 1.34 times higher than that in women, the difference is not statistically significant ($p > 0.05$). We found similarities in this result with the studies of (Mohd-Shaharuddin, N. *et al.,* 2018) and (Nisha, M. *et al.,* 2020), but they were not statistically significant. This result is also consistent with the trend recorded in many domestic studies such as (Trinh, HVNT 2019) (Thuy, B. C. A. 2019) (Nam, D. H. 2020) (Cuong, N. V. 2019) and (Lien, N. T. 2023) all of which showed that women had a higher infection prevalence than men, but the difference was not statistically significant.

The prevalence of STH infection in the age group ≥ 15 years was 1.50 times higher than that in the age group < 15 years and the difference was statistically significant ($p < 0.05$). Our results are similar to the results of author (Thuy, B. C. A. 2019)conducted in Quang Hiep commune, Cu M'gar district ($p < 0.001$). Older people are at higher risk of infection, possibly because they undertake jobs that involve a lot of contact with soil such as agriculture, animal husbandry or construction. Studies by many other authors in the world such as (Kurscheid, J. *et al.,* 2020), (Nisha, M. *et al.,* 2020) (Okafor, N. M. *et al.,* 2023) also showed a similar trend but the difference was not statistically significant ($p > 0.05$).

The relationship between education level and STH infection prevalence was clearly shown: the group with no/never attended school had the highest

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infection prevalence (34.21%), followed by the group with secondary education (30.10%), primary education (25.84%), while the group with high school education or higher had the lowest prevalence (29.73%). However, the difference between the groups was not statistically significant (PR ranged from 0.86 to 1.15; all $p > 0.05$). Our results are consistent with the results in the study of (Anh, PTL. 2015) and (Nisha, M. *et al.*, 2020). Our results also reflect the role of education in awareness of STH infection prevention.

Occupation is a factor strongly associated with the prevalence of infection with STHs. The group of farmers had a 1.94 times higher infection prevalence than the group of other occupations; this difference was statistically significant ($p < 0.05$). Our results are similar to the research results of (Thuy, B. C. A. 2019) and (Lien, N. T. 2023). This is explained by the behavior of farmers who are in frequent contact with soil, wastewater and the environment containing pathogens.

Regarding knowledge, Table 4 shows that the group of people who did not hear/know information about soil-transmitted helminthiasis had a 1.77 times higher infection prevalence than the group who heard/knew information about soil-transmitted helminthiasis, but the difference was not statistically significant ($p > 0.05$). Our results are similar to the results in the study of (Nam, D. H. 2020). and (Lien, N. T. 2023). This emphasizes the essential role of health education communication in the community, especially in remote areas where people have little access to medical information and/or their lives are still facing many difficulties. People who did not hear/know the causes of soil-transmitted helminthiasis had a 1.65 times higher infection prevalence than the group who heard/knew this cause, but the difference was not statistically significant ($p > 0.05$). The research results of (Lien, N. T. 2023). (Trinh, HVNT 2019) (Thuy, B. C. A. 2019) and (Nam, D. H. 2020). also showed this similarity with our research results. Although not statistically significant, the significant difference in infection prevalence between the two groups suggests that correct awareness of the cause is an important protective factor. Similarly, the group of people who did not hear/know the cause of environmental contamination with worm eggs had a 1.51 times higher infection prevalence than the group who heard/knew, the difference was not statistically significant ($p > 0.05$). Our results are similar to the research results of (Nam, D. H. 2020) and (Lien, N. T. 2023). These results reinforce the hypothesis that ecological knowledge plays an important role in disease prevention practices.

People who did not hear/know the harm caused by STHs had a lower infection prevalence than the group who heard/know the harm caused by STHs (22.58% vs. 38.03%), but the difference was not statistically significant ($p > 0.05$). Our results are different from previous research results by many authors such as (Trinh, HVNT 2019) (Lien, N. T. 2023) (Nam, D. H. 2020) (Thuy, B. C. A. 2019)and (Anh, PTL. 2015). The possible explanation for this difference is that the group who heard/know the harm caused by STHs are people who have been or are infected with worms, and then received information about the disease during treatment. In addition, recall bias may also affect this result. Notably, the group of people who did not hear/know how to prevent STHs had a 2.08 times higher infection prevalence than the group of people who heard/know how to prevent STHs, and the difference was statistically significant ($p < 0.05$). This is a specific demonstration of the effectiveness of health education in preventing STHs and is the basis for communication and education interventions in the community here. Our data is similar to many other authors such as (Trinh, HVNT 2019) (Thuy, B. C. A. 2019). (Nam, D. H. 2020) and (Lien, N. T. 2023)

Regarding behavior, Table 5 shows that people who have the habit of drinking raw water have an infection prevalence almost equivalent to the group of people who do not drink raw water (31.58% compared to 33.73%), the difference is not statistically significant ($p > 0.05$). It is likely that the water source at the research site has been treated roughly (boiled, filtered) or the level of worm egg contamination in the water source is not high. Our research results are similar to the results of the authors (Anh, PTL. 2015) (Thuy, B. C. A. 2019). (Nam, D. H. 2020) and (Lien, N. T. 2023) Our results are different from the results of (Trinh, HVNT 2019) and (Mohd-Shaharuddin, N. *et al.*, 2018) when both showed that the group of people with the habit of drinking raw water had a higher infection prevalence of 2.39 times and 3.15 times higher than the group that did not drink raw water ($p < 0.05$), respectively. People with the habit of eating raw vegetables at the research site were recorded to have a 1.09 times higher prevalence of infection with STHs (95% CI: 0.60–1.97) than the group that did not eat raw vegetables, the

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difference was not statistically significant ($p > 0.05$). The similarity in the research results of authors (Lien, N. T. 2023) (Trinh, HVNT 2019), (Thuy, B. C. A. 2019). and (Nam, D. H. 2020) further supported our results in this characteristic.

Prevalence of STH infections in people who do not have the habit of washing their hands before eating nearly twice as high as the group with this habit, but the difference was not statistically significant ($p > 0.05$). Although not reaching statistical significance, the clear trend of increased risk in the group that did not wash their hands before eating suggests that this is a risky behavior that needs special attention. Our results are similar to those of (Anh, PTL. 2015) and (Lien, N. T. 2023). People who did not wash their hands after defecation had a 1.60 times higher prevalence of STH infection than the group that practiced hand washing, the difference was not statistically significant ($p > 0.05$). Our results are similar to the domestic results of (Anh, PTL. 2015) (Nam, D. H. 2020) and (Lien, N. T. 2023). In practice, health education strategies should be combined with guidance on proper handwashing techniques (washing hands with soap or antibacterial soap, rubbing for at least 20-30 seconds), improving sanitation infrastructure (handwashing sinks, soap, clean water sources) and monitoring of behavior.

For the group of people who regularly come into contact with soil, the prevalence of infection with STHs in this group is 1.04 times higher than the group who do not regularly come into contact with soil and the difference is not statistically significant ($p > 0.05$). For rural areas such as the research site, where most people work in agriculture, contact with soil is inevitable. The results of our study are also in line with the trend of increasing infection prevalence in the group who have the habit of coming into contact with soil, along with the authors (Trinh, HVNT 2019) (Nam, D. H. 2020) and (Lien, N. T. 2023). However, the authors showed that this difference is statistically significant ($p < 0.05$). It is highly likely that either the environment in the authors' study contained many eggs and/or larvae of worms, or there was a lack of protection in workers who regularly come into contact with soil, or children who have the habit of playing on dirty soil. People who do not use protective gear have a prevalence of infection with STHs that is twice as high as the group that uses protective gear, and the difference is statistically significant ($p < 0.05$). Not wearing protective gear while working, especially protective gear covering the feet and hands (shoes, gloves), causes workers to come into direct contact with the soil or wet mud environment–places that are highly likely to be contaminated by eggs and larvae of hookworms/helminths or other worms. Worm larvae can penetrate human skin from small scratches or even through the intact epidermis, thereby entering the circulation, moving to target organs and causing disease. The results of this study not only emphasize the essential role of using protective gear in preventing STH infections, but also contribute to strengthening scientific evidence from the studies of (Trinh, HVNT 2019) and (Thuy, B. C. A. 2019). confirming the importance of this factor.

The group of people using unsanitary latrines had a 1.54 times higher prevalence of infection with STHs than the group with hygienic latrines, but the difference was not statistically significant ($p > 0.05$). The lack of an effective human fecal treatment system means an increased risk of environmental pollution–especially soil, water and food–thereby creating favorable conditions for the biological cycle of STHs to continue to develop and spread in the community. Our results are in line with the trend of increasing infection prevalence with STHs in the group without hygienic latrines as shown by the research results of (Anh, PTL. 2015) (Nam, D. H. 2020) and (Lien, N. T. 2023). However, all the hypotheses showed statistically significant differences ($p < 0.05$). Next, the prevalence of infection with STHs in the group of people who defecate in the ground around the house is 1.24 times higher than in the group who do not have this behavior, the difference is not statistically significant ($p > 0.05$). Defecation in the surrounding environment not only causes unhygienic conditions but also spreads worm eggs to the ground, increasing the possibility of reinfection and spreading in the community, especially when there is direct contact with the soil such as playing, working or farming. Our results are similar to the research results of (Thuy, B. C. A. 2019). and are in the trend of increasing the prevalence of infection with STHs in the group with the above behavior with domestic studies by (Anh, PTL. 2015) (Nam, D. H. 2020). (Lien, N. T. 2023). and in the world such as (Mohd-Shaharuddin, N. *et al.*, 2018).

Dak Lak, with the characteristic of a province with a high proportion of people living on agriculture, especially in remote areas, is still popular in the practice of using human or animal feces to directly

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fertilize crops such as coffee, pepper, green vegetables or short-term crops. This is a favorable environment for eggs and larvae of STHs to survive and spread, increasing the risk of infection to people through direct contact with soil, irrigation water or through unsafely processed food. The results in Table 5 show that the prevalence of infection with soil- transmitted helminths in the group of people who use fresh feces to fertilize crops is 1.42 times higher than that of the group who do not use it and the difference is not statistically significant ($p > 0.05$). Our results are similar to those of (Lien, N. T. 2023). Our results are in line with the trend of increasing STH infections in the group with the above behavior, along with the studies of (Anh, PTL. 2015)and (Nam, D. H. 2020). The two authors showed a statistically significant difference ($p < 0.05$). From the above evidence, it can be seen that the use of fresh manure is a factor of concern in controlling helminth infections, especially in the Central Highlands provinces such as Dak Lak, where agricultural cultivation is still traditional and environmental sanitation and waste treatment conditions are uneven among regions. Raising public awareness and encouraging the use of biologically treated or properly composted manure is a necessary measure not only to prevent STH infections but also to improve public health in general.

Finally, the group of people who did not take deworming medication every 6 months had a 2.27 times higher prevalence of STH infection than the group who did, and the difference was statistically significant ($p < 0.05$). Deworming not only helps eliminate parasites that exist in the body, but also reduces the source of transmission in the community, especially in rural areas of the Ede people. Our results are similar to the trend recorded in many previous studies in Vietnam, showing a clear association between irregular deworming and high risk of helminth infection such as (Anh, PTL. 2015) (Lien, N. T. 2023) (Trinh, HVNT 2019) and (Thuy, B. C. A. 2019). Thus, strengthening the regular deworming program, combined with public health education, especially targeting poor Ede people, is an effective solution to control STH infections. This is not only a medical intervention, but also an activity integrated into a sustainable community development policy in disadvantaged areas.

CONCLUSION

The prevalence of STH infections among the Ede people in Ea Phe commune, Krong Pac, Dak Lak province in 2025 was 29.84% (95% CI = 24.75%–35.31%). The prevalence of STH infections was higher among men than women. The prevalence of single infection was 27.87% and 1.97% of multiple infections. 100% of the Ede people had low intensity of infection with STHs.

There is a relationship between the prevalence of STH infection and age group, occupation, knowledge/hearing about how to prevent STH infections, use of labor protection and periodic deworming every 6 months.

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