

# Prevalence of intestinal parasites in food handlers of the city of Saqqez in 2016

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**Abstract** This study was aimed at determining the prevalence of parasitic infections among the food handlers of Saqqez County in 2016. Stool samples collected from 1530 food handlers. All samples were examined by both direct technique and sedimentation technique using formalin-ethyl acetate for detecting the intestinal parasites. Of total participants, 1462 (95.6%) were male and 62 (4.4%) female. Intestinal parasitic infections were found in 92 (6.01%) individuals. The highest infection rate was due to *Giardia lamblia* (4.1%) and the lowest associated with *Endolimax nana*, *Iodamoeba butschlii*, and *Hymenolepis nana* (0.1%). No significant correlation between the intestinal parasitic infections and age, gender, education level, gastrointestinal signs and symptoms, and the type of profession, was established. The results of the present study revealed that only a small number of food handlers in Saqqez County were infected with intestinal parasites with *G. lamblia* as the most common cause of infection. More strict health control for those working in food industries is of vital importance and continuous education to improve the level of general health in these people is undoubtedly

considered as a key determinant towards lower number of parasitic infections.

**Keywords** Prevalence · Intestinal parasitic infection · Food handlers

## Introduction

Infection with intestinal parasites is considered as one of the health challenges in many countries in particular the developing countries (Saab et al. 2004). Despite extensive medical developments and also relative reduction in the number of parasitic infections within the last decades, the agents of such diseases still affect the health of humans and cause various types of medical complications such as malnutrition, diarrhea, weight loss, and anemia especially among children and elderly people (Schmunis and López-Antuñano 2010). The transmission of intestinal parasites through consumption of contaminated water and foods, and also direct or indirect contact with contaminated hands highlights the importance of fecal–oral transmission route among those with parasitic infections (Zaglool et al. 2011).

The professional activity of food handlers with poor hygiene indices in many food preparation and distribution centers could potentially cause contamination of foods with many microorganisms including the parasitic agents following routine manipulations of foodstuffs and eventually transmission and spread of such organisms among the members of the public (Takalkar et al. 2010). It is estimated by WHO that almost 30% of the whole world population suffer from the food-borne diseases annually, with approximately 2 million deaths merely in the developing countries every year (Abera et al. 2010). Based on numerous studies on food suppliers, food handlers, and

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food vendors carried out in different parts of the world, the prevalence rate of parasitic infections with different protozoa and helminths is reported between 3.7 and 45.3%, globally (Hegazy et al. 2014; Ayeh-Kumi et al. 2009; Colli et al. 2014; Abdel-Dayem et al. 2014; Soliman et al. 2013; Siala et al. 2011; Babiker et al. 2009; Gündüz et al. 2008), and 3.82–30.2%, domestically (Sharif et al. 2015, 2016; Niazi et al. 2013; Sadeghi and Borji 2015; Shahbazi et al. 2014; Koohsar et al. 2012; Hazrati et al. 2015; Atashnafas et al. 2007; Davodi et al. 2004; Rostami et al. 2012). Therefore, identification, screening, and eventually treatment of the individuals engaged in food processing, packaging, and distribution can promote the public health quality measures in a society.

Considering the climate of Kurdistan province, life quality, and the way people make a living especially in rural areas and the use of animal waste as compost and soil fertilizer in farms, and lack of research activities regarding the presence of parasitic intestinal infections in a wide range of food handlers in this province and in particular in Saqqez county, the authors of the present study aimed at investigating the status of different parasitic infections by using routine parasitological procedures, identifying the most common parasitic infections, and finally in further steps achieving the molecular characterization of the most prevalent genotypes in the region.

## Materials and methods

Following making initial arrangements and coordination with the health deputy of Kurdistan University of Medical Sciences and the authorities at local Public Healthcare system of Saqqez County in 2016, a total 1530 stool samples were collected from different people who were somehow involved in food preparation and handling in the city of Saqqez and referred to local health center for periodic medical examinations and laboratory tests. All patients were provided written informed consent after explanation of the study purpose and procedures. Ethical approval of the study was obtained by the Medical Ethics Committee of the Qazvin University of Medical Sciences (IR. QUMS. REG. 1396. 256).

The participants were given full explanations over the objectives of the study before the study began. Later, each stool sample was collected in a special stool container without preservative solution and labeled with the number and the name of the participant recorded on the information list and the relevant questionnaire. Following collection of samples, the stool specimens were transferred to Parasitology Department laboratory at Medical School, Qazvin University of Medical Sciences. All stool samples were initially examined macroscopically for color, form, texture,

consistency, the presence or absence of blood as well as *Taenia* segment etc. A wet mount smear using saline and lugol solutions was prepared from each sample and observed under a light microscope. Also, a formalin ethyl acetate concentration test was performed for all stool samples. The samples suspected of having amoeba or intestinal flagellates were stained with trichrome staining solution. The results of the samples positive for intestinal parasites were reported to the environmental health section at local healthcare center of Saqqez County for further actions and follow-ups.

## Results

In the present study, a total 1530 individuals, engaged in food preparation, handling, and distribution, agreed to be part of the research project among those 1462 (95.6%) were male and 62 (4.4%) female. From an age point of view, the highest and lowest age groups examined were 30–39-year (38.3%) and > 60-year (1.4%) age groups, respectively. Of total 1530 participants, 92 (6.01%) were found to be infected with intestinal parasites. Of those with parasitic infections, except one (0.1%) who had helminthic infection with *Hymenolepis nana*, the rest were infected with intestinal protozoans with *Giardia lamblia* as the dominant cause of protozoan infection (4.1%) and *Endolimax nana* and *Iodamoeba butschlii* as the two less frequent protozoans (0.1%) involved in causing parasitic infection (Table 1).

The prevalence rate of intestinal parasites in male and female food handlers was 6.2% and 5.9%, respectively, showing no significant difference between two genders (Table 2).

In the current study, there was no significant correlation between the status of intestinal parasitic infection and age group. The highest and lowest infection rate was observed in those > 60-year (9.5%) and the individuals < 30-year

**Table 1** Frequency distribution of food handlers referred to Karbasi Health center of Saqqez County for periodic laboratory tests associated with intestinal parasitic infection in 2016

Parasite	Frequency	%
Non-infected	1436	93.9
<i>Giardia lamblia</i>	62	4.1
<i>Hymenolepis nana</i>	1	0.1
<i>Blastocystis hominis</i>	12	0.8
<i>Entamoeba coli</i>	15	1
<i>Endolimax nana</i>	2	0.1
<i>Iodamoeba butschlii</i>	2	0.1
Total	1530	100

**Table 2** Frequency distribution of food handlers referred to Karbasi Health center of Saqqez County for periodic laboratory checks on intestinal parasitic infection in 2016 according to sex

Parasitic infection	Gender				Total	
	Male		Female		Number	%
	Number	%	Number	%		
Non-infected	1372	93.8	64	94.1	1436	93.9
Infected with intestinal parasites	90	6.2	4	5.9	94	6.1
Total	1462	100	68	100	1530	100

age groups, respectively. The infection rate with different types of intestinal parasites in the food handlers of Saqqez County, based on the age groups used in the present study, demonstrated that the highest infection rate was due to *Giardia lamblia* (5.5%) which observed in 40–49-year age group. The present study revealed that the highest infection rate among different professions, involved in food preparation, processing, packaging, and distribution, was associated with food-producing workshops (10.1%) whereas the lowest infection rate was related to supermarkets and groceries (0.8%) however, the prevalence rate of intestinal parasites, based on occupational variation, showed no significant difference, statistically.

The frequency distribution of the study individuals with various intestinal parasitic infections, based on different professions, demonstrated that the highest parasitic infection rate was due to *Giardia lamblia* (7.8%) and observed in those working in sandwich and fresh fruit juice shops (Table 3).

The present study showed no significant correlation between the status of intestinal parasitic infection and the education level however, the highest infection rate was found among illiterate persons (7.1%) and the lowest among those with associate’s degree (0%). Infection with intestinal parasites based on the level of education revealed that the highest rate of parasitic infection was due to *Giardia lamblia* (5.6%) and observed in those with high school diploma whereas no intestinal parasite was found in people with associate’s degree (0%). Finally, there was no significant correlation between the status of intestinal parasitic infection and the occurrence of gastrointestinal signs and symptoms however the most common symptom reported by the people with parasitic infection was abdominal pain (6.8%) whereas fever was the less frequent sign observed in infected participants (0%). The frequency distribution of the individuals with intestinal parasitic infection, based on gastrointestinal signs and symptoms, demonstrated that the highest infection rate was due to

**Table 3** Frequency distribution of food handlers referred to Karbasi Health center of Saqqez County for periodic laboratory checks on intestinal parasitic infection in 2016 according to occupational variation

Parasitic infection	Profession									
	Food manufac. workshops	Kebab shops and restaurants	Confectionaries and candy shops	Bakeries	Sandwich and fruit juice shops	Butchery	Dairy and ice cream shops	Supermarkets and Groceries	Chicken and meat products shops	Total
	No. and %	No. and %	No. and %	No. and %	No. and %	No. and %	No. and %	No. and %	No. and %	No. and %
Non-infected	71 (89.9)	127 (95.5)	60 (98.4)	425 (95.9)	59 (92.2)	38 (95)	53 (94.6)	572 (92)	31 (96.9)	1436 (93.9)
<i>G. lamblia</i>	5 (6.3)	5 (3.8)	1 (1.6)	12 (2.7)	5 (7.8)	0 (0)	2 (3.6)	31 (5)	1 (3.1)	62 (4.1)
<i>H. nana</i>	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	1 (0.1)
<i>B. hominis</i>	1 (1.3)	0 (0)	0 (0)	2 (0.5)	0 (0)	0 (0)	0 (0)	9 (1.4)	0 (0)	12 (0.8)
<i>E. coli</i>	1 (1.3)	1 (0.8)	0 (0)	4 (0.9)	0 (0)	2 (5)	0 (0)	7 (1.1)	0 (0)	15 (1)
<i>E. nana</i>	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	1 (0.2)	0 (0)	2 (0.1)
<i>I. butschlii</i>	1 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	2 (0.1)
Total	79 (100)	133 (100)	61 (100)	443 (100)	64 (100)	40 (100)	56 (100)	622 (100)	32 (100)	1530 (100)

**Table 4** Frequency distribution of food handlers referred to Karbasi Health center of Saqqez County for periodic laboratory checks on intestinal parasitic infection in 2016 according to gastrointestinal signs and symptoms

Parasitic infection	Gastrointestinal signs					
	None No. and %	Abdominal pain No. and %	Diarrhea No. and %	Weight loss No. and %	Fever No. and %	Total No. and %
Non-infected	1230 (93.7)	124 (93.2)	41 (97.6)	24 (96)	17 (100)	1436 (93.9)
<i>G. lamblia</i>	57 (4.3)	4 (3)	0 (0)	1 (4)	0 (0)	62 (4.1)
<i>H. nana</i>	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.1)
<i>B. hominis</i>	11 (0.8)	1 (0.8)	0 (0)	0 (0)	0 (0)	12 (0.8)
<i>E. coli</i>	11 (0.8)	3 (2.3)	1 (2.4)	0 (0)	0 (0)	15 (1)
<i>E. nana</i>	1 (0.1)	1 (0.8)	0 (0)	0 (0)	0 (0)	2 (0.1)
<i>I. butschlii</i>	2 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.1)
Total	1313 (100)	133 (100)	42 (100)	25 (100)	17 (100)	1530 (100)

*Giardia lamblia* and observed in asymptomatic persons (Table 4).

## Discussion

In the present study the prevalence rate of intestinal parasites in the food handlers of Saqqez County was considerably low (6.1%) as only one case of helminthic infection with *Hymenolepis nana* (0.1%) was found among the study population. In contrast with the findings of the present study, in other research projects carried out in other cities of Iran, higher prevalence rates of 54.4, 30.2, 25.4, and 15.5% were reported from Kashan, Noshahr and Chalus, Zabol, and Sari, respectively (Koohsar et al. 2012; Vali et al. 1997; Abedi et al. 2013). This highlights better health conditions of the food handlers in Saqqez County. Consistent with our work, Salari et al. and Ghorbani et al. reported infection rates of 1.2% and 1.98% for Kerman and Saraein, respectively (Salary and Salary 2013; Ziaali and Masoud 1996). These discrepancies between different reports could be associated with suitability or unsuitability of cultural variation in considering or ignoring various personal and public health norms in diverse communities which may be attributed to expansion or limitation of public healthcare services, contamination of surface soil with human feces, difference in education level, familiarity with antiparasitic agents drugs, and local climate and also the level of public health has increased during last decades which may have led to a reduction in reported cases of parasitic disease. Besides difference in methods and experience of technicians, may be involved as important affecting factors on the results among the various studies.

In the current study, *Giardia lamblia* was found to be the most common protozoan with an infection rate of 4.1% which could be a significant finding because this parasite is considered as an important human pathogen. There are

several studies comparable with the present study that have reported low infection rate with *giardia lamblia* among food handlers including those by Koohsar et al. (2012) from Sari, Iran (3.4%); from Sanandaj, Iran (5.8%); and Baswaid et al. from Yemen (5.2%) (Koohsar et al. 2012; Baswaid and Al-Haddad 2008; Aminzadeh et al. 2001). A number of studies from different countries have also reported even lower infection rates, compared to our study, by *G. lamblia* in food handlers of Ghana (2.1%), Ethiopia (0.8%), Kenya (1.3%), Nigeria ((1.8%), and Brazil (2.7%) (Ayeh-Kumi et al. 2009; Colli et al. 2014; Kamau et al. 2012; Andargie et al. 2008; Ifeadike et al. 2012).

Contrary to the present study, the infection rate caused by *G. lamblia* in food handlers has been reported at levels higher than that found in our study including the reports from Khorramabad, Iran (7.9%); Noshahr, Iran (9.2%); Sari, Iran (9.53%); Kashan, Iran (16.3%); Zabol, Iran (56.6%); Tunisia (7.6%); and Sudan (9.7%) (Sharif et al. 2015; Abedi et al. 2013; Baswaid and Al-Haddad 2008; Rohani et al. 2000; Kheirandish et al. 2003; Siala et al. 2011; Babiker et al. 2009). The observation of low or high infection rates by *G. lamblia* in food handlers in various regions could, in addition to the way the health principles is dealt with by people, depend on the quality of management and supervision exerted by local health authorities.

In our study, the infection rate by *Entamoeba coli* was 1%, although it is considered as a nonpathogenic parasite yet could be regarded as an important health criterion. Infection with *E. coli* in the present study was significantly lower than those reported in other studies from Sanandaj, Iran (3.7%); Sari, Iran (5.15%); Zabol, Iran (28.3%); and Sudan (15.3%) (Sharif et al. 2015; Abedi et al. 2013; Babiker et al. 2009; Aminzadeh et al. 2001). The infection rate with *Blastocystis hominis* in food handlers was 0.8% in our study which is comparable with a study by Aminzadeh et al. who reported an infection rate of 0.8% by this parasite in the food handlers of Sanandaj, Iran in 1997 (Aminzadeh

et al. 2001). Similarly, an infection rate of 2.44% by *B. hominis* was reported from Jordan (Abdel-Dayem et al. 2014). On the contrary, Sharifzadeh et al. reported an infection rate of 18% by *B. hominis* in food handlers of Sari (Iran); a finding quite higher than that found in the present study (Sharif et al. 2015). This similarity and discrepancy in the prevalence rate of this parasite between the present work and those from other parts of the country could be associated with several factors such as drinking water supplies, health knowledge and awareness, and climate conditions in different regions of the country.

*Hymenolepis nana* infection rate among the food handlers of the present study was 0.1% and this could be regarded as a significant health concern when considering the direct transmission route and the pathogenic nature of the parasite. The infection rate caused by this parasite is reported in a number of studies conducted in different parts of Iran including Kashan (2.4%) (Vali et al. 1997); Sari (1.9%) (Babiker et al. 2009); Gorgan (0.6%) (Koohsar et al. 2012); Noshahr and Chalus (3.1%) (Rohani et al. 2000); Sanandaj (1.2%) (Aminzadeh et al. 2001); and Zabol (1.89%) (Abedi et al. 2013). Likewise, in two studies by Baswaid et al. from Yemen and Babixer et al. from Sudan, the infection rate by *H. nana* among the food handlers was reported around 4.4% and 4.7%, respectively (Baswaid and Al-Haddad 2008; Babiker et al. 2009). The lower infection rate by this parasite in our present study, compared to similar studies elsewhere, could be due to greater commitment of food suppliers to consider the principles of personal and public health in Saqqez County.

The prevalence rate of intestinal parasites in the food handlers of the current study, based on age, sex, occupation, education level, and gastrointestinal signs and symptoms demonstrated no significant correlation, statistically. However, despite lack of significant correlation between the infection rate and gender, the highest number of infections was found among the male participants, a finding in agreement with studies reported from other parts of the country such as Sari and Zabol (Sharif et al. 2015; Sarkari et al. 2016; Niazi et al. 2013; Sadeghi and Borji 2015; Shahbazi et al. 2014; Koohsar et al. 2012; Hazrati et al. 2015; Atashnafas et al. 2007; Davodi et al. 2004; Rostami et al. 2012; Vali et al. 1997; Abedi et al. 2013). This could be justified by better practice of health principles by women engaged in various fields of food industries although this needs further investigations. In our study, the highest level of parasitic infection (9.5%) was observed among the age group over 60 years and the lowest (1.4%) in the age group under 30 years. The observation of high level parasitic infections among the age groups over 50 years has been also reported in other studies (Koohsar et al. 2012; Babiker et al. 2009) and that in some studies even a significant correlation between the parasitic

infection and age group was demonstrated (Koohsar et al. 2012). In contrast with our study, in a number of other studies, high level parasitic infections was attributed to younger age groups (Rostami et al. 2012), a discrepancy which could be associated with employing people of different ages (depending on the type of job, Labor Office regulations, tendency of employer to evade the law in terms of hiring children as cheap workers etc.) in food producing companies and workshops (preparation, processing, packaging, and distribution) located in different regions of the country.

In our present work, the highest degree of parasitic infection including the one caused by *G. lamblia* was observed in those working in sandwich and fresh fruit juice shops although no significant correlation between these types of occupational activities and the parasitic infection was established. Contrarily to the present study, in some reports (Koohsar et al. 2012; Hazrati et al. 2015; Salary and Salary 2013), a significant correlation between the parasitic infection and the type of profession was claimed that could be due to better managing of employees in following the principles of both personal and public health in a number of professions which could be generalized into other occupations although the practice of such generalization needs further investigations. Our study, in harmony with some other studies, confirmed the occurrence of highest level of intestinal parasitic infections among the uneducated people (7.1%), a finding comparable to those observed in Noshahr, Iran (43.3%) (Rohani et al. 2000 May); Khorramabad, Iran (13.2%) (Kheirandish et al. 2003); Gorgan, Iran (7.4%) (Koohsar et al. 2012); and Jordan (2.44%) (Abdel-Dayem et al. 2014), a piece of information that should attract the serious attention of healthcare system authorities in paving the way for increasing the awareness and knowledge of employers, employees, and workers over health measures in different occupations.

## Conclusion

The prevalence rate of intestinal parasitic infection in food handlers of Saqqez County was low and except one case, no intestinal helminthic infection was observed and this could highlight the appropriate practice of principles of both personal and professional health by those involved in different fields of food industry in the region. However, considering the presence of some parasitic infections caused by pathogenic organisms including *G. lamblia* and *H. nana* in food handlers of Saqqez County, more continuous supervision by the local healthcare system authorities on different professions associated with food manufacturing industries (preparation, processing, packaging, and distribution) could undoubtedly promote the quality of both

personal and occupational health, leading to significant reduction in the number of parasitic infections.

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**Authors' contributions** MSH and MA conceived the project, designed the study and analysis of data. HA and MS collected samples. MS provided suggestion. EH and PH wrote, reviewed and edited the manuscript.

#### Compliance with ethical standards

**Conflict of interest** The authors declare there is no conflict of interests.

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