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Prevalence of Intestinal Parasitic Infections among Catering Staff of Students' Canteens at Shiraz, Southern Iran

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Abstract: The main purpose of this study was to identify possible positive cases of intestinal parasitic infection among the catering staff of a university canteen, thus preventing possible morbidity and protecting the health of the consumers. All 39 catering personnel were examined in a descriptive, cross-sectional study. Blood, urine and three stool samples on three consecutive days were collected from each person. To diagnose the presence of parasitic infections, Formalin-Ether Concentration Technique (FECT), Direct Fecal Smear (DFS) test and Scotch-tape test were used. The data indicated that intestinal parasites were present in 59.4% of the food handlers examined. Among these 26% were infected with pathogenic parasites and 33.4% infected with non-pathogenic parasites. The most frequently-observed intestinal parasites were *Blastocystis hominis*, *Entamoeba coli*, *Giardia lamblia*, *Chilomastix mesnili* and *Taenia saginata*, respectively. The observation of a relatively high prevalence rate of parasitic infections among university catering staff with respect to their sensitive job which is almost, quantitatively, in agreements with the findings of other investigators in other parts of the country calls for a most strict supervision on the side of the responsible health authorities. Furthermore, it emphasizes on the importance of personal and public health education on pathogenic intestinal parasites and methods of their prevention and control. Similarly, it indicates that food handlers should undergo compulsory periodic clinical tests and obtain health certificates.

Key words: Catering staff, intestinal parasites, food-handlers, protozoa, helminths

INTRODUCTION

Parasites present a persistent and intolerable threat to the health of millions of people mainly in the tropics and subtropics and the cost of hosting parasites in terms of human misery and economic loss is incalculable. Parasites have been living with and so adapted to, all other major animal phyla since antiquity. It is thus premature to think of their control or eradication following elucidation of their entire life cycles and the development of drugs, vaccines and anti-vector measures (Cox, 1996).

One of the common health indicators in every community is the prevalence status of parasitic diseases among its people. The capacity to perceive these parasitic diseases and the effective causes in their establishment and dispersion patterns, thus, enhances the health monitoring. In many countries, an important facet of national development programs, reflected by decimation of Gross National Product (GNP), is devoted to the control of parasitic diseases (Evans and Jamison, 1994).

Studies carried out recently show that parasitic infections are still prolific in many parts of the world particularly in the tropical and subtropical regions. Parasitic diseases continue to impose a substantial burden on the poorest people in the poorest countries. Despite the fact that 90% of the global disease burden (GBD) occurs in the tropics, only about 5% of world health research and development investment is shifted to reducing that burden (Godal, 1994).

The global infection rates due to gastrointestinal parasites are on a remarkable scale. In a survey for enteric parasites in food handlers from two private and three public hospitals in Niteroi city of Brazil, the potential transmission risk of intestinal protozoa was shown (Lourenco *et al*., 2004). The most frequent (48.5%) parasite was *Entamoeba coli*. In another study in Brazil, stool samples from 104 female cooks and other catering staff working in elementary schools were collected (Costa-Cruz *et al*., 1995). Intestinal parasites were present in 85% of the studied schools and 47.1% of the catering personnel. *Giardia lamblia* and *Entamoeba coli* were each found in 21.1% of the collected samples. About 65% of the 49 infected cooks carried a single parasite, while 35% harbored two parasites. Sadek *et al*. (1997) working in Egypt showed that among 1700 male food handlers, 19% were infected with intestinal parasites, including *Blastocystis hominis*. In a recent cross-sectional study carried out on food handlers of

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a tertiary hospital in Manila, Philippines, 42.4% of the cooking personnel were positive for at least one intestinal parasite (Esparar *et al*., 2004). The most common parasite observed was *B. hominis* (40.7%).

Numerous other studies of food-borne transmissions of parasites have been carried out in a wide variety of conditions. Some 128 refugee children up to the age of 16 from 6 Latin American countries were part of a study conducted to find about intestinal parasitic infections (Sarfaty *et al*., 1983). Data indicated that 46% had pathogenic parasites including *G. lamblia* and *Entamoeba histolytica*. In a survey on Saudi Arabian children less than six years of age, the overall prevalence of intestinal parasites was 18.4%, the most common parasite being *G. lamblia* (Al-Ballaa *et al*., 1993). Utzinger *et al.* (1999) found that an infection with *E. histolytica/E. dispar* was significantly associated with an *E. coli* infection in school children. In a study on primary school students in Tehran, the prevalence rate of intestinal parasitic infection was 18.4% (Nematian *et al*., 2004). They found an inverse relationship between the educational level of parents and the parasite burden in children. A retrospective study conducted on expatriate workers including food handlers arriving from several Asian countries in one of the Persian Gulf littoral states, found the overall parasitic prevalence to be 23.1% (Ibrahim *et al*., 1993). Although it is stated that a small percentage of the adult population is usually predisposed to reinfection or persistent parasitoses (WHO, 1981), it is essential to note that many of these studies have been carried out on samples of different age groups in this field (Al Ballaa *et al*., 1993; Hill, 1995; Nematian *et al*., 2004; Sarfaty *et al*., 1983).

Poor personal hygiene and public health, innate susceptibility, malnutrition, adverse climate, immune competence, coexistent disease and drug therapy are the most important host factors leading to the prevalence of parasitic diseases among people (WHO, 1981). The impact of parasitic diseases on the peoples of this world is truly enormous. In fact, the negative impact of parasitic diseases has undergone little amelioration up to the present time. Parasites cause morbidities and mortalities among men and animals. They induce damage in agricultural products, loss of manpower and nutritional foodstuffs, so affecting the global economics. Among the top six major infectious diseases on the WHO tropical diseases research program (TDR) list of priorities, five of them (malaria, leishmaniases, trypanosomiases, onchocerciasis and schistosomiases) are parasitic. More than a billion people worldwide suffer from such parasitic infections. Most of these individuals live in the low and middle-income countries of the tropical world. Parasitic diseases are also among the major health issues in Iran.

Intestinal parasitic infections are among the most prevalent diseases in some parts of Iran. At certain foci of infections, some parasitic diseases like malaria, leishmaniases and hydatidosis are regarded as the most important public health problems. Within different social groups, individuals associated with the preparation, processing and distribution of foodstuffs (food-handlers) could play an important role in the dissemination and transmission of parasitic infections, particularly intestinal parasites. They could also transmit and contaminate foods while handling and preparing cooked foods from raw materials.

Prevention and control of parasitic diseases among public and special risk groups, i.e., food handlers, require epidemiological studies to determine the type and prevalence rate of these infections. Proper screening procedures, therefore, are needed in order to diagnose the infected food handlers, thus preventing possible morbidity and protecting the health of the consumers. To the best of authors' knowledge, to date, no documented study has been carried out to assess the extent, frequency, causes and major outcome (s) of intestinal parasitic infections among the catering staff of student's canteens in Shiraz who are responsible for the delicate preparation, processing and cooking of foodstuffs for about 6000 students. The current study was, therefore, undertaken to address these issues.

MATERIALS AND METHODS

This descriptive, cross-sectional study was carried out in the dietary section of a university in Shiraz (52°30' N, 29°40' E). All 39 catering personnel who were responsible for cooking and distribution of foodstuffs at central self-services were screened by sampling their blood, urine and stool specimens. Permission was obtained from the University Dietary Service Director regarding the conduct of the study. It was agreed that the name of the university was not to be mentioned in any report or publication for the sake of confidentiality.

In order to perform this study, all 39 food handlers were subjected to direct fecal test with normal saline, direct fecal test with Lugol iodine solution, precipitation test with formalin ether, saturated saline floatation test and lamellae test containing adhesive Scotch tape using Graham's method. Specimens were collected in the summer season of the year 2002.

Each sample was processed and examined immediately after collection using Direct Fecal Smear (DFS) and Formalin Ether Concentration Technique (FECT) according to the guidelines set by World Health Organization (WHO) Bench Aids for the Diagnosis of Intestinal Parasites (WHO, 1994).

In the DFS method, an applicator stick was used to mix about 0. 2 g of stool with one to two drops of normal saline placed on a clean glass slide. An even suspension was made and covered with a 22 mm^2 glass cover slip.

In the FECT method, 10 mL of 10% formalin was added to about 1 g stool and was allowed to stand for 10 min. The resultant suspension was filtered through wet 2-layered gauze into a 15 mL conical centrifuge tube. About 7 mL clean water was added to the filtrate. It was subsequently centrifuged at 3200 rpm for 3 min. The supernatant was then discarded, after which 3 mL of ether and 6 mL of clean water was added. Centrifugation was repeated. With the use of an applicator stick, the layer that formed on top of the tube was then ringed and discarded. The remaining sediment was transferred to a clean glass slide and topped with a 22 mm^2 glass cover slip.

The data were analyzed using EPI info version 6.0 software.

RESULTS

Table 1 shows the relative frequency of infection with intestinal protozoa and helminths among catering personnel of one of the universities in Shiraz. In general, intestinal parasites were found in 59.4% of food handlers (3% intestinal helminths and 56.4% intestinal protozoa). Among these, 26% were infected with pathogenic parasites and 33.4% were infected with non-pathogenic parasites.

As shown, five different species of parasites were identified, four of which were intestinal protozoa and the remaining one was a tapeworm. The highest percentage of infection (25.4%) was observed for the protozoan *Blastocystis hominis* and the lowest percentage of infection (3%) was for tapeworm.

Table 2 shows the percentage relative frequency of infection with regard to personal characteristics. Among the people who were identified as being infected with parasites, 49% had less than three years of work experience, while those with 7-10 years work experience in food processing had the lowest percentage infection frequency (10%).

Of all the people under study 5% were female and 95% were male. All people under study had access to hygienic municipal water. They were resident in Shiraz and no significant difference was found between them as far as important socioeconomic and demographic variables are concerned. None of them had any history of parasitic infections.

Most (90%) of them had attended the personal and public health educational curricula and only 10% had not attended such training sessions. Amongst these people 85% of observed cases of parasitic infections were related to those who did not attend training and 15% were related to those who attended such curricula.

Table 1: The relative frequency of infection with intestinal protozoa and helminths among dietary unit staff at one of the university self-services in Shiraz

Protozoa	No.	Relative frequency (%)	Helminth	No.	Relative frequency (%)
E. coli	6	15	*T. saginata*	1	3
B. hominis	10	25.4			
G. lamblia	3	8			
C. mesnili	3	8			
Total	32	56.4		1	3

Table 2: The percentage relative frequency of infection with respect to personal traits

Variable	Relative infection frequency (%)
Male (95% catering staff)	100
Female (5% catering staff)	0
Length of employment : 0-3 years	49
Length of employment : 4-6 years	23
Length of employment : 7-10 years	10
Length of employment : >10 years	18
Educated	85
Illiterate	15
With health card	8
Without health card	92
With history of laboratory test for diagnosis of intestinal parasites in the past 6 months before study	21
With history of laboratory test for diagnosis of intestinal parasites in the past 4 years before study	79
Practice in washing raw vegetables:	
Washing only with tap water	0
Disinfection with germicidal compounds	41
Decontamination with disinfectants and detergents	49

All catering personnel (100%) had access to disinfectants, antiseptics, detergents and other sanitary means. There was, thus, no difference between infected and non- infected food handlers in this respect. In the sample population, 92% of cases with positive parasite test were observed among individuals who lacked health care card. Moreover, some 85 and 15% of persons under investigation had been tested for parasitic infections in the last six months or previous four years leading to the initiation of this study, respectively. About 3% of the population used to clean fresh fruits and vegetables at home by routine washing with tap water, while 74% used chlorine or ammonia quaternary compounds for disinfection and the remaining 23% used both disinfectants and detergents followed by washing in clean water.

DISCUSSION

Despite development in the delivery of health services, parasitic diseases remain as the most important

public health problem in most countries, particularly the developing countries, of the world. Infectious food-borne illnesses constitute a substantial health burden in these countries. The effects of intestinal parasitic infections vary according to species and burden of infection. These parasites are commonly transmitted through ingestion of contaminated food or water as a result of poor sanitation and hygiene. In some instances, transmission occurs through close contact between infected and uninfected individuals as in infected food handlers and consumers, respectively. Food handlers are people who have contact with food from the time of preparation up to the time of serving it to the consumers. A study conducted in Malaysia indicated that approximately 10-20% of food-borne disease outbreaks were due to contamination by the food handlers (Zain and Naing, 2002). Proper screening procedure, therefore, may be needed in order to diagnose the infected food handlers, thus, preventing possible morbidity and protecting the health of the consumers.

The results of similar studies carried out on the catering staff at another university in Iran indicated that 55.3% were contaminated with parasitic infections, 19.1% of whom had pathogenic parasites and 36.2% had non-pathogenic parasites (Kotabi *et al*., 2001). In addition, the prevalent parasitic protozoan species were very similar to this study. In another study on school students in Tehran, 44.31% had parasitic infections; 16.43% and 27.88% of them were contaminated with pathogenic and non-pathogenic parasites, respectively (Gharavi and Islami, 2002).

In the present study, the highest rate of parasitic infection (25.4%) belonged to *Blastocystis hominis*. This is an anaerobic enteric protozoan of man with indefinite affinities and with a multinucleated cyst of 5-30 μm in size and a persistent trophozoite producing no lesions. This persistence of trophozoites produces a state of clinical immunity referred to as 'premunition' in man (Cohen, 1974). *B. hominis* causes diarrhea in pig, monkey, guinea-pig and some birds, but man is the most sensitive host. Nowadays, it is regarded as a pathogenic agent causing enteritis particularly in the immunocompromised individuals like AIDS patients (Cirioni *et al*., 1999; Garcia, 2001). This protozoan parasite is not usually pathogenic, unless in patients suffering from abdominal pain that excrete it in a large number and no other aetiological agent is found in them. It is stated that about 1-20% of stools are positive for *B. hominis*. Some studies have reported acute and chronic diarrheal disease and abdominal discomfort in people infected with *B. hominis*, but other studies with controls have not substantiated a correlation of *B. hominis* infection with intestinal symptoms. It is thus postulated that two virulent and avirulent strains of *B. hominis* exist (Sears, 1995). Considering the interesting fact that the virulence of *Entamoeba histolytica* is in part due to the association of certain bacteria with amoeba which augments the virulence of the latter under suitable circumstances (Mirelman *et al*., 1983); it is likely that a similar interplay also exists for *B. hominis*.

The second highly frequent parasite was *E. coli* (15%). This occurs in some 30% of world population. It differs from *E. histolytica* by its coarser nucleus with an eccentric karyosome (Smyth, 1994). It has an eight-nucleated cyst with a size of 20-45 μm. It is generally a harmless scavenger, feeding on bacteria and detritus in the human colon.

Chilomastix mesnili (8%) is the largest intestinal flagellate of man. It has three anterior flagella and a fourth one in its oral groove and feeds commensally on intestinal fluids. It has a pyriform cyst with a single nucleus. *E. coli* and *C. mesnili* are not pathogenic and evidence indicates that when they are abundant, they may produce a mild inflammation in cecal region of the large intestine causing abdominal discomfort and diarrhea (Soulsby, 1982; Garcia, 2001). Although both of them are non-pathogenic, their mere presence among the study participants may indicate that the food and water consumed are contaminated with fecal material.

Giardia lamblia (8%), which causes giardiasis, is the most prevalent pathogenic parasite in Iran. Its prevalence rate varies between 10-40% according to the prevailing sanitary conditions. It is also the most prevalent enteric infection in the developed world. Recent reports that have documented transmission of *Giardia* in commercial food establishments, corporate office settings and in small gatherings indicate that food borne transmission of giardiasis is more common than previously recognized (Hill, 1995).

The least relative frequency (3%) was found for the tapeworm, *Taenia saginata*. This worm is identified by its eggs or its gravid proglottids. Human infection is acquired from the ingestion of raw or poorly cooked beef.

It was found that both pathogenic and non-pathogenic parasitic infections were high among food handlers. Several measures should ideally be used to control the unraveled dissemination of food borne parasites in public places, improve policies, regulations and practices regarding parasitological screening.

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