



## The Parasitic Contamination of Raw Vegetables Consumed in Zahedan, Iran

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### ABSTRACT

**Background:** 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 regarding fresh vegetables.

**Objectives:** The objective of this study was to evaluate the parasitological contamination of vegetables which are consumed raw and commercialized in Zahedan, Iran. These findings could lead to better practices in handling vegetables to protect against intestinal parasitic infections.

**Material and Methods:** We studied 96 samples of raw vegetables including Garden cress, Wild Leek, sweet basil, cultivated radish, Dill, Coriander, Parsley, Peppermint and Scallion collected from markets in Zahedan City, Iran between June and August 2012. The study was performed in the Department of Parasitology, Faculty of Medicine, and Zahedan University of Medical Sciences. The vegetables were washed in tap water including an anionic detergent, the washing solution was then centrifuged and the sediments were examined for parasites.

**Results:** The findings of forty three samples (44.8%) of all vegetables were microscopically positive for the presence of pathogenic metazoans, the results of 22 (22.9%) were positive for pathogenic protozoa and the results of 34 (35.4%) were positive for nonpathogenic protozoa species.

**Conclusions:** It may be concluded that parasites are common in vegetables that are frequently eaten raw, and the use of tap water does little to remove them. Regarding the 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.

**Keywords:** Parasitology; Vegetables; Iran

### 1. Background

Food-borne illnesses caused by intestinal parasites are still a public health problem in the developing countries (1). About one third of the world, more than two billion people, is infected with intestinal parasites (2). Food

normally becomes a potential source of human infection by contamination, during production, collection, transport, preparation or processing (3). Vegetables are essential for good health, and they form a major component of human diet in every family. They are vital energy

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The content and results of the present communication has identified the amount of parasitic contamination among vegetables consumed in Zahedan and it is useful for the policy/decision makers to reduce the intestinal infections by reducing parasitic contamination of raw vegetables.

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contributors which are depended upon by all levels of human as food supplement or nutrient (4). Since vegetables require a moist environment for their growth, particularly those eaten raw and without peeling, have been demonstrated to be a way for transmission a wide range of parasites (5). Various parasites have been associated with vegetables including protozoa and helminthes (6, 7). According to many studies, there is a strong association between vegetables, especially raw ones and parasitic infections (7-10). Moreover, many outbreaks of protozoan infections in humans have been linked to raw fruits and vegetables (11).

Vegetables are used extensively in different parts of the country, but unfortunately people do not know how to consume them properly. Previous studies have revealed that many types of vegetables, purchased at markets in different regions from many developing countries, were contaminated with parasites (8, 11). Some previous studies have reported the rate of vegetable contamination to parasitic outputs from 1.94% to 68.3% in different parts of Iran (12, 13).

Epidemiological research performed in different areas in Zahedan has shown that the social and economic situation of individuals is an important factor in the prevalence of intestinal parasites. In addition, poor sanitary and environmental conditions are known to be relevant in the propagation of these infectious agents (11).

## 2. Objectives

No studies to our knowledge have examined the parasitic contamination of commercial vegetables in Zahedan. These findings could open a new avenue of research in vegetables and could also lead to better practices in growing and handling vegetables to protect against intestinal parasitic infections.

## 3. Materials and Methods

### 3.1. Study Area and Subjects

During June and August 2012, we collected different types of vegetables that are frequently eaten from the vegetables markets in variant parts of Zahedan city. The city of Zahedan with an estimated population of 567449 individuals is located near Pakistan and Afghanistan, only about 41 km south of the tripoint of the borders of the three countries, at an altitude of 1,352 meters above the sea level and at a distance of 1,605 km from the Iranian capital of Tehran. Zahedan lies east of the Kavir-e Loot desert. Most of vegetables consumed in Zahedan are imported from other cities, therefore we did not consider any vegetable to be cultivated in Zahedan. The vegetables consumed in Zahedan are mostly imported from other cities, especially from Khash, 182 Km south of Zahedan city.

### 3.2. Sample Collection

The vegetables used in the study were Garden cress, Wild Leek, sweet basil, cultivated radish, Dill, Coriander, Parsley, Peppermint, and Scallion. Ninety-six samples of vegetables were picked up to obtain qualitative estimation of parasitic contamination. Sampling from different districts of Zahedan, was performed, including 20 different grocery stores selling fresh vegetables.

### 3.3. Sample Analysis

#### 3.3.1. Sedimentation Method

200-250 g samples of each vegetable were washed in distilled water in a plastic container for the parasites removal of the parasitic ova, larva or cysts. The suspension was strained through a sterile sieve to remove undesirable materials (14). The filtrate was centrifuged at 5000 rpm for 5 minutes (12), and the supernatant was discarded into the disinfectant jar. The sediment was mixed and a drop was applied on the center of a clean grease-free slide, a clean cover slip was placed gently to avoid air bubbles and overflowing. The preparation was examined under microscope to investigate parasites using X10 and X40 objectives.

#### 3.3.2. Floatation Method

200-250 g samples of each vegetable were washed in distilled water in a plastic container for the removal of parasitic ova, larva or cysts. The suspension was strained through a sterile sieve to remove undesirable materials (14). The filtrate was centrifuged at 5000 rpm for 5 minutes (12) and the supernatant was discarded into the disinfectant jar. The sediment obtained was resuspended in zinc sulphate floatation fluid and recentrifuged. The floatation fluid was added to fill to the brim and a cover slip was superimposed on it. The cover slip was lifted and examined under microscope using X10 and X40 objectives.

## 4. Results

Nine different types of vegetables were sampled from twenty different markets in Zahedan. A total of 96 samples were examined for the presence of parasite contamination. Each slide for the each type of vegetable was examined to confirm the findings. As shown in *Table 1*, the findings of 43 (44.8%) of the 96 vegetables were microscopically positive for the presence of pathogenic metazoans, the results of 22 (22.9%) of all vegetables were positive for pathogenic protozoa and 34 (35.4%) of 96 samples results were positive for nonpathogenic protozoa species. Among these vegetables, scallion had the highest number of parasitic contamination for the presence of pathogenic metazoans (100%), sweet basil had the highest rate of pathogenic

protozoa (35%), and cultivated radish had the highest rate of nonpathogenic protozoa contamination (100%). Table 1 shows the parasitic profile of the each vegetable sample.

Table 2 shows the frequency of parasites isolated on

vegetables and the life stage observed microscopically. The most common metazoan parasite isolated was the ova of *Taenia* spp (13.1%), while the most frequent protozoa observed was *Entamoeba coli* (29.3%).

**Table 1.** The Rate of Parasitic Contamination in Vegetables Consumed in Zahedan

Type of Vegetables	Parasite, NO.	Metazoans		Protozoa	
		Pathogen, No. (%)	Nonpathogen, No. (%)	Pathogen, No. (%)	Nonpathogen, No. (%)
Wild Leek	20	8 (40)	0 (0)	5 (25)	12 (60)
Sweet basil	20	11 (55)	0 (0)	7 (35)	10 (50)
Cultivated radish	4	3 (75)	0 (0)	2 (50)	4 (100)
Dill	5	2 (40)	0 (0)	0 (0)	2 (40)
Coriander	5	2 (40)	0 (0)	1 (20)	1 (20)
Parsley	12	4 (33.3)	0 (0)	2 (16.7)	0 (0)
Peppermint	16	5 (31.3)	0 (0)	2 (12.5)	0 (0)
Scallion	5	5 (100)	0 (0)	1 (20)	0 (0)
Garden cress	9	3 (33.3)	0 (0)	2 (22.2)	5 (55.6)
<b>Total</b>	<b>96</b>	<b>43 (44.8)</b>	<b>0 (0)</b>	<b>22 (22.9)</b>	<b>34 (35.4)</b>

**Table 2.** The Prevalence of Parasitic Contamination of Raw Vegetables in Zahedan

Parasite	Life-Stage Observed	Contamination Rate, No (%)
<b>Metazoan</b>		
<i>Taenia</i> spp	ova	13 (13.1)
<i>Ascaris Lumbricoides</i>	ova	6 (6.1)
<i>Toxocara canis</i>	ova	4 (4.1)
<i>Fasciola hepatica</i>	ova	5 (5.1)
<i>Dicrocoelium dendriticum</i>	ova	5 (5.1)
<i>Trichostrongylus</i> spp	ova	1 (1.0)
<i>Enterobius vermicularis</i>	ova	8 (8.1)
<i>Trichuris trichiura</i>	ova	1 (1.0)
<i>Heterophyes heterophyes</i>	ova	1 (1.0)
<i>Hymenolepis nana</i>	ova	5 (5.0)
<i>Hymenolepis diminuta</i>	ova	2 (2.0)
<b>Protozoan</b>		
<i>Entamoeba histolytica</i>	cyst	5 (5.0)
<i>Giardia duodenalis</i>	cyst	8 (8.1)
<i>Isospora belli</i>	oocyst	2 (2.0)
<i>Entamoeba coli</i>	cyst	29 (29.3)
<b><i>Chilomastix mesnili</i></b>	cyst	4 (4.0)

## 5. Discussions

Vegetables may act as passive vehicles for transmission of pathogenic parasites and protozoa which are primarily transmitted through the fecal-oral route (15). The consumption of raw vegetables plays a major epidemiological role in the transmission of parasitic food-borne

diseases. Intestinal parasites are widely prevalent in developing countries, probably due to poor sanitation and inadequate personal hygiene (16).

As awareness of the potential for food-borne outbreaks of parasitic infections increases, studies involving the recovery of parasites from vegetables are increased worldwide. To our knowledge no previous studies have either

examined or discussed the parasitic contamination of vegetables in Zahedan. For this reason, the recovery of parasites from vegetables which are found to be the source of infection may be of considerable importance in epidemiologic considerations. The consumption of raw or undercooked vegetables facilitates transmission of large numbers of zoonotic infections (17).

A total of 96 samples were examined for the presence of parasite contamination, in which scallion had the highest number of parasitic contamination for the presence of pathogenic metazoans (100%), sweet basil had the highest rate of pathogenic protozoa (35%), and cultivated radish had the highest rate of nonpathogenic protozoa contamination (100%). These results are similar to the study performed by Soleimanpoor et al. in Zabol city (18). In other areas of Iran as for pathogenic protozoa, *Giardia duodenalis* was proved to possess the highest rate of contamination. The overall rate of vegetables contamination to parasitic out puts in different parts of Iran ranged from %1.94 to %68. *Ascaris Lumbricoides* encompasses the highest rate in this regard as a pathogenic metazoan (13, 19, 20).

A previous study performed in South Western of Saudi Arabia has demonstrated that eggs of *Ancylostoma* and *Ascaris* together with cysts of *Entamoeba coli* and *Blastocystis hominis* are the most common parasites stages found in the 5 leafy vegetable plants investigated (8). Results of the mentioned study have shown that 76 of 470 samples (16.2%) contained parasite stages which is a much lower contamination in comparison to the one reported in this area (8). In Kenya the intestinal parasites found on the vegetable samples included protozoa: *Entamoeba histolytica*, *Giardia lamblia* and *Balantidium coli* and helminthes: *Ascaris lumbricoides*, *Trichuris trichiura* and hookworms (20). The final hosts of *Toxocara* are cats and dogs, but their immature shape in the form of visceral larvae is seen in human. *Enterobius vermicularis* ova can also enter the digestive tract by ingestion of soil, vegetables and food products, although the main source of transmission is direct.

In this study any kind of *Taenia* egg which also isolated identified to be merely the ova of *Taenia*, which was the most common pathogenic metazoan recognized. Considering the protozoa, amoebic cysts and *Giardia* under the good condition can survive for a long time and could be ingested via vegetables. Southeast of Iran is an endemic area for many parasitic diseases. Population size, density, and socioeconomic conditions, all contribute to the development and transmission of many parasites, as do environmental factors such as the warm climate, the sandy and clay nature of the soil, and the salty nature of the water. Contamination of vegetables may occur in a variety of ways, such as from contact with soil, and from contact pre- and postharvest. In most cases, contamination is associated with the water used for irrigation.

In conclusion, our study showed that parasites are common in vegetables that are frequently eaten raw, and the use of tap water does little to remove them. Scallion and radish were more likely to be contaminated with parasites, followed by wild leek and sweet basil. Ova of *Taenia* spp and *Enterobius vermicularis* were the most common isolated pathogenic parasites. Meanwhile, the least common pathogenic parasites in the study were *Trichuris trichiura* and *Heterophyes heterophyes*. These findings may have important implications for those concerned with global food safety and indicate the need for further investigation in this area.

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None declared.

## Authors' Contribution

All authors contributed substantially to the study. Adel Ebrahimzadeh conceptualized the design and Saeed Mohammadi and Ali Jamshidi implemented samples collection, Laboratory diagnosis and data collection. All authors contributed to the literature review and writing of the article.

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