

PREVALENCE OF INTESTINAL PARASITES AMONG FOOD HANDLERS OF SARI, NORTHERN IRAN

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SUMMARY

Parasitic infection is highly prevalent throughout the developing countries of the world. Food handlers are a potential source of infection for many intestinal parasites and other enteropathogenic infections as well. The aim of this study was to determine the prevalence of intestinal parasite carriers among food handlers attending the public health center laboratory in Sari, Northern Iran for annual check-up. The study was performed from August 2011 through February 2012. Stool samples were collected from 1041 male and female food handlers of different jobs aged between 18 to 63 years and were examined following standard procedures. Sociodemographic, environmental and behavioral data analysis of the food handlers were recorded in a separate questionnaire. Intestinal parasites were found in 161 (15.5%) of the studied samples. Seven species of protozoan or helminth infections were detected. Most of the participants were infected with *Giardia lamblia* (53.9%) followed by *Blastocystis hominis* (18%), *Entamoeba coli* (15.5%), *Entamoeba histolytica/dispar* (5.5%), *Cryptosporidium* sp. (3.1%), *Iodamoeba butschlii* (3.1%) and *Hymenolepis nana* (1.9%) as the only helminth infection. The findings emphasized that food handlers with different pathogenic organisms may predispose consumers to significant health risks. Routine screening and treatment of food handlers is a proper tool in preventing food-borne infections.

KEYWORDS: Prevalence; Intestinal parasites; Food handlers; Iran.

INTRODUCTION

Intestinal parasitic infections cause significant problems in individuals and public health, particularly in developing countries, with a prevalence rate of 30-60%²⁷. Transmission of intestinal parasites that occurs directly or indirectly through food, water or hands indicates the importance of fecal-oral human-to-human transmission³⁷. Foodborne diseases are large problems in developed and developing countries. The spread of disease by food handlers is a common and persistent problem^{5,38} worldwide. Food handlers with poor personal hygiene working in the food service settings can be infected by different enteropathogens³⁵, possibly causing fecal contamination of foods by their hands during food preparation, and finally, may be implicated in the transmission of many infections to the public in the local community¹⁹. Therefore, a proper screening procedure for food handlers is helpful in the prevention of probable morbidity and the protection of consumer health.

According to National Food Safety Standards in Iran, all food handlers must undergo parasitological stool examination prior to receiving their health certificate. Therefore, all food handlers were referred to a health center medical diagnosis laboratory in order to check for intestinal parasitic infections. The objective of this study was to assess the prevalence of intestinal parasites among food handlers working in the

food service setting who were attending the Health Center Diagnostic Laboratory in Sari, Northern Iran, for annual check-ups.

MATERIALS AND METHODS

A cross-sectional study was carried out on 1041 food handlers (620 male and 421 female; age range 18-63) attending the Health Center Diagnostic Laboratory in Sari, Northern Iran from August 2011 to February 2012.

Sari lies at the center of the Mazandaran province in Northern Iran (lat. 35°58–36°50N, long. 52°56–53°59E). Sari has a population of approximately 261,293 individuals. The mean yearly relative humidity is 85.83%, with rainfall occurring in all seasons of the year, and the average temperature is 17 °C.

The sample size was originally calculated to be 896 participants, based on the prevalence of 30% in Northern Iran^{11,30}. The sample size was extended to 1041, to take into account possible technical difficulties in the study. The study was carried out on food handlers of different jobs, from different geographical areas in the city of Sari, during a five-month period, with a total of 421 (40.5%) females and 620 (59.5%) males and an age range of 18-63 years (mean age 33 ± 15 yrs). The participants were categorized according to the nature of their occupational duties. The

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subjects under study were, 112 (10.7%) bakers, 137 (13.2%) butchers, 59 (5.7%) cooks and kitchen helpers, 36 (3.4%) confectioners, 67 (6.4%) chicken store workers, 185 (17.8%) fast-food workers, 56 (5.4%) fruit/vegetable sellers, 198 (19%) restaurant workers, 18 (1.8%) school cafeteria workers and 173 (16.6%) supermarket staff. Written consent was obtained from both the health center administration and participants.

A structured questionnaire was used to collect data on age, sex, educational level, income and the hygienic status of each study subject.

Fresh fecal specimens were collected in a clean stool cup. Each container was labeled and immediately transferred to the parasitology laboratory at Sari Medical School. The diagnosis was made on direct wet mount, formalin-ether concentration, and with confirmation of positive stool specimens on Ziehl-Neelsen and Trichrome stained slides.

A Chi-square test was used to assess associations among the variables. The significance level was 5%. SPSS 16 software was used for statistical analysis. The study was approved by the research committee of Mazandaran University of Medical Sciences, Sari, Iran.

RESULTS

Overall, positive stool results for intestinal parasites were 161 (15.5%). As shown in Table 1, the positive rates among males and females were 19% (118/620) and 10.2% (43/421). There was an equal distribution of parasitic infection among all age groups of food handlers, ranging from 11.2-16.8% with a higher prevalence in the 30-39 years group and a lower one in the below 19 years group.

Table 1

Prevalence of intestinal parasitic infections, as determined by analysis of stool specimens, according to age group and sex of 1041 food handlers in Sari, Northern Iran, 2011-2012

Variable	Total n (%)	Positive n (%)	OR	p-value
Sex				
Male	620 (59.5)	118 (19)	0.48 [0.33,0.70]	0.0001
Female	421 (40.5)	43 (10.2)		
Age group				
<19	197 (18.9)	22 (11.2)	0.62 [0.37,1.02]	0.06
20-29	170 (16.3)	28 (16.8)		
30-39	499 (47.9)	84 (16.8)		
40-49	155 (15)	24 (15.5)		
>50	20 (1.9)	3 (15)		

The prevalence of the intestinal parasites detected in the study is shown in Table 2. Of the study subjects, 15.2 % (n = 158) were infected with a single parasite and 0.3% (n = 3) had a double infection. The prevalence of *G. lamblia* as a predominant species was 82 (50.9%), followed by *B. hominis* 29 (18%), *E. coli* 25 (15.5%), *E. histolytica* 9 (5.6%), *Cryptosporidium sp.* 5 (3.1%), *I. butschlii* 5 (3.1%), and *H. nana* 3 (1.9%).

Table 2

Prevalence of intestinal parasitic infections among 1041 food handlers, aged 18-64 years in Sari, northern Iran, 2011-2012

Intestinal parasite	n	Positive (%) n = 162	Positive (%) n = 1041
Single infection			
<i>G. lamblia</i>	82	50.9	7.9
<i>B. hominis</i>	29	18	2.8
<i>E. coli</i>	25	15.5	2.4
<i>E. histolytica</i>	9	5.6	0.8
<i>Cryptosporidium spp.</i>	5	3.1	0.5
<i>I. butschlii</i>	5	3.1	0.5
<i>H. nana</i>	3	1.9	0.3
Double infection			
<i>G. lamblia</i> + <i>I. butschlii</i>	2	1.3	0.2
<i>H. nana</i> + <i>E. coli</i>	1	0.6	0.1
Total infected	161	100	15.5

The occurrence of parasites was associated with occupational category ($p < 0.0001$). Fruit/Vegetable sellers 23/56 (41.1%), school cafeteria workers 5/18 (27.8%), chicken store workers 16/67 (23.9%), cooks and kitchen helpers 13/59 (22%), restaurant workers 38/198 (19.2%), fast-food workers 33/185 (17.8%), confectioners 3/36 (8.3%), bakers 9/112 (8%), butchers 11/137 (8%), and supermarket staff 10/173 (5.8%) (Table 3).

Table 3

Prevalence of intestinal parasitic infections occurrence of enteroparasites in six occupational categories of 1041 food handlers, aged 18-64 years in Sari, Northern Iran, 2011-2012

Occupation	Total examined n (%)	Positive n (%)
Fruits/vegetables sellers	56 (5.4)	23 (41.1)
School cafeterias	18 (1.8)	5 (27.8)
Chicken store workers	67 (6.4)	16 (23.9)
Cooks and kitchen helpers	59 (5.7)	13 (22)
Restaurant workers	198 (19)	38 (19.2)
Fast-food workers	185 (17.8)	33 (17.8)
Confectioners	36 (3.4)	3 (8.3)
Bakers	112 (10.7)	9 (8)
Butchers	137 (13.2)	11 (8)
Supermarket staff	173 (16.6)	10 (5.8)
Total	1041 (100)	161 (15.5)

As shown in Table 4, factors related to intestinal parasitism included educational level, hand washing prior to eating and after using the toilet,

Table 4
Relationship between prevalence of intestinal parasitic infections and certain assumed risk factors among 1041 food handlers aged 18-64 years in Sari, northern Iran, 2011-2012

Risk factors	Total examined n (%)	Positive n (%)	OR	p-value
Place of living				
Rural	350 (33.6)	60 (17.1)	1.2 [0.85,1.71]	0.31
Urban	691 (66.4)	101 (14.6)		
Educational level				
Illiterate	186 (17.9)	56 (30.1)	2.12 [1.39,3.24]	<0.005
Primary school	332 (31.9)	58 (17.5)		
Secondary school	475 (45.6)	43 (9)		
College studies	48 (4.6)	4 (8.3)		
Economic status				
≤200 US \$	816 (78.4)	131 (16)	1.24 [0.81,1.9]	0.34
>200 US \$	225 (21.6)	30 (13.3)		
Hand washing after toilet				
Yes	938 (90.1)	136 (14.5)	0.52 [0.32,1.9]	0.01
No	103 (9.9)	25 (24.3)		
Eating with unwashed hands				
Yes	348 (33.4)	74 (21.3)	1.88 [1.33,2.64]	0.0004
No	693 (66.6)	87 (12.5)		
Eating unwashed vegetables				
Yes	796 (76.5)	123 (15.4)	0.99 [0.67,1.47]	1.00
No	245 (23.5)	38 (15.5)		
Contact with soil				
Yes	38 (3.7)	29 (76.3)	21.26 [9.48,45.93]	<0.0001
No	1003 (96.3)	132 (13.1)		
Contact with cat or dog				
Yes	95 (9.1)	21 (22.1)	1.63 [0.97,2.74]	0.07
No	946 (90.9)	140 (14.8)		
Number living in home				
2-4	615 (59.1)	107 (17.4)	1.45[1.01,2.06]	0.04
≥5	426 (40.9)	54 (12.7)		

contact with soil, and number of people sharing the same home. Parasitic infections were negatively associated with household income level, contact with dogs and cats, place of living, and eating raw vegetables that were not washed with detergent ($p > 0.05$).

DISCUSSION

Several authors across the world have emphasized the significance of food handlers with poor personal hygiene as a risk in the transmission of parasitic and bacterial diseases³⁵. In this study, stool microscopic examination of 1041 food handlers investigated the presence of intestinal parasites. The overall prevalence of protozoan infections was 15.1% and that of helminthic infections was 0.4%. Mixed intestinal parasite infections were detected in 1.9% of the study samples. Higher prevalence rates have been reported from food handlers in Hamadan, Western Iran (74%)¹³, Khuzestan, Southern Iran (34/25%)²⁸, while lower ones have

been reported in Golestan, Northern Iran (6%)²⁰. Recent reports in Iran showed the prevalence of intestinal parasites as between 18.4 to 33.3% in different studies^{11,16,23,24,29}. When the data of the present study were compared with those of the reports of recent years, which were carried out on different groups of people in Iran, the lowest prevalence of parasitic infections was found among food handlers in Sari, Northern Iran. Possible explanations include geographic difference, the time of the study, and that the participants in this study had taken medical examination and might have been treated for intestinal parasites. Other studies on food handlers of countries neighboring Iran showed prevalence rates of 23%², 8.8% and 52.2%^{15,31}, 33.9%¹ and 6.7 to 52.2% in other countries of the world^{10,14,34}. The differences in reported prevalence in various studies may be due to socioeconomic status, climatic conditions, poverty, personal and community hygiene, different study population and the year in which these surveys were conducted. According to recent reports on different groups of people in Iran, the prevalence of the intestinal helminthic

infections was 0-3.6%^{17,18,29,30}. The prevalence of helminthic infections in this survey was 2.5%, which is comparable to some earlier studies of intestinal parasites from Iran and inhabitants of other countries 2.7-13.6%^{1,7,18,37}.

It should be mentioned that, in recent years, the prevalence of intestinal parasites, particularly of helminth infections, has decreased significantly in Iran, which could be explained by the following reasons: (a) installation and operation of a reliable sewage system, (b) Substitution of untreated human excrement with chemical fertilizer, (c) education on disinfecting vegetables before use, (e) routine drug therapy with mebendazole in health centers and (d) implementing health educational programs. The most predominant species identified were *G. lamblia* (50.9%), *B. hominis* (18.1%) and *E. coli* (15.5%). Previous similar studies conducted in Iran and other countries revealed that the leading parasites were *G. lamblia* and *B. hominis* among food handlers, as well as general population^{2,6,10,11,34}. Among protozoa, *G. lamblia* is the common cause of diarrhea worldwide. The majority of individuals infected with *G. lamblia* and *B. hominis* are asymptomatic and excrete large numbers of cysts that remain viable for long periods of time in the environment, contaminating water and food. *G. lamblia* can be directly transmitted to consumers if ingested via food or water that has been contaminated by infected food handlers.

In the current study, the prevalence was higher in males (19%) than in females (10.2%), with a statistically significant difference ($p < 0.0001$). Several studies have reported a higher prevalence of infection in males than in females^{8,12,22}, whereas other data have indicated the contrary^{26,30}. No significant difference was found in the distribution of parasitic infection among all age groups of food handlers, ranging from 11.2-16.8% prevalence, with a higher prevalence in the 20-39 years group and lower in the below 19 years group. This shows that there is equal exposure to the infection and suggests an effect of environmental conditions on infection. However, it is in accordance with a study performed in Khartoum, where the prevalence of infection with no significant difference was 29.9 to 31.7%⁷, albeit countered by other studies conducted in Northern Iran that have revealed a significant association¹⁸. In this survey, the prevalence of intestinal parasites was found to be higher among individuals living in rural areas (14.6 to 17.1%) with no significant difference ($p = 0.31$). Again, the inadequate infrastructure in these areas and the lack of sanitation and hygienic conditions were probably the main reasons for this relationship^{3,9,32}. In the current study, more intestinal parasites were detected in people with a lower income ($p = 0.34$); however, it is estimated that the better the living conditions are, the lower the prevalence rates are. A significant association was observed between the educational level of food handlers and parasitic infection ($p < 0.0001$), assuming that they were highly aware of the importance of personal hygiene. Similar results were obtained in a study on Jakarta sidewalk food vendors³³, a study among food handlers in a tertiary care hospital in Mecca, Saudi Arabia³⁷ and another survey in Santa Catarina, Brazil among 238 workers of a fast-food company²⁵. The prevalence of intestinal parasites was higher in crowded families ($p = 0.04$). This result was similar to a study conducted on 1200 individuals in Qaemshahr, Iran¹⁸. Person-to-person transmission seems to be the initial mechanism of parasite infection in crowded families. Several environmental and behavioral variables were significantly associated with intestinal parasite infection. In the current study, reduced hand washing with soap prior to eating, after using the toilet, or in both situations, and contact with soil, significantly increased the risk of infection ($p = 0.0004$,

0.01, 0.0001), which is in agreement with the data found in Mecca, Saudi Arabia³⁷. Improper hand washing before handling food is one obvious route for dissemination of infections. Parasite eggs in the soil can be transmitted to vegetables, then on to hands and hence directly into the mouth²¹, or ingested by eating raw vegetables³⁶. The observations of the present study suggest a lack of a significant relationship between parasitic infection and eating raw vegetables ($p = 1.00$). The present study showed that the occurrence of parasites was associated with occupational category ($p < 0.0001$). Fruit/Vegetable sellers (41.1%) and supermarket staff (5.8%) contributed most to this association. The result of a study conducted among 238 workers of a fast food company in Santa Catarina, Brazil revealed a statistically significant difference between the prevalence of the infection and occupational category²⁵. The fruits and vegetables may be contaminated by the hands of the sellers who don't wash their hand after defecation.

In conclusion, the intestinal parasitic infection rate of food handlers of Sari city was relatively high. The findings emphasize that food handlers with different pathogenic microorganisms may predispose consumers to significant health risks. Therefore, constant epidemiological surveillance through biannual routine parasitological tests and treatment of the infected cases along with the improvement of environmental sanitation are recommended to control the parasitic infection in food handlers.

RESUMO

Prevalência de parasitas intestinais entre manipuladores de alimentos de Sari, Norte do Iran

Infecção parasitária é altamente prevalente entre os países em desenvolvimento do mundo. Manipuladores de alimentos são fonte potencial de infecção de muitos parasitas intestinais assim como de outras infecções entero-patogênicas. O propósito deste estudo foi determinar a prevalência de portadores de parasitas intestinais entre pessoas que manipulam alimentos e atendem o centro de saúde pública em Sari, norte do Iran para possível check-up. O estudo foi conduzido de agosto de 2011 até fevereiro de 2012. Amostras de fezes foram coletadas de 1041 manipuladores de ambos os sexos e de diferentes funções entre a idade de 18 e 63 anos e foram examinados de acordo com procedimentos standard. Em questionário separado foram colocadas as análises sócio-demográficas, ambientais e de comportamento dos manipuladores de alimentos. Parasitas intestinais foram encontrados em 161 (15,5%) das amostras estudadas. Sete espécies de protozoários ou infecções por helmintos foram observadas. A maior parte dos participantes estava infectada com *Giardia lamblia* (53,9%) seguida por *Blastocystis hominis* (18%), *Entamoeba coli* (15,5%), *Entamoeba histolytica/dispar* (5,5%), *Cryptosporidium* sp. (3,1%), *Iodamoeba butschlii* (3,1%) e *Hymenolepis nana* (1,9%) como a única infecção por helminto. Os achados enfatizaram que os manipuladores de alimentos, com diferentes organismos patogênicos podem se constituir risco significante para os consumidores. Exames rotineiros e tratamento dos manipuladores de alimentos são as ferramentas apropriadas para prevenir as infecções originadas de alimentos.

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CONFLICT OF INTEREST

The authors have no conflicts of interest regarding the content of this article.

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