

Prevalence of Parasitic Infections among Patients in Teaching Hospitals: A Cross-Sectional Study

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Abstract

Background: Parasitic infections are most prevalent in developing nations and among individuals with weakened immune systems or immunocompromised.

Objectives: Due to the lack of epidemiologic information on such infections, the prevalence of enteric, respiratory, and urogenital parasites was investigated among patients in teaching hospitals in Alborz province, Iran.

Methods: In this cross-sectional study, 1248 samples were collected from January to July 2023. Microscopic examination was performed using direct wet mount, formalin-ether concentration techniques, and trichrome staining. To detect *Enterobius vermicularis* parasite, we have used the Scotch test method.

Results: The prevalence of parasitic infections was 7.1%. The most commonly identified parasitic infections in the study were *Entamoeba histolytica/dispar* (29 cases, 2.3%), and *Blastocystis* sp. (26 cases, 2.1%). 40.2% of our studied cases showed gastrointestinal symptoms and the majority of symptoms were relating to anorexia and abdominal pain.

Conclusion: Given the significant global prevalence of parasitic infections, it is crucial to identify and treat infected individuals, implement urban water improvement programs, avoid the use of human feces as fertilizer in agriculture, and maintain public, and personal hygiene.

Keywords: Parasitic Diseases, Hospitals, Cross-Sectional, Worldwide

1. Background

Parasitic infections are a widespread challenge, especially in tropical and subtropical areas, with significant worldwide social and economic impacts. The World Health Organization reported that over one billion people, accounting for 24% of the global population, suffer from parasitic diseases.¹ These infections are most prevalent in developing nations and among individuals with weakened immune systems or immunocompromised.² Parasitic diseases are transmitted directly from person to person (horizontal), indirectly through an intermediate host (vector-borne), contaminated agricultural lands with human and animal feces (fecal-oral route), consumption of infected vegetables (foodborne) or contaminated water (waterborne).^{3,4} The clinical manifestations of patients with these parasitic infections generally include diarrhea, bloody diarrhea, abdominal pain, nausea, vomiting, nutritional deficiencies, iron deficiency, anemia, and in some cases, severe complications such as intestinal obstruction, myocarditis, cholecystitis, and appendicitis.⁵ Due to various factors such as increased international

travel, compromised immune systems, growing antibiotic resistance, climate change, and socio-economic challenges like poverty, conflicts and wars, and limited access to healthcare facilities, the incidence and prevalence of such infections are increasing in human societies.⁶⁻⁸

In Iran, due to diverse climatic conditions, various parasites, including helminthic parasites like *Echinococcus granulosus*, *Ascaris lumbricoides*, *Necator americanus*, *Strongyloides stercoralis*, *Fasciola hepatica*, *Enterobius vermicularis* (*E. vermicularis*), *Trichuris trichiura* (*T. trichiura*) and protozoa parasites such as *Giardia lamblia* (*G. lamblia*), *Entamoeba histolytica* (*E. histolytica*), *Toxoplasma gondii*, *Trichomonas vaginalis* (*T. vaginalis*), *Plasmodium spp.* and *Leishmania spp.* are still considered as health challenges.⁹⁻¹² Large cities in Iran like Tehran, Karaj, Mashhad, Shiraz, and Isfahan are considered ideal locations for studying parasitic infections due to population density and the presence of migrants from various regions, which makes them illustrative of a wide range of epidemiological patterns. Most studies in this area have shown that parasitic infections are more

prevalent among children and the elderly due to weakened immune systems in these age groups.¹³ Additionally, frequent contacts with contaminated sources such as soil and water are recognized as major risk factors.^{14,15}

In recent years, there has been a growing emphasis on developing efficient, accurate, simple, rapid, and non-invasive diagnostic methods for early disease detection, especially to support elimination programs in endemic areas.¹⁶ Parasitic infections share similarities in their modes of transmission and life cycles. Therefore, the common method for detecting these parasites often rely on direct methods, such as microscopic examination of samples from stool, and bronchoalveolar lavage (BAL).

2. Objectives

Accurate statistics on the prevalence of parasitic infections are not yet available for many regions of Iran. As major referral centers, hospitals serve a diverse patient population from urban and semi-rural areas and offer comprehensive healthcare services, including specialized diagnostic facilities for parasitic infections. Therefore, reports on the frequency of parasitic infections in teaching hospitals across different regions of Iran can contribute to a better understanding of the current status of parasitic infections and provide effective strategies for their control and prevention. In light of the significant health implications of parasitic infections, the present study was conducted to determine the prevalence of parasitic infections among patients visiting Alborz teaching hospitals.

3. Methods

3.1. Study Design and Setting

This cross-sectional study was conducted at a teaching hospital in Alborz province, Iran, during January to July 2023. The study population consisted of 1,248 individuals of various ages and both genders, who visited the hospital during the study period. Patients were randomly selected and included in the study if they met the following criteria:

1. Willingness to participate and provide informed consent.
2. Patients who had not taken any systemic antiparasitic drugs before enrollment in treatment procedures to prevent any occurrence of false-negative results.

Exclusion criteria included:

1. Patients who refused to provide stool or urine samples or
2. Patients with known history of chronic conditions that

could interfere with accurate diagnosis (e.g., inflammatory bowel disease).

3.2. Sample Collection

Stool, urine, vaginal swab, and bronchoalveolar lavage fluid (BAL) samples were collected from all participants. Each patient provided a fresh stool sample in a clean, sterile container. Urine and vaginal swabs were collected from patients who were suspected of urogenital parasitic infections. The samples were transported to the parasitology laboratory for analysis.

3.3. Laboratory Analysis

All samples were examined macroscopically and microscopically for the presence of protozoan cysts, trophozoites, and helminth eggs. Microscopic examination was performed using direct wet mount, formalin-ether concentration techniques, and trichrome staining. In cases where urogenital infections were suspected, vaginal swabs and urine samples were analyzed for protozoa such as *T. vaginalis*. In order to detect *E. vermicularis* parasite, we have used the Scotch test method.^{16,17}

3.4. Demographic Data

Demographic data, including age, gender, and the presence of symptoms (teeth grinding, diarrhea, anorexia, irritability, and abdominal pain), were recorded for each participant.

3.5. Data Analysis

Statistical analysis was performed using SPSS software version 22. Descriptive statistics, including frequencies, means, and percentages, were used to summarize the data. Chi-square and t-tests were applied to assess the significance of differences between different groups. A *P*-value of <0.05 was considered statistically significant.

4. Results

4.1. Demographic Characteristics

A total of 1248 patients participated in the study, including 590 (47.3%) males and 658 (52.7%) females who were 4 to 80 years of age (Table 1). In terms of sex distribution, 50 (56.2%) and 39 (43.8%) positive cases were reported in females and males, respectively. The majority of positive cases were observed among children, that it was statistically significant (*P* < 0.01). Therefore, in the present study, the prevalence of parasitic infections was 7.1% (89/1248).

Table 1. Association between Sex and Age Variables with Positive Cases in Patients

Variables	N (%)	Positive patients N (%)	<i>P</i> value
Sex			0.286
Male	590 (47.3)	39 (6.6)	
Female	658 (52.7)	50 (7.6)	
Age group			<0.01
< 15 years	340 (27.2)	38 (11.2)	
15-50 years	502 (40.2)	39 (7.8)	
> 50 years	406 (32.6)	12 (3)	

Table 2. Prevalence of Different Parasite Types in Patients with Different Methods

Sample types Infection Frequency	Stool exam N (%)	BAL/Swabs N (%)	Perianal skin N (%)
<i>Entamoeba histolytica/dispar</i>	29 (2.3)	0 (0)	0 (0)
<i>Blastocystis</i> sp.	26 (2.1)	0 (0)	0 (0)
<i>Enterobius vermicularis</i> egg	9 (0.7)	0 (0)	17 (1.4)
<i>Giardia lamblia</i>	19 (1.5)	0 (0)	0 (0)
<i>Trichomonas vaginalis</i>	0 (0)	3 (0.24)	0 (0)
<i>Lophomonas</i> spp	0 (0)	3 (0.24)	0 (0)
<i>Trichuris trichiura</i> egg	1 (0.08)	0 (0)	0 (6)
Mixed infections	9 (0.72)	0 (0)	0 (0)
Negative	1173 (93.9)	1242 (99.52)	1231 (98.6)
Total	1248 (100)	1248 (100)	1248 (100)

4.2. Laboratory Diagnosis of Intestinal Parasites

The most commonly identified parasitic infections in the study were *E. histolytica/dispar* (29 cases, 2.3%), *Blastocystis* sp. (26 cases, 2.1%), *E. vermicularis* (17 cases, 1.4%), and *G. lamblia* (19 cases, 1.5%) (Table 2). Less frequent infections included *T. trichiura* (Figure 1). The total number of negative cases was 1,159, accounting for 92.86% of the study population.

It is necessary to mention that 9 patients (0.72%) had mixed infections, including 4 cases of *E. histolytica/*

dispar plus *G. lamblia* or *Blastocystis* sp., 3 cases of *Blastocystis* sp. plus *G. lamblia*, and 2 cases of *E. vermicularis* plus *E. histolytica/dispar* or *G. lamblia*.

4.3. Investigation of Symptoms among Patients

40.2% of our studied cases showed gastrointestinal symptoms and the majority of symptoms were relating to anorexia and abdominal pain. No significant relation was observed among age and sex groups respecting the clinical symptoms ($P > 0.05$).

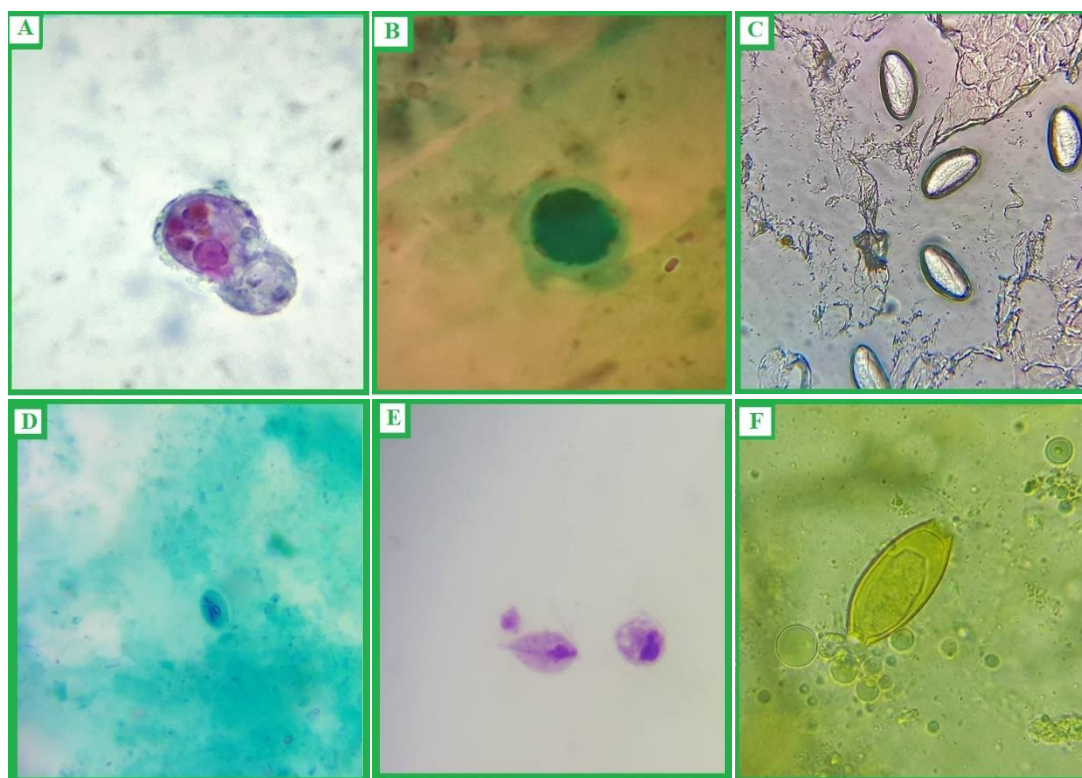


Figure 1. The most commonly identified parasitic infections. A: Trophozoite of *Entamoeba histolytica* with ingested erythrocytes stained with trichrome; B: *Blastocystis* sp. stained with trichrome; C: Eggs of *Enterobius vermicularis* detected by the scotch tape technique; D: *Giardia lamblia* cyst stained with trichrome; E: Trophozoite of *Trichomonas vaginalis* in a vaginal smear, stained with Giemsa; F: Egg of *Trichuris trichiura* in wet mount.

5. Discussion

The results of this study indicate that the infection rate

among patients at the teaching hospital in Alborz province was 7.1% (89 cases). The highest infection rate

was found in the age group under 15 years (11.2%), a difference that was statistically significant when compared to other age groups ($P < 0.01$). *E. histolytica/dispar* with the prevalence of 29 cases was found as the most prevalent parasitic infection, followed by *Blastocystis* sp. with 26 cases. A similar prevalence of *Blastocystis* sp. (28%) was reported by Hemmati et al. in the Roudhen region.⁹ Additionally, Rezaee et al. reported the prevalence of *Blastocystis* sp. at 3.7%.¹⁸ Other studies by Shahdoust et al. and Rasti et al. also reported *Blastocystis* sp. as the most common parasitic infection, with prevalence rates of 7.1% and 2.4%, respectively.^{19,20} The present study also found that protozoan infections were more common than helminthic infections, which aligns with previous researches. The higher prevalence of protozoan infections may be due to the ease of direct transmission, the resilience of protozoan cysts in harsh environmental conditions, and the ability of asymptomatic carriers to spread mature cysts, contributing to the wider dissemination of these infections compared to other parasitic diseases.

This study also found that the prevalence of parasitic infections was higher in women than in men, though this difference was not statistically significant. This finding is in line with previous studies by Sharif et al., Rasti et al., and Rezaei et al., which reported similar results.¹⁸⁻²¹ The prevalence of human parasites in the residents of Alborz was 7.1%, which is significantly lower than the 32.3% reported in a study conducted on apparently healthy population of rural and semi-rural areas in western (Lorestan), northwestern (West Azerbaijan), and northeastern (Golestan) Iran.²² Additionally, it is lower than the previous prevalence (19.3%) reported in the general population throughout the country and the prevalence reported in the rural areas of Bandar-Abbas (48.8%).^{23,24}

Variations in the prevalence of intestinal parasites across these studies may be largely due to differences in the sensitivity of parasitology techniques used, as well as variations in the socio-economic, geographical, health, cultural, educational, and nutritional status of the studied populations. The current study employed the Graham method and BAL (bronchoalveolar lavage) samples for diagnosing parasitic infections, an approach that was less emphasized in earlier studies. In this study, 17 cases of *E. vermicularis* were detected using the Graham method, whereas only 9 cases of this parasite's eggs were identified in stool samples from the same patients, underscoring the importance of using precise and standardized diagnostic techniques. *Lophomonas* spp. a newly emerging protozoan, was also detected in BAL samples with a low prevalence (0.2%). The key clinical symptoms for diagnosing *Lophomonas* spp. include chronic cough, sputum production, and fever.

In this study, *E. histolytica/dispar* were reported together due to their close morphological similarity,

resulting in a total of 29 cases being recorded. This approach differs from other studies, which only reported *E. histolytica*, likely leading to an underestimation of the true prevalence compared to the findings of this study. Haghghi et al. and Solaymani-Mohammadi et al. did not detect *E. histolytica*, and Hooshyar et al. found only eight *E. histolytica* infections among 101 successfully cultured *Entamoeba*-cyst positive isolates, which were obtained from a large screening of 16592 individuals.^{22,25,26} Since *E. histolytica* cysts cannot be distinguished from *E. dispar* cysts, and their trophozoites can only be differentiated when they are hematophagous, it is recommended that asymptomatic patients or those without RBC-containing trophozoites undergo further differentiation through methods such as PCR or isoenzyme techniques.^{27,28}

This study found that the prevalence of trichomoniasis among women attending the hospital was relatively low (0.24%), similar to the findings of Fallah and colleagues (0.9%).²⁹ Previous studies reported *T. vaginalis* prevalence in Iran ranging from 2% to 8%, which differs from our results.³⁰ These discrepancies may be due to differences in the social demographics of the populations studied, sample size, age, and marital status, all of which are important factors in the incidence and clinical manifestation of trichomoniasis.

Parasitic infections remain a significant public health concern in many countries, including Iran, as evident from various studies conducted globally. Factors such as hygienic food preparation and distribution, health education, educational level, oversight by health organizations of food distribution centers, proper food packaging to minimize hand contact, as well as conducting necessary tests (at least annually), can play a crucial role in mitigating the spread of parasitic infections.

5.1. Limitations

This study was limited to the population visiting one teaching hospital in Karaj and may not fully represent the prevalence of parasitic infections across the entire country. Additionally, since this was a cross-sectional study, it only provides a snapshot of the infection rates during the study period and does not account for seasonal variations.

6. Conclusion

Given the significant global prevalence of parasitic infections, it is crucial to identify and treat infected individuals, implement urban water improvement programs, avoid using human feces as fertilizer in agriculture, and maintain public and personal hygiene. To better assess the prevalence of parasitic infections, multiple testing sessions and the use of modern diagnostic methods are recommended.

Research Highlights

What Is Already Known?

In Iran, due to diverse climatic conditions, various parasitic infections, including helminthic infections like hydatid cysts, hookworms, visceral larva migrans, strongyloidiasis, fascioliasis, and protozoan diseases such as toxoplasmosis, giardiasis, trichomoniasis, leishmaniasis, and malaria are still considered as health challenges.

What Does This Study Add?

Lophomonas spp., a newly emerging protozoan, was detected in BAL samples with a low prevalence (0.2%). The key clinical symptoms for diagnosing *Lophomonas* include chronic cough, sputum production, and fever.

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Author Contributions

Authors contributed equally to this work.

Conflict of Interest Disclosures

All authors declared that they have no conflict of interest.

Ethical Approval

The study was approved by the Ethics Committee of the hospital. All participants provided written informed consent prior to sample collection. For children under the age of 18, consent was obtained from their parents or legal guardians. The confidentiality of the patients' personal information was strictly maintained throughout the study.

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