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Letter to the Editor

The Parasitic Contamination of Edible Raw Vegetables in Karaj, Iran in 2017

Aliehsan HEIDARI [1], Mahsa HEZAROSI [2], Ensieh NASSERKHAIL [2], Monireh SEZAVAR [1], Hossein KESHAVARZ [3], Amir BAIRAMI [1], Mohammad ZIBAEI [1], Kourosh KABIR [1]

1. *Department of Medical Parasitology, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran*
2. *Student Research Committee, Alborz University of Medical Sciences, Karaj, Iran*
3. *Department of Medical Parasitology and Mycology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran*

***Corresponding Author:** Email: aliehsan2001@yahoo.com

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Dear Editor-in-Chief

In many countries, including Iran, the consumption of edible raw vegetables is culturally accepted by people and holds a distinct place in their daily diet (1).

Since no studies have yet been conducted to evaluate the contamination of vegetables with worm eggs and larvae and the cysts and oocysts of protozoa in Karaj, the present study was conducted. Karaj is Alborz Province center, with a population of 1,973,000, is located 30 km from Tehran, the capital city of Iran (2).

A typical Iranian diet includes 6 types of vegetables (leek, radish, basil, mint, cress, and spring onion) consumed raw. We sought to investigate contamination in these vegetables in fresh markets in spring and summer.

Two fresh markets were randomly selected from each region of Karaj, including the east, west, north, center and south in 2017. For this purpose, ten fresh markets were selected in each season, and six vegetable types were obtained from each market, making for a total of 60 vegetable samples in each season.

The smears were prepared from each sample according previous report (3). The Sheather floatation technique and fast acid staining were used for the observation of intestinal coccidian parasites under an optical microscope, and a fluorescein isothiocyanate-labeled (FITC-labeled) monoclonal antibody was used for the observation of *Cryptosporidium* and *Giardia* parasites under an immunofluorescent microscope.

Data were analyzed in SPSS-version 21. A. (Chicago, IL, USA).

Of the 120 vegetable samples, 37.5% (n=45) had parasitic contamination. Sixteen types of cysts and oocysts of protozoa and worm eggs and larvae were detected in the vegetable samples. Flagellated Protozoa including *T*richomonas, Free-living larvae including *Strongyloides stercoralis*, *Blastocystis hominis* and *Entamoeba coli* were the most prevalent types of parasitic contamination observed in the samples (Table 1).

No significant differences were observed in the parasitic contamination of the vegetables in the five different sampling regions of Karaj. In the spring, 46.7% (n=28) of the samples were contaminated with an average of 1.13 various parasites, while in the summer, 28.3% (n=17) were contaminated with an average of 0.45 different parasites (Table 1). There was a statistically significant relationship between the level of parasitic contamination and the vegetable harvest season ($P<0.05$).

Table 1: Prevalence of parasites in six types edible raw vegetables obtained in spring and summer in Karaj, Iran in 2017

Parasite	*Spring onion*		*Radish*		*Leek*		*Basil*		*Mint*		*Cress*		*Total*				*Confidence Interval 95%*	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A+b	%	Lower	Upper
Entamoeba coli	1	1	1		1	1	1		2	1	2	1	8	4	12	10	5.3	16.8
Cryptosporidium			1				1		1		1		4		4	3.3	0.9	8.3
Other coccidas					1		1		1		2		5		5	4.2	1.4	9.5
Endolimax			1								1		2		2	1.2	0.2	5.9
Ascaris lumbricoides	1		1				1	1				1	3	2	5	4.2	1.4	9.5
Giardia lamblia	1						1		1		2	1	5	1	6	5	1.9	10.6
Blastocystis hominis	1		1		1		1	1	2	1	2	2	8	4	12	10	5.3	16.8
Flagellar form	1	1	2		3	1	4	1	3	1	1	3	14	7	21	17.5	11.2	25.5
Free living Larva	1	1	2		2	1	3	1	1	1			9	4	13	10.8	5.9	17.8
Entamoeba histolytica	1							1			1		2	1	3	2.5	0.5	7.1
Taenia ova			1				1	2	1				3	2	5	4.2	1.4	9.5
Hymenolepis nana's ova				1			1						1	1	2	1.7	0.2	5.9
Iodamoeba buetschlii					1		1						2		2	1.7	0.2	5.9
Dicrocoelium dendriti-cum			**1**										1		1	.83	0	4.6
Animal Nematoda's ova							1						1		1	.83	0	4.6
Tricuris tricura										1				1	1	.83	0	4.6
Total	7	3	11	1	9	3	17	7	12	5	12	8	68	27	95	37.5	28.8	46.8

A= spring // B= summer

Overall, 3.3% of the samples were contaminated with the *Cryptosporidium* genus according to the FITC-labeled monoclonal antibody with immunofluorescence microscopy. *Taenia* ova, including *Echinococcus*, were observed more in the basil than in the other samples (P<0.05). *Giardia* was seen more in the cress than in the other kinds of vegetables (P<0.05).

Overall, basil had the highest level of contamination in this study (Fig. 1). However there is not significant association between six types of vegetables and the parasitic contamination of the vegetables.

The increased amount of rainfall, the greater contamination of flowing waters and also the increased use of human and animal fertilizers in the spring appear to be the reason for the increased parasitic contamination of vegetables in this season.

This study showed that raw vegetables have a substantial level of parasitic contamination and this contamination can pose health risk to consumers of edible raw vegetables. Moreover, given the role of edible vegetables in people's diets, efforts should be made toward public training on the proper washing and disinfecting of vegetables. The use of wastewater for vegetable irrigation be banned and that only safe water be utilized for this purpose

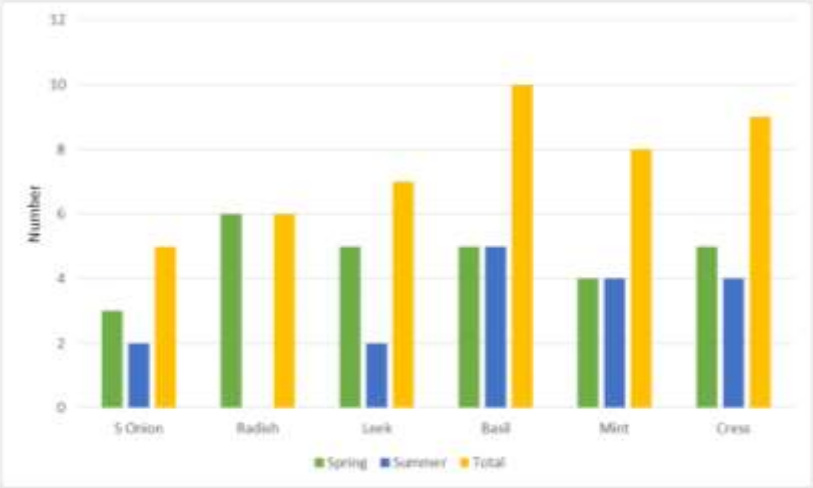

Fig. 1: Prevalence of parasitic contamination of six type edible raw vegetables in Karaj, Iran in 2017

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Conflict of interest

The authors declare that there is no conflict of interests.

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