# The prevalence of parasites in commonly used leafy vegetables in South Western Saudi Arabia

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## ABSTRACT

**Objective:** To determine the degree of contamination caused by parasites in commonly used leafy vegetables in Abha, Kingdom of Saudi Arabia (KSA).

**Methods:** We carried out the study in the Department of Clinical Microbiology and Parasitology, King Khalid University, Abha, KSA, during the period September 2004 to May 2005. Five commonly used leafy vegetables, namely, green onion, radish, watercress, lettuce and leek, were washed each in water and Tris-buffer-saline (TBS). The washing solution was then centrifuged and the sediments were examined for parasites.

**Results:** The use of TBS for the extraction, significantly increased the isolation rate (27.2%) of the parasites compared with the use of tap water (7.8%) ($z=4.72$ $p<0.001$). The prevalence of the parasites was 28% in green onion, 25% in radish, 17% in watercress, 17% in lettuce, and 13% in leek. The parasites were more common in the months of September to December. *Ankylostoma duodenale, Entameba coli, Ascaris lumbricoides* and *Blastocystis hominis* were the most common isolated parasites. We encountered 12 genera of parasites during the study and the least common was *iodamoeba butschlii*.

**Conclusion:** The study shows that parasites are common in leafy vegetables and the use of tap water does little to remove them. The public health implications of our findings will be communicated to the Aseer regional health authorities for appropriate community health education and other necessary actions.

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Ill health related to food-borne infection transcends all geographical, political and cultural boundaries. The incidence of food-borne diseases continues to adversely affect the health and productivity of populations in most countries, especially non-industrialized ones.[1] Most people are not aware of the danger to their health posed by parasites nor do they know from where and how parasites are acquired. Parasites are found worldwide, including the developed and wealthy countries,[2,3] although poor sanitation increases the possibility of their acquisition and frequency. Parasites are present in our food, water, pets, and gardens, to name just a few. Humans acquire parasites in a variety of ways: through the consumption of food, fruits, vegetables, meat, and water and in contact with pets and other people. Once in the body, parasites can settle almost anywhere, causing damage to organs, blocking and sapping nutrients from the host. Humans may be hosts to over 100 different types of parasites, covering several parasitic families, which include roundworms, tape worms, flukes, and single-cell parasites (protozoa). It is estimated that

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25% of the world's population are infected with round worms.[2] The effects of parasites in humans are many and involve several organs. They include digestive disturbances such as dysentery, diarrhea, bloating and flatulence, obstruction, fatigue and anemia. Although we are commonly exposed to protozoa, our immune systems usually keep them under control. However, people with weakened immune system or toxic condition, can not fight off these parasites. They lodge in various organs and tissues, releasing toxins and tissue-destroying enzymes, which may cause arthritis, asthma, degenerative muscle diseases, multiple sclerosis, ovarian cysts, psoriasis, cutaneous ulcers, dermatitis, and more.[2,4]

The aim of this study was to find out the prevalence of these parasites in commonly consumed leafy vegetables in Abha, a rapidly-growing academic, commercial, tourists and high-altitude city, located in the south-western region of Saudi Arabia.

**Methods.** The following commonly used leafy vegetables locally cultivated were purchased once weekly from the central vegetable market in Abha, Kingdom of Saudi Arabia (KSA). The Abha central vegetable market supplies vegetables to all major supermarkets and retailer shops in Abha. The market is approximately 5 km from our college. The vegetables include: green onion, radish, watercress, lettuce and leek. The study covered a period of 9 months, from September 2004 to May 2005. Thirty-six samples of each vegetable were analyzed (36 × 5 =180). The vegetables were processed immediately on arrival in our laboratory by an experienced technician. Each vegetable was divided into 3 parts (leaves, middle parts and roots), each part was further divided into 2 small portions. Tap water and Tris-buffer-saline (TBS) (20 mM tris base, 0.5 mM sodium chloride, 0.2% tween 20 and double-distilled water), were used as washing solutions. All the 3 parts of each vegetable were mixed together and approximately 100 gm were soaked in 150 ml of the extraction solution in 500 ml beaker. With the aid of a mechanical shaker, the beaker was shaken at 150 rpm for 30 minutes. The washing solution (TBS or tap water), was poured through a sterile gauze into a sedimentation flask and left to sediment for 45 minutes. After this time, the supernatant was decanted and the sediment was transferred into a 15 ml conical centrifuge. The tube was filled to 15 ml with the washing solution and centrifuged at 1500 rpm for 5 minutes. The supernatant was decanted, a few drops of 10% formal-saline (10 ml formalin in 90 ml of 9% normal saline), was added and the mixture was spread on at least 3 slides and examined for parasites.

Data were analyzed using the Z test for proportion and the Statistical Package for Social Sciences software version 10.

**Results.** We examined each slide (to confirm the findings) for each type of vegetable. Out of the 5 leafy vegetables examined, the highest number of parasites was found in green onions [17 (28%)] and the lowest in leek [8 (13%)]. The prevalence of parasites in other vegetables was 16 (25%) in radish, and 11 (17%) in each of lettuce and watercress. *Ankylostoma duodenale (A. duodenale)* and *Entameba coli (E. coli),* were the most common parasites detected [12 (19.04%)] followed by *Ascaris lumbricoides (A. lumbricoides)* [10 (15.8%)], then *Blastocystis hominis (B. hominis)* [8 (12.6%)]. Meanwhile, the least detected parasite

**Table 1 -** Distribution of parasites detected in the vegetables examined.

| Parasites | Vegetables | | | | | |
|---|---|---|---|---|---|---|
| | Lettuce | Watercress | Radish | Green onion | Leek | Total (%) |
| *Entamoeba histolytica* | 0 | 0 | 1 | 1 | 0 | **2 (3.1)** |
| *Entamoeba coli* | 0 | 4 | 1 | 4 | 3 | **12 (19)** |
| *Giardia lamblia* | 1 | 0 | 0 | 0 | 1 | **2 (3.1)** |
| *Cryptosporidium parvum* | 0 | 3 | 0 | 0 | 1 | **4 (6.3)** |
| *Iodamoeba butschlii* | 0 | 0 | 0 | 0 | 1 | **1 (1.6)** |
| *Blastocystis hominis* | 1 | 1 | 2 | 4 | 0 | **8 (12.6)** |
| *Ascaris lumbricoides* | 3 | 1 | 5 | 0 | 1 | **10 (15.8)** |
| *Toxocara canis* | 1 | 0 | 1 | 0 | 0 | **2 (3.1)** |
| *Ankylostoma duodenale* | 3 | 1 | 3 | 4 | 1 | **12 (19)** |
| *Strongyloides stercoralis* | 0 | 1 | 1 | 2 | 0 | **4 (6.3)** |
| *Enterobius vermicularis* | 2 | 0 | 2 | 0 | 0 | **4 (6.3)** |
| *Trichostrongylus colubriformis* | 0 | 0 | 0 | 2 | 0 | **2 (3.1)** |
| **Total (%)** | **11 (17)** | **11 (17)** | **16 (25)** | **17 (28)** | **8 (13)** | **63 (100)** |

**Table 2 -** Seasonal variation of parasites found in the vegetables examined from September 2004 to May 2005.

| Examination period | No. of parasites (%) |
|---|---|
| September 2004 | 8 (12.6) |
| October 2004 | 9 (14.2) |
| November 2004 | 5 (8) |
| December 2004 | 10 (15.9) |
| January 2005 | 5 (8) |
| February 2005 | 5 (8) |
| March 2005 | 6 (9.5) |
| April 2005 | 10 (15.9) |
| May 2005 | 5 (8) |
| September 2004 - May 2005 | 63 (100) |

was *iodamoeba butschlii (I. butschlii)* [1 (1.6%)]. Other parasites detected in the examined vegetables are shown in **Table 1**. A seasonal variation of the density of parasitic infections in the vegetables examined is shown in **Table 2**. The months of September, October and December, showed higher rates. In contrast to this, in November it was 8% only. The use of TBS for the extraction, significantly increased the isolation rate. In 180 samples, 49 parasites were detected using TBS (27.2%); while only 14 parasites (7.8%) were detected using tap water ($z=4.72$ $p<0.001$).

**Discussion.** High incidence of intestinal parasites has been found in communities that consume raw vegetables, especially where those vegetables are cultivated on farms fertilized with untreated human and animal fertilizers.[5-7] Although contamination of vegetables may occur in a variety of ways such as contact with the soil, the water used for irrigation, contact pre and post-harvest, in most cases, it is associated with the water used for irrigation.[3,6,8] In Abha, most of the vegetables in the market sampled, were irrigated with well water.

*Entameba coli*, a non-pathogenic parasite (denotes a fecal contamination), and *A. duodenale*, a highly dangerous nematode, were most frequently encountered. This is in contrast to several reports that found *A. lumbricoides* as the most common parasite in vegetables.[5,7-11] Robertson and Gjerde[3] however, did not encounter *Ascaris* at all. Varied human and environmental factors might explain this difference. *Cryptosporidium* is a common cause of prolonged diarrhea in both immunocompetent and immunocompromised hosts, particularly patients with HIV/AIDS.[12,13] Unfortunately, this parasite is not often looked for in routine microbiology laboratories. Its presence in our study and the reports cited in this paper, call for increased vigilance by microbiologists and clinicians in our region.

The wide variation in reported frequencies of parasitic contamination in vegetables relates to the level of environmental contamination as well as the diagnostic methods employed. For example, Robertson and Gjerde,[14] found that the use of immunomagnetic separation and identification by immunofluorescence, appreciably improved the yield for *Giardia* and *Cryptosporidium*. Similarly, Kniel and Jenkins[15] found that the use of polyclonal sera specific to the recombinant viral capsid protein (rCPV40) in a dot blotted hybridization assay to detect *Cryptosporidium* oocysts from green onions and cilantro was superior to other methods.

Our study covered only 9 months (September 2004 to May 2005); nonetheless, we found that parasite isolation rates were higher in the months of September to December, the dry period in Abha. Although the reason for this finding is not clear, it is in agreement with the report by Monge et al.[16] In contrast to this, in November it was 8% only. The reason for this is also not clear. This finding contradicts other reports that had a higher parasite rates in the rainy season.[3,6] However, our finding of the highest parasite load in green onions agree with those of Srikanth and Naik.[5] The recent report that neurocysticercosis may result from the consumption of contaminated vegetables,[17] underscores the public health importance of parasites in vegetables.

The data obtained in our study revealed that tap water does little to remove parasites from vegetables; we must continue our search for a safe and common household chemical that can easily and safely do the job. In the mean time, educational programs should alert producers how to improve the cultivation and harvesting of vegetables, and how to monitor the quality of the water used for irrigation.

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