Research Article

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2025.60.009440

Epidemiological Evaluation of Schistosomiasis in Brazil in the Last Ten Years

Giovanna Nunes Barea[1] and Maria de Lourdes Rego Neves Farinas[2]*

[1]*Student of the Biomedicine course, Brazil*

[2]*Work advisor, Professor of the Biomedicine Course, Brazil*

***Corresponding author:** Maria de Lourdes Rego Neves Farinas, Work advisor, Professor of the Biomedicine Course, Brazil

ARTICLE INFO

Received: January 10, 2025

Published: January 24, 2025

Citation: Giovanna Nunes Barea and Maria de Lourdes Rego Neves Farinas. Epidemiological Evaluation of Schistosomiasis in Brazil in the Last Ten Years. Biomed J Sci & Tech Res 60(2)-2025. BJSTR. MS.ID.009440.

SUMMARY

Schistosomiasis is a parasitic disease caused by *Schistosoma mansoni*, popularly known as "schistosis", "snail disease" or "water belly", its transmission occurs through fresh water, rivers and lakes, by snails of the speciesBiomphalaria spp. It is a neglected tropical disease that affects several countries, including Brazil. According to the WHO, schistosomiasis is the second most widespread disease, after malaria, and is the most prevalent disease linked to water.

Keywords: Schistosomiasis; *Schistosoma Mansoni*; Water Belly; Epidemiology; Parasitology

Abbreviations: ECP: Emergency Control Plan; SEM: Scanning Electron Microscope

Introduction

Schistosomiasis is a parasitic disease whose main host is humans, while the intermediate hosts are the snails of the species *Biomphalaria spp*. Caused by helminths of the genus Schistosoma, it is transmitted through fresh water, such as rivers and lakes [1].

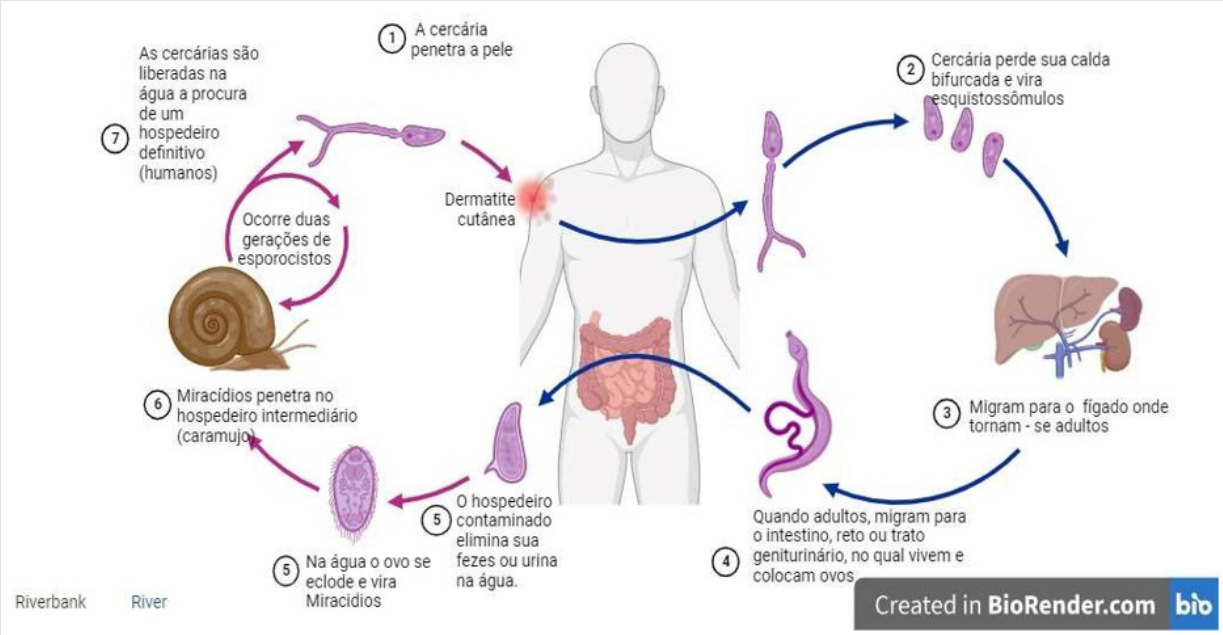
Life Cycle of Schistosomiasis

The life cycle begins when Schistosoma eggs are released by an infected human host who eliminates feces and urine into the water. These eggs hatch, releasing miracidia, which seek an intermediate host [2]. Upon penetrating the snail, the miracidia lose their mobility after 48 hours and transform into primary sporocysts, whose germ cells multiply, giving rise to secondary sporocysts. After four to seven weeks of infection, the snails begin to release cercariae, producing 100,000 to 300,000 of them, which survive for up to 48 hours to reach the definitive host (Figure 1) [2,3]. Upon contact with humans, the cercariae penetrate the human body, leaving their forked tail behind and transforming into schistosomula. These migrate through the venous circulation to the liver, where they develop into adult male and female worms. These worms then travel to the intestine, rectum or genitourinary tract, where they begin the process. reproductive, releasing eggs and completing the infection cycle (Figure 2) [3,4].

The Most Infectious Species of Schistosomiasis

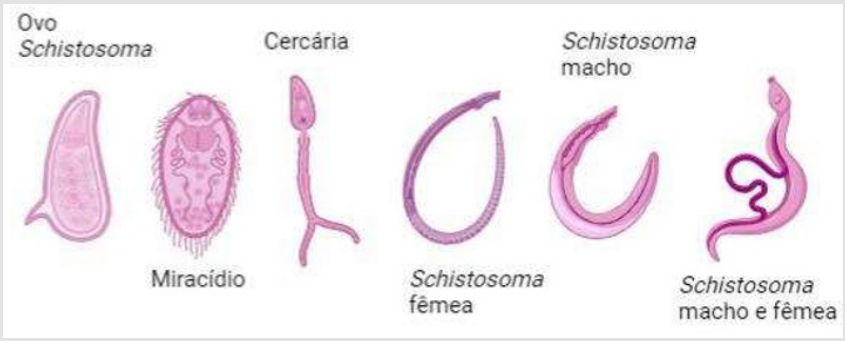
Schistosoma Japonicum: It is a species of parasite that belongs to the hepatointestinal schistosomiasis group. It is widely distributed in regions such as China, the Philippines, Indonesia, and Japan. Transmission of this disease occurs mainly in endemic areas and depends largely on the availability and abundance of suitable hosts (Figure 3) [5,6]. Although its main form of infection is in humans, the Schistosoma japonicum can also infect other mammals, such as cattle, pigs, dogs and rodents. This versatility of hosts contributes to the maintenance of the disease in areas where the parasite is present [6].

DOI: 10.26717/BJSTR.2025.60.009440



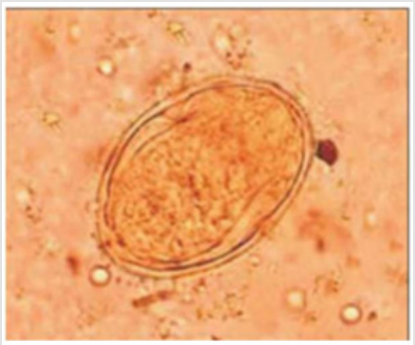
Note: Source: Prepared by the author.

Figure 1: Biological cycle of schistosomiasis.



Note: Source: Prepared by the author.

Figure 2: Morphology of the *Schistosoma sp*.

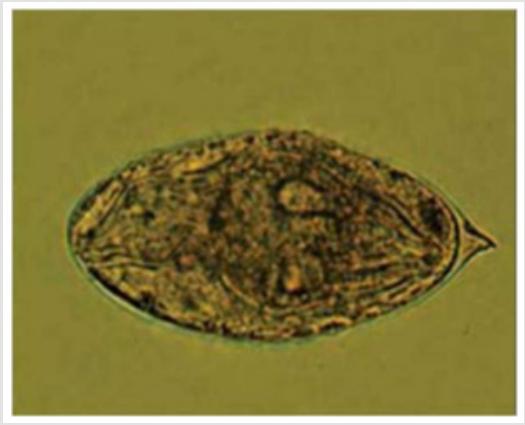


Note: Source: Diagnostic Atlas of Human Parasitology.

Figure 3: Eggs ofS. japonicumlarge and spherical measuring about 70 to 100 µm by 55 to 65 µm. Transparent shell with small spicule varying between different strains of parasite. In the image the spicule is not visible.

***Schistosoma Haematobium*:** Schistosomiasis caused by *Schistosoma haematobium*is endemic, mainly in Africa and the Middle East. TheS. haematobiumis of concern due to its significant impact on the reproductive and urinary systems and can cause symptoms such as dysuria and hematuria. In addition, the infection can result in growth retardation, nutritional deficiencies, and impaired cognitive development (Figure 4) [6,7].

***Schistosoma Intercalatum*:** Schistosomiasis caused by *Schistosoma intercalatum*is little known, being prevalent in West and Central Africa, especially in the Democratic Republic of Congo region. TheS. intercalatumcauses intestinal impairment, focusing on the perianal region, and is associated with causes of chronic diarrhea and pathological changes in the colon (Figure 5) [8].



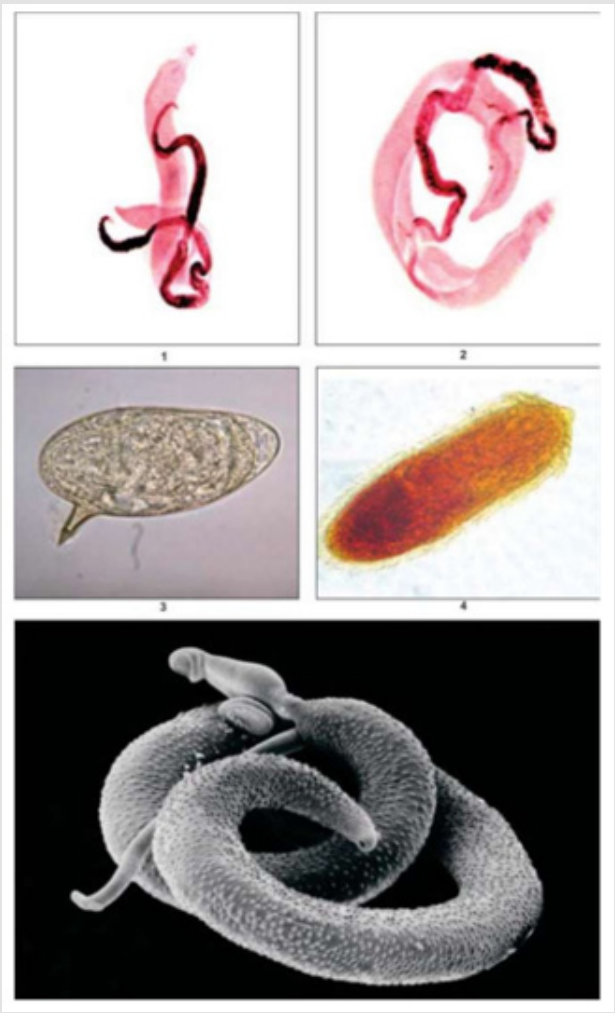
Note: Source: Diagnostic Atlas of Human Parasitology.

Figure 4: Eggs ofS. haematobiumlarge, measuring 112 to 170 µm by 40 to 70 µm, not operulate, presenting a transparent shell with a terminal spicule prominent.

Note: Source -LAMBERTUCCI, 2006 apud BRASIL, 2014.

Figure 5: Cercarial dermatitis.

***Schistosoma Mansoni*:** In Brazil, the *Schistosoma mansoni* is recognized as a serious public health problem. The disease it causes is hepatointestinal and, due to the complexity of its transmission mechanism and the diversity of factors that condition and affect the control of the disease, it is crucial to detect it early and start treatment promptly. This is essential to prevent the cumulative action of the eggs of the *S. mansonicauses* damage to the affected organs, especially the liver (Figure 6) [9].

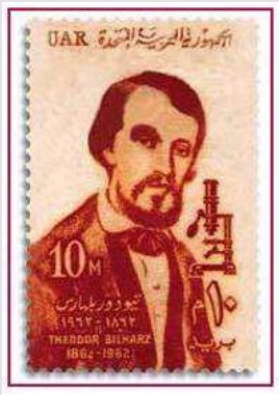


Note: Source: Diagnostic Atlas of Human Parasitology.

Figure 6: Couple S.mansonicopulation, female lodged in the male's gynecophore canal [1,2, 5]; Egg observed by direct examination of fresh eggs measures approximately 114 to 175 µm by 45 to 70 µm, oval in shape and with a longer part, with a spicule facing backwards [3]; Miracidia stained with iodine solution [4]; Microphotograph by scanning electron microscope (SEM). Observe the female lodged in the male's gynecophoric canal and the oral suckers and ventral male and female.

History of Schistosomiasis in Brazil

The disease was identified by German pathologist Theodore Bilharz in 1851 (Figure 7), in Egypt, during an autopsy on a young man. During the examination, a long white helminth was discovered in the blood from the vein. In addition, eggs with a terminal spike were observed, which were found in the feces and urine. Bilharz also noticed that the helminths had two suckers, which he assumed were mouths, and named them Distomun haematobium, "Distomun" meaning "two mouths". In 1858, zoologist David Weinland and scientist Thomas Spancer, while studying the species, noticed that it had only one sucker in the oral cavity. They then suggested the name Schistosoma (split body to the male), because the female adheres to the male, which is larger [10]. Schistosomiasis was brought to Brazil by African slaves who disembarked at the ports of Recife and Salvador during the colonial period. These slaves, many of whom worked in the sugarcane fields, were the initial carriers of the disease. Its spread began in northeastern Brazil, establishing an area of transmission among the states of Rio Grande do Norte and Bahia [3]. The disease found favorable conditions for its development, including poor sanitation, abundant presence of streams, lakes, dams and exposed population. In the 18th century, with the decline of sugar production in the northeast region and the emergence of the diamond and gold economic cycle in Minas Gerais, a migratory movement brought the endemic disease to this new area [3-9].



Note: Source: Brazil School.
Figure 7: Theodor Bilharz.

The spread of the disease spread widely throughout the national territory due to population movements, covering the five regions of the country (South, North, Southeast, Northeast and Central-West). It was particularly concentrated in nine states, with two in the Southeast (Minas Gerais and Espírito Santo) and seven in the Northeast (Pernambuco, Sergipe, Alagoas, Bahia, Paraíba, Maranhão and Rio Grande do Norte), identified as endemic areas. The spread of schistosomiasis is a complex and comprehensive issue, influenced by an interaction of biological, environmental, socioeconomic and behavioral factors. Therefore, this disease represents a considerable challenge to public health [11].

Neglected Parasitic Diseases and Schistosomiasis

Neglected Tropical Diseases (NTDs) consist of a group of approximately 20 diseases, including some of them, malaria, Chagas disease, trachoma, leprosy, dengue and schistosomiasis [12]. These diseases have a disproportionate impact on disadvantaged communities, who live in poverty and have limited access to basic sanitation, mainly in Africa, Asia and Latin America [13,14]. According to the WHO, in 2021, NTDs were responsible for approximately 500 thousand to 1 million deaths annually [15]. Schistosomiasis is a neglected disease in rural areas with infrastructure precarious, hindering access to drinking water and water sanitation methods. It was implemented in the World Health Organization (WHO) plan to combat NCDs from 2000 to 2015 and continues to be a current concern [16].

Pathophysiology of Schistosomiasis

Schistosomiasis infection can be divided into three stages, which can be influenced by the duration of the infection in the individual [16].

Acute Stage: After penetration, some of the larvae will die, while the rest will enter the venous circulation through the blood or lymphatic vessels. The cercariae present in the skin can trigger hypersensitivity reactions and pmaculopapular ruriginous, known as cercarial dermatitis (Figure 5) [16]. This condition is barely noticeable in people living in endemic areas and is most commonly observed only in primary infections. Symptoms include the formation of small blisters called phlyctenae and urticarial reactions. This is a delayed hypersensitivity cellular response characterized by the presence of lymphocytes, eosinophils and mononuclear cells, resulting in the death of approximately half of the cercariae that penetrate the skin [17]. After the cercariae have settled and the schistosomula have matured, the infection can progress to an acute symptomatic stage. Symptoms include eosinophilia, leukocytosis, generalized lymphadenopathy, and pulmonary infiltrates. The response to schistosomula is a continuation of the immune response triggered by cercariae. Stimulation of both the innate and acquired responses is observed, with a strong polarization toward the Th1 (T helper 1 cell) response [18].

Established Active Infection: Acute schistosomiasis is rarely seen as the disease progresses to an established active infection, with mature worms and well-defined egg production. At this stage, it is characterized by the excretion of live eggs in the feces and urine. The live adult worms present in the blood vessels do not cause local infection and are not directly symptomatic. The main symptoms and lesions are related to the infected organs due to the inflammatory response against the parasite eggs. These eggs secrete antigenic glycoproteins that facilitate their passage from the blood vessels to the intestine and urinary bladder, thus promoting the transmission of the disease and triggering an immune response [16]. Acute schistosomiasis is rarely observed, as the disease progresses to an established active infection, with mature worms and well-defined egg production. At this stage, it is characterized by the excretion of live eggs in the feces and urine. The adult worms present in the blood vessels do not cause local infection nor are they directly symptomatic. The main symptoms and lesions are related to the infected organs due to the inflammatory response against the parasite eggs. These eggs secrete antigenic glycoproteins that facilitate their passage from the blood vessels to the intestine and urinary bladder, promoting the transmission of the disease and triggering an immune response [17].

Chronic Infection: In the chronic phase, a modulated response is observed, with a reduction in inflammation in relation to the new eggs that continue to reach the liver. With the cumulative effect of granulatomas, due to the eggs that become trapped in the portal spaces, the liver changes begin to become serious, leading to "Symmers fibrosis", a granulomatous peripylephlebitis, with a new formation of connective vascular tissue around the portal vessels. This obstruction will cause typical and serious manifestations, such as: splenomegaly; pulmonary fibrosis; chronic intestinal obstruction; hydronephrosis; bladder cancer and even invasion of the central nervous system, which can cause paralysis, mental changes and convulsions [19,20].

Objectives

General Objective

Carry out a survey of epidemiological data on schistosomiasis from 2012 to 2022.

Specific Objectives

Conduct an epidemiological survey based on DATASUS to verify the situation of schistosomiasis in Brazil during the determined period. Investigate and update the literature with the data obtained and contribute to a survey on the situation of the disease.

Methodology

This is a descriptive epidemiological study with data obtained through query the DATASUS database. The time frame applied was ten years, with cases reported by region, age group and symptoms being accepted. The collected data were organized into tables and graphs in the Excel program to better organization and visualization of data.

Results and Bibliographical Discussion

Schistosomiasis is considered a neglected tropical disease, affecting countries likeSub-Saharan Africa, Asia and Latin America. It is the second most widespread parasitic disease, behind only malaria, and results in about 240 million cases [21]. Brazil is one of the countries with the highest transmission of schistosomiasis of the species *Schistosoma mansoni*, due to its tropical climate, with high temperatures and aquatic habitats, which favor the reproduction of the parasite and the spread of the disease to humans [22]. The data provided by DATASUS indicate that, in the last ten years, the two regions with the highest number of reports of schistosomiasis, as shown in Figure 8, were the Southeast with 38,816 and the Northeast 11,300 cases, with a decline in numbers from 2019 to 2022. Meanwhile, the other regions had cases in the last ten years, such as the Center-West with 632 cases; North 577 and South with 527 cases; but the numbers were not as large as the Southeast and Northeast. Interestingly, the drop in schistosomiasis cases between 2019 and 2022 suggested that the Emergency Control Plan (ECP) activities were effective in controlling the disease. However, in 2019, due to the pandemic, the WHO advised the government to postpone diagnosis and treatment campaigns, which may have led to failures in disease control actions, such as inadequate diagnosis and treatment, making it difficult to reduce clinical complications of diseases associated with schistosomiasis [23].

ANO NOTIFICAÇÃO	NORTE	NORDESTE	SUDESTE	SUL	CENTRO OESTE	TOTAL ANUAL
2012	33	1.318	6.921	61	34	8.367
2013	42	1.185	5.098	40	69	6.437
2014	70	1.419	4.863	51	63	6.466
2015	59	1.483	4.733	43	65	6.383
2016	64	1.091	3.860	59	69	5.140
2017	97	1.176	2.949	62	73	4.357
2018	83	899	3.118	63	56	4.219
2019	42	720	2.728	63	55	3.608
2020	27	500	1.271	22	53	1.873
2021	34	747	1.529	33	52	2.395
2022	59	762	1.746	30	43	2.640
TOTAL DOS 10 ANOS	577	11.300	38.816	527	632	51.885

Note: Source -Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net. DATASUS.
Figure 8: Region and year of notification, 2012 to 2022.

However, schistosomiasis is detected in 19 states, divided between endemic and focal areas. In Figure 9, the red dots indicate the endemic areas, where the disease is prevalent, such as Alagoas, Bahia, Pernambuco, Rio Grande do Norte, Paraíba, Sergipe, Espirito Santo and Minas Gerais, this is due to climatic and rainfall factors, especially at the end of the rainy season [24]. While the blue dots are the focal areas, such as Maranhão, Pará, Ceará, Piauí, São Paulo, Rio de Janeiro, Paraná, Santa Catarina, Rio Grande do Sul, Goiás and Distrito Federal, focal transmission does not extend over large areas, as occurs with endemic areas. Furthermore, the states in the Northeast and Southeast regions are areas with greater flows of tourists and immigrants in Brazil, especially in coastal cities. It is of great It is important to emphasize that visitors are exposed to infection by S. mansoni in these areas, contributing to the spread of the disease throughout the country and continents [25]. Based on the social variables analyzed, in Figure 10, that infection by Schistosomiasis is higher in men with 940 cases, than in women with 616 cases, in the year 2022.It was also observed that the most affected age group was between 20 and 59 years old for both genders. In the case of men, 238 cases were recorded between 20 and 39 years old and 364 cases between 40 and 59 years old. As for women, 173 cases were recorded between the ages of 20 and 39 and 233 cases were recorded between the ages of 40 and 59.

Note: Source -Ministry of Health,2022; created by Biohender,2024.
Figure 9: States with endemic and focal areas, 2022.

940 casos

616 casos

Faixa Etária	Masculino
15 - 19	38
20 - 39	238
40-59	364
60-64	68

Faixa Etária	Feminino
15 - 19	30
20 - 39	173
40-59	233
60-64	38

Note: Source -Ministry of Health/SVS - Notifiable Diseases Information System - Sinan Net. DATASUS.
Figure 10: Confirmed Cases by Sex according to Age Group, 2022.

This is because men are more exposed, whether through occupational and leisure activities such as fishing, free swimming in lakes and rivers, as well as work such as agriculture, aquaculture, among others. The majority of cases reported among women are due to the way of life in which they live, most of these women live in communities where basic sanitation is precarious [25]. The PCE, despite adopting actions, did not control the disease in these regions over time, thus, transmission was maintained [26]. The assessment of schistosomiasis comorbidities is essential to expand knowledge about the clinical aspects and epidemiological profile of the disease. Observing Figure 11, we can highlight that the most common clinical form in the last ten years, with 15,148 cases, is the intestinal form. This form is the most frequent aspect of the disease and can cause discomfort such as gastritis, abdominal pain and the presence of blood in the stool [27]. The second most common form is the acute phase, with 1,287 cases, which causes fever, headache, chills and myalgia [27,28]. This phase can lead to complications such as hepato-intestinal, with 1,175 cases, and hepatosplenic, with 751 cases, which involve enlargement of the liver and of the spleen, which can lead to complications such as portal hypertension, associated with a high parasitic load and an intense immune response [28].

ANO	IGN/BRANCO	INTESTINAL	HEPATO INTESTINAL	HEPATO ESPLÊNICA	AGUDA	OUTRO
2012	3.369	1.617	82	60	31	52
2013	1.174	1.968	129	92	239	53
2014	1.109	1.668	423	87	226	89
2015	921	2.153	147	99	189	140
2016	325	2.154	93	93	88	139
2017	396	1.224	93	75	79	106
2018	301	1.256	104	74	244	90
2019	345	1.088	88	62	91	104
2020	299	602	28	28	25	55
2021	375	732	37	40	37	59
2022	508	686	44	41	38	100
TOTAL	9.122	15.148	1.175	751	1.287	987

Note: Source -Ministry of Health/SVS - Notifiable Diseases Information System - Sinan.Net. DATASUS.
Figure 11: Confirmed Cases by Year of Notification according to Clinical Form, 2012 to 2022.

In addition to these, other clinical forms, totaling 987 cases, include pulmonary, neurological or other manifestations, which occur in advanced or severe cases of the disease [28]. In Figure 11, it is also notable that 9,122 of the cases are marked as "Ign/ Blank", indicating that these cases were not recorded, either because they were ignored or because there was no information. The assessment of comorbidities in patients with schistosomiasis, especially in chronic forms of the disease, is extremely important. This assessment is essential to administer appropriate treatment and reduce the risk of serious clinical complications and even mortality [25] (Figure 12).

Note: Source: ResearchGate.

Figure 12: Eggs ofS. Intercalatum with terminal spine in the feces, measuring 140 to 240µm, they are long and thinner.

Conclusion

The data collected show that the Southeast and Northeast regions of Brazil have the highest incidence of cases of the disease, affecting adults aged 20 to 59 years. The disease is related to the lack of basic sanitation, inadequate access to drinking water and inadequate health care, which contribute to the transmission of the disease. This only reinforces the seriousness of schistosomiasis as a persistent public health problem, fully justifying its title of "neglected disease." However, the PCE, in collaboration with the WHO, should implement more effective and rigorous measures to combat the disease. These include health education practices for communities in endemic areas, adopting measures such as surface water treatment to eliminate vector snails, and carrying out regular screening and diagnostic campaigns in endemic areas. It is essential to ensure easy access to rapid and effective diagnostic tests, as well as establishing rigorous monitoring to monitor the prevalence and incidence of the disease..

References

1. (2018) HEALTH, Surveillance Secretariat Schistosomiasis mansoni. Banhia Pioneer.
2. MARTINS, Fabiana Lopes, CARVALHO, Fabio Luiz Oliveira de (2019) Risk factors and possible causes of schistosomiasis. Brazil Unisepe.
3. (2014) BRAZIL. Ministry of Health. Health Surveillance Secretariat. Department of Health Surveillance Epidemiological. Schistosomiasis Mansoni surveillance: technical guidelines. Brasilia: Ministry of Health.
4. SALVIANO, FWB, VIEIRA, JEBA (2023) Epidemiology of schistosomiasis: a retrospective study. Brazil Concilium 23(16):413-431.
5. NELWAN M L (2019) Schistosomiasis: Life Cycle, Diagnosis, and Control. Current Therapeutic Research Clinical and Experimental PubMed 22(91): 5-9.
6. LI H, CHEN Y, Zhu Y, Yilu Feng, Yuncheng Qian, et al. (2023) Exploring the immune interactions between Oncomelania hupensis and Schistosoma japonicum, with a cross-comparison of immunological research progress in other intermediate host snails. Parasitology Vectors PubMed 16(1):453.
7. CARDOSO TCS, Carlos Bruno de Araújo, Laysa Gomes Portilho, Luiz Guilherme Alves Mendes, Tamires Caixeta Alves, et al. (2020) Computational prediction and characterization of miRNAs and their pathway genes in human schistosomiasis caused by Schistosoma haematobium. Memoirs of the Oswaldo Cruz Institute PubMed 115: e190378.
8. KOŁODZIEJ Przemysław, Beata Szostakowska, Anna Lass, Małgorzata Sulima, Katarzyna Sikorska, et al. (2023) Chronic intestinal schistosomiasis caused by co-infection with Schistosoma intercalatum and Schistosoma mansoni. Lancet Infect Dis 24(3): e196-e205.
9. (2018) BRAZIL. Ministry of Health. Health Surveillance Secretariat. Department of Health Surveillance of Communicable Diseases. Health education for the control of schistosomiasis. Brasilia: Ministry of Health.
10. SANTOS, Amanda (2020) The story of the discovery of Schistosoma mansoni. Fiocruz.
11. SILVA Thaysa Carolina Gonçalves, SILVA Amanda Gabriela da, SILVA Marisa Kele da, PEREIRA, Carolina Luisa Diniz (2023) Schistosomiasis mansoni mortality in the region Northeast Brazil between 2018 and 2022. Recife.
12. ETTARI R (2023) Cysteine Proteases as Validated Targets for the Treatment of Neglected and Poverty-Related Parasitic Diseases. International Journal of Molecular Sciences PubMed 24(12).
13. BIRTH, IJDS, CAVALCANTI, MAT (2023) Exploring N-myristoyltransferase as a promising drug target against neglected tropical parasitic diseases. European Journal of Medicinal Chemistry pubmed.

14. (2022) BRAZIL Ministry of Health, Ministry of Education. Program Thematic Notebook Health at School: Prevention of neglected diseases. Brasilia Ministry of Health.

15. (2023) BRAZIL Ministry of Health. NTDs: Brazil has more than 90% of new cases leprosy recorded in the Americas.

16. POSADA MARTÍNEZ EL, GONZALEZ BARRERA LG, LIBLIK K, Juan Esteban Gomez-Mesa, Clara Saldarriag, et al. (2022) Schistosomiasis & Heart - On Behalf of the Neglected Tropical Diseases and others Infectious Diseases affecting the Heart (the NET-Heart Project). Brazilian Archives of Cardiology pubmed 118(5): 885-893.

17. MCMANUS DP, David W Dunne, Moussa Sacko, Jürg Utzinger, Birgitte J Vennervald, et al. (2018) Schistosomiasis. Nature Reviews Disease Primers PubMed 4(1):13.

18. GOMES, Elainne CS, DOMINGUES, Ana Lucia C, BARBOSA, et al. (2017) Schistosomiasis: clinical and epidemiological management in primary care. Recife Fiocruz Pernambuco.

19. LAMBERTUCCI JR (2014) Revisiting the concept of hepatosplenic schistosomiasis and its challenges using traditional and new tools. Journal of the Brazilian Society of Medicine Tropical, PubMed 47(2): 130-136.

20. NEVES, David Pereira (1974) Human Parasitology.11th ed. New York: Routledge.

21. SILVA FILHO, José Damião da (2017) Schistosoma mansoni in schoolchildren and workers construction site for the transposition of the São Francisco River in the municipality of Brejo Santo-CE. Fortaleza-CE.

22. BROWN, John (2020) Intermediate host molluscs of Schistosoma mansoni of Brazil. Belo Horizonte René Rachou Institute / Oswaldo Cruz Foundation.

23. KURA K, AYABINA D, TOOR J, HOLLINGSWORTH TD, ANDERSON R M (2021) Disruptions to schistosomiasis programs due to COVID-19: an analysis of potential impact and mitigation strategies. Transactions of the Royal Society of Tropical Medicine and Hygiene PubMed 115(3):236-244.

24. BARRETO BL, LOBO CG (2021) Epidemiological aspects and distribution of cases of schistosomiasis in Northeastern Brazil from 2010 to 2017. Nursing Journal Contemporary.

25. SILVA DA PAZ W, DOS SANTOS REIS E, LEAL IB, ARBOSA YM, ARAÚJO KCG, et al. (2021) Basic and associated causes of schistosomiasis-related mortality in Brazil: A population-based study and a 20-year time series of a disease still neglected. Journal of Global Health, PubMed.

26. CRUZ, Jose Icaro Nunes, SALAZAR Gabriela de Oliveira, COURT Roseli La (2020) Setback of the Schistosomiasis Control Program in the state with the highest prevalence of the disease in Brazil. Pan-Amazonian Health Magazine.

27. (2021) BRAZIL. Ministry of Health. Schistosomiasis Mansoni. Ribeirão Preto: Secretary of Health Surveillance.

28. SINKALA E, KAPULU MC, BESA E, Kanekwa Zyambo, Paul Kelly, et al. (2016) Hepatosplenic schistosomiasis is characterized by high blood markers of translocation, inflammation and fibrosis. Liver International 36(5): 707-717.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2025.60.009440

Maria de Lourdes Rego Neves Farinas. Biomed J Sci & Tech Res

Submission Link: https://biomedres.us/submit-manuscript.php