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Parasitic Contamination of Fresh Vegetables Consumed in Tabriz, Iran

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Abstract: Fresh vegetables are an important part of a healthy diet. In recent years there has been an increase in the number of reported cases of food-borne illness linked to fresh vegetables. The consumption of raw vegetables is a major way in the transmission of parasitic contaminations. The goal of this study was to determine the parasitological contamination of vegetables sold at markets and obtained from gardens. A total of 100 samples from different vegetables were randomly selected from the markets and gardens (markets: 50; gardens: 50) and then were examined by a concentration method. Each sample was washed with water, allowing sedimentation at room temperature for 24 h. About 5 mL of sediment were centrifuged at 3000 rpm for 5 min. Sediment was examined in lugol stained slides through light microscopy. About 40% (20/50) of markets vegetables and 76% (38/50) of gardens vegetables were contaminated with different parasites. Prevalences of pathogenic parasites in vegetables of markets and gardens were 20 and 25%, respectively. Parasites detected were Giardia cysts (7%), Dicrocoelium eggs (4%), Fasciola eggs (3%) and Ascaris eggs (1%). In regard to results of this study, the importance of vegetables in the transmission of intestinal parasites in stressed and it is necessary to improve the sanitary conditions of these kinds of food.

Key words: Parasitic contamination, vegetables, eggs, markets, Tabriz, Iran

INTRODUCTION

The increased demand, global sourcing and transport of foods, especially salad vegetables, enhance both the likelihood of surface contamination and survival of the transmissive stages of parasites pathogenic to man. Food normally becomes a potential source of human infection by contamination, during production, collection, transport and preparation or during processing and the sources of zoonotic contamination are usually faeces, faecally contaminated soil or water (Slifko *et al*., 2000). Intestinal parasites are widely prevalent in developing countries, probably due to poor sanitation and inadequate personal hygiene (Kang *et al*., 1998). It is estimated that as much as 60% of the world's population is infected with gut parasites (pathogen and nonpathogen) which may be transmitted through direct and indirect contact, food, water, soil, vertebrate and arthropod vectors and rarely from mother to offspring (Brown and Neva, 1987; Kang *et al*., 1998). The consumption of properly washed vegetables is a major way for transmission of parasitic contaminations (e.g., Fasciola). Several surveys in different parts of the world show that the vegetables can be agent of transmission of protozoa cysts and oocysts (Giardia, Entamoeba, Toxoplasma and Isospora) and helminths eggs and larvae (Hymenolepis, Taenia, Fasciola, Whipworm, Trichostrongylus, Strongyloides and Hook worms) (Choi, 1972; Choi *et al*., 1982; Coelho *et al*., 2001; Erdogrul and Sener, 2005). This problem is becoming an increasing concern because of the expanding number of susceptible people (i.e., the elderly and the immunocom-promised) more extensive produce trade across international borders and changes in national and international policies concerning food safety (Robertson and Gjerde, 2000).

Further trends in many countries toward eating more raw or lightly cooked vegetables to preserve taste and heat labile nutrients may also increase the likelihood of foodborne parasitic infections (Erdogrul and Sener, 2005). On the other hand in some parts of the world, application of sewage on agricultural land is a customary rule which results in transmission of pathogenic organisms from irrigated soil to crops, grazing animals and humans (Erdogrul and Sener, 2005; Ingham *et al*., 2004; Korentajer, 1991).

The high prevalence of intestinal parasites such as *Giardia lamblia*, *Blastocystis hominis*, *Ascaris lumbricoides*, *Hymenolepis nana* and *Taenia* sp., among the inhabitants of Ardabil city, Iran were reported by Daryani (2002). It was probably due to poor sanitation, inadequate public hygiene and eating raw vegetables and without peeling. However, the parasitic prevalence in vegetables was still undetermined. The aim of this study was to evaluate the prevalence of parasites attached to

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imported vegetables those collected from native gardens in Tabriz city, Iran to provide epidemiologic and parasitical information on vegetables in the region.

MATERIALS AND METHODS

This cross-sectional study was carried out on native and imported vegetables consumed in Tabriz city, Iran between Spring and Summer, 2010. The city of Tabriz is located in neighbouring on the Caspian sea, in the Northwest of Iran. The climate is cold (max 33°C) during the hot Summer months. The Winters are long bitter cold with a temperature plummeting to -22°C. The annual rainfall is around 320 mm. A total of 100 vegetable samples (markets: 50; gardens: 50) from following vegetables were selected for this survey: radish, taragon, leek, parsley, dill, lettuce, coriander and spearment. These vegetables were collected randomly from markets with the same vendors (for imported vegetables from Northwest and South of Iran) and gardens (for native vegetables from throughout the city) monthly. A portion of vegetables was weighted (250 g for all cases) into plastic bags and washed with 10, l physiological saline solution (0.95% NaCl) and the washing water/saline was left for about 24 h for sedimentation to take place. The top water was discarded and 5 mL of the remaining washing water centrifuged at 2000 g for 5 min. The supernatant was discarded and the residue carefully collected. The samples were agitated gently by hand in physiological saline solution containing lugol again for further distribution of the cysts and eggs and then were examined in lugol stained through light microscopy (Bailenger, 1962).

RESULTS AND DISCUSSION

About 40% (20/50) of imported vegetables and 76% (38/50) of native vegetables were contaminated with different intestinal parasites containing pathogen and non-pathogen ones. Table 1 shows kind of contamination in different vegetables. Prevalence of pathogenic parasites in native vegetables was higher than imported ones. The most common parasites in imported and native vegetables were Taenia eggs and *Entamoeba coli* cysts, respectively (Table 1). Most frequency of pathogen parasites in imported vegetables was seen in September whereas in native vegetables that collected only in Summer season, most frequency of pathogen parasites was seen in August, the middle of Summer (Table 2). Table 3 shows parasitic contaminations (pathogen or non-pathogen) in imported and native vegetables. The consumption of raw vegetables plays an important role in the transmission of parasitic contaminations

Table 1: Prevalence of intestinal parasites in vegetables consumed in Tabriz city, Iran (2010)

	Imported vegetables (50)		Native vegetables (50)	
Characteristics	No.	%	No.	%
Infection position				
Non-infected	25	50	17	34
Infected	25	50	33	66
Polyparasitism				
One parasite	20	21	29	64
Two parasites	4	5	4	9
Three parasites	1	1	0	0
Kind of parasite				
Pathogen±non-pathogen	13	52	11	24
Only non-pathogen	12	48	22	48
Name of parasite				
Free-living flagellates	6	8	5	16
Entamoeba coli	8	8	6	16
Giardia lamblia	5	7	2	9
Taenia sp., egg	11	11	5	13
Fasciola hepatica	3	3	1	4
Dicrocoelium	4	4	2	7
Trichostrongylus egg	1	1	0	0
Hymenolepis nana	1	1	1	4
Ascaris	1	1	0	0
Mite	3	5	1	2
Free-living larva	4	6	2	7

Table 2: Monthly prevalence of intestinal parasites detected in imported and native vegetables consumed in Tabriz, Iran (2010)

	Kind of parasites			
	Pathogen+non-pathogen		Non-pathogen	
Kind of vegetable/Season	No.	%	No.	%
Imported vegetables				
April	3	19	6	38
May	4	25	7	44
June	1	6	4	25
July	4	25	3	19
August	5	31	1	6
September	7	44	3	19
Native vegetables				
July	4	27	5	33
August	6	40	7	47
September	3	20	7	47

(Anuar, 1977). Recovery of parasites from vegetables used as the source of contamination may be helpful in indicating the incidence of intestinal parasites among a community. Several studies into the recovery of parasites from vegetables have been conducted in Iran and the prevalence was high in all examined vegetables and parasites such as *G. lamblia*, *E. coli*, *A. lumbricoides* eggs and *Taenia* sp., eggs have been reported (Akhlaghi and Oormazdi, 2000; Davami *et al*., 2000; Sahebani *et al*., 1999; Sarkari, 1996; Sayyed Tabai and Sadjjadi, 1998; Zohour and Molazadeh, 2001). This is partially explained by the fact that Iranians are fond of raw vegetables which were cultivated on the gardens and fertilized with non-treated night soil. Of course, since using night soil is not common in this area, it seems that using sewage is an important agent in contamination of native vegetables.

Table 3: Distribution of intestinal parasites in different imported and native vegetables consumed in Tabriz city, Iran (2010)

	Imported vegetables						Native vegetables					
	Without infection		Pathogenic±non-pathogenic parasites		Non-pathogenic parasites		Without infection		Pathogenic±non-pathogenic parasites		Nonpathogenic parasites	
Name of vegetables	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Leek	1	17	2	33	3	50	0	0	1	33	2	67
Radish	4	67	2	33	0	0	0	0	1	33	2	67
Parsley	3	50	1	17	2	33	2	67	1	33	0	0
Coriander	2	33	3	50	1	17	1	33	1	33	1	33
Tarragon	5	83	1	17	0	0	1	33	1	33	1	33
Lettuce	3	50	2	33	1	17	0	0	1	33	2	67
Spearment	2	33	0	0	4	67	0	0	0	0	3	100
Dill	1	17	4	67	1	17	0	0	1	33	2	67

Bryan (1977) indicated that field vegetables are directly contaminated by irrigation water or indirectly by contact with soiled ground. Also many epidemiological studies have relieved on excess of parasitic contaminations associated with raw water reuse in irrigation (Al-Salem and Tarazi, 1992; Bradely and Hadidy, 1981; Cifuentes *et al*., 1992). Larkin *et al*. (1978) reported that crops such as lettuce, cabbage and other broad leafed vegetables would have large contact areas with the soil surface and root crops would be continuously exposed to the contaminants. Daryani (2002) in a study on individuals in Kargan village in Ardabil showed that 17% were infected with *G. lamblia*. In another study on primary school children, prevalence of *G. lamblia* has been shown 14% (Daryani and Ettehad, 2005). These studies indicate that contamination with this parasite in Tabriz is high. In this survey, 7% of imported vegetables and 9% of vegetables cultivated in Tabriz were contaminated with *G. lamblia*. Prevalence of Giardia in other cities of Iran was as follow: Ahwaz 10% (Akhlaghi and Oormazdi, 2000), Yasouj 11% (Sarkari, 1996), Hamadan 5% (Sayyed Tabai and Sadjjadi, 1998) and Jiruft 14% (Zohour and Molazadeh, 2001).

Monge and Arias (1996) in a study on vegetables in Costa Rica showed that 5% of them were contaminated with Giardia cysts. In Norway, contamination rate with Giardia was 2% (Robertson and Gjerde, 2000). Of eight outbreaks of food-borne giardiasis documented only one reports the possibility of food (i.e., tripe) being intrinsically infected. The other outbreaks, affecting 217 individuals between 1979 and 1990 are associated with contamination by food handlers and include foods such as salmon, fruit salad, raw vegetables, Lettuce, onions and tomatoes. In two out breaks, the original source of infection was traced to the infected infant of the food handler (Girdwood and Smith, 1999). In this survey 8% of imported vegetables and 16% of those cultivated in Tabriz were contaminated with *E. coli*. Although, this parasite is non-pathogen, it is considered as a health indicator. Since, this parasite lives only in human body (intestine), therefore those vegetables have been contaminated with human faeces (by sewage) and the probability of existence of other intestinal pathogenic and non-pathogenic parasites on vegetables is too much. *A. lumbricoides* is also a soil transmitted parasite and can be transmitted by vegetables. In this study, 1% of imported vegetables were contaminated with eggs of this parasite. Prevalence of Ascaris in other cities of Iran including Hamadan, Yasouj and Jiruft was 90, 6 and 1%, respectively (Sarkari, 1996; Sayyed Tabai and Sadjjadi, 1998; Zohour and Molazadeh, 2001). Choi and Chang (1967) in Korea showed that contamination rates with Ascaris in cabbage and radish were 56 and 40%, respectively.

Although at present, contamination rates of Ascaris have been reduced contamination rates with other helminths are unfortunately still highly prevalent throughout the world. In this survey, 11% of imported vegetables and 13% of those cultivated in Tabriz were contaminated with *Taenia* sp., eggs. Of course, *Taenia saginata* eggs are excreted only by human faeces and are not infective for human beings but *Echinococcus* sp., eggs are excreted by dogs and are infective for humans; if Taenia eggs found on vegetables belong to Echinococcus, eating raw vegetables contaminated with Taenia eggs may increase risk of infection with hydatid cyst. Prevalence of hydatid cyst in sheep and cattle slaughtered in industrial abattoir of Tabriz was 65 and 31%, respectively (Garedaghi and Bahavarnia, 2011). These animals are infected by hydatid cyst be eating infected provender. Thus, it appears that most of the dogs in Tabriz areas are infected with adult worm of Echinococcus and by excretion of Taenia eggs causing contamination of water, soil, vegetables and provender and finally animals and human beings.

CONCLUSION

In regard to results of this study, the importance of vegetables in the transmission of intestinal parasites is stressed and it is necessary to improve the sanitary conditions of these kinds of food. The disinfection of

vegetables is a treatment applied in order to reduce their natural contamination or processes to the product along the different steps of the food chain until its consumption. The use of night soil as fertilizer in farms may be solved by storage or by chemical disinfection of faeces.

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