

ORIGINAL ARTICLE

IMPACTS OF EDUCATIONAL INTERVENTIONS ON SCHISTOSOMIASIS AWARENESS IN A SCHOOL COMMUNITY

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ABSTRACT

Schistosomiasis mansoni is an anthropozoonosis caused by the flatworm *Schistosoma mansoni* and represents a significant public health issue in Brazil, primarily affecting economically disadvantaged populations. This study aimed to develop educational activities on schistosomiasis and subsequently assess the level of knowledge among Basic Education students in the municipality of Zé Doca, Maranhão, regarding the disease. This is a descriptive, cross-sectional study with an exploratory nature and a quantitative approach. The study included students who were regularly enrolled at Professor Francisco de Assis Amorim Educational Center and voluntarily agreed to participate in the proposed activities. Initially, health education activities on schistosomiasis were conducted, followed by the administration of a questionnaire to evaluate students' knowledge of fundamental aspects of the disease. A total of 96 students were interviewed, with an average age of 16.5 years, of whom 62.5% were female. Among the participants, 73.9% reported consuming filtered water, 77.0% stated that there were no snails near their residences, and 63.4% were previously unaware of schistosomiasis before participating in educational activities. Additionally, 70.8% correctly identified the diagnostic method, 56.2% recognized the causative agent, 69.7% acknowledged the primary mode of transmission, 83.3% indicated avoiding contact with contaminated water as an effective preventive measure, and 76.0% had never participated in an educational campaign on the topic. The findings suggest that most participants comprehended the information provided during the educational activities, reinforcing the effectiveness of these initiatives as promising tools for enhancing students' knowledge about the disease.

KEY WORDS: Health education; public health education; school-based health promotion; tropical diseases.

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INTRODUCTION

Schistosomiasis mansoni is an anthropozoonosis caused by the flatworm *Schistosoma mansoni* (Sambon, 1907) and is highly prevalent in economically disadvantaged communities lacking access to potable water and adequate sanitation (Lo et al., 2022).

The transmission of *S. mansoni* occurs when an infected individual excretes parasite eggs through feces. When these eggs meet water, they hatch, releasing miracidia that subsequently infect snails of the genus *Biomphalaria* spp. (Preston, 1910).

It is important to note that not all species within this genus participate in the transmission cycle. In Brazil, three species are considered the main vectors of *S. mansoni*: *B. glabrata*, *B. tenagophila*, and *B. straminea*, as described by Paraense (2001). Within these snails, the parasite develops into cercariae, infectious forms capable of penetrating the skin of healthy individuals, initiating the infectious cycle and causing a range of complications (Nelwan, 2019; Brasil, 2022b).

The clinical manifestations of schistosomiasis depend on the stage of infection, which may be classified as acute or chronic, with or without symptoms. Diagnosis is conducted through laboratory analysis of feces, which identifies the presence of *S. mansoni* eggs (De França et al., 2020). Treatment is carried out using specific medications based on the disease stage, both of which are provided by the Sistema Único de Saúde (SUS) (Brasil, 2022b).

According to the World Health Organization (WHO), schistosomiasis has been reported in 78 countries (WHO, 2023b). Most cases are concentrated in sub-Saharan Africa, South America, the Caribbean, the Middle East, and Southeast Asia (Lo et al., 2022). In Brazil, the first records of the disease date back to approximately 1904. Despite the establishment of the Programa de Vigilância e Controle da Esquistosomose (PCE) in 1975, the disease remains a significant public health issue, primarily affecting states in the Northeast and Southeast regions (Brasil, 2022a; Silva et al., 2022).

In the Northeast region, the disease has intensified in several areas, particularly in States such as Alagoas, Bahia, Pernambuco, and Rio Grande do Norte, with a predominance in agricultural zones. Over the past decade, its spread has reached urban and coastal areas (Cruz et al., 2020). In the state of Maranhão, schistosomiasis has been recorded since 1920, with a high prevalence in the northern coastal region and the northwest of the State (David, 2018). From 2019 to 2023, 83 cases were confirmed in the State, although no cases were reported in the municipality of Zé Doca during this period (Brasil, 2022a; Brasil, 2023).

Health education initiatives aimed at raising public awareness, particularly among adolescents, are essential for implementing preventive measures against schistosomiasis in daily life. These actions play a crucial

role in reducing the burden of this parasitic disease. Furthermore, educational interventions not only raise awareness but also empower individuals to disseminate the knowledge they acquire, promoting the adoption of safer health practices (Batista et al., 2024).

In this context, this study aimed to develop educational activities on schistosomiasis and subsequently assess the level of knowledge among basic education students at a school in the municipality of Zé Doca, state of Maranhão, regarding the disease.

MATERIAL AND METHODS

Study Area and Target Population

This study was conducted in the municipality of Zé Doca, located in the northwest region state of Maranhão State, 325 km from the capital, São Luís. The municipality has a territorial area of 2,140.109 km² and an estimated population of 40,801 inhabitants as of 2022. Zé Doca is notable for having one of the lowest Human Development Indexes (HDI) in Brazil, with an average value of 0.59 in 2010. In terms of education, the municipality reported a Basic Education Development Index (IDEB) of 6.1 for the early years of primary education and 4.1 for the final years in 2023. As of 2023, the city had 69 educational institutions and, as of 2009, 13 healthcare facilities (IBGE, 2023b). For this study, a convenience sampling method was employed, involving 96 students of both sexes, aged between 14 and 19 years, who were regularly enrolled in the 1st, 2nd, and 3rd years of high school at the Professor Francisco de Assis Amorim Educational Center.

Study Design and Research Instrument

This study was a descriptive, cross-sectional research project with an exploratory and quantitative approach, conducted between June and October 2023. The field research was carried out in two main stages: initially, health education activities on schistosomiasis were conducted, followed by the application of a semi-structured questionnaire containing closed-ended questions on the symptoms, diagnosis, transmission, and prevention of the disease. The primary objective was to assess the students' knowledge of schistosomiasis following educational activities, including lectures, distribution of educational booklets, and dissemination of podcasts and social media posts on the disease. The questionnaire enabled the measurement of students' learning outcomes on the subject, evaluating the impact of the educational activities conducted.

Ethical Aspects

This study involved basic education students who were regularly enrolled at the Professor Francisco de Assis Amorim Educational Center and who agreed to participate in the proposed activities. For students aged 18 or older, participation required signing the Free and Informed Consent Form (FICF). For students under 18, consent was obtained through the signature of the FICF by their legal guardians, accompanied by the Free and Informed Assent Form (FIAF), which the students themselves signed. The study was approved by the Ethics and Research Committee of the Universidade Estadual do Maranhão, under protocol CAAE no. 66833222.9.0000.5554.

Data Analysis

The data obtained from the questionnaires were organized using Microsoft Excel spreadsheets (Washington, United States of America). Absolute and relative frequencies were calculated and presented in tables. Microsoft Word and Microsoft Excel (Washington, United States of America) were used to prepare and format the tables.

RESULTS

A total of 96 high school students from the 1st, 2nd, and 3rd years were interviewed. The students had an average age of 16.5 years. Most participants were female (62.5%), in the 2nd year of high school (37.5%), self-identified as mixed-race (62.5%), and were unable to report their household income (45.8%). Regarding household size, 50.0% of the students reported living with 4 to 6 people.

In terms of housing characteristics, 60.4% of the respondents indicated living in homes with five or more rooms, and 72.9% stated that their residences were built with bricks and coated with plaster. A significant portion of the students reported being unemployed (64.5%), while the majority stated they consumed filtered water (73.9%). However, 26.0% reported not consuming adequately treated water. When asked about the presence of snails near their homes, 77.0% of the students indicated that snails were not present in their surroundings (Table 1).

Table 1. Distribution of sociodemographic data of high school students from the Professor Francisco de Assis Amorim Educational Center, Zé Doca, Maranhão.

Variables	Categories	n (%)
Age	14 years	5 (5.2)
	15 years	10 (10.4)
	16 years	34 (35.4)
	17 years	29 (30.2)
	18 years	14 (14.5)
Sex	19 years	4 (4.1)
	Female	60 (62.5)
Educational level	Male	36 (37.5)
	1 st year of high school	29 (30.2)
	2 nd year of high school	36 (37.5)
Race	3 rd year of high school	31 (32.9)
	Brown	60 (62.5)
	White	16 (16.6)
	Black	14 (14.5)
	Indigenous	4 (4.1)
Household income	Yellow	2 (2.0)
	Less than 1 minimum wage	24 (25.0)
	1 to 3 minimum wages	21 (21.8)
	More than 3 minimum wages	7 (7.2)
How many people live with you?	Not informed	44 (45.8)
	1 to 3 individuals	29 (30.2)
	4 to 6 individuals	48 (50.0)
	More than 6 individuals	11 (11.4)
	Living alone	3 (3.1)
How many rooms are in your residence?	Not specified	5 (5.2)
	2 to 4 rooms	31 (32.2)
	5 or more rooms	58 (60.4)
	Not specified	7 (7.2)
What type of infrastructure does your residence have?	Clay	1 (1.0)
	Wattle and daub	5 (5.2)
	Plastered brick	70 (72.9)
	Unplastered brick	20 (20.8)
Do you work?	Yes	34 (35.4)
	No	62 (64.5)
Do you use filtered water?	Yes	71 (73.9)
	No	25 (26.0)
Are there many snails where you live?	Yes	19 (19.7)
	No	74 (77.0)
	Not specified	3 (3.1)

n= number of respondents; % = percentage of respondents.

Regarding students' prior knowledge about schistosomiasis before the educational activities, 63.4% of respondents stated that they were unaware of the disease. Additionally, all participants (100%) reported that they had never been diagnosed with this parasitic disease and, consequently, did not exhibit any associated symptoms.

Concerning the correct method for diagnosing schistosomiasis, 70.8% identified laboratory tests as the primary diagnostic approach. Although most respondents (86.4%) stated that they did not know anyone in their family or social circle who had been diagnosed with this disease, 13.5% reported being aware of at least one case.

When asked about the causative agent of schistosomiasis, 56.2% correctly identified the parasite as a helminth. Additionally, 69.7% recognized that the disease could be transmitted through contact with water containing the infectious forms of the parasite.

Regarding preventive measures, 83.3% indicated that avoiding contact with water where snails are present is an effective strategy to prevent schistosomiasis. Furthermore, 76.0% stated that they had never participated in an educational campaign on the topic. Among those who had, all mentioned that the campaign occurred at school (Table 2).

When asked what they appreciated most about the educational activity, the students predominantly mentioned learning new information (42.7%), the ease of understanding the content (32.2%), and the relevance of the topic addressed (25.0%). Additionally, most students indicated that, after the educational campaign, they intend to incorporate preventive actions into their routines, such as avoiding walking barefoot, avoiding contact with snails, and refraining from bathing in potentially contaminated water, as strategies to prevent schistosomiasis.

Table 2. Knowledge of symptoms, diagnosis, transmission, and prevention of schistosomiasis after educational activities among high school students at the Professor Francisco de Assis Amorim Educational Center, Zé Doca, Maranhão.

Variables	Categories	N (%)
Had you heard of schistosomiasis before the Educational Campaign?	Yes No Not specified	34 (35.4) 61 (63.4) 1 (1.0)
Have you ever been diagnosed with schistosomiasis?	Yes No	0 (0.0) 96 (100.0)
If you have been diagnosed with schistosomiasis, what symptoms did you experience?	I have never had the disease	96 (100.0)
What is the correct method for diagnosing schistosomiasis?	By laboratory tests By a doctor By the patient/ family member I don't know	68 (70.8) 19 (19.7) 2 (2.0) 7 (7.2)
Has anyone in your social circle ever been diagnosed with schistosomiasis?	Yes No	13 (13.5) 83 (86.4)
What agent is responsible for transmitting schistosomiasis?	Helminth parasite Human parasite Bacterium Virus I don't know	54 (56.2) 6 (6.2) 9 (9.3) 4 (4.1) 23 (23.9)
How is schistosomiasis transmitted?	By bathing in water containing forms of the parasite (cercariae) By direct/indirect contact with the feces of infected humans/ animals I don't know	67 (69.7) 22 (22.9) 7 (7.2)
How can schistosomiasis be prevented?	Avoid using water where snails are present Use of antibiotics Seeking information on the internet I don't know	80 (83.3) 3 (3.1) 5 (5.2) 8 (8.3)
Have you previously participated in any educational campaign about schistosomiasis?	Yes No Not specified	15 (15.6) 73 (76.0) 8 (8.3)
If you have participated in any educational campaign about schistosomiasis, where did it take place?	At school	15 (100.0)

n= number of respondents; % = percentage of respondents.

DISCUSSION

Schistosomiasis is a significant public health issue in Brazil, particularly in the Northeast and Southeast regions of the country. In Maranhão State, 83 cases were confirmed between 2019 and 2023. Although no cases were reported in the municipality of Zé Doca during this period, health education activities targeting the population, particularly young people, represent a vital strategy for promoting health and empowering youth to share this knowledge within their family circles (Brasil, 2022a; Brasil, 2023).

The sociodemographic profile of the study participants consisted of individuals with an average age of 16.5 years old. In Brazil, high school students typically range from 15 to 17 years old, assuming there are no interruptions or grade repetitions in their educational journey (Brasil, 2021). Thus, the participants' age aligns with the expected profile for high school students.

Most students were female (62.5%), in the 2nd year of high school (37.5%), and self-identified as mixed-race (62.5%). According to the 2022 IBGE Census, most Maranhão's population self-identifies as mixed-race (IBGE, 2023a). Consequently, the racial characteristics observed in this study reflect the predominant demographic profile of the State, demonstrating alignment with regional patterns.

Although most participants were unable to report on their household income, 25.0% stated that it was below the minimum wage. This finding reflects Maranhão's socioeconomic reality, as the State recorded the lowest per capita household income in Brazil in 2023, approximately R\$945.00. This economic context affects the population's access to basic services and their overall quality of life (IBGE, 2024). The State's economic scenario, characterized by low-income levels, may directly affect access to sanitation and health services, which are critical factors in the continued transmission of schistosomiasis.

Regarding housing conditions, most students reported living with four to six people (50.0%), in houses with five or more rooms (60.4%), constructed with bricks and coated with plaster (72.9%). It is important to note that housing conditions are critical determinants of physical and psychological well-being, as well as quality of life and academic performance. Poor living conditions can increase the risk of disease (Cohen et al., 2019).

Although 73.9% of respondents reported consuming filtered water, 26.0% stated that they did not have access to adequately treated water. Consuming untreated water poses significant health risks, facilitating the transmission of parasitic and infectious diseases (WHO, 2023a).

While 77.0% of students reported no presence of snails near their homes, 19.7% reported their presence, which suggests potential areas of contamination risk. Snails of the *Biomphalaria* genus are the intermediate hosts in the life cycle of *S. mansoni*. In Maranhão, the recorded *Biomphalaria*

species include *B. glabrata*, *B. straminea*, and *B. schrammi* (David, 2018). Effective measures to reduce the risk of schistosomiasis infection include snail population control and health education activities targeted at the local population (Lacerda & Brandão, 2020).

The majority of participants (63.4%) reported being unaware of schistosomiasis prior to the educational activities, emphasizing the importance of health education initiatives. These efforts are crucial for disseminating essential information to the population, particularly about neglected diseases like schistosomiasis, to improve knowledge and, consequently, foster preventive attitudes and practices (Dos Santos et al., 2023).

All participants (100%) stated that they had never been diagnosed with schistosomiasis and, consequently, had not exhibited any associated symptoms. Schistosomiasis affects individuals across all age groups; however, in Brazil, the disease is more prevalent among adults (Rocha et al., 2021).

A considerable proportion of students (70.8%) identified laboratory tests as the primary method for diagnosing schistosomiasis. This result reflects a solid understanding of the information provided during the educational activities, as the diagnosis of this disease is typically performed through laboratory tests, particularly parasitological examinations, which detect the presence of *S. mansoni* eggs in feces (Chala, 2023). The World Health Organization (WHO) recommends the Kato-Katz technique due to its simplicity, low cost, high efficiency, and ability to quantify parasite load (WHO, 2013).

While most respondents (86.4%) stated they did not know anyone in their family or social circle who had been diagnosed with the disease, 13.5% reported being aware of at least one case. This finding further highlights the importance of preventive education activities in schools, as disseminating knowledge about schistosomiasis can significantly contribute to disrupting the transmission cycle of the disease (De Oliveira & Wanderley, 2022).

Most students (56.2%) correctly identified the etiological agent of schistosomiasis as a helminth, indicating their comprehension of the information shared. *S. mansoni*, a helminth endemic to tropical and subtropical regions, is the only *Schistosoma* species endemic to Brazil (LoVerde, 2019; Souza et al., 2023).

Additionally, 69.7% of students reported that schistosomiasis transmission could occur during contact with water contaminated with the parasite's infective stage, the cercariae. This finding demonstrates that the students understood the information provided and recognized that inadequate sanitation conditions are critical factors in the spread of parasitic diseases, such as schistosomiasis. Limited access to essential services, such as proper sanitation and a safe water supply, significantly contributes to the maintenance of the disease's transmission cycle (Santos & Heller, 2023).

Regarding preventive measures, 83.3% of participants reported that avoiding contact with water where snails are present is an effective strategy to prevent schistosomiasis. This finding demonstrates the students' understanding of disease prevention, considering that the transmission cycle of *S. mansoni* occurs only in the presence of the parasite's intermediate host, snails of the *Biomphalaria* genus (Cardoso et al., 2024).

Moreover, 76.0% of participants stated that they had never participated in an educational campaign on schistosomiasis. A similar study conducted in the municipality of São Bento, located in the Baixada Maranhense microregion, also highlighted the lack of educational initiatives on this topic within the community (Da Silva et al., 2020). These findings underscore the importance of health education initiatives on schistosomiasis, as disease control relies on multiple factors, including preventive measures, basic sanitation, and health education (Torres et al., 2024).

Participants who reported having participated in health education activities on schistosomiasis indicated that these initiatives took place at school. It is important to emphasize that schools are critical environments for educational initiatives, serving as spaces for formal learning and social integration (Lacerda & Brandão, 2020).

Students stated that they most appreciated learning new information (42.7%), the ease of understanding the content (32.2%), and the relevance of the topic addressed (25.0%). These findings show that health education activities are well-received by students, confirming their importance in raising awareness about schistosomiasis. Such initiatives enable students to better understand the disease, take preventive actions, and act as disseminators of this knowledge (Dubeux et al., 2019).

Most students indicated that preventive strategies such as avoiding walking barefoot, avoiding contact with snails, and refraining from bathing in high-risk areas would be measures they plan to incorporate into their daily lives to prevent *S. mansoni* infection. This highlights the positive impact of educational activities on the adoption of preventive practices against schistosomiasis.

Based on the data presented, the importance of health education initiatives focused on schistosomiasis in school settings is evident, highlighting their potential as effective tools for raising awareness and controlling the disease. Studies have shown that educational interventions contribute significantly to reducing risk behaviors and strengthening the prevention of parasitic diseases, particularly among vulnerable populations (Favre et al., 2021; Santana et al., 2021). Accordingly, it is recommended that such initiatives be expanded to other educational institutions located in both rural and urban areas, including regions classified as either endemic or non-endemic for schistosomiasis.

The main limitation of the study was the inclusion of only one school, which restricted the reach of participant engagement. In addition, the refusal of

some students to participate affected the final sample size.

The findings of this study revealed that most participants demonstrated a solid understanding of the information provided during the educational campaigns, gaining knowledge of the basic aspects of schistosomiasis. These results underscore the value of combining social media with in-person health education activities as effective tools for health promotion. Such strategies can directly contribute to the prevention of schistosomiasis and interrupt its transmission by empowering students to adopt control and prevention measures.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest to disclose.

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