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Prevalence Intestinal Parasites in Leafy Vegetables in Riyadh, Saudi Arabia

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Abstract: Green leafy vegetables are important part of daily diet invarious parts of the world. The present study was carried out to evaluate some of the leafy vegetable plants sold in local markets for human consumption to check whether they harbor different parasites stages. Results of the present study has shown that 76 out of 470 samples (16%) contained parasite stages. Depending on the type of leafy plant examined the prevalence of parasitic stages in these plants was found to be 27.8% (17/61) in lettuce, 22.8% (13/57) in watercress, 20.6% (7/34) in leek, 19.1% (9/47) in green onion, 17.4% (15/87) in parsley, 15.4% (4/26) in spinach, 13.6% (3/22) in basil, 11.5% (3/26) in coriander, 9.4% (3/32) in radish, 5.3% (1/19) in dill and 4.7% (2/42) in mint. No parasites were detected in 17 samples collected from cabbage. Stages of intestinal parasites detected were *Entamoeba coli* (35.5%), *Giardia lamblia* (31.6%), *Dicrocoelium* sp. (28.9%), *Ascaris* sp. (26.3%), *Taenia* sp. (19.7%), *Blastocystis hominis* (17.1%), *Fasciola* sp. (14.5%), Hymenolepis sp. (14.5%), *Ancylostoma* sp. (11.8%), *Toxoplasma gondii* (6.6%) and *Trichostrongylus* sp. (2.6%). The results indicated a significant seasonal variation ($p<0.05$), with highest prevalence in spring (23.1%), followed in descending order by summer (17.9%), autumn (10.6%) and winter (9.9%).

Key words: Leafy vegetable, intestinal parasites, samples, Riyadh, Saudi Arabia

INTRODUCTION

Fresh vegetables are regarded as important part of a healthy diet. In many countries such leafy plants are eaten raw or lightly cooked to preserve taste and this practice may also favours the likelihood of food borne parasitic infections (Ozlem and Sener, 2005).

In recent years, there has been an increase in the number of reported cases of food-borne illnesses linked to consuming fresh vegetables. 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 (Kang *et al*., 1998). Several surveys in different parts of the world showed that the vegetables can be agent for transmission of protozoan cysts and oocysts (*Giardia*, *Entamoeba*, *Cryptospordium*, *Cyclospora*, *Toxoplasma* and *Isospora*) and helminths eggs and larvae (*Hymenolepis*, *Taenia*, *Fasciola*, *Toxocara*, *Ascaris*, *Trichostrongylus*, *Strongyloides* and Hookworms) (Vuong *et al*., 2007; Darchenkova *et al*., 2006; De Oliveira and Germano, 1992a, b).

Intestinal parasitic infections are among the most common infections worldwide. Various epidemiological studies indicated that the prevalence of intestinal parasites was high especially in developing countries, although in many of these, the environmental risk factors have not been clearly elucidated (Nyarango *et al*., 2008). The increasing consumption of leafy vegetable plants by many people in Saudi Arabia has urged undertaking this study to investigate the parasites stages carried by these plants in the Riyadh city.

MATERIALS AND METHODS

A total of 470 leafy vegetable samples from the following vegetables were collected for the present study: spinach, radish, leek, parsley, basil, green onion, dill, lettuce, cabbage, watercress, coriander and mint. These vegetables were collected randomly from vegetable markets and bought from retail sellers at different times of the year (123 in Summer, 113 in Autumn, 91 in winter and 143 in spring) from Riyadh city.

A subset of each sample (250 g) was chopped into small pieces, put in a plastic bag and washed with physiological saline solution (0.95% NaCl) and the washing water/saline was left overnight. After removing bits of leaves a volume of 300 mL of supernatant was removed and the remainder was transferred to 5 mL test tubes and centrifuged at 2000 g for 20 min. Following centrifugation, the supernatant was removed and the sediment was then examined under a light microscope (×100-400) for parasites stages (cysts, oocysts, eggs or larvae) after adding a drop of lugol iodine (Bailenger, 1962) and the parasites stages were identified according

to Soulsby (1982). If the sample was positive for parasites stages, the number was counted and the developmental stage recorded.

Statistical analysis: Comparisons between different groups was performed using the statistical software SPSS. Chi square test was used for multiple comparisons between rates of parasites recovery in different seasons of the year and $p<0.05$ were considered significant.

RESULTS AND DISCUSSION

The results are shown in Table 1 and 2. Out of 470 samples collected from leafy vegetables examined, 76 (16.2%) were positive for parasites stages. The highest rate of parasite stages contamination was reported from the lettuce (27.8%) and only samples collected from cabbage did not reveal any parasites. The predominant type of parasite stage was found to be cyst of *Giardia lamblia*, which has been reported in 11 (31.6%) of the positive samples showed parasites stages. Whereas the lowest frequent parasite stage was found to be *Trichostrongylus* sp. Eggs which were detected in 2 (2.6%) of the samples showed parasites stages.

Table 3 shows the seasonal differences in the parasites stages detected in leafy vegetable plants investigated in the present study. The highest rate of parasites stages was detected during the spring while the lowest rate was detected during the winter.

The present study has shown that investigation of 12 leafy vegetable plants used routinely for human consumption in the Riyadh city resulted in several parasitic stages carried by these plants. The consumption of raw vegetables plays an important role in the transmission of human parasitic infections (Anuar, 1977). Recovery of parasites stages from vegetables consumed as the source of contamination may be helpful in indicating the incidence of intestinal parasites among a given community. The consumption of poorly washed vegetables is regarded as a major way for transmission of parasitic contamination. Several surveys in different parts of the world showed that the vegetables can be agents for transmission of protozoan cysts and oocysts (*Giardia*, *Entamoeba*, *Toxoplasma*, *Cryptospordium*, *Cyclospora* and *Isospora*) and helminths eggs and larvae (*Hymenolepis*, *Taenia*, *Fasciola*, *Toxocara*, *Ascaris*, *Trichostrongylus*, *Strongyloides* and Hookworms) (Mesquita *et al*., 1999; De Silva *et al*., 1995; Vuong *et al*., 2007; Darchenkova *et al*., 2006; De Oliveira and Germano, 1992a, b). Several studies dealing with the recovery of parasites from leafy vegetables have been conducted in different country in the world and the prevalence was high in the vegetables examined and parasites such as *E. coli* and *G. lamblia* have been reported (Robertson and Gjerde, 2001; Daryani *et al*., 2008; Monge and Arias, 1996; Vuong *et al*., 2007).

A previous study carried out by Al-Binali *et al*. (2006) in south western Saudi Arabia has demonstrated that eggs of *Ancylostoma* and *Ascaris* together with cysts of *Entamoeba coli* and *Blastocystis homonis* are the most common parasites stages found in the five leafy vegetable plants investigated. Although, Al-Binali *et al*. (2006) have used a method, which they claimed giving good recovery, however, in the present study a high rate of parasitic contamination in the lettuce (27.8%) compared to 17%. This could be attributed to the fact that lettuce used in the present study is highly contaminated with parasitic stages. This finding is supported by the use of wastewater for cultivating crops around Riyadh city, whereas the agricultural schemes in south western Saudi Arabia is different to this and such schemes seldom use

Table 1: Distribution of intestinal parasites in different leafy vegetable plants consumed in the Riyadh City

Vegetable plant	Examined No.	Positive No. (%)
Spinach (*Ipomoea aquatica*)	26	4 (15.4)
Radish (*Raphanus sativus*)	32	3 (9.4)
Leek (*Allium ampeloparasum* var. *porrum*)	34	7 (20.6)
Parsley (*Petroselinum crispum*)	87	15 (17.4)
Basil (*Ocinum basilicum*)	22	3 (13.6)
Green Onion (*Allium wakegi*)	47	9 (19.1)
Dill (*Anethum graveolens*)	19	1 (5.3)
Lettuce (*Letuca sativa*)	61	17 (27.8)
Cabbage (*Brassica oleracae*)	17	0 (0.0)
Watercress (*Nasturtium officinale*)	57	13 (22.8)
Coriander (*Coriandum sativum*)	26	3 (11.5)
Mint (*Mentha* sp.)	42	2 (4.7)
Total	470	76 (16.5)

Chi square results; $\chi^2 = 19.41$, $p>0.05$

Table 2: Prevalence of intestinal parasites in leafy vegetables consumed in Riyadh

Infection position	Infection No.	Incedance
Giardia lamblia	24	31.6
Entamoeba coli	27	35.5
Blastocystis hominis	13	17.1
Toxopalsma gondii	5	6.6
Fasciola sp.	11	14.5
Dicrocoelium sp.	22	28.9
Ascaris sp.	20	26.3
Trichostrongylus egg	2	2.6
Ancylostoma sp.	9	11.8
Taenia spp.	15	19.7
Hymenolepis sp.	11	14.5

Table 3: Seasonal prevalence of intestinal parasites in leafy vegetable plants consumed in the Riyadh City

Seasons	Examined No.	Positive No. (%)
Summer	123	22 (17.9)
Autumn	113	12 (10.6)
Winter	91	9 (9.9)
Spring	143	33 (23.1)
Total no.	470	76 (16.2)

Statistical analysis: $\chi^2 = 10.48$; $p<0.05$

wastewater. Several previous studies have supported the findings of the present study, where the presence of intestinal parasites in vegetables may was attributed to the use of wastewater to irrigate vegetables (Kozan *et al*., 2007).

Kozan *et al.* (2007) however, found out that none of the vegetables washed with water contained parasite stages unlike what was found in the present study and by Al-Binali *et al.* (2006). Also some studies indicated that agriculture use of untreated wastewater was the major cause of the increase in intestinal parasites (Srikanth and Naik, 2004).

The use of sewage water plays an important role in the epidemiology of transmission of parasitic diseases to human through consuming such vegetables (Al-Salem and Tarazi, 1992), as it has been demonstrated in the present study.

Seasonal variation in the prevalence of parasites stages was noticed in the present study. This study appear incidence of present intestinal parasites in leafy vegetables was higher in the spring and lowest in winter as show in Table 3 (Clavo *et al*., 2004; Vuong, 2007; Nimri, 2003). Post-harvest faecal contamination of vegetable may also occur during handling and transport of vegetables and this occur through splashing the vegetables with contaminated water in order to keep vegetable fresh and that was done through dirty vegetable containers or unhygienic handling. In which case some of the viable parasitic cysts or oocysts will be easily transmitted to humans.

Also many epidemiological studies have relieved on excess of parasitic contamination associated with raw water reuse in irrigation (Al-Salem and Tarazi, 1992).

CONCLUSION

The findings of seasonal variation in parasites stages found in leafy vegetables coincided with what has been reported earlier by Nimri (2003), who found high prevalence of natural infection with cryptosporidiosis (caused by *Cryptosporidium* sp.) and cyclosporiasis (caused by *Cyclospora cayetanensis*) in the spring compared to other seasons. Similarly (Clavo *et al*., 2004; Vuong, 2007) found the same pattern in the leafy plants they investigated.

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