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Short Communication

Intestinal Parasitic Infections in People Referring to the Central Laboratory of Meshkin Shahr County, Ardabil Province, Iran

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Abstract

Background: Intestinal parasitic infections are still a considerable global public health problem. We aimed to determine the frequency of intestinal parasitic infections among people referring to the central laboratory of Meshkin Shahr City, Ardabil Province, Iran.

Methods: In this cross-sectional survey, 460 fecal samples were collected randomly from persons referred to the central laboratory of Meshkin Shahr City, from January to June 2022. The samples were examined by direct wet-mount, Trichrome and modified Ziehl-Neelsen staining, formalin ethyl acetate sedimentation, and agar plate culture.

Results: The frequency of intestinal parasites was 15.7% (72 out of 460 cases), with some people with numerous intestinal parasites. The frequency of protozoan infections (13.9%) was higher than the helminthic infections (2.6%). *Blastocystis* spp. (8.1%) was the most prevalent detected intestinal protozoan. *Entamoeba coli* (5.7%), *Dicrocoelium dendriticum* (2.2%), *Giardia lamblia* (1.5%), *Fasciola* spp. (0.2%), and *Hymenolepis nana* (0.2%) were other detected parasites.

Conclusion: In- spite of betterment of the health condition in Iran and reduction of parasitic infection, intestinal parasitic infections are still a considerable public health issue in some parts of Iran.

Introduction

Intestinal parasitic infection (IPIs) caused by protozoa and soil-transmitted helminths is brought up one of the significant public health issues due to its high prevalence and distribution throughout the world, especially in the populations of tropical and subtropical areas of developing countries (1). Several species of STH, *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms (*Ancylostoma duodenale* and *Necator americanus*) included as part of the neglected tropical diseases (NTDs) lately updated by the WHO (2, 3). It is approximated more than one-third of the world's people are infected with intestinal parasites, which constitutes a global health burden that causes clinical complications and mortality (4, 5). The IPIs cause the yearly loss of about 39 million disability-adjusted life years, resulting in widespread health and economic problems (6, 7). Intestinal parasites can cause a broad range of symptoms, from asymptomatic carriage, which is observed in about 90% of infected people, to diarrhea, abdominal pain, intestinal bleeding, anemia, malabsorption, malnutrition, general malaise and weakness that may affect learning capacities and physical growth (8, 9).

Indirect transmission of intestinal parasites usually occurs through ingesting contaminated water, food, and soil (fecal-oral). Some species have the possibility of direct transmission through person-to-person or animal-to-human contact (10, 11).

Several environmental, geographic, and social factors cause differences in the prevalence and distribution of IPIs from one region to another. The prevalence of intestinal parasites is closely related to socio-economic status, educational levels, environmental factors, insufficient medical care, lack or inadequate access to safe drinking water sources, improper hygiene, poor health practices and education (11, 12). In Iran, a wide range of intestinal parasite prevalence between 4.7 to 56% has been reported in apparently healthy individuals (13). However, some parasitic infections such as hookworms and ascariasis have dropped significantly in the last years (13, 14). Nevertheless, giardiasis is the most common protozoan infection in Iran (15).

So far, no study on the frequency of intestinal parasitic infections in Meshkin Shahr City. We aimed to determine the frequency of intestinal parasites among people referring to the Meshkin Shahr Central Laboratory.

Methods

Study area

Meshkin Shahr County, with an area surface of about 3,500 km2, is placed in Ardabil Province in Iran (38°26'N 47°45'E). The County is divided into four sections: Meshkin-e Sharqi District, the Central District, Moradlu District and Arshaq District and also It has six cities: Meshkin Shahr, Qasabeh, Lahrud, Moradlu, Razi and Fakhrabad. According to the 2016 census, it has inhabitants of about 149,941 with 45,999 households. Meshkin Shahr County is approximately 1400 meters above sea level, and Sabalan Mountain has located 25 km from this County. It has four climates: hot and dry Mediterranean, temperate Mediterranean, cold steppe and Cold Mountain. The length of the dry and semi-dry, and frosty season is five to eight months, and the average annual rainfall is 300 mm. Most of its vegetation consists of steppes, artichokes, hornbeam, oaks, and horrida, which provide enormous pastures for livestock, a good opportunity for the transmission and spread of zoonotic diseases in the region.

Study design

The required sample size was calculated as 202 concerning the frequency of parasitic infections in the region. To increase the studies accuracy by applying the design effect, 460 participants were included.

This cross-sectional study was performed in Meshkin Shahr City for six months between January and June 2022. Four hundred and sixty (460) fecal samples (from 284 males and 176 females) were collected by simple random sampling among individuals referring to the central laboratory of the city. At first, a screw-capped plastic container was given to each participant; then, during sampling, a standard predesigned questionnaire including gender, age, education level, occupation, type of residency and clinical indications and symptoms (e.g., nausea, diarrhea, abdominal pain and cramp) was completed through interviews by a trained clinical laboratory expert. The collected containers in insulated boxes were transported to the health research station of Meshkin Shahr, Tehran University of Medical Sciences. Finally, the samples were also processed on the same day of collection.

Stool examinations

All fresh fecal specimens were macroscopically evaluated for consistency, color, the presence of blood, mucus, and adult intestinal worms. The samples were examined using the direct wet-mount and formalin ethyl acetate sedimentation techniques to diagnosis the presence of any parasite. Subsequently, a part of each collected sample (approximately 2 g) was cultured on agar plates, and each plate was observed by stereomicroscope to detect *Strongyloides stercoralis* and *Hookworm*. The trichrome stain was applied for the detection of protozoan infections. A thin smear was prepared from diarrhea specimens, and further evaluation was performed using a modified Ziehl-Neelsen staining technique to detect coccidian parasites. Eventually, all the slides were observed under a light microscope for at least 20 min using 100×, 400× magnification and the stained slides with 1000× as final magnification.

Ethics Statement

First, the protocol of this cross-sectional study was evaluated and approved by the Ethics Committee of Tehran University of Medical Sciences (ethical code: 400000707) following the Helsinki Declaration and Guidelines. Information about the aim of the study was provided to the adult individuals and parents/legal guardians of the children; also, written informed consent was obtained from all individuals.

Statistical analysis

Data processing and analysis were conducted on SPSS 26 software (IBM Corp., Armonk, NY, USA). The chi-square test was applied to analyze the association between variables, and also Significance level was accepted at *P* values < 0.05.

Results

Over six months, 460 stool specimens from the Meshkin Shahr residents, along with 284 (61.7%) men and 176(38.3%) women, were gathered. The age of the people was between 1 year as the youngest participant to 86 years as the oldest person studied, with an average age of 31.23 ± 34.58 years, where most of the participants were middle-aged and in the age group of 30-39 (25.4%). Only 13.7% (63/460) of the participants had academic (university) education, and 22.8% (105/460) of them were illiterate. Two hundred twenty-four individuals (48.7%) lived in the rural regions and two hundred thirty-six individuals (51.3%) lived in urban regions.

The frequency of detected intestinal parasites in the participants is provided in Table 1. At least one species of intestinal parasite was found in 72 (15.7%) participants.

The frequency of infection in males and females was (16.9%) and (13.6%) respectively. Intestinal parasitic infections showed no significant correlation with gender (P= 0.34). The maximum rate of infection was seen in the 60-69 age group (26.1%), but no significant association was reported between the age group and the frequency of infection (P= 0.30). The current survey demonstrates a significant as-

sociation between clinical manifestations and infection with intestinal parasites (*P*= 0.001). However, occupation, education, and place of residence were not associated with the parasitic intestinal infection rates.

Table 1: Frequency of IPIs according to parasite species and number of infections among the participants (n=460)

Variable	*Parasite's species*	*Number of infected*	*Frequency (%)*
Single	*Blastocystis* spp.	29	6.3
	Entamoeba coli	21	4.6
	Giardia lamblia	5	1.1
	Dicrocoelium dendriticum	6	1.3
	Fasciola spp.	1	0.2
	Hymenolepis nana	1	0.2
Double	*Blastocystis* spp., *Dicrocoelium dendriticum*	3	0.7
	Blastocystis spp., *Entamoeba coli*	3	0.7
	Blastocystis spp., *Giardia lamblia*	1	0.2
	Entamoeba coli, *Dicrocoelium dendriticum*	1	0.2
Triple	*Blastocystis* spp., *Giardia lamblia*, *Entamoeba coli*	1	0.2
	Total	72	15.7

Discussion

In this cross-sectional study, 15.7% of participants were positive for intestinal parasites. According to our knowledge, this research was the first attempt to illustrate the frequency of IPIs in this area. This finding was similar to a study performed in Tehran in which the prevalence of IPIs was reported as 17% among patients visiting a referral hospital (16). In addition, the prevalence of the intestinal parasite in people referred to different medical laboratories in Babol was 12.1% (17, 18). A nationwide study of the public population reported a prevalence rate of 19.3% for IPIs in Iran (19). In the earlier studies performed on specific community groups in Ardabil, near Meshkin Shahr, the prevalence of IPIs was reported to be 3.1%, 10%, and 4.5% in the applicants receiving health card, patients with malignancy, patients referred to laboratories of two hospitals affiliated with Ardabil university of medical sciences, respectively (20, 21). The prevalence found in our study is higher than previous reports from the south of Tehran, Karaj, and Qazvin, with IPIs prevalence of 10.7%, 4.7%, and 5.8%, respectively (22-24). However, some studies reported a remarkable prevalence of 32.2% in patients with gastrointestinal diseases in Nahavand County, 32.7%, and 34.2% in inhabitants of Roudehen and Rudbar-e Jonub (13, 25, 26).

Our findings and other studies indicated that despite advancements in hygiene and public/personal health measures, there are still insufficient performances for controlling intestinal parasites, and IPIs are still a significant public health issue in Iran and developed countries (13, 17). Several factors, such as weather conditions, agriculture, and access to health facilities, study period, lifestyle, and the laboratory techniques employed for stool examination, differences in study populations, and sanitary conditions in the investigated areas, were probable causes of the differences between our findings and those of the previous studies completed in Iran in terms of the general prevalence of IPIs.

In the current study, the frequency of protozoa infections was higher at 13.9% than that

of helminth infections at 2.6%. The high frequency of protozoan parasites is likely due to their high reproductive rate and easy route of infection via contaminated water and foods (27). In addition, several studies conducted in different parts of Iran indicate that in recent years, the prevalence of intestinal helminth infections in Iran has decreased; this may be due to overall improvements in sanitation in Iran (28, 29). Our results show that about 2% of study participants were infected with multiple parasites at the same time. *Blastocystis* spp. was the most common intestinal parasite in co-infections. The prevalence of mixed infection differs in different studies conducted around the world (30). This may be due to the same transmission route in many protozoan species. *Blastocystis* spp., *E. coli*, and *G. lamblia* were the most common intestinal protozoa among participants in the current study, consistent with other studies conducted in Iran (31, 32).

In the present study, the most common intestinal parasite was *Blastocystis* spp. 8.1%, similar to other surveys conducted in Iran and worldwide (13, 33). Studies on apparently healthy population groups in Iran conducted over the past few decades have reported the variable prevalence of *Blastocystis* infection to be between 7.5 to 28.4% (26, 34).

According to our results, the frequency of *E. coli* was 5.7%. Based on the studies conducted in Iran, the prevalence of *E. coli* was reported up to 18.9% (35). As some protozoans, such as *Blastocystis* spp. and *E. coli*, are transmitted to humans through the fecal-oral route, their presence is a suitable indicator of poor hygiene, close animal contact, and contaminated food or water consumption (13, 26).

G. lamblia infection is observed worldwide, and this parasite is one of the most common protozoa that can cause diarrhea (13). The frequency of *G. lamblia* in these study participants was 1.5%. However, based on the laboratory results of several studies conducted in the different regions of Iran, the prevalence of *Giardia* has decreased from 33.9% to 1.2% in recent years compared to the previous decades (26, 34).

In terms of helminth infection, three types of parasite ova, including *D. dendriticum*, *H. nana*, and *Fasciola* spp., were found in the infected samples. The prevalence of helminth infections in Iran has decreased dramatically in recent years, while some helminths with direct fecal-oral transmission, such as *H. nana* and *Enterobius vermicularis*, remain common in some parts of the country (36). Despite the human cases of dicrocoeliasis reported in the northern regions of Iran, the *D. dendriticum* infections reported in the current study were pseudo infections due to consuming contaminated livestock liver (16). The low rate of intestinal helminth infections in Meshkin Shahr is consistent with the findings of recent reports from other regions of Iran (16, 25).

The current study examined several possible risk factors correlating with intestinal parasitic infections and found that clinical symptoms were significantly associated with intestinal parasitic infections ($P< 0.05$), consistent with the results of previous studies (18, 25).

In the current study, the frequency of IPIs was slightly lower in females (13.6%) than in males (16.9%). Although intestinal parasite infection showed no significant difference with sex, indicating equal exposure to infectious agents; similar results have also been reported in other surveys (37).

Based on our findings, the frequency of IPIs in the age group 60-69 years was 26.1% higher than in other age groups, possibly due to the low personal hygiene and education level of older people and lack of awareness of the transmission of IPIs. Nevertheless, there was no significant correlation between the frequency of IPIs and age groups, consistent with other reported studies (13, 16).

The frequency of intestinal parasites showed no significant correlation with educational level or occupation, although the highest fre-

quency was found among retired participants, 22.2% (16, 18).

There was no significant correlation between the infection and residential status, which is similar to the findings reported previously (38).

The present study was subjected to some limitations. The study was non-blinded. As the collection period was short. Another limitation was that due to facilities and financial constraints, we had not applied all the laboratory techniques for detection of parasites.

Conclusion

Although in recent years, due to the improvement of the health situation in Iran, the prevalence of IPIs in Iran has decreased. IPIs are still an important public health problem in Iran. As most of the detected parasites are directly transmitted, raising public awareness, health education, infected individuals follow-up, and treatment should be considered to prevent this infection. In this context, the results of the current study can be used as a basis for the development of public health strategies and prevention programs for IPIs.

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Conflict of interest

The authors declare that there is no conflict of interest.

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