Prevalence of helminth eggs in raw vegetables consumed in Burdur, Turkey

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ABSTRACT

This study aimed to determine the prevalence of intestinal helminths in raw vegetables consumed in Burdur, Turkey. The presence of helminth eggs on raw vegetables, including lettuce, parsley, green onions, cucumbers, carrots, cress, peppermint, spinach, leek, dill, and rocket from Bazaar in Burdur, Turkey, was determined. A total of 111 raw vegetable samples were randomly selected from the bazaar and then were examined by a concentration method and assayed by light microscopy. Helminth eggs were detected in 7 (6.3%) of 111 raw lettuce, parsley, carrots, cress, peppermint, spinach, and rocket samples (p > 0.05). No helminth eggs were detected in leek, cucumbers, dill, and green onions. Parasitological contamination of raw vegetables sold in bazaar in Burdur may pose a health risk to consumers of such products. The importance of adequate measures throughout the farm-to-table food chain was emphasized.

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1. Introduction

Intestinal parasitic infections are amongst the most common infections worldwide. Some of these infections are regarded as serious public health problem. Intestinal parasite infection as a cause of malnutrition/growth stunting is well documented and is caused by a decline in food intake and/or an increase in nutrient wastage (Stephenson, Latham, & Ottesen, 2000), also deficiencies in vitamins (A, B6, B12) and minerals (iron, calcium, and magnesium), block nutrient absorption, and diminish immunity, predisposing subjects to serious diseases (Alum, Rubino, & Ijaz, 2010; Stephenson, 1994).

Intestinal parasitic infections can be transmitted by the fecal-oral route by eating intrinsically contaminated food or via uptake of free-living parasitic stages from the environment (eggs, cysts and oocysts). Contamination of food products can be introduced via feces, soil, irrigation water, sewage, human handling (Newell et al., 2010; Pozio, 1998).

Fresh vegetables are regarded as important part of a healthy diet, but they can be agents of transmission of protozoa cysts and helminth eggs and larvae. Because vegetables require a moist environment for their growth, these conditions favor the development of transmissible forms of enteroparasites (Simões et al. 2001).

In developing countries, especially, uncontrolled use of water from sources contaminated with human and animal faeces to irrigate such vegetables has been reported to be responsible for their high rates of contamination with helminth eggs (Kozan, Gonenc, Sarimehmetoglu, & Aycicek, 2005).

Burdur is an important agricultural and livestock region in Turkey and located in the temperate zone that lived in distinct four seasons. The raw vegetables (except for carrots) are grown in Burdur all year long and consumed widely by Turkish people. However, applications of sewage are not sufficient and contaminated with human and animal faeces waste water has been used for agricultural purposes in Burdur.

Despite studies on helminthological quality of vegetables in Turkey are sufficient (Avcioglu, Soykan, & Tarakci, 2011; Kozan et al., 2005), up till now in Burdur city no studies have been conducted to evaluate the extension of helminth contamination. Therefore, the main objective of the present study was to determine the prevalence of helminth eggs on raw vegetables sold in bazaar in Burdur city.

2. Materials and methods

2.1. The study area

Burdur is a city in the southwestern Turkey and the seat of the Burdur Province of Turkey. It has a subtropical climate in the warm temperate zone and is located between 29 and 24 to 53° East and 36–53 to 37–50° North lines. Burdur has a continental Mediterranean climate with cold, snowy winters and very hot, long
and dry summers. The mean annual temperature of Burdur is 13.2 °C, while the warmest month mean is 24.8 °C and the coldest month mean is 0.2 °C. The mean annual rainfall is about 241.5 mm. Accordingly, Burdur is located in the temperate zone that lived in distinct four seasons (DPT, 1996).

2.2. Sample collection

A total of 111 samples of raw vegetables, including lettuce, parsley, green onions, cucumbers, carrots, cress, peppermint, spinach, leek, dill, and rocket were obtained randomly from bazaar in Burdur, Turkey. The samples were transported to the laboratory for analysis in sterile nylon bags.

2.3. Determination of helminth eggs

Each raw vegetable sample was weighted (100 g) into sterile plastic bags and washed with physiological saline solution (0.85% NaCl) and the washing water/saline was left for about 24 h for sedimentation to take place. The top water was discarded and 5 ml of the remaining washing water centrifuged at 2000g for 5 min. The supernatant was discarded and the residue carefully collected. The samples were agitated gently by hand in physiological saline solution containing lugol again for further distribution of the cysts and eggs, and then were examined in lugol stained through light microscopy (Bailenger, 1962).

2.4. The statistical analysis

Chi-square analysis was used to assess the differences between proportions at a significance level of 0.05 and 95% CI using Minitab for Windows Version Release 16.1. (Minitab Inc., 2010).

3. Results and discussion

Results of helminth egg contamination of raw vegetable samples are presented in Table 1. A total of 111 raw vegetables were examined, of which 7 (6.3%) were contaminated with different species of Toxocara spp., eggs from wild animals; however, Taenia spp. were suspected to be indistinguishable from Taenia spp. eggs. In our study, some of the eggs thought to be Taenia spp. were suspected to be Echinococcus spp. that are indistinguishable from Taenia spp. and are transmitted through waters contaminated with faeces of dogs. Hence ingestion of the embryonated Echinococcus spp. eggs through contaminated vegetables increases the risk of infection with hydatid cyst (Daryani, Ettehad, Sharif, Ghorbani, & Ziaei, 2008; Fallah et al., 2012). It is difficult to completely prevent exposure to Echinococcus spp. eggs from wild animals; however, food safety precautions, combined with good hygiene, can be helpful (CFSPH, 2011).

In this study, we detected Toxocara spp. in 10.0% of peppermint and 8.33% of spinach. There was no statistically significant association between the sort of vegetable surveyed and the presence of Toxocara spp. contamination (χ² = 8.291; P > 0.05). Fallah et al. (2012) detected Toxocara spp. eggs in 3.3% of the unwashed vegetable samples. Toxocarasis has a worldwide distribution, with a variable frequency, and occurs both in countries with poor sanitary, social and cultural conditions and in more developed countries (Mattia et al., 2011). Toxocarasis is human helminthozoonosis due to infestation by ascarid larvae of Toxocara canis and Toxocara cati, the most widely distributed nematode parasites in canids and felids (Gawor, Borecka, Zarnowska, Marczynska, & Dobosz, 2008). Ingestion of embryonated eggs by human through contaminated soil, hands or vegetables causes visceral and ocular larva migrans (Avcioglu et al., 2011). It should be noted that it is not possible to differentiate between eggs of the most common geoehelminths, e.g. T. cati and T. canis by means of morphology, as their eggs are rather identical. Accordingly, we did not provide information on the species of the geohelminth eggs found in the examined vegetables. Correct identification of geoehelminth eggs of these species is possible only by using methods of molecular biology (Blaszkowska, Kurnatowski, & Damecka, 2011).

We detected eggs of Ascaris lumbricoides in 9.09% of lettuce and 7.69% of parsley. There was no statistically significant association between the sort of vegetable surveyed and the presence of A. lumbricoides (χ² = 8.291; P > 0.05). These vegetables are eaten raw in Turkey and also in Burdur. The presence of Ascaris in

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Samples tested No.</th>
<th>Taenia spp. No. (%)</th>
<th>Toxocara spp. No. (%)</th>
<th>A. lumbricoides No. (%)</th>
<th>E. vermicularis No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lettuce</td>
<td>11</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (9.09)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Parsley</td>
<td>13</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (7.69)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Green onions</td>
<td>10</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>12</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Carrots</td>
<td>12</td>
<td>1 (8.3)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Cress</td>
<td>10</td>
<td>1 (10.0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Peppermint</td>
<td>10</td>
<td>0 (0)</td>
<td>1 (10.0)</td>
<td>0 (0)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td>Spinach</td>
<td>12</td>
<td>1 (8.33)</td>
<td>1 (8.33)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Leek</td>
<td>10</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Dill</td>
<td>11</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Rocket</td>
<td>11</td>
<td>0 (0)</td>
<td>1 (9.09)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>3 (2.7)</td>
<td>3 (2.7)</td>
<td>2 (1.8)</td>
<td>1 (0.9)</td>
</tr>
</tbody>
</table>
vegetables can be due to the quality of water used for irrigation, the probable use of untreated night soil, and poor hygienic practices during transportation and marketing of vegetables. In this study, eggs thought to be those of *A. lumbricoidea* are very difficult to distinguish from *Ascaris suum*. However, swine production, with which *A. suum* is associated, is extremely limited and pork consumption is rare in Turkey. Therefore, it was suggested that the eggs are most likely those of *A. lumbricoidea*. In agreement with the present study, a high prevalence of *A. lumbricoidea* contamination of raw vegetables has been reported by Koçan et al. (2005). *Ascaris* is often used as a parasitological indicator of the hygienic quality of natural compost (Blaszkowska et al., 2011; Gupta, Khan, & Santra, 2009). In the world, especially in developing countries, uncontrollable use of natural manure (e.g., cowpat, water from sources contaminated with human and animal excrement) to fertilize vegetables and fruits has been reported to be responsible for their high rates of contamination with helminth eggs. *A. lumbricoidea* was the most predominant and was observed in 85% of the contaminated vegetables in Ghana’s urban markets. This could be attributed to its high level of persistence and resistance (Amoah, Drechsel, Abaidoo, & Ntow, 2006). Gupta et al. (2009) reported that contamination rates with *Ascaris* in vegetables were 36% in India. Abougain et al. (2010) reported eggs of *Ascaris* were detected in 68% of vegetables in Libya. Fallah et al. (2012) identified eggs of the parasite were detected in 41% of the unwashed vegetable samples being the predominant intestinal parasite in Iran.

In this current study, egg of *Enterobius vermicularis* was detected in 0.9% of peppermint. There was no statistically significant association between the sort of vegetable surveyed and the presence of *E. vermicularis* ($\chi^2 = 11.293; P > 0.05$). Al-Binali, Bello, El-Shewy, and Abdulla (2006) detected *E. vermicularis* in 6.3% of lettuce and radish. *Enterobius* is normally the predominant parasite in areas where socio-economic and environmental conditions, and hygiene practice levels, are lower (Bunchu et al., 2011). The gastrointestinal pinworm *E. vermicularis* mainly causes itching, and affects more than 200 million people worldwide, especially children (Bunchu et al., 2011; Elston, 2003; Newell et al., 2010).

4. Conclusion

The result of this study has indicated that vegetables at bazaar in Burdur are contaminated with pathogenic helminth parasites and may pose a health risk to consumers of raw vegetables. It is necessary to improve the sanitary conditions in the areas where the vegetables are cultivated and consumed. Furthermore, an adequate treatment of the sewage water and banning waste water use for irrigation of plants intended for human consumption, among others, should be implemented. Proactive and practical education programs are needed at all steps in process, i.e., from the field to the consumer’s plate.

References


