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# Parasitic Contamination in the Table Vegetables Planted in Shiraz Plain, Iran

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**Abstract.** Contamination with parasites of the vegetables grown in Shiraz plains and irrigated by urban and industrial sewage-laden Shiraz Rookdhaneh Khoshk River and seasonal Soltanabad River was studied. It was found that 31.5% of the farms irrigated by the river water directly, 30.9% of the farms irrigated by water of nearby located shallow wells and 33.7% of the farms using water from the wells at a distance of one kilometer from the River were contaminated by *Ascaris* ova. 32.20% vegetables of farms irrigated by the wells located near Soltanabad river were contaminated with insects and larvae and 24.5% with *Ascaris* worm. After *Ascaris* ova, the larvae of different insects, *Strongyloides* parasite, *Sterocoralis* and *Trichostrongylus* were the contaminants most present.

**Keywords:** parasites, irrigation, vegetables, Shiraz rivers, *Ascaris*

## Introduction

Table vegetables, particularly those irrigated with raw sewage, play an effective role in the transfer of parasites specially the soil parasites and thus in spreading contagious and parasitic diseases to the consumers (Shariatpanahi, 2001; Fereydoun, 1987). The vegetables irrigated with Firoozabad-Tehran creek in 1989 and 1990 and table vegetables used in Yasooj in 1996, were found to be contaminated with parasitic worm eggs (Sarkari, 1997; Vosooghi, 1990). In south Louisiana in USA, where city and industrial sewage contaminated the agricultural lands, vegetables such as spinach, parsley, onion, asparagus, spearmint, tomato, pea, carrot and cabbage were found to be contaminated with heavy metals, the latter being 1.60% more than the permissible limit of the American National Health Society. Moreover 28.20% of the farms were contaminated with the parasitic eggs found in sewage (Ramelow *et al*., 1992).

In Japan, the researchers of Agriculture College, Tokyo University, in 1962 conducted necessary tests for finding the contamination of leek, parsley, sweet basil, spearmint and green pepper growing in the fields which were irrigated with city and industrial raw sewage and found these vegetables, heavily contaminated with parasites whereas the content of heavy metals was 2.13% more than the standards (Chino *et al*., 1991).

The researches conducted in Iran show that the vegetables may transfer eggs of worms such as *Ascaris*, *Trichocephalus*, *Hymenolepis nana*, *Taenia*, *Fasciolia hepatica*, larvae of worms such as *Trichostrongylus* and hookworms, unicellular creatures such as *Antamoeba histolytica*, *Giardia lamblia*, *Toxoplasma gondii* which cause amoebiasis, giardiasis, (lambliasis) and toxoplasmosis and other diseases (Fereydoun, 1987).

Though irrigation method should be defined in relation to the amount of water used and the type of plants being irrigated, as each plant needs a different rate of water depending on the environment and geographical conditions such as temperature, raining rate, latitude etc., it was observed that these factors are ignored in Shiraz plain irrigation; here the irrigation system is deep water which is traditional and uses about 4,000-12,000 cubic meter water per hectare, yearly. This system causes problems relating to drainage of water, environmental contamination, agricultural damages and soil errosion etc. (Rastegar, 1992).

The present study was undertaken to find the extent of contamination of vegetables irrigated directly by Shiraz Roodkhaneh Khoshk River and Soltanabad River and by nearby lying well water. Taking into consideration the diseases, such as diarrhoea, resulting from the above mentioned practice, it is intended to propose safe means of growing vegetables and prevent regional contamination of vegetables with parasites and their transfer to the consumers.

## Materials and Methods

City sewage is discharged into Shiraz Roodkhaneh Khoshk River passing through the city centre. Some districts of the city do not have proper sewage disposal means and the factories beside the river also dump their waste products

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into it. Due to disposal of garbage into the river, some agricultural irrigation places have high BOD (the index indicating sewage contamination) related to city sewage (WHO, 1989).

This study covers table vegetables planted in the farms around Shiraz where the vegetables are consumed either raw or cooked. The areas studied included Gheisar Aboonasr, Mehraghan, Eghbal Abad, Torkan, Nasirabad, Kooshkak, Mahfiroozan, Dasht Khezr, Noortaban, Khaljooy and Sharifabad villages, mountainous region and Kaftarak village, all of them located beside Roodkhaneh Khoshk River.

Parameters taken into consideration were area of the land under cultivation, type and amount of harvest, fertilizer and disinfectants, herbicides, fungicides and means of irrigation including deep and semi-deep wells and river.

The land for cultivation of table vegetables, domestic animals provender, wheat, barley and potato was about 1,372 hectares of which 128 hectares was under cultivation of the provender including alfalfa, 168 hectares that of barley, wheat and maize and 100 hectares were used for planting of potato. The land used for cultivation of vegetables was 276 hectares of which 90 hectares were irrigated with river and 186 hectares irrigated mostly by shallow wells.

Samples (140) of different vegetables cultivated in Kaftarak and Soltanabad were selected on the basis of the factors such as means of irrigation including shallow wells, wells within one km radius of the river and the river itself; one type of vegetable from each farm was sampled. 45 samples were taken from farms irrigated with river and 95 samples, from farms irrigated with deep, semi-deep and shallow wells.

The following vegetables, 250-500 g of each, were sampled:

a) Sweet basil, leek, spearmint, cress, purslane, parsley lettuce, tarragon, common dill and spinach (eaten raw).

b) Radish, tomato, cucumber, eggplant, green pepper, carrot, onion, cabbage and squash (eaten cooked except carrot)

c) Green bean, pea and okra (eaten cooked).

The samples were collected with gloved hands and put into nylex bags and carried to the related laboratories (Gholami and Mohammadi, 1998). Domestic animals provender was sampled in the same way.

## Results and Discussion

Samples of 58 shallow, semi deep and deep wells were subjected to bacteriological tests. Results indicated that 98% of the wells were contaminated with coliform, 100% of which were soil coliform. Physical and chemical properties of water did not conform to the standards, except that of 12 deep wells lying at a distance of 1,500 m from the river.

Findings show that the parasitic contamination of table vegetables depends on location of the place/farm to be irrigated, source of irrigation and type of the parasites (Table 1). Most of the farms around Roodkhaneh Khoshk river were contaminated with "*Ascaris*" and larvae of different insects. 31.50% farms irrigated directly by river (Fig. 1), 31% farms irrigated by the wells located around the Roodkhaneh Khoshk river (Fig. 2) and 33.70% by the wells within one kilometer radius of the river were contaminated with ascaris eggs; mostly the fertilizer used was human faeces (Table 1); bacteriological tests of shallow regional well water indicated faecal coliform contamination, 3 to 45 MPN/100 mL, and total coliform, 70 to 800 MPN/100 mL, whereas, total coliforms in deep well water were 5 to 45 MPN/100 mL. Physical and chemical specifications of the water used for irrigation of Shiraz plains and Roodkhaneh Khoshk farms were not within the standard limits necessary for agriculture with BOD more

**Table 1**: Parasitic contamination in the vegetables according to the irrigating source and the type of parasite

| Parasite | Roodkhaneh Khoshk water | | Wells near Roodkhaneh Khoshk | | Well within radius of 1 km from the river | | Wells near Soltanabad river | |
|---|---|---|---|---|---|---|---|---|
| | No. of parasites | % | No. of parasites | % | No. of parasites | % | No. of parasites | % |
| *Trichostrongylus* | 35 | 15.5 | 19 | 16.8 | 13 | 16.3 | 12 | 19.6 |
| *Strongyloides stercoralis* | 32 | 14.2 | 13 | 11.5 | 19 | 23.7 | 10 | 16.4 |
| *Ascaris lumbricoides* | 71 | 31.5 | 35 | 31 | 27 | 33.7 | 15 | 24.6 |
| *Trichocephalus* | 4 | 1.78 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Oxyure | 19 | 8.5 | 0 | 0.0 | 2 | 2.6 | 4 | 6.6 |
| Different insect larvae and eggs | 64 | 28.5 | 46 | 40.7 | 19 | 23.7 | 20 | 32.8 |
| Total | 225 | 100.0 | 113 | 100.0 | 80 | 100.0 | 61 | 100.0 |

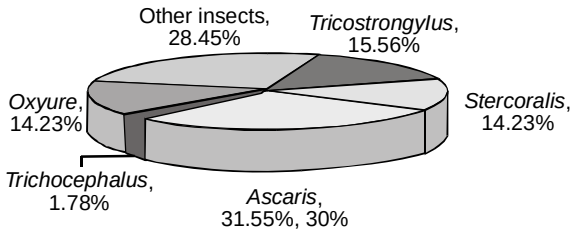


**Fig. 1.** Pollution (%) of vegetables irrigated *via* water of Khoshk river with different parasites.

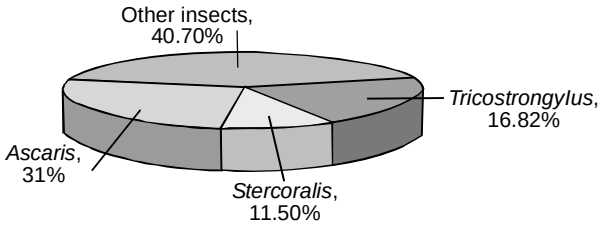


**Fig. 2.** Pollution (%) of vegetables irrigated *via* wells close to Khoshk river with different parasites.

than 100 mg/L. Also the level of some heavy metals was not within the range applicable for agricultural use. Water EC (electrical conductivity) of some well water was high, but all the wells had coliform contamination.

In transfer of parasites, three factors are involved: source of infection, means of transfer and a sensible host, which means the process depends on the way of distribution of the parasite in a defined place at a defined time. The means by which the parasite reaches from the source to the host are clear (Neva and Brown, 2001). Some parasites reach the host through direct contact whereas others have a more complicated life cycle and need to pass through some growth stages such as free life or need an intermediate host to become infective. The transfer is accomplished through direct and indirect contact, such as by means of food, water, soil and vertebrates and arthropodes. Studies show that rate of contamination with some worms in different parts of Iran is high; in Iran, around 32 human parasites were found, some of which were very common and frequent such as *Ascaris* (Mahvi, 1996). The vegetables, contaminated with parasite eggs, transfer them to the consumers (Monzavi, 1985). Raw sewage, human faeces and contaminated water, used as fertilizer and for irrigating farms, are dangerous sources of contamination for the consumers of the final products because traditional and deep water systems are still used here as the sources of potable water.

Tests showed that all the table vegetables cultivated in Shiraz plains and irrigated with Roodkhaneh Khoshk river, and the wells close to the river were contaminated with one or several faecal parasites. The range of pollution in vegetables irrigated directly by the river was (with the exception of 2% in cabbage) from 6% (in gourd) to 35% (in green beans) (Fig. 3) and in those irrigated by close-by lying wells was 4% (in gourd cabbage and onion) to 10% (in green beans) (Fig. 4). Thus it is clear that most of the contamination relates to the means of irrigation and use of man faeces (US EPA, 1981).

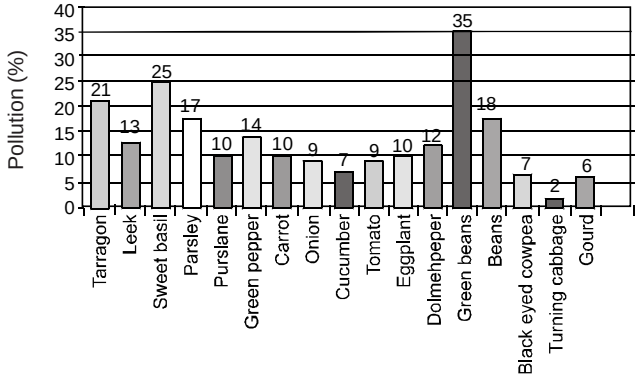


**Fig. 3.** Parasitic pollution (%) of different vegetables irrigated *via* water of Khoshk river.

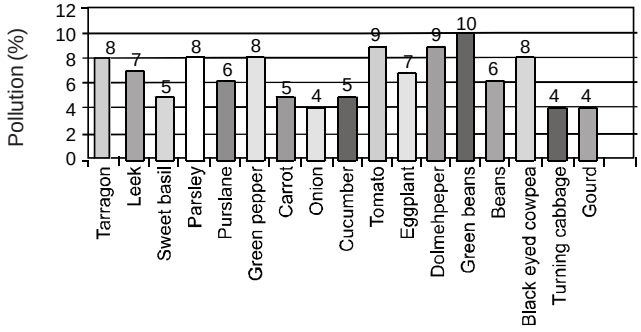


**Fig. 4.** Parasitic pollution (%) of different vegetables irrigated *via* wells close to Khoshk river.

The land measuring 276 hectares is used for cultivation of table vegetables and is irrigated with Roodkhaneh Khoshk river; these raw vegetables are distributed in Shiraz and other adjoining cities. Also the wells located within a radius of one km of the river, when tested bacteriologically, whenever less deep and farther from the river, were more contaminated; it shows that the wells were influenced by the river. The distant well water had parasitic eggs found in human faeces (used in the farm) and the differences were as follows:

a) The parasitic contamination was more in the vegetables of farms irrigated with the river water directly.

b) Contamination of the vegetables with parasite eggs was less in the farms irrigated by hand and shallow wells farther from the river than the farms irrigated directly by the river water .

c) Contamination in the farms, irrigated by deep wells more than one km distant from the river, was less than the above-mentioned two cases.

So, it is clear that the river water contaminated by sewage played main role in contaminating the consumable raw vegetables with parasite eggs.

It was found that green beans, sweet basil and tarragon were more contaminated with the eggs and larvae of *Ascaris* and *Trichostrongylus* than with the other insects. Also the farms irrigated by the shallow wells and the wells, within a radius of 50 m of the river, had vegetables contaminated with parasite eggs similar to the farms irrigated by the river water.

It was also found that the farms irrigated by the wells around the seasonal river, Soltanabad, had eggs of strongylosis, sterocoralis, ascaris and trichostrongylosis, more than other parasite eggs.

The contamination of vegetables with parasite eggs of farms irrigated by Roodkhaneh Khoshk river was found to be more frequent as compared to those irrigated by the wells beside the seasonal river, Soltanabad.

## Conclusion

The results show that the vegetables cultivated in Shiraz plain, irrigated/fertilized by sewage-containing water, play an important role in transferring important parasites such as ascaris, trichostrongylus, trichocephalus, *S. stercoralis* and oxyure. Thus sewage and human fertilizers have been the cause of contamination of farm vegetables irrigated by such means. Irrigation of agricultural farms with such sources of contamination is harmful from hygienic point of view of the consumers of crops, grown in such farms.

It is therefore, proposed that the standards and regulations relating to the irrigation water used specially for raw vegetable crops should be observed. It is recommended that unrefined as well as refined sewage may not be used for irrigating vegetable crops and for fertilization; instead animal fertilizer, whose conditions of maintenance have been observed, be used.

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