Prevalence of enteroparasites in vegetables marketed in the municipality of Conceição da Barra, Espírito Santo, Brazil

Prevalencia de enteroparásitos en hortalizas comercializadas en el municipio de Conceição da Barra, Espírito Santo, Brasil

Aiwny Cássia Jorge Antonino, Anelise Andrade de Souza y
Marco A. Andrade de Souza

ABSTRACT

Objective To monitor the frequency of enteroparasites in lettuce (*Lactuca sativa*) and parsley (*Petrosolium sativum*) samples, marketed in commercial buildings in the municipality of Conceição da Barra, Espírito Santo, Brazil.

Materials and Methods Between August 2015 and July 2016, four different popular commercial buildings (fairs, markets and supermarkets) were selected as the largest vegetable suppliers in the municipality of Conceição da Barra, Espírito Santo. A total of 40 samples were analyzed using the modified spontaneous sedimentation method at the Laboratory of Parasitology and Hematology of Centro Universitário Norte do Espirito Santo, Universidade Federal do Espírito Santo.

Results The most frequent organism in the study population were the commensal *Entamoeba coli* and the parasites *E. histolytica/E.dispar*, hookworm, *Balantidium coli*, *Ascaris* sp., *Toxocara* sp., *Taenia* sp. and *Dipylidium* sp.

Conclusions The results indicate a high degree of contamination of the vegetables, probably related to the precariousness of production, transportation and handling, making it necessary to adopt measures that guarantee the best quality of food and, consequently, better population health.

Key Words: Parasitology; vegetables; food contamination; population health (*source: MeSH, NLM*).

RESUMEN

Objetivo Monitorear la frecuencia de enteroparásitos en muestras de lechuga (*Lactuca sativa*) y perejil (*Petrosolium sativum*), comercializadas en edificios comerciales en el municipio de Conceição da Barra, Espírito Santo, Brasil.

Materiales y Métodos Entre agosto de 2015 y julio de 2016, cuatro diferentes edificios comerciales populares (ferias, mercados y supermercados) fueron seleccionados como los proveedores de vegetales más grandes en el municipio de Conceição da Barra, Espírito Santo. Se analizaron un total de 40 muestras utilizando el método modificado de sedimentación espontánea en el Laboratorio de Parasitología y Hematología del Centro Universitario Norte del Espírito Santo, Universidade Federal del Espírito Santo.

Resultados Los organismos más frecuentes en la población de estudio fue el comensal *Entamoeba coli* y los parásitos *E. histolytica/ E. dispar*, ancilostomídeo, *Balantidium coli*, *Ascaris* sp., *Toxocara* sp., *Taenia* sp. y *Dipylidium* sp.

Conclusiones Los resultados indican un alto grado de contaminación de las hortalizas, probablemente relacionado con la precariedad de la producción, el transporte y la manipulación, por lo que es necesario adoptar medidas que garanticen la mejor calidad de los alimentos y, en consecuencia, una mejor salud de la población.

Palabras Clave: Parasitología; verduras; contaminación de alimentos; salud poblacional (*fuente: DeCS, BIREME*).

AA: Bachelor of Pharmacy. Department of Health Sciences. Federal University of Espírito Santo. São Mateus, Brazil.
aiwny@hotmail.com
AS: Bachelor of Nutrition. M.Sc. Health and Nutrition. Ph.D. Collective Health. Department of Clinical and Social Nutrition. Federal University of Ouro Preto. Brazil.
anelise.souza@ufop.edu.br
MS: Bachelor of Pharmacy. M.Sc. Biological Sciences. Ph.D. Parasitology. Department of Health Sciences. Federal University of Espírito Santo. São Mateus, Brazil.
marco.souza@ufes.br

Fresh vegetables are part of the diet of many individuals due to their nutritional attributes, low caloric value, simple preparation and low production cost. The consumption of these fresh foods has increased in recent decades with a growing population search for healthier eating habits (1,2).

Despite these attractive factors, the consumption of these raw or minimally processed foods is associated with parasitic disease outbreaks caused by helminths and protozoa present in fecal waste that contaminate irrigation water, the soil used as a fertilizer, and even by the poor sanitation of enteroparasite-infected handlers, frequently asymptomatic. In this context, intestinal diseases require greater attention due to the permanence of parasites in the external environment (1,3).

Parasitic diseases represent a serious and constant problem for public health, due to the diversity of clinical manifestations and their high prevalence, especially in low-income communities in developing countries (3,4).

Since Brazil is a tropical developing country, it has favorable conditions, such as climate and socioeconomic situation, for the occurrence of intestinal parasitic diseases. These diseases are widely disseminated by the population due to precarious or non-existent hygienic-sanitary conditions, the lack of knowledge of communities about prophylactic measures against parasitic diseases, and the consumption of vegetables that serve as one of the main vehicles for the transmission of intestinal diseases (4).

Considering that Brazil is still a country with poor basic sanitation conditions, regional studies to determine the presence of parasites in vegetables are important to evaluate hygiene conditions and to improve this situation (4,5). Therefore, the main purpose of this study was to monitor the frequency of enteroparasites in vegetables marketed in Conceição da Barra, Espírito Santo, through laboratory analyses of lettuce (*Lactuca sativa*) and parsley (*Petrosolium sativum*) samples, contributing to an improvement in the perception of hygienic-sanitary conditions and the quality of these products offered to the population.

MATERIAL AND METHODS

Study area

Conceição da Barra is a Brazilian municipality located in the far north of the state of Espírito Santo, which currently occupies an area of 1,184,944 km². According to the Census conducted by the Brazilian Institute of Geography and Statistics (IBGE) in 2010, the municipality had a population of 28,449 inhabitants, and may be considered small, when compared to the total population of Espírito Santo (3,514,952 inhabitants), equivalent to 0.81% of this total (6).

Sample collection

Between August 2015 and July 2016, four different popular commercial buildings (fairs, markets and supermarkets) were selected as the largest vegetable suppliers in the municipality of Conceição da Barra, Espírito Santo. The samples were collected in five replicates, during the period in question, totaling 40 samples of analyzed vegetables (*Lactuca sativa* and *Petrosolium sativum*). The choice of vegetables in commercial buildings occurred at random. For the analyses, the sample unit was the head for lettuce and the package for parsley.

After being collected, isolated in individual plastic bags and identified, the samples were sent to the Laboratory of Parasitology and Hematology of Centro Universitário Norte do Espírito Santo (CEUNES), Universidade Federal do Espírito Santo, to be properly analyzed.

In the laboratory, each sample went through two washing processes. In the first technique, by rinsing, 250 mL of distilled water were added to the plastic bag containing the vegetable, shaking it manually for about 30 seconds (7), while in the second technique, by defoliation, each leaf or part of the vegetables were carefully rubbed in a plastic container with 250 mL of distilled water (8).

The washing solutions from each sample were filtered into a conical cup using a surgical gauze folded into four, resting for 24 hours. After this period, the materials were centrifuged at 9 000 rpm for 3 minutes, and the sediments obtained were transferred to test tubes (7,9).

For the parasitological analysis, the obtained sediment was placed on glass slides and stained with lugol. The parasites were identified by visualizing parasitic forms under light microscopy, where at least two slides of each sample tube were examined using 10x and/or 40x lenses (10).

Data analysis

The obtained data, systematized in a Microsoft Excel 2007 spreadsheet (11) and double typed, were analyzed using the 12.0 STATA software (12). Univariate analyses were performed using Fisher's exact test. The dependent variable chosen for this study was the presence of parasitic diseases. The independent variable was the commercialization of vegetables (supermarket, fairs and fruit carts). Those that showed statistical significance ($p<0.20$) in Fisher's exact test were included in the Poisson regression model. The Prevalence Ratio was obtained and a 95% confidence interval ($p<0.05$) was adopted in the final model.

RESULTS

A total of 40 samples of vegetables were collected from supermarkets and fairs in the municipality of Conceição da Barra, from which a parasite contamination rate of

100% was obtained for lettuce and parsley samples. It was observed that 80% of lettuce samples were contaminated with more than two parasitic species (polyparasitism) and 20% were equivalent to the samples contaminated with one parasite species (monoparasitism). This value was also high for parsley samples with polyparasitism, equivalent to 90% of the analyzed samples (Table 1).

Table 1. Contamination of lettuce and parsley samples, by parasitic forms, in commercial buildings of the municipality of Conceição da Barra, Espírito Santo, Brazil, 2016

Lettuce samples Building Collections					
	1st	2nd	3rd	4th	5th
Supermarket 1	Anc + Bc + Ec + Eh	Eh + T	Anc + Bc	Anc + A	Anc + Ec
Supermarket 2	Anc + Bc + Ec + Eh	Bc + Ec	Anc + Ec + Eh	Anc + A + Ec	Bc
Fair 1	Anc + Ec + Eh	A + Ec + Eh	Bc + Ec	Bc + Ec	Eh
Fair 2	A + Ec +Eh	A + D + Ec	A	A + Ec + Eh	Anc
Parsley samples Building Collections					
	1st	2nd	3rd	4th	5th
Supermarket 1	Anc + Bc + Ec + Eh + To	Anc + Bc + Ec	Ec + Eh	Eh	Anc + Eh
Supermarket 2	Anc + Ec + Eh	Ec + Eh	Anc	Anc + Eh	Bc + Ec + Eh
Fair 1	Anc + Bc + Ec + Eh	Ec + Eh	A + Ec	Ec + Eh + To	Bc + Eh
Fair 2	Anc + Ec + Eh	Anc + A	Anc + A + Eh	Ec	Bc + Ec

A: *Ascaris* sp.; Anc: Hookworm; Bc: *B. coli*; D: *Dipylidium* sp.; Eh: *E. histolytica/E. dispar;* Ec: *E. coli;* T: *Taenia* sp.*;* To: *Toxocara* sp.

In the univariate analyses, values of p<0.20 were observed for the presence of hookworm, *Ascaris* sp. and *B. coli*. However, there was no significant association in the final regression model, which indicates that there is no difference in the contamination of vegetables according to their selling places.

Regarding parasitic species, the most frequent species in lettuce samples were *Entamoeba coli* (65.0%) and Hookworm (60.0%) (Table 2).

Table 2. Frequency of enteroparasites in lettuce (*Lactuca sativa*) samples of commercial buildings in the municipality of Conceição da Barra, Espírito Santo, Brazil

Parasitic specie	Frequency (%)
Dipylidum sp.	5
Taenia sp.	10
Ascaris sp.	25
Balantidium coli	35
Entamoeba histolytica/E. dispar	45
Hookworms	60
Entamoeba coli	65

In relation to parsley samples, the most frequent parasite was *Entamoeba histolytica/E. dispar* (45%), followed by *E. coli* (65%) (Table 3).

Table 3. Frequency of enteroparasites in parsley (*Petrosolium sativum*) samples of commercial buildings in the municipality of Conceição da Barra, Espírito Santo, Brazil

Parasitic specie	Frequency (%)
Toxocara sp.	10
Ascaris sp.	15
Balantidium coli	25
Hookworms	50
Entamoeba coli	65
Entamoeba histolytica/E. dispar	70

DISCUSSION

The vegetables commercialized in the municipality of Conceição da Barra, Espírito Santo, have an important role in the dissemination of enteroparasites, given the high contamination rates.

Studies conducted in Presidente Prudente, state of São Paulo, and in the municipality of Teresina, Piauí, showed that 33.06% and 34.1% of the collected vegetables were contaminated with some parasitic species (1,13), while in Ipatinga, Minas Gerais and Cuiabá, Mato Grosso, these rates reached 60.0% and 66.7%, respectively (14,15).

On the other hand, the samples collected in Conceição da Barra had very high rates of enteroparasite contamination and the majority showed multiple contamination.

According to the Census conducted by the IBGE (6), the municipality of Conceição da Barra had about 8,482 households, of which 84.78% had water supply networks and 82.53% had waste sorting, while only 18.53% had access to sewerage. According to ANDRADE et al. (16), living, housing and basic sanitation conditions can be considered determinants for the transmission of parasites and the results observed in Conceição da Barra may be a reflection of these deficiencies.

In addition, untreated water from dams and other water resources is an important contamination source for vegetables, both in the production and commercial chain, and in sanitizing by consumers (4). Precarious sanitation conditions, water and/or soil contaminated with fecal material, besides poor hygiene of handlers can be considered the main factors responsible for food contamination.

The results indicate a high degree of contamination of the vegetables and are probably related to precariousness, when it comes to hygiene care, which directly influences the quality of these products - according to the National Sanitary Surveillance Agency (17), any type of food must be free from foreign matter indicating health risks such as dirt, insects and parasites, so that they are suitable for consumption.

Therefore, in order to avoid parasitic disease outbreaks it is necessary to improve hygiene and sanitation during food production, processing, transportation and final handling, thus ensuring a better food quality for the entire population ♦

Conflict of interest: None.

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