Pattern of Parasitic Infestations in Patients with Persistent Lower Gastrointestinal Symptoms in Ismailia Governorate

Ahmad Samir Helmy Seddik [1], Nader Attia Elnemr [2], Nayera Sayed Attik [3], Nageh Louis Mahrous [2]

[1]Department of Endemic Disease, Gastroenterology and Hepatology, Ismailia Medical Complex, Egypt.
[2]Department of Endemic and Infectious Diseases, Faculty of Medicine, Suez Canal University, Ismailia,, Egypt.
[3]Department of Parasitology, Faculty of Medicine, Suez Canal University, Ismailia, Egypt.

Corresponding Author
Ahmad Samir Helmy Seddik
Tel. +2 01146990079
E-mail:
Ahmadsamirnasri007@gmail.com

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Background and study aim: Intestinal parasitic infections remain common worldwide and contribute substantially to morbidity, particularly in low-resource settings. We aimed to define the pattern of parasitic infestations among adults presenting with persistent lower gastrointestinal (GI) symptoms at two primary health care centers, one rural and one urban, in Ismailia Governorate, Egypt.

Patients and Methods: We conducted a cross-sectional study of 300 adults (≥18 years) with lower-GI symptoms persisting >2 weeks who attended Hai El-Salam (urban) and El-Abtal (rural) primary health care centers. Fresh stool specimens were examined by direct microscopy. Baseline demographics, clinical features, and laboratory parameters (complete blood count including eosinophilia) were recorded. Abdominal examination and pelvi-abdominal ultrasonography were performed.

Results: Nine parasitic species were identified. The most frequent was *Entamoeba histolytica* in 18/300 (6%). Other detections included *E. coli* (commensal) 16 (5.3%), *Hymenolepis nana* 15 (5.0%), *Giardia duodenalis* 15 (5.0%), *Cyclospora cayetanensis* 15 (5.0%), *Enterobius vermicularis* 15 (5.0%), *Cryptosporidium parvum* 12 (4.0%), and *Microsporidia* 11 (3.7%); mixed infections also occurred. Infected patients more often reported abdominal bloating (51.7% vs 39.9%) and excessive flatus (51.0% vs 39.2%); both differences were significant (P=0.04 for each). White blood cell count and eosinophilia were higher among infected participants (P<0.001), and platelet count was lower (P=0.02). No significant rural–urban difference in overall infection prevalence was observed (P=0.70).

Conclusion: Among adults with persistent lower-GI symptoms in primary care, intestinal parasites were common, with *E. histolytica* most prevalent. Bloating and flatus were associated with infection, whereas residence (rural vs urban) was not. Strengthening parasite prevention and timely diagnosis in primary care may reduce symptom burden.

INTRODUCTION

The term "gastrointestinal disorders" describes illnesses that influence the small and large intestines, stomach, and rectum, among other parts of the gastrointestinal system. Numerous symptoms, involving dyspepsia, bloating, constipation, nausea, vomiting, diarrhea, and stomach pain, are linked to them. It has been demonstrated that intestinal parasites are associated with the symptoms of gastrointestinal illnesses and are more prevalent in individuals with these conditions [1]. Infections with parasites are more likely to cause lower gastrointestinal symptoms, including diarrhea, constipation, and lower abdominal discomfort, than higher ones [2].

Although intestinal parasite infestations are a prevalent health issue observed worldwide, they are more common in tropical regions, particularly in communities with low socioeconomic status, such as those with open defecation, limited water supplies, poor sanitation, and poor personal hygiene [3].

In Egypt, the total prevalence of adult parasite illnesses ranges from 46.2% to 50%, with rural regions having a higher frequency than urban ones. The two most common parasites are E. histolytica and Blastocystis species [4].

The principal protozoan pathogens responsible for intestinal parasitic infections include Cryptosporidium spp., Cyclospora cayetanensis, Cystoisospora belli, Giardia lamblia, Entamoeba histolytica, and Microsporidia spp. In contrast, common intestinal helminths comprise Ascaris lumbricoides, Trichuris trichiura, hookworms, Strongyloides stercoralis, Enterobius vermicularis, Taenia spp., and Hymenolepis nana [5].

Helminth infections are known to skew host immunity toward a T-helper (Th2-dominant) response, with low-grade inflammation reported in a subset of affected individuals; in line with the "hygiene hypothesis," prior reviews have suggested that higher helminth exposure may modulate immune reactivity and influence disease incidence [6].

Although the evidence is heterogeneous, several studies implicate intestinal parasites as contributors to persistent lower gastrointestinal (GI) symptoms. To inform primary care practice and symptom-directed prevention strategies, this study aimed to characterize the spectrum of parasitic infestations among adults presenting with persistent lower-GI complaints and to explore their clinical correlates.

PATIENTS AND METHODS

This cross-sectional study was conducted between June 2024 and June 2025 at two primary health care centers in Ismailia Governorate, Egypt: Hai El-Salam (urban) and El-Abtal (rural). Both centers serve heterogeneous populations and represent distinct sociodemographic settings, allowing assessment of potential differences between rural and urban residents.

Study population

A total of 300 adult patients (≥18 years) presenting with persistent lower gastrointestinal (GI) symptoms lasting more than two weeks were enrolled. Symptoms included diarrhea, abdominal pain, bloating, excessive flatus, or altered bowel habits. Patients who had received antiparasitic therapy within the preceding four weeks, or who had known chronic GI disorders (such as inflammatory bowel disease, celiac disease, or irritable bowel syndrome), were excluded to minimize confounding.

Clinical and Radiological Assessment

All participants underwent a detailed clinical evaluation, including a history of presenting symptoms, duration, and associated factors. They also underwent a physical examination with special emphasis on abdominal findings. Pelvi-abdominal ultrasonography was conducted when indicated to exclude other intra-abdominal pathology.

Laboratory investigations

Fresh stool specimens were collected from each participant in sterile, wide-mouthed containers. Samples were processed promptly and examined by direct wet mount and iodine-stained preparations. Where relevant, concentration techniques and modified acid-fast staining were applied to detect protozoal oocysts and helminthic eggs. Standard parasitological identification criteria were used. In addition, venous blood samples were obtained for complete blood count (CBC), with particular attention to leukocyte count, hemoglobin concentration, platelet count, and peripheral eosinophilia.

Management

Following confirmation of stool examination results, patients were counseled and specific antiparasitic therapy was prescribed according to the identified parasite and prevailing treatment guidelines.

RESULTS

In this study, we included 300 patients suffering from persistent lower gastrointestinal symptoms for more than two weeks. The mean age of the study participants was 36.37±12.99 years, ranging from 18 to 64. Regarding gender, it was found that 158 (52.7%) were males, while 142 (47.3%) were females. Slightly more than half of the participants, 167 (55.7%), were from rural areas, while 133 (44.3%) were from urban areas. The majority of participants, 146 (48.7%), were employed, 82 (27.3%) were farmers, while only 72 (24%) were not working. Regarding marital status, about half of the participants, 160 (53.3%), were married, 87 (29%) were singles, 36 (12%) were widowed, and only 17 (6.7%)

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were divorced. The majority of participants, 224 (71.3%), were nonsmokers, and only 86 (28.7%) were smokers (Table 1).

Regarding the participants' presenting symptoms, 56.7% presented with abdominal colic, 45.7% with abdominal bloating, 26.7% with diarrhea, 30% with constipation, 50.7% with tenesmus, 48% with burping, 45% with flatus, 48% with mucus in stool, 16.7% with blood in stool, and 36.7% with normal bowel habits (Figure 1).

Regarding the infection status, 153 (51%) had no infection, 83 (27.7%) were naive, and 64 (21.3%) had recurrent infections (Figure 2).

Concerning the parasitic infections, it was found that the most common parasitic infection found was E. histolytica in 18 (6%), followed by E. coli in 16 (5.3%), then by H. nana in 15 (5%), G. duodenalis in 15 (5%), C. cayetanensis in 15 (5%), E. vermicularis in 15 (5%), C. parvum in

12 (4%), Microspora in 11 (3.7%), G. duodenalis, C. cayetanensis in 5 (1.7%), E. vermicularis, E.coli in 5 (1.7%), E. histolytica, E. coli in 4 (1.3%), E. histolytica, G. duodenalis in 4 (1.3%), E. coli, G. duodenalis in 4 (1.3%), E. coli, E. histolytica in 1 (0.3%), C. parvum, E. coli in 1 patient (0.3%), and C. parvum, E. coli in 1 patient (0.3%) (Figure 3).

There was statistically insignificant variance among the two groups regarding infection status or medical history (Table 2). However, there was statistically significant variance among the two groups regarding abdominal bloating (p=0.04) and flatus (p= 0.04) (Table 3).

There was statistically significant variance among the two groups regarding platelets (p= 0.02), WBCs (p=0.00), and the presence of eosinophilia (p= 0.00) (Table 4).

There was statistically insignificant variance between the rural and urban residences regarding parasitic infections (p= 0.70) (Table 5).

Table (1). Demographic characteristics of study participants.

Variables		**All patients (n = 300)**	
Age (Years)	**Mean ± SD**	36.37±12.99	
	Range (Min-Max)	46 (18-64)	
		Number (N)	**Percentage (%)**
Gender	**Male**	158	52.7
	Female	142	47.3
Residency	**Urban**	133	44.3
	Rural	167	55.7
Occupation	**Employer**	146	48.7
	Farmer	82	27.3
	Not working	72	24
Marital status	**Single**	87	29
	Married	160	53.3
	Widowed	36	12
	Divorced	17	5.7
Smoking	**Nonsmokers**	214	71.3
	Smokers	86	28.7

SD = standard deviation, Min = minimum; Max = maximum.

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Table (2). Comparison of infection status and demographic characteristics of study participants.

		No parasitic infection (n= 153)	Parasitic infection (n= 147)	Test value	P value
Age (Years)	36.56 ± 13.69		36.18 ± 12.28	0.25[1]	0.80
Gender	**Male**	74	84	2.32[2]	0.13
	Female	79	63		
Residency	**Urban**	68	65	0.00[2]	0.97
	Rural	85	82		
Occupation	**Employer**	72	74	0.46[2]	0.79
	Farmer	42	40		
	Not working	39	33		
Marital status	**Single**	44	43	2.03[2]	0.57
	Married	83	77		
	Widowed	20	16		
	Divorced	6	11		
Smoking	**Nonsmokers**	109	105	0.00[2]	0.97
	Smokers	44	42		

1. Independent t-test ; 2. Chi square test.

Table (3). Comparison of infection status and presenting symptoms of study participants.

		No parasitic infection (n= 153)	Parasitic infection (n= 147)	Test value	P value
Abdominal colic	**Yes**	90	82	0.28[1]	0.59
	No	63	65		
Abdominal bloating	**Yes**	61	76	4.23[1]	**0.04***
	No	92	71		
Diarrhea	**Yes**	84	86	0.39[1]	0.53
	No	69	61		
Constipation	**Yes**	69	61	0.39[1]	0.53
	No	84	86		
Tenesmus	**Yes**	76	76	0.12[1]	0.73
	No	77	71		
Burping	**Yes**	69	75	1.05[1]	0.30
	No	84	72		
Flatus	**Yes**	60	75	4.22[1]	**0.04***
	No	93	72		
Mucus in stool	**Yes**	69	75	1.05[1]	0.30
	No	84	72		
Blood in stool	**Yes**	52	46	0.43[1]	0.62
	No	101	101		

1. Chi square test *Statistically significant asp<0.05.

Table (4). Comparison of infection status and laboratory findings of study participants.

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		No parasitic infection (n= 153)	Parasitic infection (n= 147)	Test value	P value
Hb (g/dl)		10.74 ± 1.13	10.79 ± 1.24	0.34[1]	0.71
Platelets (×10³/mm³)		283.04 ± 68.93	262.56± 77.01	2.43[1]	**0.02***
WBCs (×10³/mm³)		6.98 ± 2.42	10.77± 2.74	12.68[1]	**0.00***
WBCs	**No eosinophilia**	153	118	33.41[2]	**0.00***
	Eosinophilia	0	29		

Hb = hemoglobin; WBCs = white blood cells.

1. Independent t-test ; 2. Chi square test.

*Statistically significant asp<0.05.

Table (5). Comparison of parasitic infections regarding the residence of study participants.

	Rural (n= 28)	Urban (n= 27)	Test value	P value
C. parvum, E. coli	0	1	5.135[1]	0.70
C. parvum, G. duodenalis	2	1		
E. coli, E. histolytica	3	2		
E. coli, G. duodenalis	3	3		
E. histolytica, G. duodenalis	3	1		
E. vermicularis, E.coli	2	3		
G. duodenalis, C. cayetanensis	4	1		
H. nana, Microspora	11	15		

1. Fisher's Exact test.

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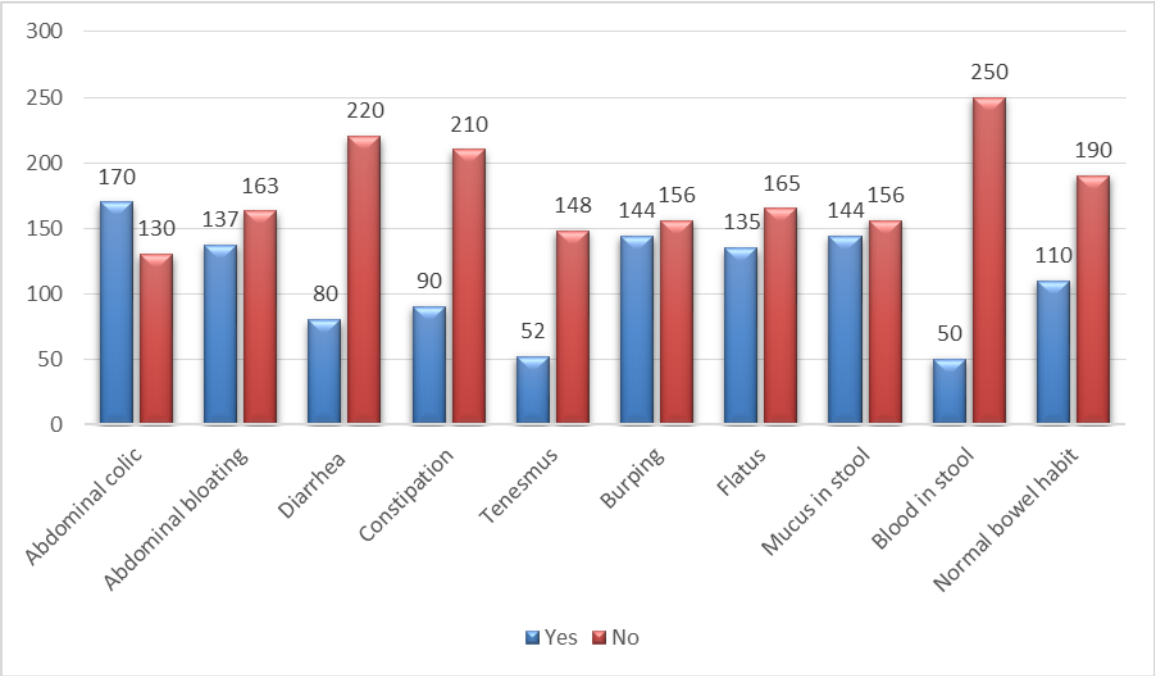

Figure (1). Presenting symptoms of study participants.

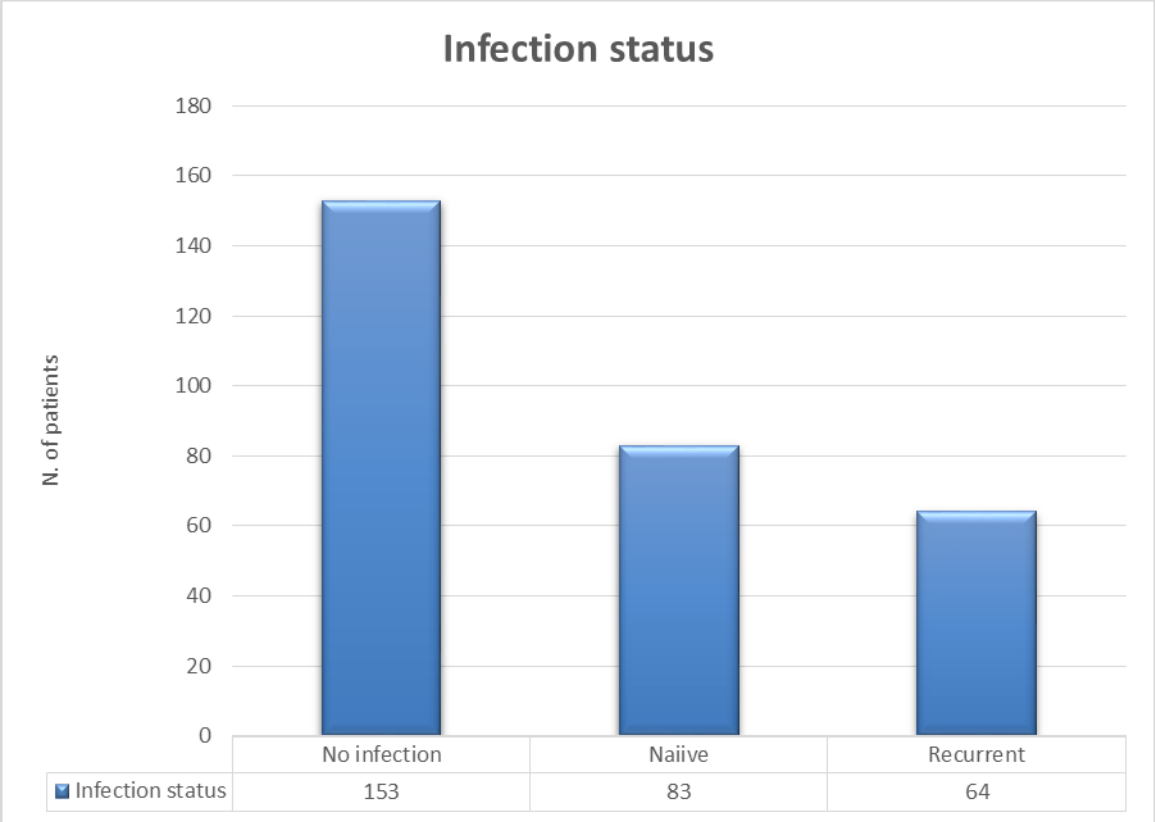

Figure (2). Infection status and presence of parasites among study participants.

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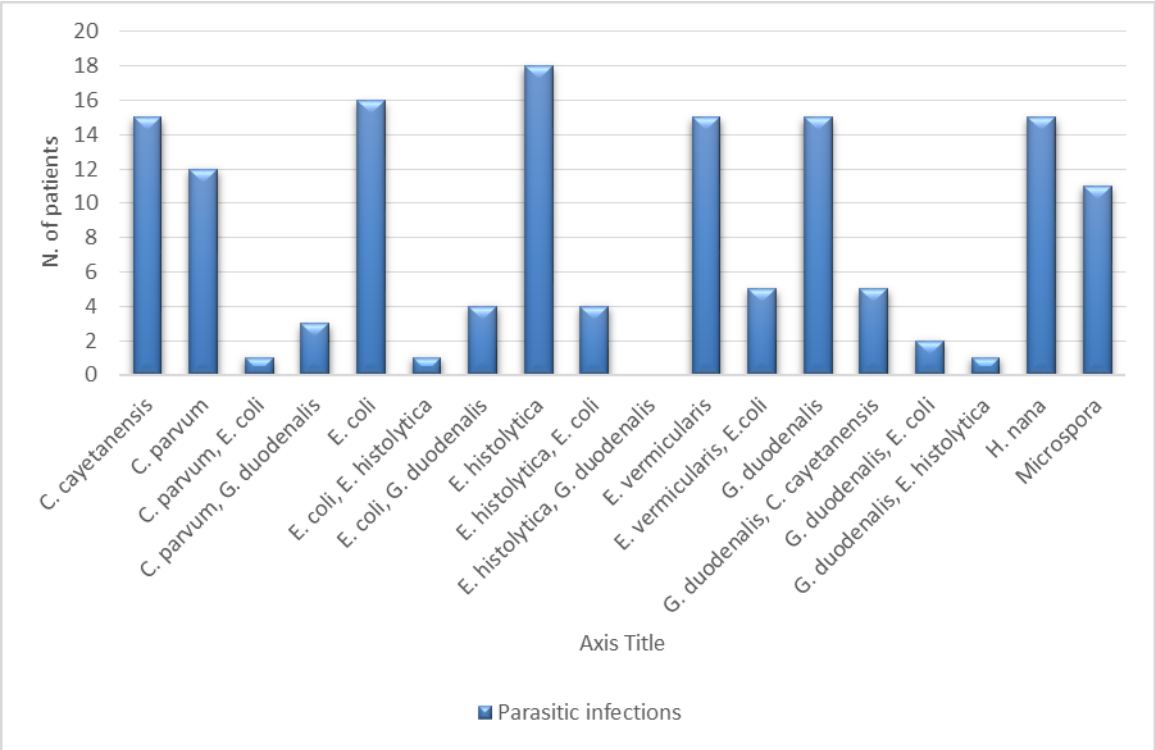

Figure (3). Parasitic infections among study participants.

DISCUSSION

Intestinal parasitic infections remain a major global health concern, especially in developing countries where sanitation, hygiene, and access to clean water remain suboptimal. The present study investigated the prevalence and clinical significance of intestinal parasites among patients presenting with persistent lower gastrointestinal (GI) symptoms in Ismailia Governorate. The overall prevalence was 49%. Comparable prevalence rates were also documented in other regional studies confirming that intestinal parasites continue to represent a significant and often underrecognized cause of chronic GI morbidity in Egypt and other countries [2, 5, 6-10].

Determining incidence and different kinds of parasitic infestations in cases with persistent lower gastrointestinal symptoms was the primary goal of this study. El-Abtal, which is a primary healthcare facility in a rural area of the Ismailia governorate, and Hai El-Salam, a primary healthcare facility in an urban area, were the sites of this cross-sectional study. Furthermore, 300 individuals were split into two groups for this study: those with parasite infections (n = 147) and those without (n = 153).

Participants in the current research varied in age from 18 to 64, with a mean age of 36.37±12.99 years. In terms of gender, 158 (52.7%) of the participants were males, and 142 (47.3%) were females. 133 (44.3%) of the participants were from metropolitan regions, while 167 (55.7%) were from rural areas, making up somewhat more than half. Just 72 (24%) of the individuals were unemployed, compared to 146 (48.7%) who were employers and 82 (27.3%) who were farmers. In terms of marital status, 160 individuals (53.3%) were married, 87 participants (29%) were single, 36 participants (12%) were widowed, and only 17 participants (6.7%) were divorced. Just 86 (28.7%) of the volunteers smoked, whereas the bulk, 224 (71.3%), did not.

The overall frequency of infection in the current study aligns closely with the rates reported by El-Wakil et al. [4], who found intestinal parasites in 59.6% of Egyptian patients, and Mohammed et al. [9], who reported infestations in approximately one-third of the examined population. Such variation between studies likely reflects differences in geographic distribution, environmental exposure, diagnostic methods, and local sanitation conditions

The predominant parasites identified were Entamoeba histolytica (6%), E. coli (5.3%), Hymenolepis nana (5%), Giardia duodenalis (5%), Cyclospora cayetanensis (5%), Enterobius vermicularis (5%), and Cryptosporidium parvum (4%), with mixed infections accounting for approximately 8%. Similar findings were reported by El-Wakil et al. [4], who observed a 59.6% overall prevalence in Egyptian patients, with Blastocystis (47.8%), E. histolytica (26%), and Giardia intestinalis (10.4%) as the most common parasites. Comparable results were observed by Omran et al. [11] and Bakr et al. [12], who identified E. histolytica as the most frequent pathogenic protozoon. Reported prevalence variations among studies likely reflect differences in diagnostic techniques, sample population, and local environmental factors.

Although rural residents exhibited a slightly higher infection rate than urban ones, the difference was not statistically significant, aligning with El-Wakil et al. [4]. However, Langbang et al. [7] and Tigabu et al. [13] reported significantly higher infection rates in rural populations, attributing this to poor sanitation and close contact with contaminated water sources and livestock. The lack of significant association with demographic factors (age, sex, occupation, and smoking) in the current study suggests that environmental and behavioral factors have a greater influence on transmission, consistent with Mohammed et al. [9] and Omran et al. [11]. In addition to protozoal infections predominated over helminthic infections in this study, consistent with previous reports from both urban and rural Egyptian communities.

Clinically, abdominal bloating and flatus were significantly associated with parasitic infection, while diarrhea and abdominal pain were not. This observation may indicate chronic, low-grade infections with submucosal involvement rather than acute invasive disease. Kiani et al. [1] and Omran et al. [11] similarly reported that non-specific GI symptoms especially flatulence and dyspepsia were predominant in parasitized patients. Mechanistically, persistent GI symptoms may result from (1) direct mucosal invasion and inflammation by invasive protozoa (E. histolytica), (2) malabsorptive changes from Giardia infection, (3) altered gut motility secondary to immune activation, and (4) gut microbiota dysbiosis post-infection.

From a mechanistic standpoint, Tigabu et al. [13] reported that protozoa such as E. histolytica and Giardia duodenalis are transmitted mainly through contaminated food and water, confirming the fecal–oral route as the principal mode of spread. E. histolytica invades the colonic mucosa via proteolytic enzymes and induces inflammatory infiltration, resulting in ulceration, dysentery and post-infectious irritability of the bowel. Ortega et al. [14] similarly have reported that Cryptosporidium parvum and Cyclospora cayetanensis induce epithelial injury, crypt hyperplasia, and barrier dysfunction leading to prolonged diarrhea and nutrient malabsorption.

El-Wakil et al. [4] demonstrated the superior accuracy of PCR in distinguishing E. histolytica from the non-pathogenic E. dispar, a limitation of microscopy and antigen detection tests. Similarly, Sánchez et al. [15] showed that multiplex PCR can simultaneously detect Giardia, Cryptosporidium, and Entamoeba with higher sensitivity and specificity compared to conventional methods.

The comprehensive methodological framework adopted in this study allowed for a multidimensional assessment of intestinal parasitic infections by integrating clinical evaluation with hematological profiling, ultrasonographic, and stool microscopic examinations. However, reliance on conventional microscopy limits diagnostic sensitivity due to intermittent cyst shedding and morphological similarities between pathogenic and non-pathogenic species. Recent advances in molecular diagnostic techniques, including polymerase chain reaction (PCR) and real-time PCR (RT-PCR), have greatly improved the detection and differentiation of intestinal protozoa [16–19].

Fitri et al. [20] reported that molecular methods can detect submicroscopic infections in asymptomatic carriers, highlighting their value in epidemiological surveillance. Furthermore, the introduction of quantitative PCR (qPCR) and loop-mediated isothermal amplification (LAMP) has enabled rapid, field-applicable diagnostics with comparable sensitivity to laboratory-based assays as mentioned in similar molecular studies

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have been conducted in other endemic regions [18, 19, 21-23].

In addition to conventional microscopy, Dyab et al. [8] evaluated the use of immunochromatographic testing (ICT) combined with stained microscopic smears for the detection of Giardia lamblia among Egyptian children, reporting high sensitivity in cases of persistent diarrhea. Such immunological assays offer a valuable bridge between microscopy and molecular diagnostics.

Incorporation of such molecular tools in endemic regions like Egypt can substantially enhance early detection, guide appropriate therapy, and reduce transmission risk. However, their routine implementation remains limited by cost, infrastructure, and technical expertise as demonstrated in the study conducted by Robert-Gangneux et al [17]. Strengthening local laboratory capacity and promoting molecular surveillance programs should therefore be public health priorities.

A key strength of this study is its relatively large sample size, which enhances the reliability of the findings. The present study benefits from inclusion of both rural and urban participants, which increases the representativeness and generalizability of its findings. In addition, the use of multiple diagnostic modalities, including stool microscopy, complete blood counts, and ultrasonography, allowed for a more comprehensive assessment of parasitic infections and their clinical correlations. The inclusion of both rural and urban participants further increases the generalizability of the results within the studied population.

This study also has certain limitations. Being hospital-based, the findings may not fully reflect the prevalence of intestinal parasitic infections in the wider community. Moreover, the cross-sectional design restricts the ability to establish causal relationships between risk factors and outcomes. Finally, while stool microscopy remains a widely available diagnostic tool, more advanced molecular methods were not universally applied, which may have led to underestimation of some protozoal infections.

In conclusion, intestinal parasitic infections remain a prevalent cause of persistent lower GI symptoms, dominated by protozoal pathogens transmitted through contaminated water and food. Enhanced diagnostic accuracy through molecular testing is essential to identify asymptomatic carriers and prevent ongoing transmission. The present findings underscore the need for combined clinical vigilance, molecular diagnostics, and preventive measures—such as health education, safe water access, and sanitation improvement—to mitigate the burden of intestinal parasitic diseases in Egypt and other endemic settings.

CONCLUSION

In this research, we assessed the incidence of parasitic infections in cases with persistent lower gastrointestinal symptoms and identified the various parasitic infestation types in these individuals.

Thus, the study showed that E. histolytica and E. Coli were the most prevalent parasite infections.

Patients who have lower gastrointestinal symptoms are more likely to have intestinal parasites. There is no discernible difference in the prevalence of parasitic infestations in rural and urban areas. E. histolytica and E. coli infections may be linked to bowel irritation and should be regarded as potential irritant factors. However, parasitic infestations do not always result in changed bowel habits or eosinophilia.

Notwithstanding the aforementioned points, the study's findings showed no conclusive evidence linking GIT parasite infections to GI symptoms.

Staining and formal concentration methods have demonstrated a high sensitivity rate in identifying several gastrointestinal parasites .

To validate the current findings, draw insightful inferences, and account for confounding variables, more research with a bigger sample size and a longer follow-up time is required.

It is advised that large, comparative observational studies or carefully planned randomised controlled trials be used in future research.

Ethical Considerations: The study was carried out in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of the Faculty of Medicine, Suez Canal University (approval number:4943). Written informed consent was obtained from all participants prior to inclusion.

Author contribution: We declare that all listed authors have made substantial contributions to all of the following three parts of the manuscript:

-Research design, or acquisition, analysis or interpretation of data؛

-drafting the paper or revising it critically؛

-approving the submitted version.

We also declare that no-one who qualifies for authorship has been excluded from the list of authors.

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Conflict of interest

None.

HIGHLIGHTS

- Nearly half of patients with persistent lower gastrointestinal symptoms were found to have intestinal parasitic infections, underscoring their clinical significance in differential diagnosis.
- Protozoal infections were more prevalent than helminthic infections, with abdominal bloating and excessive flatus showing significant associations with parasitic infestation.
- Integration of stool analysis, hematological indices, and ultrasonography provided a practical diagnostic approach, with rural residence linked to a broader diversity of parasitic species.

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