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Clinical characteristics and prevalence of schistosomal infection in Brazil: exploratory ecological study

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ABSTRACT

OBJECTIVE

To describe and analyze the clinical characteristics and prevalence of schistosomal infection in Brazil according to federation units in the last four years.

METHOD

An exploratory ecological study was conducted, with multiple groups, with data from the Notifiable Diseases Information System made available by the Information and Informatics Department of the Unified Health System (TabNet). The data were processed using Microsoft Excel® for tabulation, Jamovi® for descriptive analysis and QGIS® to create maps of new cases.

RESULTS

A total of 13,575 cases were reported between 2019 and 2023, with a predominance in the Northeast and Southeast regions, highlighting Minas Gerais, Bahia, Pernambuco, Sergipe and São Paulo. The disease affected mostly men, aged 20 to 59 years, brown skin, who presented the hepatointestinal form and evolved to cure. The prevalence during the period remained below 2 cases per 100,000 inhabitants, indicating improvements in the population's living conditions and sanitation.

CONCLUSION

Schistosomiasis remains a relevant public health issue in Brazil, requiring actions and investments in sanitary conditions, health education and access to health services, in order to reduce its impact and prevalence in Brazil.

KEYWORDS

Schistosomiasis mansoni; Ecological studies; Epidemiology.

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INTRODUCTION

Schistosomiasis mansoni (MS), known as water belly, is a disease caused by Schistosoma mansoni and its transmission occurs when the infected person, considered the definitive host, eliminates eggs containing the etiological agent through their feces which, when they come into contact with water, hatch and release larvae that infect snails of the genus Biomphalaria, known as intermediate hosts that live in freshwater[1].

MS stands out for being one of the most prevalent neglected tropical diseases in the country, affecting populations living in areas with poor sanitary infrastructure, where access to the sewage system and drinking water is limited[1]. MS is a disease that mainly affects populations living in rural and peri-urban areas, being more prevalent in the North, Northeast and Southeast regions of Brazil. The states that are particularly known for having endemic foci of the disease are Pernambuco, Bahia, Alagoas, Minas Gerais and Espírito Santo[1,2].

It is estimated that approximately 1.5 million Brazilians are infected with MS. However, these numbers are probably underestimated due to several difficulties, such as the complexity of diagnosis and low case reporting, especially in remote areas where access to health services is limited[2,3]. MS is strongly associated with precarious socioeconomic conditions. In many communities, sanitation shortages result in the contamination of water bodies, which become environments conducive to the proliferation of the pathogen that causes MS. In addition, the lack of awareness about the disease contributes to its spread, since many people living in the affected regions have little access to information on how to prevent infection, which further aggravates the situation[2,3].

Immediately after contact with cercariae, MS has its clinical course divided into two phases: early and late. The initial phase consists of acute, asymptomatic and symptomatic forms, where in addition to malaise, fever, and pain in the liver region, there is a pruritic manifestation on the skin, cercarial dermatitis, which can appear between three and four weeks after infection. In the late phase, chronicity is marked by satisfactory modulation of the granuloma, with less liver damage and, when unsatisfactory, gives rise to hepatointestinal, hepatic and hepatosplenic forms[4].

In Brazil, the Unified Health System (SUS) adopts a multidisciplinary approach to prevent, diagnose and treat the disease. The main strategies include the use of antiparasitic drugs, such as praziquantel, health education campaigns to raise awareness of the risks of exposure to contaminated water, and improvements in the quality of basic sanitation in specific regions[5].

However, significant challenges remain, such as the lack of uniformity in the work process of health teams, ineffective monitoring of diagnoses in remote areas, dissimilarity in epidemiological data, and the difficulty in maintaining sustainable control programs in the long term. In addition, there is a discrepancy between control policies and the reality faced by affected populations, who are often marginalized and have limited access to quality health services[6].

The monitoring of diagnostic processes and the equitable distribution of resources to the most affected regions are critical factors for improving disease control. The implementation of an effective epidemiological surveillance system, which allows for the early identification of outbreaks and a rapid response, is also essential to prevent the spread of the disease to new areas[7].

Therefore, MS is not only a public health challenge, but also a reflection of the social and economic inequalities that affect a large part of the Brazilian population. Addressing this issue requires a joint effort to improve the quality of life of these communities, including investments in basic sanitation, education, and access to quality health services[7]. Although the national positivity rate remains below 5%, the target expected by the country's Schistosomal Control Program, 14.9% of endemic states had a high positivity rate between 2019 and 2022, which justifies an analysis of this period to understand the behavior of the disease in the period between endemic and non-endemic regions with a view to contributing to the discussion about the goal of eliminating this disease as a public health problem proposed by the World Health Organization[1,2]. In this context, the objective of this study was to describe and analyze the clinical characteristics and prevalence of schistosomal infection in Brazil, according to federation units and a four-year time frame.

MATERIALS AND METHODS

Exploratory ecological study, of the multiple groups type, which used the number of confirmed cases of MS from the Notifiable Diseases Information System (SINAN) made available by the data tabulator of the Department of Information and Informatics of the Unified Health System (TabNet/DATASUS).

The term ecological study can be used to designate an investigation that uses a group of people, in a given location, as the unit of analysis. The multiple groups type aims to describe and compare the rates of a given disease between different geographic areas or aggregates in a set period[8,9].

Cases reported between 2019 and 2023 were considered and included, where "federation unit" was selected in the row and the column was not active to allow the selection of multiple contents and periods. The variables collected for this study included: biological sex (Male/Female), age group (<1 year; 1 to 4 years; 5 to 9 years; 10 to 14 years; 15 to 19 years; 20 to 39 years; 40 to 59 years; 60 to 64 years; 65 to 69 years; 70 to 79 years; 80 years and over), self-declared race (White; Black; Yellow; Brown; Indigenous), clinical form (Intestinal; Hepato-Intestinal, Hepato-Splenic, Acute), evolution (Cure; No Cure; Death from MS; Death from other causes) and prevalence of schistosomal infection (Number of people with MS in the population, in a given period, divided by the number of people in this same population, in the same period, multiplied by 100,000). The collected data were entered and stored in a Microsoft Excel® spreadsheet and exported to Jamovi® software version 2.3.26.0 to support descriptive analysis of the information.

To calculate prevalence, the population for each year of the time frame analyzed was used, according to the Population Projection of the Federative Units by sex, simple age or age group: 2010-2060 (2024 Edition), available for public consultation on the website of the Brazilian Institute of Geography and Statistics[10].

The data are presented in tables and graphs, indicating absolute and relative numbers and the prevalence presented by region and year. To construct the maps referring to the absolute number of cases by year of notification, the Brazilian territorial grid by federative unit was used, with a cartographic basis from the SIRGAS 2000 reference system, using the QGIS® software version 3.38.3-Grenoble. The subtitle presentation intervals were created by this software, adopting fixed intervals and divided into 5 classes.

This study was developed with anonymous secondary data, and did not require submission and assessment by a Research Ethics Committee.

RESULTS

Between 2019 and 2023, 13,575 cases of MS were reported in Brazil, with the Northeast and Southeast regions (Table 1) accounting for the highest number of cases in the historical series, with the states of Bahia (11.3%), Minas Gerais (52.1%) and Rio de Janeiro (9.1%) recording the highest percentages of notifications in the period (Table 2).

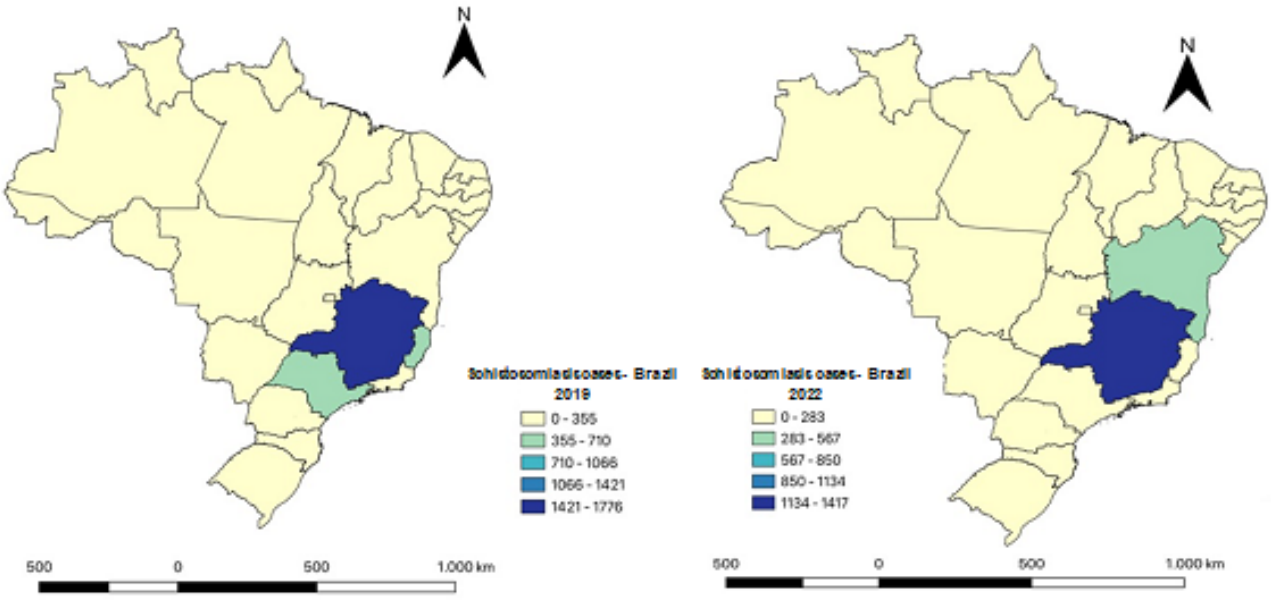
Table 1 - MS cases in Brazil according to macroregion and year of notification. Brazil, 2024.

Macroregion	2019	%	2020	%	2021	%	2022	%	2023	%
North Region	42	1,16	27	1,44	34	1,42	59	2,23	38	1,24
Northeast Region	720	19,96	500	26,70	747	31,19	762	28,86	1008	32,95
Southeast Region	2728	75,61	1271	67,86	1529	63,84	1746	66,14	1958	64,01
South Region	63	1,75	22	1,17	33	1,38	30	1,14	33	1,08
Central-West Region	55	1,52	53	2,83	52	2,17	43	1,63	22	0,72
TOTAL	**3608**	**100,00**	**1873**	**100,00**	**2395**	**100,00**	**2640**	**100,00**	**3059**	**100,00**

Source: Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net, 2024.

When mapping the macro-regions according to the absolute number of MS cases, it is possible to see that Minas Gerais remained with the highest concentration of notifications (fifth interval) and, after a transition in the period analyzed, where in 2019 São Paulo and Espírito Santo appear in the third interval (710-1066) in number of cases and in 2022, Bahia assumes this position (Figure 1).

Figure 1 – Absolute number of MS cases in Brazil according to year of notification. Brazil, 2024.



Source: Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net. 2024.

In the period analyzed, it is possible to notice a sharp drop in the number of notifications between 2019 and 2020, a period that included the beginning of the cases and subsequent COVID-19 pandemic, a fact that may explain this drop. From 2021 onwards, the number of cases resumed growth, maintaining a linear trend. The states with the highest proportion of cases reported throughout the period were Pernambuco, Sergipe, Bahia, Minas Gerais and São Paulo (Table 2).

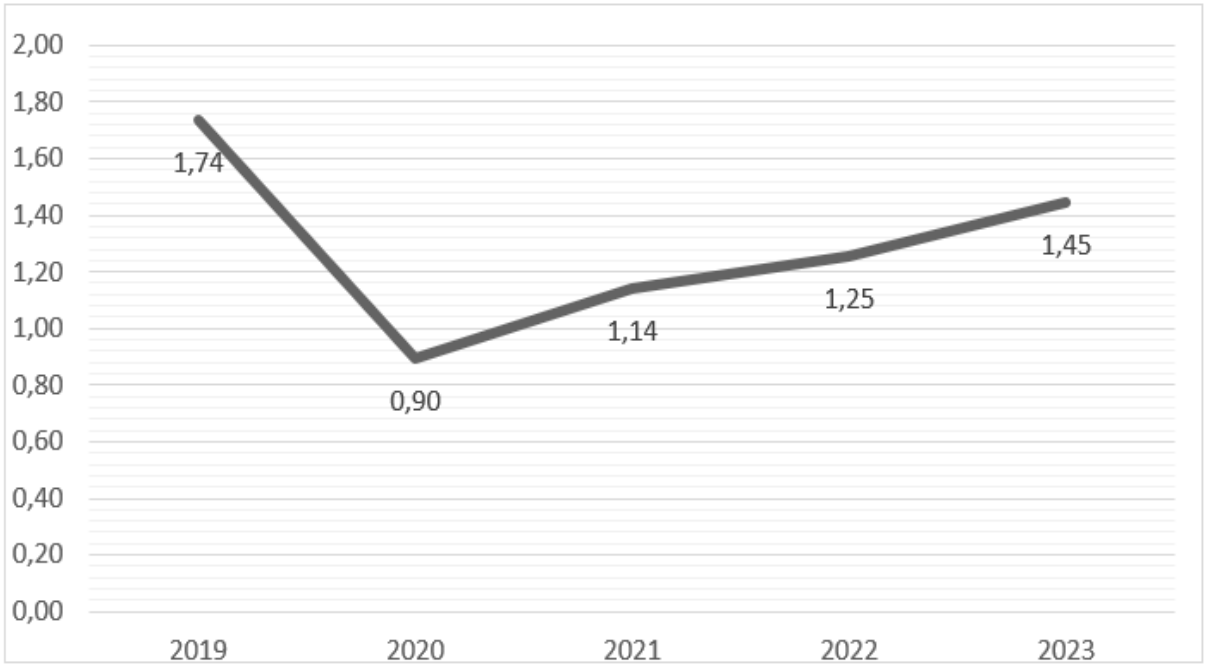
Table 2 - Number of MS cases in Brazil according to Federation Unit and year of notification. Brazil, 2024.

Federation Unit	2019	%	2020	%	2021	%	2022	%	2023	%
Acre	1	0,03	0	0,00	0	0,00	1	0,04	0	0,00
Amazonas	0	0,00	0	0,00	1	0,04	0	0,00	0	0,00
Pará	22	0,61	7	0,37	10	0,42	19	0,72	16	0,52
Amapá	0	0,00	0	0,00	4	0,17	0	0,00	1	0,03
Tocantins	0	0,00	0	0,00	2	0,08	2	0,08	5	0,16
Maranhão	12	0,33	7	0,37	20	0,84	21	0,80	24	0,78
Piauí	0	0,00	1	0,05	3	0,13	1	0,04	4	0,13
Ceará	26	0,72	19	1,01	29	1,21	22	0,83	17	0,56
Rio Grande do Norte	29	0,80	17	0,91	41	1,71	25	0,95	22	0,72
Paraíba	30	0,83	38	2,03	66	2,76	90	3,41	79	2,58
Pernambuco	157	4,35	126	6,73	202	8,43	150	5,68	143	4,67
Alagoas	87	2,41	39	2,08	70	2,92	45	1,70	75	2,45
Sergipe	108	2,99	60	3,20	73	3,05	111	4,20	100	3,27
Bahia	271	7,51	193	10,30	243	10,15	297	11,25	544	17,78
Minas Gerais	1776	49,22	1036	55,31	1278	53,36	1417	53,67	1659	54,23
Espírito Santo	487	13,50	3	0,16	0	0,00	0	0,00	0	0,00
Rio de Janeiro	48	1,33	29	1,55	24	1,00	129	4,89	97	3,17
São Paulo	417	11,56	203	10,84	227	9,48	200	7,58	202	6,60
Paraná	54	1,50	14	0,75	15	0,63	21	0,80	18	0,59
Santa Catarina	8	0,22	7	0,37	15	0,63	9	0,34	13	0,42
Rio Grande do Sul	1	0,03	1	0,05	3	0,13	0	0,00	2	0,07
Mato Grosso do Sul	16	0,44	5	0,27	3	0,13	3	0,11	3	0,10
Mato Grosso	20	0,55	13	0,69	12	0,50	11	0,42	9	0,29
Goiás	3	0,08	19	1,01	16	0,67	14	0,53	2	0,07
Distrito Federal	16	0,44	16	0,85	21	0,88	15	0,57	8	0,26
Rondônia	19	0,53	20	1,07	17	0,71	37	1,40	16	0,52
Roraima	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
Total	3608	100	1873	100	2395	100	2640	100	3059	100

Source: Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net, 2024.

The prevalence of schistosomal infection decreased between 2019 and 2020 and, after this period, it maintained a linear trend of gradual increase from 2021 onwards, as shown in graph 1 below.

Graph 1 - Prevalence of Schistosomal Infection in the Brazilian population according to year of notification. Brazil, 2024.



Source: Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net, 2024.

It is important to highlight the significant percentage of unknown/blank data recorded in the variables race/color, clinical form and disease progression, which prevents the understanding of the epidemiological profile and clinical characteristics of the disease, in addition to hindering intersectoral actions and implementation of public policies (Table 3).

Table 3 - Sociodemographic and clinical characteristics of the population affected by MS between 2019 and 2023. Brazil. 2024.

Study Variables		n	%
Sex	Blank/Ignored	2	0,01
	Male	8225	60,59
	Female	5348	39,40
Age Group	Blank/Ignored	2	0,02
	<1 Ano	126	0,93
	01-04	133	0,98
	05-09	411	3,03
	10-14	650	4,79
	15-19	692	5,10
	20-39	4144	30,53
	40-59	4951	36,47
	60-64	878	6,47
	65-69	639	4,71
	70-79	698	5,14
	80 e +	250	1,84
Race/Color	Blank/Ignored	852	6,28
	White	3558	26,21
	Black	1163	8,57
	Yellow	135	0,99
	Brown	7812	57,55
	Indigenous	55	0,41

	Blank/Ignored	4404	32,44
	Intestinal	6581	48,48
Clinical Form	Hepato Intestinal	611	4,50
	Hepato Splenic	719	5,30
	Acute	448	3,30
	Other	812	5,98
	Blank/Ignored	5749	42,35
	Cure	7081	52,16
Evolution	No Cure	273	2,01
	Death from MS	330	2,43
	Death from other causes	142	1,05
Total		**13575**	**100,00**

Source: Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net, 2024.

DISCUSSION

This study showed that MS, from 2019 to 2023, mostly affected brown men who presented the intestinal form of the disease and evolved to recovery. In addition, the notifications were concentrated in the Northeast and Southeast regions, where the states of Pernambuco, Sergipe, Bahia, Minas Gerais, and São Paulo had the highest proportions of cases in the historical period. In addition, the prevalence of schistosomal infection, after a considerable drop between 2019 and 2020, resumed growth from 2021 and maintained this trend until 2023.

The federated units with the highest proportions of cases found in this study legitimize the data in the literature, which considers them as endemic areas for MS, with established transmission. Studies[11,12,13] showed higher notifications of the disease in the Northeast and Southeast regions, with emphasis on the states of Minas Gerais, Bahia, Pernambuco, Paraíba, and Sergipe. Because they are endemic areas, the population is at increased risk of illness, especially those in vulnerable situations who live under inadequate environmental and sanitary conditions, which contributes to the maintenance of MS as a public health problem[4].

Historically, these states belong to a section of the national territory with unequal distribution of access to basic sanitation and, in addition, they have been and continue to be affected by seasonal floods that contribute to the accumulation of waste and transport of the disease vector[14].

This study revealed that the age group most affected by MS was between 20 and 59 years old, comprising 67% of the reported cases. According to Ferreira[13], in Juatuba in Florestal - MG, the age group with the highest number of reported cases was between 15 and 49 years old and between 20 and 59 years old in the study conducted by Rodrigues in the city of Ubá - MG[15]. In the state of Maranhão, the age group observed with the highest frequency of cases corroborates the findings of this study and others, that is, 15 to 49 years old[16]. This age group coincides with the economically active population, that is, people of both sexes, over 15 years old, who constitute the workforce for the production of economic goods and services[17] and who may be exposed to harm during their work activities.

Regarding the gender variable, the male population was the most affected in the period analyzed, representing more than 60% of the cases in this study, consistent with the findings of Almeida Júnior *et al.*[16] and Holanda *et al.*[18], in which the male population presented the highest proportions of cases, that is, 95.05% and 73.6%, respectively. One of the explanations for the greater incidence of MS in men may be associated with a series of barriers to access for this public in the health service, including the time and delay in care, shame of exposing the body to health professionals and gender stereotypes, which often lead to late discovery of the disease, compromising treatment and increasing the risk of preventable deaths. It is necessary to reinforce the commitment to deconstructing machismo and encourage men to take care of their health[19]. The clinical form of MS depends on the host's response to the invasion and intensity of the infection, a fact considered a challenge for the early identification of cases, since many people develop the disease silently, progressing until the development of severe forms[20]. The intestinal form was the most reported in this study, corresponding to 48.48% of cases. In the study by Silva *et al.*[21], the intestinal form was present in 29% of cases and for Cardoso *et al.*[22], 49.5% of cases reported in Minas Gerais presented the intestinal form of MS. According to the Technical Guidelines for MS Surveillance, the intestinal form is currently designated and comprises the hepatointestinal form, since all people living in endemic areas present this form of the disease, since all already have hepatic granulomas even without a palpable liver and periportal fibrosis[4].

Regarding the final outcome of the cases, in this study, 52.16% of cases evolved to cure, in line with other studies. Increased cure rates indicate improved access to treatment for the disease, which aims to reduce the host's parasite load, prevent progression to severe forms, and contribute to primary prevention actions in the context of eliminating eggs and the vector of the disease[23].

It is important to highlight that in the period analyzed in this study, 32.44% were classified as unknown or the field was left blank for clinical form and 42.35% for progression, a fact that prevents a more robust epidemiological analysis both in terms of the importance of the disease for public health and in the adoption of control measures[24].

The prevalence of schistosomal infection has remained low, less than 2 cases per 100,000 inhabitants, as indicated by the results of this study. This fact confirms the increase in the treatment of cases, the expansion of actions to eliminate transmission foci and the significant improvement in socioeconomic conditions, especially in the water supply and sanitation in endemic areas of the Northeast and in the state of Minas Gerais[25].

Despite the reduction in the prevalence of MS in Brazil, the disease is still a serious health problem and one of the main diseases transmitted by water. In developing countries, rural and peripheral urban populations are at increased risk of developing the disease, where poor sanitation conditions and low socioeconomic levels can still be found[26, 27].

Since this is a study based on secondary data, the results should be interpreted considering their limitations, including the quality, completeness and reliability of the information available, as well as possible inconsistencies in the records and duplications. This may restrict the capacity for detailed analysis and make it difficult to interpret the results.

CONCLUSION

MS still represents a serious public health problem that af-

fects populations that are more vulnerable in terms of socioeconomic status and access to basic sanitation goods and services.

This study revealed that men of working age mostly presented the hepatointestinal form of the disease and evolved towards a cure. The Northeast and Southeast regions and their respective states of Pernambuco, Sergipe, Bahia, Minas Gerais and São Paulo concentrated the highest proportions of cases.

As for prevalence, although it remained low in the period analyzed, it is a focus of attention and intensification of preventive and control measures so that the goal of its elimination is achieved according to the pact between Brazil and the World Health Organization. In addition, it is important to expand health education activities and detect new cases early so that treatment can be initiated. The epidemiological criterion, considering endemic and non-endemic areas, can assist health professionals in the differential diagnosis of MS.

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