

Prevalence of Parasitic Contamination in Some Leafy Vegetables in Al-Najaf Al-Ashraf province

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Abstract:

The current study was designed to identify parasites contaminating some types of vegetables available in local markets in Najaf. Six types of leafy vegetables were collected, including: Chard (*Beta vulgaris*), Celery (*Apium graveolens*), Parsley (*Petroselinum crispum*), Leek (*Allium ampeloprasum*), Spinach (*Spinacia oleracea*) Lettuce (*Lactuca sativa*).

The most common intestinal parasites were Giardia cysts, which were found in leek and celery in particular (7 instances each). These were followed by *E. coli* cysts and *E. histolytica* cysts, which were also commonly found in leek and celery. The biggest numbers were found in spinach and lettuce, while *Ascaris* and *H. nana* eggs were found at lower frequency. Chard had the lowest overall contamination levels, while celery and leek had the highest. These results show that there are notable differences in parasite contamination amongst various vegetables, with Giardia being the most common contaminant.

Kew words: Contamination, intestinal parasites, vegetables, Najaf.

INTRODUCTION

Fresh vegetables are essential for human nutrition. Because of the health benefits. A vegetarian diet is high in vitamins, fiber, and minerals, they contain vitamins necessary for the human body, such as vitamin C, E, and A, and other elements such as calcium, magnesium, potassium and iron, which can reduce the risk of stroke and cardiovascular disease. It may also protect the body from some infections Types of cancer (1) Recent reports indicate a high risk of parasite contamination when eating fresh vegetables. Residents from many nations Eating raw can raise the risk of parasites and their spread to humans (2), Despite their advantages Vegetables can

harbor harmful germs, viruses, and parasites during collection, processing, and consumption (3). Approximately 300 million individuals in underdeveloped nations suffer from severe helminthic infections, resulting in 200,000 deaths (4) Vegetables, especially those eaten raw and without peeling, can transmit 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 (5,6,7).

Using wastewater to water crops It is also an important source of transmission of various types of parasites to soil, animals, and humans (8). Many studies have indicated, including Study (9) which studied vegetable contamination Leaves were infected with parasites, and the percentage of leeks was (45%), and they were isolated Six types of parasites were (*Giardia spp*, *Hook worm*, *Trichostrongylus sp*, *Enterobius vermicularis* and *Trichuris trichiur*). In the city of Najaf, a study was conducted (10) blinded seven types of vegetables The rate of contamination with parasites was 20.5%, and it was isolated *E. coli* 23.7% and *Giardia* 17.8% as well as Where Leeks were the most polluted vegetable (41.5%).

Materials and Methods

uring the year 2025, 90 vegetable samples were collected, 15 samples for each type including chard, celery, parsley, leek, spinach and lettuce. Were Collected randomly from vegetable markets in Najaf province. All purchased vegetables purchased, were placed in individual plastic bags, transported to the laboratory.

Sample examination

Then 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 (11,12)

Results and Discussion

Laboratory tests on leafy vegetable samples taken from the markets of Najaf city revealed that the vegetables were contaminated with intestinal parasites (*Entamoeba histolytica*, *Giardia Lamblia*, *Entamoeba coli*) and intestinal worms (*Ascaris lumbricoides*, *Hymenolypis nana*) at a high level. All six samples were contaminated with protozoa, meaning the contamination rate was 100%. The results of the current study showed, as shown in Table (1)

Table (1): Distribution of intestinal parasites contaminating chard samples.

Types	Microorganisms * Growth Crosstabulation				Chi-square	p-value
			Growth			
			Yes	No		
Chard	<i>Ascaris</i> egg	Count	0	15	12.692	0.013*
		% Within Microorganisms	0.0%	100.0%		
		% Within Growth	0.0%	23.1%		
	<i>E. histolytica</i> cyst	Count	1	14		
		% Within Microorganisms	6.7%	93.3%		
		% Within Growth	10.0%	21.5%		
	<i>H. Nana</i> egg	Count	0	15		
		% Within Microorganisms	0.0%	100.0%		
		% Within Growth	0.0%	23.1%		
	<i>E. coli</i> cyst	Count	4	11		
		% Within Microorganisms	26.7%	73.3%		
		% Within Growth	40.0%	16.9%		
	<i>Giaradia</i> cyst	Count	5	10		
		% Within Microorganisms	33.3%	66.7%		
		% Within Growth	50.0%	15.4%		
Total	Count	10	65			
	% Within Microorganisms	13.3%	86.7%			

The chi-square test revealed a statistically significant correlation between the parasite's growth ability and its type ($\chi^2 = 12.692$, $P = 0.013$). This suggests that the discrepancies that have

been noticed are not the result of random variation. *Ascaris* eggs and *H. nana* eggs did not grow at all (0%), but cyst-forming parasites, especially *Giardia* (33.3%) and *E. coli* (26.7%), showed the highest growth percentages.

These results are consistent with those of (14) in Saudi Arabia, who found that protozoan cysts, including *Giardia*, were more common in contaminated areas than helminthic eggs. In Egypt, (15) discovered that the parasites most commonly observed in leafy greens were *Giardia* cysts and *E. coli*. However, our findings run counter to those of (16) , who found that *Ascaris* eggs were more common in vegetables in Vietnam. These disparities could be caused by post-harvest handling procedures, irrigation sources, and environmental factors.

The lack of *Ascaris* and *H. nana* eggs in the current samples might be because, in contrast to protozoan cysts, which are more resilient to adverse environmental conditions, these organisms need more favorable environmental conditions to finish their egg development.

Overall, the results show that protozoan cysts like *Giardia* and *E. coli* may be transported by green plants, especially chard. In order to lower the danger of foodborne parasite transmission, this emphasizes the significance of thorough washing, sanitary handling, and stringent irrigation water quality monitoring.

Table (2) : Distribution of intestinal parasites contaminating celery samples .

Celery	<i>Ascars egg</i>	Count	2	13	6.217	0.184
		% Within Microorganisms	13.3%	86.7%		
		% Within Growth	9.5%	24.1%		
	<i>E. histolytica cyst</i>	Count	5	10		
		% Within Microorganisms	33.3%	66.7%		
		% Within Growth	23.8%	18.5%		
	<i>H. Nana egg</i>	Count	2	13		
		% Within Microorganisms	13.3%	86.7%		
		% Within Growth	9.5%	24.1%		
	<i>E. coli cyst</i>	Count	5	10		
		% Within Microorganisms	33.3%	66.7%		
		% Within Growth	23.8%	18.5%		
	<i>Giaradia cyst</i>	Count	7	8		
		% Within Microorganisms	46.7%	53.3%		

		% Within Growth	33.3%	14.8%		
Total		Count	21	54		
		% Within Microorganisms	28.0%	72.0%		

The results of the statistical analysis of the celery samples revealed that 28% of the samples that were examined were contaminated with different intestinal parasites. The most common cysts were Giardia (46.7%), followed by *E. histolytica* and *E. coli* (33.3% each). The prevalence of *Ascaris* and *H. nana* eggs, however were lower at 13.3%. This non-significant Chi-Square test result: $\chi^2 (1) = 6.217, p = .184; i.e., p > 0.05$). It would thus appear that there are no significant differences between the parasites collected. Although statistically non-significant data, the descriptive distribution indicates that Giardia cyst was most frequently detected of parasites in the celery samples.

Higher prevalences of detection of cysts of Giardia and Entamoeba reflect other studies in Saudi Arabia by (17) showing, that green crops with the substantive plant for consumption found was often contaminated by protozoa, especially celery and parsley. In line with our results (46.7%) (18) has been reported Giardia cysts in over 40 percent of the samples. Based on these results, protozoan cysts tolerate drastic climatic condition and continue to grow in the moist, wrinkled areas of celery leaves. Nevertheless, their low occurrence could be because eggs of *A. lumbricoides* and *H. nana* depend on specific environmental factors, including type of soil, humidity and temperature for survival that might be more prone in other Green leafy vegetables like lettuce and spinach. (19) in Egypt, *Ascaris* eggs were isolated more frequently from arugula and lettuce than those found on celery.

Given that celery is so commonly consumed raw, in salads and other typical preparations - the study's 28% overall contamination rate raises epidemiological questions. This further emphasises how incorrect washing or disinfection processes can become a threat to public health. Further, El-Sherbini and Shoukry (2022) stressed on adhering to good hygiene when dealing with cooking green leafy vegetables especially under situation where sanitary facilities are inadequate.

Table (3): Distribution of intestinal parasites contaminating parsley samples.

Parsley	Ascars egg	Count	2	13	2.579	0.630
		% Within Microorganisms	13.3%	86.7%		
		% Within Growth	16.7%	20.6%		
	<i>E. histolytica</i> cyst	Count	2	13		
		% Within Microorganisms	13.3%	86.7%		
		% Within Growth	16.7%	20.6%		
	<i>H. Nana</i> egg	Count	1	14		
		% Within Microorganisms	6.7%	93.3%		
		% Within Growth	8.3%	22.2%		
	<i>E. coli</i> cyst	Count	3	12		
		% Within Microorganisms	20.0%	80.0%		
		% Within Growth	25.0%	19.0%		
	<i>Giardia</i> cyst	Count	4	11		
		% Within Microorganisms	26.7%	73.3%		
		% Within Growth	33.3%	17.5%		
Total	Count	12	63			
	% Within Microorganisms	16.0%	84.0%			

A total of 16% of the parsley samples that were analyzed showed infection with various intestinal parasites, according to statistical analysis. The highest prevalence was found for Giardia cyst (26.7%), followed by E. coli cyst (20%), while Ascaris eggs and E. histolytica cyst were detected at identical rates (13.3% each). H. nana eggs showed the lowest prevalence (6.7%). The Chi-Square test ($\chi^2 = 2.579$) produced a p-value of 0.630, which is not statistically significant ($p > 0.05$).

Because parsley leaves are finely divided and have the ability to hold moisture and soil particles, which favors the adherence of small cysts, the incidence of protozoan cysts (Giardia and E. coli) is comparatively larger than that of helminth eggs. (21) in Iran observed similar results, identifying parsley as one of the vegetables most contaminated with protozoan cysts.(13.3%) of parsley samples had Ascaris eggs, which is consistent with findings from (22) in Egypt, where Ascaris was frequently identified in leafy greens although at lower concentrations than in crops

like lettuce. Earlier findings by (23) that such helminths are less commonly isolated from vegetables compared to protozoa are supported by the extremely low incidence of *H. nana* eggs (6.7%).

It's interesting to note that the total contamination rate in parsley (16.0%) was lower than in celery (28%), indicating that environmental and morphological factors may influence the degree of parasitic attachment. Variable contamination levels were also found among leafy vegetables in a Saudi Arabian study by (24) Al-Megrin (2019), with parsley exhibiting moderate contamination rates. The finding of *Giardia* and *E. coli* cysts in parsley is particularly concerning from the standpoint of public health because parsley is frequently eaten raw in salads and these parasites can induce gastrointestinal disorders even at low infectious levels. This emphasizes how crucial it is to thoroughly wash and disinfect before consuming.

Table (4): Distribution of intestinal parasites contaminating leek samples .

Leek	<i>Ascars</i> egg	Count	2	13	12.169	0.016*
		% Within Microorganisms	13.3%	86.7%		
		% Within Growth	9.5%	24.1%		
	<i>E. histolytica</i> cyst	Count	6	9		
		% Within Microorganisms	40.0%	60.0%		
		% Within Growth	28.6%	16.7%		
	<i>H. Nana</i> egg	Count	0	15		
		% Within Microorganisms	0.0%	100.0%		
		% Within Growth	0.0%	27.8%		
	<i>E. coli</i> cyst	Count	6	9		
		% Within Microorganisms	40.0%	60.0%		
		% Within Growth	28.6%	16.7%		
	<i>Giaradia</i> cyst	Count	7	8		
		% Within Microorganisms	46.7%	53.3%		
		% Within Growth	33.3%	14.8%		
Total	Count	21	54			
	% Within Microorganisms	28.0%	72.0%			

The statistical analysis of leek samples revealed that 28% of the samples under examination were contaminated overall with several intestinal parasites. Giardia cysts had the largest prevalence (46.7%), followed by *E. histolytica* and *E. coli* cysts, which were equally prevalent (40%) each. While *H. nana* eggs were not found in any of the leek samples that were analyzed, *Ascaris* eggs were found in 13.3% of the samples.

The Chi-Square analysis of comparison between ECMO and non-ECMO survival outcome resulted in p-value < 0.016, statistically significant ($p < 0.05$) ($\chi^2 = 12.169$). This means that the parasite distribution is quite variable in leek samples. Box 1 Descriptive data revealed that the most commonly identified parasite was the Giardia cyst, although there are other parasites. *H. nana* was not found at all.

Hence similar to the current study, in other previous research reported that green vegetables including leek might be contaminated with cysts of protozoans and the eggs of helminths. For example, (25) found Saudi Arabian leafy greens had high Giardia and Entamoeba cyst concentrations, results upholding that inadequate irrigation and bad post-harvest management might be reasons. A similar result was reported by (25), which reported that *Ascaris* eggs were less common than protozoa, but still significantly associated with several crops including parsley and leek. Also in the present study, protozoan parasites were more prevalent than helminths in leek samples. (27) which is consistent where higher loads of Giardia and *E. histolytica* were found from leafy vegetables irrigated with wastewater in the fields.

Overall, the potential public health risks of consumption of raw or inappropriately washed vegetables are illustrated by high prevalence of protozoa including Giardia and *E. histolytica* from leek samples. The relationship between the prevalence of *Ascaris* eggs and abundance of growing worms is very close, suggesting that soil contamination and agricultural practices are major determinants in parasite transmission.

Table (5): Distribution of intestinal parasites contaminating spinach samples.

Spinach	<i>Ascars</i> egg	Count	3	12	4.687	0.321
		% Within Microorganisms	20.0%	80.0%		
		% Within Growth	27.3%	18.8%		
	<i>E. histolytica</i> cyst	Count	2	13		
		% Within Microorganisms	13.3%	86.7%		
		% Within Growth	18.2%	20.3%		
	<i>H. Nana</i> egg	Count	0	15		
		% Within Microorganisms	0.0%	100.0%		
		% Within Growth	0.0%	23.4%		
	<i>E. coli</i> cyst	Count	2	13		
		% Within Microorganisms	13.3%	86.7%		
		% Within Growth	18.2%	20.3%		
	<i>Giardia</i> cyst	Count	4	11		
		% Within Microorganisms	26.7%	73.3%		
% Within Growth		36.4%	17.2%			
Total	Count	11	64			
	% Within Microorganisms	14.7%	85.3%			

A total of 14.7% of the samples that were analyzed showed contamination with several intestinal parasites, according to the statistical analysis of spinach samples. While *E. histolytica* and *E. coli* cysts were found at identical rates of 13.3% each, *Giardia* cysts had the highest incidence (26.7%), followed by *Ascaris* eggs (20%). No *H. nana* eggs were found in any of the spinach samples that were analyzed (0%). The p-value of 0.321 from the Chi-Square test ($\chi^2 = 4.687$) is not statistically significant ($p > 0.05$).

These results are in line with past investigations that showed protozoan cysts, not helminth eggs, are the most common source of spinach contamination. For instance, (28) discovered that *Ascaris* eggs were less common in spinach, whereas *Giardia* cysts were among the most common parasites. Similarly, compared to other green vegetables, spinach irrigated with wastewater had a greater incidence of protozoa, especially *Giardia* and *Entamoeba*, according to (28). Although helminth egg contamination is less common, spinach generally seems to be a

moderate carrier of intestinal protozoa, particularly Giardia. This emphasizes how crucial it is to wash spinach well and handle it hygienically before eating.

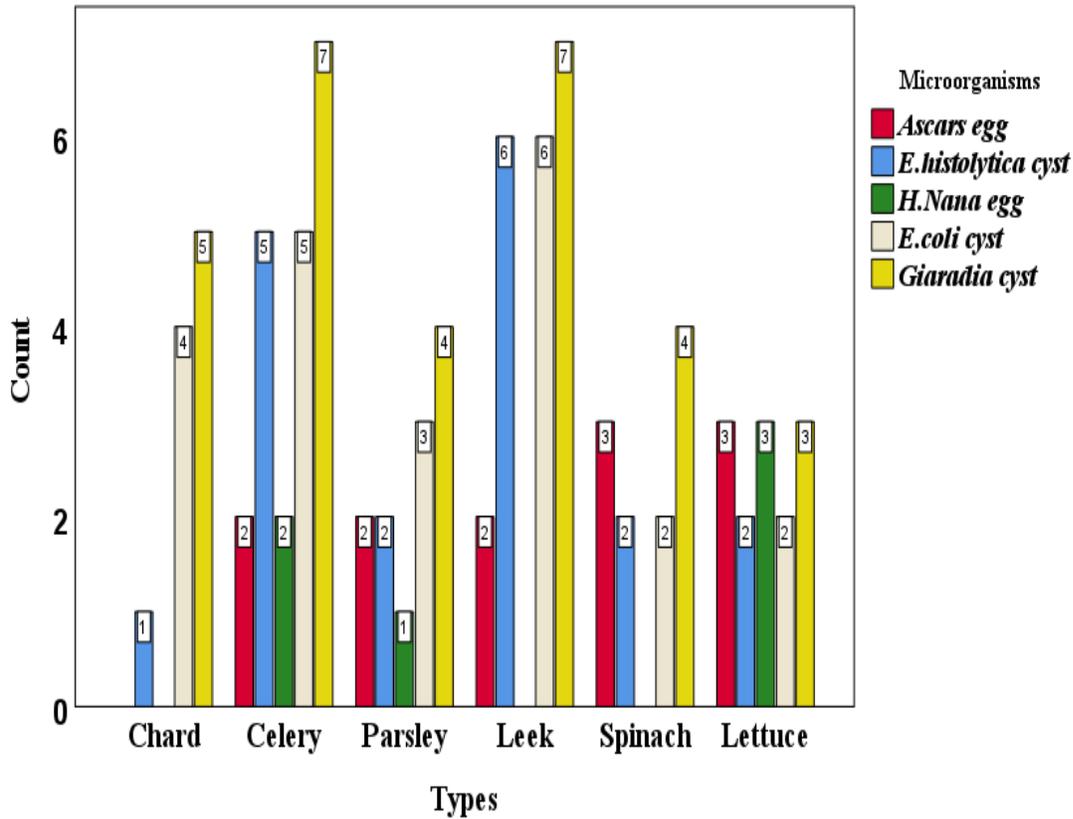


Figure (1): Numbers and percentages of parasites contaminating vegetables

Comparing the intestinal parasite distribution of several green vegetables showed that Giardia lamblia cysts were the most common contaminant, with the greatest counts (7 each) found in leek and celery. The occurrence of protozoa contamination in leaf vegetables in this data shows a similar pattern, as reported from several other studies which determined that Giardia was commonly spread from fresh fruit vegetables (15–17). E. coli and E. histolytica cysts were also frequently found particularly in leek and celery indicating that such vegetables might be important raw vehicles for the dissemination of protozoa.

In contrast, helminth eggs were less frequently detected. Ascaris eggs from the majority of crops were scant (1–3), while the least common was the H. nana eggs, which were found only in parsley and lettuce. The common occurrence of protozoa in contaminated vegetables compared

with helminths which may also be related to their environmental resistance and transmission modes. Spinach and lettuce ranked among the lowest overall based on their relative capacity to attach to or protect cysts and eggs — characteristics which are associated with the morphology and production practices of leeks and celery resulting in parasite loads for these foods being higher than for leafy vegetables. Foliage, or green vegetables with increased surface layering or folding had higher protozoan infection in studies from Saudi Arabia (25) and Egypt (28)

The authors concluded that the results highlight the importance of fresh green vegetables for public health related to protozoan parasites, especially Giardia. The results stressed the need for adequate cleaning, hygienic practices, and possibly disinfection techniques to minimize the risk of transmission to consumers.

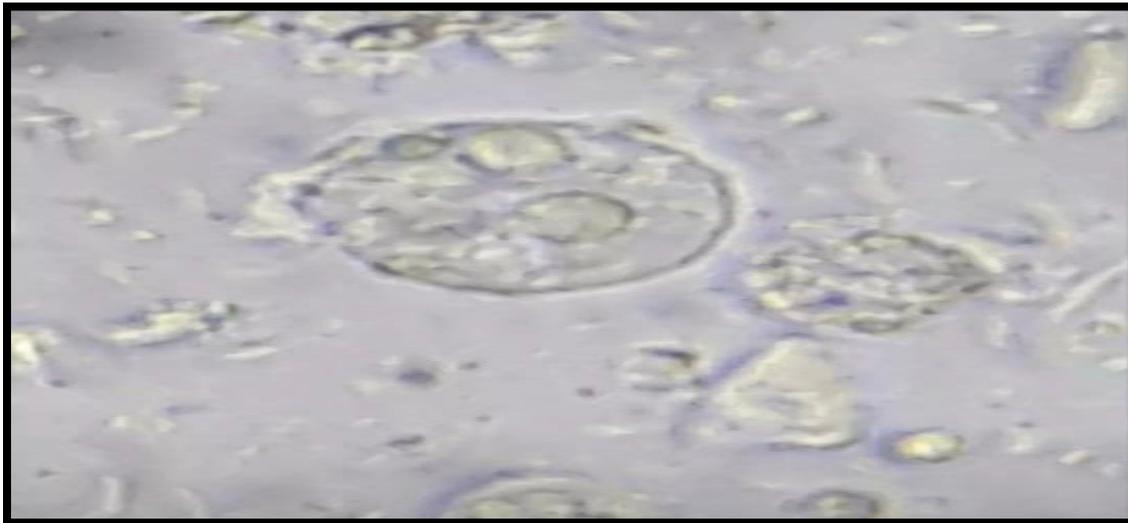


Figure (1-1): shows the cyst stage of *Entamoeba histolytica* (100 X)

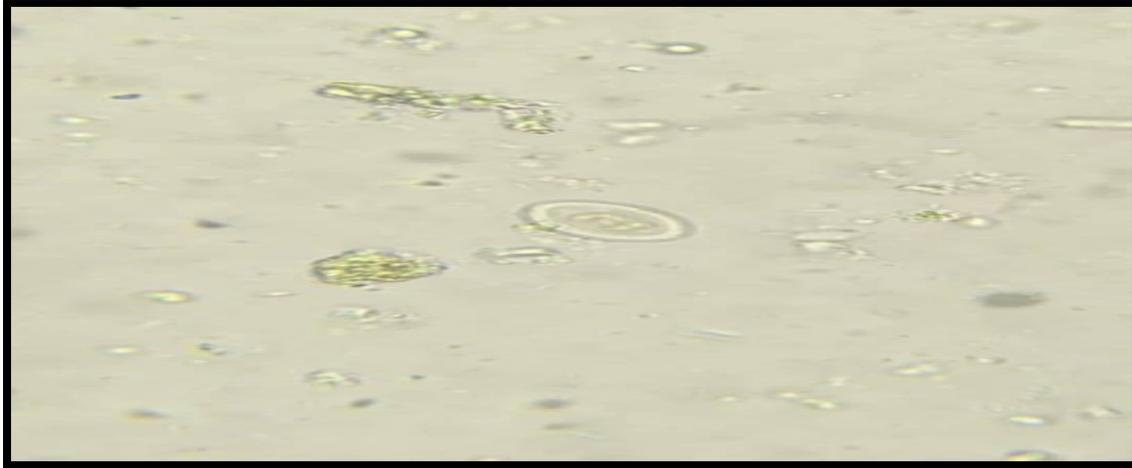


Figure (1-2): Shows the cyst stage of *Giardia* (100 X)

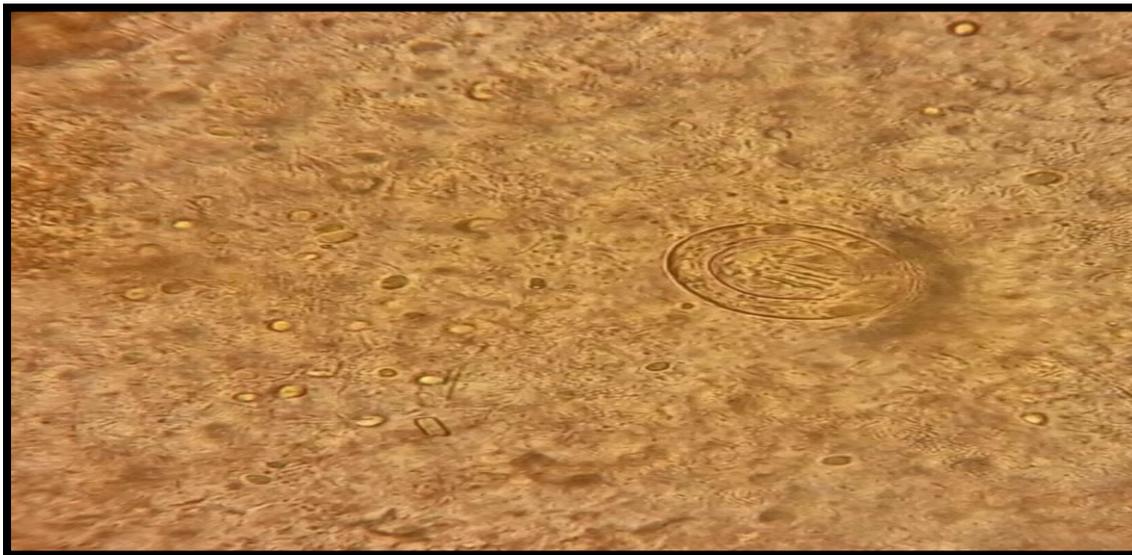


Figure (1-3): Shows the *Hymenolepis nana* egg (100 X)

Conclusions:

1. The results indicated that of all leafy vegetables, celery and leek were most affected by parasites.
2. The research, which covered a wide range of leafy vegetables, showed that Giardia and Entamoeba are the most widespread parasites among such food items.

3. Survival time and development potential is highly stage dependent with cysts being more resistant than eggs to environmental fluctuations.
4. The parasites could be spreading to people through leafy vegetables sold in markets.

Recommendations:

1. Wash thoroughly most vegetables using clean water, particularly if these are leeks and celery.
2. The next step would be to increase sample sizes with this aim to investigate rare parasites such as *Ascaris* and *H. nana*.
3. Instilling good handling of vegetables both among farmers as well as consumers

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