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Assessment of Parasitic Contamination in Imported Fresh Vegetables and Comparative Analysis with Locally Grown Vegetables in Derna, Libya

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ABSTRACT

Parasites are commonly associated with vegetable or fruit borne outbreaks of gastroenteritis. Helminthes cause the greatest number of parasitic infections in humans and animals, especially in developing countries. This study was aimed to detect parasitic contamination of some imported and local fresh vegetables consumed and compare them in terms of the most infected in the City of Derna. Samples were collected including (Lettuce, tomato, cucumber, green pepper, onion, zucchini, potato and Orange). Of the 160 imported samples and 160 samples of local samples were examined. Results from imported samples were found that about 106 samples (66.3%) infected with the parasite. As for the examined local vegetables, the infection rate was about 73 samples, an average of (45.6%). It became clear that the rate of contamination with parasitic primary cysts was about 76 with percentage (71.1%). While the rate of contamination in local samples was 18 with percentage (24.7%). In addition, the rate of contamination with helminthes in the imported vegetables was found 91 (8.85%), meanwhile the rate of infection with helminthes in local vegetables was 57 (78.1%). After the comparison between the infections, we notice that the percentage of infection with parasitic worms in the imported vegetables is the highest contamination rate, which is 91 (85.5%), while the infection with intestinal parasites in local vegetables was the lowest percentage of contamination, estimated at about 18 (24.7%). Results of this study show that parasitological contamination of vegetables sold in Derna markets may pose a health risk to consumers of such products.

1. INTRODUCTION

An important ingredient of healthy diet is raw (fresh) vegetables (Abougrain *et al*., 2010). Is also considered one of the most important sources for the transmission of parasitic diseases, and one of the main reasons for its pollution is the use of untreated sewage water for irrigation, as well as the use of animal dung as fertilizer for the soil. Fresh vegetables can be a factor for transferring primary cysts, as well as eggs and parasitic larvae (Amoah *et al.,* 2007). Although cooking at high temperatures is considered fatal to most pathogens, it unfortunately cannot be applied to fresh vegetables, which are considered one of the main sources of vitamins, minerals and dietary fiber, which in turn protect the body and reduce the risk of heart disease, stroke and some types of cancer (Tefera *et al.,*2014).

One of the main reasons for its pollution is the use of untreated sewage water for irrigation, as well as the use of animal dung as fertilizer for the soil (Slifko *et al*. 2000). In addition, fresh vegetables can be a factor for transferring primary cysts, as well as eggs and parasitic larvae (Duedu *et al*., 2014). The extent of contamination in vegetables depends on several factors, the most important of which are: the use of water contaminated with sewage water for irrigation, as well as the use of animal dung for fertilization, also methods of collecting and transporting it to places of sale (David *et al*., 2005). The majority of geohelminths live in the digestive system (gastrointestinal tract) of humans but the eggs laid by adult worms are excreted outside the body via the stool. There are some differences in the infection and migration pathways of geohelminths inside their host, but generally the eggs contaminate the soil, vegetables, water and then are transmitted to humans (Mirzaei *et al*., 2021). Since the studies conducted on parasitic infection in fresh vegetables in Libya are very few compared to other studies in neighboring countries, so the aim of this study was to detect parasitic contamination of some imported and local fresh vegetables consumed and compare them in terms of the most infected in the City of Derna.

2. MATERIALS AND METHODS

Study Area

A cross-sectional study was conducted to determine the level of parasitic contamination of fruits and vegetables sold in selected local markets in Derna City from (December 2022 to February 2023).

Sample Collection and Analysis

Eight types of fruits and vegetables including lettuce, tomato, cucumber, green pepper, onion, zucchini, potato and Orange were purchased from three conveniently selected local markets found in Derna City. Equal numbers of samples (20 each, totally20 *8 samples) were collected from the selected markets. The samples were collected and put in plastic bags, properly labeled, and brought to the Medical Parasitology Laboratory of Derna University, for parasitological analysis (Abougrain *et al .,*2010). Meanwhile, the same types of vegetables (8 types) were collected from local farms in the City of Derna. A portion (200 g) of each fruit and vegetable was washed separately in 500 mL of normal saline for detaching the parasitic stages (ova, larvae, cysts or oocysts) of helminthes and protozoan parasites commonly assumed associated with vegetable contamination. It was placed in suitable containers for immersion (soaking) in a physiological solution. Samples were left soaked in the physiological solution (Normal saline) for a whole night, then the soaked was taken and placed in test tubes in a centrifuge (with a power of 4000 rpm for 10 minutes) (Fumilayo *et al*.,2017). The upper part of the liquid was removed from the solution, and a drop of the precipitate was taken for examination on a glass slide, then examined under a compound light microscope at a magnification of 40X and 10X to distinguish the types of parasites and other microorganisms. Where I examined the number of 3 slides from each sample in order to confirm the infection or not, so that one of them was dyed with iodine (Avcioglu *et al.*, 2011).

3. RESULT

The results of this study, conducted on eight types of local and imported vegetables and fruits in the city of Derna including tomatoes, cucumbers, peppers, zucchini, onions, cabbage, potatoes, and oranges—aimed to determine and compare the rates of parasitic contamination in both local and imported produce. A total of 160 imported and 160 local samples were examined. Among the imported samples, 106 (66.3%) were found to be infected with parasites, while73 local samples (45.6%) were contaminated (Table 1, Figure 1). Microscopic examination revealed various stages of parasitic infections, including *protozoan cysts and helminthes eggs, specifically Giardia spp., Entamoeba histolytica, Entamoeba coli, Strongyloides spp., Toxocara spp., Isospora spp., Ascaris lumbricoides, Ancylostoma spp., and nematode larvae* (Table 2). The highest rate of parasitic contamination among imported vegetables was found in onions (100%), followed by tomatoes and potatoes (95% each). The lowest contamination rate was observed in imported oranges (30%) (Table 3, Figure 2). Among local vegetables, the highest infection rates were recorded in tomatoes and cabbage (55% each), while the lowest rate was in zucchini (20%). The contamination rate with protozoan cysts in imported vegetables was 76 samples (71.1%), compared to 18 samples (24.7%) in local vegetables (Figure 3). Additionally, helminth contamination was recorded in 91 imported samples (85.5%) and 57 local samples (78.1%) (Figure 2). Overall, the results demonstrate that imported vegetables had a higher rate of parasitic contamination (66.3%) compared to local vegetables (45.6%) (Figure 4). Helminthes infections were the most prevalent in imported vegetables (91 cases, 85.5%), while protozoan infections were least common in local vegetables (18 cases, 24.7%), Table (3). According to Table 4, the most frequently detected parasites *were E. coli and nematode larvae* (8 cases, 5% each), followed by *Giardia lamblia and Ascaris lumbricoides* (7 cases, 4.3% each). *E. histolytica* was found in 5 cases (3.1%), while *Ancylostoma spp.and Strongyloides spp*. were the least detected, with 2 cases (1.25%) each (Figures 4 and 5).

4. DISCUSSION

Our study, which involved 160 samples of local vegetables and 160 samples of imported vegetables, revealed that the percentage of parasitic contamination in imported vegetables (66.3%) was higher than that in local vegetables (45.6%). Additionally, the infection rate with helminthes (91 cases, 85.8%) surpassed that of parasitic protozoa (57 cases, 78.1%). We compared our findings with various studies conducted in Libya and neighboring countries. For instance, our results aligned with a study in Tabriz (Davoud Balarak et al., 2014), which reported that the contamination percentage from parasitic worms was 10.8% higher than that of parasitic protozoa at a rate of 8.07%. Furthermore, this study noted that the most prevalent parasites were *Ascaris spp*. and *Entamoeba coli*, which is consistent with our findings. In another study conducted in Ethiopia (Bekele & Shumbej, 2019), out of 270 fresh vegetable and fruit samples, 115 (42.6%) tested positive for intestinal parasites, with *Ascaris lumbricoides* being the most common at 16.7%. This was also in alignment with our results. However, it was higher than the contamination rates reported by (Abougrain *et al.,* 2010). in Tripoli, which estimated a total of about 58%. In their examination of various vegetables, including 36 tomato, 36 cucumber, 27 lettuce, and 27 cress samples, they found *Ascaris spp*. eggs in 19%, 75%, 96%, and 96%, respectively. Cysts of *Giardia spp*. were detected in 3%, 19%, 4%, and 11%, respectively. In a separate study conducted in Morocco in 2013 (Hajjami *et al*., 2013). Out of 128 vegetable samples, 80 (62.5%) were found to be contaminated with parasites, including helminthes eggs such as *Ascaris spp.* at a rate of 10.2%. These studies indicate that the level of helminthes egg contamination in vegetable crops is highly influenced by the level of contamination in irrigation water. This corroborates findings from several authors who have noted that roots are the most contaminated part of the plants due to direct contact with contaminated water during irrigation cycles.

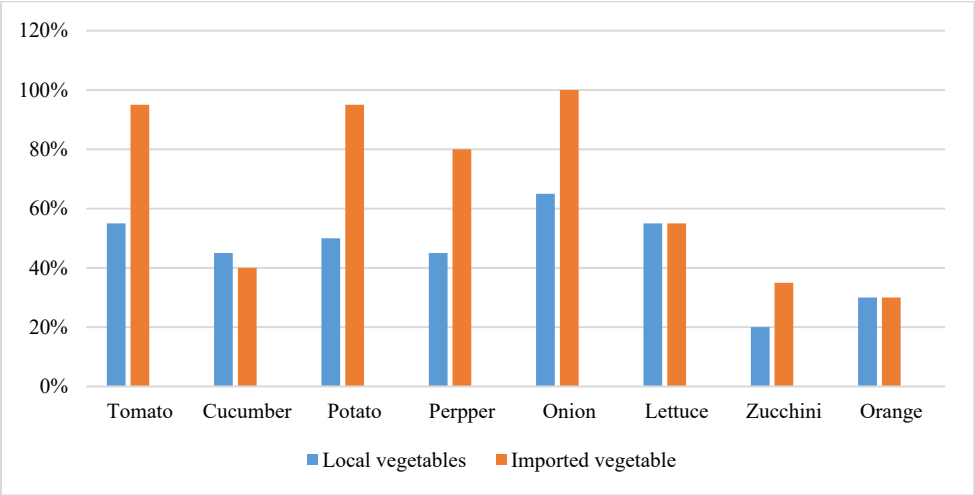

Figure (1) The number and percentage of contaminated samples in each type of green local vegetables and imported vegetable in Darna. Libya

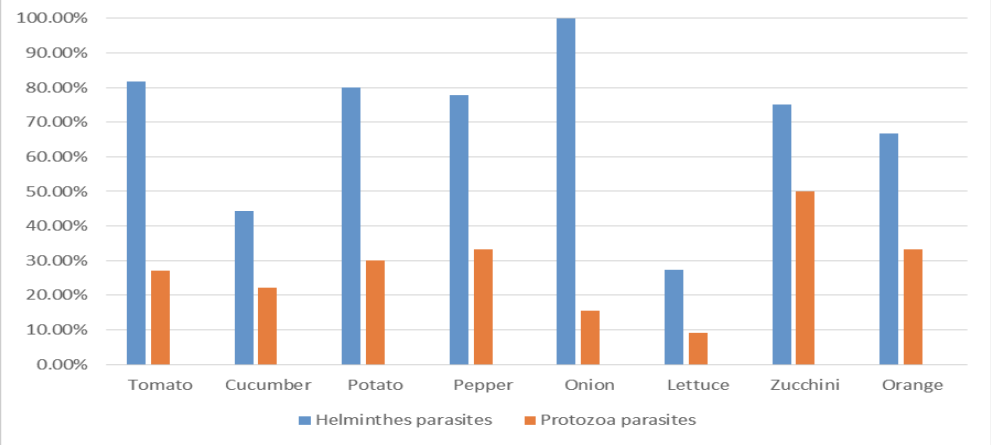

Figure (2) Total contamination rate with helminthes and of the tested vegetables of Local vegetables.

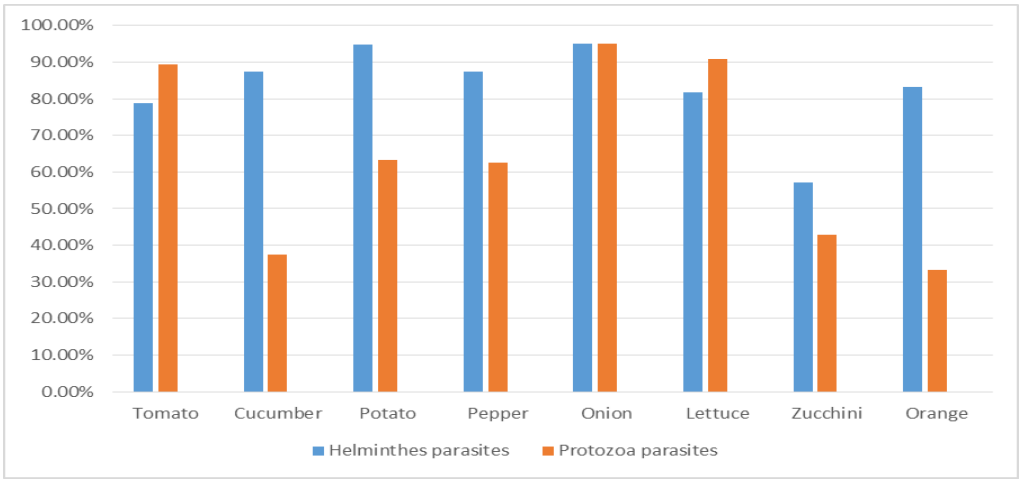

Figure (3) Total contamination rate with helminthes and protozoa of the tested vegetables of Imports vegetables.

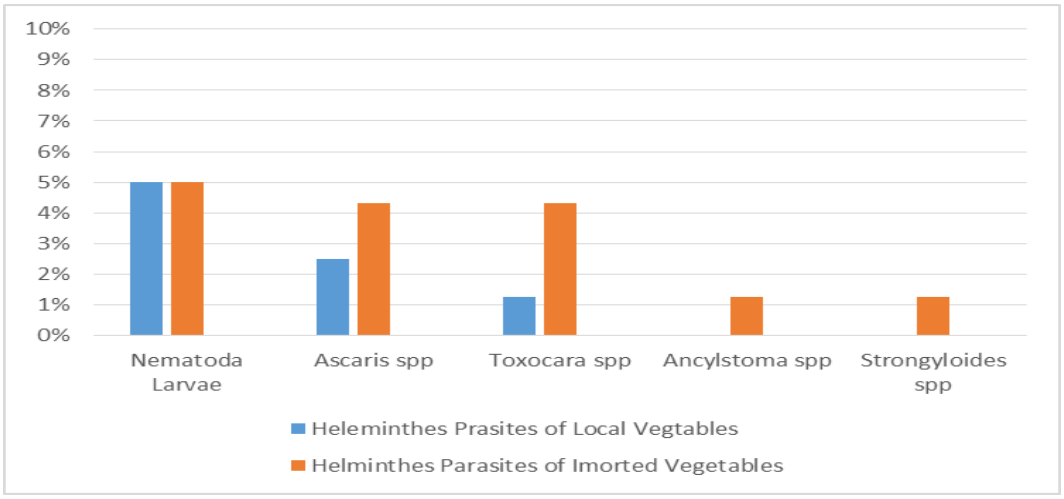

Figure (4): Total contamination rate of helminthes species of contaminated samples each type of green local and imported vegetable.

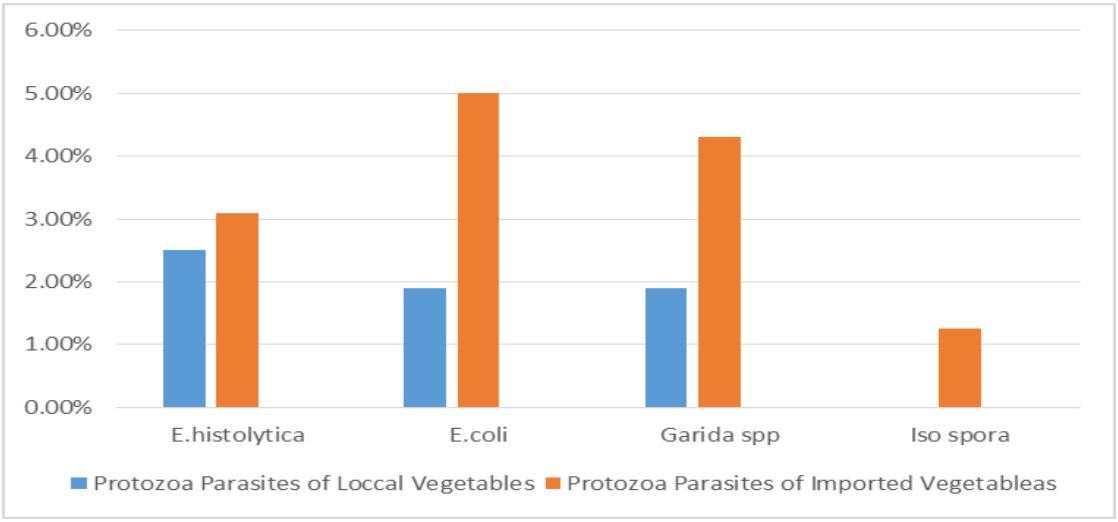

Figure (5): Total contamination rate of protozoan species of contaminated samples each type of green local and imported vegetable.

Table.1. Total contamination rate of the tested samples.

Checked samples	*Local Samples*			Imported samples		
	Infected number	Number of scans	%	Infected number	Number of scans	%
Tomato	11	20	*%55*	19	20	%95
Cucumber	9	20	*%45*	8	20	%40
Potato	10	20	*%50*	19	20	%95
Pepper	9	20	*%45*	16	20	%80
Onion	13	20	*%65*	20	20	%100
Lettuce	11	20	*%55*	11	20	%55
Zucchini	4	20	*%20*	7	20	%35
Orange	6	20	*%30*	6	20	%30
total summation	**73**	**160**	***%45.6***	**106**	**160**	**%66.3**

Table.2. The most important parasitic species that were diagnose in the examined samples.

Checked samples	Local Samples		Imported samples	
	Protozoa Parasites	Helminthes parasites	Protozoa Parasites	Helminthes parasites
Tomato	*E. coli* *Garida.spp*	*Nematode larva* *Ascaris spp*	*E. coli* *E. histolytic* *Garida.spp*	*Ascaris spp* *Nematode larva* *Toxocara spp*
Cucumber	*Garida spp*	*Nematode larva*	*Isospora spp* *E. coli* *Garida.spp*	*Toxocara spp* *Nematode larva* *Strongyloides spp*
Potato	*E. histolytica*	*Nematode larva* *Ascaris spp*	*E.histolytica* *Garida spp* *E.coli*	*Nematode larva* *Ascaris spp* *Toxocara spp* *Ancylstoma spp*
Pepper	*E. histolytica* *Garida spp*	*Nematode larva*	*E.coli* *E.histolytica*	*Nematoda larva* *Ascaris spp* *Toxocara spp*
Onion	*E.histolytica*	*Nematode larva* *Ascaris spp*	*E.coli* *Garida spp*	*Ascaris spp* *Nematoda larva* *Strongyloides spp* *Toxocara spp* *Ancylstoma spp*
Lettuce	*E. coli*	*Nematode larva*	*E.coli* *Garida spp* *E.histolytica* *Isospora spp.*	*Toxocara spp* *Ascaris spp* *Nematode larva*
Zucchini	*E.histolytica*	*Nematode larva* *Toxocara spp*	*E.coli* *Garida spp*	*Ascaris spp* *Nematoda larva*
Orange	*E.coli*	*Nematode larva* *Toxocara spp* *Ascaris spp*	*E.histolytica* *Garida spp* *E.coli*	*Toxocara spp* *Ascaris spp* *Nematode larva*

Table.3 .Total contamination rate with helminthes of the tested samples.

	Local vegetables		Imported vegetables	
Checked vegetables	***Protozoa parasites* No. (%)**	**Helminthes Parasites No. (%)**	**Protozoa parasites No. (%)**	**Helminthes Parasites No. (%)**
Tomato	*3 (27.2)*	9(81.8)	17(89.4)	15(78.9)
Cucumber	*2(22.2)*	4(44.4)	3(37.5)	7(87.5)
Potato	*3(30)*	8(80)	12(63.2)	18(94.7)
Pepper	*3(33.3)*	7 (77.7)	10(62.5)	14(87.5)
Onion	*2(15.4)*	13 (100)	19(95)	19(95)
Lettuce	*1(9.1)*	9 (27.3)	10(90.9)	9(81.8)
Zucchini	*2 (50)*	3 (75)	3(42.9)	4(57.1)
Orange	*2 (33.3)*	4 (66.7)	2(33.3)	5(83.3)
total summation	*18 (24.7)*	57 (78.1)	76 (71.7)	91(85.8)

Table.4. Total contamination rate of protozoan species and helminthes of the tested samples.

Local vegetables				Imported vegetables			
Protozoa parasites No. (%)		**Helminthes Parasites No. (%)**		**Protozoa parasites No. (%)**		**Helminthes Parasites No. (%)**	
E.histolytica	4(2.5)	*Nematode larva*	*8(5)*	*E.histolytica*	5(3.1)	*Nematode larva*	8(5)
E. coli	3(1.9)	*Ascaris spp*	*4(2.5)*	*E. coli*	8(5)	*Ascaris spp*	7(4.3)
Garida.spp	3(1.9)	*Toxocara spp*	*2(1.25)*	*Garida.spp*	7(4.3)	*Toxocara spp*	7(4.3)
_	_	-	_	*Iso spora*	2(1.25)	*Ancylstoma spp*	2(1.25)
_-	_	-	_	-	-	*Strongyloides spp.*	2(1.25)

5. CONCLUSION

Through the study, it was noticed that there is a large discrepancy between pollution rates between local and imported vegetables and this may be a result of the use of untreated animal manure in fertilization or the use of sewage water. In addition, the high degree of humidity in the air allows parasites to keep their cysts for a longer period in plants. Accordingly, the necessary measures and methods must be followed to address this problem, which affects human health and endangers his life. In addition, this study has shown that fruits and vegetables, which are sold in the study area, are highly contaminated with medically important parasites. Fruits and vegetables sold in the study area may play a role in the transmission of intestinal parasitic infections to humans.

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