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## Research Article

### PARASITOLOGICAL ANALYSIS OF STRAWBERRIES SOLD IN STREET MARKETS AND SUPERMARKETS IN A CITY FROM THE INTERIOR OF BAHIA

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#### ABSTRACT

The morphological structure of strawberries acts as a good transmission vehicle parasitic to the fruit, and, due to its structure, it complicates the sanitization effectiveness. This study aims to verify the occurrence of enteroparasites in strawberries commercialized in street markets and supermarkets, in Vitória da Conquista, Bahia - Brazil. The strawberry lots were analyzed in isolation by site, with each lot containing 23 fruit units totaling 522 samples. The samples were analyzed by spontaneous sedimentation method. It was noted that 92.5% of the samples were contaminated by enteroparasites, such as: *hookworms* eggs, *Entamoeba coli* cysts, *Strongyloids* larvae, Yeast hypha, *Giardia* cysts, *Endolimax nana* cysts, mite ectoparasites, *Fasciola hepatica* eggs and *Ascaris lumbricoides* eggs. It was concluded that the strawberries commercialized in the street markets and supermarkets in Vitória da Conquista (BA), has a major role in the dissemination of enteroparasitic diseases when not properly cleaned and sanitized before its consumption.

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#### INTRODUCTION

The progress of intestinal parasites is directly caused by the precarious health and poor hygiene. For this reason, the population is subjected to parasitic contamination caused precisely by this lack of sanitation, thus favoring the development of opportune environments for spreading these infections being evidenced a large public health concern (Esteves; Figuerôa, 2009),(Kumar et al., 2017).

The food habit of using vegetables *in natura*<sup>1</sup>It provides great exposure to the forms of transmission of intestinal parasites (Soares; Cantos, 2006),(Yeniet al., 2015). This propagation occurs in most cases by fecal / oral route, is through consumption of water and / or food contaminated by fecal waste containing larvae or helminth eggs, protozoan cysts or fecal coliforms (Soares; Cantos, 2005),(Mulder, 2017).

According Oliveira et al. (2016), as well as supermarkets, grocery stores and produce, at street markets can be found vegetables in general, however, the way they are exposed at trade shows, displayed in pads or the ground, it is more a risk

factor for infection of such especially when it comes to foods that are usually eaten raw and do not need to be peeled for consumption.

The strawberry, for this reason, it is stands out in the list of the most contaminated food list, especially for being consumed in its natural state, it is widely used in cooking and, moreover, be a ground plant that is more exposed to dirt ground (Oshita; Garden, 2012). According Antunes, Carvalho and Santos (2011), the strawberry is classified as a pseudo fruit because it comes from a flower that has multiple ovaries and these ovaries are producers of fruits. Also according to the authors, the strawberry component that is commonly called seed, is actually the true fruit, named achene. The same also emphasize that the true fruit is actually the part where are the seeds, as with apples, for example.

Despite the risk of contamination, strawberry, as well as other vegetables are indicated in daily meals, since they have functional and nutritional properties quite diverse. However, it is important highlight the risks that consumers are exposed, for example, microbiological contamination and parasite, which as certify Esteves and Figueirôa (2009) and Kumar et al. (2014), in

<sup>1</sup>In pure state; without passing through processing (Michaelis, 2017)

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cases of infection"cancause symptoms such as diarrhea, anemia, intestinal obstruction, bleeding and death".

Still on the care of the cleaning of *Fragariavesca* (Strawberry), the Agência Nacional de Vigilância Sanitária (ANVISA) defined by Resolution No. 12 of 1978 that strawberries must conform to a standard in relation to a group of bacteria and no dirt, parasites and larvae.

Thus, conducting research on the presence of parasites becomes important, because through the diagnosis is obtained information about the hygienic sanitary conditions during production, storage, transport and handling at the time of marketing of vegetables (Silva et al., 2014). The study was directed to research parasitological quality strawberries sold in street markets and supermarkets in the city of Vitória da Conquista – BA.

### METHODOLOGY

The study site, the city of Vitória da Conquista, has a tropical climate, tempered by the relative altitude of the place and is one of the cities that record the milder temperatures in the state of Bahia, reaching record 6.2°C in 2006 although temperatures have already been recorded below 5°C in several previous years (Vitória da Conquista, 2017).

Strawberry samples were collected sold in 03 street markets and 03 supermarkets, selected randomly in the city of Vitória da Conquista - Bahia, between the months of May and June 2017 are collected in each location 01 lot (23 strawberry samples) per week for four weeks, totalizing 24 batches (552 strawberry samples). The collection was randomly made, as well as the place that was sold to the consumer.

The street markets are quite popular and frequented on a daily basis by the population, however, is over the weekend that the flow of people is more evident, resulting in a greater amount of marketed products (Oliveira et al., 2016). As well as the street markets, the chosen supermarkets, which are also located in different districts of the city, made it possible to obtain a larger sample in order to not achieve similar results if the suppliers are the same.

All samples were sent to the Parasitology Laboratory, Faculdade Independente do Nordeste - FAINOR, packed in aseptic disposable plastic bags and analyzed by spontaneous sedimentation method, also known as the method Hoffman Pons and Janer (HPJ)(1934) widely used for its low cost and easy implementation. This method is specific mainly for research eggs or larvae of helminths, cysts and oocysts of protozoan.

In the laboratory to prepare the sample was used 200g of strawberry, which is equivalent to a lot, to be rubbed and washed in 250ml of distilled water. The washing water was filtered in sieve covered with gauze folded four times, deposited on glass for 24 hours as the spontaneous sedimentation technique.

After this process, the supernatant liquid was carefully discarded, and then homogenizing the sediment and collect a drop of the same. Part of sediment was placed into a blade superimposing a coverslip and examined under microscope at 10x and/or 40x objective. Each slide was examined in duplicate.

For identification of protozoan cysts and larvae of helminths, the preparation was stained with lugol, for better viewing.

### RESULTS AND DISCUSSION

We analyzed 12 different batches of each street market and each supermarket, and totaled 522 samples of fruits. In 483 (92.5%) were identified parasitic provisions, such as hookworms eggs, *Entamoeba colicysts*, larvae of *Strongyloidesstercoralis*, hyphae yeast, *Giardia lamblia* cysts, *Endolimaxnana*, ectoparasitic mites, *Fasciola hepatica* eggs and eggs of *Ascarislumbricoides*.

There has been a considerable disparity between the results found in the samples collected in supermarkets and street markets, because they had less parasitic provisions in relation to samples from supermarkets, as evidenced in Tables 1 and 2 below. Note that in a few weeks when we did the analyzes of strawberries, it was observed that the samples collected showed no forms of contamination as result, information that can also be seen in Tables 1 and 2.

**Table 1** Enteroparasites found in three supermarkets in a city in Bahia in the four-week period.

Parasites	Supermarket		
	A	B	C
Hookworms eggs	x		
Entamoeba coli cysts	x	x x	x
Strongyloidsstercoralis larvae	x	x x x x x x	x X
Yeast hypha	X		x
Giardialamblia cysts		x	x
Endolimax nana cysts		x	
Fasciola hepatica eggs			x
Mite Ectoparasites	x		
Ascaris lumbricoides eggs			

Source: Research Data, 2017

**Table 2** Enteroparasites found in three street market in a city in Bahia in the four-week period.

Parasites	Street Market		
	A	B	C
Hookworms eggs			
Entamoeba coli cysts		x	
Strongyloidsstercoralis larvae	x x	x x x x	x x
Yeast hypha	x x		
Giardialamblia cysts	x	x x	
Endolimax nana cysts			
Fasciola hepatica eggs			
Mite Ectoparasites			
Ascaris lumbricoides eggs		x	

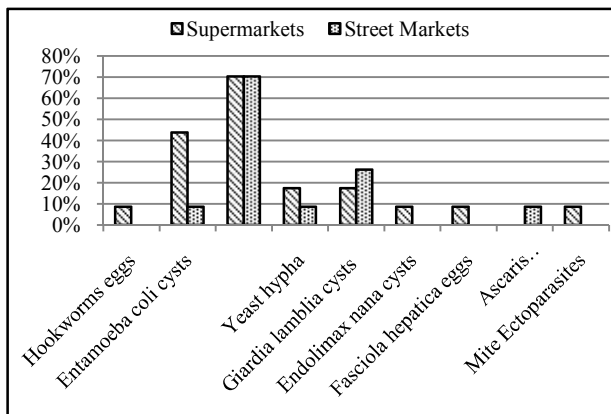
Source: Research Data, 2017.

The results corroborate with the studies of Silva et al. (2014), conducted in the Federal District, using the Hoffman and Willis method, and Silva et al. (2016), in Goiânia with the techniques of Hoffman and Faust, even though only cleaned washing and Hoffman technique, in which the same parasitic species: Hookworm, *Endolimax nana*, *Strongyloides spp.*, *Entamoeba coli*, *Ascaris lumbricoides*.

For Silva et al. (2014), the contamination of strawberries can happen as a result of scarce hygiene among handlers of strawberries, contact between contaminated soil and strawberries, irrigation with contaminated water or even across contamination after harvest and storage. This study was conducted with all appropriate IPE – Individual Protection

Equipment to simulate exactly the same displacement conditions of strawberries, originating at street markets and supermarkets, aimed at consumers' homes. Silva *et al.* (2014) who comprises that the soil is a favorable environment for the helminths, this would be a probable route of contamination.

It can be seen from Graph 1, both in supermarkets and in the street markets there are, the presence of larvae of *S. stercoralis* similar to the work of Oliveira *et al.* (2016), where the most frequent group in almost all their samples belonged to this nematode whose has as component of its life cycle the soil, and has man as its main reservoir and source of infection.



**Graph 1** Comparison of parasites found in strawberries sold in supermarkets and street markets of a city in Bahia.

Source: Research data, 2017.

The survey was based by analyzing articles about the contamination of vegetables, which is similar to strawberries, for lack of research on the topic. However, as Rocha, Mendes and Barbosa (2008) and Duedu *et al.* (2014), claims which in made discussion about *stercoralis* *Strongyloides* and other parasites found in lettuce in Recife, due to poor sanitation and hygiene, vegetables are classified as one of the main vehicle transmission.

Although *Entamoeba histolytica* is the kind of pathogenic amoeba, one should not disregard the presence of other types of food amoeba such as *Entamoeba coli*, for reasons of contamination by fecal-oral equipment (Esteves; Figuerôa, 2009)(MOHAMED *et al.*, 2016). Therefore, it is important that the diagnosis be made and be reported that the presence of these commensals, due the development of prophylactic measures in order to preserve infections, for this and other parasites (NOMURA *et al.*, 2015).

Not unlike Nomura *et al.* (2015) and Oliveira *et al.* (2016), *Ascaris lumbricoides* were found in small quantities. As Mites ectoparasites and unidentified species, from fresh water, since there are often used in irrigation. (Oliveira *et al.*, 2016).

It should be analyzed morphological structure of strawberries, for reasons of this conformation complicate the sanitizing effectiveness. Thus, fresh produce such as vegetables and fruits, such that the strawberries are highly perishable and extremely vulnerable to parasitic attacks (Silva *et al.*, 2014). In addition to monitoring the hygienic conditions of the soil, irrigation water, transportation and handling of these foods, it is important emphasize the importance of health education process, such as the sewerage system and cesspools for all, giving a better hygienic condition to handlers and population

who consumes these foods (Esteves; Figuerôa, 2009), (LUZ *et al.*, 2017).

## CONCLUSION

On the results obtained in this study, it is considered that the samples of strawberries sold in street markets and supermarkets in Vitória da Conquista in Bahia, had different parasitic forms. It is also observed that the strawberries sold insupermarkets were more contaminated compared to strawberries sold instreet markets.

This means that this fruit has a low hygienic standard, making it necessary to sanitize before consumption occur the infection of the consumer. However, if adequate cleaning procedures are not carried out, there may be consumer infection, since this fruit is considered a good vehicle for the transmission of intestinal parasites.

Therefore would be appropriate educational campaigns for guidance of producers and consumers to warn the risk of strawberries not properly washed and disinfected before consumption.

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