Prevalence of intestinal parasites among food handlers in Kashan, central Iran, 2017–2018

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Abstract The most important transmission path of intestinal parasites is the consumption of contaminated water and food. This survey was conducted to determine the prevalence of intestinal parasites among food handlers in Kashan, central Iran. This cross-sectional study was carried on 1018 food handlers who referred to the health centers in order to receive health certificate in 2017–2018. Stool samples of food handlers were collected and examined using direct and formalin-ethyl acetate methods. Results were recorded in information form along with some demographic data such as sex, age. The data were analyzed based on the tests of descriptive statistics by SPSS 16. Of the 1018 individuals examined 851 (83.6%) were men and 167 (16.4%) were female. Infection rate was 10.2% among the population and 9 types of parasites were diagnosed totally. Rate of infection to protozoan intestinal parasites were: *Blastocystis* sp. 7.17%, *Giardia duodenalis* 1.2%, *Entamoeba coli* 1.27%, *Endolimax nana* 1.08%, *Dientamoeba fragilis* 0.3%, *Iodamoeba butschlii* 0.3%, *Entamoeba histolytica/E. dispar* 0.2%, *Chilomastix mesnili* 0.1%. *Hymenolepis nana* (0.1%) was the only intestinal worm that observed. In this investigation, 8.9% of the individual were infected by one parasite, 1.08% by two and 0.2% by 3 or more parasites. This study showed that infection to intestinal helminthic is rare among food handlers in Kashan but the prevalence of protozoan intestinal

parasites is high that similar to other regions of Iran. To reduce the rate of parasitic infections and inhibition of their transmission, continuing the process of promoting the health level is recommended.

Keywords Prevalence · Intestinal parasites · Foodhandlers · Kashan · Iran

Introduction

Parasitic infection with the origins of intestinal worms and protozoa is well-known as one of the most prevalent infections worldwide. In spite of promotion in public hygiene of the society and increasing people's awareness, nowadays remains as one of the public hygiene problems and also an economic and social issue especially in developing countries. Based on the reports of World Health Organization (WHO), more than 2 billion people are infected by intestine parasites worldwide (Curval et al. 2017; World Health Organization 2009; Haque 2007).

In addition, more than 1.5 billion people (24% of world's population) are infected to parasitic infections with the origin of worms such as *Ascaris lumbricoides*, Hookworms and *Trichuris trichiura* (Dudlová et al. 2016). Distribution and transmission of these infections are vast in tropical and semi-tropical regions and most of the cases are related to sub-Saharan African countries, northern and southern America, china and east of Asia (Dudlová et al. 2016; Pullan et al. 2014). The most prominent pathogenic human intestinal protozoans are: *Entamoeba histolytica*, *Blastocystis* sp., *Giardia intestinalis* and *Dientamoeba fragilis* (Haque 2007; Ramírez et al. 2014).

The species of *Blastocystis* are prevalent parasites in the world and are recognized as the most common eukaryotic

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organisms in the stool sample of human and other animals (Nora et al. 2015). The prevalence of the parasite in developed countries is 0.5–23% while in developing countries is more than 60% (Edrisian et al. 2008; Khoshnood et al. 2015; Tan 2004). In a systematic review, the average infection to this parasite is reported to be 3% in Iran (Badparva et al. 2017). *G. intestinalis* is also one of the most common parasitic reasons for diarrhea in developed and developing countries and it has infected about 200 million people in the world (Gyang et al. 2017). The global prevalence of this protozoa in human being is about 8% to 30% in developing countries whereas it is 1–8% for developed countries (Smith and Mank 2011). Infection rate by intestinal parasites in different parts of Iran was 1.2–38% (Hooshyar et al. 2017). Amoebiasis is the third reason of mortality due to parasitic diseases worldwide. The WHO has reported that *E. histolytica* infects about 50 million people in the world and leads to death of about 90,000 to 110,000 people annually (Ben Ayed and Sabbahi 2017).

Except mortality, parasitic infections can endanger the health of human being especially children and old people and considering the parasite load and the immunity system of the host, they can cause numerous symptoms and side effects such as Iron deficiency, malnutrition, weight loss, delayed growth in children and ileus and appendicitis. One of the common ways of transmitting intestinal parasites is the consumption of contaminated food and water (Xiao et al. 2015). Parasitic infection of food handlers and also disobeying hygiene principles are main ways of the transmission of this infection in the society (Southgate 2000). As Kashan is one of the touristic areas in Iran and many tourists visit the city, the consumption of processed foods in the restaurants and fast food centers and also the confections with ancient history are appreciated by tourists and other people considerably. So gathering precise information about the prevalence of parasitic infections among food handlers in this city is very important by doing essential tests in order to reduce parasitic infection and decrease its transmission into the society. This study was carried out to investigate the prevalence of intestinal parasitic infections in food handlers of Kashan city, 2017–2018.

Materials and methods

This study is a cross-sectional- descriptive research conducted from July 2017 to June 2018 on 1018 food-handlers who had referred to health centers of Kashan to acquire health certificate.

Kashan, with the total area of 4415.07 km², is located in center of Iran, north of Isfahan province (50° 55′–52° 29′

Elongitude and 33° 30′–34° 27′ north latitude). Due to its heights this region, has two relatively different climates: moderate in mountainous and hot and arid one in deserts. The annual precipitation of this city is 45.61 mm and its annual average temperature is 19.7 °C.

The demographic data of the subjects including age, gender, occupation and season were recorded in the questionnaires. Fresh stool samples were collected in clean stool cup and immediately transferred to parasitology lab, Kashan University of Medical Sciences. To diagnose cyst or trophozoite of the protozoan cysts and helminths eggs, direct smear technique was first employed. Then, to enhance the test accuracy, the formalin–ethyl acetate concentration method was used followed by Lugol staining.

The results were entered into the questionnaire and each person's information was entered into spss16 software where the data were analyzed by Chi-square statistical test. The confidence level of 95% and *P* value < 0.05 were considered as significant level. It must be mentioned that the subjects' information was kept completely confidential and entered as a code into the study.

Findings

In this study, among 1018 referring subjects, 851 (83.6%) were men and 167 (16.4%) of them were women. Overall, 104 (10.2%) were infected with intestinal parasites among which 9 parasitic species were identified. One person (0.1%) was infected with helminthic infection (*Hymenolepis nana*) and the others were infected with intestinal protozoans. The rate of intestinal protozoan infection was as follows:

Blastocystis sp. 73 (7.17%), *Entamoeba coli* 13 (1.27%), *Giardia lamblia* 12 (1.2%), *Endolimax nana* 11 (1.08%), *Iodamoeba butschlii* 3 (0.3%), *Dientamoeba fragilis* 3 (0.3%), *E. histolytica*/*E. dispar* 2 (0.2%) and *Chilomastix mesnili* 1 (0.1%), (Table 1).

In terms of parasitic diversity, 91 subjects (8.9%) were infected with one parasitic species, 11 samples (1.08%) had two while 2 persons (0.2%) had three or more species, simultaneously (Fig. 1).

The youngest infected person was 19 years old while the oldest one was 80 (39.7 ± 9.4). Age and job distribution of infected people are shown in Table 2 The highest rate of infection was observed among restaurants and fast food workers (34.6%) whereas vegetable and fruit sellers showed the lowest infection rate (1.9%).

The highest frequency of parasitic infection was observed in spring (34.5%) and lowest in autumn (17.3%). Chi-square test showed a significant relationship between seasons and prevalence of intestinal parasites infection (*P* = 0.012) (Fig. 2).

Table 1 Frequency distribution of intestinal parasites in food handlers, Kashan, Iran

Parasite	Number	Percent (%)
<i>Blastocystis</i> sp.	7	7.17
<i>Entamoeba coli</i>	13	1.27
<i>Giardia lamblia</i>	12	1.2
<i>Endolimax nana</i>	11	1.08
<i>Dientamoeba fragilis</i>	3	0.3
<i>Idamoeba butschlii</i>	3	0.3
<i>E. histolytica/E. dispar</i>	2	0.2
<i>C. mesnili</i>	1	0.1
<i>Hymenolepis nana</i>	1	0.1

Fig. 1 Frequency distribution of intestinal parasites in food handlers in Kashan**Table 2** Age and job distribution of infected food handlers, Kashan, Iran

Vegetable	Category	No (%)
Age	20 ≤	1 (0.96%)
	20–29	30 (28.8%)
	30–39	29 (27.9%)
	40–59	23 (22.1%)
	50–59	13 (12.5%)
	60–69	5 (4.8%)
	≥ 70	3 (2.9%)
	Total	104 (100%)
Job	Grocery	6 (5.8%)
	Vegetables and fruits	2 (1.9%)
	Making rosewater	10 (9.6%)
	Super market	15 (14.4%)
	Butcher shop	3 (2.9%)
	Juice and ice cream shop	7 (6.7%)
	Dairy	10 (9.6%)
	Baker	10 (9.6%)
	Restaurant and fast food	36 (34.6%)
	Total	104 (100%)

Discussions

Based on the results of this study, 10.2% of food-handlers in Kashan were infected with intestinal parasites. In this study, 8 protozoan genera and only one helminthic infection (*Hymenolepis nana*) were observed. These findings are in line with recent studies indicating the reduction of helminthic infection in Iran (Rokni 2008). In contrary to helminthic infection, intestinal protozoans can be immediately transmitted after being discharge to the environment, therefore, the food-handlers can play a significant role in infection spread. *Blastocystis* sp., *G. lamblia*, *D. fragilis* and *E. histolytica/E. dispar* were the most common pathogenic protozoans detected in this study. High infection rates were observed among restaurant and fastfood workers (34.6%) in the age range of 20–30 (28.8%). Similar studies on the prevalence of intestinal parasitic infection in Iran have shown that the reported rate in this study is significant and sometimes similar to the other previous studies. In a study conducted by Sharif et al (2015) in Sari, prevalence of intestinal parasites was 15.5% among the food-handlers with *G. lamblia* (9.53%) and *I. butschlii* (0.5%) having the maximum and minimum prevalence rates, respectively. *Hymenolepis nana* was the only reported helminthic infection (Sharif et al. 2015). Balarak et al. (2016) studied the intestinal parasite frequency among food-handlers in Zahedan which showed 3.73% prevalence; among which, 90.69% cases were intestinal protozoans and 9.3% were intestinal helminths. In terms of intestinal helminths, in addition to *Hymenolepis nana* (5.81%), *Ascaris* infection was also reported in infected individuals. In contrast to our study, the highest infection rate was found in supermarkets followed by restaurant workers (Balarak et al. 2016). Motazedian et al. (2015) in Shiraz showed that, the prevalence of parasitic infections was 10.4% where the highest rate was for intestinal protozoan infections and only one case of *Hymenolepis nana* was observed. The highest infection rate was detected among the age group of 21–30 which is consistent with our study (Motazedian et al. 2015).

Abera et al. 2010 showed the prevalence of intestinal parasites as 41.1% in northwest of Ethiopia, with the highest infection frequency occurring in the age group of 20–40. In contrary to our study, the diversity of helminthic infection was higher than protozoan infection. Among the intestinal protozoan, *E. histolytica* and *G. lamblia* were reported while intestinal helminths were more divers: in addition to *Hymenolepis nana*, they also reported other intestinal helminths, such as *A. lumbricoides*, *Strongyloides stercoralis*, *T. trichiura*, *Schistosoma mansoni*, and *Taenia* sp. (Abera et al. 2010). In a study conducted in Saudi Arabia, the prevalence of intestinal parasites was 23%

Fig. 2 Distribution prevalence of parasites according to season in food handlers

among food-handlers, with the highest rates of infection reported in the age group of 24–42. In this study, more than 10 types of parasites were identified, the highest prevalence among the six intestinal protozoans species was recorded for *G. lamblia* (9%) and among the four types of helminths, *A. lumbricoides* showed the highest rate (2.5%) (Zaglool et al. 2011). Low prevalence of intestinal parasites in Iran, especially intestinal helminths, can be attributed to style of food consumption, avoiding raw or under-cooked foods and relative improvement of health awareness. However, in comparison with other regions of Iran, the prevalence of parasitic infection, especially intestinal protozoan, is significant in Kashan region. In this regard, food-handlers have a significant role in infection spread if they don't comply with personal and public hygiene. On the other hand, regarding the fact that Kashan is a touristic city, the tourists' arrival and consumption of ready-to-eat foods and sweets could serve as a suitable transmit platform for human intestinal parasites.

Data collection on the prevalence of intestinal parasites among food-handlers as well as their treatment and control can play a decisive role in reduction of parasitic infection prevalence. Therefore, it is recommended that healthcare authorities prevent from the parasitic infections spread to society by identification of infected individuals and their health training.

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Author's contribution Study concept and design: HH, MA, acquisition of data: SKA, BA, RPM, ME, analysis and interpretation: SKA, HH.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical standards The manuscript does not contain clinical studies or patient data. The intellectual property through necessary coordination and getting informed consent from participants was obtained from the deputy of Iran, Kashan University of Medical Sciences Research committee and attaining the ethics code of (IR.KAUMS.MEDNT.REC.1396.118).

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