International Journal of Zoological Research

ISSN 1811-9778

Academic Journals Inc.

www.academicjournals.com

International Journal of Zoological Research 6 (3): 190-195, 2010
ISSN 1811-9778

Prevalence of Intestinal Parasites in Leafy Vegetables in Riyadh, Saudi Arabia

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Abstract: 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. A total of 470 leafy vegetable samples were collected from 12 different plant species randomly from local markets in the Riyadh city during the period April and March 2008. The samples were analysed in the laboratory for parasitic stages contained in these samples after washing them in physiological saline and then examining the sediment. Results of the present study has shown that 76 out of 470 samples (16.2%) 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, 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 favors the likelihood of food-borne parasitic infections (Ozlem and Sener, 2005). Food normally becomes a potential source of human infection by contamination, during production, collection, transport and preparation or during processing and the sources of zoonotic contamination are usually faeces, faecally contaminated soil or water (Slifko *et al*., 2000; Daryani *et al*., 2008; Damen *et al*., 2007).

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 (Pozio, 2008). 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 investigation: spinach, radish, leek, parsley, basil, green onion, dill, lettuce, cabbage, watercress, coriander, mint (during period from April 2007 to March 2008). 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 (x100-400) 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. p-values less than 0.05 were considered significant (Greenwood and Nikulin, 1996).

RESULTS

The results of the parasitic stages recovered from different leafy plants and the different parasitic stages from these plants are shown in Table 1 and 2, respectively. 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 *Entamoeba coli* which has been reported in 27 (35.5%) samples out of 76 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. There was no significant difference in the frequency of reporting parasites stages from different leafy vegetables investigated ($\chi^2 = 19.41$, $p>0.05$).

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

Vegetable plant	No. examined	No. positive (%)
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)
Watercress (*Nasturtium officinale*)	57	13 (22.8)
Coriander (*Coriandum sativum*)	26	3 (11.5)
Mint (*Mentha* sp.)	42	2 (4.7)
Total	470	76 (16.2)
Statistical analysis		
$\chi^2 = 19.41$		
$p>0.05$ *		

*p>0.05 no significant difference

Table 2: Prevalence of intestinal parasites in leafy vegetable plants consumed in Riyadh city

Infection position	No. Infected	Prevalence (%)
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
Aucylostoma sp.	9	11.8
Taenia sp.	15	19.7
Hymenolepis sp.	11	14.5

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

Year seasons	No. examined	No. positive (%)
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		
$\chi^2 = 10.48$		
$p<0.05$ *		

*p<0.05 significant difference between different seasons

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 (23.1%) while, the lowest rate was detected during the Winter (9.9%). There was significant difference in the prevalence of parasites stages in different leafy vegetables examined in different season ($\chi^2 = 10.48$, $p<0.05$).

DISCUSSION

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). Reporting 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 parts of the world and the prevalence was high in the vegetables examined with parasite stages such as those of *E. coli* and *G. lamblia* have been reported by Robertson and Gjerde (2001), Daryani *et al.* (2008), Monge and Arias (1996) and 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 5 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% reported by Al-Binali *et al.* (2006). 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 wastewater. Previous studies have supported the findings of the present study where, the presence of intestinal parasites in vegetables may have resulted from the use of wastewater to irrigate vegetables (Kozan *et al*., 2007). However, Kozan *et al.* (2007) found out that no helminthes or developmental parasitic stages in the treated water as opposed to untreated water where, they found stages of helminthes eggs in untreated water. The presence of parasitic stages of different parasites is dependent on the parasitic fauna carried by the community and it is likely that the parasites reported from the leafy vegetables in this investigation and those of Al-Binali *et al.* (2006) are prevalent in the community so it contaminated the sewage. Also some studies indicated that agricultural 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 (Gupta *et al*., 2009) 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 shows incidence of present intestinal parasites in leafy vegetables was higher in Spring and lower in Winter as shown in Table 3 (Clavo *et al*., 2004; Vuong *et al*., 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 relied on excess of parasitic contamination associated with raw water reuse in irrigation (Gupta *et al*., 2009).

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, (Calvo *et al*., 2004; Vuong *et al*., 2007) found the same pattern in the leafy plants they investigated.

CONCLUSION

There is a high risk of infection with intestinal parasites in the sampled markets. The high level of leafy vegetables contamination with parasitic stages is significant hence, the inhabitants of the Riyadh City should be informed and educated with regard to food safety, good distribution practices and improvement on sanitary conditions in the local vegetable markets. People must also avoid using of untreated sewage for the irrigation of vegetables as this constitutes an important route of intestinal parasites transmission.

REFERENCES

Al-Binali, A.M., C.S. Bello, K. El-Shewy and S.E. Abdulla, 2006. The prevalence of parasites in commonly used leafy vegetables in South Western, Saudi Arabia. Saudi Med. J., 27: 613-616.

Anuar, A.K., 1977. A study on the prevalence of soil transmitted helminths among lettuce leaves sold in local markets in Penang, Malaysia. Med. J. Malaysia, 31: 262-265.

Bailenger, J., 1962. Valuer compare des ethodes denrichissement en coprologie parasitaire. Pharm. Biol., 3: 249-259.

Clavo, M., M. Carazo, M.L. Arias, C. Chaves, R. Monge and M. Chinchilla, 2004. Prevalence of *Cyclospora* sp., *Cryptosporidium* sp., microsporidia and fecal coliform determination in fresh fruit and vegetables consumed in Costa Rica. Arch. Latinoam. Nutr., 54: 428-432.

Damen, J.G., E.B. Banwat, D.Z. Egah and J.A. Allanana, 2007. Parasitic contamination of vegetables in Jose, Nigeria. Ann. Afr. Med., 6: 115-118.

Darchenkova, N.N., N.A. Romanenko and A.I. Chernyshenko, 2006. Current ascariasis situation in the russian federation. Med. Parasitol., 4: 40-43.

Daryani, A., G.H. Ettehad, M. Sharif, L. Ghorbani and H. Ziaei, 2008. Prevalence of intestinal parasites in vegetables consumed in Ardabil, Iran. Food Control, 19: 790-794.

De Oliveira, C.A. and P.M. Germano, 1992a. Presence of intestinal parasites in vegetables sold in the metropolitan area of Sao Paulo-SP, Brazil. II-Research on intestinal protozoans. Rev. Saude Publica, 26: 332-335.

De Oliveira, C.A. and P.M. Germano, 1992b. Presence of intestinal parasites in vegetables sold in the metropolitan region of Sao Paulo, SP, Brazil. I-Search of helminths. Rev. Saudi Publica, 26: 283-289.

De Silva, J.P., M.C. Marzochi, L. Camillo-Coura, A. Messias-Ade and S. Marques, 1995. Intestinal parasite contamination of vegetables sold at supermarkets in the city of Rio de Janeiro. Rev. Soc. Bras. Med. Trop., 28: 237-241.

Greenwood, P.E. and M.S. Nikulin, 1996. A Guide to Chi-Squared Testing. John Wiley and Sons Inc., New York, ISBN: 047155779X, pp: 280.

Gupta, N., D.K. Khan and S.C. Santra, 2009. Prevalence of intestinal helminth eggs on vegetables grown in wastewater-irrigated areas of Titagarh, West Bengal, India. Food Control, 20: 942-945.

Kang, G., M.S. Mathew, D.P. Rajan, J.D. Daniel, M.M. Mathan, V.I. Mathan and J.P. Muliyil, 1998. Prevalence of intestinal parasites in rural Southern Indians. Trop. Med. Int. Health, 3: 70-75.

Kozan, E., F.K. Sevimi, M. Kose, M. Eserm and H. Cicek, 2007. Examination of helminth contaminated wastewaters used for agricultural purposes in Afyonkarahisar. Turk. Parasitol. Derg., 31: 197-200.

Mesquita, V.C., C.M. Serra, O.M. Bastos and C.M. Uchoa, 1999. The enteroparasitic contamination of commercial vegetables in the cities of Niteroi and Rio de Janeiro, Brazil. Rev. Soc. Bras. Med. Trop., 32: 363-366.

Monge, R. and M.L. Arias, 1996. Presence of various pathogenic microorganisms in fresh vegetables in Costa Rica. Arch. Latinoam. Nutr., 46: 292-294.

Nimri, L.F., 2003. Cyclospora cayetanensis and other intestinal parasites associated with diarrhea in a rural area of Jordan. Int. Microbiol., 6: 131-135.

Nyarango, R.M., P.A. Aloo, E.W. Kabiru and B.O. Nyanchongi, 2008. The risk of pathogenic intestinal parasite infections in Kisii Municipality, Kenya. BMC Public Health, 8: 237-237.

Ozlem, E. and H. Sener, 2005. The contamination of various fruit and vegetable with *Enterobius vermicularis, Ascaris* eggs, *Entamoeba histolytica* cysts and *Giardia* lamblia cysts. J. Food Control, 16: 557-560.

Pozio, E., 2008. Epidemiology and control prospects of foodborne parasitic zoonoses in the European Union. Parsitologia, 50: 17-24.

Robertson, L.J. and B. Gjerde, 2001. Occurrence of parasites on fruits and vegetables in Norway. J. Food. Prot., 64: 1793-1798.

Slifko, T.R., H.V. Smith and J.B. Rose, 2000. Emerging parasite zoonoses associated with water and food. Int. J. Parasitol., 30: 1379-1393.

Soulsby, E.J.L., 1982. Helminths, Arthropods and Protozoa of Domesticated Animals. 7th Edn., Bailliere Tindall, London.

Srikanth, R. and D. Naik, 2004. Prevalence of Giardiasis due to wastewater reuse for agriculture in the suburbs of Asmara City, Eritrea. Int. J. Environ. Health Res., 14: 43-52.

Vuong, T.A., T.T. Nguyen, L.T. Klank, D.C. Phung and A. Dalsgaard, 2007. Faecal and protozoan parasite contamination of water spinach (*Ipomoea aquatica*) cultivated in urban wastewater in Phnom Penh, Cambodia. Trop. Med. Int. Health, 12: 73-81.