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# Epidemiology of intestinal parasitic infections in Babol City, Iran, during a seven years period

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Original Article

## Abstract

**BACKGROUND:** The north of Iran has a temperate and humid climate, leading to a higher prevalence of parasitic infections compared to other regions. This study aimed to determine the prevalence of intestinal parasitic infections in the northern part of Iran.

**METHODS:** This qualitative, retrospective, descriptive-analytical, and cross-sectional study was conducted from March 2017 to the end of March 2024. Data from 6962 patients recorded in the Hospital Information System (HIS) of Ayatollah Rouhani Teaching Hospital in Babol City, Mazandaran Province, Iran, were analyzed. Direct microscopic examination and formalin-ether concentration techniques were used to diagnose intestinal parasites. Data analysis was performed using SPSS software, with frequency (percentage) calculation and chi-square test ($P < 0.05$).

**RESULTS:** A total of 680 (9.76%) samples were infected with intestinal parasites. The prevalence was higher in women (54.30%) than in men (45.69%). Additionally, 55.80% of patients were from rural areas, while 44.19% were from urban areas. Entamoeba histolytica was the most common parasite, accounting for 32.05% of infections. The highest prevalence of parasitic infections was observed in the age group of 50-68 years (38%).

**CONCLUSION:** The study confirmed the presence of various intestinal parasites in stool samples. Women had a higher infection rate than men, and most infected individuals lived in rural areas. Entamoeba histolytica was the most prevalent parasite.

**KEYWORDS:** Infections; Parasites; Entamoeba Histolytica; Epidemiology

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## Introduction

Intestinal parasitic infections are a major public health problem in developing countries. Approximately 3.5 billion people worldwide are infected with intestinal parasites. In Sub-Saharan Africa, it is estimated that up to 250 million people suffer from intestinal parasitic infections. Ascaris lumbricoides, Trichuris trichiura, and hookworms can infect more than one billion, 795 million, and 740 million people worldwide, respectively.[1] Infection with these parasites, particularly in children and the elderly, can lead to malnutrition, stunted physical growth, anemia, and reduced learning capacity. Additionally, humid climatic conditions are favorable for most parasitic diseases. According to reports,

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Fasciola, a flat and leaf-shaped helminth, is specific to the northern part of Iran (a humid region) and is the most common parasite in Babol City, Mazandaran Province, the north of Iran.[2] Overall, the prevalence of parasitic infections among 549 individuals in Sari City, Mazandaran Province (the north of Iran), was 5.4%. The infection rates of Trichostrongylus and *Strongyloides stercoralis* were 3% and 0.2%, respectively.[3] Among 700 individuals examined in Anzali City, Gilan Province (the north of Iran), 15.1% were infected with intestinal parasites, including 3.3% pathogenic parasites. The most common pathogenic parasites were Giardia lamblia (14.2%), Strongyloides stercoralis (9%), and Hymenolepis nana (3%).[4] In Tehran City, Tehran Province (the north of Iran), the prevalence of intestinal parasites was 32.7%, with Blastocystis (28.4%) being the most common intestinal protozoa.[5]

One of the key indicators of a community's health status is the prevalence of parasitic infections, particularly intestinal parasitic infections. Despite improvements in medical services for diagnosing and treating parasitic diseases, parasitic infections remain a significant challenge for healthcare centers and personnel in many developing countries.[6] The relatively high prevalence of intestinal parasites and their transmission within families and communities poses a major public health challenge. North of Iran is among the country's humid regions, making periodic epidemiological studies essential. The data obtained from such studies can be used by health and medical authorities for monitoring, controlling, and treating intestinal parasitic infections.[2,6,7] This study aimed to investigate the prevalence of intestinal parasitic infections in stool samples from patients visiting Ayatollah Rouhani Hospital in Babol City.

## Methods

This qualitative, retrospective, descriptive-analytical, and cross-sectional study was conducted based on the patient records available in the Hospital Information System (HIS) of Ayatollah Rouhani Teaching and Treatment Hospital, located in Babol City. A non-probability, convenience sampling method was employed, with a total of 6962 samples. Since all individuals did not have an equal chance of being selected, sampling was carried out among all patients who underwent stool tests during the specified period (from March 2017 to the end of March 2024).

Patients who had undergone a stool test within the seven-year study period (2017-2024) were included in the study. These patients presented with symptoms such as persistent diarrhea, abdominal pain, gastrointestinal bleeding, or other digestive symptoms.

The exclusion criteria included patients who had consumed barium, bismuth, castor oil, or antiparasitics such as albendazole and mebendazole within two weeks before sample collection (as these medications eliminate parasites, making them undetectable in stool tests) and patients who did not undergo stool tests during the specified period. Stool samples that were more than two hours old at the time of testing (as they lose clinical and diagnostic value) and individuals who had consumed red meat, poultry, fish, turnips, radishes, iron supplements, indomethacin, colchicine, aspirin, ibuprofen, corticosteroids, or vitamin C within 48 to 72 hours before sample collection were excluded. Individuals with gum bleeding were advised to refrain from brushing their teeth or using dental floss 48 hours before testing.

The stool samples had to be delivered to the laboratory promptly and should not be contaminated with urine or other substances. The collected data included: age (all age groups), gender (man/woman), place of residence (urban/rural), and type of parasite detected. Direct microscopic examination of stool samples was performed using normal

saline, Lugol's iodine, and the formalin-ether concentration technique to diagnose intestinal parasitic infections.[8]

SPSS software (version 21, IBM Corporation, Armonk, NY, USA) was used to analyze the data. Numbers and percentages were used to describe qualitative data (determining frequency and prevalence). The chi-square test was used to analyze the relationship between qualitative variables (Ethics code: IR.MUBABOL.REC.1403.042).

## Results

In this study, 3885 (55.80%) patients were from rural areas, while 3077 (44.19%) patients were from urban areas. The number of infected women (3781 cases, 54.30%) was higher than that of infected male patients (3181 cases, 45.69%). Out of 6962 stool samples, 680 (9.76%) tested positive for intestinal parasites. The most prevalent parasite was Entamoeba histolytica (218 cases, 32.05%), while the least common was Trichuris trichiura egg (1 case, 0.01%) (Table 1).

**Table 1. Prevalence of intestinal parasites (based on 680 positive stool samples) in Babol City, Iran, during seven years**

| Parasite type | n (%) |
|---|---|
| Entamoeba histolytica | 218 (32.05) |
| Entamoeba coli | 125 (18.38) |
| Giardia lamblia | 79 (11.61) |
| Strongyloides stercoralis | 73 (10.73) |
| Endolimax nana | 69 (10.14) |
| Hookworm egg | 35 (4.26) |
| Blastocystis hominins | 29 (4.26) |
| Iodamoeba buetschlii | 23 (3.38) |
| Dicrocoelium dendriticum | 7 (1.02) |
| Taenia egg | 6 (0.88) |
| Enterobius vermicularis | 6 (0.88) |
| Dientamoeba fragilis | 6 (0.88) |
| Hymenolepis nana | 3 (0.44) |
| Trichuris trichiura egg | 1 (0.14) |
| Total | 680 (100) |

The highest prevalence of intestinal parasite infections (among 6962 suspected cases) was observed in the age group of 50-68 years (38%, 2646 patients), while the lowest prevalence was in the < 11 age group (4%, 279 patients) (Table 2).

**Table 2. Prevalence of intestinal parasites (based on 6962 suspected cases) in Babol City, Iran, by age group**

| Age group (year) | n (%) |
|---|---|
| < 11 | 279 (4.00) |
| 12-30 | 1184 (17.00) |
| 31-49 | 1879 (26.98) |
| 50-68 | 2646 (38.00) |
| 69-90 | 974 (13.99) |
| Total | 6962 (100) |

Across all variables (location, gender, and age), no significant differences were found in the frequency of different parasites (P > 0.05).

## Discussion

This study investigated the prevalence of intestinal parasitic infections in Babol City over seven years. The results showed that intestinal parasites were prevalent in this region. In Iran, factors such as geographical location and suitable climate (especially in northern Iran with its humid and temperate climate) significantly contribute to the prevalence of intestinal parasitic infections.[8-10] A study by Asmar et al. examined the prevalence of intestinal parasites in 700 residents of Bandar Anzali City (the north of Iran).[4] Similar to our study, the formalin-ether concentration method and direct microscopic examination were used for parasite identification. Their findings indicated that 15.1% of cases were infected with various pathogenic and non-pathogenic intestinal parasites, while 3.3% had pathogenic intestinal parasites. This prevalence was lower than that in our study (9.76%). Additionally, Asmar et al. reported that pathogenic intestinal parasites were more common in women (65.2%) than in men (34.8%), which is consistent with our findings, where women (54.30%) had a higher prevalence than men (45.69%). Asmar et al. also found that the most common pathogenic parasites were Giardia lamblia (2.14%),

Strongyloides stercoralis (0.9%), and Hymenolepis nana (0.3%). In our study, however, the prevalence of Giardia lamblia (11.61%), Strongyloides stercoralis (10.73%), and Hymenolepis nana (0.44%) was higher. The prevalence of intestinal parasitic infections has significantly decreased compared to past decades, reflecting improvements in personal and environmental hygiene standards, increased public awareness, proper human waste disposal, and improved sanitation of water and food. However, continued control measures and education remain necessary.[4] Differences in hygiene behavior and occupational exposure may explain variations in prevalence between men and women.[9,10] In another study conducted by Rezaee et al. in Gerash City (the south of Iran), 5100 stool samples were examined using direct and formalin-ether concentration methods.[11] Their results showed that 172 (3.3%) cases were infected with intestinal parasites, with Blastocystis hominis being the most (73.3%) prevalent parasite. In contrast, the prevalence of Blastocystis hominis in our study was lower (4.26%). Despite differences in specific parasite prevalence, both studies (our study: 9.76%, Rezaee et al.: 3.3%) highlight the relative frequency of intestinal parasitic infections in Iran. Differences in prevalence across regions are closely linked to socioeconomic conditions, nutrition, drinking water quality, health services, personal hygiene, and climate.[12,13]

A study by Barazesh et al. in Urmia City, the northwest of Iran, using direct examination and the formalin-ether concentration method, found that 34% (47 cases) of individuals were infected with at least one intestinal parasite, while 13.6% had multiple infections. The most common parasites were Blastocystis hominis (16.2%), Entamoeba coli (16%), Iodamoeba buetschlii (9%), Entamoeba hartmanni, Giardia lamblia, and Enterobius vermicularis (each 2.3%). In comparison, the prevalence of these parasites in our study was Blastocystis hominis (4.26%), Entamoeba coli (18.38%), Iodamoeba buetschlii (3.38%), and Giardia lamblia (11.61%). In our study, the prevalence of Blastocystis, Entamoeba coli, Iodamoeba buetschlii, and Giardia lamblia was 4.26%, 38.18%, 3.38%, and 11.61%, respectively. Similar to our findings, Barazesh et al. found no significant association between age and parasitic infection rates.[14] Differences in exposure to parasites across geographical areas, occupational conditions, and the ease of parasite transmission in humid regions play a crucial role in the spread of protozoan and helminth infections. The presence of resistant cysts and their excretion by asymptomatic carriers further contribute to the persistence of these infections. Additionally, seasonal variations affect host behavior and exposure to parasites.[11,14] A systematic review and meta-analysis by Chelkeba et al. in Ethiopia reported an intestinal parasite prevalence of 48%,[15] which was higher than that in our study (9.76%). In Thailand, Wattano et al. reported that 62% of the population were infected with one or more types of intestinal parasites (method: direct "wet" smear and formalin-ethyl acetate), which was higher (62%) than our study (9.76%). The highest prevalence of intestinal parasitic infections in Wattano et al.'s study was observed in the age group of 11-20 years, but in our study, the highest prevalence was in the population of 50-68 years (38%) and the lowest prevalence was in people < 11 years (4%). Similar to our study, in the study of Wattano et al., no significant difference was observed between the frequency of parasite species and the place of residence of the people.[16] A study [method: polymerase chain reaction (PCR)] by Flaih et al. in Iraq, was conducted over six years and analyzed 341505 intestinal parasitic infections. The prevalence of intestinal parasitic infections was 49.84% in women and 50.16% in men, with no significant difference between genders. The highest infection rate (35.13%) was observed in the age

group of 5-14 years, while the lowest (4.12%) was in children < 1 year old. The most common infections were Hymenolepis nana, Ascariasis, and Taeniasis. The study concluded that intestinal parasitic infections remained an uncontrolled public health problem in Iraq, particularly in low-hygiene rural areas and among younger age groups.[17] Debash et al. in Ethiopia, in another systematic review and meta-analysis, found an intestinal parasite prevalence of 31% among patients with diabetes.[18] Our study, conducted for seven years, also demonstrated a significant prevalence of intestinal parasites in Iran, a developing country. Poor hygiene was identified as the most important risk factor for infection. Due to weak healthcare systems in developing countries, risk groups such as human immunodeficiency virus (HIV)-positive individuals, high population density, genetic and immune system factors, warm and humid climates, poor living conditions, and limited access to healthcare services contribute to the high prevalence of parasitic infections.[18] Furthermore, parasite diversity and prevalence within an ecosystem are strongly influenced by environmental factors. Temperature, humidity, food availability, host presence, and biotic and abiotic factors all impact parasite transmission. Humid environments are particularly associated with higher parasite prevalence. Some parasites thrive in moist conditions, facilitating host-to-host transmission, whereas others require dry environments to complete their life cycles. For instance, soil-transmitted parasites such as hookworms and Ascaris require moisture for survival and are more prevalent in regions with high soil humidity. Additionally, high humidity enhances vector survival and reproduction, further promoting the spread of parasitic infections.[19] In the United States (US), Singer et al. analyzed 43 stool samples and found 62.8% positive for Blastocystis species and 2.3% for Giardia lamblia. Among 97 serum samples, 16.5% tested positive for Strongyloides stercoralis [methods: PCR and enzyme-linked immunosorbent assay (ELISA)].[20] A systematic review and meta-analysis by Kantzanou et al. in Greece reported an overall prevalence of 5.9% among children in European countries.[21] The prevalence of intestinal parasitic infections reported by Singer et al.[20] and Kantzanou et al.[21] was lower than that in our study (10.23%) and African countries (35.13%). The lower prevalence of parasitic infections in European countries is attributed to physician guidance for families and children, effective diagnostic methods, and access to medical, social, and demographic information, including travel and migration history.[2] Based on the findings from various countries,[9,11,14-18,22] intestinal parasitic infections remain prevalent worldwide and pose a serious public health threat.[9,22]

The limitations of this study include its restriction to a single health center and inaccurate sample collection by some patients.

## Conclusion

To better understand the prevalence of intestinal parasitic infections, it is recommended that multiple diagnostic tests be conducted and modern diagnostic methods be utilized. Additionally, to improve family and community health, continuous educational programs should be implemented to raise awareness about transmission routes and preventive measures. Essential actions include monitoring hygiene practices, educating parents, and ensuring proper treatment for infected individuals.

## Conflict of Interests

Authors have no conflict of interests.

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