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Parasitological analysis of vegetables sold in supermarkets and fairs in the city of Araguaína, state of Tocantins, Brazil

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Abstract**—** *The consumption of fresh vegetables has become more commonplace, thus, the occurrence of parasitic structures in these food causes several pathologies, between them, intestinal diseases, once helminths, protozoa and other pathogens may be present in these vegetables. The objective of this study was to identify the incidence of parasites in vegetables sold in supermarkets and fairs of Araguaína-Tocantins. A total of 80 samples were collected and analyzed, 40 samples of curly lettuce (Lactuca sativa* L.*) and 40 samples of arugula (Eruca vesicaria). The analysis was performed at the food quality control laboratory of UNITPAC. There were found, Entamoeba coli cysts, Iodamoeba butschili, on lettuce, and larva and eggs of ancylostomids, also the presence of Strongyloides stercoralis present in both lettuce and arugula. In this perspective, the results expressed, demonstrate the need for more effective hygienic-sanitary measures, aiming at an improvement in the population's quality of life.*

Keywords**— *Vegetables. Parasites. Pathologies. Food. Hygienic-sanitary.***

I. INTRODUCTION

The current scenario has brought several changes in the eating habits of Brazilians, especially when talking about a more nutritious and healthier diet. Due to these changes, vegetables have been gaining more space in the lives of citizens, since these food possesses a low caloric content and also present nutrients which bring benefits to the body.[1]

In this perspective, lettuce and arugula are the most popular leafy vegetables, also the most consumed in Brazil and around the world, as they are used mainly in the form of salads, due to their convenience. Lettuce (*Lactuca sativa* L.) is a vegetable that has an Asian origin and belongs to the Asteraceae family, this vegetable has several benefits, such as vitamins A, B1, B2, B5 [2], whereas arugula (*Eruca vesicaria*) is rich in folic acid and antioxidant.

However, they represent a vehicle for the transmission of parasites, mediated by biological, social and cultural factors, since their cultivation occurs mainly through the use of water, and it may be related to contamination with fecal material of human origin, thus, the use of irrigation with water and soil contamination by the use of organic fertilizer with fecal residues, is a relevant factor for the cultivation of vegetables. [3]

Therefore, intestinal parasites (helminths and protozoa) reflect a problem for public health. Brazil, for example, has a high prevalence of parasites in less favored communities and with precarious basic sanitation and sewage systems. Thus, the conditions of personal, environmental and sanitary hygiene in which these populations live determine the cycle of parasites. [2]

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Some studies have shown a high frequency of protozoa and helminths in vegetables sold in supermarkets, fairs and restaurants [4]. In this context, the confirmation of the presence of parasites in vegetables is of a great importance for public health, since it provides data for health surveillance about the sanitary hygienic status of these products, allowing the optimization of control in the cultivation of vegetables. [5]

In addition, the population's eating habits of consuming fresh vegetables make it possible the exposure to a large portion of the people to the most varied forms of transmission of these parasites. From this perspective, it is essential to control the quality of fresh food, since they are directly and indirectly linked to infections in individuals. With this, it is necessary to guide the population on the correct consumption and hygiene of these food, as it is of great importance to preserve and maintain the population's food quality.

Thus, we see the need to conduct this study in order to review the relationship of parasites with public health, as well as the importance of quality control in parasitic contamination of vegetables and identification of the incidence of parasites in vegetables sold in supermarkets and fairs in the city of Araguaína, state of Tocantins.

II. MATERIALS AND METHODS

The research was carried out from August to September 2019, where 80 samples of vegetables were collected and analyzed, 40 of lettuce (*Lactuca sativa* L.), 40 of arugula (*Eruca vesicaria*), in a supermarket and in an open market (in the city center) in Araguaína - Tocantins.

The collection of samples was carried out during a period of eight weeks, in the morning shift on five days of the week, from Monday to Friday, and a sample of fresh lettuce and arugula was collected randomly, *in natura*, whole, from the lot of vegetables to sale in a supermarket in Araguaína – Tocantins. Moreover, fresh samples of the studied vegetables sold at weekly opening fairs were collected during one day each week.

Establishments with a large flow of customers were selected and for the selection of samples, the criterion used was that each sample unit had its own visual organoleptic characteristics, being composed of a set of stems and leaves tied with a bow.

The samples were individually packed in polyethylene bags for first use and in a styrofoam box soon after, duly identified, were sent to the Quality Control Laboratory of the Centro Universitário Presidente Antônio Carlos - UNITPAC. The time elapsed for the collection of the samples and the preparation of them was of 2 hours, yet for the beginning of the exam, it was expected the sedimentation of 24 hours.

The samples were analyzed using the Hoffman parasitological method (spontaneous sedimentation). Each type of vegetable was washed twice with 600 mL of distilled water, in a plastic bowl, with each unit separately in the same water. This washing liquid was captured in 150 mL conical cups, the liquid remaining for 24 hours in rest to perform the spontaneous sedimentation technique. Then, 0.1 mL of the obtained sediment was removed, which was analyzed by optical microscopy, directly on a slide stained with lugol solution. The 10X objective blade scanning technique was adopted to identify parasites or free-living larvae and the confirmation of parasitic structures was performed using the 40X objective.

III. RESULTS AND DISCUSSION

The contamination levels of the two vegetable variations showed that the percentage of helminths and protozoa found in the samples of vegetables sold in open markets and supermarkets in the city of Araguaína, state of Tocantins is significant, since it was found that 95% (76/80) of the vegetable samples showed contamination with some type of helminths and that 2.5% (2/80) are contaminated by some type of protozoa from a total of 80 samples analyzed, as shown in Chart 1.

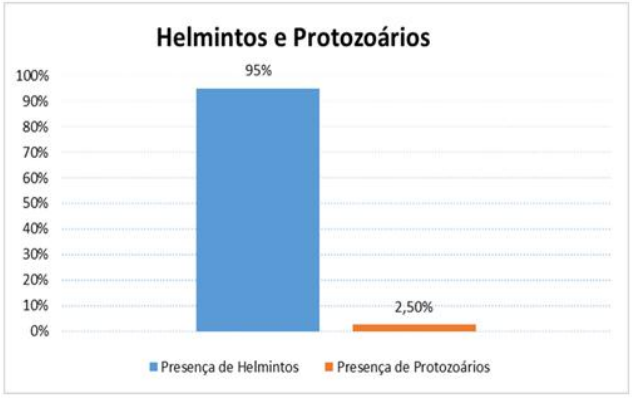

Fig.1: Frequency of helminths and protozoa in lettuce and arugula samples

Similar results were found by Medeiros et al. [6], where after optical microscopy analysis of arugula and green onion samples from markets in the city of Vitoria da Conquista, state of Bahia, reported that 100% (10/10) of the arugula samples and 80% (8/10) of green onion were positive for the presence of parasites.

Falavigna et al. [7], in the city of Maringá, state of Paraná, by analyzing samples of curly and iceberg lettuce from fairs, also found expressive results, with a percentage

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of 70% and 76% of the samples, respectively, positive for parasitological research.

Other studies carried out also demonstrated the presence of parasites in the analyzed vegetables. According to França et al. [8], in 2009, in the city of Uberlândia, state of Minas Gerais, it was found that 100% (96/96) of lettuce analyzed, of the curly variety, which were marketed by producers at a fair, presented some evolutionary form of parasites. The same result was obtained by Nomura et al. [9], where in the analysis of 8 samples of lettuce from a fair and a supermarket analyzed in the city of Londrina state of Paraná, all were positive for some species of parasite.

It was possible to observe the presence cysts of *Iodamoeba butschili* and *Entamoeda coli* appearing in smaller proportions, with a prevalence of 1.25% (1/80) for both parasites and being present only in lettuce, as shown in Table 1. These data are lower than those detected by Medeiros et al. [6] who found contamination rates in the range of 44.82%. Even though the presence of *Entamoeba coli* in food samples is not considered pathogenic, it is indicative of low hygienic-sanitary conditions. [10]

Table 1: Frequency of enteroparasites found in lettuce and arugula samples.

	Parasita	Local da Coleta			
		Supermercado		Feira	
		Alface	Rúcula	Alface	Rúcula
Cisto	Cisto de Iodamoeba butschili	1			
	Cisto de entamoeba coli			1	
Larva	Larva rabditóide ancislostomídeo	1	19		10
	Larva filarióide ancislostomídeo	6	4	1	17
	Larva filarióide Strongyloides Stercoralis		9	5	3
Ovo	Ovo de ancilostomídeo		1		
Total		8	33	7	30

When comparing the group of helminths, we can highlight the presence of larvae and eggs, however, the highest prevalence was rabditoid Ancislostomid larvae reaching a frequency of 37.5% (30/80) among all samples examined. Higher data than those found by Neres et al. [11], who reported rates of 5.41% for lettuce samples from supermarkets and 16.67% for samples from open markets, in the city of Anapólis - Goiás.

The pathology known as larva migrans can be acquired in contact with larvae of Ancylostomids (parasitic hookworms), however, it is worth mentioning that despite the fact that it penetrates the skin of man, this larva infects dogs and cats, being caused by the species of *Ancylostoma caninum*, however in contact with the skin, the larva penetrates the skin making an erratic cycle leaving a path through which it passes, causing common symptoms such as intense itching. [12]

Thus, the presence of rhabditoid and filarioid larvae in lettuce and arugula, can cause various symptoms, such as bronchitis / alveolitis, when installed in the lungs. The intestine is mainly affected by the formation of intestinal ulcers caused by the hematophagous activity of the parasites, which can favor the occurrence of microcytic and hypochromic anemia and even hypoproteinemia. [12]

Thereby, the possibility of contamination of these vegetables may be associated with various forms of contamination, which may be through the practice of using organic fertilizer, the use of contaminated water for irrigation, transportation made in open crates and the lack of personal hygiene in moment of food handling, such practices were seen as possible forms of contamination. [13].

IV. CONCLUSIONS

The occurrence of parasites in food consumed *in natura* is an alert, due to the possibility of transmission of viable organisms that can invade them causing diseases. Therefore, it is important to know how the vegetables offered in fairs and supermarkets are presented so that quality control measures and possible interventions are adopted in order to obtain a reliable product.

According to the data obtained in this study, it is pointed out that the samples of lettuce (*Lactuca sativa* L.) and arugula (*Eruca vesicaria*) *in natura*, which are sold in supermarkets and street markets in the city of Araguaína-Tocantins, showed a low quality in the hygienic-sanitary question, according to the microscopic analyzes performed. In addition, structures of parasites that cause disease in humans have been shown in most samples, especially in arugula samples, thus, vegetables marketed in these establishments, become inappropriate for consumption according to the standards established by ANVISA.

The results expressed in this study represent a need for greater understanding about the quality control methods of these vegetables from planting to arrival at supermarket fairs.

In this perspective, it is necessary to know and act for control actions in the production of food that are consumed fresh, especially lettuce and arugula bought in fairs and supermarkets. Surveillance measures can be taken to control the vegetable production process. As well as in the domestic environment, asepsis of vegetables and fruits for consumption can be performed by immersion in a chlorine solution prepared from commercial bleach.

Therefore, reinforcing the hygiene of vegetables. This study aims to alert health professionals so that they can play their roles with the community and public health

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agencies, acting effectively in orienting the stages of the production, transport and hygiene process of these food, as well as prioritizing measures that allow the treatment of infected individuals.

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