International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 12 No. 1, 2026
https://theaspd.com/index.php

Prevalence Of Intestinal Parasites In Fresh Produce Sold In Local Market And Roadside Stands In The Suburb Of El Harrach, Algiers Province, Algeria: A Pilot Aestival Cross-Sectional Study

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Received: 24-09-2025 **Revised:** 12-12-2025 **Accepted:** 04-01-2026

Abstract

Background: *The transmission of intestinal parasites via contaminated produce is a recognized global issue. However, there is a scarcity of research on prevalence rate and complexity of intestinal parasiticcontamination in different Algerian retail outlets.The main aim of this study was to fill this gap by assessing the prevalence and the complexity of thiscontaminationin aestival producewithin El Harrach suburb of Algiers province, a climate vulnerability hotspot.*

Methods: *A total of 384 produce samples, composed of14 botanical families, 28 species and 4 subspecies, were acquired from market and various roadside stands in El Harrach suburb. Standard diagnostic protocol was used to detect and identify the parasites found in the examined produce. Data underwent statistical analysis using R software (version 4.5.1) and the RStudio (version 2025.05.1+513).*

Results: *An overall prevalence (23,2%) of parasitic contamination was found in the 384produce samples. The Bicontamination pattern had the highest prevalence (8.9%). Vegetable category demonstrated a significantly ($p<0.05$) higher contamination prevalence (17.7%). Cucurbitaceae family showed a substantially ($p<0.05$) higher prevalence (7,6 %). Prevalence rates were significantly ($p<0.05$) higher (2.6 %) in Lactuca sativa (species) and Beta vulgaris subsp. cicla (subspecies). There was no significant ($p>0.05$) difference in the prevalence of intestinal parasitic contamination across the different sampling locations. Ascaris lumbricoides was the most prevalent parasite species (23,2%). Prevalence rates of intestinal parasitic contamination among the identified Protozoan and Helminths parasite species were not significantly different ($p>0.05$).*

Conclusion: *The prevalence and the complexity of intestinal parasitic contamination in aestival produce sold in El Harrach suburb of Algiers province represent a substantial public health risk.*

Keywords: *Public health; Food safety; Foodborne diseases; Intestinal Parasites; Protozoa; Helminths; Prevalence; contamination pattern; retail outlets; El Harrach; Algeria*

INTRODUCTION

The global population is progressively adopting plant-based nutritional regimens, a transition driven by a heightened awareness of the health benefits conferred by the consumption of fresh fruits and vegetables (Slavin & Lloyd, 2012; Komati et al., 2025). This healthy dietrepresents a key driver in promoting global health and nutrition agendas bynotably supporting the United Nations Sustainable Development Goal 3: Good Health and Well-Being (SDG 3). However, these freshproduceconstitute a significant public health risk because they are hand-manipulated and consumed raw, rendering them a vector forvarious pathogenic agents, involving intestinal parasites. In fact,the consumption of raw produce worldwide has been associated with diseases caused by pathogenic Protozoa and Helminths parasites, which are frequently linked to digestive disorders (Li et al., 2020; Santomauro et al., 2024).Although this alarming evidence, intestinal parasitic contamination of fresh marketed produce is under-researched in many countries, including Algeria.This research lacuna is particularly critical given the high risk of intestinal parasitic infections on Algerian provinces like Algiers and its suburbs.A recent and unique preliminarystudy from Ain Témouchent province demonstrated analarmingly high prevalence of Cyclospora spp. (88%) and Cryptosporidium spp(72%) in examined lettuce (Ziane et al., 2021).

Prompted by this concerning prevalence rates, our cross-sectional survey aims to expand on this preliminary investigation by conducting the first comprehensive analysis of the prevalence and complexity of intestinal parasitic contamination in a broader array of fruits and vegetables collectedfrom market and roadside stands, and by targeting a very criticalstudy area

and period. Indeed, El Harrach suburb's vulnerability to global warming, resulting mainly from limited natural ventilation and greenhouse gas emissions from human activities (Bouattou et al., 2022), creates a microclimate favourable to the proliferation of parasites due to the accumulated heat. The summer period, coinciding with high ambient temperatures and a peak in irrigation activity, represents the period of highest risk. Heat and contaminated irrigation water elevate the survival and transmission of intestinal parasite stages (Protozoa cysts and Helminths eggs), which contaminate produce.Determining the prevalence and complexity of this contamination provides baseline data to improve food safety practices, inform public health policies and ultimately reduce the risk of intestinal parasitic infections in the studied suburb.

MATERIALS AND METHODS

Study Design, Area and Period

This study was a cross-sectional survey carried out between June and July 2025 to specifically encompass the summer season.Produce samples were acquired from randomly selected market and roadside stands situated in the suburb of El Harrach, Algeria (Fig. 1). El Harrach's suburb (36° 43′ 16″ N, 3° 08′ 15″ E)is positioned approximately 10 km from the east of the Algiers city centre and geographically separated into two distinct parts by the El Harrach river. This suburb belongs to the Mediterranean bioclimatic scale, with mild, wet winters and hot, dry summers. Average temperatures typically range from a mean minimum of 10.5 °C in January to a mean maximum of 27.5 °C in August. Annual rainfall is 438.63 mm with a five-month dry period from May to September (Boulaouad et al., 2018). El Harrach represents a densely populated suburb of Algiers, which plays a pivotal role in industry, trade and transportation.

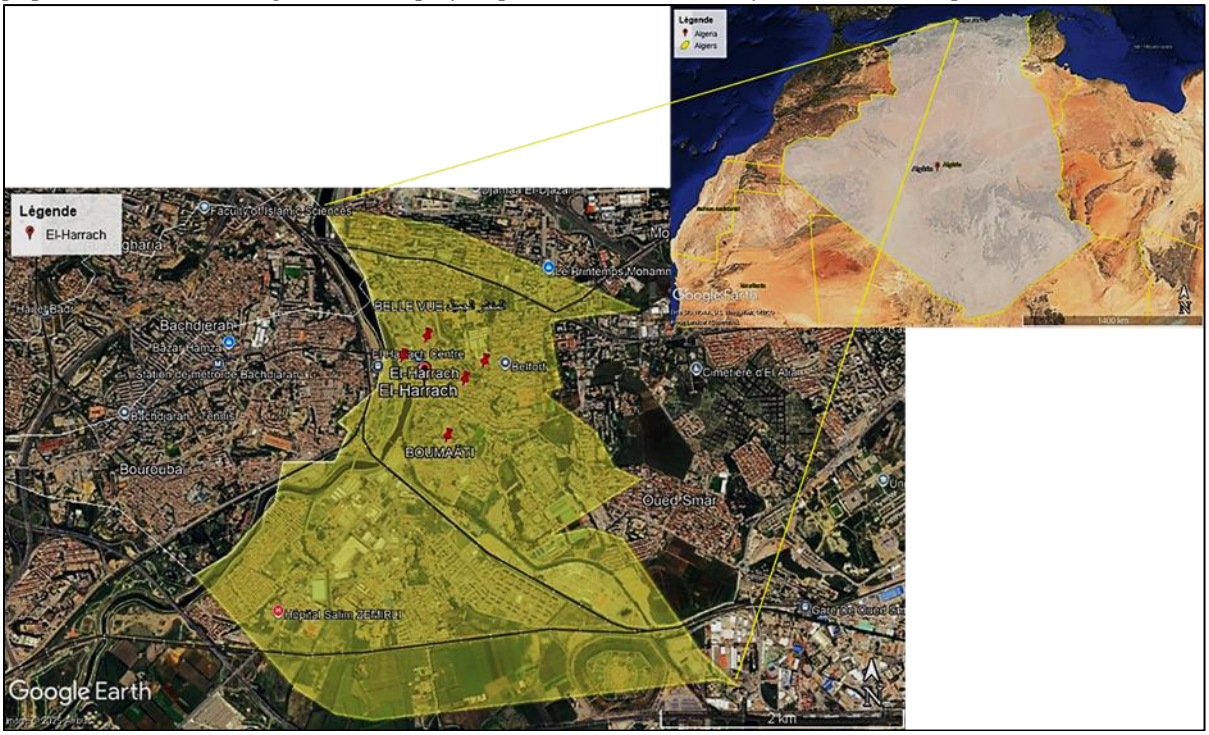

Figure 1. Map of study area and sampling location (Google Earth, 2025). Red push pin represents the locations of the local markets in the suburb of El Harrach where fresh fruit and vegetable samples were purchased.

Sample Size Estimation

The sample size for this cross-sectional study was determined using Cochran's formula (Ahmed, 2024).

$$n_0 = \frac{Z^2.\ p.(1-p)}{E^2}$$

Where:

n_0 = initial sample size,

Z = z-value(1.96 for 95% Confidence),

p = estimated population proportion(use 0.5 if unknown),

E = margin of error.

To calculate the largest possible sample size, a95% confidence level (Z=1.96), a5% margin of error (E = 0.05) and an estimated population proportion (p) of 0.5 were used.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 12 No. 1, 2026
https://theaspd.com/index.php

Substituting the values in the formula:

$$n_0 = \frac{1.96^2.\ 0.5.(1-0.5)}{0.05^2}$$

n_0=384

Sampling Technique

To ensure comparability with previous research, the sampling methodology described by Faith Feranmi et al. (2022) was followed. This technique involved the random sampling approach of produce from market and various roadside stands. The samples were procured under normal purchase conditions from a selection of available vendors at market and each roadside stand to ensure the representativeness of the fruits and vegetables being sold.

Sample Collection

A total of 384 fruit and vegetable samples, divided into 14 botanical families, 28 species and 4 subspecies, were collected through daily random sampling with 12 units per species and subspecies. These 32 distinct produce exhibited a high taxonomic diversity. The fruits and vegetables sampled, as detailed in table 1, provided a robust framework for comparative analysis of intestinal parasitic contamination prevalence.

Table 1. List of Fresh Produce Examined in the Study: Botanical Family, Common name, Local name, Scientific Name and Illustration.

Botanical Family	Common name	Local name	Scientific Name	Illustration
Amaryllidaceae	Onion (**A**)	Bsel / Basla	*Allium cepa*	 A B
	Garlic (**B**)	Thom / Toum	*Allium sativum*	
Apiaceae	Carrot (**C**)	Zrodia	*Daucus carota*	 C D E
	Celery (**D**)	Krafas	*Apium graveolens*	
	Parsley (**E**)	Ma'adnouss	*Petroselinum crispum*	
Amaranthaceae	Sugar Beetroot (**F**)	Biterraf	*Beta vulgaris*	 FG
	Blette / Chard (**G**)	Selq	*Beta vulgaris subsp. cicla*	
Asteraceae	Lettuce (**H**)	Chlada	*Lactuca sativa*	 H
Brassicaceae	Turnip (**I**)	Left	*Brassica rapa subsp. rapa*	 I
Cactaceae	Prickly Pear (**J**)	El Hendi	*Opuntia ficus-indica*	 J

International Journal of Environmental Sciences
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Vol. 12 No. 1, 2026
https://theaspd.com/index.php

Cucurbitaceae	Cucumber (**K**)	Khiar	*Cucumis sativus*	 **K L M N O P**
	Watermelon (**L**)	Dellaâ	*Citrullus lanatus*	
	Pumpkin (**M**)	Kabouya	*Cucurbita maxima*	
	Zucchini (**N**)	Qara'a	*Cucurbita pepo*	
	Canary Melon (**O**)	Batikh	*Cucumis melo*	
	Cantaloupe (**P**)	Kantalou	*Cucumis melo var. cantalupensis*	
Fabaceae	Green Bean (**Q**)	LoubiaMachtou	*Phaseolus vulgaris*	 **Q**
Lamiaceae	Mint (**R**)	Naanaa'	*Mentha spicata*	 **R**
Moraceae	Fig (**S**)	Bakhsis	*Ficus carica*	 **S**
Rosaceae	Pear (**T**)	Lanjas	*Pyrus communis*	 **T U V W X Y**
	Apple (**U**)	Teffah	*Malus domestica*	
	Peach (**V**)	Khokh	*Prunus persica*	
	Cherry (**W**)	Hab El Melouk	*Prunus avium*	
	Plum (**X**)	Berkouk	*Prunus domestica*	
	Apricot (**Y**)	Mechmach	*Prunus armeniaca*	
	Nectarine (**Z**)	Nectarine	*Prunus persica var. nucipersica*	**W**
Solanaceae	Eggplant (**AA**)	Badindjel	*Solanum melongena*	 **AA BB CC DD**
	Potato (**BB**)	Batata	*Solanum tuberosum*	
	Pepper (**CC**)	Fel-fel	*Capsicum annuum*	
	Tomato (**DD**)	Tomatich	*Solanum lycopersicum*	
Urticaceae	Common Nettle (**EE**)	H'chichmkatfa	*Urtica dioica*	 **EE**
Vitaceae	Grape (**FF**)	Enab	*Vitis vinifera*	 **FF**

Sample Handling and Transport

Immediately after acquisition, each produce sample was individually encapsulated in sterile polyethylene bag to prevent cross-contamination. To ensure traceability, each bag waslabelled with a unique identification number, date and sampling location. Handled samples were transported from sampling sites to the stool laboratory unit of the parasitology and mycology department, Mustapha tertiary care hospital in the shortest possible time using insulated ice cooler bags for parasitological examination.

Macroscopic Examination of Samples

Upon handled produce arrival, each sample underwent a meticulous macroscopic inspection to determine its integrity and detect any signs ofobvious alteration.This step included registering the presence of alteration, fecal matter, and soil. Produce samples with detectable alteration, fecal contamination, and soil were subjected to priority microscopic examination.

Sample Processing

The protocol for processing and washing the macroscopically examined produce was adapted from the protocol detailed by and by El Said Said(2012); Bekele &Shumbej(2019);Al-Mozan (2022);Ahmed et al. (2024) and Laoraksawong et al. (2025). A 200 g weighted portion of each produce sample was individually rinsed in 500 ml of a normal saline solution (0.85% NaCl). This step was performed to remove parasite forms (eggs, larvae, cysts, oocysts) from produce subsamples.

Parasite Concentration Procedure

The resulting wash water was collected and left to decant overnight (24h), allowing for sedimentation. The recovered concentrated sediment was transferred into 15 ml conical tubes and centrifuged for 10 minutes at 2,000 rpm. After centrifugation, the supernatant was carefully aspirated with a pipette to avoid disruption of the pellet at the bottom. The obtained pellet was then examined using a light microscope (Said, 2012; Bekele &Shumbej, 2019; Laoraksawong et al., 2025).

Microscopic Examination

For microscopic examination, the obtained pellet was agitated, mixed with a drop of 1% Lugol's iodine solution and examinedas described by Faith Feranmi et al. (2022) and Laoraksawong et al. (2025).A drop of the pellet was placed on the center of a clean microscope slide andcarefully covered with a clean coverslip, taking care to avoid air bubbles and excess fluid. The wet mount preparation was examined under a light microscope using x10 magnification lenses for an initial scan and x40 magnification lenses for the detailed identification of intestinal parasitic stages.

Parasite Identification

The identification of intestinal parasitic stages was performed according to their distinct morphological features, which were determinedusing available bench aids and recent reference (WHO, 1994, 2019;Laoraksawong et al., 2025). The observed forms, including Protozoan cysts and Helminth eggs and larvae, were identified in accordance with these guidelines. The identification was verified and validated by the Head of Parasitology and mycology Department, Mustapha tertiary care hospital, in order to guarantee the accuracy of the findings.

Prevalence assessment

In accordance with the study of Morales-Figueroa et al. (2021), prevalence of parasites in the fresh produce was quantified as the proportion of positive cases per genus or species of parasite in relation to the total count of experimental units examined in each defined group, with the value expressed as a percentage. The positive case was the produce sample with at least one parasitic agent identified via microscopic examination and/or the other technique.

Statistical Analysis

The results were entered in the Microsoft Excel (Version 2507, Build 19029.20136) and analyzed using the R software for windows (version 4.5.1; R Core Team, 2025) and the RStudio integrated development environment for windows (version 2025.05.1+513). Descriptive statistics, encompassing proportions and basic tables, were employed to present the findings. The chi-square ($\chi 2$) test was applied to assess the association between the categorical dependent variable (the prevalence of intestinal parasitic contamination in examined produce) and three categorical independent variables. These independent variables involvedthe categories of thecommercial and culinary classification of the produce (fruits andvegetables) and of thetaxonomic classification of the produce(botanical family, species and subspecies) plus the sampling location from which the produce were acquired the of the produce. Statistical significance was set at $p<0.05$.

Safety Measures and Ethical Compliance

All procedures were performed in strict adherence to institutional and national safety guidelines and ethical standards. This study did not involve human or animal samples, and therefore did not require ethics committee approval.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 12 No. 1, 2026
https://theaspd.com/index.php

RESULTS

Overall Prevalence of Intestinal Parasitic Contamination in the Examined Produce

A total of 384fresh produce samples were acquired from market as well as roadside stands and examined for intestinal parasitic contamination. Of these, 89 examined produce (23,2%) were identified as being contaminated with at least one stage of intestinal parasite species. The identified species included one ProtozoanEntamoeba coli (cyst), and three Helminthes Ascaris lumbricoides (ova), Hookworm (ova) andRhabditiform larvae (unidentified Nematoda species) (Fig. 2). The findings reveal a significant prevalence of intestinal parasitic contamination on the studied produce (Tab. 2).

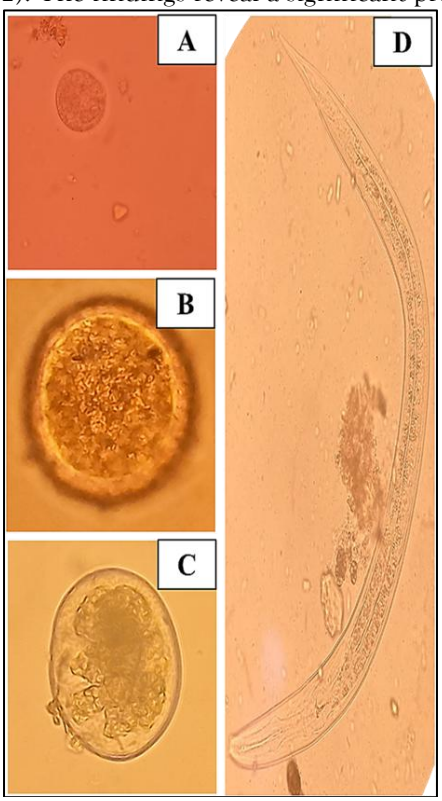

Figure 2. Images of intestinal parasites found in this cross-sectional survey. A. Entamoeba coli cyst; B. Fertilized ovum of Ascaris lumbricoides. C. Hookworm ovum. D. Rhabditiform larva (unidentified Nematoda species). Original magnification: 40X.

Complexity of Intestinal Parasitic Contamination in the Examined Produce

The complexity of contamination was analyzed based on the number of intestinal parasite species identified (Fig. 2) in each contaminated produce sample. This analysis disclosed a high degree of complexity of the assessed contamination. The complexity of contamination was sorted as follows :mono contamination pattern(contamination with a single parasite species), bicontamination pattern (contamination with two parasite species), tricontamination pattern (contamination with three parasite species) and quadracontamination pattern (contamination with four parasite species).The bicontamination pattern was predominant with 8.9% (34 samples) followed by the tricontamination pattern with 5.5% (21 samples) and the quadracontamination pattern with 5.9% (23 samples). However, the monocontamination pattern was less frequent, contaminating only 2.9% (11 samples) of the total produce samples examined. A chi-square test (X^2= 0.034651, df = 3, p-value = 0.9983) demonstrated that there was no statistically significant difference in the prevalence of these patterns (Tab.2).

Table 2: Overall Prevalence and Complexity of Intestinal Parasitic Contamination in the Examined Produce

	Produce		Complexity of Intestinal Parasite Contamination			
Sampling Location	Number of examined samples	Number of contaminated samples	Number of monocontaminated samples	Number of bicontaminated samples	Number of tricontaminated samples	Number of quadracontaminated samples

Markets and Roadside stands	384	89 (23,2%)	11 (2,9%)	34 (8,9%)	21 (5,5%)	23 (5,9%)
			Statistical test	Chi-squared test (χ^2) = 0.034651, df = 3, p-value = 0.9983		

Prevalence of Intestinal Parasitic Contamination by the Category of the Commercial and Culinary Classification of the Examined Produce

The prevalence of intestinal parasitic contaminationvaried substantially between fruit and vegetablecategories (Tab.3). Produceof vegetablecategory demonstrated a significantly higher contamination proportion, reaching17.7% (68 samples), compared to only5.5% (21 samples) forproduce of fruitcategory. A chi-square test of independence confirmed a significant association between produce category and contamination prevalence, χ 2= 13.025, df = 1, p-value = 0.0003074, indicating that contamination is produce category dependent.

Table 3: Prevalence of Intestinal Parasitic Contamination by the Category of the Commercial and Culinary Classification of the Examined Produce (Fruits and Vegetables)

Produce	**Category of the Commercial and Culinary Classification**	**Sample size**	**Positive samples**
Prickly Pear (*Opuntia ficus-indica)*	Fruit	156	21 (5,5%)
Watermelon (*Citrulluslanatus)*	Fruit		
Canary Melon (*Cucumismelo)*	Fruit		
Cantaloupe (*Cucumismelo var. cantalupensis)*	Fruit		
Fig (*Ficus carica)*	Fruit		
Pear (*Pyruscommunis)*	Fruit		
Apple (*Malus domestica)*	Fruit		
Peach (*Prunus persica)*	Fruit		
Cherry (*Prunus avium)*	Fruit		
Plum (*Prunus domestica)*	Fruit		
Apricot (*Prunus armeniaca)*	Fruit		
Nectarine (*Prunus persica var. nucipersica)*	Fruit		
Grape (*Vitis vinifera)*	Fruit		
Onion(*Allium cepa*)	Vegetable	228	68 (17,7%)
Garlic (*Allium sativum*)	Vegetable		
Carrot (*Daucus carota)*	Vegetable		
Celery (*Apiumgraveolens)*	Vegetable		
Parsley (*Petroselinumcrispum)*	Vegetable		
Sugar Beetroot (*Beta vulgaris)*	Vegetable		
Blette / Chard (*Beta vulgaris subsp. cicla)*	Vegetable		
Lettuce (*Lactuca sativa)*	Vegetable		
Turnip (*Brassicarapasubsp. Rapa)*	Vegetable		
Cucumber (*Cucumissativus)*	Vegetable		
Pumpkin (*Cucurbita maxima)*	Vegetable		
Zucchini (*Cucurbitapepo)*	Vegetable		
Green Bean (*Phaseolus vulgaris)*	Vegetable		
Mint (*Menthaspicata)*	Vegetable		
Eggplant (*Solanum melongena)*	Vegetable		
Potato (*Solanum tuberosum)*	Vegetable		
Pepper (*Capsicum annuum)*	Vegetable		
Tomato (*Solanum lycopersicum)*	Vegetable		
Common Nettle (*Urticadioica)*	Vegetable		
Total	2	384	89 (23,2%)

Statistical test	Chi-squared test (χ^2) = 13.025, df = 1, *p-value* = 0.0003074

Prevalence of Intestinal Parasitic Contamination by the rank of the Taxonomic Classification of the Examined Produce
The prevalence of intestinal parasitic contamination of the examined produce was determined according to two taxonomic ranks: family and species/subspecies.

Prevalence of Intestinal Parasitic Contamination by Botanical Family

The prevalence of intestinal parasitic contamination was evaluated by classifying the studied produce into 14 distinct botanical families.Prevalence of this contamination varied considerably among families (Table 4). A chi-square test of independence established a highly significant association between contamination prevalencesand different botanical families($\chi2$ = 98.037, df = 13, p-value = $3.98e^{-15}$ (p= 0.000)). Prevalences of intestinal parasitic contamination varied from 0% in 4 families (Cactaceae; Fabaceae; Rosaceae and Vitaceae) to 3,4 % (13 samples) in family Amaranthaceae. The Cucurbitaceae family had the largest number of contaminated samples, with 29, giving a contamination proportion of 7,6 %. These results revealed a high familial susceptibility to intestinal parasitic contamination (Tab.4).

Table 4: Prevalence of Intestinal Parasitic Contamination by the Botanical Family of the Examined Produce.

Produce		**Botanical Family**	**Sample size**	**Positive samples**
Onion	*Allium cepa*	Amaryllidaceae	24	8 (2,1%)
Garlic	*Allium sativum*	Amaryllidaceae		
Carrot	*Daucus carota*	Apiaceae	36	7 (1,8%)
Celery	*Apiumgraveolens*	Apiaceae		
Parsley	*Petroselinumcrispum*	Apiaceae		
Sugar Beetroot	*Beta vulgaris*	Amaranthaceae	24	13 (3,4 %)
Blette / Chard	*Beta vulgaris subsp. cicla*	Amaranthaceae		
Lettuce	*Lactuca sativa*	Asteraceae	12	10 (2.6 %)
Turnip	*Brassicarapasubsp. rapa*	Brassicaceae	12	6 (1,6 %)
PricklyPear	*Opuntia ficus-indica*	Cactaceae	12	0 (0 %)
Cucumber	*Cucumissativus*	Cucurbitaceae	72	29 (7,6 %)
Watermelon	*Citrulluslanatus*	Cucurbitaceae		
Pumpkin	*Cucurbita maxima*	Cucurbitaceae		
Zucchini	*Cucurbitapepo*	Cucurbitaceae		
Canary Melon	*Cucumismelo*	Cucurbitaceae		
Cantaloupe	*Cucumismelo var. cantalupensis*	Cucurbitaceae		
Green Bean	*Phaseolus vulgaris*	Fabaceae	12	0 (0 %)
Mint	*Menthaspicata*	Lamiaceae	12	4 (1,1 %)
Fig	*Ficus carica*	Moraceae	12	0 (0 %)
Pear	*Pyruscommunis*	Rosaceae	84	0 (0 %)
Apple	*Malus domestica*	Rosaceae		
Peach	*Prunus persica*	Rosaceae		
Cherry	*Prunus avium*	Rosaceae		
Plum	*Prunus domestica*	Rosaceae		
Apricot	*Prunus armeniaca*	Rosaceae		
Nectarine	*Prunus persica var. nucipersica*	Rosaceae		
Eggplant	*Solanum melongena*	Solanaceae	48	8 (2,1 %)
Potato	*Solanum tuberosum*	Solanaceae		
Pepper	*Capsicum annuum*	Solanaceae		
Tomato	*Solanum lycopersicum*	Solanaceae		
Common Nettle	*Urticadioica*	Urticaceae	12	4 (1,1 %)
Grape	*Vitis vinifera*	Urticaceae	12	0 (0 %)
Total			384	89 (23,2%)
Statistical test	Chi-squared test (χ^2) =98.037, df = 13, *p-value* = $3.98e^{-15}$ (*p*= 0.000)			

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ISSN: 2229-7359
Vol. 12 No. 1, 2026
https://theaspd.com/index.php

Prevalence of Intestinal Parasitic Contamination by Specific Species and Subspecies

The analysis of Table 5indicated a significant variation in intestinal parasitic contamination prevalences. These prevalences differed considerably among species and subspecies. A chi-square test of independence revealed a highly significant association between contamination prevalences andproduce species and subspecies(χ 2 = 136.41, df = 31, p-value = 3.51^{e-15} (p= 0.000)). Intestinal parasitic contamination prevalences ranged from 0% in 12 species and one subspecies (Opuntia ficus-indica, Phaseolus vulgaris, Ficus carica, Pyrus communis, Malus domestica, Prunus persica, Prunus avium, Prunus domestica, Prunus armeniaca, Solanum melongena, Capsicum annuum, Vitis vinifera and Prunus persica var. nucipersica) to a high of 2.6 % (10 samples) in Lactuca sativa(species) and Beta vulgaris subsp. cicla (subspecies). The subspecies Cucumis melo var. cantalupensis had the next highest contamination proportion at 2,1 % (8 samples), followed by the species Cucumis melo at 1.8% (7 samples). These findings highlighted a pronounced specific species and subspecies susceptibility to intestinal parasitic contamination.

Table 5: Prevalence of Intestinal Parasitic Contamination by Specific Species/ Subspecies of the Examined Produce.

Produce		**Specific Species / Subspecies**	**Sample size**	**Positive samples**
Onion	*Allium cepa*	Species	12	5 (1.3 %)
Garlic	*Allium sativum*	Species	12	3 (0,8%)
Carrot	*Daucus carota*	Species	12	2 (0,5 %)
Celery	*Apiumgraveolens*	Species	12	2 (0,5 %)
Parsley	*Petroselinumcrispum*	Species	12	3 (0,8%)
Sugar Beetroot	*Beta vulgaris*	Species	12	3 (0,8%)
Blette / Chard	*Beta vulgaris subsp. cicla*	Subspecies	12	10 (2.6 %)
Lettuce	*Lactuca sativa*	Species	12	10 (2.6 %)
Turnip	*Brassicarapasubsp. rapa*	Subspecies	12	6 (1,6 %)
PricklyPear	*Opuntia ficus-indica*	Subspecies	12	0 (0 %)
Cucumber	*Cucumissativus*	Species	12	3 (0,8%)
Watermelon	*Citrulluslanatus*	Species	12	6 (1,6 %)
Pumpkin	*Cucurbita maxima*	Species	12	3 (0,8%)
Zucchini	*Cucurbitapepo*	Species	12	2 (0,5 %)
Canary Melon	*Cucumismelo*	Species	12	7 (1,8%)
Cantaloupe	*Cucumismelo var. cantalupensis*	SubSpecies	12	8 (2,1 %)
Green Bean	*Phaseolus vulgaris*	Species	12	0 (0 %)
Mint	*Menthaspicata*	Species	12	4 (1,1 %)
Fig	*Ficus carica*	Species	12	0 (0 %)
Pear	*Pyruscommunis*	Species	12	0 (0 %)
Apple	*Malus domestica*	Species	12	0 (0 %)
Peach	*Prunus persica*	Species	12	0 (0 %)
Cherry	*Prunus avium*	Species	12	0 (0 %)
Plum	*Prunus domestica*	Species	12	0 (0 %)
Apricot	*Prunus armeniaca*	Species	12	0 (0 %)
Nectarine	*Prunus persica var. nucipersica*	Subspecies	12	0 (0 %)
Eggplant	*Solanum melongena*	Species	12	0 (0 %)
Potato	*Solanum tuberosum*	Species	12	6 (1,6 %)
Pepper	*Capsicum annuum*	Species	12	0 (0 %)
Tomato	*Solanum lycopersicum*	Species	12	2 (0,5 %)
Common Nettle	*Urticadioica*	Species	12	4 (1,1 %)
Grape	*Vitis vinifera*	Species	12	0 (0 %)
Total			384	89 (23,2%)
Statistical test	Chi-squared test (χ^2) = 136.41, df = 31, *p-value* = $3.51e^{-15}$ (*p*= 0.000)			

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Prevalence of Intestinal Parasitic Contamination in Produce by Sampling Location

The prevalence of intestinal parasitic contamination was evaluated across differentsampling locations, market and roadside stands. At market, out of 192 total produce samples, 44 (22,9%) were contaminated by intestinal parasites. Likewise, roadside stands had 45contaminated samples (23,4%) out of a total of 192produce samples.A Chi-squared test demonstrated no statistically significant difference in the prevalence of intestinal parasitic contamination between the two sampling locations (χ 2 = 0, df = 1, p-value = 1). The data suggested a comparable prevalence rates of intestinal parasitic contamination at the different sampling locations (Tab. 6).

Table 6: Prevalence of Intestinal Parasitic Contamination in Produce by Sampling Location.

	Produce Market				**Roadside Produce Stands**			
Produce	**Sample size**	**Positive samples**	**Parasite species Number**	**Parasite species**	**Sample size**	**Positive samples**	**Parasite species Number**	**Parasite species**
Allium cepa	6	2 (33,3%)	2	*Ascaris lumbricoides* ova	6	3 (50%)	2	*Ascaris lumbricoides* ova
				Hookworm ova				Hookworm ova
Allium sativum	6	2 (33,3%)	3	*Ascaris lumbricoides* ova	6	1 (16,7%)	2	*Ascaris lumbricoides* ova
				Hookworm ova				Hookworm ova
				Rhabditiform larvae				
Daucus carota	6	1 (16,7%)	1	*Ascaris lumbricoides* ova	6	1 (16,7%)	1	*Ascaris lumbricoides* ova
Apium graveolens	6	2 (33,3%)	2	*Ascaris lumbricoides* ova	6	0 (0%)	0	-
				Hookworm ova				
Petroselinum crispum	6	1 (16,7%)	2	*Ascaris lumbricoides* ova	6	2 (33,3%)	2	*Ascaris lumbricoides* ova
				Hookworm ova				Hookworm ova
Beta vulgaris	6	2 (33,3%)	1	*Ascaris lumbricoides* ova	6	1 (16,7%)	1	*Ascaris lumbricoides* ova
Beta vulgaris subsp. cicla	6	5 (83,3%)	4	*Entamoeba coli* cyst	6	5 (83,3%)	4	*Entamoeba coli* cyst
				Ascaris lumbricoides ova				*Ascaris lumbricoides* ova
				Hookworm ova				Hookworm ova
				Rhabditiform larvae				Rhabditiform larvae
Lactuca sativa	6	5 (83,3%)	4	*Entamoeba coli* cyst	6	5 (83,3%)	4	*Entamoeba coli* cyst
				Ascaris lumbricoides ova				*Ascaris lumbricoides* ova

				Hookworm ova				Hookworm ova
				Rhabditiform larvae				Rhabditiform larvae
Brassica rapa subsp. rapa	6	3 (50%)	2	*Ascaris lumbricoides* ova	6	3 (50%)	2	*Ascaris lumbricoides* ova
				Hookworm ova				Hookworm ova
Opuntia ficus-indica	6	0 (0%)	0	-	6	0 (0%)	0	-
Cucumis sativus	6	1 (16,7%)	1	*Ascaris lumbricoides* ova	6	2 (33,3%)	1	*Ascaris lumbricoides* ova
Citrullus lanatus	6	2 (33,3%)	3	*Entamoeba coli* cyst	6	4 (66,7%)	2	*Entamoeba coli* cyst
				Ascaris lumbricoides ova				*Ascaris lumbricoides* ova
				Hookworm ova				
Cucurbita maxima	6	2 (33,3%)	1	*Ascaris lumbricoides* ova	6	1 (16,7%)	1	*Ascaris lumbricoides* ova
Cucurbita pepo	6	1 (16,7%)	1	*Ascaris lumbricoides* ova	6	1 (16,7%)	2	*Ascaris lumbricoides* ova
								Hookworm ova
Cucumis melo	6	4 (66,7%)	3	*Entamoeba coli* cyst	6	3 (50%)	2	*Entamoeba coli* cyst
				Ascaris lumbricoides ova				*Ascaris lumbricoides* ova
				Hookworm ova				
Cucumis melo var. cantalupensis	6	3 (50%)	2	*Entamoeba coli* cyst	6	5 (83,3%)	3	*Entamoeba coli* cyst
				Ascaris lumbricoides ova				*Ascaris lumbricoides* ova
								Hookworm ova
Phaseolus vulgaris	6	0 (0%)	0	-	6	0 (0%)	0	-
Mentha spicata	6	3 (50%)	2	*Ascaris lumbricoides* ova	6	1 (16,7%)	2	*Ascaris lumbricoides* ova
				Hookworm ova				Hookworm ova
Ficus carica	6	0 (0%)	0	-	6	0 (0%)	0	-
Pyrus communis	6	0 (0%)	0	-	6	0 (0%)	0	-
Malus domestica	6	0 (0%)	0	-	6	0 (0%)	0	-
Prunus persica	6	0 (0%)	0	-	6	0 (0%)	0	-
Prunus avium	6	0 (0%)	0	-	6	0 (0%)	0	-
Prunus domestica	6	0 (0%)	0	-	6	0 (0%)	0	-
Prunus armeniaca	6	0 (0%)	0	-	6	0 (0%)	0	-

Prunus persica var. nucipersica	6	0 (0%)	0	-	6	0 (0%)	0	-
Solanum melongena	6	0 (0%)	0	-	6	0 (0%)	0	-
Solanum tuberosum	6	2 (33,3%)	2	*Ascaris lumbricoides* ova Hookworm ova	6	4 (66,7%)	2	*Ascaris lumbricoides* ova Hookworm ova
Capsicum annuum	6	0 (0%)	0	-	6	0 (0%)	0	-
Solanum lycopersicum	6	1 (16,7%)	1	*Ascaris lumbricoides* ova	6	1 (16,7%)	2	*Entamoeba coli* cyst *Ascaris lumbricoides* ova
Urtica dioica	6	2 (33,3%)	2	*Ascaris lumbricoides* ova Hookworm ova	6	2 (33,3%)	1	*Ascaris lumbricoides* ova
Vitis vinifera	6	0 (0%)	0	-	6	0 (0%)	0	-
Total by location	**192**	**44 (22,9%)**	**4**	-	**192**	**45 (23,4%)**	**4**	-
Grand total	**384**	**89 (23,2%)**	**4**	***Entamoeba coli* cyst** ***Ascaris lumbricoides* ova** **Hookworm ova** **Rhabditiform larvae**	**Statistical test**		Chi-squared test (χ^2) =0, df = 1, *p-value* = 1	

Prevalence of Intestinal Parasitic Contamination by Parasite Species

The prevalence of intestinal parasitic contamination was assessed across 4 parasites species, Entamoeba coli, Ascaris lumbricoides, Hookworm and Rhabditiform. The analysis of Table 7 exhibited no significant variation in the prevalence ofproduce contamination across these parasite species. A chi-square test of independence found no statistically significant association between contamination prevalences and parasite species (χ 2 = 0.268, df = 3, p-value = 0.9659). The prevalence rates of intestinal parasitic contamination spanned from a low of 2,8% in Rhabditiform larvae to a high of 23,2% in Ascaris lumbricoides. These results highlighteda similar prevalence rate of contamination among the identified parasite species.

Table 7: Prevalence of Intestinal Parasitic Contamination in the Examined Produce by Parasite Species across the sampling locations.

	Produce Market								**Roadside Produce Stands**							
	***Entamoeba coli* cyst**		***Ascaris lumbricoides ova***		**Hookworm ova**		**Rhabditiform larvae (unidentified Nematoda species)**		***Entamoeba coli cyst***		***Ascaris lumbricoides ova***		**Hookworm ova**		**Rhabditiform larvae (unidentified Nematoda species)**	
Produce	Positive samples	Negative samples	Positive samples	Negative samples	Positive samples	Negative samples	Positive samples	Negative samples	Positive samples	Negative samples	Positive samples	Negative samples	Positive samples	Negative samples	Positive samples	Negative samples
Allium cepa	0 (0%)	6 (100%)	2 (33,3%)	4 (66,7%)	2 (33,3%)	4 (66,7%)	0 (0%)	6 (100%)	0 (0%)	6 (100%)	3 (50%)	3 (50%)	1 (16,7%)	5 (83,3%)	0 (0%)	6 (100%)

Allium sativum	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	4 (66, 7%)	2 (33,3 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	3 (50 %)	3 (50%)	0 (0%)	6 (100 %)
Daucus carota	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Apium graveolens	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Petroselinum crispum	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)
Beta vulgaris	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Beta vulgaris subsp. cicla	2 (33, 3%)	4 (66,7 %)	5 (83, 3%)	1 (16,7 %)	2 (33, 3%)	4 (66,7 %)	5 (83, 3%)	1 (16,7 %)	1 (16, 7%)	5 (83,3 %)	5 (83, 3%)	1 (16,7 %)	3 (50 %)	3 (50%)	2 (33, 3%)	4 (66,7 %)
Lactuca sativa	3 (50 %)	3 (50%)	5 (83, 3%)	1 (16,7 %)	2 (33, 3%)	4 (66,7 %)	1 (16, 7%)	5 (83,3 %)	2 (33, 3%)	4 (66,7 %)	5 (83, 3%)	1 (16,7 %)	1 (16, 7%)	5 (83,3 %)	2 (33, 3%)	4 (66,7 %)
Brassica rapa subsp. rapa	0 (0%)	6 (100 %)	3 (50 %)	3 (50%)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	3 (50 %)	3 (50%)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)
Opuntia ficus-indica	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Cucumis sativus	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Citrullus lanatus	1 (16, 7%)	5 (83,3 %)	2 (33, 3%)	4 (66,7 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	4 (66, 7%)	2 (33,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Cucurbita maxima	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Cucurbita pepo	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)
Cucumis melo	2 (33, 3%)	4 (66,7 %)	4 (66, 7%)	2 (33,3 %)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	3 (50 %)	3 (50%)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Cucumis melo var. cantalupensis	2 (33, 3%)	4 (66,7 %)	3 (50 %)	3 (50%)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	3 (50 %)	3 (50%)	5 (83, 3%)	1 (16,7 %)	3 (50 %)	3 (50%)	0 (0%)	6 (100 %)
Phaseolus vulgaris	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)

Mentha spicata	0 (0%)	6 (100 %)	3 (50 %)	3 (50%)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)
Ficus carica	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Pyrus communis	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Malus domestica	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Prunus persica	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Prunus avium	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Prunus domestica	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Prunus armeniaca	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Prunus persica var. nucipersica	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Solanum melongena	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Solanum tuberosum	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	4 (66, 7%)	2 (33,3 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)
Capsicum annuum	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Solanum lycopersicum	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	1 (16, 7%)	5 (83,3 %)	1 (16, 7%)	5 (83,3 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Urtica dioica	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	2 (33, 3%)	4 (66,7 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Vitis vinifera	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)	0 (0%)	6 (100 %)
Prevalence of each	**10 (5,2 0%)**	182 (94,8 %)	**44 (22, 9%)**	148 (77,1 %)	**22 (14, 5%)**	170 (85,5 %)	**7 (3,6 %)**	185 (96,4 %)	**10 (5,2 0%)**	182 (94,8 %)	**45 (23, 4%)**	147 (76,3 %)	**17 (8,9 %)**	175 (91,1 %)	**4 (2,1 %)**	188 (97,9 %)

parasite species by location																
Global Prevalence of each parasite species	**20 (5,20%)**	364 (94,8 %)	**89 (23, 2%)**	295 (76,8 %)	**39 (10, 2%)**	345 (89,8 %)	**11 (2,8 %)**	373 (97,2 %)	**Statistical test**	Chi-squared test (χ 2) = 0.268, df = 3, p-value = 0.9659						

DISCUSSION

The findings of this cross-sectional surveyindicate a substantial prevalence (23,2%) of intestinal parasitic contamination on fresh aestival produce, with contamination proportionsvarying significantly among different commercial/culinary categories. Vegetables demonstrated a notably elevated contamination proportionrelative to fruits. The identified parasitic species were Ascaris lumbricoides, Entamoeba coli, Hookworm, and Rhabditiform larvae, and their prevalences were statistically comparable. The survey also emphasized a high familial and specific-species/subspecies vulnerability, with certain produce families and species/subspeciesexhibiting a much-elevated contamination level. Intriguingly, there was no significant variation in contamination prevalences between the two sampling locations, reflecting a generalized issue rather than a localized concern.

Our results of a 23,2% overall contamination prevalence corroborate results from numerous studiesacrossvarious countries, which have documenteda high prevalence of intestinal parasitic contamination on fresh produce, with prevalences often ranging from 20% to over 85% (Daryani et al., 2008; Klapec & Borecka, 2012; Al-Hindi et al., 2016;Ismail, 2016;Mohamed et al., 2016; Bekele et al., 2017; Etewa et al., 2017; Bekele & Shumbej, 2019;Punsawad et al., 2019;Al Nahhas & Aboualchamat, 2020; El Bakri et al., 2020; Alemu et al., 2020; M'rad et al., 2020; López-Mata & Quihui-Cota, 2021; Abdullah, 2021;Ziane et al., 2021;Gboeloh, 2022;El Safadi et al., 2023;Muqbel, &Binsaad, 2023;Animaw et al., 2024; Elmnefi et al., 2024; Amen et al., 2025; Gunathilaka et al., 2025;Al-Awadhi & Jamshaid, 2025). The detected predominance of bicontamination pattern and the reduced prevalence of monocontamination pattern indicates that fruits and vegetablesarecommonly subjected to a range of sources of contamination, presumably from contaminated soil or irrigation water. The notably higher contamination rate in vegetables versus fruits represents a significant result that may be due to surface roughness of produce. The rougher surface of vegetables, in comparison to fruits, can contribute to a higher retention of parasites. This survey highlights the critical role of produce category dependence in the development of effective produce safety protocols and the formulation of produce safety regulations.

The vulnerability across different taxonomic ranks(family,species and subspecies) is a novel and substantial contribution of this research. The observed variability may be attributed to differences in the phenotypic traits of the produce, which mayplay a role in the adhesion and retention of infectious stages of parasites. It may also be associated with agronomic practices (organic fertilizers, irrigation methods). This cross-sectional studyis paramount to tailoredpublic health strategies and could shape agricultural methodsto reduce contamination threats. The absence of a significant variation between sampling locationssupports the conclusion that the contamination is not restricted to a single market or roadside stand but rather points to a pervasive problem linked to comprehensive agricultural and post-harvest handling procedures.

This study had some limitations. It was limited to a specific suburb, and the results may not be extensible to other suburbs of Algeria's provinces with diverse agricultural and environmental contexts. Further research is needed to undertake a similar cross-sectional survey in differentAlgerian provinces to evaluate the generalizability of our findings,and investigate the specific sources of contamination (irrigation water, organic fertilizers, soil, and the hygiene practices of produce handlers) to clarify the transmission pathways as well asinstructand develop robust mitigation strategies. Additionally, the adopted methodology provided a valuable preliminary assessment of the prevalence of parasitic contamination in produce sampled from the study area. However, the basic diagnostic protocol used, although effective in this preliminary study, has some limitations, including a risk of underestimating prevalence. To overcome this problem and ensure a comprehensive and reliable assessment, an integrated approach using complementary and more accurate techniques, such as biomolecular analyses, is recommended.

CONCLUSION

A high prevalence of intestinal parasitic contamination was found in the aestival produce within El Harrach suburb of Algiers province, indicating a significant public health threat. This pilot aestival cross-sectional study's results revealed analarming finding:bicontamination pattern had the highest prevalence;vegetable category demonstrated a substantially higher contamination prevalence; Cucurbitaceae family showed a significantly higher prevalence;prevalence rates were substantially higher in Lactuca sativa (species) and Beta vulgaris subsp. cicla (subspecies);prevalence of intestinal parasitic contamination was similar across all sampling locations;Ascaris lumbricoides was the most prevalent parasite species; andprevalence rates of intestinal parasitic contamination among the identified Protozoa and Helminths parasite species were comparable. These findingsdisplayed a direct risk of food-borne transmission to the local population and underscored the pressing need for stronger public health measures, for which we propose two-pronged approach:

- Public awareness campaign and educational interventions: Intensifying public awareness campaigns and educational interventions is crucial to enlighten the entire citizenry about good hygiene practices and proper produce handling to reduce intestinal parasitic contamination.
- Regulatory Reform: The current Algerian regulatory framework and standards for produce must be urgentlyamended to include specific regulations and acceptable thresholds for intestinal parasitesto monitor and ensure the safety of marketed produce.

In addition, a dual classification system, which combines the practical relevance of commercial categorieswith the scientific rigor of taxonomical families, is recommended for the most comprehensiveanalysis of intestinal parasitic contamination, guaranteeing both a meaningful assessment and effective public health communication.

Furthermore, our pilot aestival cross-sectional surveyhighlightedthe imperative to develop and implement a novel approach tomonitoring foodborne parasites. We argue that a reliance on traditional parasitological methods is limited and failed to present an exhaustiveassessmentof prevalence and complexity of intestinal parasitic contamination, requiring the employment of more sensitive techniques such as immunological and molecular techniques.

Ultimately, a synergistic strategy combining public awareness, rigorous regulatory frameworks, dual classification system, and multi-modal monitoring protocol is essential to mitigate parasitic contamination of marketed produce.

Declaration of generative AI in scientific writing

During the preparation of this work the authors used ChatGPT in order toensure linguistic correctness. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Acknowledgments

The authors acknowledge the Director and Technician of the Stool Laboratory Unit of the Parasitology and mycology Department, Mustapha tertiary care hospital, for their support in providing laboratory equipment for this study. In addition, the authors express their gratitude to the sellers and buyers of edible plants who participated in the study.

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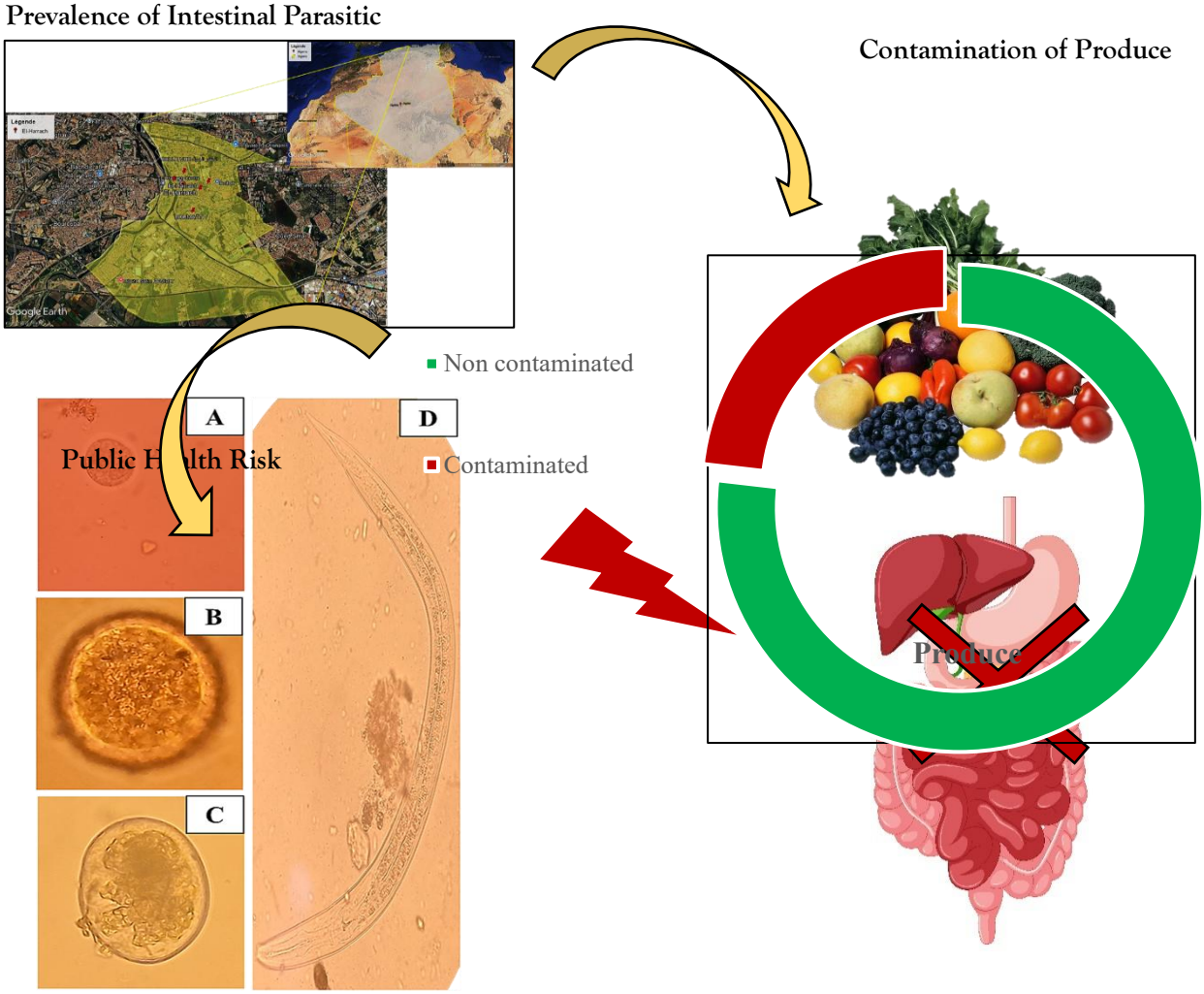
HIGHLIGHTS

- 23,2% of estival produce samples were contaminated.
- Contamination prevalences were highest in Cucurbitaceae family.
- Contamination prevalences were highest in *Lactuca sativa* species and *Beta vulgaris subsp. cicla* subspecies.
- Prevalent parasite: *Ascaris lumbricoides* (23,2%).
- Cross-sectional study establishes a baseline for produce safety surveillance.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 12 No. 1, 2026
https://theaspd.com/index.php

Graphical Abstract



A. *Entamoeba coli* cyst;
B. Fertilized ovum of *Ascaris lumbricoides*.
C. Hookworm ovum.
D. Rhabditiform larva (unidentified Nematoda species).