

Evaluation of seasonal influence on the incidence of eggs and larvae of intestinal parasites in squares in the city of Macapá-AP

Avaliação da influência sazonal na incidência de ovos e larvas de parasitos intestinais em praças no município de Macapá-AP

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ABSTRACT

Diseases related to parasitosis are a relevant public health problem due to the different complications that these can cause, and the provision of epidemiological data is aimed at reversing this situation. The objective of this work was to evaluate the frequency of eggs and larvae of helminths in the county of Macapá, as well as the influence of seasonality on the incidence of contamination of public squares in seasons from winter to summer. In this study 1 sample containing 3 strategic points of soil of each square was analyzed, totaling 39 squares, divided in different neighborhoods. The choice was made according to the zones that divide the county, totaling 39 samples in properly sealed containers. The methods used were: Hoffman, Direct, Willis and Baermann Moraes. The results showed the high parasitic load in the public places, mainly in the winter season, when we noted a high prevalence of *Toxocara* spp. In the summer and winter we obtained a highest prevalence of *Ancylostoma* spp. eggs, which justifies an immediate action by the public authorities regarding the presence of these agents in the environment, with control of animals, basic sanitation, availability of treatment and periodic maintenance of public squares.

KEYWORDS: Parasitosis; Helminths; *Ancylostoma*; *Toxocara*

RESUMO

Doenças relacionadas a parasitoses mostram-se um relevante problema de saúde pública devido às diferentes complicações que estas podem causar, e o fornecimento de dados epidemiológicos tem o objetivo de reverter esse quadro. O trabalho visou avaliar a frequência de ovos e larvas de helmintos no município de Macapá, assim como a influência da sazonalidade na incidência da contaminação das praças públicas nos períodos compreendidos como inverno e verão. Nesse estudo foi analisado uma amostra contendo três pontos estratégicos de solo de cada praça, totalizando 39 praças, divididas em diferentes bairros. A escolha foi feita de acordo com as zonas que dividem o município, totalizando 39 amostras em recipientes devidamente vedados. Os métodos utilizados foram: Hoffman, Direto, Willis e Baermann Moraes. Os resultados mostraram a alta carga parasitária nos locais públicos, principalmente na época do inverno, onde se notou a alta prevalência de ovos *Toxocara* spp. no período do verão e, no período do inverno, obteve-se a prevalência maior de ovos de *Ancylostoma* spp., o que justifica uma ação imediata do poder público em relação a presença desses agentes no meio ambiente, com controle de animais, saneamento básico, disponibilização de tratamento e manutenção periódica das praças públicas.

PALAVRAS-CHAVE: Parasitoses; Helmintos; *Ancylostoma*; *Toxocara*

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INTRODUCTION

Parasitic infections grow alarmingly in Brazil and other countries. Their transmission occurs essentially through contact with water, hands, fecal waste or poor hygiene and generates a global problem¹. The socioeconomic factor and the hygienic and sanitary conditions are important to explain its high prevalence in Brazil². The tropical climate, with its high humidity, rainfall and temperatures, associated with the lack of information about the parasites and their diseases, needs to be highlighted³.

Parasitic diseases are a relevant public health problem because of the large number of individuals affected and harmed by these agents². Parasitism can occur both in humans and animals. Some zoonoses affect humans and are largely transmitted throughout the world through domestic animals like cats and dogs⁴.

Public authority disregard, lack of sanitary control and the large number of stray animals contribute to the possibility that the soil of squares and public places become a source of parasite dissemination. This hypothesis is supported by the fact that the environment is part of the biological cycle of several helminths, and also by the resistance of the infecting form for a time that can last from days to months^{5,6}. All of the factors described above constitute a serious public health problem, not only locally but also globally, given the easy spread of these diseases⁷.

There are few studies about parasitic diseases in Macapá, and there is no data that accurately shows the number of cases involving helminths. This shortage of information compromises the planning for combating these diseases and prevents the development of projects that can be more effective in this area. This study aimed to evaluate the frequency of eggs and larvae of helminths in Macapá, as well as the influence of seasonality on the incidence of contamination of public squares in winter and summer.

METHODS

This study sought to perform the seasonal analysis of the soil of squares in September and October 2014 (summer) and in January and February 2016 (winter) in Macapá. The city has about 60 districts and 46 squares, which were divided into zones: north, south, east and downtown. As a criterion for inclusion, this study took into account the flow of people, presence of animals and lack of public restrooms. We excluded only the squares with blocked entrance due to maintenance work. Therefore, soil analysis was made in squares of different districts scattered about the four zones of the city. A total of 39 public places were chosen among squares and arenas with squares.

The selected districts were grouped according to the zone of the city:

- North Zone: Jardim Felicidade I, Jardim Felicidade II, Renascer;
- Downtown: Central, Jesus de Nazaré, Perpétuo Socorro, Santa Inês, Trem, Santa Rita;

- South Zone: Congós, Buritizal, University, Beiril, Araxá, Muca, Marco Zero, Santa Inês;
- East Zone: Cabralzinho, Marabaixo, Alvorada.

The collection was made in strategic places of the squares, where we observed the greatest flow of people and animals, or in places that were ideal for the development of the parasites. Three collections were made in each square: two of them in its extremities and one in the center. These were mixed and only one container was obtained per square.

The containers consisted of a sample of sand or earth (about 200 g), which in some situations presented feces of animal that lived in the place. The samples were collected with a spatula in the three specified points removing the surface layer until a maximum depth of 3 cm, stored in disposable containers, sealed with plastic and identified with the date and place of collection. The containers were analyzed in the Clinical Analysis Laboratory of the Federal University of Amapá⁸.

The methods were chosen according to the parasitic infections mostly described in similar studies conducted in other cities^{7,9}. The methods were: Hoffman, which is based on spontaneous sedimentation of the sample in order to check for heavy eggs; Direct, which consists of a direct pre-diluted analysis; Baermann Moraes, which relies on thermotropism and hydrotropism of the larvae with its sedimentation; and Willis, which is based on the floating principle of eggs of nematodes, cysts and oocysts^{10,11}.

The statistical survey method for the prevalence of parasitoses was done by the simple format, through data feeding into tables using Microsoft Excel 2010 provided by Microsoft Corporation. Information is shown in tables and charts made available by that software. Data was presented in percentages, comparing the amount of positive results for each type of parasite in relation to the amount of squares that we investigated.

RESULTS AND DISCUSSION

The analyzed places include downtown and peripheral areas of the city which, for better analysis, was divided into north, south, east and downtown zones. There were several squares per zone, as shown in Table 1 and Figure 1. Public spaces have their own characteristics such as: ponds, more or fewer trees, moist or dry soils and the presence of feces. The feces were collected and analyzed along with the soil of the squares. The feces could be from animals or even homeless people, which were found in smaller numbers.

Table 2 shows the percentage of results found during winter and summer and demonstrates a higher percentage of larvae and total eggs in winter. Also, the number of positive squares increased considerably during that season.

The percentage of parasitic findings in winter was considerably higher, corroborating with other studies that found differences in



positivity of parasitic contamination of the soil of public squares depending on the season¹², as demonstrated in Table 3. Data showed that environmental variations are of great relevance in the frequency of parasites in public spaces, especially the zoonotic ones, such as toxocarasis, hookworm and strongyloidiasis, thus increasing the risk of infection at certain times of the year.

Macapá is the capital of the state of Amapá, Brazil. The city is located in the southern part of the state and lies on the banks of the Amazon River, 00° 02' 20" N Latitude and 51° 03' 59" W Longitude. Its climate is equatorial, hot, humid and there are two seasons: rainy (winter) and dry (summer). The local temperature ranges from 23° C to 38° C¹³.

Factors such as high humidity, temperature (20° C to 30° C) and good oxygenation are closely related to the development of helminth eggs, since they favor embryogenesis, larval formation and, in some cases, hatching¹⁴. The collections held in summer, according to data from the Nucleus of Hydrometeorology and Renewable Energy from Amapá Scientific Research and Studies Institute (IEPA), were made under maximum and minimum temperatures of 32.66° C and 23.86° C, respectively, in September and, in October, 33.12°

C and 24.21° C, respectively. In winter, January showed maximum and minimum temperatures of 34.3° C and 22° C, respectively, and February, 33.9° C and 21.8° C, respectively.

Still taking into account the high Relative Humidity (RH) in the state capital, which was between 90% and 47%, with maximum and minimum values in summer and winter of 98% and 56%, we deduced that the climate is ideal for the proliferation and prevalence of these parasites and that the results were more robust in winter, while in summer we found more *Toxocara* spp. Eggs (Figure 2). In winter, we found a high incidence of *Ancylostoma* spp. eggs, with 53.85% of positivity, i.e. 21 of the 39 squares analyzed. *Toxocara* spp. eggs resist to environmental conditions and are viable in the soil for several days, whereas exposure to light is a decisive factor in larval development¹⁵. However, hookworm larvae hatch in 24 to 48 hours, making their development difficult in unfavorable environmental conditions¹⁶.

Among the relevant symptoms of *Ancylostoma* spp. identified in this work, we can highlight abdominal and epigastric pain, lack of appetite, indigestion, cramps, malaise, nausea, vomiting, and, in some cases, bloody diarrhea. The chronicity of this infection causes anemia due to iron deficiency¹⁰.

A study conducted in the state of São Paulo State found that temperature and rainfall correlated to the presence or absence of *Toxocara* spp. eggs and that high temperatures would facilitate a higher occurrence of viable eggs⁹. Exposure to light was a major factor in the development and viability of these eggs, and it was observed that eggs kept in obscurity could not evolve into first stage larvae¹⁵.

Data presented here corroborates with literature on the incidence of *Toxocara* spp. eggs (Figure 3): in summer we found 74.35% of positivity, 29 of 39 squares, while in winter we found, 28.20% of positivity, 11 of 39 squares. The decrease in the incidence of *Toxocara* spp. eggs would be intrinsically associated with the rainy season, which made the high temperatures decrease and made it difficult for direct solar rays to penetrate.

Humans *Toxocara* spp. infection occurs through the accidental ingestion of eggs from contaminated soil, food, fomites or direct contact with dogs¹⁷. The eggs hatch in the gut, releasing the second stage larvae that migrate through the tissues, including the brain, developing for long periods of time. These parasites may remain viable in the body for at least seven years after infection. Larvae can also migrate in the human body but not mature. Instead, encystment as second stage larvae occurs¹⁸.

The analysis through the Baermann Moraes method showed positivity of 71.79%, 28 of the 39 squares, in winter. This is higher

Table 1. Number of squares per zone in Macapá, state of Amapá, Brazil.

Zones of the city	N. of squares
North Zone	7
South Zone	12
East Zone:	9
Downtown	11
Total of squares	39



Figure 1. Macapá map highlighting the public squares

Table 2. Parasitological findings by method in summer and winter (%).

Season	Summer				Winter				
	Method	Direct	Willis	Hoffman	Baermann Moraes	Direct	Willis	Hoffman	Baermann Moraes
Total larvae		35.89	17.94	48.71	25	74.36	30.77	61.54	71.79
Total eggs		38.46	66.66	61.53	0	71.80	76.92	71.79	7.69
Total found		64.10	71.79	82.05	25	82.05	76.92	82.05	71.79



Table 3. Percentage of positive results per zone by method

Methods used	North (7*)	South (12*)	East (9*)	Downtown (11*)
Percentage of positive results by the number of squares per zone in summer				
Direct	42.85% (3*)	58.33% (7*)	100% (9*)	54.54% (6*)
Hoffman	57.14% (4*)	91.66% (11*)	88.88% (8*)	81.81% (9*)
Willis	100% (7*)	75% (9*)	55.55% (5*)	63.63% (7*)
Baermann	0% (0*)	33.33% (4*)	33.33% (3*)	27.27% (3*)
Percentage of positive results by the number of squares per zone in winter				
Direct	85.72% (7*)	66.66% (8*)	88.88% (8*)	90.90% (10*)
Hoffman	100% (7*)	75% (9*)	100% (9*)	63.63% (7*)
Willis	57.14% (4*)	91.66% (11*)	88.88% (8*)	63.63% (7*)
Baermann	71.42% (5*)	75% (9*)	88.88% (8*)	54.54% (6*)

Source: Primary

*Number of squares

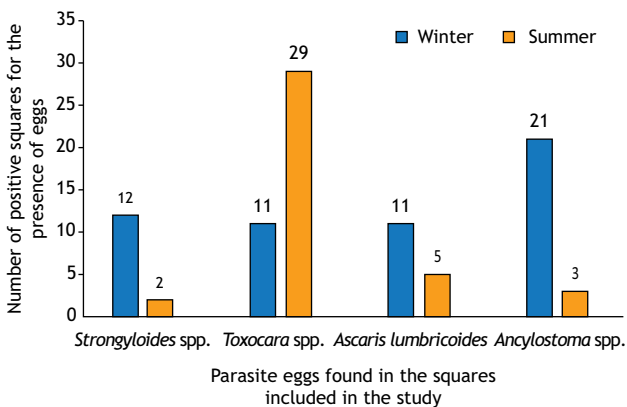
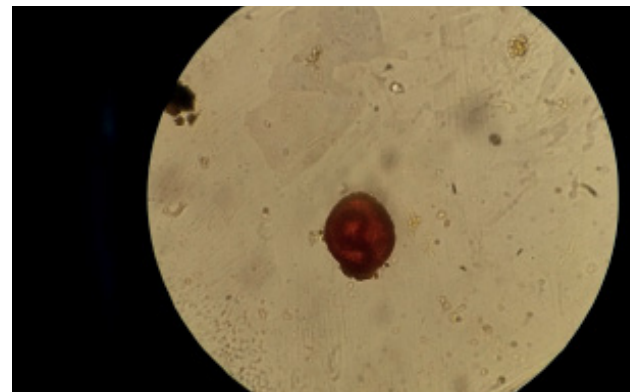


Figure 2. Comparison of eggs found in summer and winter.



Source: Primary

Figure 3. *Toxocara* spp. egg, Willis method, objective of 40x - Renascer Square

if compared to summer, whose percentage was 25%, 10 of the 39 squares. In winter, conditions lead to increased larvae contamination in public squares. The results are similar to a study performed in the recreation areas of day care centers¹⁹, where a larger number of larvae was found in rainy months. In the periods with low rainfall and high sunlight incidence, we observed a decrease in larvae. These factors are associated with egg resecting and helminth larvae elimination. A total of 37 positive squares were found as to the presence of larvae, which gave us 94.87% of positivity.

CONCLUSIONS

The factors associated with humidity, rainfall and temperature are highly relevant to the parasitic load of Macapá's public

squares, which presented 100% of positivity in at least one of the six methods applied in this study. Our data revealed the severity of the situation regarding parasitism in public places, mainly during winter, when the incidence of larvae and eggs of parasites increased.

Therefore, the need to raise people's awareness as to their pets and the caution that must be taken during leisure times is undeniable, since this can lead to a decrease in the prevalence of parasites in squares and arenas. Another pressing matter is related to public authorities. They must take action regarding animal control, basic sanitation for the population, medical examinations, treatment of parasitic diseases and constant maintenance of these places in order to ensure the well-being of the population.

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Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.



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