



## The Relationship Between Worm Infection and Nutritional Status of Elementary School Students in the Working Area of the Nulle Public Health Center

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### ABSTRACT

**Background:** Soil-transmitted helminth (STH) infections remain a neglected public health problem in tropical regions, particularly in areas with poor sanitation and hygiene. These infections predominantly affect school-aged children and may contribute to impaired nutritional status. The working area of the Nulle Public Health Center is located in South Central Timor Regency, an area known to have a high prevalence of chronic malnutrition, highlighting the need to evaluate factors associated with nutritional problems.

**Objective:** To determine the prevalence of worm infection, nutritional status, and the association between worm infection and nutritional status among elementary school students in the working area of the Nulle Public Health Center.

**Methods:** This study employed a descriptive-analytic design with a cross-sectional approach. A total of 263 elementary school students were selected using cluster random sampling. Data collection included a risk-factor questionnaire, microscopic stool examination using 1% Lugol solution and eosin, and anthropometric assessment for nutritional status. Data were analyzed using univariate and bivariate methods. Fisher's exact test was applied with a significance level of  $p < 0.05$ .

**Results:** The prevalence of worm infection was 4.6% (12 out of 263 students). The most common helminth species identified was *Ascaris lumbricoides* (83.3%), followed by *Trichuris trichiura* and mixed infections (8.3% each). Nutritional status was predominantly normal (61.6%), followed by undernutrition (21.3%), severe malnutrition (13.3%), and overnutrition (3.8%). Among students with positive worm infection, the majority were classified as severely malnourished. Statistical analysis demonstrated a significant association between worm infection and nutritional status ( $p < 0.05$ ).

**Conclusion:** There is a significant relationship between worm infection and nutritional status among elementary school students in the working area of the Nulle Public Health Center.

**KEYWORDS:** Worm infection, nutritional status, elementary school students, soil-transmitted helminths

### INTRODUCTION

Soil-transmitted helminth (STH) infections remain a major neglected tropical disease burden in many low- and middle-income settings. Globally, STH infections are among the most common infections, affecting an estimated 1.5 billion people (approximately 24% of the world's population), with transmission concentrated in communities with inadequate water, sanitation, and hygiene (WASH).<sup>1</sup> Beyond immediate gastrointestinal morbidity, STH infections are epidemiologically linked to adverse child health outcomes, including impaired nutritional status and growth, particularly among school-aged children who experience frequent soil exposure and hygiene-related risks.<sup>1,2</sup>



The biological plausibility for an association between STH infection and poor nutritional status is supported by multiple mechanisms. STH may contribute to undernutrition through reduced dietary intake, intestinal inflammation, competition for nutrients, malabsorption, and (particularly for hookworm) chronic blood loss leading to anemia and reduced physical capacity.<sup>1,3</sup> In addition, in resource-limited environments, repeated enteric infections can compound nutritional deficits through chronic intestinal injury and systemic inflammation, which are recognized pathways that may hinder linear growth and broader child development.<sup>4,5</sup> However, the magnitude and consistency of associations between STH infection and anthropometric outcomes vary across settings, reflecting heterogeneity in infection intensity, species distribution, background dietary adequacy, co-infections, and WASH conditions.<sup>3,6</sup>

In Indonesia, STH remains a persisting public health issue in several provinces and is relevant to child nutrition and anemia outcomes.<sup>3</sup> East Nusa Tenggara (NTT) has been repeatedly highlighted as a high-burden context for both infectious and nutritional problems, and South Central Timor Regency has been reported to have a stunting prevalence of 48.3%, indicating a severe chronic malnutrition challenge at the population level.<sup>7</sup> This epidemiological overlap provides a strong rationale to evaluate whether STH infection is associated with nutritional status among children in local settings where structural determinants (poverty, sanitation, and household WASH) may sustain transmission and exacerbate malnutrition.

Against this background, the present study assesses the prevalence of worm infection and nutritional status among elementary school students in the working area of the Nulle Public Health Center and examines the association between worm infection and nutritional status. Evidence generated from a local, school-based population is expected to inform integrated programming that combines deworming, WASH risk reduction, and nutrition interventions, aligned with the needs of high-risk districts.

## METHODS

This study employed a descriptive-analytic design with a cross-sectional approach to assess the relationship between worm infection and nutritional status among elementary school students. The research was conducted in the working area of the Nulle Public Health Center, South Central Timor Regency, East Nusa Tenggara Province, Indonesia, during 2025.

The study population consisted of elementary school students enrolled in schools within the working area of the Nulle Public Health Center. A total of 263 students were included in the study. Sampling was carried out using a cluster random sampling technique, with schools serving as sampling units.

Participants were included if they were registered as active students in elementary schools within the study area, were present during data collection, and had obtained written informed consent from parents or legal guardians. Students who were absent during stool sample collection or anthropometric measurement, declined participation, or had incomplete data were excluded from the study.

Data collection involved questionnaire-based assessment, stool examination, and anthropometric measurement. A structured questionnaire was used to obtain demographic information and identify potential risk factors related to worm infection. Stool samples were collected using sterile, labeled containers and examined microscopically through direct smear methods using 1% Lugol solution and eosin to detect the presence and species of intestinal helminths.

Assessment of nutritional status was performed using anthropometric measurements, including body weight and height. Body mass index-for-age was calculated and categorized according to standard nutritional status classifications.

Data were processed and analyzed using statistical software. Univariate analysis was conducted to describe the distribution of worm infection and nutritional status among participants. Bivariate analysis was performed to evaluate the association between worm infection and nutritional status using Fisher's exact test. Statistical significance was defined as a p-value of less than 0.05.

Ethical approval for this study was obtained from the Research Ethics Committee of the Faculty of Medicine and Veterinary Medicine, Universitas Nusa Cendana. The study was declared ethically feasible under ethical clearance number 005054/KEPK FKM UNDANA/2025, dated 15 October 2025. Written informed consent was obtained from parents or legal guardians prior to participation, and confidentiality of all participant information was strictly maintained throughout the research process.

## RESULTS

A total of 263 elementary school students were included in the analysis. Stool examination identified 12 students (4.6%) with soil-transmitted helminth infection, while 251 students (95.4%) were not infected. Among infected students, *Ascaris lumbricoides* was the predominant species, accounting for 83.3% of cases, followed by *Trichuris trichiura* and mixed infections (8.3% each).

Anthropometric assessment revealed that most students had normal nutritional status (61.6%). Undernutrition was observed in 21.3% of students, severe malnutrition in 13.3%, and overnutrition in 3.8%.



The distribution of helminth infection by species and overall nutritional status of the study population are summarized in Table 1.

**Table 1. Distribution of Worm Infection and Nutritional Status Among Elementary School Students (n = 263)**

Variable	Category	n	%
Worm infection status	Positive	12	4.6
	Negative	251	95.4
Helminth species (n=12)	<i>Ascaris lumbricoides</i>	10	83.3
	<i>Trichuris trichiura</i>	1	8.3
	Mixed infection	1	8.3
Nutritional status	Normal	162	61.6
	Undernutrition	56	21.3
	Severe malnutrition	35	13.3
	Overnutrition	10	3.8

Further analysis examined the association between worm infection and nutritional status. Among students with positive worm infection, 75.0% were classified as having severe malnutrition, while 25.0% had normal nutritional status. No cases of undernutrition or overnutrition were observed among infected students. In contrast, students without worm infection predominantly had normal nutritional status.

**Table 2. Association Between Worm Infection and Nutritional Status Using Fisher’s Exact Test**

Nutritional status	Worm positive n (%)	Worm negative n (%)	Total (n)	p-value*
Normal	3 (25.0)	159 (63.3)	162	<b>p &lt; 0.05</b>
Undernutrition	0 (0.0)	56 (22.3)	56	
Severe malnutrition	9 (75.0)	26 (10.4)	35	
Overnutrition	0 (0.0)	10 (4.0)	10	
<b>Total</b>	<b>12 (100)</b>	<b>251 (100)</b>	<b>263</b>	

\*Fisher’s exact test

Fisher’s exact test demonstrated a statistically significant association between worm infection and nutritional status ( $p < 0.05$ ), indicating that students with helminth infection were significantly more likely to experience severe malnutrition compared with uninfected students.

## DISCUSSION

This study demonstrated a statistically significant association between soil-transmitted helminth (STH) infection and nutritional status among elementary school students, with the majority of infected children classified as severely malnourished. This finding supports existing evidence that parasitic infections and nutritional impairment frequently coexist in vulnerable pediatric populations living in resource-limited environments.<sup>1,2</sup>

The predominance of *Ascaris lumbricoides* observed in this study is consistent with global epidemiological patterns, where *Ascaris* remains the most prevalent STH species affecting school-aged children in tropical and subtropical regions.<sup>1,3,4</sup> Several studies conducted in Southeast Asia and other endemic settings similarly report *Ascaris* as the dominant species, reflecting persistent fecal–oral transmission and environmental contamination despite ongoing deworming efforts.<sup>5,6</sup>

The biological mechanisms linking STH infection to poor nutritional status are multifactorial. Helminths may impair nutritional status through reduced appetite, intestinal inflammation, malabsorption of macronutrients and micronutrients, and increased metabolic demands.<sup>1,7</sup> In addition, chronic infections may lead to deficiencies of iron, vitamin A, and other essential nutrients that



are critical for growth and immune competence.<sup>8,9</sup> Although hookworm-related blood loss is classically associated with anemia, non-hematophagous species such as *Ascaris lumbricoides* have also been shown to contribute to growth retardation through intestinal dysfunction and nutrient competition.<sup>10</sup>

Beyond direct nutrient loss, repeated exposure to enteric pathogens, including STH, may contribute to chronic intestinal injury described as environmental enteric dysfunction (EED). EED is characterized by persistent intestinal inflammation, increased gut permeability, and impaired nutrient utilization, and has been increasingly recognized as an important determinant of growth failure in children living in low-resource settings.<sup>11,12</sup> The coexistence of helminth infection, inadequate sanitation, and undernutrition in high-burden regions supports the plausibility of this biological pathway.

The findings of this study are consistent with previous research conducted in East Nusa Tenggara, which reported significant associations between STH infection and adverse nutritional outcomes among school-aged children.<sup>13,14</sup> Similar associations have been reported in multi-country analyses and systematic reviews, demonstrating higher odds of underweight and stunting among children infected with STH compared with uninfected peers.<sup>15,16</sup> However, several studies have reported inconsistent or weak associations, particularly in settings with low infection intensity or effective preventive chemotherapy coverage.<sup>17</sup>

The relatively low prevalence of STH infection observed in the present study may be influenced by local heterogeneity in transmission, periodic mass drug administration, or diagnostic limitations. Direct smear microscopy, although practical for field-based surveys, has lower sensitivity for detecting light-intensity infections compared with quantitative parasitological methods.<sup>18,19</sup> As a result, subclinical infections may remain undetected, potentially underestimating the true burden of exposure.

Interpretation of these findings should consider the limitations inherent to a cross-sectional design. Causal relationships cannot be established, and the association between helminth infection and nutritional status may be bidirectional. Malnutrition may increase susceptibility to infection through immune impairment, while infection may exacerbate nutritional deficiencies, creating a reinforcing cycle.<sup>20,21</sup> Furthermore, unmeasured confounding factors such as household food insecurity, dietary diversity, parental education, and sanitation access may influence both infection risk and nutritional outcomes.<sup>22</sup>

From a public health perspective, the results emphasize the importance of integrated intervention strategies. The World Health Organization recommends that preventive chemotherapy be implemented alongside improvements in water, sanitation, hygiene, and nutrition to achieve sustainable reductions in STH transmission and its health consequences.<sup>1,23</sup> In high-burden areas such as South Central Timor, where chronic malnutrition remains prevalent, school-based deworming programs should be combined with targeted nutritional support and hygiene promotion to optimize child health outcomes.<sup>24,25</sup>

Future research should incorporate longitudinal designs, assessment of infection intensity, anemia indicators, dietary intake, and WASH-related variables to better elucidate causal pathways and inform locally tailored intervention strategies.

## CONCLUSION

This study demonstrates a significant association between soil-transmitted helminth infection and nutritional status among elementary school students in the working area of the Nulle Public Health Center. Students infected with helminths were more likely to experience severe malnutrition compared with non-infected students.

Although the overall prevalence of worm infection was relatively low, the concentration of poor nutritional status among infected children highlights the clinical and public health relevance of helminth infection in nutritionally vulnerable populations. These findings indicate that even low-level transmission may contribute to adverse nutritional outcomes when occurring in settings characterized by chronic deprivation.

The results underscore the importance of integrated child health interventions that combine periodic deworming, nutritional support, hygiene education, and improvements in environmental sanitation. Such combined strategies are essential to reduce reinfection risk and to address the multifactorial determinants of malnutrition among school-aged children in high-burden areas.

Further studies using longitudinal designs and more sensitive diagnostic methods are recommended to clarify causal relationships and to support evidence-based planning of comprehensive parasite control and nutrition programs.

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