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Original paper

Investigating the prevalence of intestinal parasites with an emphasis on *Strongyloides stercoralis* infection in hospitalized patients: a regional report from Iran

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ABSTRACT. Intestinal parasitic infections such as strongyloidosis are more common among individuals with immune deficiency and sometimes accompanied by severe symptoms. The purpose of this cross-sectional study was to evaluate the prevalence of intestinal parasites with focus on strongyloidosis in hospitalized patients. A total number of 566 faecal samples were obtained from different wards and assessed by the use of direct smear, formalin-ether concentration, and agar plate culture procedures in order to find parasitic protozoa and helminthes. The findings revealed that 10.1% (n=57) of the examined samples were positive for intestinal parasites. The highest prevalence rate was related to *Entamoeba coli* (4.6%, n=26) and the lowest one was related to *Strongyloides stercoralis* (0.5%, n=3). In addition, *Giardia lamblia* prevalence rate was 3.2% (n=18) and the prevalence rate of *Blastocystis hominis* was 1.8% (n=10). The sensitivity of *S. stercoralis* diagnosis was equal for agar plate culture and formalin-ether concentration methods. This study demonstrated the significance of focus on intestinal parasites in hospitalized patients and highlighted the necessity of improving the insight in health care providers about the occurrence of parasitic infections especially strongyloidiasis in these patients.

Keywords: *Strongyloides stercoralis*, hospitalization, intestinal parasite, prevalence, Iran

Introduction

Humans are host to a wide range of parasitic worms and protozoa. Health and economic poverty play a major role in the chance of getting infected by these parasites. Most importantly, parasitic diseases among people in mental retardation centers, rehabilitation centers, and nursing homes are more relevant [1]. Spread of parasitic infection in the above-mentioned centers can result in life threatening consequences. This is mainly due to the inability to care for themselves and low personal hygienic care at an acceptable level [2]. Many parasites such as *Blastocystis hominis*, *Giardia lamblia*, *Entamoeba coli* and *Strongyloides stercoralis* have direct life cycle and can be easily transmitted from an infected person to another one.

S. stercoralis is a soil-transmitted helminth that is endemic in many areas of the world. The World Health Organization (WHO) has not included

strongyloidosis in its original list of 17 neglected tropical diseases. Strongyloidosis is endemic in Southeast Asia, sub-Saharan Africa, and Latin America. Humans are the main host of *S. stercoralis* parasite [3,4].

Transmission of *S. stercoralis* occurs with three forms: heteroinfection, internal and external autoinfection [5]. Globally, it is estimated that two billion people are affected by intestinal parasites. This estimation refers to 576–740 million people who have been infected with hookworm and 50–100 million people in 70 countries infected with *S. stercoralis* [6,7]. Although *S. stercoralis* elicits clinically asymptomatic and chronic infection, the number of parasite can remarkably increase in those who are immunocompromised, resulting in spreading, hyper-infection, and death if not early diagnosed. Therefore, the treatment of chronically infected individuals and carriers is very important because the infection in these persons may remain undetectable for decades [8–10]. Definitive detection of strongyloidosis is not usually straightforward by the use of detecting larvae in the stool samples because the number of parasite is often very low and the final larval level is minimal and irregular [9,10].

A variety of methods have been used to detect the larvae in stool specimens. This includes direct fecal smear in saline-Lugol's iodine stain, nutrient agar plate cultures, Harada-Mori filter paper culture, and concentration methods including: Baermann and formalin-ether [11]. Newly developed diagnostic procedures are expected to improve the quality of epidemiological surveys and attempts for prevention and treatment of strongyloidosis. The aim of this study was to investigate the prevalence of intestinal parasites with emphasis on *S. stercoralis* in hospitalized patients at different wards of the Imam Hossein hospital of Shahrood, Semnan Province, Northeast of Iran.

Materials and Methods

Sample size calculation. In line with a previous relevant report [12], the sample size was obtained on seroprevalence of 28%, d=0.0378 at a confidence level of 95%. The total population of sample size was calculated to be 540.

Sample collection. This cross sectional study was conducted between October 2014 to November 2015 on hospitalized patients at different wards of the Imam Hossein hospital of Shahrood, Semnan province, North-East of Iran. Five hundred and sixty-six fecal samples were randomly collected from the wards including urology, infectious diseases, dialysis, gastroenterology, and psychiatric ward. The samples were collected from the participants on the day that the questionnaire was completed. The applied questionnaire was based on clinical and demographic data on a standard form including age, gender, residency (rural/urban), ward, and occupation. An informed consent form was also considered for each participant.

Stool examination. The parasitological examination was conducted using direct smear, formalin-ether technique, and agar plate culture. Initially, all samples were examined through wet mount within one hour of receipt. The formalin-ether concentration method was performed accorging to what was described by Ritchie [13]. In addition, agar plate culture was carried out based on the method described by Koga et al. [14].

Statistical analysis. The frequency index was considered to describe each variable. Moreover, the data the data was analyzed using IBM SPSS software, ver.23, (IBM SPSS, Chicago, IL, USA) and P-value of less than 0.05 was considered statistically significant.

Results

Participants

A total of 566 patients were recruited into this study, of them 301 (53.2%) were men and 265 (46.8%) were women. The mean±SD age of the participants was 55.32±15.78 years, ranging from 10 to 93 years. Furthermore, 267 (47.17%) participants were rural and 299 (52.82%) were urban dwellers. Occupational groups were student, unemployed or casual laborers, peasant farmers, government employees, housewives, the self-employed, and retired. The largest group was related to housewives (29.6%) and the lowest one was related to students (3.7%) (Fig. 1).

Prevalence of intestinal parasite infections based on sociodemographic factors

Stool examinations revealed that 10.6% (n=32) of males and 9% (n=25) of females were infected with the enteric parasites (P<0.637). With regard to age, the median (interquartile range) age was 56 (20) in non-infected and 58 (21.50) in infected patients, respectively (P<0.656) (Fig. 2). In terms of location of residency, 7% (n=21) of the urban residents and 13.5% (n=36) of the rural dwellers

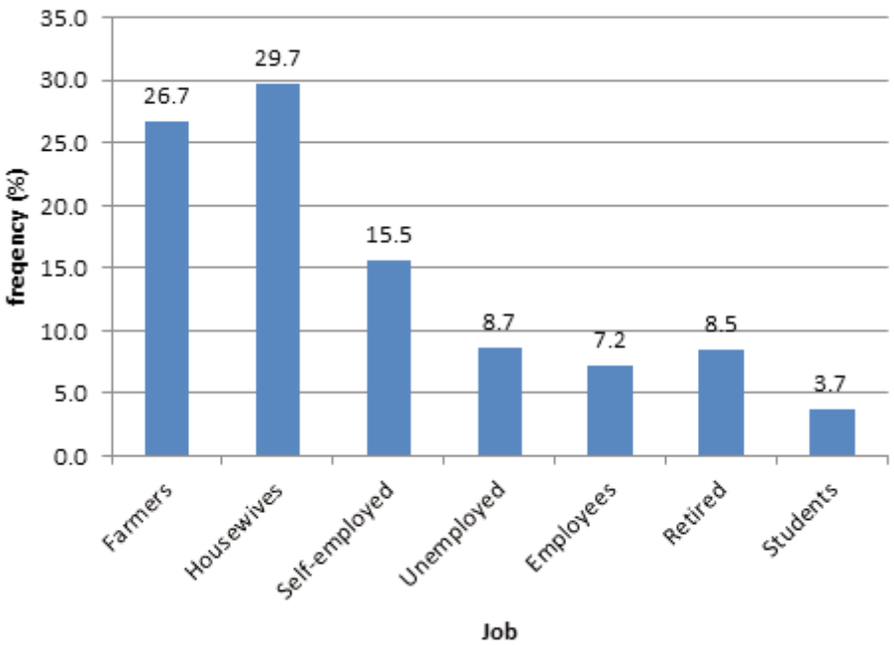

Figure 1. Distribution of different occupational groups in hospitalized patients referred to Imam Hossein hospital in Shahrood, Iran

Table 1. Association between presence of intestinal parasite infections among rural and urban dwellers in hospitalized patients referred to Imam Hossein hospital in Shahrood, Iran

Residency	Intestinal parasite infections		Odds ratio (OR)	95% CI lower – upper	*P-value*
	N (%) of infected	N (%) of uninfected			
Rural	36 (13.5)	231 (86.5)	2.06	1.17-3.633	0.011
Urban	21 (7)	278 (93)			

were infected with enteric parasites (P<0.011) (Table 1).

Prevalence of intestinal parasitic infections based on clinical status

Out of 566 patients assessed for intestinal protozoa, 57 subjects were found to be infected by at least one or more types of the protozoa with a prevalence of 10.1%. Analysis of stool sample revealed that the main enteric protozoa identified among the studied subjects in order of frequency were *Entamoeba coli*, *Giardia lamblia*, *and Blastocystis hominis*. It should be noted that the only helminthic infection was *S. stercoralis*. The highest prevalence rate was related to *E. coli* (4.6%, n=26), followed by *G. lamblia* (3.2%, n=18); and the lowest infection rate was for *S. stercoralis* (0.5%, n=3) (Fig. 3).

The prevalence of enteric parasite in different wards was as follows: 12.3% (n=14) in the dialysis ward, 12.1% (n=4) in the psychiatric ward, 10.2% (n=29) in the infectious diseases ward, 7.9% (n=3) in the urology ward, and 7.1% (n=7) in the gastroenterology ward (P < 0.753) (Table 2).

In contrast, no significant differences in age, gender, socioeconomic status were observed. Moreover, the results of comparison among the

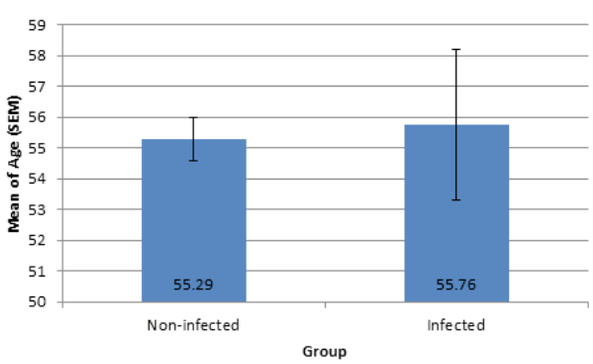

Figure 2. Comparison of age between infected and non-infected groups in hospitalized patients referred to Imam Hossein hospital in Shahrood, Iran

Table 2. Prevalence of intestinal parasite infections in hospitalized patients of different wards of Imam Hossein hospital in Shahrood, Iran

	Freqency	Intestinal parasitic infections	
		N (%) of infected	N (%) of uninfected
Dialysis	114	14 (12.3)	100 (87.7)
Psychiatric	33	4 (12.1)	29 (87.9)
Infectious diseases	283	29 (10.2)	254 (89.8)
Urology	38	3 (7.9)	35 (92.1)
Gastroenterology	98	7 (7.1)	91 (92.9)
Total	566	57 (10.1)	509 (89.9)

Table 3. Comparison of the results of methods for detection of *Strongyloides stercoralis* and other intestinal parasites in hospitalized patients referred to Imam Hossein hospital in Shahrood, Iran

Parasites	Direct smear N (%)	Formalin-ether N (%)	Agar culture N (%)
Entamoeba coli	20 (3.5)	26 (4.6)	–
Giardia lamblia	14 (2.4)	18 (3.2)	–
Blastocystis hominis	8 (1.4)	10 (1.8)	–
Strongyloides stercoralis	0	3 (0.5)	3 (0.5)

three methods are shown in Table 3.

Discussion

The examination of stool samples collected from the studied subjects revealed that 10.1% (n=57) of individuals are infected with intestinal parasites. In the present study, the prevalence of intestinal parasites was not significantly affected by demographic variables such as age, sex, and job status.

The infection with intestinal parasites was considerably high in rural hospitalized patients compared to the urban counterparts. In developing countries, such as Iran, rural life is associated with a high risk of infections due to low socioeconomic status, higher contact rates with animal reservoirs of parasite infection, inadequate environmental sanitation and poor health knowledge [15].

Consistent with other reports [16,17], our results showed that infection with helminthic parasites were lower than protozoan parasites. It seems that a decrease of parasitic infection is due to improvement in public health sanitation among people who live in

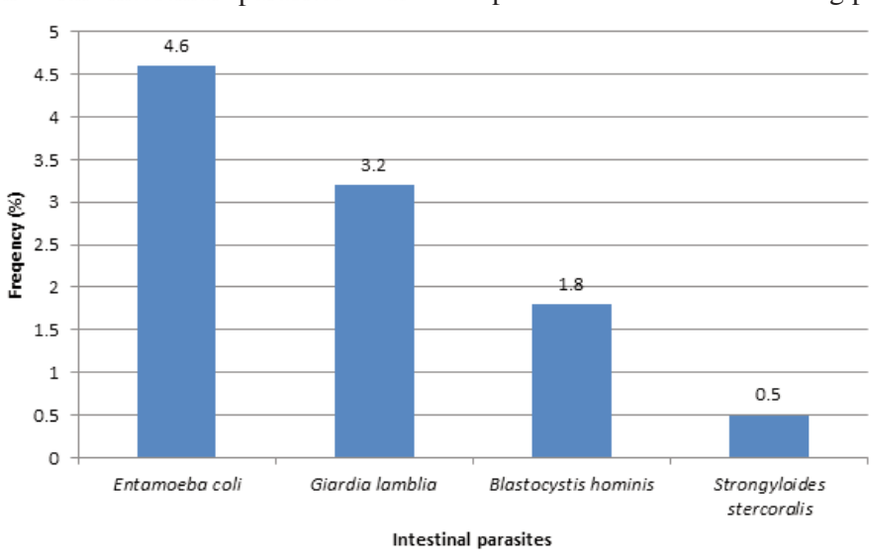

Figure 3. Prevalence of intestinal parasitic infections in hospitalized patients referred to Imam Hossein hospital in Shahrood, Iran

rural areas. Different studies in Iran showed that the prevalence rate of parasitic infections was 21.2 % in Tehran [18], 4.7% in Karaj [19], 27.3% in Zahedan [20], and 25% in Mazandaran [21]. Differences in geographical area, sample size, duration and type of study (prospective or retrospective), and studied population are the factors that influence the prevalence of parasitic disease [22]. In the study of Maniey et al. [23], 6.2% of the patients were infected with intestinal parasites. Moreover, the rate of infection with *G. lamblia* was 3.2% that was in line with the results of our study.

In a previous study conducted on 5200 patients in Japan, the prevalence of *S. stercoralis* infection was reported to be 5.2% among all patients [24].

According to the results of another study in the North of Iran at the rehabilitation centers, the most frequently reported parasites were *Giardia lamblia* (8%) and *Entamoeba coli* (5.5%) [25].

In two other similar studies by Shokri et al. [26], in rehabilitation centers of Hormozgan province, and Hazrati et al. [27], in Urmia, the most common protozoan infection was *E. coli*, with the prevalence 9.8% and 9.7%, respectively. Moreover, the prevalence rates of intestinal parasites were 20.5% and 26.2%, respectively. The absence of a definitive gold standard for diagnosing *S. stercoralis* infection makes it difficult to calculate diagnostic efficiency parameters [28]. Although, the agar plate protocol takes time (~2–3 days) and is more expensive, it is more sensitive compared to other common methods (direct faecal smear, Harada-Mori filter paper and formalin-ether concentration) for the detection of larvae in faeces [29]. Another study also has shown that the agar plate method is twice as sensitive as the formalin-ether concentration technique in order to detect *S. stercoralis* [30] while, in our study, the sensitivity of *S. stercoralis* diagnosis was equal for both methods. Cabral et al. [5], have stated that strongyloidosis needs to be regularly examined in hospitalized patients, regardless of taking immuno-suppressant medications.

Taking into consideration that strongyloidosis is a life threatening infection especially in hospitalized and under-care patients with complex conditions, we recommend these patients to be routinely checked and examined for the presence of *S. stercoralis*, regardless of immunosuppressive therapy. Formalin-ether and agar culture techniques are also suggested to be used simultaneously for *S. stercoralis* detection.

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Ethical approval. The study was approved by Ethics Committee of the Shahrood University of Medical Sciences with Ethics Identification Number: 920/20.

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