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Detection of Parasites Contaminating Raw Consumable Vegetables in Kalar City, Kurdistan Region, Iraq

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Abstract

Intestinal parasitic infections are one of the most important health problems. Although fresh vegetables are considered as a vital element of a healthy diet, they are a potential source of human intestinal parasitic infections during production, collection, transportation, preparation and consumption. The present study was carried out to determine and detect the parasite contaminants of fresh vegetables that are sold at different open-aired markets in Kalar city, Kurdistan Region, Iraq. A total of 240 raw vegetable samples were examined by sedimentation technique after washing the samples with normal saline. Of the 240 samples, 124 (51.7%) were microscopically positive for intestinal parasites. Particularly, a high rate of contamination was recorded in cress (*Lepidium sativum*) with 70%. However, the least contaminated sample was lettuce (*Lactuca sativa*) with 36.7%. The most encountered parasite was *Taenia* spp. (egg 12.9%), whereas *Trichuris trichiura* (0.83%) was the least detected parasite. Since, the results emphasize the fresh vegetables are potential sources of transmission for intestinal parasites in central markets of Kalar city, strict hygienic measures should always be adopted to avoid parasitic contamination. Untreated sewage and the manure used by greengrocer as fertilizer can be implicated in vegetable contamination.

Keywords: Intestinal parasites, Vegetables, Contamination, Kalar city

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الكشف عن الطفيليات الملوثة للخضروات الغير مطبوخة والقابلة للاستهلاك في مدينة كلار، منطقة كردستان، العراق

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الخلاصة

العدوى الطفيلية المعوية هي واحدة من أهم المشاكل الصحية. على الرغم من أن الخضروات الطازجة تعتبر عنصرًا حيويًا في اي نظام غذائي صحي، إلا أنها مصدر محتمل للإصابات الطفيلية المعوية البشرية أثناء عمليات الإنتاج والجمع والنقل التحضي والاستهلاك. أجريت هذه الدراسة لتحديد واكتشاف الملوثات الطفيلية للخضروات الطازجة التي تباع في العديد من الأسواق مفتوحة في مدينة كلار، منطقة كردستان، العراق. تم فحص ما مجموعه 240 عينة من الخضار الطازج عن طريق تقنية الترسيب بعد غسل العينات بمحلول (ملحي طبيعي). من بين 240 عينة، اظهرت الفحوصات المجهرية124 (51.7 ٪) عينه إيجابية للطفيليات المعوية. على وجه الخصوص، تم تسجيل معدل تلوث مرتفع في Cress(*Lepidium sativum*) مع 70 ٪. ومع ذلك، فإن العينة الأقل تلوثًا هي الخس (*Lactuca sativa*) بنسبة 36.7 ٪. كان الطفيلي ترددا العينات الأكثر مواجهة هو *Taenia spp*. (البيض 12.9 ٪)، في حين أن الطفيلي (*Trichuris trichiura* %0.83) كانت الأقل انتشارا. تشير النتائج على أن الخضروات الطازجة هي مصادر محتمل للنقل الطفيليات المعوية في الأسواق المركزية في مدينة كالار، لذلك يجب دائمًا اعتماد التدابير الصحية الصارمة لتجنب التلوث الطفيلي. يمكن أن يكون مياه الصرف الصحي غير المعالجة والسماد الذي يستخدمه المزارعين دورا في تلوث الخضار.

الكلمات المفتاحية: الطفيليات المعوية، خضروات، تلوث، مدينة كلار

Introduction

Fresh vegetables are essential for human nutrition Due to nourish health advantages. A vegetarian diet is a rich source of vitamins, fibers, and minerals which normally decreases the incidence of stroke, cardiovascular illnesses, and perhaps protects human body against some kinds of cancers [1]. Despite their advantages, vegetables are a possible source of infective agents such as bacteria, viruses, and parasites during collecting, processing, and ingestion [2]. It has been claimed that around 300 million people severe helminthic infections are diagnosed only in developing countries leading to approximately 200,000 deaths [3]. In addition to humans, gastrointestinal diseases create various issues in the cattle business and incur large

economic losses [4]. Belonging to phylum nematode, geohelminths (also known as soil-transmitted helminths) are intestinal parasitic worms of humans and animals which afflict more than 2 billion people worldwide [5]. The majority of geohelminths reside in the digestive system (gastrointestinal tract) of humans but the eggs deposited by adult worms are expelled outside the body through the feces. There are various variances in the infection and migratory paths of geohelminths within their host, but typically the eggs contaminate the soil, plants, water and subsequently are passed to via vegetables [6]. In many parts of the world, especially in undeveloped countries, sewage sludge and wastewater are frequently utilized to irrigate agricultural land which results in the transmission of pathogenic organisms particularly intestinal microorganisms from the soil to crops, grazing animals, and humans [7,8]. Several studies have shown that the vegetables, especially those are eaten raw and without peeling, can act as a tool for the transmission of protozoa cysts, oocysts (*Giardia*, *Entamoeba*, *Toxoplasma* and *Isospora*), helminth eggs and larvae (*Hymenolepis*, *Taenia*, *Echinococcus granulosus Fasciola*, *Trichuris*, *Trichostrongylus*, *Strongyloides* and hookworms) to new hosts [7,9,10]. The personnel engaged in the manufacturing and processing phases of vegetables for sale including pickers, handlers, packers, might possibly be infected with the intestinal parasites [11]. In underdeveloped countries, owing to lack of high-tech system for detection of foodborne pathogens, and sufficient monitoring, generally outbreaks caused by contaminated vegetables cannot be discovered and the prevalence of foodborne pathogens is overestimated. Moreover, a significant incidence of intestinal parasites has been found in populations who eat unwashed vegetables indicating that the ingestion of raw vegetable is an essential route of the transmission [12]. Eating unwashed vegetables, particularly local veggies and salads is a prevalent ritual among Kurdish communities. Accordingly, the danger of intestinal parasite infections would be enhanced when they are improperly cleansed. To our knowledge, few research have explored the contamination of fresh vegetables consumed in Kurdistan and according to current scientific literature, no prior assessment has analyzed the rate of parasite infection in vegetables from Kalar. Therefore, this research was done to determine the incidence of intestinal parasites in vegetables eaten in Kalar city.

Materials and Methods

This study was carried out from January to May 2022. A total of 240 leafy vegetable samples including cress, celery, leek, green onion, Basil, Dill and lettuce.were Collected randomly from vegetable markets in Kalar city. All purchased vegetables purchased, were placed in individual plastic bags, transported to the laboratory and each sample was chopped into small pieces, then each unit was washed with 50ml of physiological saline solution (0.9% NaCl) and left for 8 hours at room temperature to allow sedimentation of the parasites. Next, 5 ml of sediment were centrifuged at 3000 rpm for 5 minutes. Following centrifugation, the supernatant was removed and the sediment was then examined under a light microscope with magnification power of 100 and 400X for parasites stages (cysts, oocyst, ova and larvae) after adding a drop of Lugol's iodine solution [13].

Results

Out of 240 leafy vegetable samples, 124 (51.7%) were positive. As it can be seen in Table 1, the parasitic contamination rate was 28 (70%), 22 (55%), 24 (60%), 14 (46.7%), 12 (40%), 8 (26.7%) and 11 (36.7%) in cress, celery, leek, green onion, basil, dill and lettuce respectively. The highest rate of parasites contamination was found in cress samples. Significant differences were noticed among the various types of vegetables (**P**<0.05).

Table 2 shows the parasitic stages (cysts, ova and larvae) which found in in cress, celery, leek, green onion, basil, dill and lettuce. One or more parasites were observed in each vegetable sample among the parasites identified *Entamoeba histolytica* was the most prevalent one (11.7%), other parasites observed were *Entamoeba coli* (9.16%), *Giardia lamblia* (16.25%), ciliates (3.33%), flagellates (3.75%), *Taenia* spp. (12.9%), *Fasciola spp.* (1.25%), *Ascaris lumbricoides* (2%), *Trichuris trichiura* (0.83%), *Toxocara* spp. (5%) and *Arthropods* (2.9%). Statistical analysis showed significant differences between prevalence rates of parasitic organisms among the vegetables (***P***-value < 0.05).

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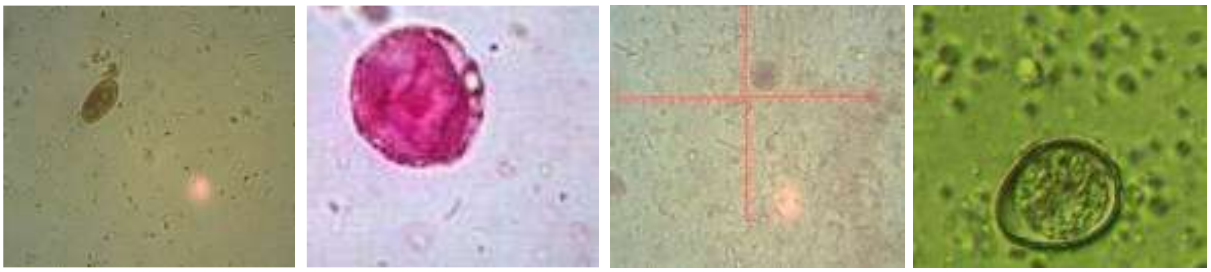
Table 1: Contamination rate of intestinal parasites in vegetables according to their types in Kalar city

Vegetables	No. examined	No. contaminated	Contamination (%)	Statistical analysis
cress	40	28	70	**p**-value<0.05
celery	40	22	55	
leek	40	24	60	
green onion	30	14	46.7	
basil	30	12	40	
dill	30	13	43.3	
lettuce	30	11	36.7	
Total	240	124	51.7	

Table 2: Distribution of parasite species according to the type's vegetables.

Parasites	cress	celery	leek	green onion	basil	dill	lettuce	Total (%)
Entamoeba histolytica cyst	8	8	6	2	1	3	0	28 (11.7%)
Entamoeba coli cyst	2	6	5	1	4	2	2	22(9.16%)
Giardia lamblia	7	3	6	3	2	1	2	24(10%)
Ciliates (B. coli)	4	2	1	0	0	1	0	8(3.33%)
Flagellates(T. hominis)	3	0	4	0	0	1	1	9(3.75%)
Taenia spp. Ova	12	8	6	2	1	0	2	31(12.9%)
Fasciola ova	1	2	0	0	0	0	0	3(1.25%)
Ascaris lumbricoides ova	4	1	0	0	0	0	0	5 (2%)
Trichuris trichiura	1	0	1	0	0	0	0	2 (0.83%)
Toxocara spp.	6	3	1	0	1	1	0	12 (5%)
Arthropods	1	2	1	0	1	1	1	7 (2.9%)
Total	49	35	31	8	10	10	8	151(62.9 %)

P-value <0.05



1 **2** **3** **4**

Picture 1: Shows the parasitic protozoa under study 1-*Entamoeba histolytica* cyst. 2- *Entamoeba coli* cyst. 3-*Giardia lambelia* cyst. 4 -*Balantidium coli* cyst.

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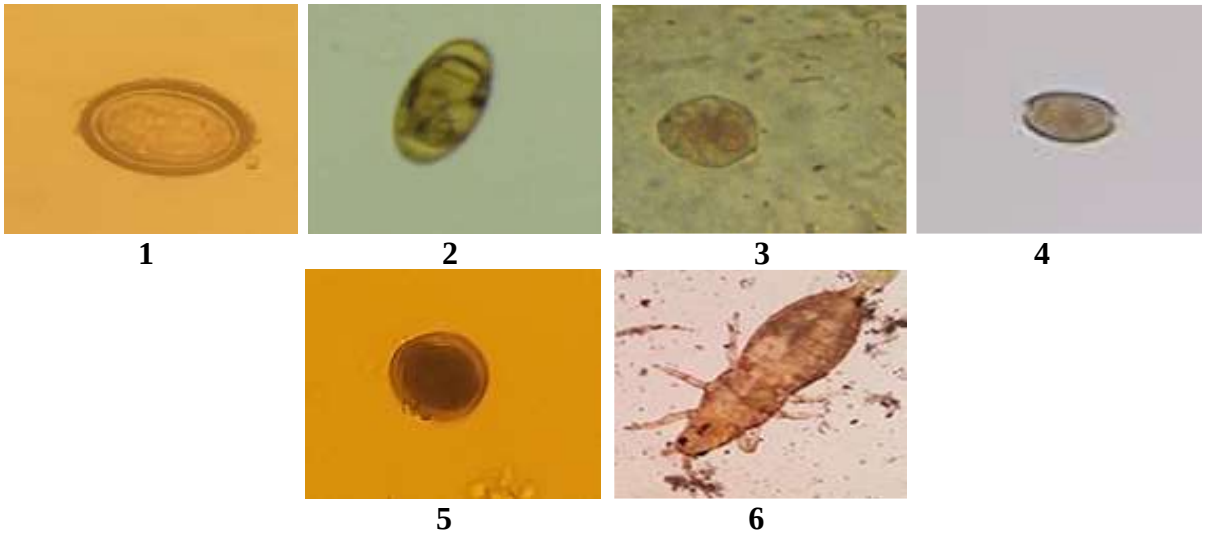

Picture 2: Shows the parasitic helminthes under study 1- *Taenea spp*. eggs .2- *Fasciola hepatica* eggs.3-*Ascaris lumbricoid* eggs. 4- *Trichuris trichura* eggs. 5-*Toxocara spp*. eggs. 6-Arthopods

Discussion

In the present study, seven types of vegetables that are commonly consumed in Kalar were examined and, 11 types of parasites were detected protozoa *Entamoeba histolytica* cyst 28 (11.7%) and helminths *Taenia spp.* Ova31 (12.9%). According to several reports, high incidences of intestinal parasitic infections have occurred in societies that consume raw vegetables, especially in circumstances that unrefined sewage or human and animal fertilizers are used for cultivation of vegetables [14]. This study showed a considerably high level of contamination with intestinal parasites (51.7%). Some studies in other parts of the world show the lower rate of contamination such as 48.4 % in Soran city, were examined vegetables (cress, celery, leek, garden radish and lettuce.

The most encountered parasite was Taenia spp. egg [15], 10.2 in Duhok city [16] 32.6% in Iran (Ardabil) [17] and 16.4% in Saudi Arabia [18]. However, other researchers have recorded higher levels of contamination compared to our study, for example, 71% in Iran (Shahrekord) [19], 58% in Libya [20] and 75.9% in Kenya [21]. The observed discrepancies can be attributed to variations in geographical location, the size and type of sampling, parasitic infection rate of hosts in each area, techniques employed for sampling and even the agricultural methods in

different regions. Different laboratory procedures may also play a role in retrieving different parasites since some procedures can either float or sediment the parasites. From Table 1, cress had the highest contamination rate (70 %) because leafy vegetables and/or vegetables with uneven surfaces make it easier for the parasite stage to attach to the surface on the farm or when washed with contaminated water, also followed by leek (60%), celery (55 %), green onion (46.7 %), dill (43.3 %), basil (40 %), and lettuce (36.7%). The high level of contamination in these samples is probably due to the utilization of high amounts of animal manures. It should be mentioned that in the majority of the examined samples, animal manure adhered to vegetables was observed.

As seen in Table 2, the most prevalent pathogenic parasites were *E. histolytica* (11.7 %), *G. lamblia* cyst (10 %), *Ascaris* ova (2%), *Taenia* spp. Ova (12.9%) and *Fasciola* spp. ova (1.25%) this may be due to the use of sewage water in irrigation. The use of sewage water plays an important role in the epidemiology and transmission of parasitic disease to human through consuming such vegetables; this is in agreement with the results recorded in Sulaimani city [22]. The use of human feces and animal manure in production of vegetables would also play a key role in contamination of the vegetables with intestinal parasite that would be passed to human by ingesting inadequately cleaned or unwashed vegetables [23,24].Although published information on probable infections of animals and people with these parasites is exceedingly poor in Kalar city, the high prevalence of vegetable contamination might certainly be attributed to the high infection rate of hosts, especially cattle in this location.

Conclusion

The research demonstrated a high incidence parasitic contamination in vegetables in a variable pattern, the problem needs modulation or even discovering alternative safe techniques of farming, watering and washing to minimize or eradicate such contamination in the local community

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