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DETECTION AND PREVALENCE OF COMMON INTESTINAL PARASITES IN STOOL SAMPLES

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ABSTRACT

Background: Intestinal parasitic infections (IPIs) remain a major public health concern, particularly in communities with limited access to clean water and sanitation. These infections contribute significantly to morbidity, especially among children, causing malnutrition, anemia, and impaired cognitive development. Accurate, localized epidemiological data is crucial for designing effective public health interventions. **Materials and Methods:** A cross-sectional study was conducted between January 2023 to December 2023, involving 400 randomly selected individuals. A single stool sample was collected from each participant. Sociodemographic data and information on potential risk factors were obtained using a structured questionnaire. Samples were processed and examined using direct wet mount microscopy (saline and iodine) and the formalin-ether concentration technique (FECT). Data were analyzed using SPSS version 25.0. Chi-square tests were used to assess associations, with a p-value < 0.05 considered statistically significant. **Result:** The overall prevalence of IPIs was 38.5% (154/400). At least one parasite was detected in the samples. The most prevalent parasite was *Giardia lamblia* (18.0%), followed by *Ascaris lumbricoides* (12.3%), *Entamoeba histolytica/dispar* (8.5%), *Trichuris trichiura* (6.8%), and Hookworm species (4.3%). Single infections (29.5%) were more common than polyparasitism (9.0%). The prevalence of IPIs was significantly higher in children aged ≤14 years (55.2%) compared to adults >14 years (21.8%) ($\chi^2 = 34.5$, $p < 0.001$). Individuals using well water as their primary drinking source had a significantly higher infection rate (52.1%) than those using treated tap water (24.9%) ($\chi^2 = 25.1$, $p < 0.001$). No significant association was found between infection prevalence and gender ($p = 0.452$). The mean age of participants was 25.4 ± 15.2 years. **Conclusion:** The prevalence of intestinal parasites is considerably high, with children and users of untreated water sources being the most vulnerable groups. These findings underscore the urgent need for targeted public health strategies, including health education, improvements in water and sanitation infrastructure, and periodic deworming programs to mitigate the burden of these infections.

INTRODUCTION

Intestinal parasitic infections (IPIs) are among the most common infections worldwide, affecting an estimated 3.5 billion people and causing significant morbidity and mortality.[1] These infections are caused by a wide range of protozoa and helminths and are predominantly concentrated in tropical and subtropical regions, especially in communities characterized by poverty, inadequate sanitation, and limited access to safe drinking water.[2] The global burden of IPIs is substantial, with soil-transmitted helminths (STHs) such as Ascaris lumbricoides, Trichuris trichiura, and hookworms, along with protozoans like Giardia lamblia and Entamoeba histolytica, being the primary causative agents.[3]

The clinical manifestations of IPIs vary depending on the parasite species and the host's immune status but commonly include diarrhea, abdominal pain, malnutrition, iron-deficiency anemia, and vitamin A deficiency. In children, chronic infections can lead to severe long-term consequences, including stunted growth, impaired physical development, and reduced cognitive function, thereby perpetuating a cycle of poverty and disease.[4] The public health significance of these infections is therefore not only medical but also socioeconomic.

Diagnosis of IPIs in resource-limited settings traditionally relies on conventional microscopic examination of stool samples, such as direct wet mount and concentration techniques. While cost-effective and widely available, these methods have limitations, including variable sensitivity, especially in cases of low parasite load or intermittent shedding, and dependency on the skill of the microscopist.[5] Despite these limitations, microscopy remains the cornerstone for epidemiological surveys in many parts of the world.

The prevalence of IPIs shows considerable geographical variation, influenced by local climate, environmental sanitation, hygiene practices, and socioeconomic conditions. Recent studies from various regions have reported diverse prevalence rates.[6,7]

The aim of this study was to determine the prevalence of common intestinal parasites and to identify the associated sociodemographic and environmental risk factors among. The findings are intended to inform local health authorities and guide the implementation of effective prevention and control strategies.

MATERIALS AND METHODS

Study Design and Area: A community-based cross-sectional study was conducted from January 2023 to December 2023.

Sample Size and Sampling Technique: The sample size was calculated using the single population proportion formula, $n = Z^2P(1-P)/d^2$, assuming an expected prevalence (P) of 50% to obtain the maximum sample size, a 95% confidence level (Z=1.96), and a 5% margin of error (d). The calculated sample size was 384. To account for potential non-response, the sample size was increased to 400. A multi-stage random sampling technique was employed. First, four of the ten administrative wards within the district were selected randomly. Then, households within these wards were selected using systematic random sampling. One individual per selected household was then invited to participate.

Inclusion and Exclusion Criteria: All individuals aged one year and above who had been residents of the selected households for at least six months and provided informed consent (parental consent for minors) were included. Individuals who had taken anti-parasitic medication within the four weeks prior to the study or were too ill to participate were excluded.

Data Collection: A pre-tested, structured questionnaire was administered by trained data collectors to gather information on sociodemographic characteristics (age, gender), environmental factors (source of drinking water, type of toilet facility), and hygiene practices (handwashing habits).

Stool Sample Collection and Processing: Each participant was provided with a clean, dry, wide-mouthed, and labeled screw-cap container and instructed on how to collect a single stool sample (approximately 10 grams). Samples were collected by participants and returned to a central point within two hours. Upon receipt, a portion of each sample was preserved in 10% formalin solution and transported in a cool box to the Parasitology Laboratory at the University of Global Health Sciences for analysis.

Laboratory Analysis: Each stool sample was processed and examined using two standard parasitological techniques:

1. **Direct Wet Mount:** A small portion of the fresh stool was emulsified in a drop of normal saline on one end of a glass slide and in a drop of Lugol's iodine on the other. The preparations were covered with a coverslip and examined under a light microscope at 100x and 400x magnification to detect motile trophozoites, cysts, ova, and larvae.
2. **Formalin-Ether Concentration Technique (FECT):** Approximately 1-2 grams of the preserved stool sample was emulsified in 10 mL of 10% formalin, sieved through a gauze mesh, and centrifuged. The supernatant was discarded, and the sediment was re-suspended. Diethyl ether was added, the mixture was shaken vigorously and then centrifuged. The supernatant layers were discarded, and the resulting sediment was examined microscopically for parasite eggs, cysts, and larvae after placing a drop on a slide with a drop of Lugol's iodine.

Statistical Analysis: Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics, including frequencies, percentages, mean, and standard deviation (SD), were used to summarize the data. The Chi-square (χ^2) test was used to assess the association between the prevalence of IPIs and categorical variables (age group, gender, water source, etc.). A p-value of less than 0.05 was considered statistically significant.

RESULTS

Sociodemographic Characteristics of Study Participants

A total of 400 participants were enrolled in the study. Of these, 188 (47.0%) were male and 212 (53.0%) were female. The age of the participants ranged from 1 to 72 years, with a mean age of 25.4 ± 15.2 years. For analysis, participants were categorized into two age groups: ≤14 years (n=145, 36.3%) and >14 years (n=255, 63.7%). The majority of participants (65.0%) reported using treated tap water as their primary drinking source, while 35.0% used water from private

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wells. The detailed sociodemographic characteristics are presented in Table 1.

Table 1: Sociodemographic Characteristics of the Study Participants (N=400)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (years)	≤14	145	36.3
	>14	255	63.7
Gender	Male	188	47.0
	Female	212	53.0
Water Source	Treated Tap Water	260	65.0
	Well Water	140	35.0
Toilet Facility	Flush Toilet	225	56.3
	Pit Latrine	175	43.7

Overall Prevalence of Intestinal Parasitic Infections

Out of the 400 stool samples examined, 154 were found to be positive for at least one intestinal parasite, yielding an overall prevalence of 38.5%. A total of five different parasite species were identified. The most frequently detected parasite was the protozoan Giardia lamblia (18.0%), followed by the helminth Ascaris lumbricoides (12.3%). The prevalence of other parasites was as follows: Entamoeba histolytica/dispar (8.5%), Trichuris trichiura (6.8%), and Hookworm species (4.3%). Single infections were observed in 118 (29.5%) participants, while multiple infections (polyparasitism) were detected in 36 (9.0%) participants. The most common co-infection was a combination of A. lumbricoides and T. trichiura. The distribution of identified parasites is shown in Table 2.

Table 2: Prevalence and Distribution of Intestinal Parasites Detected (N=400)

Parasite Species	Number of Positive Samples (n)	Prevalence (%)
Protozoa		
Giardia lamblia	72	18.0
Entamoeba histolytica/dispar	34	8.5
Helminths		
Ascaris lumbricoides	49	12.3
Trichuris trichiura	27	6.8
Hookworm species	17	4.3
Overall Infection	154	38.5
Single Infection	118	29.5
Multiple Infections	36	9.0

Association between IPIs and Sociodemographic Factors

The prevalence of IPIs was analyzed in relation to various sociodemographic and environmental factors. A statistically significant association was observed between IPIs and age group. The infection rate in children (≤14 years) was 55.2% (80/145), which was significantly higher than the 21.8% (74/255) rate observed in adults (>14 years) (χ^2 = 34.5, p < 0.001). The source of drinking water was also a significant risk factor. Participants who used well water had a significantly higher prevalence of infection (52.1%) compared to those who used treated tap water (24.9%) (χ^2 = 25.1, p < 0.001). There was no statistically significant difference in prevalence between males (39.9%) and females (37.3%) (p = 0.452). These associations are detailed in Table 3.

Table 3: Association of Sociodemographic and Clinical Factors with Intestinal Parasitic Infection

Variable	Category	Total (N)	Infected (n, %)	Uninfected (n, %)	χ^2 value	p-value
Age Group	≤14 years	145	80 (55.2)	65 (44.8)	34.5	**<0.001**
	>14 years	255	74 (21.8)	181 (78.2)		
Gender	Male	188	75 (39.9)	113 (60.1)	0.56	0.452
	Female	212	79 (37.3)	133 (62.7)		
Water Source	Treated Tap Water	260	65 (24.9)	195 (75.1)	25.1	**<0.001**
	Well Water	140	73 (52.1)	67 (47.9)		
Toilet Facility	Flush Toilet	225	70 (31.1)	155 (68.9)	9.87	**0.002**
	Pit Latrine	175	84 (48.0)	91 (52.0)		

DISCUSSION

The overall prevalence of 38.5% indicates that IPIs are a significant public health problem in this area, aligning with findings from other developing regions but also highlighting local specificities. This prevalence is comparable to a study conducted which reported a rate of 35.8%,[8] but lower than the 53.1% reported in a rural community.[9] These variations can be attributed to differences in socioeconomic status, environmental sanitation, study population, and diagnostic methods used.

In our study, the most predominant parasite was Giardia lamblia (18.0%). This high prevalence of a

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waterborne protozoan strongly suggests contamination of water sources, a finding supported by the significant association between infection and the use of well water. Giardia cysts are notoriously resistant to environmental conditions and standard chlorine disinfection, making contaminated wells a persistent source of infection if not properly protected and maintained.[10] The second most common parasite was Ascaris lumbricoides (12.3%), a soil-transmitted helminth. The presence of STHs like Ascaris and Trichuris points towards fecal contamination of the soil, often due to poor sanitation facilities and hygiene practices, such as inadequate handwashing and consumption of unwashed raw vegetables.[11]

One of the most compelling findings of this study is the strong association between age and infection prevalence. Children aged 14 years and younger were significantly more likely to be infected than adults. This is a consistent finding in parasitological surveys worldwide.[12] Children's greater susceptibility can be explained by their less developed immune systems, frequent playing in contaminated soil, and poorer personal hygiene practices, such as pica and infrequent handwashing.[4]. This finding underscores the need for child-focused interventions, such as school-based health and hygiene education programs and targeted deworming campaigns.

The strong correlation between the use of well water and a higher prevalence of IPIs is another critical finding. Individuals relying on well water were more than twice as likely to be infected as those using treated tap water. This highlights a critical failure in public infrastructure and suggests that a large portion of the community is consuming fecally contaminated water. Similar findings have been reported from studies in other low-resource settings, where access to safe, piped water remains a major challenge.[13] This emphasizes that improving water quality, safety, and accessibility is a fundamental prerequisite for controlling IPIs.

The study also found a significant link between the type of toilet facility and infection rates, with higher prevalence among users of pit latrines compared to flush toilets. While pit latrines are an improvement over open defecation, they can still contribute to environmental contamination if not properly constructed, maintained, or located far from water sources.[14]

This study has several limitations. First, its cross-sectional design does not allow for the establishment of causality. Second, the diagnosis was based on a single stool sample from each participant, which may have underestimated the true prevalence, as some parasites are shed intermittently. Third, conventional microscopy, while standard, may have missed low-density infections that could be detected by more sensitive molecular techniques like PCR.[15] Future studies could incorporate such methods for a more accurate assessment.

CONCLUSION

Giardia lamblia and Ascaris lumbricoides are the most common parasites in the community. Children and individuals who rely on untreated well water for drinking are the most vulnerable populations. These findings clearly indicate that current water, sanitation, and hygiene (WASH) conditions in the district are inadequate for preventing fecal-oral transmission of parasites. Based on this evidence, it is strongly recommended that local health authorities implement an integrated control program that includes: (1) strengthening public health education on personal hygiene and food safety; (2) investing in the improvement of water treatment and sanitation infrastructure, with a focus on protecting wells from contamination; and (3) implementing targeted, periodic deworming programs, especially for school-aged children. Addressing these issues is essential to reduce the burden of IPIs and improve the overall health and well-being of the community.

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