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Prevalence of intestinal parasitic infections among patients attending a tertiary care hospital from August 2022 to May 2024

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ABSTRACT

Objective: To determine the prevalence of intestinal parasitic infections and to identify temporal trends over a two-year period among patients attending a tertiary care hospital.

Methods: A retrospective study was conducted in the Microbiology Department, AIIMS Kalyani, West Bengal. Stool samples sent for diagnostic screening from August 2022 to May 2024 were included in the analysis. Complete patient details and blood parameters were retrieved from hospital records.

Results: Out of the 532 subjects, 64.7% were males and 35.3% were females, with 39.8% of the children aged between 0-18 years. The prevalence of intestinal parasitosis was 6.8%. The highest prevalence of parasitosis was observed in the age group over 60 years, followed by 46-60 age year group, at 14.1% and 9.5% respectively. The lowest prevalence was found in the age group of 31-45 years at 2.2%. *Entamoeba histolytica/dispar* showed the highest prevalence at 61.1%, followed by *Giardia* spp. at 16.7%. Multi-parasitism was observed in only 2.8 % of the subjects.

Conclusions: There was an annual increase in the trend of intestinal parasitic infections over the 2 year period from 2022 to 2024. Therefore, important interventions are warranted, such as enhancing sanitary conditions, implementing periodic deworming programs, and educating the public about the risks of faecal contamination of water, the importance of drinking boiled water, and promoting environmental hygienic practices.

KEYWORDS: Intestinal parasite; Concentration methods; *Entamoeba* spp.; Multi-parasitism

1. Introduction

An estimated 3.5 billion individuals worldwide are affected by intestinal parasitic infections, with 450 million suffering from illness and over 200 000 dying each year[1]. In underdeveloped nations, intestinal parasitic infections are among the most common illnesses in people. Compared to helminths, protozoan parasites are more frequently responsible for gastrointestinal illnesses in developed nations[2]. The World Health Organization (WHO) estimates that intestinal parasites like soil-transmitted helminths may infect around 21% of India's population, and that helminths are responsible for 39 million disability-adjusted life years of illness worldwide[3]. Gut parasites may infect up to 60% of the global population, and they have a significant impact on morbidity and death rates particularly in the paediatric population[4].

According to a WHO report, intestinal amoebiasis caused by the protozoan parasite *Entamoeba* (*E.*) *histolytica* is thought to affect nearly 50 million people globally and is a leading cause of morbidity and mortality, followed by Giardiasis and Cryptosporidiosis[5].

Significance

In developing countries like India, intestinal parasitic infections still remain the most important public health concern. It is presumed that the prevalence is high in developing countries probably due to poor sanitary conditions and improper personal hygiene practice. The aim of this study was to determine the prevalence of intestinal parasitic infections and to identify temporal trends over a two-year period among patients attending a tertiary care hospital. Intestinal parasitic infections increased over the the study period, highlighting the importance of implementing effective interventions to mitigate the risk of intestinal parasitic infections.

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Ascaris lumbricoides (20%), hookworm (18%), *Trichuris trichiura* (10%), and *E. histolytica* (10%) are the most prevalent parasitic infections documented worldwide[3]. Prevalence data are crucial for implementing effective control measures. Developing targeted prevention measures against intestinal parasites infections (IPIs) may also benefit from an awareness of age-related trends, temporal trends, and seasonality patterns. In this study, a retrospective analysis was performed to establish the prevalence of intestinal parasitic infections and to determine any age-related or temporal trends among patients attending a tertiary care hospital in West Bengal's Nadia district during a two-year period.

2. Subjects and methods

A retrospective study was conducted in the Microbiology Department of a tertiary care hospital in Kalyani, Nadia district, West Bengal. Stool samples sent to the parasitology laboratory for diagnostic screening from August 2022 to May 2024 were included. Full details regarding age, gender, residence and blood parameters were retrieved from the Health Management Information System and the results of stool microscopy were obtained from the laboratory records maintained in the department.

Patients were provided with wide-mouthed, clean, dry, screw-capped plastic containers for stool samples collection. Three consecutive stool samples were collected from each patient but only one patient was counted and enrolled for the purpose of the study. The fresh stool samples were examined within 1-2 hours of collection. Macroscopic examination was conducted to identify structures such as proglottids, scolices, adult tapeworm, and adult parasites of *Enterobius*, *Ascaris*, *Trichuris* and hookworms. Direct and concentration methods were done on the stool samples before microscopy. Unstained saline mount procedures were used to detect trophozoites, eggs, or larvae, as well as motility, while iodine mounts were used to detect eggs or cysts and examine their internal structures.

Saline (0.85%) and iodine (Lugol's) wet mounts were made on the same slide within an hour of receiving the fresh stool samples in order to identify trophozoites, cysts, eggs and larvae of helminths[6]. At first, a low magnification objective lens (10× magnification) was used for screening. If anything suspicious was found, it was examined under high magnification (40×) for confirmation. Two separate observers screened these. Modified acid fast staining was done for identification of intestinal coccidian parasites and trichrome staining done for the rest of the parasites in the permanent staining methods[4]. The identification of interior structures validated the diagnosis. After being collected, all of the samples were processed within 1-2 hours.

Stool concentration techniques, including salt flotation and formal ether sedimentation (Allen-Ridley) were done. Wet mounts and stained smears were examined for the existence of parasitic trophozoites, larvae, cysts and ova.

A resident working in the department's parasitology lab and the laboratory technician independently screened each smear. A consultant microbiologist with a master's degree in microbiology cross-checked all the positive slides and 10% of the negative slides to confirm the positivity.

3. Results

3.1. Demographic distribution

The result included all participants, both rural and urban, whose stool samples were received during the study period. A total of 532 subjects were included in the study consisting of 344 males (64.7%) and 188 females (35.3%). Among them, there were 212 children (39.8%) aged between 0-18 years. A comprehensive overview of baseline demographic data is provided in Table 1. The age group that showed the highest prevalence of parasitosis was >60 years (14.1%), followed by 46-60 years (9.5%), while the lowest prevalence was found in the 31-45 year age group (1.1%). *E. histolytica/dispar* was the predominant parasite among all age groups. The parasitosis rate among children was found to be 6.6% (Table 2).

3.2. Overall prevalence of intestinal parasites

The overall prevalence of intestinal parasites in the studied population was estimated to be 6.8% (36/532). Figure 1 shows that the prevalence of *E. histolytica/dispar* was the highest (61.1%), followed by *Giardia* spp. (16.7%), *Strongyloides* (*S.*) *stercoralis* (13.9%) and hookworm (5.6%). *Cryptosporidium* spp. and *Blastocystis* spp. together accounted for 2.8% of the entire total positive sample. No significant age associated trend was found for *Blastocystis* spp. and none of the samples from the 0-5 year age group tested positive for *Blastocystis* spp. The potential for *Blastocystis* spp. as a pathogen is in debate.

3.3. Parasite prevalence by sex and age

Prevalence of IPIs in males and females were 7.0% and 6.4%, respectively. Males had a higher prevalence of *Entamoeba* (54.2%) compared to other parasites (45.8%), while females had a higher prevalence of *Entamoeba* (75.0%) compared to other parasites (25.0%) shown in Table 3. However, the difference is not statistically significant (P=0.227). The mean age for participants diagnosed with *Entamoeba* was 34.0±25.5 years and 36.4±28.7 years for other parasites. *Entamoeba* was found in 69.2% of participants under the age of 18, compared to 56.5% for those aged 18 or older. The differences are not statistically significant (P=0.242, 95%*CI*: -0.139 to 0.213). Prevalence of parasitic infections by age and sex is provided in Table 2 and the comparison of microbiological diagnosis of the participants with respect to selected socio-demographic variables is provided in Table 3.

Table 1. Baseline demographic data [*n* (%)].

Age group	Male	Female	Total
0-5 years	61 (17.7)	37 (19.7)	98 (18.4)
6-18 years	70 (20.3)	44 (23.4)	114 (21.4)
19-30 years	39 (11.3)	31 (16.5)	70 (13.2)
31-45 years	62 (18.0)	29 (15.4)	91 (17.1)
46-60 years	62 (18.0)	33 (17.5)	95 (17.9)
>60 years	50 (14.5)	14 (7.5)	64 (12.0)
Total	344 (64.7)	188 (35.3)	532
Mean age ± SD	37.2 ± 18.7	33.5 ± 16.3	35.7 ± 17.8

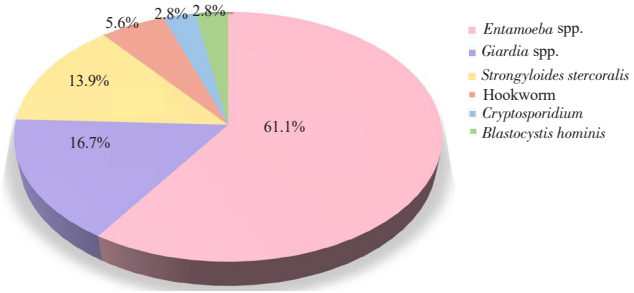

Figure 1. Relative prevalence of intestinal parasite.

3.4. Clinical symptoms and eosinophilia

Most positive cases presented with symptoms such as abdominal pain and frequent loose stools (4-6 episodes in 24 hours). Absolute eosinophil counts (AEC) were elevated in 10.3% of the positive cases, with AEC values ranging from 180 to 1 500 cells/μL, and the mean AEC being 1 725 cells/μL. Elevated eosinophil counts were more frequently associated with helminthic infections.

3.5. Inpatient and outpatient distribution

Out of the 36 positive cases, 25 were from the In Patient Department (IPD), with 11 were from Medicine, 10 from Paediatrics and 3 from Pulmonary Medicine Department. The 11 positive cases were from the Out Patient Department (OPD), with 8 were from Medicine and 3 from Paediatrics departments. Only 2.8% of specimens showed multi-parasitism (1/36) in all stool positive specimens screened. The combination detected was *Giardia intestinalis* and *Entamoeba* spp. in a 72-year-old male patient. Multiple parasitic infections were not frequent among children or in other age groups.

3.6. Seasonal and temporal trends

The highest prevalence of parasite was recorded in November for both 2022 and 2023 (25.0% and 11.5%, respectively), while the highest prevalence in first half of 2024 (January to May) was found in April (15.6%). Prevalence of IPIs increased from 6.8% to 8.2% over 2 years. A month-wise breakdown of the prevalence of various intestinal parasites from 2022 to 2024 is shown in Figure 2. The study also revealed seasonal variations with the highest prevalence in autumn (9.3%) and lowest in the months of monsoon (3.8%) among the total samples received. Temporal trends show changes in the overall prevalence of different parasitic infections over time: *Entamoeba* spp. increased from 20.5% to 30.8%, with a statistically significant (*P*=0.012, 95%*CI*: 0.045-0.115), suggesting a real increase in prevalence. *Giardia* spp. decreased from 7.7% to 2.6%, with a significant *P*-value of 0.025 and a 95%*CI* of -0.104 to -0.032, indicating a true decrease in infection rate. *S. stercoralis* decreased from 7.7% to 5.1%, but the *P*-value of 0.065 suggests this change was not statistically significant (95%*CI*: -0.091 to 0.001).

However, there were no significant linear changes observed for *Cryptosporidium* and hookworm. The breakdown of seasonal variation and annual increasing trend are shown in Table 4.

3.7. Statistical analysis

It was done using *Chi*-square test which is illustrated in Table 3. For comparison of non-parametric continuous variables Wilcoxon Rank Sum test was used. A significant difference was noted with respect to the ward (*P*=0.043). Among those diagnosed with *Entamoeba*, 72.0% were from IPD, while 63.6% of those with other parasites were from OPD. The *P*-value indicates statistical significance, with a value below 0.05 considered significant. In this case, the only significant difference was observed in the distribution by ward (OPD *vs*. IPD). This may be due to patients admitted to the hospital have more severe or complicated infections, leading to serious gastrointestinal symptoms that require hospitalization that explains the higher prevalence of *Entamoeba*. Positive findings from the study are illustrated in Figure 3.

Table 2. Prevalence of parasitic infections by age and sex [*n* (%)].

Age group	Male		Females		Total positive	*P*
	Positive (%)	95%*CI*	Positive (%)	95%*CI*		
0-5 years	4/61 (6.5)	0.35-12.77	3/37 (8.1)	0.00-12.69	7/98 (7.1)	0.604
6-18 years	3/70 (4.3)	0.00-9.03	4/44 (9.1)	0.60-7.59	7/114 (6.1)	0.298
19-30 years	2/39 (5.1)	0.00-16.06	1/31 (3.2)	0.00-9.45	3/70 (4.3)	0.767
31-45 years	1/62 (1.6)	0.00-7.62	0/29 (0.0)	0.00-0.00	1/91 (1.1)	**0.003**
46-60 years	6/62 (9.7)	2.32-17.04	3/33 (9.1)	0.00-18.90	9/95 (9.5)	0.133
>60 years	8/50 (16.0)	5.84-26.16	1/14 (7.1)	0.00-20.63	9/64 (14.1)	0.926
Total	24/344 (7.0)	4.76-10.35	12/188 (6.4)	2.83-9.87	36/532 (6.8)	0.242

Table 3. Comparison of microbiological diagnosis [*n* (%)].

Variables	*Entamoeba* (*n*=22)	Other parasites (*n*=14)	*P*	95% *CI*
Sex				
Male	13 (54.2)	11(45.8)	0.227	-0.044 to 0.157
Female	9 (75.0)	3 (25.0)		
Age (years)				
< 18	9 (69.2)	4 (30.8)	0.242	-0.139 to 0.213
≥ 18	13(56.5)	10 (43.5)		
Ward				
OPD	4 (36.4)	7 (63.6)	**0.043**	0.021 to 0.128
IPD	18 (72.0)	7 (28.0)		

OPD: Out Patient Department; IPD: In Patient Department.

Table 4. Seasonal variations in intestinal parasite prevalence [*n* (%)].

Seasonal variations	Total sample	Total positive
Monsoon (mid June-mid Sept)	132	5 (3.8)
Autumn (mid Sept-mid Nov)	75	7 (9.3)
Winter (mid Nov-Jan)	81	6 (7.4)
Spring (Feb-March)	141	9 (6.4)
Summer (April-mid June)	125	10 (8.0)
August 2022-July 2023	249	17 (6.8)
August 2023-May 2024	305	26 (8.5)

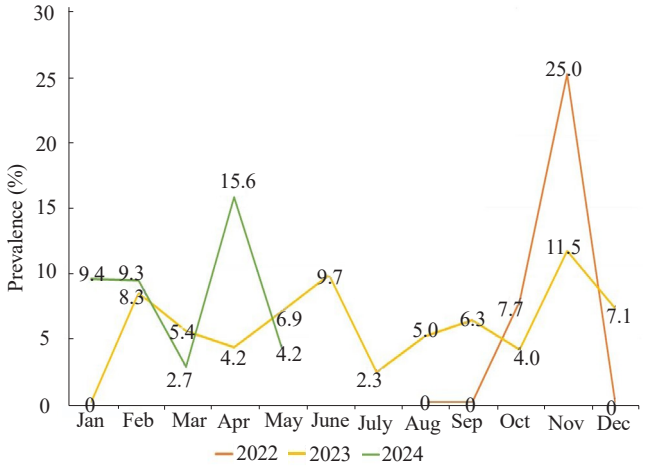

Figure 2. Month wise intestinal prevalence (2022-2024).

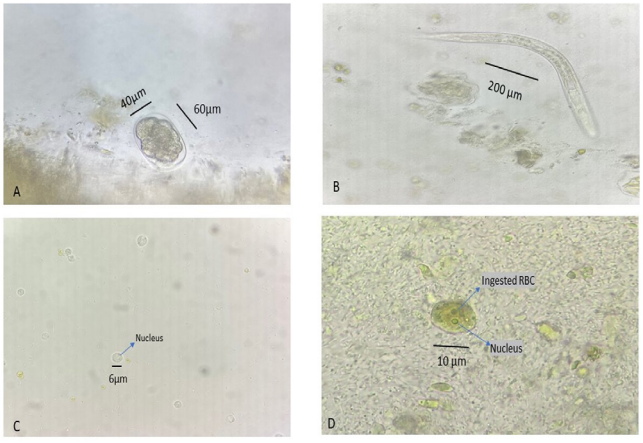

Figure 3. Fertilised egg of hookworm, filariform larva of *Strongylodies stercoralis*, cystic stage of *Entamoeba* spp., trophozoite stage of *Entamoeba* spp.

4. Discussion

The overall prevalence of intestinal parasitic infections over the two-year period (August 2022-May 2024) was 6.8% which is comparable to other studies done in other tertiary care hospitals in India[3]. This was lower than reports from the Indian subcontinent and elsewhere in the developing world. This discrepancy can result from the setting, as many patients may have received community-based treatment before stool sample collection. In a similar hospital-based study of intestinal parasites from a tertiary care hospital, South India, Ira praharaj *et al.* reported a total of 8.9% of the total samples screened to be positive for intestinal parasites[3]. Another study by Masucci *et al.* reported a total of 11.1% to be positive for intestinal parasites[7]. Our prevalence estimates were lower than studies from western Maharashtra where overall prevalence of intestinal parasitosis was found to be 49.4% and a tertiary care hospital from rural Haryana where overall prevalence was 17.5%[8,9].

In our setting, *E. histolytica/dispar* was the major parasite (61.1%) overall, followed by *Giardia intestinalis* (16.7%) and *S. stercoralis* (13.9%). According to other research, *Giardia intestinalis* was the most prevalent parasite, followed by *Entamoeba* spp.[3] This may be caused by variations in the incidence of intestinal parasites between geographical areas.

In our study, the prevalence of IPIs in males and females were 7.0% and 6.4%. This was similar with other studies that reported males having a higher prevalence of parasitic infection compared to females by Sethi *et al.*[10]. This can be better explained as women are involved in household work and men in this region are engaged in field work and handling of livestock thus more exposed to contaminated water and soil, a major predisposing factor for infection.

The present study also reveals seasonal variations in the prevalence of IPIs, with the highest prevalence (9.3%) in autumn (mid September-mid November); and lowest (3.8%) in the months of monsoon (mid June to mid September) which is different from Hemant Kumar *et al.* where highest prevalence was recorded in autumn season (80.5%) and lowest in spring (43.9%)[8].

The current study also revealed elevated AEC in 10.3% of patients who were diagnosed positive for STH. AEC ranged from 180 to 1 500 cells/mm^3. Helminthic infections can be predicted by eosinophilia, as it is an indicator of a T-helper type 2 cell response[11]. Therefore, even in asymptomatic people with elevated AEC, intestinal parasite infection may be suspected.

In the trend analysis, there was increase in prevalence of IPIs from 6.8 % to 8.2 % in a period of 2 years. There was an increase in trend of *E. histolytica/ dispar* from 20.5 % to 30.8%, while decrease in trend of *Giardia* from 7.7% to 2.6% and *Strongyloides* from 7.7% to 5.1%. This is may be due to the preventive measure of national deworming day that was started in India from 2015 which covered the adolescent age group and remaining age groups may be due to improvement in living and sanitary conditions.

If the age factor is considered, highest percentage of parasitosis in our study were in the age group >60 year group (14.1%) followed by 46-60 years (9.5%), 6-18 years (6.1%), 0-5 years (7.1%), 19-30 years (4.3%) and 31-45 years (1.1%). A study by J. Sangwan *et al.* showed the burden of IPI in patients attending tertiary care hospital in rural Haryana have also found similar pattern[9]. This can be due to the elderly and children's lower immunity. Furthermore, overcrowding, increased outdoor activity, and exposure to contaminated surroundings raise the incidence of these diseases among children and young adults[10].

In this investigation, multiple IPIs were uncommon. In a Laos People's Democratic Republic study, it was discovered that 86.6% of the individuals had two or more intestinal parasites at the same time[12]. A study conducted in Karachi by Mehraj *et al.* found that 10.0% of all children who were screened for intestinal parasites had two or more parasites at a same time[13]. To determine the true burden of intestinal multi-parasitism, it may be necessary to use various diagnostic procedures and screen many samples[14].

The limitation of our study was the difficulty to differentiate between *E. dispar* and *E. histolytica* cysts, as they have similar microscopic appearances and we have done only microscopy for the routine diagnostic tests. Furthermore, we have used only 2-year data of patients attending our hospital, which result in a smaller

percentage of total samples. We have used only microscopic techniques for the identification of parasites and a follow up sample after treatment was not taken. Microscopy has its drawbacks as the results might be under estimated because the diagnosis depends on the intensity of infection and also it is labor-intensive. Additionally, we haven't included other methods like serology and molecular methods like Polymerase Chain Reaction, which is another limitation of our study.

5. Conclusions

There was an increase in trend of IPIs within this two-year study. As a result, important interventions such as enhancing sanitary conditions, periodic deworming, mass screening, awareness creation campaigns, and educating the public about faecal contamination of water and the importance of drinking boiling water, personal and environmental hygienic practices are warranted. To gain an accurate understanding of the parasite burden in this area, it may be required to conduct larger sample sizes and longitudinal studies with more parameters and more advanced diagnostic modalities.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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Data availability statement

The data supporting the findings of this study are available from the corresponding author upon request.

Authors' contributions

Bhaumik S searched for articles, Nayak G collected and interpreted the data, Kshetrimayum A created the tables and figures, Rajkumari N drafted and revised the manuscript. Ghoshal U and Chatterjee SS also contributed to the study design and review. Nonika R supervised entire process of the research study from development of the tool to the data analysis. All authors approved the final version of the manuscript.

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