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JOÃO RICARDO PEREIRA DA CRUZ FILHO

AVALIAÇÃO DA PREVALÊNCIA DE ESQUISTOSSOMOSE EM TRABAHADORES DE HORTIFRUTICULTURAS NA CIDADE DE SALVADOR-BAHIA

SALVADOR – BA
2019

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AVALIAÇÃO DA PREVALÊNCIA DE ESQUISTOSSOMOSE EM TRABALHADORES DE HORTIFRUTICULTAURAS NA CIDADE DE SALVADOR-BAHIA

Trabalho de Conclusão de Curso apresentado à Escola Bahiana de Medicina e Saúde Pública, como parte dos requisitos para obtenção do título de Bacharel em Biomedicina.

Orientador: Dr. Lúcio Macedo Barbosa

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Este Trabalho de Conclusão de Curso foi julgado adequado à obtenção do grau de Bacharel em Biomedicina e aprovado em sua forma final pelo Curso de Biomedicina da Escola Bahiana de Medicina e Saúde Pública.

Salvador – BA, 09 de novembro de 2019.

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Ao meu Sonho Vivo.
Ao meu Céu Estrelado.
Ao meu Espelho Mágico.

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Aos meus pais eu agradeço por todo o esforço e boa vontade. Sem o seu desejo de me ver crescer eu jamais chegaria até aqui.

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"- Professor, isso é real, ou está acontecendo somente na minha mente?
- É claro que está acontecendo na sua mente, mas por que isso significa que não é real?"
J. K. Rowling

RESUMO

Em 2011, um trabalho de nossa equipe descreveu uma área de agricultura local, em Salvador, com alta prevalência de esquistossomose e indicando um alto risco entre os trabalhadores. Este trabalho visa descrever a prevalência *Schistosoma mansoni* em trabalhadores agrícolas locais, além de verificar a intensidade de infecção e eficácia no tratamento. Cada trabalhador que aceitou participar do projeto respondeu a um questionário epidemiológico e forneceu uma amostra fecal, que foi avaliada pelo método Kato-Katz (duas lâminas). Indivíduos positivos para *S. mansoni* foram tratados com praziquantel e albendazol quando infectados por outras helmintíases. Das 43 hortas existentes em 2013, 18 ainda permanecem ativas, distribuídas em 4 distritos sanitários da cidade de Salvador. Foram incluídos 36 trabalhadores sendo 83,3% (30/36) do sexo masculino com uma média de idade de 51,1 ± 14,6 anos. A maioria dos indivíduos (80,5%) eram nascidos fora de Salvador. Cerca de 41,1% dos indivíduos indicaram que já tiveram esquistossomose. A prevalência de *S. mansoni*, entre as hortas avaliadas, foi de 27.7% (5/18). Entre os trabalhadores, de forma global, a prevalência de esquistossomose foi de 25% (9/36). Outras helmintíases foram encontradas em 13,8% (5/36) dos indivíduos, sendo identificadas amostras de *Trichuris trichiura* e ancilostomídeos. Neste estudo foram encontrados valores de prevalência superiores ao último inquérito nacional realizado pelo Ministério da Saúde, demonstrando a existência de micro-áreas com alta positividade e que demandam políticas públicas de atenção e cuidado para essas populações vulneráveis.

Palavas-chave: Esquistossomose, Planejamento Urbano, Cultivos Agrícolas.

SUMÁRIO

1 ARTIGO CIENTÍFICO

PREVALENCE OF SCHISTOSOMOSIS IN HORTICULTURE WORKERS IN SALVADOR – BA

Schistosomiasis in horticulture

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Abstract

INTRODUCTION: In 2011, a study by our team described an area of urban garden in Salvador with a high prevalence of schistosomiasis and indicating a high risk among local workers. This paper aims to describe the prevalence of *Schistosoma mansoni* in local agricultural workers, as well as to verify the intensity of infection and treatment effectiveness.

METHODS: Each worker answered an epidemiological questionnaire and provided a single stool sample to be evaluated by the Kato-Katz method (two slides). Positive individuals were treated with praziquantel or albendazole when infected with other helminthiasis.

RESULTS: Of the 43 existing gardens in 2013, 18 remain active, distributed in 4 health districts in the city of Salvador. Thirty-six workers were included, 83.3% (30/36) male with a mean age of 51.1 ± 14.6 years. Most individuals (80.5%) were born outside Salvador. About 41.1% indicated that they already had schistosomiasis. The prevalence of *S. mansoni* among the evaluated gardens was 27.7% (5/18). Among workers, overall, the prevalence of schistosomiasis was 25.0% (9/36). Other helminthiases were found in 13.8% (5/36) individuals, and samples of *Trichuris trichiura* and *Ancylostoma sp*.

CONCLUSIONS: In this study we found prevalence values higher than the last national survey conducted by the Ministry of Health, indicating the existence of micro-areas with high positivity and that demand public attention and care policies for these vulnerable populations.

Keywords: Schistosomiasis, City Planning, Agricultural Cultivation

INTRODUCTION

Mansonic schistosomiasis is a neglected, easily treatable and potentially fatal tropical disease caused by the trematode parasite *Schistosoma mansoni*. Although there are other species of genus *Schistosoma* with clinical and epidemiological relevance in the world, such as *S. haematobium* and *S. japonicum*, it is believed that they could not settle in Brazil due to the absence of their intermediate hosts[1]. For *S. mansoni*, snails of the genus *Biomphalaria* are highly susceptible to infection and responsible for the establishment of the cycle in Brazil. Among the species of this snail, *B. glabrata* is considered the most efficient for schistosomiasis transmission and is widely distributed throughout the country[2]. The infection of these animals occurs in water bodies with contaminated feces that will eliminate miracidia. *Biomphalaria* will eliminate cercariae that will actively penetrate the skin of individuals who use these waters for various activities, such as agriculture, fishing, domestic activities and leisure[1].

Historically, schistosomiasis is a rural disease, however, numerous cases have been described in large cities[3–7]. The intense process of immigration from rural areas observed in recent decades in Brazil is the main reason for this[8]. Searching for better life conditions, people settle in unplanned urban areas with poor infrastructure, where lack of piped water and poor sanitation support the establishment of the parasite's life cycle[9,10]. This association between new urban settlements in poor infrastructure conditions and presence of schistosomiasis could be observed in a previous study conducted by our research group in 2011[11]. We described a prevalence of approximately 25% in 1228 residents of São Bartolomeu Park surroundings in the northwestern part of Salvador. This

area began its occupation in the 1970's with the emergence of the industry complex at the city of Camaçari[12].

In the described work, a subpopulation of workers from a local garden were described with a higher prevalence of schistosomiasis. At that moment, individuals had a parasitic load about ten times higher than the commonly used for high burden (400 eggs per gram of feces [opg]). Six years after the initial treatment of these workers, a new parasitological survey was conducted on site indicating a 100% reinfection rate among these farmers (unpublished data). These results indicated the possible of an occupational risk for garden workers, considering that the overall prevalence for schistosomiasis in the city of Salvador is described around 2-3%[13]. Our studies in 2017 identified approximately 86% of positivity among workers in this urban garden, besides observing the existence of *B. glabrata* in their direct contact water bodies[14]. Similar urban garden scenarios are observed throughout Salvador, thus this paper aims to describe the prevalence of *Schistosoma mansoni* among horticultural workers in the city, as well as to determine the parasitic burden of individuals and to evaluate the effectiveness of the treatment provided.

METHODS

This is a cross-sectional study, that includes an epidemiological and parasitological surveys, that was developed between August 2018 and August 2019. Regarding the test used, it is sensitive to the detection of helminths other than the main focus of this work. Are they: *Ascaris lumbricoides, Enterobius vermicularis and Trichuris trichiura*.

STUDY AREA

The city of Salvador, capital of the state of Bahia, is currently the fourth largest metropolis in Brazil, according to the Brazilian Institute of Geography and Statistics[15]. The existing gardens in the municipality were mapped and previously described by Lídice Paraguassú in 2013[16].Thus, this literature served as a geospatial basis for confirmation and identification of vegetable gardens in the research.

EPIDEMIOLOGICAL AND PARASITOLOGICAL SURVEY

The identified workers from each garden were invited and signed an informed consent form to participate in the epidemiological survey. This work included all commercial garden workers in the city of Salvador, so the research N represents in its entirety the vegetable garden workers in the city. These individuals were submitted to a socio-demographic questionnaire with questions related to age, gender, education level, place of birth and residence time in the capital, contact with natural water sources (rivers, lakes, waterfalls, etc.), previous infection with *S. mansoni*, among others. For the parasitological survey, a single stool sample was requested from each participant. Samples were stored in thermal boxes containing chemical ice (approximately 4ºC) and immediately sent to the Parasitology Laboratory of the Bahiana School of Medicine and Public Health (EBMSP). The samples were submitted to the Kato-Katz method and two slides were produced for each sample. Parasitic load was described as eggs per gram of feces (opg) and determined by multiplying the number of eggs found on each slide by 24[1].

Participants who were positive for schistosomiasis were treated with praziquantel following Ministry of Health guidance. Treatment was administered orally in a single dose of 60 mg/kg for children and 50 mg/kg weight for adults[17]. Other helminthiasis

were treated with albendazole, following instructions on the package leaflet. Thirty days after chemotherapy, the parasitological survey was repeated on infected individuals to verify treatment efficacy.

ETHICAL CONSIDERATIONS

This project was submitted and approved by the Research Ethics Committee of the Oswaldo Cruz Foundation - BA (CEP-FIOCRUZ) - CAAE: 42424915.9.0000.0040.

RESULTS

Out of the 43 gardens described in 2013[16], 18 were identified as active in 2019 in the city of Salvador. They are distributed in the neighborhoods of: Pernambués (n = 3); Cabula (n = 2); Narandiba (n = 1); Saramandaia (n = 5); São Marcos (n = 3); São Rafael (n = 1); Pirajá (n = 2); Valéria (n = 1). These neighborhoods are located in 4 of the 12 health districts of the municipality, which are: Cabula / Beiru (n = 11); Pau da Lima (n = 4); Subúrbio Ferroviário (n = 2); and São Caetano / Valéria (n = 1) (Figure 1a).

Thirty-six workers were identified in the selected gardens (table 1). Most individuals were male (83.3%) with a mean age of 51.1 years ± 14.6. About 70% of the individuals were illiterate or did not complete elementary school 2 (36.1% illiterate and 33.3% with incomplete elementary school 2) and only 13.8% had completed high school. Most individuals (77.7%) declared themselves mixed. Only 19.4% (7/36) of the workers included in the project are from Salvador. However, workers reported having lived about 57.6% of their lives in Salvador. It was reported that 22.2% (8/36) of participants had direct contact with natural water sources such as rivers, lakes and waterfalls. Regarding

history of schistosomiasis, 36.11% (13/36) of the research participants reported previous infection with *S. mansoni*, and only one of these participants (1/13) reported not having had previous treatment against schistosomiasis.

PARASITOLOGICAL DATA

The prevalence of schistosomiasis in Salvador's urban gardens was 27.7% (5/18). The gardens that presented infected individuals were in the sanitary districts of Cabula/Beiru and Subúrbio Ferroviário, within neighborhoods of Pernambués and Pirajá, respectively (Figure 1b). Evaluating in an individual level, *S. mansoni* prevalence was 25.0% (9/36) on the Salvador's urban gardens workers, with a mean parasite load of 366.6 ± 548.8 opg. Four of the individuals presented low parasitic load, three presented moderate parasitic load and the other two presented high parasitic load. Positivity of other helminthiasis was 13.8% (5/36) with four individuals with *Trichuris trichiura* and one with hookworms (Table 2).

CHARACTERISTICS OF INFECTED WORKERS

Among individuals with schistosomiasis, 33.3% (3/9) worked in gardens belonging to the Cabula/Beiru health district. The other individuals (6/9) are divided into two gardens of the Subúrbio Ferroviário health district. All infected workers were male with a mean age of 43.4 years (± 14.5). Of these, 3 were illiterate (33.3%), 4 had completed elementary school 1 (44.4) and the other 2 had completed elementary school 2 (16.6%). All individuals infected with *S. mansoni* declared themselves mixed. Regarding city of birth, 44.4% (4/9) were born in the city of Salvador, and all lived on average 74.2% of their lives in Salvador (Table 2). Only one of the nine individuals infected with *S. mansoni*

reported direct contact with natural water bodies (11.1%). Almost all individuals (66.6% - 6/9) reported having been infected with the parasite at some point in their lives, and only one reported not being treated for the disease. All subjects who were positive for schistosomiasis received the correct Praziquantel doses and, 33.3% (3/9) of these individuals remained shedding eggs in the stool thirty days after chemotherapy.

DISCUSSION

Recent studies show that Brazil remains an endemic country for schistosomiasis, with the disease occurring in almost all federal units, being the Northeast and Southeast regions present the highest positivity rates, with 1.3% and 2.4% respectively[18]. In addition, some parts of the city of Salvador continues to present all the necessary factors for the establishment of the *S. manson*i cycle. Lack of basic sanitation coupled with the presence of infected *Biomphalaria glabrata* are scattered throughout the city's water collections[14].

The prevalence for garden workers in Salvador infected with *S. mansoni* (25.0%) was higher than the overall prevalence of schistosomiasis of 2.9% described by the national survey published by Naftale Katz in 2018 for the state of Bahia[18]. This discrepancy in the data found points to the possible existence of an increased occupational risk of this parasite infection for individuals working in urban agriculture. In addition, population-based studies conducted by our research group (unpublished data) in neighborhoods of the city of Salvador also show high numbers of positivity when compared to the national survey, they are in the São Bartolomeu neighborhood with 5.5%, Saramandaia with 5.2% and Pirajá with 5.9%. The numbers we described, however, here could be underestimated.

Only one stool sample was collected from each individual, and the recommended number of three samples per person to increase the sensitivity of the Kato- Katz, especially in low endemic areas such as Salvador. Other possibility is the remarkable reduction in the number of urban gardens described in 2019. Within 6 years, we identified a 41.8% reduction in the number of units, therefore, former workers could not be identified, and their parasitological status not accessed.

Even though this work was conducted in a major metropolis of Brazil, the epidemiological characteristics of the garden workers were similar to the described in agricultural workers in poor rural areas. Majority of individuals were male and immigrants from other cities[19]. Similarly, the social context in which Brazil is inserted is able to explain the direct association between the levels of low education found mostly among the participants in this study and the exercise of activities considered as underemployment. According to Capucha, 2010[20] the lower an individual's level of education, the greater the chances that he will be distanced from the regular labor market, often leaving, as described in this paper, sub-existence activities.

Treatment was not effective in all individuals. Three of the treated subjects remained shedding eggs in the stool after 30 days of treatment. Only one of them reported having done the treatment completely an as indicated by the team´s physician. This individual presented a lower parasite load, indicating a recent infection. The remaining two individuals did not performed treatment as indicated.

Our results indicate not only an issue in the public health for the city but also directly to the workers. High parasite loads along with long periods exposure to infection sites increase chances for severe forms of the disease. Improving working conditions is imperative to prevent infection and reinfections. On the other hand, the tendency for

schistosomiasis is to further decrease in the garden workers. Due to the intense process of modernization and urbanization that Salvador has been undergoing, the current model of gardens will cease to exist, as well as the possible occupational risk for schistosomiasis offered by them.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Pre-Submission Language Editing: All manuscripts submitted to the *Revista da Sociedade Brasileira de Medicina Tropical* / Journal of the Brazilian Society of Tropical Medicine must be in English. It is highly recommended that the authors use a professional English editing and/or translation service prior to submission. However, engaging in language editing does not guarantee that the manuscript will be accepted for publication.

Manuscript layout

The manuscript should be prepared using standard word processing software and should use Times New Roman size 12 font with double spacing throughout the text, figure title/legends, and references, with margins of at least 3 cm. Divide the manuscript into the following sections: Cover Letter (addressed to the Editor-in Chief), Title Page, Manuscript Title, Running title, Abstract, Keywords, Manuscript Text, Conflict of Interest statement, Acknowledgments, Financial Support, References, and Figure Titles/Legends. Cover Letter, Title Page, Acknowledgments, and Financial Support must be provided in a separate document. Abbreviations should be used sparingly.

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Title: The title should be as concise, clear, and informative as possible. It should not contain abbreviations and should not exceed 200 characters, including spaces.

Running Title: The running title may include up to 40 characters.

Structured Abstract: The structured abstract should summarize the results obtained and the major conclusions in such a way that a reader not already familiar with the particular topic of the paper can understand the implications of the article. The abstract should not exceed 250 words (100 words in the case of Short Communications) and must be structured with the following headings: *Introduction, Methods, Results*, and *Conclusions. A*bbreviations should be avoided.

Keywords: Three to six keywords should be listed in English immediately below the structured abstract.

Introduction: The article's introduction should be brief, setting out the purposes for which the study has been performed. Previous studies should be cited only when essential.

Methods: The methods used in the study should be reported in sufficient detail so that readers and reviewers can understand precisely what has been done; any description

should be thorough enough to allow repetition or replication by others. Standard techniques only need to be referenced; detailed descriptions are not required.

Ethics: When reporting on experiments on human beings, indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional, regional, or national) and in keeping with the Helsinki Declaration of 1964, as revised in 1975, 1983, 1989, 1996, and 2000. When reporting on experiments on animals, indicate whether a national research council's guide for animal experimentation or any law on the care and use of laboratory animals was complied with; the approval number must be sent to the Journal. In case of research on humans, authors must include in the methods section (ethical considerations subsection) a statement that the study was approved by the Institutional Ethics Committee.

Clinical trials: In the case of clinical trials, the manuscript should be accompanied by the number and agency of register of the relevant clinical trial (REBEC platform). This requirement is in accordance with guidelines set by BIREME/OPAS/OMS, International Committee of Medical Journal Editors (www.icmje.org), and Workshop ICTPR.

Results: The results section should be a concise and impersonal account of the new information revealed by the study or research in question. Avoid repeating in the text the data presented in the tables or illustrations.

Discussion: The discussion section should directly relate to the study being reported. Do not include a general review of the topic. Keep the discussion concise and relevant.

Acknowledgments: Any acknowledgments should be short, concise, and restricted to those that are necessary. In case of sponsoring institutions, do not use acronyms.

Conflict of Interest: All authors should disclose any type of conflict of interest during the development of the study.

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References: Only references cited in the text should be referenced. They should be numbered consecutively in Arabic numerals and in Vancouver format as they appear in the text. List all authors when there are up to six. For seven or more authors, list the first six, followed by "et al." Type the reference list on a separate page at the end of the manuscript, using double spacing.

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   Example 1: Petitti DB, Crooks VC, Buckwalter JG, Chiu V. Blood pressure levels before dementia. Arch Neurol. 2005;62(1):112-6.

   Example 2: Freitas EC, Oliveira MF, Vasconcelos ASOB, Filho JDS, Viana CEM, Gomes KCMS, et al. Analysis of the seroprevalence of and factors associated with Chagas disease in an endemic area in northeastern Brazil. Rev Soc Bras Med Trop. 2016;50(1):

2. Book chapter: Cite last names and initials of all Authors of the chapter, Chapters' full title, Editors, Title of book, edition, Place of Publication: Publisher, Year of publication, chapter pages.

Example: Blaxter PS, Farnsworth TP. Social health and class inequalities. In: Carter C, Peel JR, editors. Equalities and inequalities in health. 2nd ed. London: Academic Press; 1976. p. 165-78.

3. Book: Last names and initials of the authors, Title of book, edition, Place of Publication: Publisher, Year of publication, Pagination.

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b. Proofs will be sent to the corresponding author to be carefully checked for typesetting accuracy. Changes or additions to the edited manuscript cannot be allowed at this stage of the editing process. The corrected proofs should be returned to the Journal as soon as possible after their receipt by the corresponding author.
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Workflow

SUBMISSION WORKFLOW OF THE *REVISTA DA SOCIEDADE BRASILEIRA DE MEDICINA TROPICAL*

All manuscripts to be considered for publication in the *Revista da Sociedade Brasileira de Medicina Tropical* or *Journal of the Brazilian Society of Tropical Medicine* should be submitted in electronic form via the online submission system (http://mc04.manuscriptcentral.com/rsbmt-scielo).

Journal's review policy (workflow):

1 – All manuscripts submitted for publication in the Journal are initially evaluated by the Journal's administrative staff to ensure that the text adheres to the Journal's rules.

2 – Manuscripts that meet the standards of the journal are evaluated by the Editor, Associate Editors, or Section Editors to determine whether they fit the scope and editorial policy of the Journal. The administrative staff then sends these manuscripts to the Editor-in-Chief.

3 – The Editor-in-Chief (or Associate/Section Editors) assigns a manuscript to reviewers.

4 - Each submitted paper is sent to at least two reviewers for a double-blind peer review culminating in an evaluation and comprehensive written report. The manuscript is also sent to reviewers specializing in quantitative methods for analysis. The Editors use these reports to decide whether to accept the paper. If there is a difference of opinion among the reviewers, the manuscript will be sent to a third reviewer to help reach a final decision by the Journal's editorial board.

5 – Reviewer comments (Free Form Review) are forwarded to the corresponding author (principal contact for editorial correspondence); the corresponding author must answer any queries made.

6 – The authors must respond to the queries and return a revised version of the manuscript. The revised version is sent back to reviewers, who provide a final, reasoned report on the manuscript.

7 – Reviewers' scores of the manuscript and the authors' responses are analyzed by the Editor, Associate Editors, or Section Editors.

8 – The Editor-in-Chief makes the final decision on accepting the manuscript for publication.

9 – The final editorial decision (acceptance or rejection) is sent to the authors.

10 – The editorial process begins after the manuscript's official acceptance. Accepted manuscripts are sent for English editing and a full review.

11 – The English review results and edited document are sent to the authors for analysis; the authors must state whether they accept the edited version.

12 – Next, the layout process begins. The Journal will communicate closely with the corresponding author regarding figures, tables, photographs, maps, illustrations, and the article's general format.

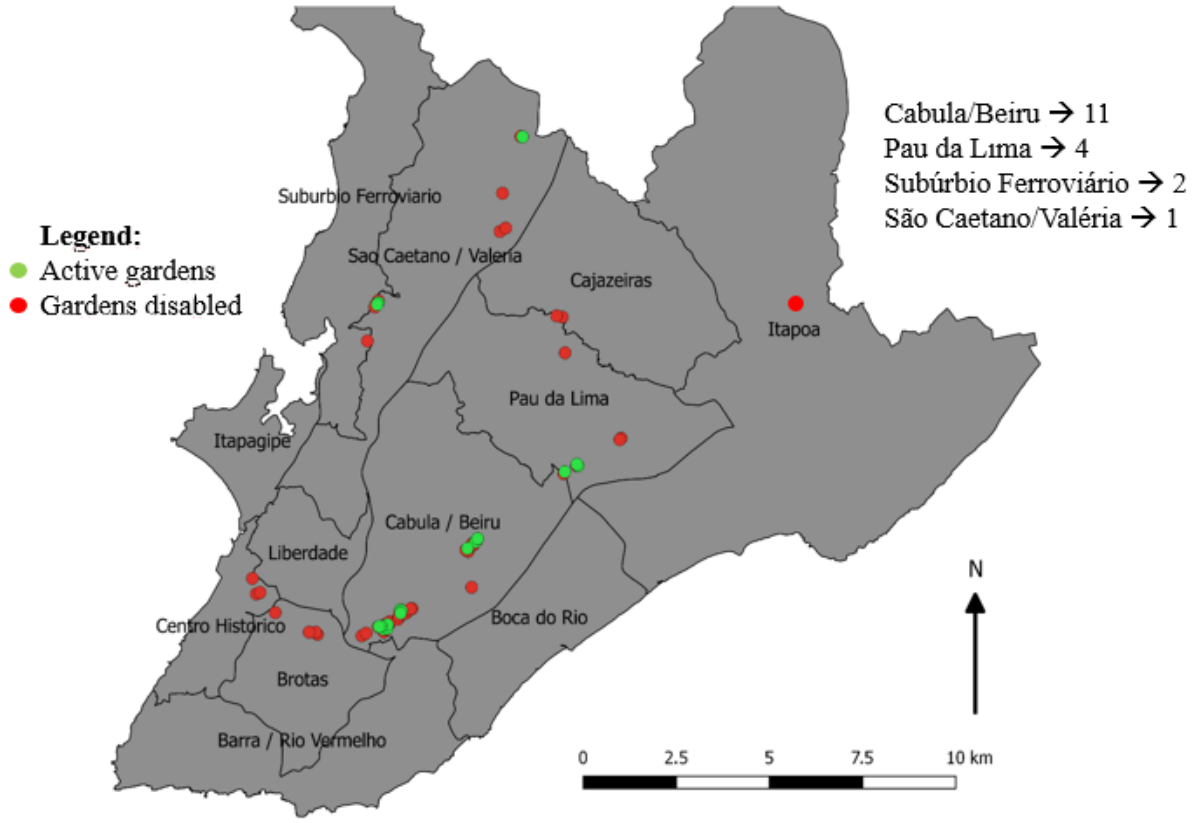
13 – Authors must disclose any conflicts of interest or financial support and must provide a signed copyright assignment form.

14 – Proofs are sent to the corresponding authors to be checked for typesetting accuracy.

15 – The final version of each manuscript is selected, in the order received and edited, for use in issues of the Journal; manuscripts that are ready for publication are sent to Ahead of Print in SciELO Platform.

16 – The printed version of the Journal is published on a bimonthly basis; the Journal is also available online in open access form at http://www.scielo.br/rsbmt.

3-ANEXO Figure 1A: Geoespacil reference of active gardens existing in Salvador.



Distribution of existing gardens in Salvador-Bahia, compared to those found by PARAGUASSÚ (2013).

Figure 1B: Positive gardens for *S. mansoni* in Salavdor.

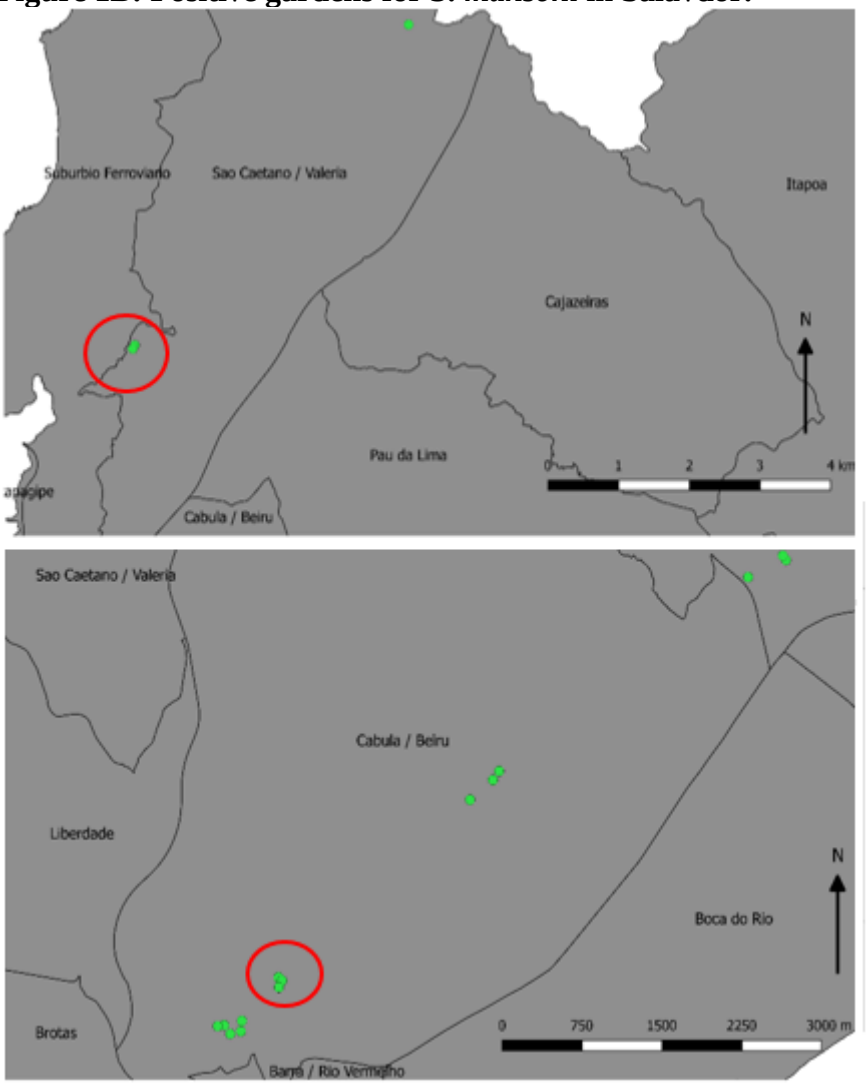


Table 1: Epidemiological characteristics of workers from vegetable gardens in Salvador - BA

Variables	n (%) ou median (±SD)	
	All workers (n=36)	Infected individuals (n=9)
GENDER (Male)	30 (83,3%)	9 (100%)
AGE	51,1 ± 14,6	41,6 ± 16,4
SCHOOLING		
Illiterate	13 (36,1%)	3 (36,1%)
Elementary 1	12 (33,3%)	4 (33,3%)
Elementary 2	6 (16,6%)	2 (16,6%)
High school	5 (13,8%)	0 (0.0)
RACE (self-declared)		
Mixed	28 (77,7%)	9 (100%)
Black	2 (5,5%)	0 (0.0)
White	3 (8,3%)	0 (0.0)
Indian	2 (5,5%)	0 (0.0)
BORN IN SALVADOR	7 (19,4%)	4 (44,4%)
% LIFE TIME IN SALVADOR	57,6%	72,2%
NATURAL WATER SOURCES	8 (22,2%)	1 (11,1%)
PREVIOUS INFECTION SM	13 (36,1%)	6 (66,6%)
FLOODED RESIDENCE	6 (16,6%)	0 (0.0%)

Table 2: Parasitological characteristics of workers from vegetable gardens in Salvador - BA

Variables	n (%)
S. mansoni	25% (9/36)
OTHER HELMINTHS	
Trichuris trichiura	11,1% (4/36)
Hookworms	2,7% (1/36)