

SOIL CONTAMINATION IN URBAN SQUARES AND BEACHES BY LARVAE OF *STRONGYLOIDES* SPP. AND HOOKWORM IN A TOURIST TOWN IN NORTHEASTERN BRAZIL

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ABSTRACT

Helminth parasites are widely distributed in nature, they are known as humans and animals parasites. The hookworms and gender *Strongyloides* spp. cause skin, pulmonary and intestinal disease. In common, these helminths have infective forms present in the soil. In this sense, this study had as objective to evaluate the contamination of beaches and squares of Natal / RN (regions of great circulation of people and animals) by larvae of hookworms and *Strongyloides* spp. during the period between July 21, 2015, and February 1, 2016. The larvae were searched in regions of different humidity and luminosity. The soil samples were submitted to the Baermann-Moraes method to search for the larvae, which were then morphologically differentiated by light microscopy. The prevalence of human parasites in the six beaches was 16.7% while in 118 urban squares was 11.76%, in both sites the hookworms were more common. The parasites were found preferentially in hot and rainy periods. This is the first survey of the type carried out in the State and in an unprecedented way concludes that in Natal/RN there are squares and beaches contaminated by parasites that may represent a risk to human health, so are necessary public health measures that act mainly on the adequate removal of sewage, trash and stray animals.

Keywords: Hookworm. *Strongyloides* spp. Soil. Beaches. Squares.

RESUMO

Os helmintos são parasitos amplamente distribuídos na natureza, nestes diferentes ambientes são reconhecidos por parasitar humanos e animais. Dentre vários, os ancilostomídeos e o gênero *Strongyloides* spp. aparecem como causadores de doenças da pele, pulmonar e intestinal. Em comum, esses helmintos apresentam formas infectantes presentes no solo. Neste sentido, este estudo teve como objetivo avaliar a contaminação de praias e praças da cidade do Natal/RN (regiões de grande circulação de pessoas e animais) por larvas de ancilostomídeos e *Strongyloides* spp. durante o período entre 21 de julho de 2015 a 01 de fevereiro de 2016. As larvas foram pesquisadas em amostras de solo expostos a diferentes umidade e luminosidade e posteriormente estas foram submetidas ao método de Baermann-Moraes para busca das larvas, que foram então diferenciadas morfológicamente por microscopia óptica. A prevalência dos parasitos investigados nas seis praias foi de 16,7% enquanto que nas 118 praças urbanas foi de 11,76%, em ambos os locais os ancilostomídeos foram mais encontrados. Os parasitos foram encontrados preferencialmente nos períodos quente e chuvoso. Esta é a primeira pesquisa do tipo realizada no Estado e de forma inédita conclui que em Natal/RN existem praças e praias contaminadas por parasitos que podem representar um risco à saúde humana, sendo necessárias medidas de saúde pública que atuem principalmente na remoção adequada de esgotos, lixo e animais vadios.

Palavras-chave: Ancilostomídeos. *Strongyloides* spp. Solo. Praias. Praças.

1. INTRODUCTION

Contamination of public places such as parks and beaches by human or animal feces are a major public health problem [1] because of the possibility of parasitosis transmission, especially for children, which often have less knowledge about good hygiene practices. This

condition makes them vulnerable to infection by parasites that live in the soil, especially the group of hookworms and *Strongyloides* spp. [2,3].

These cause ancylostomiasis (*A. duodenale*, *Necator americanus*) and strongyloidiasis (*S. stercoralis*) which are intestinal diseases that can affect the nutritional balance. These diseases affect the absorption of nutrients (causing anemia), can cause intestinal bleeding, decrease food intake and may also cause other significant complications such as abscess formation, which may cause the death of the individual [4,5,6]. However, in some cases may be observed atypical symptomatology as in accidental human infection with *Ancylostoma caninum*, with the development of cutaneous larva migrans [3,7]. About typical manifestations can occur eosinophilic enteritis and suggested as a possible cause of diffuse unilateral subacute neuro retinitis in humans. Others typicals manifestations include eosinophilic pneumonitis, localized myositis, folliculitis, erythema multiforme, or ophthalmological manifestations [8]. In patients who use corticosteroids may be observed hyper infection by *Strongyloides* that is usually fatal [4,9].

These parasites have a cosmopolitan distribution and are more common in developing countries, especially in areas of poor sanitation [3,10]. As these helminths do not require an intermediate host and the maturation of their eggs or larvae occurs essentially in the soil, their cycles are dependent and influenced by the fate of human waste and community basic sanitation, with the correct treatment of the sewage before its release in the environment [11,12]. It is well established that the maturing of the eggs and the period of survival of the larvae depends on factors such as temperature, humidity, pH, soil porosity and consistency, degree of exposure to solar radiation, rains, winds, besides the presence of some animals, plants and microorganisms, among others [13]. So, This knowledge could then facilitate the elimination of these parasites, thus reducing the risk of infections.

Due to lack of data on the prevalence of these parasites in Natal, Brazil, this study aims to determine the local prevalence of hookworms and *Strongyloides* spp. in squares and beaches of the four areas of the city, besides elucidating characteristics associated with infection such as soil and environment temperature, and relative humidity.

2. MATERIAL AND METHODS

2.1 CHOICE OF SQUARES AND BEACHES

We investigate all 6 urban city beaches and based on information consulted at City Hall, we find that in Natal there are 245 squares. Then for a 95% confidence interval, the necessary sample size was 110 squares. Through a sample selection for convenience, we researched 118 squares distributed in 4 areas of the city.

2.2 COLLECTION AND PROCESSING OF SAMPLES

Samples were collected using a PVC pipe measuring 5 cm in length x 6 cm in diameter. At the collection time, the PVC tube was inserted and we collected 5 soil samples of 5 distinct points in each collection site. At this moment, it was also soil temperature measured. The depth reached was between 5 and 10 cm. The samples were taken from places with solar luminosity and others protected from light. We checked the ambient temperature and relative humidity at the atmospheric monitoring system.

After collection, the samples were identified with the sample number, place and date, and transported in polystyrene boxes to the Teaching Laboratory Parasitology, Department of Clinical and Toxicological Analysis, Federal University of Rio Grande do Norte. The processing of samples was conducted by Baermann-Moraes method. This method was chosen because using thermotropism and hydrotropism of these parasites. The samples were processed immediately after collection and, when it was not possible, they were stored at 4 °C for up to 24 h.

2.3 IDENTIFICATION OF LARVAE

We carry out the identification of the larvae through their morphological differences in optical microscopy, in 10 or 40x magnification, focusing on the mouth, tail and genital primordium.

2.4 DATA ANALYSIS

After samples' analysis, we classify the beaches and squares into different categories according to the presence or absence of Hookworms or *Strongyloides*. Then, data were analysed by one way analysis of variance (ANOVA). It was used GraphPad 6.0 software for graphical design (GraphPad Software, La Jolla, CA, USA) and statistical analysis.

3. RESULTS

Among the 6 analyzed beaches, we found helminth larvae in 3 of these (prevalence of 50%). However, in only one sample it was possible to observe some of the parasites investigated (filariform larval hookworm), the overall prevalence of 16.7%. During this period, the soil temperature varied between 26-31°C, the ambient temperature ranged between 24.4-26°C and air relative humidity (%) between 87-95%.

When analyzing the soil samples from different squares, we found that 11.86% of these were contaminated by hookworm larvae or *Strongyloides* spp., with prevalences of approximately 54% and 40%, respectively (Table 1).

Table 1. Total number of squares from municipal and parasites found in these.

Zones	Number of squares	Negative	Positive (Hookworm)	Positive (<i>Strongyloides</i>)	Other parasites
North	30	28	0	1	1
South	40	24	3	1	13
East	36	16	5	2	12
West	12	10	0	2	1
Total	118	78	8	6	27

Among the positive samples, we verified that the air relative humidity (67 versus 66.1%) and soil temperature (31.3 versus 25°C) were higher than in negative samples. Our data show that the positive results were preferentially verified in the samples collected in the second half of the year (Figure 1). In this period, traditionally there is a greater amount of rainfall in northeastern Brazil.

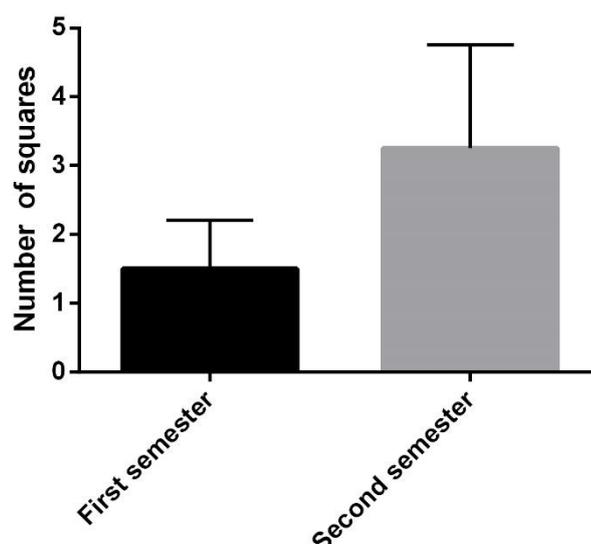


Figure 1: Number of positive squares for larvae of human parasites according to time of year.

4. DISCUSSION

Natal, Brazil, has about 870 000 residents and is famous for a large number of tourists it receives annually. It has a tropical humid climate (average temperature 28°C) and is located at latitude 5°47'42" S and longitude 35°12'32" W. The hookworm-related infection are common in endemic areas mainly in low-income communities, but also in tourists visiting beach destinations in tropical areas. The caused disease presents discomfort and substantial morbidity [14]. This is particularly dangerous for tourists because they are often unaware of the risks to which they are exposed.

The presence of larval hookworm and *Strongyloides*' forms in public squares soils have been reported in other similar studies [15,16,17]. Similar to the observed in this research, we also find in the scientific literature that it is common to find a superior prevalence of hookworm larvae in relation to *Strongyloides* spp. [18,19]. It is also important to reaffirm that many people who circulate in these places may be the major risk groups for severe forms of parasitic diseases, where they are often unaware of the risks.

It is of great importance to emphasize that the presence of the larvae of these helminths is a serious public health problem since the larval stages are the infective forms of these parasites, representing a fast route of infection [19]. It is also important to reaffirm that many people who circulate in these places may be the major risk groups for severe forms of parasitic diseases [9,20], where they are often unaware of the risks.

In our research, we observed soil temperatures and air humidity higher in samples positive for larvae of these helminths. These are factors previously confirmed that influence the larvae's development until they reach the point of being infectious to humans [21].

In northeastern Brazil it has been observed that the occurrence of larvae of soil parasites is directly related to the composition and temperature of the soil, also depending on the amount of rain [22]. Our data show that the results are positive especially when the collection occurs in the second half of the year, where there is a greater amount of rainfall. The peak incidence coinciding with the rainy season was noted earlier [17,23,24]. It is well reported that embryonated eggs and larvae survive longer in wet soil than in dry soil and are dispersed over a wide area by heavy rainfalls. Consequently, the risk of desiccation of eggs and larvae is much higher in the dry season than the rainy season [14]. This explains the higher prevalence of these helminths in moist soil.

Finally, the other parasites are normal and probably occurs by animals that roam freely in these areas, freeing up their feces and then favoring the spread of these organisms [25].

5. CONCLUSIONS

The general knowledge about the contamination of public environments by geohelminths larvae is very limited both by the population and by the public authorities, although there are some isolated studies. Our data show that there are potentially infectious environments in this city. We also conclude that in the squares and beaches investigated there was a higher prevalence of hookworm larvae. Positivity was higher in warmer areas and during the period of increased rainfall. This prevalence is unprecedented research in the region and serves as a warning to health authorities and the general population using these public areas.

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