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Prevalence of parasitic contamination of edible vegetables in Isfahan, Iran

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Abstract

Introduction: Today, the parasitic contamination of edible vegetables, which are usually consumed raw, is one of the important issues of human societies. Parasitic contamination has been repeatedly identified in previous studies on edible vegetables. Due to the changes in farmers' behavior regarding the use of fertilizers for agricultural land fertility over recent years, some changes have certainly happened in the contamination level of these crops, which are investigated in this study.

Objectives: The present study seeks to examine the changes in the infection of vegetables caused by the use of chemical fertilizers as an alternative to animal and human excretion for the fertilization of cultivatable soil.

Materials and Methods: This study was conducted using the descriptive cross-sectional method in Isfahan, Iran. In this regard, 70 samples from 10 types of edible vegetables, including leek, basil, mint, spring onion, radish, parsley, lettuce, cress, tarragon, and coriander, were prepared from 70 vegetable shops of the city. Each sample was placed in a separate bag and evaluated after washing, centrifugation, sedimentation, and staining. Eventually, the results were reported as descriptive statistics.

Results: None of the prepared samples were contaminated with the pathogen parasite in the present study.

Conclusion: Due to the change in farmers' behavior concerning fertilization of agricultural products, it seems that the parasitic contamination of these products has lowered, and it is necessary to focus on other contaminants of these products, such as chemicals.

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Introduction

Parasitic contamination is among the critical health problems in the world. This issue is especially significant for the parasites transmitted from soil to humans. Today, eliminating parasitic contamination in societies with low-transmission and improving the morbidity status in societies with high transmission and contamination have become essential goals of health systems (1). On the other hand, the committee for soil parasitic contamination focuses on using chemical substances to prevent parasites (1). Parasites harm human health in different ways, the most significant of which is malnutrition. Thus, eradicating parasitic contamination in the individuals of a community can significantly help the improvement of health and well-being in that society. It is estimated that about 1.5 billion people are contaminated with soil-borne parasites, most of which are the annelids, such as ascaris and strongyloides stercoralis. Whipworms and hookworms are also among these causes (2). It seems that most of these contaminations occur in tropical and subtropical regions where the health, economic, and social status is not desirable (3).

Key point

Given the change in farmers' behavior toward fertilizing agricultural products, it seems that the parasitic contamination of these products has been reduced; Therefore, it is necessary to focus on the other contaminants of these products, such as chemicals.

Eating edible, fragrant, and raw vegetables with food has been among the eating habits of Iranians. These vegetables provide a

considerable percentage of the vitamins and nutrients essential for the human body. Thus, omitting such vegetables from the diet does not seem reasonable. On the other hand, there is always a risk of parasitic contamination of such vegetables with different contaminants, which can cause parasitic diseases in humans. The use of sewage and animal manures in irrigation and enrichment of agricultural lands is one of the main causes of parasitic contamination in these vegetables (4). Numerous factors, including the economic, social, and cultural conditions of a society, as well as the observance of personal hygiene, affect the spread of parasites. (3). Meanwhile, no appropriate washing of edible vegetables is one of the major ways of transmitting parasitic diseases. Several studies have been conducted on the parasitic contamination of vegetables in Iran.

For example, a study in Rasht in 2017 showed that 5.3% of edible vegetables were parasitically contaminated with different worms and protozoa, such as hookworms, Toxocaridae, *Trichostrongylus*, *Trichuris trichiura*, *Strongylus*, free-living amoebae, such as *Naegleria and Acanthamoeba*, and non-pathogenic amoebae (5). In addition, the rate of parasitic contamination in edible vegetables in Qom was reported 31.5%, which included Ascaris eggs, Hymenolepis nana eggs, *Heterophyes*, pinworm eggs, and *Giardia duodenalis* (6). Another study in Sanandaj in 2013 reported 16.3% parasitic contamination in the vegetables of this city (7). In a study conducted on 480 vegetable samples obtained from farms in different regions of Isfahan in 2003, parasitic contamination reached about 13.76%. The prevalence of parasites was as follows: Dicrocoelium egg 12.1%, *Hymenolepis nana* egg 21.2%, Ascaris egg 24.2%, *Trichostrongylus* egg 15.1%, whipworm egg 9%, *Giardia duodenalis* 10.6%, and Taenia egg 5.7% (8). In this study, most of the contaminations were caused by worm eggs, and the only parasitic protozoan found was Giardia, while no other dangerous protozoa such as *Entamoeba histolytica* was found.

It is worth mentioning that the vegetables produced in the Isfahan plain are not sufficient. Thus, a large amount of edible vegetables required for the people of Isfahan are brought from cities near and far. As a result, parasitic contaminations from other cities may reach Isfahan, as well, and evaluating the vegetables produced in Isfahan farms cannot necessarily indicate the contamination of edible vegetables consumed in Isfahan. Accordingly, evaluating the vegetables that reach the consumers in shops is of particular significance. For this reason, this study was designed to determine the contamination rate of vegetables consumed by people. The samples of vegetables provided directly to the people were collected. After transferring them to a laboratory, they were evaluated in terms of a parasitic contamination. The contamination status of different edible vegetables in Isfahan was evaluated, and the obtained information can help improve the health status of its citizens.

Objectives

This study aimed to find the status and type of parasitic contamination of edible vegetables in Isfahan to help those involved in applying control methods and improve public health.

Materials and Methods

Study design

This investigation is a descriptive cross-sectional study in which samples of edible vegetables were collected from shops in Isfahan in the early morning hours using simple methods. Given the 14% prevalence of contamination reported in previous studies, 70 samples were considered for this study.

In order for the random selection of samples, at first, 14 districts of Isfahan were marked based on the division of Isfahan municipality, and then five shops from each district were selected and marked. Accordingly, a total of 70 shops from different districts of the city were randomly selected for evaluation. Some edible vegetables, such as leek, radish, tarragon, parsley, mint, spring onion, cress, basil, coriander, and lettuce, were selected for sampling.

By going to all 70 marked shops, different samples of vegetables were bought, and each sample was put in a plastic bag. Then, the specifications of each sample, including the district where it was bought from and the place where it was produced (obtained by asking from the sellers), were written on each bag. Each day, a number of samples were prepared and transferred to the laboratory. In the laboratory, the samples were divided into separate groups according to the districts from which they were bought and the provinces in which they were produced.

After this classification, the vegetable samples were first immersed in ordinary water and left in the same laboratory conditions for one hour. After being cleaned from mud, the vegetables were rinsed and placed in another container where 10 grams of detergent (dishwashing liquid) dissolved in five liters of water was poured on the vegetables until covering them and then stirred every 10 minutes. After one hour, they were rinsed, and the resulting washing liquid was passed through a thin four-layer piece of cloth, poured into a special container, and kept at 4°C for four hours. Then, 10 cc of the precipitated sediment were collected and centrifuged at 2500 rpm for 5 minutes, and the resulting sediment was prepared using the formol-ether method and examined under a microscope. In terms of the presence of parasitic agents, including protozoa cysts, parasite eggs, and worm larvae, the required search was conducted, and a separate report was prepared for each sample. Finally, the results obtained from the studies were collected.

Results

The studied vegetables, collected from 14 districts of Isfahan municipality, were brought from different cities. They were found to be provided from Ahvaz, Kashan,

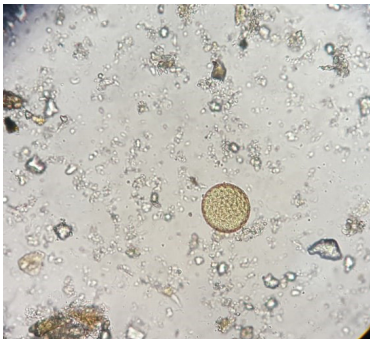

Figure 1. Plant pollen found in microscopic examination of the deposited sediment (40×).

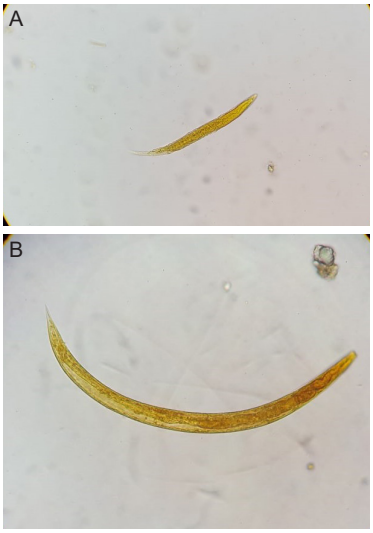

Figure 2. Free larvae found in microscopic examination of the deposited sediment (40×).

Bandar Abbas, Shiraz, and Isfahan. The evaluations were conducted several times on different samples to search for parasite eggs and protozoan parasites, however no parasitic pathogens were found despite free larvae and plant pollen (Figures 1 and 2).

Discussion

Nowadays, a critical concern of people and health systems is the parasitic and microbial contamination of food, especially fruits and vegetables, which are typically consumed raw. They can easily contaminate people with pathogens, particularly parasites, and cause health problems. On the other hand, the consumption of such edible vegetables is highly important for health and cannot be easily omitted from the diet. Thus, the only way left is the consumption of healthy vegetables and fruits or the removal of their contamination, if there is any. However, there is another argument that the use of disinfectants can be dangerous to health. Cleaning vegetables and fruits with the help of these disinfectants is questionable since these disinfectants may damage the tissue of such foods and reduce their nutritional value. The main question is how much contaminated the vegetables and fruits consumed in society are and what kind of parasitic contamination they have. Over recent years, human fertilizers have not been used to feed such plants in Iran; so, the life cycle of many pathogenic parasites for humans has been disrupted, highly lowering the probability of contaminating vegetables.

Therefore, parasitic contamination transmitted from human to human through the consumption of vegetables should be very insignificant. Nevertheless, the possibility of various parasitic contaminations transmitted from intermediate animals (such as cats, dogs, and cattle) through the consumption of vegetables by humans is still common. However, the contamination of edible vegetables has not been studied comprehensively in Iran, and more studies are required to answer these questions. The historical study of parasitic contaminations reported from different parts of Iran indicates that parasitic contamination of raw vegetables has decreased over time. In a study on raw vegetables in Ardabil conducted by Davami et al in 68.3% of the tested vegetables were contaminated with human pathogenic parasites (9). In this study, the highest contamination belonged to the vegetables grown in Isfahan. In a similar study carried out by Gharavi et al in Tehran , the contamination was reported at 65.2% (10). The parasitic contamination of vegetables in Iranian cities has lowered over time, therefore in a study conducted in Shahrekord in 2012, about 32.6% of edible vegetables were contaminated with a variety of parasites and parasitic eggs (11).

The reduction in contamination is also evident in a study conducted in Zahedan in 2012 by Ebrahimzadeh et al on raw vegetables. In this study, 44.8% of vegetables were contaminated with metazoan eggs, 22.9% were contaminated with pathogenic protozoa, and 35.4% were contaminated with non-pathogenic protozoa (12). Parasitic contamination has also been reported in neighboring countries like the reports of Iran. A study in Lahore, Pakistan, in 2014 showed that 31.2% of vegetables were contaminated with parasites, and lettuce was the most contaminated one (13). This result is almost similar to those of studies conducted in Syria and Egypt in which parasitic contaminations of vegetables were reported 31.38% and 31.31%, respectively (14, 15). In some other countries, including Ethiopia, higher rates were reported. In the studies conducted in this country in 2014 and 2018, the parasitic contamination of raw vegetables was reported at 54.4% and 87%, respectively (16, 17).

In a study conducted by Isazadeh et al in Tehran in 2018 on raw vegetables, such as basil, leek, coriander, parsley, and lettuce, parasitic contaminations were reported in 25.8% of cases, with the highest and lowest contamination belonging to coriander and lettuce, respectively. This study did not mention from where the vegetables were prepared

(18). It should be noted that other studies have been conducted in Iran in recent years, which have reported the high parasitic contamination of vegetables. Among these studies, Siyadatpanah et al and Heidari et al can be mentioned, which reported the parasitic contamination of vegetables at 46.5% and 37.5%, respectively (19, 20). There are still studies that indicate a reduction in the parasitic contamination of raw vegetables in Iran. For instance, Taherimoghaddam et al and Matini et al reported the contamination of 25% and 8.4% in Hamedan and Assadabad, respectively (21,22).

On the other hand, no parasitic contamination was found in vegetables in the present study. This result can be due to different causes, including the fact that parasitic contamination may vary in different geographical locations and different seasons, and this comparison is impossible due to the lack of time to harvest vegetables in these articles. Another reason for this difference may be the limited number of samples in different studies, including the present study. However, it should be noted that the process of reducing the contamination of raw edible vegetables in Iran continues due to the improved health factors in fertilizing agricultural lands or may have reached a minimum since the reduction of parasitic contamination in raw vegetables. In addition, this issue is highly significant and expresses the need to re-evaluate the parasitic contamination of raw vegetables in different cities of Iran.

On the other hand, this study shows that health officials should emphasize the continued observance of hygienic principles for wastewater disposal and fertilization of agricultural lands and focus on the observance of non-infectious health principles in the fertility of agricultural lands. Today, chemical fertilizers are easily available to farmers and widely used by them in Iran; thus, chemical poisoning can be a health priority for the country.

Conclusion

The agricultural products have a very low parasitic contamination, given the change in the behavior of farmers who do not utilize human fertilizers to fertilize vegetables anymore. Accordingly, the country's health officials should focus on the non-infectious contamination of such products.

Limitations of the study

We could gain more accurate results by increasing the sample size and incorporating more cities and provinces in a more extensive study.

Authors' contribution

MP and SHH were the principal investigators of the study. FN, PS, ST, AY and KE were included in preparing the concept and design. MM and AA revisited the manuscript and critically evaluated the intellectual contents. All authors participated in preparing the final draft of the manuscript, revised the manuscript and critically evaluated the intellectual contents. All authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. The Ethics Committee of Isfahan University of Medical Sciences approved this study. The institutional ethical committee at Isfahan University of Medical Sciences approved all study protocols (IR.MUI.MED.REC.1396.3.757). Accordingly, written informed consent taken from all participants before any intervention. This study was extracted from M.D., thesis of Fatemeh Nikokar at this university (Thesis#398502). Besides, ethical issues (including plagiarism, data fabrication and double publication) have been completely observed by the authors.

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