Parasitological Evaluation of Vegetables *Petroselinum crispum, Allium fistulosum and Coriandrum sativum* Sold in Municipality in the Interior of Brazil

This paper describes a methodology an experimental research of coriander vegetables (Coriandrum sativum), chives (Allium fistulosum) and parsley (Petroselinum crispum) sold in establishments such as the public market, supermarkets, street markets and greengrocers in various places, with the objective of investigating the presence of protozoa and other possible parasitic agents that can infect consumers by ingesting them in natura. A bibliographic review was sought in several theoretical contributions. In addition to the sanitizer used for their treatment. A comparison was made with several studies carried out for the same purpose in different municipalities and states, in order to obtain an objective conclusion. There was a discrepancy in the programs aimed at controlling parasites in countries where there are precarious investments in public health and with great social inequalities, which makes it impossible for individuals to have health and well-being, therefore, it is more than essential educational strategies that promote together with producers, sellers and the population in general habits that reduce the risk of contamination in the use and ingestion of raw vegetables. A investment in health education is proposed through popular education in hygienic habits.

Keywords: *Vegetables, parasites, Coriandrum sativum, Allium fistulosum health education.*

Introduction

Studying vegetables is interesting for its possibilities of studies, both parasitological, microbiological, with analysis of helminths, protozoa, bacteria and viruses. characteristic and proper. The combination of chives (*Allium fistulosum*) and coriander (*Coriandrum sativum*) is the most common in Brazilian preference, and therefore more easily found in street markets throughout the national territory. They have great nutritional value and are a source of vitamin C, vitamin A and calcium, another commonly used combination is chives (*Allium fistulosum*) and parsley (*Petroselinum crispum*) [1][2]. The free fair is the most common commercial activity and has unique characteristics, becoming a cultural expression of the Brazilian people. It is carried out in a public place and with temporary and removable installations. The products are offered and/or displayed in a way that can generate risks of contamination by the handling of customers and passersby, making their consumption without prior cleaning an easy gateway for various infectious agents, such as bacteria, fungi, viruses, among other pathological agents [3]. Therefore, this course conclusion work aimed to analyze the possible contamination in the green smell marketed in the municipality of Bragança Paulista-SP. Parasitological analysis was performed for the possible and most

common parasitic diseases caused by helminths and protozoa that cause infections that affect individuals of all social classes as well as at all ages. According to [3], a higher prevalence of these infections is observed in rural areas or in marginalized areas. According to [4], it is very common to use water contaminated by domestic sewage, the use of animal manure, in addition to the handling, transport, storage and commercialization of vegetables that result in contamination of vegetables sold in various public spaces such as markets, open markets and greengrocers. In the first chapter, the origin of the researched vegetables will be described, the planting and the forms of cultivation, the possible causes of contamination and its consequences and the most known parasites, so that you can have a better understanding and give a broad sense to the research. The second chapter presents the methodology used in the research, the collection of vegetables, the procedures used and the results found.

This work is justified by the changes that have taken place in recent decades related to changes in eating habits, highlighting the need for an improvement in the quality of life. One way to have a healthier diet is to use fresh vegetables as a possibility to reach the "health" objective, as an alternative to already processed foods. In addition, the increase in family farming producers was encouraged, which can lead to planting without technical knowledge of specific care with the land and its respective procedures such as sanitation, fertilization, use of insecticides and fertilizers, and also without the necessary supervision by responsible organs.

Origin of vegetables

According to [5], vegetables are a category of vegetables that include legumes and vegetables. They are foods grown and/or produced, for family consumption or on a large scale in vegetable gardens and that the vegetable is the mother that embraces everyone. Vegetables are made up of more or less 90% water, they are rich in vitamins C, B vitamins, potassium, calcium, iron and magnesium. Among the vegetables, greens stood out here, more precisely coriander (*Coriandrum sativum L.*), chives (*Allium fistulosum*) and parsley (*Petroselinum crispum*) for being in common use throughout Brazil in cooking and home medicine. In addition to having a characteristic flavor, coriander stands out in its use. Coriander (*Coriandrum sativum L.*) is a herbaceous plant of unknown origin. It is believed to be from the Mediterranean or Asia and others claim to be from China or Rome [6]. It is known that it was already known and used by the Egyptians for more than two thousand years. Ancient peoples used coriander as a medicinal plant, due to its calming, digestive, aphrodisiac properties and even in the embalming of bodies in funeral rites[6]. It has an annual life cycle, its leaves are green and of different shapes, the base being lobed and the apex divided into thin segments. It is 15 cm to 30 cm tall, blooms during spring, is small and beautiful, is white or slightly pink and appears in umbel-like inflorescences (figure 1) [7].

The chives (figure 2) have their oldest evidence of cultivation around 3200 years BC in the Persian civilization. There are two species and both belong to the same family: Allium fistulosum or green chives, native to Siberia and Allium schoenoprasum (thin-leaf chives or Galician chives), from Europe [7]. It has a perennial life cycle, its leaves are green, long and cylindrical, like hollow tubes, inflated from the base. With a herbaceous texture with a height of 15 cm to 0.4 meters in height, it produces flowers during the winter and spring that have a greenish-white color, gathered in an umbel. It must be irrigated regularly and adapted to any continental, Mediterranean, subtropical, temperate and tropical climate [8]. Parsley (*Petroselinum crispum*) (figure 3) is a biennial plant with very divided rosette-shaped leaves, it reaches 10 to 25 cm in height and its stalks can exceed 60 cm, with flowering plants of 1 to 3 cm and a tuber used as winter booking. It develops a flower stalk up to 75 cm tall with sparse leaves and an entire flat umbel with a diameter of 3 to 10 cm, with several yellow-green flowers of 2 mm in diameter. The seeds are ovoid from 2 to 3 mm, normally dies after the ripening of the seeds [9].

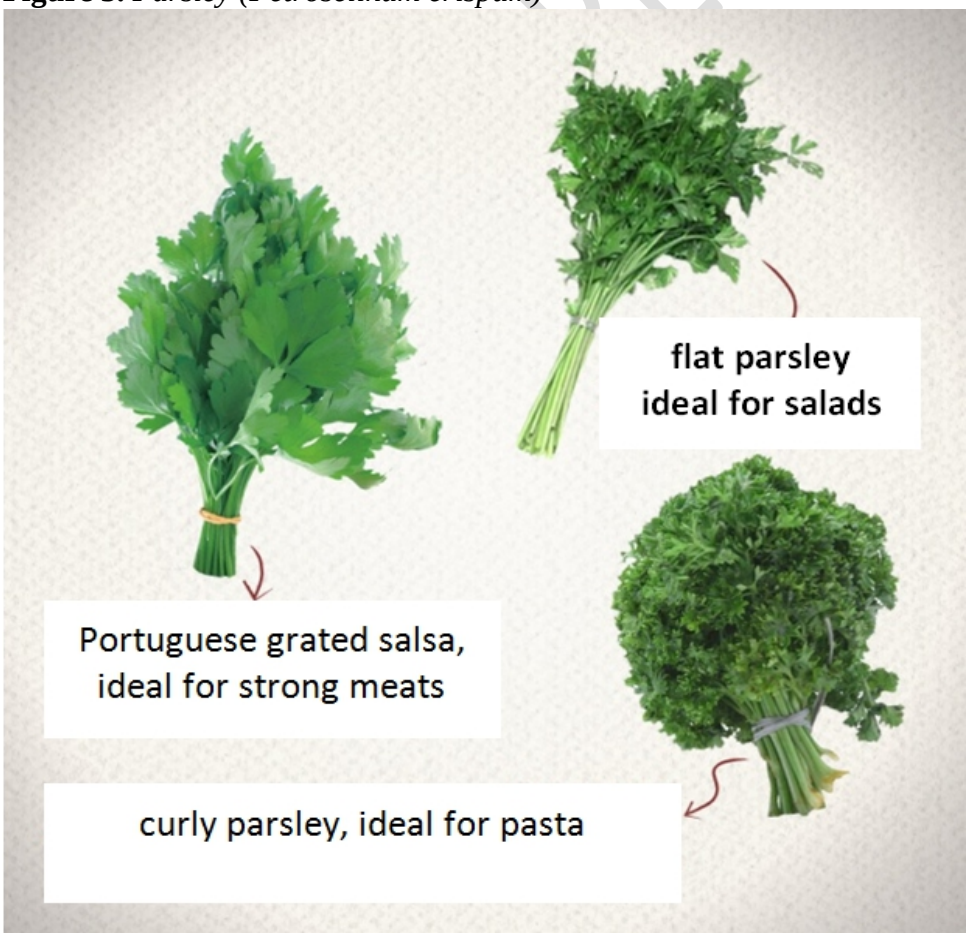
Figure 1. *Coriander (Coriandrum sativum L.)*

Source: Pixabay (https://www.ciclovico.com.br)

Figure 2. *Chives (Allium schoenoprasum)*

Source: Tiagoorganico - https://brasilescola.uol.com.br/saude/cebolinha.htm.

Figure 3. *Parsley (Petroselinum crispum)*



Source: Vamoscomerbem.com

Planting and Cultivation of vegetables (green smell herb)

In the last decades there has been a great increase and a concern with the quality of food and the quality of life, the United Nations Food and Agriculture Organization (FAO) presents a new concept in food security based on a tripod: safe food, quality of food and diet balance, aiming at the well-being of world pollution [10][11]. The consumption of in natura foods increases, without concern for risk factors in the use and/or consumption of these in natura, that is, there is no concern about their origin, in how they are planted and taken care of until they reach the commercial establishments and, finally, the table [10]. The vegetables mentioned here are cultivated in a traditional way, they are used single cultivation in the field, that is, they are planted separately and later harvested by means of cuts close to the neck of the plants and then taken to the packaging room, where the leaves are selected. and prepared in the form of mixed bunches of coriander and chives to be sold as green smell in markets and fairs [12][13]. Although this system and form of cultivation is simpler in its management, it is known that it is highly polluting both for water sources and for vegetables that when ingested will certainly cause infections to consumers. It is known that the contamination of plant products can occur before their commercialization in fairs[15]:

> *{...} the contamination of plant products can occur well before their commercialization in open markets, given that the main form of contamination by parasites in vegetables occurs, above all, through the use of water contaminated by fecal material used in irrigation as well as in soil fertilization, which is often also done by feces.*

It is understood in the cited text that the water used in irrigation is taken directly from a watercourse (river, stream...) or from dammed water, which is certainly polluted, and it may be, according to [16] that the presence of rotifers, animals that are bio-indicators of polluted areas, have a preference for water with organic pollution. Contamination of vegetables by parasitic structures can occur at different stages of the production chain, because producers do not have information for their correct cultivation, either through irrigation with contaminated water or fertilization with human and animal waste, which can lead to contamination. . As a result, the habit of consuming vegetables in natura, despite being considered of great nutritional benefit, favors the exposure of the population to various forms of transmission of parasites [17]. The increase in foodborne infections by helminths and protozoa caused by the ingestion of fresh vegetables is the result of several factors, with water contamination being the most common. It appears that, in most cases, basic sanitation is deficient, the sewage network leads to the dumping of waste into streams and rivers, from where water is commonly withdrawn for irrigation of the cultivation sites [18]. This same water is used for washing and/or asepsis of the same vegetables, which further increases the level of contamination [19]. It is worth mentioning that individuals who handle food can also represent a major source of transmission and dissemination, as they are often

asymptomatic carriers of enteroparasites [20]. In view of the above, the explanations described above were considered through a literature review to understand how possible contamination of vegetables used in their natural state occurs. Countless studies carried out in this direction, unfortunately, show the presence of several infectious agents in vegetables, which contradicts the norms established by the National Commission of Norms and Standards for Food (CNNPA), which states in its resolution nº 12, Brazilian official government newspaper, "Diário Oficial da União Federal do Brasil", of 07/24/1978 "vegetables must not contain dirt, parasites and larvae". These studies reafirm the presence of these infectious agents, specifically those that cause intestinal parasites.

> *{...} regardless of the variety and origin, they presented low hygienic standards, indicated by the presence of parasitological structures of animal and/or human origin, as well as the presence of environmental contaminants.*

Thus, it can be said that the conditions in which the cultivation of vegetables and the handling of them until their arrival at the places of consumption, mainly in the peripheral areas, small-medium-sized cities have a precarious basic sanitation, the rural area with its creation of animals that is aggravated by the presence of streams, lakes and streams of polluted water, discharge of human and animal waste, contribute to their contamination.

> *{...} the ideal cultivation of this hardwood requires some care regarding hygienic-sanitary aspects, as they are considered sources of transmission of parasites, bringing serious consequences to the health of consumers when not properly sanitized [21].*

It is understood that it is necessary to expand the technical knowledge for the handling of these vegetables from planting to their commercialization, observe the technical norms stipulated by Organs competent bodies and, still, understand the ethical importance of guaranteeing the supply of quality products to the population, observing basic factors such as: sanitation in its entirety and scope, use of water resources, garbage and sustainability in the use of the soil.

Parasitic contamination and vegetables

There are numerous ways of contamination by parasitic structures and consequent ingestion of vegetables in natura, considering the various stages in the production chain that can contribute to contamination. In the previous paragraphs, some elements were described for the occurrence of foodborne infection by ingestion of vegetables. In order to have a better understanding of contamination by parasitic structures, it is necessary to define them, that is, what is a parasite and how does contamination occur and its consequences? Parasites are organisms that live in association with others from which they remove the means for their survival, normally harming the organism where

they live, a process known as parasitism [22]. The term parasite has its origin in the Latin *parasitus*, which in turn derives from the Greek tapagitoc (parasites), referring to "one who eats at someone else's table". It became to mean the diner who flattered someone of high social status so that he could eat for free at his home [7][8]. According to [8]: Parasitism is defined as the interaction between two species, one of which is unable to survive and reproduce independently of the other, seeking two fundamental aspects: obtaining food and protection, leading to metabolic dependence on the part of the parasite, and having the host as the only one harmed. When contamination by parasites occurs, which are already installed, several physiological functions can be affected in the host, as they interfere with the absorption of nutrients, causing intestinal bleeding, diarrhea, intestinal obstruction, epileptic seizures, rectal prolapse, portal hypertension, formation of abscesses, anemia. , among others [11]. According to the World Health Organization (WHO) intestinal parasites are the main causes of death worldwide and their highest prevalence occurs in sub-Saharan Africa, Latin America and the Caribbean. Regions that have a geographic zone of hot climate and hygienic-sanitary conditions with rates below the required by the WHO [12].

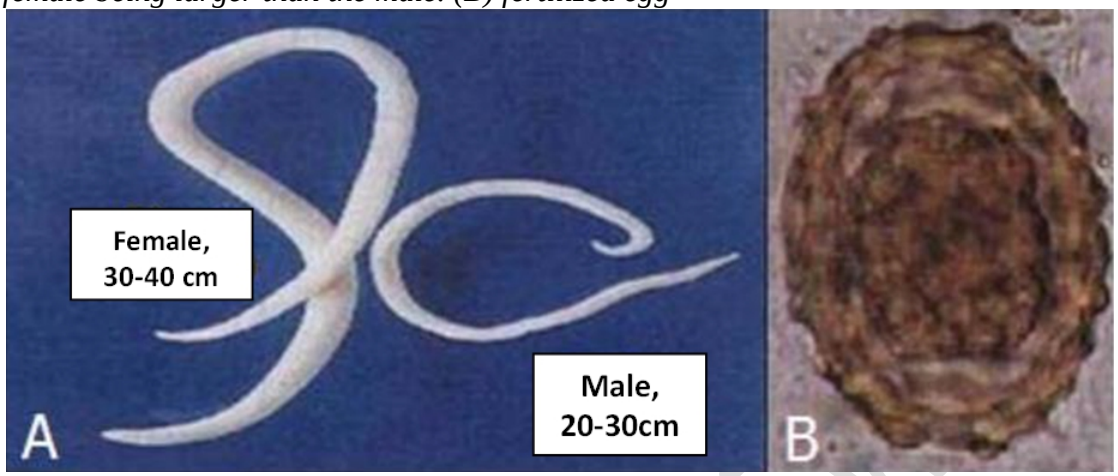
Most common parasites - Helminths

Parasitism by helminths is often associated with infections by nematodes, such as *Ascaris lumbricoides, Trichuris trichiura* [14][15].

Ascaris lumbricoides

According to [16] Ascaris lumbricoides (figure 4) is a cosmopolitan nematode, commonly known as intestinal roundworm, which affects about 30% of the world population. It normally lodges in the small intestine, and can travel to other parts of the body. Its length varies from 15 to 25 cm when male, with spikes on its tail, the female measures from 35 to 40 cm, and both the female and the male have a trilibiate mouth peculiar to the species. Contamination is usually due to the ingestion of eggs present in food, water, dirty objects that are taken to the mouth and the probable presence of eggs in the inhalation or swallowing of respiratory secretions [17]. Also according to [2], the cycle of this parasite takes place in two phases, comprising pulmonary migration (Loss cycle) and the chronic phase that occurs in the small intestine, a period lasting forty days and in which the eggs mature. mouth or feces, starting a new cycle.

Figure 4. *Ascaris lumbricoides. (A) male and female with affiliated ends, the female being larger than the male. (B) fertilized egg*

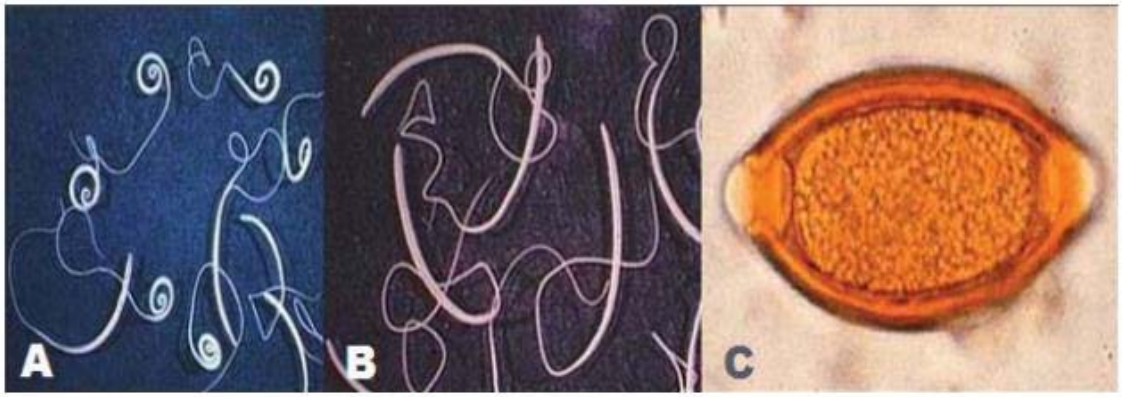


Source: DOLLABELA and BARBOSA, 2006.

Trichuris trichiura

The nematode called *Trichuris trichiura* (figure 5) according to [8], affects mainly children under 15 years of age. Being a cosmopolitan parasite, with prevalence in tropical countries and for its high temperatures that make the eggs evolve more quickly. In addition to socioeconomic characteristics, that is, social inequalities are extremely high. This parasite when adult measures approximately 4 cm in length and whitish in color, the anterior end of the body is filiform and is usually larger than the posterior, where the sexual organs and intestines are located. Adult females lay about 8000 eggs per day, have an elliptical shape, with prominent pores and transparent coloration at both ends, when exposed to favorable environmental conditions, they become embryos in the soil, resisting environmental conditions for many months [3]. Also according [11], in the host the parasite usually lives in the intestinal lumen of the cecum and sigmoid, they are also found in some cases in the colon, gallbladder and digestive tract, causing complications that can lead to death. It was observed that the transmission of these parasites is similar and that it occurs via the fecal-oral route [19]): The mode of transmission is similar to *A. lumbricoides*, through the ingestion of embryonated eggs containing infective larvae via the fecal-oral route. However, a peculiarity of T. trichiura is that it does not perform a pulmonary cycle, and its evolution occurs only in the intestinal lumen [22]. After ingestion of eggs, it takes an average of 30 to 60 days for trichurosis to worsen, as this is caused by the parasite load as well as its duration and may be directly linked to the nutritional status and age of the host. When few parasites inhabit the host the infection is asymptomatic, in moderate infections symptoms such as colic and diarrhea may occur, and when the parasite load is high there is chronic dysentery, tenesmus and abdominal spasms. In children, this infection can cause developmental delay, anemia, rectal prolapse, and subacute or chronic appendix [6].

Figure 5. *Trichuris trichiura. A) Males have a ventrally curved posterior end of the body. B) Females, with the posterior end of the body straight. C) Egg*



Source: DOLLABELA and BARBOSA, 2006

Hookworms

Hookworm is caused by two parasites of the Ancylostomidade family, namely Ancylostoma duodenale and Necator americanus (figure 6). They are relatively small, measuring between 0.5 and 1.5 cm in diameter, and have a head with a hook-like shape, differing in the shape of the teeth. A. duodenale has two pairs of pointed teeth, while N. americanus has a shape of sharp plates, which are essential for such parasites to adhere and attach to the walls of the host's intestine, allowing for hematophagy [5]. These parasites have an infectious cycle different from other parasites, because in their different stages, before infecting humans, they feed on bacteria and organic materials. While they do not infect the host, the larvae still in the soil transform into second and third stage larvae, feeding only on bacteria and organic materials in the soil. After five to seven days, third-stage larvae infect humans directly through skin contact with the larvae or indirectly through ingestion of the larvae [5]. Still speaking of cycles, after the infection of the parasite, the larvae reach the cutaneous venules and lymphatic vessels reaching the afferent circulation to the host, lodge in the pulmonary capillaries, cross the wall of the alveoli and climb the bronchial tree passing through the larynx and pharynx, where they are swallowed and proceed to the small intestine, transforming into adult larvae, according to [7]. Thus, the host presents discrete symptoms such as diarrhea, nausea, vomiting, fatigue, abdominal pain, anemia and malnutrition, since the parasite feeds on blood (hematophagia) and proteins, according to [8].

Figure 6. *Ancylostoma duodenale and Necator americanus respectively. Following, a microscopic image of a hookworm piercing the intestinal wall*

Source: PINHEIRO, 2014.

Protozoa and the main parasitic diseases

According to [9], protozoa are eukaryotic beings, that is, they have a cell nucleus organized within a karyotheca. They are generally heterotrophs, although some are autotrophs, they produce chlorophyll, with which they produce photosynthesis and thus produce their own food. Most protozoa are free-living and aquatic, and can be found in fresh, brackish or salt water. They also live in damp places, crawling on the ground or on decomposing organic matter. Many of them live most of their life as hosts for different species of living beings causing diseases. Reproduction usually takes place asexually, it happens by multiple division, where these microorganisms divide into copies of themselves, other times sexual reproduction occurs, with the exchange of genetic material between one microorganism and another. The term protozoan has its origin in the Latin "proto" – primitive and "zoon" – animal, that is, primitive animal. They are considered animals because they are heterotrophs. The same author classifies protozoa by their ability to move: ciliates, flagellates, rhizopods and sporozoans, as follows:

a) *Ciliates* – move by beating cilia;
b) *Flagellates* – they move by flagella, structures adapted for swimming;
c) *Rhizopods* - they crawl by amoeboid movements, characteristics that microorganisms change shape by the emission of pseudopods, that is, false feet;
d) *Sporozoans* – parasitic microorganisms that spread through the environment and produce many spores that are carried by, through the air and by vector animals such as flies, mosquitoes, ticks.... They do not have locomotor organelles or contractile vacuoles. They contaminate individuals causing diseases and are easily transmitted to other animals [2]. The main diseases that affect human health by protozoa are *Giardiasis, Amebiasis, Trichomoniasis, Toxoplasmosis, Leishmaniasis*, Chagas Diseases and Malaria. The protozooses that can be transmitted by food are presented below.

Giardia lamblia (*Giardia duodenalis*)

Giardiasis is an infection of the small intestine caused by Giardia lamblia (figure 7), also called *Giardia duodenalis*. It is a monoxenous parasite as it does not need an intermediate host. Human contamination occurs by ingestion of the cyst released in the feces of infected people. Having a higher frequency among children and places with precarious sanitary conditions, its transmission is verified directly between children, sexual partners or even, indirectly, through contaminated food or water. The main symptoms are nausea, flatulence, abdominal complaints, bulky foul-smelling stools and diarrhea. The condition is serious and makes it impossible to absorb the most important foods and nutrients, and consequently weight loss occurs. Its dissemination is related to the conditions of hygiene, health education and food [2].

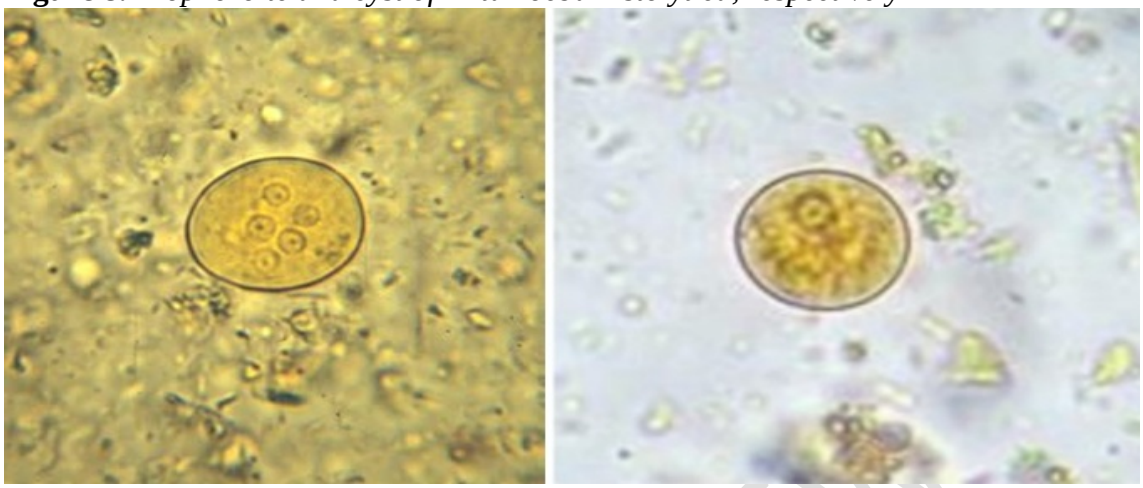
Figure 7. *Trophozoite and cyst of Giardia lamblia, respectively*

Source: https://www.biomedicinapadrao.com.br/2014/03/giardia-lamblia-g-duodenalis-g.html

Amebiasis by Entamoeba histolytica

Amebiasis – Its etiological agent is Entamoeba histolytica (figure 8) which has several intestinal complications, affecting about 4% of cases, interfering with morbidity and mortality. It can cause extraintestinal amoebiasis affecting other organs such as the liver, lung, kidney, brain or skin, although it is rare. Its main symptom is mucoanguinolent evacuation [15].

Figure 8. *Trophozoite and cyst of Entamoeba histolytica, respectively*



Source: https://ibapcursos.com.br/amebiase-entamoeba-histolytica

According to [16], transmission occurs by ingestion of water and food contaminated with cysts or by direct person-to-person contact, through hand contact with dirt from human feces and insects that act as vectors. In 90% of cases the infection can be asymptomatic. It has two clinical forms of consequences, dysenteric and non-dysenteric amoebic colitis, the former being less common and occurring with ulcers in the colon and rectum. The second usually presents with diarrhea outbreaks, alternating with improvements, normal and dry stools. Its chronic form is usually marked by episodes of abdominal pain and non-bloody diarrhea, weight loss, and may cause ameboma or liver abscess.

Toxoplasma gondii

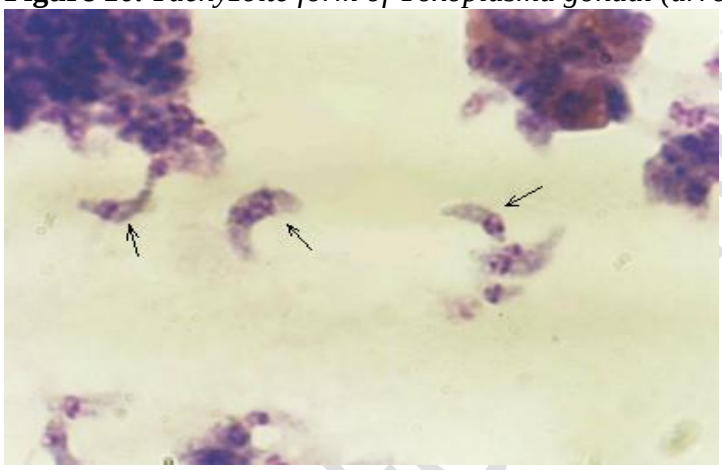
Toxoplasmosis – The etiologic agent of toxoplasmosis is Toxoplasma gondii. The parasite invades the cells of warm-blooded hosts. In adults, it causes asymptomatic chronic infection, which can affect 15% to 60% or more of the population, generating a feverish condition with lymphadenopathy. In children it produces subacute infections with encephalopathy and chorioretinitis which, in congenital cases, is particularly severe. Immunocompromised people with positive serology develop encephalitis. In some cases they present subclinical forms, with adenopathies and fever, malaise, headache, myalgia and anorexia. Its most severe form is congenital [11].

Chagas Disease - *American Trypanosomiasis*

Chagas disease or American trypanosomiasis, a zoonosis that affects 16 to 18 million people in Latin America and 100 million are exposed to the risk of infection. *Trypanosoma cruzi* (figure 11) is transmitted by the feces of the hemipteran insect commonly called barbeiro belonging to the Triatomidae family, especially Triatoma infestans. Chagas' infection has two distinct phases: the acute or initial phase, asymptomatic, or symptomatic, with fever,

adenomegaly, hepaesplenomegaly, unilateral conjunctivitis (Roman's sign), myocarditis and meningoencephalitis. It is fatal in 10% of severe cases. It can remain dormant for 10 to 15 years and affected people can develop three main forms of the disease: the cardiac form (chronic myocarditis and heart failure), the digestive form (megaesophagus and megacolon) and the mixed form, heart diseases and megas simultaneously). In a survey carried out by [14] analyzed data on oral infection of acute Chagas disease and the lethality rate of this form of transmission. In a systemic review of 973 articles published from 1968 to 2018, 2470 cases were recorded, with 97 deaths. The study states, “that today the contamination occurs more by the ingestion of contaminated foods, in particular, açaí, but other foods can also be contaminated, as is the case of sugar cane, juices and other foods”.

Figure 10. *Tachyzoite form of Toxoplasma gonddi (arrow)*



Source: http://www.ufrgs.br/para-site/siteantigo/Imagensatlas/Protozoa/ Toxoplasma.htm

Figure 11. *Epimastigote forms of Trypanosoma cruzi predominant in invertebrate hosts. It evolves into the metacyclic trypomastigote and can contaminate food through the contaminated feces of the insect vector (hemipterans known as “vinchuca”).*https://estudeparasitologia.wordpress.com/2016/05/28/19/t-cruzi-epimastigota-2-2/

In view of the above, it is understood that understanding how the transmission and infection of parasites takes place, as well as which are the main and best known, is necessary to complement the learning process in the collection of research data, the primary objective of this work.

Materials and Methods

Type of study

This is an experimental quantitative research, with the objective of verifying how many specimens of green smell are contaminated.

Study location

The study was developed in the municipality of Bragança Paulista, state of São Paulo, Brazil.

Sampling

The green smell samples (chives, parsley and coriander) were randomly acquired in street markets, municipal market, retail stores and supermarkets in different districts of the city. The name of the establishments will be identified by letters (A, B, C...). The collections were carried out in two moments: a collection in September 2018 and another research in April, 2019.

Processing and Analysis of Samples

In the proposed months, 15 samples of green chives composed of chives and parsley and 15 samples of green chives composed of chives and coriander were collected, totaling at the end, 60 samples of chives, 30 of parsley and 30 of cilantro.

The samples were individually packed in airtight plastic bags, placed in styrofoam boxes and sent to the Multidisciplinary Laboratory of the Faculty of Sciences and Letters of Bragança Paulista (FESB) immediately after collection. At the time of analysis, roots, stalks and bulbs of the samples were discarded. Subsequently, the properly selected leaves (disregarding the deteriorated ones) were weighed and washed in 200 ml of distilled water with five drops of neutral detergent. The resulting liquid was filtered through gauze into a sedimentation cup and the filtrate subjected to the spontaneous sedimentation method for 24 hours, - spontaneous sedimentation is also known as the Lutz or Hoffman, Pons and Janner method, it allows eggs to be found, of helminth larvae and protozoan cysts [19]. Figures 12, 13, 14 and 15 show the process carried out in the laboratory to obtain the filtrate to be sedimented and subsequently analyzed. After 24 hours of sedimentation, 6 ml of the precipitate was collected and centrifuged at 3000 rpm for 3 minutes. The final sediment

was transferred to a slide, stained with lugol, covered with a glass coverslip for direct examination under an optical microscope at 40x magnification to look for parasite eggs. Two analyzes were performed for each sample. The structures visualized were identified using specific literature. The entire procedure, from the collection to the end of the analysis, was developed using latex gloves.

Results

In total, 38 samples obtained from four different establishments were analyzed. The results are shown in table 1, identifying the type of parasitic structure found. The results refer to the analysis of 38 processed samples. Of these, only 9, that is, 23.6% were negative for parasitic structures or structures similar to these, that is, 76.4% presented some form of parasitic structure that is not necessarily human.

Figures 12 and 13. *Preparation of the material (green smell) that was selected, cut and washed with distilled water and detergent for subsequent sedimentation*

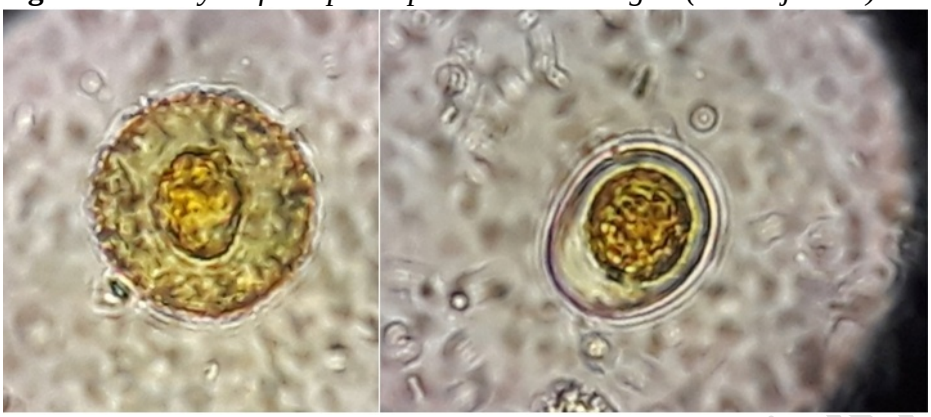
Figures 14 and 15. *After being filtered, the material was subjected to spontaneous sedimentation for 24 hours*

Among the parasitic structures found, we can observe eggs of Hymenolepis nana, eggs of *Hymenolepis diminuta*, oocyst of *Isospora sp*. and *Eimeria* and *Endolimax nana* cysts. *Hymenolepis nana*, also known as "dwarf tapeworm" is a small flatworm that can infect humans. It has medical importance, easy resolution and symptoms only appear when the individual has a large number of worms. Rodents have a species of hymenolepis (*Hymenolepis fraterna*) morphologically identical to H. nana. In this case, only an examination of the genotype of the tapeworms found would be able to determine the species [13]. *Hymenolepis diminuta* is known as the mouse tapeworm. Its medical importance is almost nil, and when the human being is infected, the cure can be spontaneous or it is processed by the administration of a simple purgative or any drug with tenifugal action [13]. The genus Isospora contains many species and therefore can parasitize a wide variety of hosts. Important species include parasites of swine, dogs and cats, animals that live close to humans and are often found in vegetable growing areas. It can cause alterations in the intestinal mucosa, whose severity is related to the parasite density and the location of the parasites in the mucosa [15]. According to [11], isospores produce benign infections of the small intestine, causing an inflammatory reaction in the mucosa. However, most cases are asymptomatic and cure spontaneously. In the case of oocysts of *Eimeria sp*., numerous species belong to the suborder Eimeriina, causing serious diseases in birds, cattle and other animals of economic importance to humans. There is no medical importance for humans. Of those mentioned, only *E. nana* is an exclusively human protozoan that, however, is not considered a parasite but a commensal of the intestine. In three samples (7.89%) *Giardia lamblia (G.*

duodenalis) cysts were detected. Giardiasis, being considered a zoonosis, can contaminate domestic and wild animals, in addition to humans. The cysts found may come from animals that had access to the vegetables that make up the green smell examined. According to [4] *Giardia lamblia* presents great genetic heterogeneity, despite the uniform morphology. Only certain genotypes infect humans and other animals, while others correspond to zoonosis and do not parasitize humans. As mentioned for the *Hymenolepis*, only tests related to the genotype would determine whether the species found could parasitize humans. Amoebids that were not subject to specific identification were also observed. Eleven samples (34.3%) had hookworm larvae. Hookworms are difficult to identify, since they can be parasites of humans, other animals, free-living and also parasites of plants (phytoparasites), requiring the specimens found to be identified through specific techniques. Only free-living nematodes and phytoparasites were identified in the positive samples. In the case of hookworms from other animals, an attempt to penetrate the human skin may occur, which is the form of infection of the worm. In this case, serpiginous dermatitis or cutaneous larva migrans may occur in large infections where the number of worms is abundant. In the case of dog or cat hookworms (Ancylostoma caninum and Ancylostoma braziliense respectively), the worms normally roam the skin, failing to penetrate to the intestine, causing the "cutaneous larva migrans", better known as geographic bug. Phytoparasitic hookworms do not cause problems for humans. In the soil, there are also many species of free-living nematodes, which make up the edaphic fauna, not having a parasitic relationship with plants or any other animal.

Trichostrongylus sp. is a common worm in animals, especially in ruminants, having medical importance in veterinary medicine. The incidence is low in humans. In a work developed by Pardini, et al. (s.d.), the results of 290738 routine coproparasitological examinations, carried out from September 1996 to May 1997, in individuals of both sexes, aged between five and 72 years, were analyzed. Of the samples analyzed, only 23 (0.0079%) were positive for eggs of Trichostrongylus sp. Other structures similar to eggs and cysts of parasites were also found, but which are not human parasites, indicating contamination by feces from other animals. Figures 16, 17 and 18 show some structures found.

Figure 16. *Egg of Hymenolepis diminuta stained with lugol (40x objective)*
Figure 17. *Oocyst of Isospora sp. stained with lugol (40x objective)*



Comparing the results obtained so far with other works found in the specific literature and dealing with the same topic, the green scents purchased in supermarkets and retail stores in Bragança Paulista-SP are shown to be little contaminated with parasitic forms of medical importance.

Figure 18. *Free-living hookworm larvae stained with lugol (40x objective)*

Table 1. *Result of the analysis of 38 samples of green scent acquired in establishments in the municipality of Bragança Paulista between the months of September 2018 and another in the month of April 2019. The table identifies the place where the green scent was acquired, the quantity of samples, the total weight and the qualitative diagnosis per sample analyzed*

Location	Number of samples	Total weight	Diagnosis
A	4 samples	332,81 g	A1- hookworm larva A2 – Hymenolepis diminuta egg, Trichostrongylus egg, Endolimax nana cyst, amoebid A3 – Hymenolepis diminuta egg A4 – Trichostrongylus egg
B	4 samples	217,04 g	A5 – egg of Hymenolepis diminuta, oocyst of Eimeria A6 – hookworm larva, Eimeria oocyst A7 – Eimeria oocyst A8 – Hymenolepis diminuta egg
C	3 samples	240,35 g	A9 – hookworm larva A10 – hookworm larva A11 - negative
D	4 samples	526,61 g	A12 – hookworm larva A13 - negative A14 - negative A15 – Trichostrogylus egg
	4 samples	458,21 g	A16 – Endolimax nana cyst A17 – Blastocystis sp cyst A18 – Endolimax nana cyst A19 – Blastocystis sp cyst
D	3 samples	321,14 g	*A20 - negative* *A21 - negative* *A22 – Giardia lamblia cyst, Eimeria oocyst*
	4 samples 4 samples		A23 – hookworm larva, Endolimax nana cyst A24 – hookworm larva A25 – hookworm larva A26 – hookworm larva *A32 – amoebiasis cyst* *A33 – Trichostrongylus egg* *A34 – Endolimax nana cyst, Giardia lamblia cyst* *A35 – Giardia lamblia cyst, hookworm larva, Trichostrongylus egg*
	3 samples		A36 - negative A37 – hookworm larva A38 – hookworm larva
TOTAL	**38**		

At the end of the research, it was concluded that further studies are necessary to analyze each structure compatible with human parasitism found, the possible risks of contamination and possible forms of prophylaxis and possible control of application in the sale and consumption of vegetables consumed in natura.

Discussion and Conclusions

At the end of the research, it is concluded that, when compared with other researches, little contamination of the vegetables in question was observed. Given this, it does not mean to say that it does not exist, but that there is or was care taken with the hygiene of the products throughout the planting and cultivation process, stock and sale. When analyzing the results obtained and comparing them with the specific literature, it is necessary to emphasize that, in addition to ensuring good practices in the production of vegetables, the consumer must ensure their adequate hygiene before consuming them, especially in the case of vegetables consumed raw, such as the green smell herbs.

Sanitization does not eliminate all organisms to a level that poses no risk to the consumer. Total elimination only happens when the product is sterilized and/or cooked, according to [22] (Annex A). It still has references of when and how to use the sanitizer (Table II). It was also noticed, in the literature review, that there is a mismatch in programs aimed at controlling parasitic diseases in countries where there is precarious investment in public health and basic sanitation and with great social inequalities, which makes it impossible for individuals to have adequate access to health and well-being. Therefore, it is more than essential educational strategies that promote, together with producers, sellers and the general population (consumers), habits that reduce the risks of contamination in the use and ingestion of raw vegetables.

Vegetables for consumption must not contain any type of parasitic structure. In this study with vegetables, specifically the green smell, eggs and cysts of some hookworm parasites and larvae were found, although most of them do not cause direct damage to the health of the population. Therefore, the importance of broad investment in health education is emphasized through popular education on hygienic habits, mainly involving rural producers. The lack of knowledge can lead the producer to use untreated water that can be contaminated with parasites, to use feces of non-wormed animals as fertilizer and also the lack of hygiene at the time of handling. This influences the quality of the products, putting the health of those who consume these vegetables at risk. In this sense, municipal health programs such as the Family Health Program (PSF), for example, can help clarify adequate hygienic habits. It is also important to discuss with the public management of basic sanitation services the importance of these strategies. As stated by [2], “sanitary education is based on the design of planning that aims at benefits and efficient public management of basic sanitation services”. With regard to consumers, the

insertion of health education in the school context is of paramount importance, in order to teach and promote basic hygienic habits for the maintenance of health in children, adolescents and, by extension, for the whole family.

Table 2. *Types of vegetables and proper conduct in cleaning each type*

Vegetables	Washing in running water	Sanitization	Rinse
Leafy vegetables eaten raw (examples: lettuce, chicory, cabbage, watercress, arugula).	**Yes**	**Yes**	**Yes**
Leafy vegetables consumed cooked (examples: kale, cabbage, spinach).	**Yes**	**not needed**	**not needed**
Other vegetables consumed raw with the skin (examples: tomato, radish, cucumber).	**Yes**	**Yes**	**Yes**
Other vegetables consumed raw without skin (examples: carrots, beets).	**Yes**	**not needed**	**not needed**
Cooked vegetables (all).	**Yes**	**not needed**	**not needed**

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