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THE CONTROL OF PARASITIC SPP. OCCURRENCE IN COMMON RAW VEGETABLES

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Abstract:

Fruits and vegetables are an important part of daily diet. These crops are exposed to pollutants from various sources, leading to their contamination with bacteria and parasites. This study was designed to determine the degree of contamination of vegetables and fruits with parasites and to find an easy, safe, and available method to reduce parasite transmission. In this study, 60 random samples were collected from four types of vegetables: lettuce, cabbage, leeks, and green onions, with 15 samples of each type. Parasites were isolated from these samples by sedimentation method, then stained using iodine dye and examined under a microscope. Positive samples were immersed in two types of disinfectants, potassium permanganate at a concentration of 150 ppm and salt water at a concentration of 1.2% for 5 minutes. The parasites were detected in 51.6 %(31/60) of samples. The highest rate of contamination was detected in leeks at 66.6% and lettuce at 60%, followed by cabbage at 46.6%, and green onion at 33.3%. In this study, ten types of parasites were investigated Ascaris lumbricoides ,Enterobius vermicularis ,Hymenolepis nana eggs ,Larva of nematoda, Schistosoma mansoni ,Taenia saginata ,Fasciola hepatica ,Trichomonas hominis ,Giardia lamblia ,Entamoeba histolytica.Ascaris lumbricoides was the highest prevalent intestinal parasite at 18.3%,followed by Trichomonas hominis, and Giardia lamblia at 15%,11.6 %respectively .Taenia saginata and Larva of nematoda 8.3%, Enterobius vermicularis 5%, Fasciola hepatica3.3%, Hymenolepis nana eggs, and Schistosoma mansoni were both 1.6%. The mean intensity of parasites were reduced by using potassium permanganate and saltwater compared with tap water but the statistical differences between the percentages were insignificant.

Keywords: vegetables, parasites, prevalence, consumption, disinfectant.

Introduction

The consuming of vegetables and fruits can maintain human health as they contain different minerals, carbohydrates and vitamins[1]. Also, the danger of specific illness like stroke diseases ,cardiovascular diseases and chronic diseases can be minimized by consuming raw vegetables[2].The consistent consumption of fresh vegetables is related to lowering the danger of growth of specific kinds of cancer[3].

Consumption of raw vegetables can help with weight loss and decrease the risk of obesity. In 2003 FAO and WHO encouraged the consuming of vegetables and fruits because it helps in the Maintenance of a human health[4] .Some vegetables are eaten raw as salad to retain the natural taste and preserve heat liable nutrients. Different diseases could be transmitted by ingestion of raw vegetables as they have porosity and complicated surface, which makes pathogens easily survive on it[5]. Without precise washing the consuming raw vegetables could be way for parasitic diseases transmission. The number of food-borne illness relate with raw vegetables has risen [6].

There are many reasons of vegetable contamination, starting from farm workers, as well as in the process of the transportation of crops to the market, sellers, or during the process of packing these vegetables. Also, the soil in which crops are grown, the type of irrigation water, and the fertilizer that is used to grow these crops. In many developing countries, untreated wastewater is used to irrigate and grow crops because it is cheap and accessible, and this is the main reason for the transmission of pathogenic parasites to humans[6][7][8].The public health can be threaten by Food borne-illnesses [9]. In many developing countries there are specific agents which contribute to foodborne illnesses[10].

Recently, the cases number of foodborne illness related to consuming of raw vegetables has been a rise. The transition of parasitic foodborne illness plays a major epidemiological role with The consumption of raw vegetables[11][12]. The Intestinal parasites like *Giardia lamblia, Ascaris lumbricoides, Trichuris trichiura, Cryptosporidium spp. , Entamoeba histolytica, Hymenolepis spp., Toxocara spp., Enterobius vermicularis, Fasciola spp., Trichostrongylidae, Taenia spp.*, could transmission to humans as a result of consuming contaminated, improperly washed , or uncooked vegetables[13] [3].

Many studies have been done in Saudi Arabia[14], Ethiopia[15], Iran[16], Libya[17], the Philippine[18], and Egypt[19], to estimate the role of fruits and uncooked vegetables in the carrying of pathogenic parasites. Consumption of unwashed, raw vegetables has played a major role in carrying such pathogenic parasites as helminths and protozoans[20].

According to our knowledge, there are a few studies that have been done in the province of Wasit/Iraq about the parasitic contamination of raw vegetables. Therefore, this study was conducted to find out about the parasitic contamination in a few vegetables commonly consumed raw, and research a practical way of decontamination of raw vegetables from parasitic infection so the vegetable can be safely consumed.

Materials and methods

The plan

Between December 2022 and April 2023, we obtained different samples of raw vegetables from three different markets of Wasit province/Iraq under natural conditions, a total of 60 samples of four types of vegetables were selected for this study (15 of each), which was collected over a 5-month study period which were lettuce (Lactuca sativa); spring onions (Allium cepa L.); leeks (Allium porrum); cabbage (Brassica oleracean).

Process of collecting samples, preparation, and washing.

Samples of raw vegetables were randomly collected from different markets in Waist City. Each sample was placed in labeled nylon bags with a unique number and immediately transported to the laboratory. Approximately 200-300 gm of each vegetable was weighed after removing rotten parts. All samples were soaked for 15 minutes, the vegetables and big particles were removed, the remaining water was then left for 10 h for sedimentation to occur, 10 mL of the washing solution was centrifuged at 2,000 rpm for 10 minutes. After that, the top layer was cautiously discarded and the leftover sediment was collected and examined using 10× and 40× objectives of light microscope [47].

Two disinfectant solutions were applied. Sodium chloride 1.2 % prepare by dissolved Sodium chloride crystals in distilled water and dissolved Potassium permanganate in distilled water to have 150 ppm.

The suspension of positive samples was divided into two tubes and exposed to 5ml of disinfectant for 10 minutes, and centrifuged for 5 minutes at 1500 rpm.

Two types of smears were prepared, direct smear by applying a drop of sediment before placing a coverslip to a slide, and in order to staining the cysts we used Iodine smear by adding a small drop of iodine stained to the sediment before placing a coverslip.

Statistical analysis

The obtained data were analyzed statically by using the Microsoft Excel program. The t-test was performed to compare the contamination level of raw vegetables. The degree of contamination of parasites using disinfectant was compared using a t-test. The differences were considered significant at $p< 0.05$.

Results and discussion

The transmission of parasites to humans is associated with the consumption of raw vegetables. One thing that helped us better understand the potential source of pathogenic parasite acquisition in this study area is the recovery of parasites from vegetables. High rates of intestinal parasitic diseases have been found in people who consume raw vegetables [17]. Moreover, many people prefer to eat slightly cooked or raw vegetables without treatment to save nutrients from heat, which may increase the risk of parasite infection[21].There are a few studies and researches that estimate the intensity and degree of parasitic infections that are transmitted from raw vegetables and fruits to humans in this region.

This study revealed a high degree of parasitic contamination including protozoa cysts and Helminth eggs. The overall prevalence was 51.6 %(31/60) (Fig1). The previous study has a similar rate to our study conducted in Misan City/Iraq (51%) [46] , and approximately similar to previous detection from Saudi Arabia (46%)[22], and Tripoli, Libya (58%) [17].

The current finding was lower than findings of Thi-Qar Province, Iraq (88.3%) [7] , Khorramabad, Iran (79%)[23] , and Kenya (75.9%)[24] .

However, a lower percent of contamination was detect in Benha, Egypt (29.6%)[25] , Alexandria, Egypt (31.7%)[19] ,Ardabil, Iran (29%)[20] ,Turkey (6.3%)[26], and Riyadh,

Saudi Arabia (16.2%)[14] . Obviously, this difference of parasitic contamination among this study and prior ones might be caused by type and number of specimen investigated, environmental and geographical state, irrigation water, hygiene and sanitation, the surface and shape of vegetables [19] . It is clear that there are Variations in the results obtained from the examination of raw vegetables, this difference in contamination among various vegetables results from the differences in shape and surface area of the plant[27] [30].

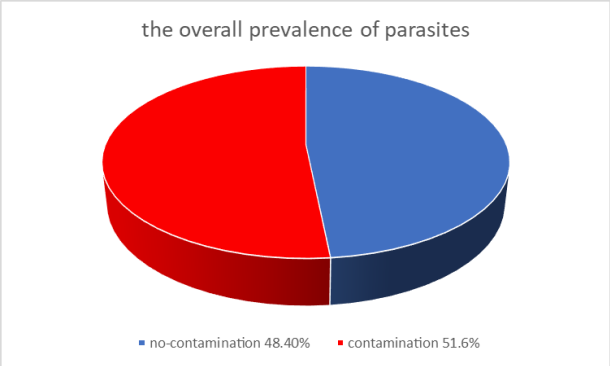

Figure 1. The overall prevalence of parasites among raw vegetables.

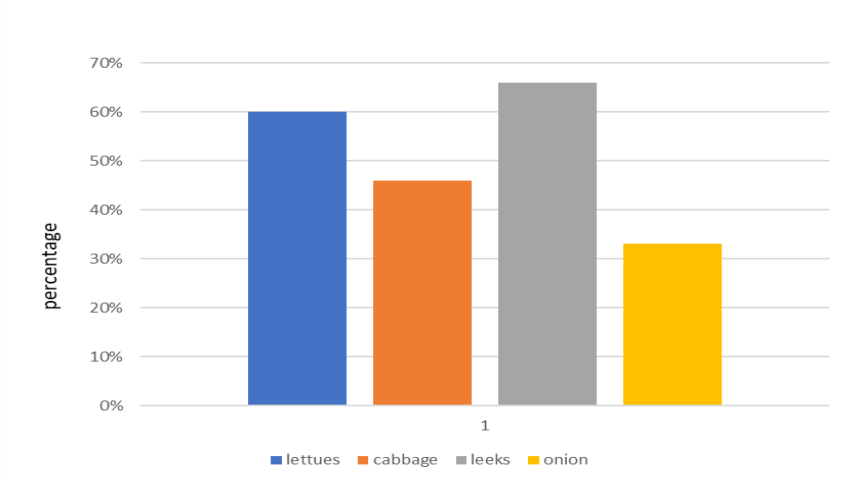

Figure 2. The prevalence percentage of parasites of each type of vegetable that is used in this study.

This study detected high rates of parasitic contamination of vegetables at 51.6%, the highest rate of contamination was detected in leeks at 66.60% and lettuce at 60%, followed by cabbage at 46.6%, and green onion at 33.30 % (Fig2). Leafy vegetables like lettuce and cabbage have an irregular surface area that easily lets the parasitic cysts and eggs attach to the leaf. Moreover, the smooth surface of vegetables has a low degree of parasitic contamination due to the difficulty of attaching the surface like green onion [19].

In this present study, of ten types of parasites investigated (Tabl1), *Ascaris lumbricoides* was the highest prevalent intestinal parasite at 18.3%. *Ascaris lumbricoides* were found in all four types of vegetables. Many studies have been done in different regions that demonstrate a high

prevalence rate of *Ascaris lumbricoides* ,the prevalence rate in Sana'a, Yemen (36.67%) [3], in Tripoli, Libya (68%) [17] ,Mosul City, Iraq (40%) and (29%) [28]. The contamination rates of *Ascaris* eggs were much lower in other regions, southern Thailand (2.6%) [29], South West Ethiopia((16.7%)[30], , in Bahir Dar City, Northwest Ethiopia 1.3%[27], Karbala, Iraq (11%)[28], and in Thi-Qar Province, Iraq (15.6%)[7]. The environmental contamination with *Ascaris spp.* eggs which was detected at high levels which is related to the high rate of fertility [31] and also because of the ability of these parasites to survive in harsh environmental conditions for up to 6 years[8]. The occurrence of helminth eggs may be related to the untreated night soil [19] or contamination of irrigating water [25].

The percentage of contamination with H. nana and *Schistosoma mansoni* eggs was very low, being at 1.6 % for both. H. nana was found in leeks only, while *Schistosoma mansoni* was found in lettuce. A study conducted in Thi-Qar Province, Iraq, has similarly low results for these two types of parasites at 0.8 % [7] ., another study in Sana'a City, Yemen revealed a high prevalence for H. nana and *Schistosoma mansoni* at 35.33% and 24.67% respectively[3]. In most of the studies, there were reported cases of *H. nana*, in contrast to *Schistosoma mansoni*, which was absent. The Lowest rate was recorded for *H. nana* eggs in Qazvin, Iran at 0.5%[32], slightly higher in Banha, Egypt (2.8%)[25] , Alexandria, Egypt at 2.6%[19] ,and in Turkey at 6.25%[13] .while the high prevalence was recorded in (Arba Minch town), Southern Ethiopia at 15.56% [15] , and in Riyad, Saudi Arabia at14.5% [14]. The variance of the prevalence in different studies might be related to the difference in geographical location and climatic conditions[25][33].

The eggs of *Enterobius vermicularis* were detected in 5% of the examined sample. Almost the same results have been seen in Khorramabad, Iran, with a rate of *Enterobius vermicularis* at 5.1% [34], in Benha, Egypt at 4.9 %[25], and in Manila, Philippines, at 4.5% [18]. A lower degree of contamination was detected in Turkey at (0.9%) [26] , while the highest degree of contamination was discovered in Zahedan, Iran, and in Thi-Qar Province, Iraq at(8.1%) and (10.2 %)respectively[35][7] .*Enterobius vermicularis* prevalence is related to bad hygienic practices, environmental and socio-economic conditions [26].

In this study, we detected one of the neglected zoonotic diseases parasites, *Fasciola* species with a prevalence degree of 3.3%. lower prevalence degree was detected in Ghana at 0.3%, and in Thi-Qar Province, Iraq at 0.8 % [7] [36][36].

In this study, the prevalence of *Taenia saginata* and Larva of the nematode was 8.3% for both of them, which doesn't match with the study conducted in Thi-Qar Province, Iraq and in Qazvin Province, Iran[7] [37].

The helminth eggs that are found in different vegetables are possibly associated with the contamination of irrigating water and the contamination of soil[19] .Even though contamination of vegetables could happen in a different manner, it is generally related to irrigation water[6].

Protozoa prevalence was lower than helminths, represented by *Trichomonas hominins, Giardia lamblia*, and *Entamoeba*. The prevalence rate of *Trichomonas hominins* was higher among the protozoa parasites at 15% followed by *Giardia lamblia*, and *Entamoeba* at 11.6%

and 6.6% respectively. Many studies indicate the same result for *Giardia spp* , in Libya it was 10%[17] ,in Sharkyia, Egypt at12.6% [38], and in Amman and Baqa'a in Jordan at 8.8%[39]. The highest prevalence was indicated in Thi-Qar, Iraq at 71.1 % [7], and in Sana'a City, Yemen at 65.3%[3] .The lowest prevalence reported in Norway at 2.1% [40] , and 4% in Qazvin[32]. *G. lamblia* was the most prevalent protozoan parasite in many studies around the world as this type of parasite did not need an intermediate host and it was directly transmitted[41].

In the present study, potassium permanganate and salt water had a lethal effect while tap water did not have this ability Fig (4) showed the effectiveness of salt water and potassium permanganate as disinfectants by compared with tap water. The obtained results exhibit that the main intensity of parasites egg and larva declined by using salt water and potassium permanganate as disinfectants.

Table 1. The percentages and numbers of each parasite found in four types of vegetables in this study.

Parasite species	Lettuce No=15 (%)	Green onion No=15 (%)	Cabbage No=15 (%)	Leek No=15 (%)	Total No=60 (%)
Ascaris lumbricoides	4 (26.2)	1 (6.6)	2 (13.3)	4 (26.2)	11 (18.3)
Enterobius vermicularis	1 (6.6)	0 (0.0)	0 (0.0)	2 (13.3)	3 (5)
Hymenolepis nana eggs	0 (0.0)	0 (0.0)	0 (0.0)	1 (6.6)	1 (1.6)
Larva of nematoda	3 (20)	1 (6.6)	0 (0.0)	2 (13.3)	5 (8.3)
Schistosoma mansoni	1 (6.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.6)
Taenia saginata	2 (13.3)	0 (0.0)	1 (6.6)	2 (13.3)	5 (8.3)
Fasciola hepatica	2 (13.3)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.3)
Trichomonas hominis	3 (20)	0 (0.0)	2 (13.3)	4 (26)	9 (15)
Giardia lamblia	3 (20)	1 (6.6)	2 (13.3)	1 (6.6)	7 (11.6)
Entamoeba histolytica	2 (13.3)	0 (0.0)	1 (6.6)	1 (6.6)	4 (6.6)

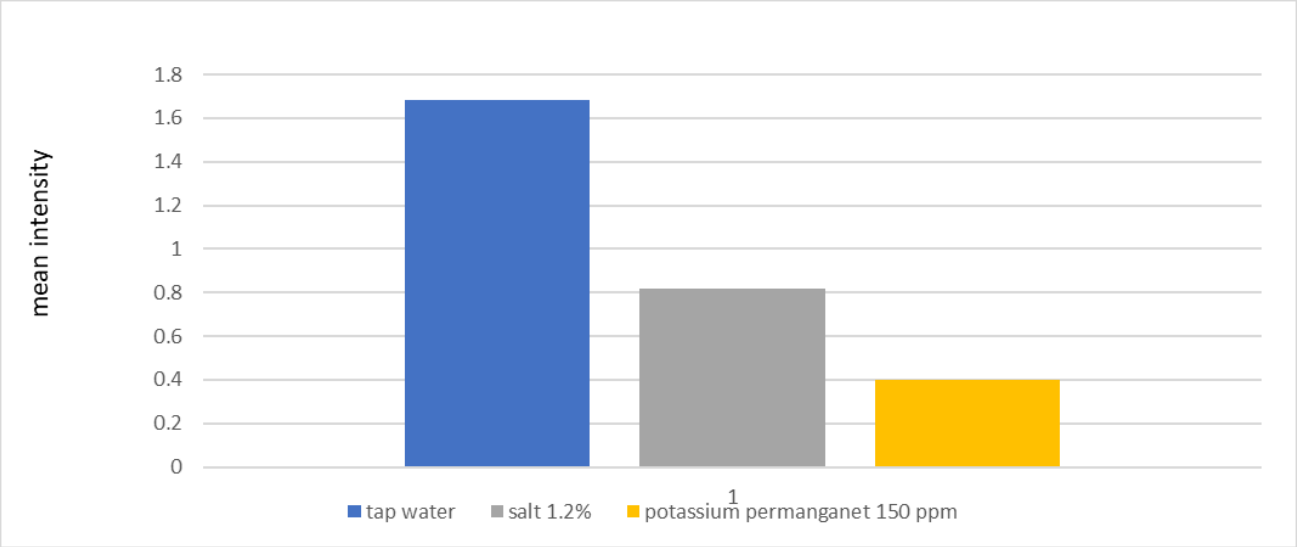

Figure 4. The mean intensity of the parasite using two disinfectant solutions compared with tap water

This study showed that the main intensity of parasite eggs and larvae was reduced to (0. 4) by using Potassium permanganate solution compared with tap water were (1.68) (Fig .4). Many studies revealed that the solution of Potassium permanganate was used to reduce parasites and pathogenic bacteria on fresh fruits and vegetables [40, 41, 42]. That agreed with the study done in Egypt in 2022 which reported that using sodium salt solution (1.5%), potassium permanganate (150ppm) to minimize infective parasitic stages[45]. The use of salt water has many benefits including safe for human beings, on-the-spot preparation, ease of application, effective disinfection, and cost-effectiveness, compared to other sanitizers and disinfectants

Conclusions

In conclusion, the study results show that common raw vegetables city may threaten the vegetable consumer and cause health problems because it is contaminated with intestinal parasites. For the food safety assurance by prevent or reduce the contamination of vegetables and fruits can be performed by using the right washing method and using disinfectants.

This study directed us to the use of easy and effective techniques to reduce parasite infection. The use of specific kinds of disinfectants like sodium chloride (table salt) and potassium permanganate is safe and easy to prepare and it is an effective way to reduce pathogenic bacteria and parasites.

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