Diversitas Journal
ISSN 2525-5215
Volume 8, Número 3 (jul./set. 2023) p. 1455 – 1469
https://diversitasjournal.com.br/diversitas_journal

Epidemiological and operational indicators of the schistosomiasis control program: an ecological study in an endemic region in the state of Alagoas, Brazil, 2008 - 2016

Indicadores epidemiológicos e operacionais do programa de controle da esquistossomose: estudo ecológico em região endêmica no estado de Alagoas, Brasil, 2008 - 2016

SANTOS, Adriano José dos[1]; CAVALCANTI, Eliane Aparecida Holanda[2]; SILVA, José Rodrigo Santos[3]; SILVA, Emanuel Júnior Pereira da[4]; ROCHA, Mabel Alencar do Nascimento[5]; SANTOS, Israel Gomes de Amorim[6]

[1] 0000-0002-4619-5232; Federal University of Sergipe (*Universidade Federal de Sergipe*), Graduate Program in Parasitic Biology. São Cristóvão, SE, Brazil. Email: adriano.bio17@gmail.com.
[2] 0000-0002-6658-3005; Federal University of Alagoas (*Universidade Federal de Alagoas*), Biological Sciences Degree Course. Maceió, AL, Brazil. Email: eliane.cavalcanti@arapiraca.ufal.br.
[3] 0000-0002-1918-7122; Federal University of Sergipe (*Universidade Federal de Sergipe*), Department of Statistics and Actuarial Sciences, Graduate Program in Parasitic Biology. São Cristóvão, SE, Brazil. Email: rodrigo.silva@academico.ufs.br.
[4] 0000-0001-6503-2909; Federal University of Alagoas (*Universidade Federal de Alagoas*), Biological Sciences Degree Course. Penedo, AL, Brazil. Email: emanuel.silva@penedo.ufal.br.
[5] 0000-0002-7769-5002; State University of Alagoas (*Universidade Estadual de Alagoas*), *Campus* I, Biological Sciences Degree Course. Arapiraca, AL, Brazil. Email: mabel.rocha@uneal.edu.br.
[6] 0000-0002-5210-6697; State University of Alagoas (*Universidade Estadual de Alagoas*), *Campus* II, Biological Sciences Degree Course. Santana do Ipanema, AL, Brazil. Email: israel.santos@uneal.edu.br.

ABSTRACT

Schistosomiasis mansoni is a neglected tropical disease with an important health impact on the affected populations in Brazil and worldwide. Thus, the objective of the study was to perform a retrospective analysis of the epidemiological situation of *schistosomiasis mansoni* and describe the actions to control the disease in the municipality of Feira Grande/AL, between 2008 and 2016. This is an ecological study, with data obtained from the Information System of the Surveillance and Control of Schistosomiasis Program, which generated the indicators: Operational actions (Percentage of coproscopic exams performed) and epidemiological actions (Percentage of positivity, Percentage of non-treatment, and Proportion of infected per class of infection intensity). For each indicator the mean, standard deviation, minimum and maximum were calculated. In addition, it was analyzed whether the time series had a decreasing, stationary or increasing trend, as well as the annual growth rate. There were 1,159 (8.8%) reported cases of schistosomiasis in Feira Grande in the analyzed period. The percentage of tests performed remained below adequate coverage (< 90%) throughout the period studied, with 2008, 2009, 2010 and 2013 showing average endemicity. The lowest treatment coverage occurred in 2014, 2016, and 2013. The proportion of infected (PI) with low amount of eggs per slide (PI-low) predominated throughout the studied period and, in the temporal evaluation, the indicator Proportion of no treatment showed an increasing trend. The results point to an insufficiency in control actions, besides showing that the epidemiological indicators point to a resurgence of the disease in the municipality.

INFORMAÇÕES DO ARTIGO

Histórico do Artigo:
Submetido: 29/09/2022
Aprovado: 03/10/2022
Publicação: 03/08/2023

Keywords:
Ecological study, Helminthiasis, *Schistosoma mansoni*, Epidemiological surveillance.

RESUMO

A *esquistossomose mansoni* é uma doença tropical negligenciada, de importante impacto em saúde para as populações acometidas no Brasil e no mundo. Dessa forma, o objetivo do estudo foi realizar análise retrospectiva da situação epidemiológica da *esquistossomose mansoni* e descrever as ações de controle da doença no município de Feira Grande/AL, entre 2008 e 2016. Trata-se de um estudo ecológico, com dados obtidos do Sistema de Informação do Programa de Vigilância e Controle da Esquistossomose, os quais geraram os indicadores: ações operacionais (Percentual de exames coproscópicos realizados) e ações epidemiológicas (Percentual de positividade, Percentual de não tratamento e Proporção de infectados por classe de intensidade da infecção). Para cada indicador calculou-se a média, desvio padrão, mínimo e máximo. Além disso, analisou-se se a série temporal teve tendência decrescente, estacionária ou crescente, assim como a taxa de crescimento anual. Foram reportados 1.159 (8,8%) casos de esquistossomose em

Palavras-Chave:
Estudo ecológico, Helmintíase, *Schistosoma mansoni*, Vigilância epidemiológica.

DOI: 10.48017/dj.v8i3.2444

Feira Grande no período analisado. O percentual de exames realizados se manteve abaixo da cobertura adequada (< 90%) em todo o período estudado, com 2008, 2009, 2010 e 2013 apresentando endemicidade média. As menores coberturas de tratamento ocorreram em 2014, 2016 e 2013. A proporção de infectados (PI) com baixa quantidade de ovos por lâmina (PI-baixa) predominou em todo o período estudado e, na avaliação temporal, o indicador Proporção de não tratamento apresentou uma tendência crescente. Os resultados apontam uma insuficiência nas ações de controle, além de mostrarem que os indicadores epidemiológicos apontam para um recrudescimento da doença no município.

Introduction

Schistosomiasis is a parasitic infection that affects a large contingent of the world's population, with an estimated 240 million people affected by it. According to the World Health Organization (WHO), in 2019, more than 230 million people required preventive treatment against this parasitosis. Prevalent in tropical areas, in Brazil the disease occurs predominantly in the intestinal form, called schistosomiasis mansoni (MS), where it´s estimated that 1.5 million people need preventive care annually (Brazil, 2014; World Health Organization [Who], 2022).

MS is caused by *Schistosoma mansoni*, transmitted to humans by contact with the infecting forms of the parasite, the cercariae, in water collections. Clinically, this pathology can present itself in an acute phase, which can be asymptomatic for individuals of endemic area or in a severe form in individuals without previous contact with the parasite, and evolve into a chronic phase, which in its most severe form can provoke a condition of hepatosplenomegaly and ascites, leading the host to death, in the majority of cases in which it´s not treated (Melo & Coelho, 2016; Rocha et al., 2016; Who, 2022).

Regarded as a neglected tropical disease (NCD), of major impact on health for the affected populations, this parasitosis is associated with poverty and low socioeconomic development, as well as the lack of access to infrastructure in adequate basic sanitation, which sometimes condition the population to risk factors, such as direct contact with contaminated natural waters or that are liable to become outbreaks of transmission. In addition, unhealthy hygiene habits and the low level of information about the disease and its forms of prevention by the population, are factors that corroborate its occurrence (Centers for Disease Control and Prevention [Cdc], 2018; Katz & Peixoto, 2000; Melo & Coelho, 2016).

For the control of the disease in the country there is the Schistosomiasis Control Program (PCE in the Portuguese acronym), which is decentralized to the municipalities and is therefore responsible for the activities of ative search of cases and treatment of the positives. Thus, the diagnosis of the disease by parasitic examination of feces is carried out by means of the Kato-Katz method, which has been shown to be of low sensitivity in the current epidemiological scenario, despite being considered the gold standard by virtue of its specificity, easy execution, low cost and effectiveness (Brazil, 2014; Katz et al., 1972; Vitorino et al., 2012).

According to data from the Information System of the Schistosomiasis Surveillance and Control Program (SISPCE), between the years 2009 and 2019, the positivity for schistosomiasis in endemic areas in Brazil fell from 5.20% (n=76,719) in 2009, to 3.22% (n=13,237) in 2019 (Brazil, 2021). In the Northeast region of Brazil, Alagoas is one of the endemic states for MS, with a considerable positivity rate (3.35%) in the last National Survey of Prevalence of Schistosomiasis mansoni and Geo-helminthiases (INPEG) (Katz, 2018).

According to data from the Department of Health of the State of Alagoas (SESAU), the state has 70 (69%) municipalities endemic for the disease, out of a total of 102 municipalities in Alagoas, in which in 2018, 1,582 cases of infection were diagnosed, with 47.53% (752) having been treated and 18 deaths recorded (Alagoas, 2018). In contrast, in 2020, 2,334 individuals infected with *S. mansoni* were diagnosed, with a percentage of 71.63% treated and a total of 58 deaths (Alagoas, 2021).

The municipality of Feira Grande is part of the endemic area for schistosomiasis in Alagoas, and next to the municipalities of Atalaia, Cajueiro, Capela, Igreja Nova, Pindoba and Rio Largo, also endemic for the disease,has already presented prevalence rates higher than 15% in 2010 (15.77%) and 2013 (15.23%) (Rocha et al., 2016).

Considering the context of a state with prevalence rate considered relevant (Katz, 2018), where 25.7% (18) of municipalities in its endemic area did not perform schistosomiasis control activities in the year 2020 (Alagoas, 2021), it becomes pertinent to evaluate data regarding disease control activities, seeking to describe the current scenario so that health authorities can seek strategies for improvements in disease control actions.

In this context, the study aimed to conduct retrospective analysis of the epidemiological situation of schistosomiasis mansoni and to describe the disease control actions in the municipality of Feira Grande/AL, between 2008 and 2016.

Methods

Type of study

This is a descriptive, ecological study, with a retrospective temporal approach of human cases of schistosomiasis mansoni in the municipality of Feira Grande/AL, carried out from the data recorded in the Information System of the Schistosomiasis Surveillance and Control Program (SISPCE), of the Brazilian Ministry of Health. SISPCE is the information system used to record the results of active search of schistosomiasis mansoni cases in the endemic area of Brazil. In the Schistosomiasis Control Program (PCE), the analyzes of fecal material from the population worked on are done by means of the Kato-Katz method, which allows the diagnosis of the infection and quantification of the parasitic load (Brazil, 2014; Katz et al., 1972).

Area of study

The municipality of Feira Grande is located in the south-central region of the same rural region of Alagoas and micro-region of Arapiraca (09º 54' 01" S; 36º 40' 39" W). It has a territorial extension of 175,906 km² and an estimated 2021 population of 22,192, with a population density of 123.42/km² and an HDI of 0.533. Regarding sanitation and water supply in the municipality, only 7.8% of households have an appropriate sanitary drainage system and only 3% of urban households are located on public roads with adequate urbanization, that is, presence of manhole, sidewalk, paving and curb (Brazil, 2020). In addition, Feira Grande has an estimated 2,400 homes supplied by the Alagoas Sanitation Company (CASAL) (Alagoas, 2018).

Data collection and analysis

The data collected were for the period 2008 to 2016, generating a time series, which started in 2008 due to the lack of data from previous years, and last year 2016, due to the stability of occurrence reports in that municipality through SISPCE and also because there was only data for 2021, without registration for the period 2017 to 2020.

The following variables were collected: number of examinations performed, total population worked (number of subjects enrolled for the parasitological survey), number of positive examinations, number of treated subjects, number of untreated subjects and number of subjects by infection intensity class (1 to 4, 5 to 16 or ≥ 17 eggs per stool slide analyzed). The collected data was tabulated and stored in the Microsoft Excel program (version 2013) for further statistical analysis.

From the collected data, some parameters were established which generated: 1 - indicators of operational actions (Percentage of coproscopic examinations performed) of the PCE and 2 - indicators of epidemiological actions (Percentage of positivity, percentage of non-treatment and Proportion of infected per class of infection intensity). The indicators used in the evaluation of the coverage of the activities of the Schistosomiasis Control Program were calculated as described in Table 1.

The endemicity levels were inferred from the positivity indicator, being low endemicity: the year of the study in which the positivity of the disease was up to 10% positive exams among all the exams carried out that year. Mean endemic: the year of the study in which the positivity of the disease was between 10 and 25% of positive examinations among all the examinations

carried out that year. High endemicity: study year in which the positivity of the disease was equal to the greater than 25% (Brazil, 2014; Gomes de Amorim Santos et al., 2020).

Table 1.

Variables and indicators used in the evaluation of the coverage of the Schistosomiasis Control Program activities in the municipality of Feira Grande, Alagoas, 2008 to 2016.

Variables	Construction	Usefulness	Parameters
Examinations carried out	—	Create a variable to be used as the denominator in the positivity calculation.	Number of individuals who actually had fecal material collected and analyzed.
Total population worked	—	Create a variable to be used as numerator in the calculation of the coverage of PCE shares.	Number of individuals eligible to participate in the coproparasitological survey.
Number of Positive tests	—	Create a variable to be used as numerator when calculating prevalence	Number of individuals in the occupied population with *S. mansoni* eggs, diagnosed in Kato-katz.
Non-treatment due to refusal and/or absence	—	Create a variable to be used as numerator in the calculation of the treatment coverage of eligible individuals.	Number of subjects who should but did not receive treatment for schistosomiasis.
Number of subjects by infection intensity class	—	Create a variable to be used as numerator when calculating the proportion of infected per egg number class	Number of subjects diagnosed positive with 1 to 4, 5 to 16 or ≥ 17 eggs per blade.
Indicators	**Construction**	**Usefulness**	**Parameters**
Percentage of coproscopic examinations performed	*Numerator*: number of examinations performed *Denominator*: population worked. *Multiplication factor*: 100.	Measure the proportion of eligible individuals in the municipality who actually had the coproparasitological diagnosis performed.	Adequate coverage: > 90% Inadequate coverage: < 90%
Non-treatment ratio	*Numerator*: number of non-treatment due to refusal and/or absence. *Denominator*: number of individuals to be treated. *Multiplication factor*: 100.	Know the proportion of individuals who have not been treated for schistosomiasis and thus indirectly measure the risk of maintaining the condition in the study areas.	Adequate coverage: up to 10% non-treatment Inadequate coverage: over 10% non-treatment

Percentage of disease positivity	*Numerator*: number of positive tests. *Denominator*: Number of examinations performed. *Multiplication factor*: 100.	Know the epidemiological situation of the disease in the study areas.	Low endemicity: up to 10% Medium endemic: between 10% and 25% High endemicity:> 25%
Proportion of Infected by Infection Intensity Class	*Numerator*: number of positive tests per class of number of eggs per gram of feces *Denominator*: Total number of positive tests. *Multiplication factor*: 100.	To know the proportion of positive people per bands of number of eggs found in the blade, in relation to the total of positive cases	1-4 (low = PI-low) 5-16 (average = PI-media) ≥17 (high = PI- high)

Source: Adaptado de Brasil (2014). Note: PI - Proportion of infected by class of number of eggs counted in the blade.

For each of the indicators, a descriptive analysis was carried out, with the calculation of mean, standard deviation, minimum and maximum. They were represented by graphs in rows, and the temporal evaluation was done by simple linear regression, which admitted the indicators as independent variables and the years as independent. It was analyzed whether the time series had a decreasing, stationary or increasing trend, as well as the annual growth rate. The level of significance adopted was 5%, and the software used was R (version 4.1.2).

Ethical aspects

The data collected for this study comes from a system in the public domain and completely exempt from any nominal identification of patients, and it was not necessary to submit to a human research ethics committee according to resolution 466/2012 of the National Health Council.

Results

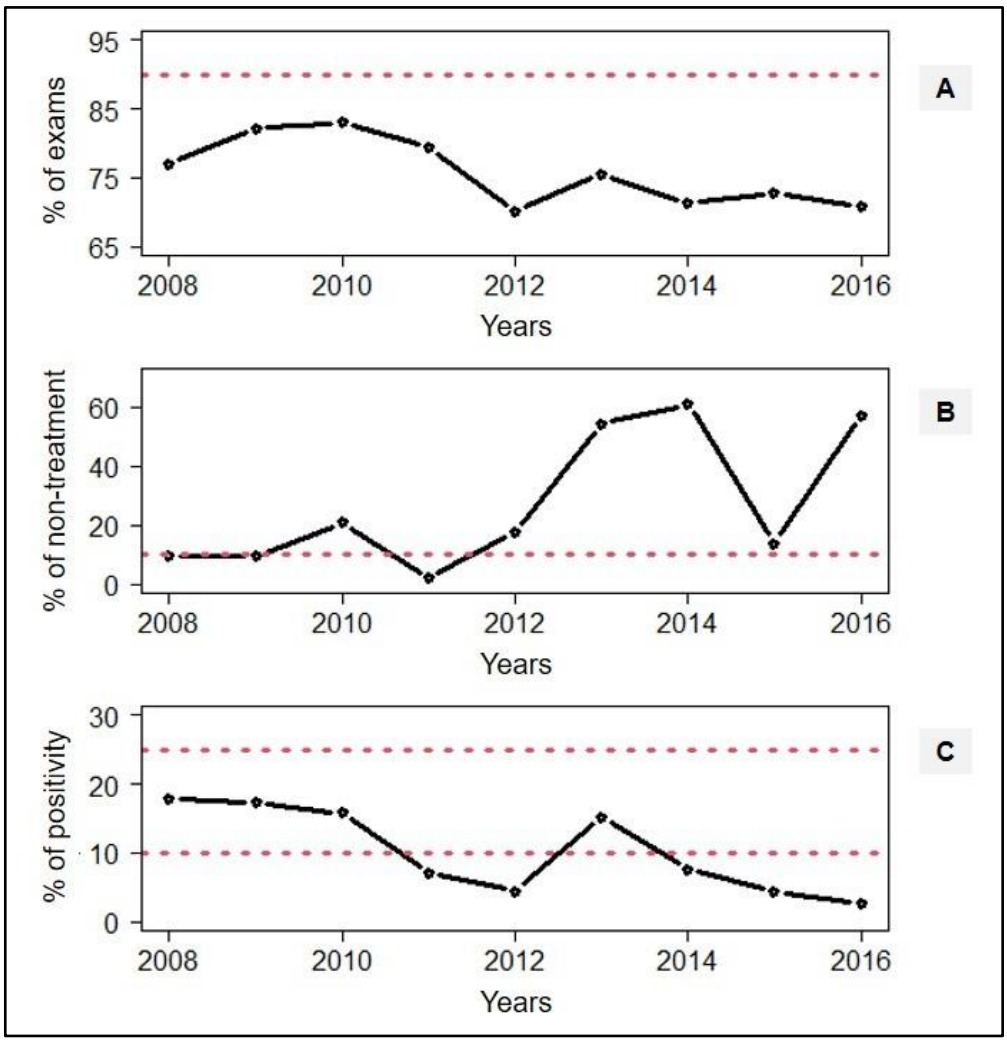
In the period analyzed, the population worked in Feira Grande was 17,598 individuals, of which 13,134 had fecal material collected and analyzed according to the routine of the PCE. 1,159 cases of schistosomiasis mansoni were reported in the city, which represented a positivity of 8.8%. Of the total of positives, 330 (28.5%) were not treated.

In the time series analyzed here, the operational actions indicator shows that the percentage of examinations performed remained below adequate coverage (<90%) throughout the period studied, pointing to the years 2012 and 2016 as those with the lowest coverage proportions, followed by 2014 and 2015 (Graph 1.A).

For the proportion of non-treatment indicator, 2011 was the year that presented the best scenario, with more than 95% of the subjects eligible for treatment being treated. On the other hand, the years 2013, 2014, 2016 recorded the highest rates of non-treatment in the period (Graph 1.B). In relation to the percentage indicator of positivity, the years 2008, 2009, 2010 and 2013 had average endemicity (between 10% and 25%) for the municipality, with the highest rate occurring in 2008 and with the other years showing low endemicity (up to 10%) (Graph 1.C).

Graph 1.

Indicators of operational and epidemiological actions of the PCE in the municipality of Feira Grande, Alagoas, 2008 - 2016: (A) percentage (%) of coproscopic examinations performed; (B) proportion (%) of non-treatment; (C) percentage (%) of positivity.



Source: The authors (2023). *Note:* % of exams - percentage of examinations performed; % of non- treatment - proportion of non-treatment; % of positivity - percentage of positivity.

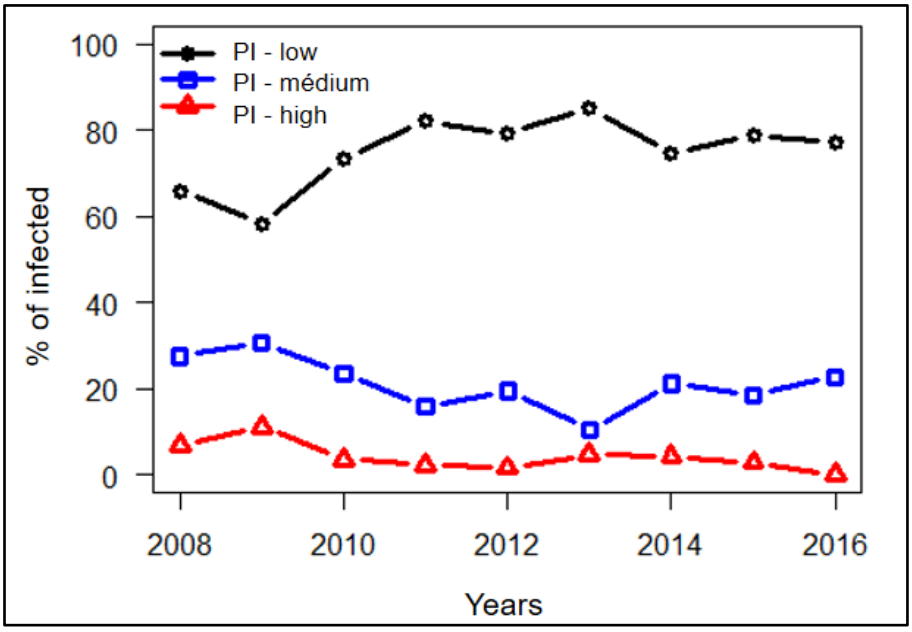
Of the 1,159 cases of infection, 856 (73.86%) were diagnosed as having a low intensity of infection (1 to 4 eggs counted in the blade), 245 (21.14%) cases moderate intensity of

infection (5 to 16 eggs counted in the blade), and another 58 (5.0%) cases with intensity of infection classified as heavy (from 17 eggs found in the blade).

The proportion of infected (PI) with low egg count per blade (PI-low) was higher in all years of the historical series analyzed, especially in 2011 (82.0%) and 2013 (85.0%). In 2009, the lowest PI - low (58.3%) and the highest PI - medium (30.6%) and high (11.1%) were recorded when compared to the other years (Graph 2).

Graph 2.

Indicator of Proportion of Infected (PI) per class of intensity of infection in the municipality of Feira Grande, Alagoas, 2008 - 2016.



Source: The authors (2022). Note: PI-low - 1 - 4 eggs per blade; PI- average - 5 - 16 eggs per blade; PI- high - ≥17 eggs per blade.

The time evaluation showed that indicators PI – high, Proportion (%) of exams performed e Proportion (%) of positivity showed a decreasing temporal trend, on the other hand, the Proportions of Infected (PIs) - low and medium had a stationary trend, and only the indicator Proportion (%) of non-treatment showed a growing trend (Table 2).

Table 2.

Temporal trend of the indicators of operational and epidemiological actions of the SCP in the municipality of Feira Grande, Alagoas, 2008 - 2016.

Variable	Med.	S.D.	Min.	Max.	Trend	P-value	Rate of Growth
PI - low	74.91	8.31	58.33	85.05	Stationary	0.074	
PI - medium	21.00	6.03	10.31	30.56	Stationary	0.182	
PI - high	4.09	3.28	0.00	11.11	Decreasing	0.046	-0.81

% of exams performed	75.82	4.89	70.22	82.97	Decreasing	0.021	-1.33
% of non- treatment	27.33	23.12	2.25	60.84	Growing	0.044	5.56
% of positivity	10.28	6.13	2.78	17.80	Decreasing	0.011	-1.78

Source: The authors (2023). Nota: Med. - Medium; S.D. - Standard Deviation; Min. - Minimum; Máx. - Maximum.

Discussion

The set of data presented in this study show that a positivity rate of 8.8% was observed for schistosomiasis mansoni in the municipality of Feira Grande, Alagoas, so that the years 2012 and 2016 presented the lowest coverage in the diagnosis of the disease. In addition, it was seen that in the years 2008, 2009, 2010 and 2013 the municipality presented an average endemicity, in addition to having the lowest treatment coverage in the years 2013, 2014 and 2016, and the prevalence of the low infection intensity rate in all years of the time series studied.

Although the population worked and the number of examinations carried out gradually increased during the period analyzed, the operational indicator of coverage of actions shows that there was an insufficiency in this aspect throughout the period analyzed, which is contrary to the recommendations of the Ministry of Health regarding the actions of the PCE. Thus, it´s suggested that the municipalities endemic for schistosomiasis mansoni, and especially the municipality of Feira Grande, can comply with the recommendations of the MS regarding the minimum targets for carrying out parasitological examinations of feces in the localities worked. By doing so, municipalities will be ensuring that individuals at risk of infection have timely diagnosis and treatment.

Although the positivity observed in the present study is not relatively high (8.8%), it should be considered the same worrying, since the city of Feira Grande is located in the endemic area of the state for schistosomiasis mansoni, in which the data of prevalence in relation to the disease are still critical (Katz, 2018).

Worryingly, the positivity rate in Feira Grande proved to be higher than the prevalence data recorded for the state of Alagoas in the five-year period from 2016 to 2020, as well as for the positivity (7.12%) recorded in the period between 2007 and 2017. In this state there is a tendency to decrease the prevalence of the disease, and important questions should be raised, about some of the factors that can contribute to this low positivity (Alagoas, 2021; Silva et al., 2020). Among these factors, highlight is the reduction of active search by endemic municipalities (Alagoas, 2021), that is, significant decrease in quantitative and population examinations, which can influence the reduction of positivity, and consequently, underestimated number of cases (Silva et al., 2020).

In this context, the rates of positivity of schistosomiasis mansoni in the present study call attention for two reasons: the first is that in the nine-year time series analyzed (2008 to

2016), the municipality presented an oscillation in the rates of positivity, which varied from medium endemicity to low endemicity in the course of the period analyzed. The second reason refers to the fact that the lowest positivity rates occurred in the years that had the lowest proportions of coprosscopic examinations carried out, which possibly interfered in the diagnosis of the positive cases.

In the period 2010 to 2014, seven municipalities of Alagoas, among them Feira Grande, showed a prevalence of more than 15% for the disease, considered alarming (Rocha et al., 2016). Between 2010 and 2016, Feira Grande occupied a position among the three municipalities endemic for schistosomiasis in the 7th health region of the state of Alagoas, which showed the highest rates of positivity when compared to the others (Araújo et al., 2020).

In studies referring to the state of Pernambuco, also endemic for schistosomiasis mansoni, in one of these studies, where the period between 2005 and 2010 was analyzed, there was a drop in positivity rates from 2007 (8.0%), with the highest rates having been recorded in the years 2005 (13.9%) and 2006 (12.6%), and the lowest rate recorded in 2010 (6.1%) (Barreto et al. 2015). In another study there were similar results, where a drop of 10.31% (2007) in the positivity rate was observed in the first year of the analyzed time series to 3.01% (2015) (Soares et al., 2019). Such results are similar to those observed in Alagoas, which showed a decline in incidence rates between 2007 and 2012, and a steady period from 2012 onwards (Silva et al., 20200).

Thus, knowing that Basic Care (AB) is the gateway to access to health services, we highlight that the work carried out under the PCE, should take place in a flow of joint actions between Health Surveillance (HCP) and AB, aiming at integral attention, from the diagnosis of positive cases and identification of risk areas, to the follow-up of treatment and monitoring of positive cases, in order to avoid recurrence of cases or even the emergence of new ones. Thus, the action of health agents and/or endemics in the routine work of the PCE is indispensable, since they represent the main link between the population and the health service, and can then guide it to the disease, so that the insufficiency of the agents, whether by a small number of professionals or work overload, will become detrimental to the effectiveness of the PCE (Barreto et al., 2015; Inobaya et al., 2014; Soares et al., 2019).

The years 2014, 2016 and 2013 had the highest proportions of non-treatment, suggesting that the lowest coverage occurred in those years. In the period between 2007 and 2017, the percentage of treaties in Alagoas was 75.48%, where only 10 endemic municipalities treated more than 90% of the positive individuals for MS, according to recommendations of the Ministry of Health (Silva et al., 2020).

This low adherence to treatment may be related to the lack of knowledge of the population about the place where the medication is made available free of charge through the

Public Health System (SUS), causing difficulty in accessing it. Corroborating this, a study carried out in Feira Grande showed that the population has low knowledge about schistosomiasis, with access to information sometimes restricted to inconsistent sources, which may reinforce low adherence to treatment (Santos et al., 2023).

In addition, another factor that may be related to not seeking treatment is the reduced amount of health agents and/or well-educated endemics regarding the guidelines regarding the treatment of the disease, so that they can guide the population correctly, seeking to demystify the fear that some people have in taking the medication, fearing possible adverse reactions caused by the drug (Barreto et al., 2015; Soares et al., 2019).

Inadequate treatment coverage with regard to the treatment of positive cases, as observed in most of the years analyzed in this study, contributes to the occurrence of asymptomatic carriers, which due to the absence of treatment, continue to release eggs into the environment and contaminate water collections, which, if inhabited by the intermediate host, can become foci of transmission of *S. mansoni* (Alencar et al., 2016; Barreto et al., 2015; Gomes de Amorim Santos et al., 2020; Inobaya et al., 2014)

The data referring to the proportion of infected according to the intensity class of the infection, suggest that the investigated municipality is possibly a region of low parasitic load, since the PI with low quantity of eggs per blade was higher than the others registered in the whole period analyzed. These results corroborate what was observed, in the study that analyzed the schistosomiasis situation in municipalities of the 7th health region of Alagoas (Arapiraca, Noia Committee, Craíbas, Feira Grande, Girau do Ponciano, Lagoa da Canoa, Limoeiro de Anadia, Major Isidoro, São Sebastião, Taquarana), between 2010 and 2016, suggesting that these municipalities, have in their majority pattern of mild infection intensity (Araújo et al., 2020).

It should also be noted that even in endemic regions, those infected may have a low parasitic load. This is attributed to the relationship between the successive reinfections and the immune response of the individuals living in these locations, so that the immune response of the definitive host acts as a regulator of the oviposition of the females, contributing markedly to the parasite load resulting from the reinfections being lower. It´s also important to point out that the high number of people having a low intensity of infection is a reflection of active searches and treatment of positive cases, as recommended by the World Health Organization and the Ministry of Health (Brazil, 2019; Pordeus et al., 2008).

Another important fatora is the diagnosis of false negatives, since in cases of patients with medium or high parasitic load, a single examination is usually sufficient to detect the parasitosis. However, in the areas of low parasitic load, as observed in the municipality studied, it´s indicated the use of three feces samples, with at least two slides for each, aiming to potentialize the chances of positive diagnosis (Costa et al., 2017; Vitorino et al., 2012).

In regions of low prevalence, such as Feira Grande, in addition to the influence of diagnostic and treatment coverage, socioeconomic aspects, such as the lack of adequate sanitary drainage and drinking water supply, which condition the population to seek water from natural water sources, coupled with environmental aspects, such as the potential of these water collections to become breeding grounds of the intermediate host, the presence of host snails, together with climatic conditions and the unhealthy hygienic habits of the population, are factors that contribute to the permanence of the disease (Cunha & Guedes, 2012; Silva & Domingues, 2011; Vasconcelos et al., 2009).

In addition, another fatora that may interfere in the actions of the PCE refers to the relocation of health agents and endemics to other activities, like the dengue control program, which is also a public health problem; its outbreaks may make it a priority for municipal health organs at certain periods. In addition, the limited number of endemic agents and a public health situation entailing restrictions as observed during the COVID-19 pandemic in 2020 and 2021, become obstacles to conducting periodic epidemiological surveys (Alagoas, 2021; Carvalho & Mendonça, 2017; RolLemberg et al., 2011).

Conclusion

The results point to an insufficiency in the actions to control the PCE, besides showing that the epidemiological indicators point to a recrudescence of the disease in the municipality, thus requiring more engagement in the work to combat and prevent schistosomiasis mansoni. It should also be noted that more effective actions of the PCE can benefit the population beyond diagnosis and treatment, and can raise awareness through education and health, making them subjects more active in self-care and disease prevention.

The data from this study comes from a secondary source, which may be subject to some errors, such as delay in feeding the system, human failure in diagnosing the infection, underreporting of cases, which consists of a limitation for a more in-depth analysis of the phenomenon under study, making it important to develop further studies investigating this phenomenon.

REFERENCES

Alagoas. Companhia de Saneamento de Alagoas. *Unidade de Negócio do Agreste – UN Agreste*. (2018). https://www.casal.al.gov.br/u-n-agreste/

Alagoas. Secretaria de Estado da Saúde (SESAU). *Boletim Epidemiológico Anual: Esquistossomose: 2021*. (2021). Maceió: Secretaria de Estado da Saúde.

Alagoas. Secretaria de Estado da Saúde (SESAU). *GEDT: Esquistossomose. Boletim Informativo*. (2018). Maceió: Secretaria de Estado da Saúde. http://www.saude.al.gov.br/wp-content/uploads/2018/06/Boletim-GEDT-Esquistossomose-n%C2%BA-5.pdf.

Alencar, M. B., Ramos, R. A., Barbosa, C., Oliveira, M. E. T., Melo, C. S. (2016). Esquistossomose mansônica: uma análise de indicadores epidemiológicos no estado de Alagoas entre os anos de 2013 e 2015. *Div. Journ*. 1(3), pp. 266-274. https://doi.org/10.17648/diversitas-journal-v1i3.468.

Araújo, M. P., Santos, C. M. A., Gomes, D. S., Cirilo, T. M., Bezerra, L. P., Lima, P. D., Machado, J. P. V., Ramos, R. E. S., Gomes, S. C., Alencar, V. J. B., Silva, G. I. L., Damasceno, I. A., Silva, L. O., Paz, W. S., Santos, I. G. A. (2016). Epidemiologia da esquistossomose em uma área de baixa prevalência de Alagoas entre 2010 e 2016. *PUBVET*. 14 (3), pp. 1-6. https://doi.org/10.31533/pubvet.v14n3a537.1-6.

Barreto, A. V. M. S., Melo, N. D., Ventura, J. V. T., Santiago, R. T., Silva, M. B. A. (2015). Análise da positividade da esquistossomose mansoni em Regionais de Saúde endêmicas em Pernambuco, 2005 a 2010. *Epidemiol Serv Saude*. 24 (1), pp. 87-96. https://doi.org/10.5123/S1679-49742015000100010.

Brasil. Instituto Brasileiro de Geografia e Estatística. *Feira Grande – AL*. (2020). https://cidades.ibge.gov.br/brasil/al/feira-grande/panorama.

Brasil. Ministério da Saúde. (2019). Secretaria de Vigilância em Saúde. *Guia de Vigilância em Saúde*. 3º ed. Brasília: Ministério da Saúde.

Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. *Boletim Epidemiológico: Doenças Tropicais Negligenciadas*. (2021). Número Especial. Brasília: Ministério da Saúde. https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/especiais/2021/boletim_especial_doencas_negligenciadas.pdf

Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. *Vigilância da Esquistossomose mansoni: diretrizes técnicas*. (2014). 4ª ed. Brasília: Ministério da Saúde. https://bvsms.saude.gov.br/bvs/publicacoes/vigilancia_esquistossome_mansoni_diretrizes_tecnicas.pdf.

Carvalho, M. E. S., Mendonça, F. A. (2017). Condicionantes socioambientais do Modelo (Re) Produtivo da Esquistossomose na região endêmica do Município de Aracaju/SE. *Hygeia*. 13(24), pp. 70-91. http://www.seer.ufu.br/index.php/hygeia/article/view/37397

Cdc. Centers for Disease Control and Prevention. *Parasites - Schistosomiasis*. (2018). https://www.cdc.gov/parasites/schistosomiasis/

Costa, C. S., Rocha, A. M., Silva, G. S., Jesus, R. P. F. S., Albuquerque, A. C. (2017). Programa de Controle da Esquistossomose: avaliação da implantação em três municípios da Zona da Mata de Pernambuco, Brasil. *Sau Deb*. 41(spe), pp. 229-241. https://doi.org/10.1590/0103-11042017S17.

Cunha, L. A. D., Guedes, S. A. G. (2012). Prevalência de esquistossomose mansônica na cidade de Nossa Senhora do Socorro. *Ide Inova*. 1(1), pp. 41–48. https://periodicos.set.edu.br/ideiaseinovacao/article/view/291.

Gomes de Amorim Santos, I., Ramos, R. E. S., Gomes, D. S., Bezerra, L. P., Silva, L. O., Cirilo, T. M., Alves, L. C., Brayner, F. A. (2020). Analysis and spatial distribution of schistosomiasis mansoni in a historically endemic area of northeastern Brazil. *Trop Med Inter Health*. 25(9), pp. 1085-1092. https://doi.org/10.1111/tmi.13458.

Inobaya, M. T., Olveda, R. M., Chau, T. N. P., Olveda, D. U., Ross, A. G. P. (2014). Prevention and control of schistosomiasis: a current perspective. *Res Rep Trop Med*. 5, pp. 65–75. https://doi.org/10.2147/RRTM.S44274

Katz, N. (2018). *Inquérito Nacional de Prevalência da Esquistossomose mansoni e Geo-helmintoses*. https://www.arca.fiocruz.br/handle/icict/25662

Katz, N., Chaves, A., Pelegrino, J. (1972). A simple device for quantitative stool thick-smear technique in schistosomiasis mansoni. *Rev Inst Med Trop São Paulo*. 14(6): pp. 397-400. https://www.researchgate.net/profile/Naftale-Katz/publication/18489942_A_simple_device_for_quantitative_stool_thick-smear_technique_in_Schistomiasis_Mansoni/links/0046353847b89135d1000000/A-simple-device-for-quantitative-stool-thick-smear-technique-in-Schistomiasis-Mansoni.pdf.

Katz, N., Peixoto, S. V. (2000). Análise crítica da estimativa do número de portadores de esquistossomose mansoni no Brasil. *Rev Soc Bras Med Trop*. 33(3), pp. 303-308. https://doi.org/10.1590/S0037-86822000000300009**.**

Melo, A. L. & Coelho, P. M. Z. (2016). *Schistosoma mansoni* e a Esquistossomose. In: D. P. Neves, A. L. Melo, P. M. Linardi, V. R. W. Almeida (orgs.), *Parasitologia Humana*. (pp. 225 -245). Atheneu.

Pordeus, L. C., Aguiar, L. R., Quinino, L. R. M., Barbosa, C. S. (2008). A ocorrência das formas aguda e crônica da esquistossomose mansônica no Brasil no período de 1997 a 2006: uma revisão de literatura. *Epidemiol. Serv Saúde*. 17(3), pp. 163-75. http://dx.doi.org/10.5123/S1679-49742008000300002.

Rocha, T. J. M., Santos, M. C. S., Lima, M. V. M., Calheiros, C. M. L., Wanderley, F. S. (2016) Aspectos epidemiológicos e distribuição dos casos de infecção pelo *Schistosoma mansoni* em municípios do Estado de Alagoas, Brasil. *Rev Pan-Ama Saúde*; 7(2), pp. 27-32. http://dx.doi.org/10.5123/S2176-62232016000200003**.**

Rollemberg, C. V. V., Santos, C. M. B., Silva, M. M. B. L., Souza, A. M. B., Silva, A. M., Almeida, J. A. P., Almeida, R. P., Jesus, A. R. (2011). Aspectos epidemiológicos e distribuição geográfica da esquistossomose e geo-helmintos, no Estado de Sergipe, de acordo com os dados do Programa de Controle da Esquistossomose. *Rev Soc Bras Med Trop*. 44(1), pp. 91-96. https://doi.org/10.1590/S0037-86822011000100020

Santos, A. J. D., Lima, S. V. M. A., Sousa, A. F. L. D., Vasconcelos dos Santos, A., Santos, I. G. D. A., Bezerra Santos, M., ... & Silva, J. R. S. (2023). Knowledge, Attitude and Practices towards the Prevention of Schistosomiasis Mansoni in an Endemic Area of Alagoas, Northeast Brazil. *Tropical Medicine and Infectious Disease*, *8*(1), 34. https://doi.org/10.3390/tropicalmed8010034

Silva, F. F., Bezerra, R. P., Souza, C. D. F., Santos, C. B. (2020). Dinâmica espaço-temporal da Esquistossomose Mansônica em Alagoas (2007-2017). *Div. Journ*. 5(3): 1738-1749. https://doi.org/10.17648/diversitas-journal-v5i3-1056.

Silva, P. C. V., Domingues, A. L. C. (2011). Aspectos epidemiológicos da esquistossomose hepatoesplênica no Estado de Pernambuco, Brasil. *Epidemiol Serv Saúde*. 20 (3), pp. 327–36. http://dx.doi.org/10.5123/S1679-49742011000300007.

Soares, D. A., Souza, A. S., Silva, D. J., Silva, A. B., Cavalcante, U. M. B., Lima, C. M. B. L. (2019). Avaliação epidemiológica da esquistossomose no estado de Pernambuco através de um modelo de regressão beta. *Arqu. Ciên. Saúde*. 26(2), pp. 116-120. https://doi.org/10.17696/2318-3691.26.2.2019.1302.

Vasconcelos, C. H., Cardoso, P. C. M., Quirino, W. C., Massara, C. L., Amaral, G. L., Cordeiro, R., Carvalho, O. S. (2009). Avaliação de medidas de controle da esquistossomose mansoni no Município de Sabará, Minas Gerais, Brasil, 1980-2007. *Cad Sau Pub*. 25(5), pp. 997–1006. https://doi.org/10.1590/S0102-311X2009000500006.

Vitorino, R. R., Souza, F. P. C., Costa, A. P., Faria Júnior, F. C., Santana, L. A., Gomes, A. P. (2012). Esquistossomose mansônica: diagnóstico, tratamento, epidemiologia, profilaxia e controle. *Rev Soc Bras ClínMéd*. 10(1), pp. 39-54. http://www.sbcm.org.br/revistas/RBCM/RBCM-2012-01.pdf#page=36.

Who. World Health Organization. *Schistosomiasis*. (2021). https://www.who.int/news-room/fact-sheets/detail/schistosomiasis.