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ORIGINAL ARTICLE

Comparative Profile of Intestinal Parasites Among Immunocompromised and Immunocompetent Patients in a Tertiary Care Hospital in North India

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Abstract

Background: Intestinal parasitic infections (IPIs) remain significant in India, particularly within immunocompromised individuals. This comparative study assessed prevalence, risk factors, and clinical features of IPIs among immunocompromised and immunocompetentpatients. **Methods**: A cross-sectional comparative study at Government Medical College, Jammu included 369 patients between May 2024 and April 2025. We defined immunocompromised status as HIV/AIDS, cancer chemotherapy, organ transplantation, or corticosteroid therapy. Immunocompetent status indicated absence of these factors. Stool analysis involved wet mounts, formalin-ether concentration, and modified Ziehl-Neelsen staining. **Results:** Out Of 369 patients, 75 were immunocompromised and 294 were immunocompetent. IPI prevalence was 36% in immunocompromised and 23% in immunocompetent patients. Giardia lamblia (11.7%) and Entamoeba histolytica (9.5%) predominated. Diarrhea (OR=37.1, p<0.001) and bloody stool (OR=5.7, p<0.001) were key risk factors. Adults (>15 years) were affected more frequently (27.4%) than children (17.4%). **Conclusion:** Immunocompromised adults are especially vulnerable to IPIs in Jammu. Regular screening, robust diagnostics, and focused interventions are needed.

Key Words

Intestinal parasites, Immunocompromised, Giardia lamblia, Entamoeba histolytica, North India.

Introduction

Intestinal parasitic infections (IPIs) remain a significant public health concern in India, largely due to poor sanitation and socioeconomic challenges.[1] Caused by protozoa such as *Giardia lamblia* and *Entamoeba histolytica* [2] and helminths including *Ascaris lumbricoides* and *Trichuris trichiura*,[3] IPIs contribute substantially to diarrhea, malnutrition, and overall morbidity, particularly affecting children and immunocompromised individuals. The reported prevalence in India varies widely, from 16.5% to 66%,[4] with the highest rates observed in overcrowded slum environments.[5] Immunocompromised populations, such as those living with HIV/AIDS, are especially vulnerable to opportunistic parasitic infections like *Cryptosporidium*.[6] This study aims to comparatively assess the prevalence, distribution, and associated risk factors of intestinal parasitic infections among immunocompromised and immunocompetent

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patients attending a tertiary care hospital in Jammu. Clarifying differences between these groups will help tailor effective diagnostic and preventive interventions in high-risk populations.

Materials and Methods

Study Design and Setting

A **cross-sectional comparative study** was conducted from May 2024 to April 2025 at the Post Graduate Department of Microbiology, Government Medical College (GMC), Jammu, a tertiary care center in North India. This design enabled assessment and comparison of intestinal parasitic infection prevalence among different patient groups.

Study Population

Patients presenting with gastrointestinal symptoms at outpatient or inpatient departments were enrolled. The study included both immunocompetent and immunocompromised individuals to allow comparative analysis.

Inclusion criteria:

- All ages and both sexes
- Immunocompetent or immunocompromised status as per defined criteria (see below)
- Written informed consent

Exclusion criteria:

- Recent antiparasitic treatment
- Inadequate stool samples
- Pregnancy or lactation
- Lack of consent

Definition of Immunocompromised and Immunocompetent Patients:

Patients were classified as immunocompromised if they had documented HIV/AIDS, were undergoing chemotherapy, had undergone organ transplantation, or received corticosteroids/immunosuppressive therapy. Those without these conditions were considered immunocompetent.

Sample Size

Using a prior prevalence of 40.99%[7], a sample size of 369 was calculated with a 95% confidence level and 5% margin of error:

$n = Z^2P(1–P)/d^2$, where $Z = 1.96$, $P = 0.4099$, $d = 0.05$.

Sample Collection and Processing

Stool samples were collected in sterile, labeled, screw-capped containers and processed within 2 hours or preserved in 10% formalin when delay was expected.

Macroscopic Examination: inspected for color, consistency, and presence of blood or visible worms.

Microscopic Techniques

- **Direct Wet Mount:** saline and iodine wet mounts examined at 10x and 40x magnifications to detect trophozoites, cysts, ova, and larvae.
- **Formalin-Ether Concentration:** utilized for improved detection of eggs and larvae.
- **Modified Ziehl-Neelsen Staining:** applied specifically for detecting coccidia such as *Cryptosporidium parvum* and *Cyclospora cayetanensis*, utilizing carbol fuchsin, acid alcohol, and methylene blue stains.[8]

Quality Control

Positive control slides were routinely used throughout the study period to ensure the accuracy and reliability of staining and microscopic identification.

Ethical Considerations

This study was approved by the Institutional Ethics Committee of GMC Jammu (IEC/GMC/2024/1986 dated 07/06/2024). Informed written consent was obtained from all participants or their guardians.

Statistical Analysis

Data were analyzed using appropriate statistical software. Descriptive statistics (means, percentages) summarized the data. Associations between variables were assessed using chi-square tests and odds ratios. A p-value less than 0.05 was considered statistically significant.

Results

Association between Immune Status and Intestinal Parasitic Infection

Out of a total of 369 patients, 294 were immunocompetent and 75 were immunocompromised, classified as per study criteria. Immunocompromised individuals showed a higher prevalence (36.0%) of intestinal parasitic infections than immunocompetent ones (23.0%), though the difference was not statistically significant ($\chi^2 = 2.18$, $p = 0.140$). Despite this, the clinical relevance highlights the need for further research in vulnerable populations. (Table 1).

Association of Demographic, Socio-economic, and Clinical Risk Factors with Intestinal Parasitic Infections in Immunocompetent and Immunocompromised Patients (Table 2):

The prevalence of intestinal parasitic infections was evaluated in relation to several demographic, socio-economic, and clinical variables. Among the 369 participants enrolled in the study, 88 individuals (23.8%)

Table 1: Association between Immune Status and Intestinal Parasitic Infection.

Immune Status	Number of Patients (n)	Positive (%)	χ^2	P-value
Immunocompetent	294	23.0	2.18	0.140
Immunocompromised	75	36.0		

Table 2: Association of Demographic, Socio-economic, and Clinical Risk Factors with Intestinal Parasitic Infections in Immunocompetent and Immunocompromised Patients.

Variable	Immunocompetent Positive (%)	Immunocompromised Positive (%)	OR	95% CI	P-value
Gender: Male	25.2	26.7	1.28	0.78–2.09	0.326
Female	21.0	22.2			
Age ≤15 years	17.1	20.0	0.56	0.33–0.95	0.031
>15 years	27.1	29.2			
Educated	23.4	25.0	0.46	0.08–2.82	0.393
Non-educated	40.0	50.0			
Employed	27.2	29.6	1.29	0.79–2.13	0.311
Unemployed	22.0	23.7			
Family size 1–6	22.6	27.3	0.62	0.32–1.19	0.146
>6	33.3	36.4			
Handwashing Yes	23.9	28.6	0.31	0.02–5.02	0.384
No	50.0	50.0			
Nail clipping Yes	23.4	26.0	0.46	0.08–2.82	0.393
No	40.0	50.0			
Bloody stool Yes	100.0	100.0	5.68	4.52–7.15	<0.001
No	17.2	21.1			
Abdominal pain Yes	23.7	27.7	0.96	0.57–1.62	0.888
No	24.3	25.0			
Itching Yes	21.3	22.2	0.87	0.41–1.84	0.720
No	24.6	27.3			
Diarrhea Yes	31.2	35.5	37.1	5.1–270.8	<0.001
No	1.1	1.8			

tested positive for one or more intestinal parasites. The analysis included variables such as gender, age, and literacy status.

With regard to gender distribution, a slightly higher prevalence was observed in males compared to females. Specifically, 55 out of 214 male participants (25.7%) were positive, while 33 out of 155 females (21.3%) showed evidence of infection. Although the odds ratio (OR = 1.28; 95% CI: 0.78–2.09) suggested a modestly increased risk in males, the difference did not reach statistical significance ($p = 0.326$).

Age-wise stratification revealed a significant association between age and infection status. Participants aged above 15 years had a significantly higher infection rate of 27.4% (65/237) compared to 17.4% (23/132) among those aged 15 years or younger. The difference was statistically significant ($p = 0.031$), with an odds ratio of 1.79 (95% CI: 1.05–3.07), indicating that individuals over 15 years were nearly 1.8 times more likely to acquire parasitic infections.

When literacy status was analyzed, the infection rate among literate individuals was 23.6% (86/364), while among illiterate participants, it was 40.0% (2/5). Despite the higher observed prevalence in the non-educated group, the sample size was too small to draw definitive conclusions. The association was not statistically significant (OR = 0.46; 95% CI: 0.08–2.82; $p = 0.393$).

These findings highlight the influence of age and, to a lesser extent, gender on the prevalence of intestinal parasitic infections. While literacy status may play a role, larger sample sizes are needed for meaningful interpretation.

Macroscopic Examination

No mucus, worms, or larvae were observed in stool samples.

Microscopic Findings of Intestinal Parasites

Microscopic examination of stool samples in this study revealed that protozoan parasites were far more common than helminths. Giardia lamblia cysts were the most frequently detected, found in 11.7% of participants, followed by Entamoeba histolytica cysts in 9.5%. Trophozoite forms were rare, with only one case of Giardia trophozoite observed. Mixed infections were uncommon, with just one dual infection involving Giardia and Entamoeba. Helminths like Ascaris lumbricoides and Trichuris trichiura were each detected in only one case. Opportunistic protozoa, Cryptosporidium parvum and Cyclospora cayetanensis, were seen in a few immunocompromised individuals, stressing the need for focused screening (**Table 3**).

Table 3: Distribution of Identified Parasites and Their Morphological Forms in Stool Samples (n = 369).

Finding	Frequency	Percentage (%)
Giardia lamblia (cyst)	43	11.7
Entamoeba histolytica (cyst)	35	9.5
Giardia lamblia (trophozoite)	1	0.3
Giardia + Entamoeba histolytica	1	0.3
Ascaris lumbricoides (egg)	1	0.3
Trichuris trichiura (egg)	1	0.3
Cryptosporidium parvum (oocyst)	6	1.6
Cyclospora cayetanensis (oocyst)	1	0.3

Microscopic Descriptions of identified eggs/trophozoites/Cysts (Fig 3):

- Giardia lamblia cyst: Oval, 8–12 µm, thick wall, four nuclei, axostyles, and median bodies (fig 3A, B).
- Entamoeba histolytica cyst: Spherical, 10–20 µm, thin wall, 1–4 nuclei, rod-like chromatoid bodies (fig 3B & 3C).
- Trichuris trichiura egg: Barrel-shaped, 50–55 µm, polar plugs, brownish shell. (fig 3D)
- Cryptosporidium parvum oocyst: Spherical, 4–6 µm, red/pink on modified Ziehl-Neelsen staining (fig 3F)
- Cyclospora cayetanensis oocyst: Spherical, 8–10 µm, pink/red on modified Ziehl-Neelsen staining (fig 3E).

Microscopic Descriptions of identified eggs/trophozoites/Cysts {Fig 3(A-F)}:

Giardia lamblia cyst: Oval, 8–12 µm, thick wall, four nuclei, axostyles, and median bodies (Fig 3A, B).

Entamoeba histolytica cyst: Spherical, 10–20 µm, thin wall, 1–4 nuclei, rod-like chromatoid bodies (Fig 3B & 3C).

Trichuris trichiura egg: Barrel-shaped, 50–55 µm, polar plugs, brownish shell. (Fig 3D)

Cryptosporidium parvum oocyst: Spherical, 4–6 µm, red/pink on modified Ziehl-Neelsen staining (Fig 3F)

Cyclospora cayetanensis oocyst: Spherical, 8–10 µm, pink/red on modified Ziehl-Neelsen staining (Fig 3E).

Figure 3(A-F): Microscopic Examination Findings of

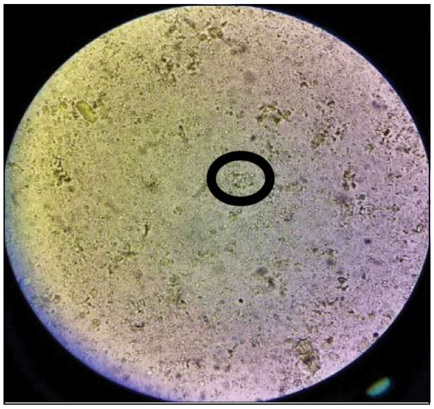

Fig 3A. Cyst of G. Lamblia

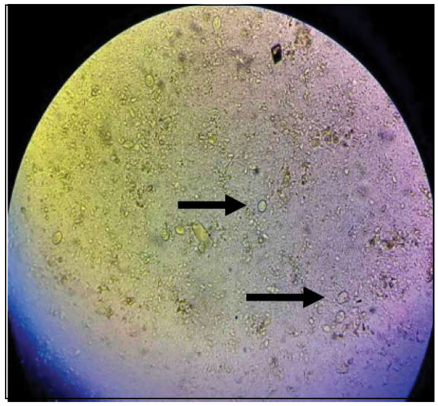

Fig 3B. Cyst of G. Lamblia & E.histolytica

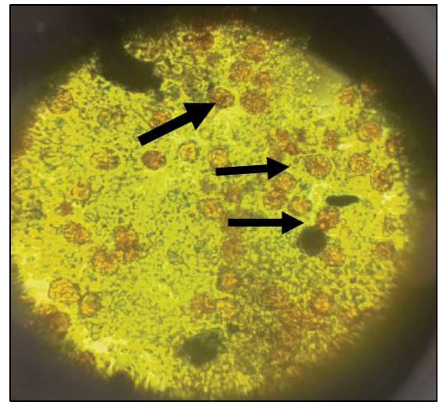

Fig 3C. Cyst of E.histolytica

Fig 3D. Egg of T.trichuris

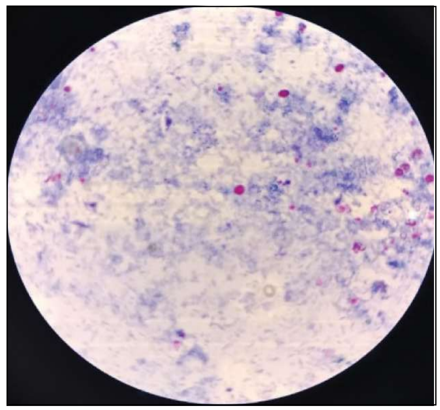

Fig 3E. Oocyst of C.cayentesis on modified ZN staining

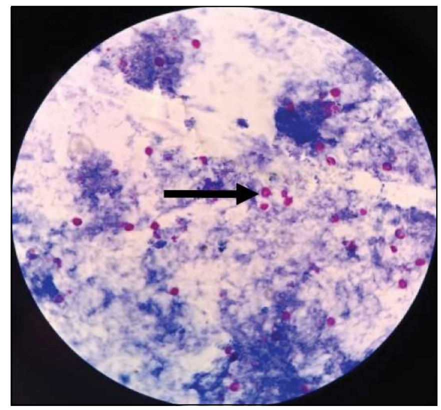

Fig 3F. Oocyst of C.parvum on modified ZN staining

Figure 3(A-F): Microscopic Examination Findings of stool for Parasite /Ova /Cyst/Eggs.

stool for Parasite /Ova /Cyst/Eggs.

Discussion

This study, conducted at a tertiary care hospital in Jammu, observed a prevalence rate of 23.8% for intestinal parasitic infections among symptomatic patients. This figure indicates that nearly one in every four individuals screened was affected by parasitic pathogens—an important public health concern. While this prevalence is consistent with findings from certain regions of India, it diverges significantly from others, underscoring the complex interplay between local environmental conditions, sanitation levels, hygiene practices, and healthcare accessibility.[5,8]

In the context of Jammu and Kashmir, our findings are somewhat lower than those reported in other regional studies. For example, a study reported a 28.4% prevalence among children in Kashmir[9], while another noted a much higher prevalence of 40% in rural South India [10]. Urban slum settings have shown even higher rates, such as the 52.8% reported in Bengaluru[11], reflecting the impact of poor sanitation and dense living conditions. The relatively lower prevalence in our setting may point to improved sanitation infrastructure and better health awareness in parts of Jammu. Nonetheless, the persistence of infections, particularly among certain subgroups, highlights ongoing challenges in health equity and disease prevention.

In Jammu and Kashmir, our findings were somewhat lower than those reported elsewhere. For instance, a study in Kashmir showed 28.4% prevalence among children[9]. while rural South India reported 40%[10], and urban slums in Bengaluru up to 52.8%[11]. Thesedifferences highlight variable local conditions affecting transmission. Improved sanitation and awareness in Jammu may partly explain the lower prevalence, yet infections among certain groups persist, indicating ongoing equity and control challenges.[8,12]

Demographically, our sample included a slightly higher proportion of males (58.0%) compared to females (42.0%). This pattern aligns with other regional hospital-based studies [12][13]. In contrast, community-based studies in Kashmir have shown a more balanced gender distribution[14][15], suggesting possible gender-based healthcare-seeking behavior discrepancies.

Age-wise, the majority of participants were adults (>15 years), representing 64.2% of the study population. This trend is consistent with previous studies[16]. The higher infection rate among adults (27.4%) compared to children (17.4%) in our study was statistically significant ($p = 0.031$), indicating greater risk in the adult population, possibly due to occupational exposure, consumption of food outside the home, and greater mobility.

The literacy rate among participants was notably high at 98.6%, significantly exceeding rates reported in rural or migrant populations. For instance, one study reported only 68.3% literacy among migrant laborers in Jammu[17]. High literacy likely correlates with better hygiene knowledge and preventive health behaviors, although the association between education and infection was not statistically significant in our analysis.

Despite high self-reported hygiene practices— 99.5% reported handwashing after toilet use and 98.6% reported regular nail clipping— these behaviors did not show statistically significant protective effects. This discrepancy aligns with findings from previous studies where observational methods revealed substantial over-reporting of hygiene practices [18]. Furthermore, infrastructural gaps such as the absence of soap at handwashing stations likely compromise effective hygiene[12].

Symptomatically, diarrhea (77.0%), persistent abdominal pain (69.9%), and bloody stool (7.6%) were the most commonly reported complaints. Of particular note, both bloody stool and diarrhea showed strong statistical associations with parasitic infections. Bloody stool had a 100% predictive value ($p < 0.001$), while diarrhea showed a striking contrast between symptomatic (30.6% positive) and asymptomatic individuals (1.2% positive), with an odds ratio of 37.093. These findings echo previous research highlighting Entamoeba histolytica in patients with bloody stools[13] and acute diarrhea as a hallmark symptom of giardiasis[14].

Interestingly, although persistent abdominal pain was common, it did not significantly correlate with infection status. Similar findings have been noted in diagnostic studies using more sensitive methods like ELISA and PCR[15], indicating that abdominal pain alone is a non-specific symptom.

Immunocompromised individuals in our cohort had a notably higher infection prevalence (36.0%) compared to immunocompetent participants (23.0%), although this difference did not reach statistical significance ($p = 0.140$). Nonetheless, the trend is consistent with broader literature reporting significantly higher parasitic burden in HIV-positive and transplant patients [16][17]. Internationally, elevated susceptibility to parasites like Cryptosporidium and Strongyloides in immunocompromised individuals has also been reported[18].

Microscopically, Giardia lamblia (11.7%) and Entamoeba histolytica (9.5%) were the predominant pathogens identified. These protozoans have also been highlighted in previous Indian studies[18]. Seasonal peaks in Giardia infections in Jammu, particularly during the monsoon months, have also been reported [16]. Helminthic infections such as Ascaris lumbricoides and Trichuris trichiura were rare (0.3% each), reflecting the success of national deworming initiatives. Post-MDA surveys in Jammu and Udhampur show a consistent decline in soil-transmitted helminth (STH) prevalence to below 1%[17].

Opportunistic infections caused by Cryptosporidium parvum (1.6%) and Cyclospora cayetanensis (0.3%) were also detected. These findings align with other Indian studies from tertiary care centers[10]. The lower prevalence of Cyclospora is consistent with national surveillance data and regional studies in northern India[14].

Overall, our study emphasizes the continued burden of intestinal parasites in both immunocompetent and vulnerable populations, the importance of accurate symptom screening, and the need for ongoing public health vigilance, especially in settings where environmental and behavioral risk factors persist.

Conclusion

The present study highlights that intestinal parasitic infections (IPIs) continue to pose a considerable public health challenge in Jammu, with an overall prevalence of 23.8% among patients attending a tertiary care hospital. This significant burden, despite ongoing efforts to improve sanitation and hygiene, suggests persistent environmental transmission and points to the need for more comprehensive control measures. Notably, the infection rate was substantially higher among immunocompromised individuals (36.0%), underscoring their increased susceptibility and the importance of proactive screening in this vulnerable group. Protozoan infections, particularly those caused by Giardia lamblia (11.7%) and Entamoeba histolytica (9.5%), were the most common, aligning with findings from other urban and semi-urban regions across India. In contrast, soil-transmitted helminth infections were rarely encountered (0.3% each for Ascaris lumbricoides and Trichuris trichiura), likely reflecting the success of nationwide deworming programs and improved sanitation practices.

Opportunistic parasites such as Cryptosporidium parvum and Cyclospora cayetanensis were found predominantly in immunocompromised patients, reinforcing the need for heightened clinical vigilance and routine stool screening in such populations. Furthermore, the presence of gastrointestinal symptoms particularly diarrhea and blood in stool was strongly associated with IPI positivity, with all patients reporting bloody stools testing positive for parasites. This highlights the diagnostic importance of symptom-based screening. Adults over 15 years of age had a higher prevalence (27.4%) compared to children (17.4%), possibly due to greater occupational and environmental exposure. Interestingly, many participants claimed to practice good hygiene; however, continued IPI prevalence suggests that self-reported behaviors may not reflect true practice or that environmental factors remain significant.

Based on these findings, we recommend strengthening health education, expanding deworming programs, screening high-risk groups, and improving diagnostic capabilities to effectively reduce the IPI burden in the region.

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Conflict of Interest: Nil

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