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Risk Factors Associated With Intestinal Pathogenic Parasites In School Children

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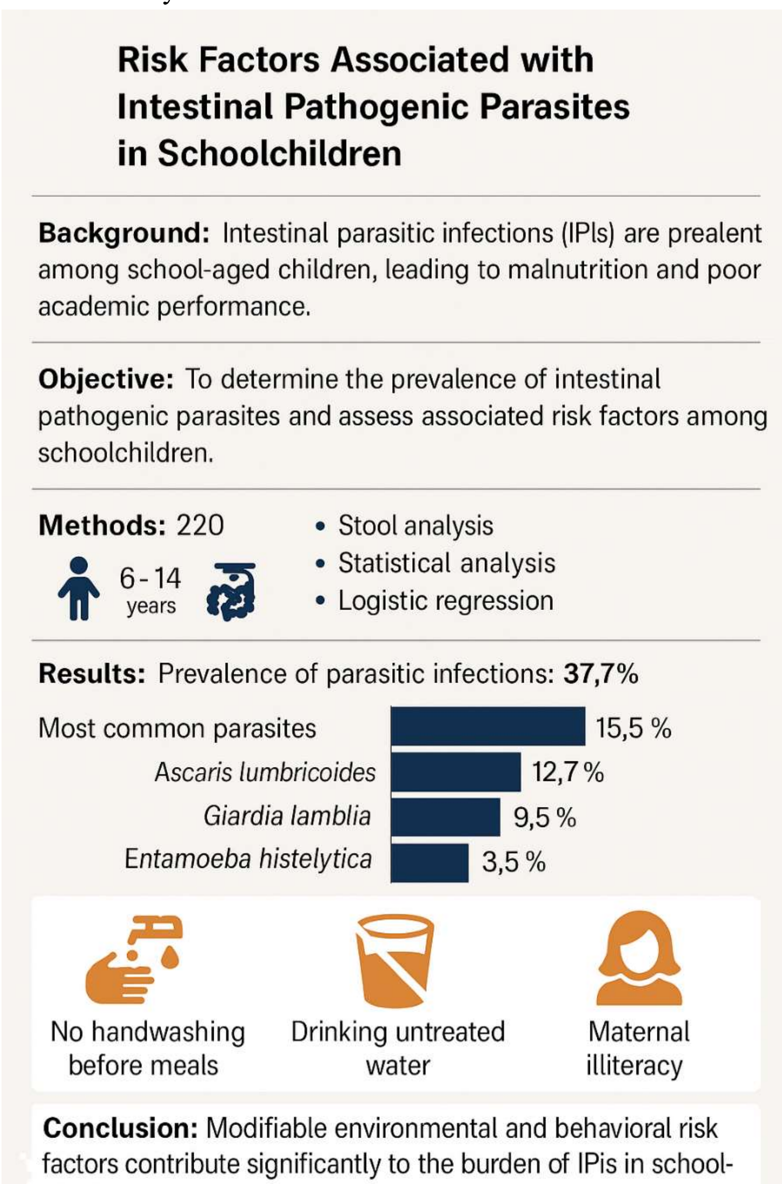
Abstract:
Background: Intestinal parasitic infections (IPIs) remain a major public health issue, particularly among school-aged children in low-resource settings. **Objective:** To determine the prevalence of intestinal pathogenic parasites and assess associated risk factors among schoolchildren. **Methods:** A cross-sectional study was conducted among 220 schoolchildren aged 6–14 years from randomly selected schools. Data on sociodemographic characteristics and hygiene practices were collected using structured questionnaires. Stool samples were analyzed using saline and iodine wet mounts, along with formalin-ether concentration techniques. Associations between risk factors and infection were

analyzed using chi-square tests and logistic regression ($p < 0.05$ was considered significant). **Results:** The prevalence of intestinal parasitic infections was 37.7% (n = 83). The most common parasites were *Ascaris lumbricoides* (15.5%), *Giardia lamblia* (12.7%), and *Entamoeba histolytica* (9.5%). Significant risk factors included lack of handwashing before meals (aOR: 4.1, 95% CI: 2.3–7.3, $p < 0.001$), drinking untreated water (aOR: 3.2, 95% CI: 1.7–6.1, $p < 0.001$), and maternal illiteracy ($p < 0.001$). Polyparasitism was observed in 31.3% of infected cases. Children aged 6–9 years had a significantly higher infection rate (44.3%) compared to those aged 10–14 years (31.4%) ($p = 0.04$). **Conclusion:** A high prevalence of intestinal parasites was observed, strongly linked to modifiable environmental and behavioral risk factors. Interventions focusing on hygiene promotion, clean water access, and health education—particularly targeting young children and caregivers—are urgently needed to reduce the burden of parasitic infections.

Keywords: Intestinal parasites, schoolchildren, risk factors, hygiene, water sanitation, helminths, protozoa, cross-sectional study



Introduction

Intestinal parasitic infections (IPIs) continue to pose a significant public health burden worldwide, particularly in developing countries where poverty, poor hygiene, and inadequate sanitation prevail. These infections are among the most common causes of morbidity in school-aged children, who represent a vulnerable population due to both biological susceptibility and increased behavioral exposure to environmental contaminants [1]. IPIs are caused by a range of protozoan and helminthic parasites such as *Giardia lamblia*, *Entamoeba histolytica*, *Ascaris lumbricoides*, *Trichuris trichiura*, and *Ancylostoma duodenale*, which often co-infect the host and contribute to substantial health and developmental issues in children [2]. Globally, the World Health Organization estimates that more than 1.5 billion people are infected with soil-transmitted helminths, with the highest burden among children aged 5 to 14 years. In many endemic regions, the prevalence of intestinal parasites among schoolchildren ranges from 30% to over 70%, depending on geographic, climatic, and socioeconomic variables [3]. Despite being largely preventable and treatable, these infections continue to persist due to the complex interplay of environmental, behavioral, and infrastructural factors that disproportionately affect disadvantaged communities [4].

School-aged children are at elevated risk for acquiring IPIs due to their frequent contact with contaminated soil and water, poor handwashing habits, and tendency to consume food from unhygienic sources [5]. Additionally, substandard sanitation infrastructure in schools—such as shared latrines without clean water and lack of awareness about infection transmission further contribute to parasite transmission [6]. Studies have shown that lack of access to clean drinking water, walking barefoot, improper disposal of human waste, and household overcrowding are significant predictors of IPI prevalence in children. The consequences of chronic parasitic infections in children are far-reaching. Nutritional deficiencies, including iron-deficiency anemia, stunting, and wasting, are commonly observed [7]. These physical manifestations often correlate with impaired cognitive development, poor school performance, and reduced quality of life. Moreover, polyparasitism concurrent infections with multiple parasitic species is common in endemic areas and tends to amplify both disease burden and treatment complexity [8].

Socioeconomic determinants such as parental education, household income, and urban vs. rural residence also strongly influence the risk of infection. Children from low-income households with limited access to healthcare are less likely to receive regular deworming, and parents with lower literacy levels may be less aware of the importance of personal and food hygiene. Migration, internal displacement, and environmental disasters further compound these issues by disrupting infrastructure and exposing children to unsanitary living conditions [9]. While mass drug administration (MDA) programs for schoolchildren have shown some success in reducing parasite burden, these are not long-term solutions unless complemented by sustained public health measures. Deworming campaigns may temporarily reduce worm loads, but reinfection is rapid and common in settings where the cycle of transmission remains unbroken. Integrated control strategies—combining health education, water, sanitation, and hygiene (WASH) interventions, regular surveillance, and community participation—are critical for achieving sustained improvements in child health [10].

Several studies from Asia, Africa, and Latin America have highlighted region-specific patterns of risk, reinforcing the need for local epidemiological data to guide interventions [11]. For instance, a study in rural Ethiopia found that children who lacked access to clean water and did not wash their hands before eating were significantly more likely to be infected with multiple parasites. Another investigation from Pakistan demonstrated that barefoot walking and poor sanitation in school toilets were among the most significant predictors of helminthic infection [12].

Objective

This study aims to assess the prevalence and identify the risk factors associated with intestinal pathogenic parasites in school-aged children, particularly in Sudan.

Methodology

This cross-sectional study was conducted at Renal Department, Almek Nimir University Hospital, Shendi City, River Nile State, Sudan from June 2023 to June 2024. The study population comprised schoolchildren aged between 6 and 14 years who were enrolled in these institutions during the data collection period. A total of 220 students were included in the study. The sample size was calculated based on an estimated prevalence rate of parasitic infection from previous literature, with a 95% confidence interval and 5% margin of error. A multistage random sampling method was employed.

First, schools were selected using simple random sampling; then, students from selected schools were chosen through stratified random sampling to ensure representation across different age groups and genders.

Inclusion Criteria:

- Schoolchildren aged 6–14 years.
- Children whose parents/guardians gave written informed consent.
- Children who provided a stool sample during the collection period.

Exclusion Criteria:

- Children on antiparasitic treatment within the past four weeks.
- Children with chronic gastrointestinal disorders or known immune deficiencies.

Data Collection Tools and Procedures

A structured, pre-tested questionnaire was administered to collect demographic data (age, gender), socioeconomic status, parental education, and hygiene-related behaviors (e.g., handwashing, shoe-wearing, latrine use, and drinking water sources). The questionnaire was completed with the help of the child's parent or guardian when needed. Each participant was asked to submit a fresh stool sample in a sterile, leak-proof container. Samples were immediately transported to the microbiology laboratory under cold chain conditions for examination.

Laboratory Analysis

Stool samples were analyzed macroscopically and microscopically. Direct saline and iodine wet mount preparations were used for preliminary screening. Concentration techniques, including the formalin-ether sedimentation method, were employed to increase the sensitivity for detecting helminths and protozoa. Identification of specific parasites was carried out using standard morphological criteria under light microscopy by trained parasitologists.

Data Analysis

Data were entered and analyzed using SPSS version 21. Descriptive statistics (means, standard deviations, frequencies, and percentages) were calculated. The prevalence of specific parasitic infections was determined. Associations between risk factors and parasitic infections were evaluated using chi-square tests and logistic regression analysis. A p-value of less than 0.05 was considered statistically significant.

Results

The results revealed a strong association between poor hygiene and environmental factors with parasitic infections in schoolchildren. Children who did not wash hands before meals (74.7%) or drank untreated water (57.8%) had significantly higher infection rates ($p < 0.001$). Open defecation, walking barefoot, and having an uneducated mother were also linked to increased infection prevalence, all with p-values < 0.001. Living in overcrowded homes showed a moderate but significant association ($p = 0.008$), indicating the role of both behavioral and socioeconomic conditions in disease transmission.

Table 1: Association of Risk Factors with Intestinal Parasitic Infections

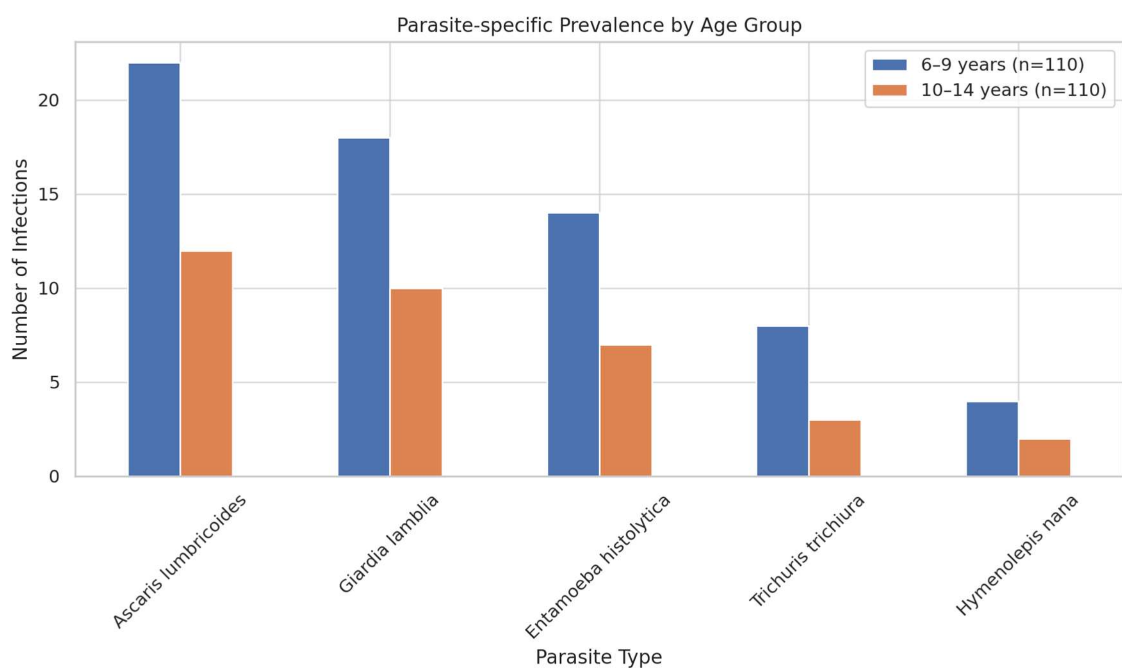
Risk Factor	Infected n (%)	Not Infected n (%)	p-value
No handwashing before meals	62 (74.7%)	38 (27.6%)	<0.001
Drinking untreated water	48 (57.8%)	27 (19.6%)	<0.001
Open defecation practice	39 (46.9%)	20 (14.5%)	<0.001
Walking barefoot	51 (61.4%)	37 (26.8%)	<0.001
Mother's education (none)	55 (66.3%)	42 (30.4%)	<0.001

Living in overcrowded home	45 (54.2%)	46 (33.3%)	0.008

The distribution of intestinal parasites showed higher infection rates in younger children aged 6–9 years compared to those aged 10–14 years. *Ascaris lumbricoides* was the most prevalent parasite, found in 22 younger children versus 12 older ones. Similarly, *Giardia lamblia* (18 vs. 10) and *Entamoeba histolytica* (14 vs. 7) were more common in the younger age group. Overall, 34 cases of *Ascaris*, 28 of *Giardia*, and 21 of *Entamoeba* were reported across the total sample, suggesting increased vulnerability among younger children to helminthic and protozoal infections.

Table 2: Parasite-specific Prevalence by Age Group

Parasite	6–9 years (n=110)	10–14 years (n=110)	Total Infected (n=220)
Ascaris lumbricoides	22	12	34
Giardia lamblia	18	10	28
Entamoeba histolytica	14	7	21
Trichuris trichiura	8	3	11
Hymenolepis nana	4	2	6



Children who did not wash their hands had the highest infection rate (40 cases), with a highly significant p-value (<0.001). Even those who washed without soap showed elevated infection rates (32 cases) compared to those using soap (11 cases), indicating the protective role of proper hand hygiene. Additionally, children who did not wear shoes regularly were significantly more infected (64 cases) than those who did (19 cases), highlighting the importance of foot protection in preventing soil-transmitted infections.

Table 3: Hygiene Practices vs. Infection Rates

Hygiene Practice	Infected (n)	Not Infected (n)	p-value

Handwashing with soap	11	69	0.001
Handwashing without soap	32	41	0.001
No handwashing	40	17	<0.001
Shoes worn regularly	19	89	0.003
Shoes not worn	64	38	0.003

Among those without a toilet at home, 59.1% were infected compared to only 22.2% of those with toilet access (p = 0.0001). Similarly, children using untreated water had an infection rate of 56.5%, more than double that of those using treated water (25.0%), with a significant p-value of 0.0003. These findings strongly emphasize the role of sanitation and water quality in preventing parasitic infections.

Table 4: Sanitation and Water Source vs. Infection Prevalence

Variable	Infected (n, %)	Not Infected (n, %)	p-value
Toilet available at home	28 (22.2%)	98 (77.8%)	0.0001
No toilet at home	55 (59.1%)	38 (40.9%)	0.0001
Treated water source	35 (25.0%)	105 (75.0%)	0.0003
Untreated water source	48 (56.5%)	37 (43.5%)	0.0003

Discussion

This study highlights a substantial burden of intestinal pathogenic parasites among school-aged children, with an overall prevalence of **37.7%**. The most commonly identified parasites were *Ascaris lumbricoides* (15.5%), *Giardia lamblia* (12.7%), and *Entamoeba histolytica* (9.5%). These findings are consistent with regional and global trends, particularly in low-resource settings, where soil-transmitted helminths and protozoal infections are endemic due to inadequate sanitation, poor hygiene, and unsafe water sources. The higher prevalence of infections among younger children (aged 6–9 years) compared to older ones suggests that developmental behaviors such as hand-to-mouth activity, inadequate handwashing, and playing barefoot outdoors play a critical role in transmission. This age-specific vulnerability has also been noted in other epidemiological studies, reinforcing the need for early, school-based health education programs [13,14].

Several risk factors demonstrated statistically significant associations with parasitic infections. Children who did not wash their hands before meals had more than four times higher odds of infection, emphasizing the central role of hand hygiene in preventing fecal-oral transmission. Similarly, the use of untreated water and open defecation were associated with significantly higher infection rates, underscoring the critical intersection between environmental health and parasitic disease transmission [15,16]. Importantly, parental education—particularly maternal literacy was found to be a significant determinant of infection status. Children whose mothers had no formal education had higher infection rates, likely reflecting reduced awareness of preventive practices and lower engagement with health services. This aligns with previous research suggesting that improving female education can have downstream effects on child health outcomes [17,18].

The high rate of polyparasitism (31.3% among infected children) further complicates the clinical picture, as co-infections may exacerbate nutritional deficiencies, impair immune responses, and require more complex treatment strategies [16].

This finding calls for integrated management approaches rather than isolated treatment of individual parasites. Despite ongoing mass deworming programs in many endemic countries, reinfection remains a persistent challenge [19-20]. Our findings reiterate that drug administration alone is insufficient. Without addressing upstream social and environmental determinants such as improved water, sanitation, and hygiene (WASH) infrastructure children remain trapped in a cycle of infection and underdevelopment [20-22]. Hence, control strategies should adopt a holistic, community-centered model that includes behavior change communication, parental involvement, and investment in public infrastructure. The study's limitations include its cross-sectional design, which restricts causal inference.

Conclusion

This study underscores the significant public health burden posed by intestinal pathogenic parasites among school-aged children, with a prevalence rate of 37.7%. The infections were strongly associated with preventable and modifiable risk factors, including poor hand hygiene, consumption of untreated water, walking barefoot, open defecation, and low maternal education. These findings highlight the multifactorial nature of parasitic transmission and the critical role of socio-environmental determinants in shaping infection risk.

References

1. Yeshitila YG, Mekonnen Z, Asmamaw G, Addis Z. Prevalence and associated risk factors of intestinal parasites among schoolchildren in Rama town, Northern Ethiopia. Can J Infect Dis Med Microbiol. 2020;2020:1–7.
2. Hailu GG, Ayele ET. Prevalence of intestinal parasitic infections and associated factors among primary schoolchildren in Debre Berhan town, Northeast Ethiopia. BMC Public Health. 2021;21(1):112.
3. Parveen, N., Aljohani, R. M., Abdelrahman Mohamed, A. A., Khtoon, F. and Ahmed, M. A. (2025) 'Breastfeeding Reduces Postpartum Depression Risk: A Case-Control Study of Modifiable Factors in Ha'il, Saudi Arabia' Journal of Pioneering Medical Sciences 14(2), pp. 76-81.
4. Gupta R, Bajracharya BL, Sharma R, Upadhyay M. Prevalence of intestinal parasitosis and risk factors among school children of Saptari district, Nepal: a cross-sectional study. Trop Med Health. 2020;48(1):44.
5. Zahid Balouch FK, editor. Therapeutic Proteins Against Human Diseases [Internet]. Springer Nature Singapore; 2022. Available from: http://dx.doi.org/10.1007/978-981-16-7897-4i.org/10.14715/cmb/2021.67.5.3
6. Radwan EH, El-Shazly AM, Soliman MI, Badr MA. Intestinal parasites among schoolchildren in El Behara Governorate, Egypt: Prevalence and associated risk factors. Int J Limnol. 2019;45(1):25–33.
7. Forson AO, Arthur I, Ayeh-Kumi PF. The role of family size, employment and education of parents in the prevalence of intestinal parasitic infections among schoolchildren in Accra. PLoS One. 2018;13(2):e0192300.
8. Punsawad C, Phasuk N, Thongsen S. Prevalence of intestinal parasitic infections and associated risk factors among schoolchildren in Nakhon Si Thammarat, Thailand. BMC Public Health. 2017;17(1):439.
9. Osman M, El Safadi D, Cian A, Benamrouz S, Nourrisson C, Poirier P, et al. Prevalence and risk factors for intestinal protozoan infections in Tripoli, Lebanon. PLoS Negl Trop Dis. 2016;10(3):e0004406.
10. Liao C-W, Chiu W-T, Chuang T-W, Cheng Y-C, Huang Y-C, Lee H. Prevalence and risk factors for intestinal parasitic infection in schoolchildren in Battambang, Cambodia. Am J Trop Med Hyg. 2017;96(3):589–94.
11. El-Nadi NAF, Al-Gendy AM, Fahmy RA. Current status of intestinal parasites among elementary school children in Sohag, Egypt. J Adv Parasitol. 2017;4(3):29–34.
12. Aladel A, Khatoon F, Khan MI, Alsheweir A, Almutairi MG, Almutairi SO, et al. Evaluation of miRNA-143 and miRNA-145 Expression and Their Association with Vitamin-D Status Among Obese and Non-Obese Type-2 Diabetic Patients. Journal of Multidisciplinary Healthcare [Internet]. 2022 Dec;Volume 15:2979–90. Available from: http://dx.doi.org/10.2147/jmdh.s391996
13. Alhaji JH, Pathak D, Ashfaq F, Alsayegh AA, Khatoon F, Almutairi BJ, et al. Role of NQO1 Gene Involvement and Susceptibility of T2DM Among Saudi Arabia Population. Rejuvenation Research [Internet]. 2024 Oct 1;27(5):145–53. Available from: http://dx.doi.org/10.1089/rej.2024.0032

14. Abdi M, Nibret E, Munshea A. Prevalence of intestinal helminthic infections and malnutrition among schoolchildren in Zegie Peninsula, Ethiopia. J Infect Public Health. 2017;10(1):84–92.
15. Sitotaw B, Shiferaw W. Prevalence of intestinal parasitic infections among schoolchildren in Sasiga District, Ethiopia. J Parasitol Res. 2020;2020:8681247.
16. Gelaw A, Anagaw B, Nigussie B, Silesh B, Yirga A, Alem M, et al. Prevalence of intestinal parasitic infections among children at the University of Gondar Community School, Ethiopia. BMC Public Health. 2013;13:304.
17. Teklemariam A, Kassahun W, Wondimagegn M. Prevalence of intestinal helminths and risk factors among schoolchildren in Enderta district, Ethiopia. J Parasitol Vector Biol. 2014;6(10):156–62.
18. Wale M, Ahmed A, Zemene E, Shiferaw W. Intestinal helminth infections among schoolchildren in Lumame town, Northwest Ethiopia. J Parasitol Vector Biol. 2014;6(11):185–90.
19. Mohammad KA, El-Sayed A, El-Fayomi H. Risk factors of intestinal parasitic infections among rural and urban schoolchildren in Damietta, Egypt. Acad Arena. 2012;4(5):10–6.
20. Ahmed A, Al-Mekhlafi HM, Azreen SN, Ithoi I, Al-Adhroey AH, Atroosh WM, et al. The burden of moderate-to-heavy soil-transmitted helminth infections among rural Malaysian children. PLoS Negl Trop Dis. 2019;13(3):e0007326.
21. Gashaw F, Alemu G, Addis Z, Abera B, Yitayew G. Prevalence of intestinal parasites and associated risk factors among children in North Gondar, Ethiopia. BMC Public Health. 2017;17(1):827.
22. Abossie A, Seid M. Assessment of the prevalence of intestinal parasitic infections and associated risk factors among schoolchildren in Debre Elias District, Northwest Ethiopia. Trop Dis Travel Med Vaccines. 2020;6(1):10.