



DENGUE IN MUTUÍPE-BA: Numbers and Educational Contexts

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ABSTRACT

Dengue is a viral disease that can cause fever, body aches, and hemorrhage. This study analyzed dengue in Mutuípe-BA, focusing on case numbers and educational contexts. Questionnaires on *Aedes aegypti* and dengue (prevention and educational projects) were administered to Science teachers of the 7th grade in middle school. Educational materials were inspected to evaluate their dengue-related content (pages, images, mosquito characteristics, diseases caused, and prevention). Data from the Municipal Health Secretariat on dengue cases between 2019 and 2023 were obtained from the National System of Notifiable Diseases (SINAN). Five teachers participated, four from public schools and one from a private school. Most (80%) addressed the topic using informational texts and videos; 60% considered the books accessible. Only one teacher reported implementing intervention projects. Public school textbooks contained more content than those used in private schools, but both presented concise figures and information about the mosquito. Between 2019 and 2023, 46 cases were reported, ranging from 1 case in 2021 and 2023 to 34 cases in 2020. The low number of cases and the simplicity of educational materials highlight the need for more effective methods in the prevention and control of dengue.

Keywords: *Aedes aegypti*; Textbook; Teachers.

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INTRODUCTION

Dengue is a viral disease caused by the DENV virus, which belongs to the Flaviviridae family and the Flavivirus genus. Currently, there are four serotypes of the virus (DENV-1, DENV-2, DENV-3, and DENV-4). Each serotype has divergent genetic material and lineage, as well as different interactions with human antibodies, with all being composed of RNA (Melo et al., 2022; Lázari; Granato, 2024).

The virus is classified as an arbovirus (transmitted by the bite of blood-feeding arthropods), and its multiplication occurs through the mosquito *Aedes aegypti* via a blood meal from an infected host. Dengue can occur worldwide, especially in tropical and subtropical regions, where climate variations favor the development and proliferation of this mosquito. The spread of the disease is also driven by rapid, unplanned urbanization and increasing temperatures, observed over the years (since 1990), which have stimulated the propagation of dengue, requiring greater attention for its control. Dengue affects humans of all ages (Barreto; Teixeira, 2008; Silva et al., 2022).

The incubation period of the disease varies, on average, from three to six days, but it can extend up to fourteen days. The transmission of the virus from humans to mosquitoes can occur between the first and sixth day after the onset of fever, a period known as the intrinsic cycle. When the already infected mosquito bites a human, the extrinsic cycle occurs (Luz et al., 2018; Ministério da Saúde, 2023).

The disease is characterized by flu-like symptoms, such as high fever, muscle and joint pain, and headache, and it can progress to more severe forms, such as severe dengue and hemorrhagic dengue, which can be fatal if not treated properly. These more severe forms can be subdivided into dengue with warning signs and dengue without warning signs (Cesarino et al., 2014). Approximately 90% of infections caused by the dengue virus are asymptomatic and self-limited, but can also have a fulminant presentation. Its complications can result in Guillain-Barré Syndrome and hemorrhagic shock syndrome (Pessanha, 2011).

Dengue prevention involves eliminating containers that can accumulate standing water, such as tires, plant pots, and poorly sealed water tanks, while treatment aims to relieve symptoms and provide supportive care, especially in more severe cases. This applies not only to large urban centers but, more importantly, to small towns, making it essential to plan, coordinate, and promote actions (Teixeira; Barreto; Guerra, 1999).

Dengue is considered a public health problem in many tropical and subtropical regions of the world, including parts of Latin America, Asia, and Africa, with Brazil being the country with the highest number of infections globally, with over 2.3 million cases of the disease. The Southeast region of Brazil had the highest incidence of the disease in 2023, with 935,000 probable cases, with the states of Minas Gerais and São Paulo being the most affected, with 408,000 and 339,000 cases, respectively (Instituto Butantan, 2023). According to the Oswaldo Cruz Foundation (Fiocruz), in 2024, Brazil recorded the highest annual number of dengue cases of this century, potentially reaching up to 5 million cases by the end of the year. To reduce the risk of infection, the use of insect repellents, protective clothing, and homemade insecticides is recommended, following the instructions on the packaging or medical advice, particularly in high-risk dengue areas or for those more vulnerable (Gatti, 2002; Brasil, 2013).

Humans are also affected by dengue in social (leisure) and economic contexts (work and income/finances). This is because, when affected by the disease, people are unable to work, which also impacts productivity. The market produces less, collects less, and circulates less money, resulting in a loss of revenue for the government (Britez et al., 2022; Machado, 2022).

Educational practices should be incorporated, especially in the classroom, with the objectives of raising awareness about dengue and engaging the population in its elimination. Through student education, it will be possible to change the domestic environment in a way that eliminates existing breeding grounds and prevents the emergence of new ones, resulting in a reduction in disease cases (Araújo et al., 2017). Furthermore, promoting interactions between schools and local communities—such as lectures, workshops, fairs, and practical street actions—are viable alternatives that serve as effective tools in combating the disease (Nunes et al., 2021).

Dengue has been a widely prevalent disease in Brazil, mobilizing many agents for its control and treatment across the national territory, with its relevance and discussion present in different settings, especially in classrooms. Thus, the objective of this study is to analyze dengue cases in Mutuípe-BA, examining the educational context related to the topic in Science classes and its relationship with strategies to prevent and control the disease in the local community.

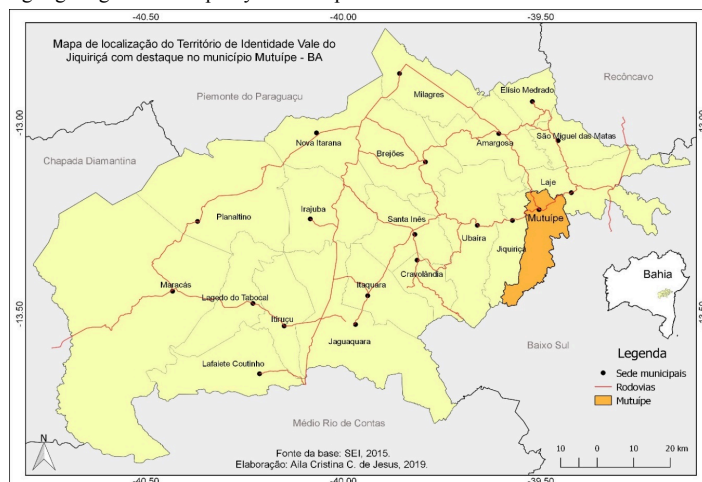


METHODS

This study adopted a qualitative and quantitative approach. In the qualitative approach, information was gathered through questionnaires administered to elementary school teachers, specifically 7th-grade classes in the city, and regarding *Aedes aegypti* in school textbooks. In the quantitative approach, data from the Municipal Health Department of Mutuípe-BA were analyzed (Gil, 2008).

The research was conducted in Mutuípe-BA, located in the Vale do Jiquiriçá, in the southwest of Bahia, approximately 250 km from Salvador, the state capital. This municipality (Figure 1) has a territorial area of 275 km² (IBGE, 2017). Characterized by a landscape that combines cerrado and Atlantic forest, with self-reports of dengue cases, the total monthly rainfall distribution in the municipality shows that, during most months of the year, there are equivalent rainfall levels, with a total annual precipitation of 1,156.1 mm.

Figure 1. Location of the Territory of Identity of Vale do Jiquiriçá-BA, highlighting the municipality of Mutuípe-BA.



Source: SEI (2015).

In this research, we studied Science teachers who teach 7th grade in elementary school II in Mutuípe-BA, analyzed the textbooks used in their classrooms, and examined the data provided by the Municipal Health Department, all covering the content on dengue and *Aedes aegypti*. These teachers were chosen because they address viral diseases in elementary school II, a stage when students begin to assimilate more complex concepts related to health, awakening their critical and analytical abilities.

A questionnaire (Appendix I) was developed, containing multiple-choice objective questions, which were answered by the

teachers. The questionnaire addressed the curricular content related to *Aedes aegypti* and public health, the pedagogical methods used to teach about dengue, the educational resources employed during the instruction of this topic, and the approaches adopted to teach about disease prevention and any specific interventions or projects that had been implemented.

In addition to the information provided by the teachers, the research included an analysis of dengue cases over the past five years, obtained from data provided by the Municipal Health Department, in order to examine the evolution of the epidemiological situation in the municipality. The selection of the municipality for this study aimed to catalog potential cases of *Aedes aegypti* and establish a correlation between the epidemiological data on dengue and the teaching strategies adopted by the teachers.

The data tabulation was carried out by comparing the teachers' responses, and tables were created to facilitate understanding, hypothesis formulation, and insight into what has been implemented.

The teachers' responses were subjected to content analysis with the aim of identifying the practices employed. Additionally, the way the content is emphasized by the textbook author, the knowledge presented, and the level of relevance of the topic covered were analyzed.

All research procedures were conducted with the consent of the parties involved, strictly following ethical work principles, ensuring the anonymity of participants, protecting the collected data, and safeguarding the rights of those involved in the study. The data from the Health Department were provided through an official letter issued by the general management of IF-Baiano, Campus Santa Inês-BA.

RESULTS AND DISCUSSION

In this study, questionnaires were administered to the five teachers who teach 7th grade in elementary school II in the schools of Mutuípe-BA, two public and one private, regarding how the topic of dengue is presented in the classroom and the teachers' impressions of the content presentation during the 2023 school year.

It was observed that 80% (4/5) of the teachers use informative texts. However, some reported searching the internet and seeking information from the municipal health department, with these activities being secondary. While one teacher stated that the



teaching material met their expectations regarding the topics covered, the organization of ideas, and clarity, another teacher questioned this information, as they believe the material lacks sufficient sources and discussions.

As mentioned by Marteis, Makowsk, and Santos (2011), there are various tools that educators can use to convey topics and enhance dengue prevention practices. In general, pamphlets are widely used. However, other tools are also employed, as reported by them: books, slides, videos, and informative texts. This underscores the importance of diversifying methods and implementing innovations and technologies within school environments (Burgan, 2012).

According to the teachers, textbooks do exist and are used as a basic tool; however, they lack certain characteristics. The content's approach does not provide sufficient clarity and does not convey information effectively, leading to interpretation issues among students and requiring a greater time investment from teachers, who could be applying it in other ways. One of the teachers stated, "the book provides information, but it is necessary to supplement it with research from other sources."

When it comes to the topic of dengue in the classroom, 80% (4/5) of the teachers address it in relation to the virus or public health. However, some discuss the topic of dengue when debating arthropods. According to Nélio and Hardoim (2023), the teaching approach in the classroom can engage students in the fight for various social causes, particularly in the field of health. Furthermore, other aspects of the study highlight Science as the main subject for discussing disease control measures, such as those for dengue (Kuno, 2009).

Of the total number of teachers, only one implemented intervention actions to combat dengue. Among the preventive measures cited were cleaning the school yard, keeping containers such as water tanks closed (80% or 4/5), cleaning plant saucers (80% or 4/5), and inspecting vacant lots with debris (60% or 3/5). According to Marteis, Makowsk, and Santos (2011), for an effective fight against dengue, it is necessary to seek materials and methods that can achieve the best results within a given context. In other words, to reach the central objectives, adaptation to the context is needed to facilitate understanding and dissemination of knowledge to all involved. It is important to analyze the students' preferences and adaptations and how these correlate with and influence the dissemination of information to the population (Donalísio; Glasser, 2002).

Approaches to dengue prevention and control are essential in the classroom, and the primary promoters and drivers of these

practices are the teachers. Other staff members also play an important role; however, the strategies, content, and methodologies come directly from the educators (Assis; Pimenta; Schal, 2013). According to Gonçalves et al. (2022), in the fight against dengue, school environments require pedagogical projects and methods as more effective forms of intervention against the disease.

Nunes et al. (2021) emphasize that society must understand the importance of the role educational institutions play in the fight against dengue. For this, schools need not only to debate the issue within the classroom but also to take knowledge beyond their walls by engaging in actions with their communities. There is a relevant and urgent need for actions to be taken as soon as possible, with schools being one of the protagonists in the fight against the disease.

Silva et al. (2017) also discuss the participation of a group of agents in efforts toward solutions, prevention, control, and health improvement. According to the researchers, activities should involve various participants so they can jointly articulate investigations and approaches to dengue control. Such projects, they state, must consider a "sociocultural approach," as they require the community's presence and its entire context, with schools being pioneers of these movements (Cavalcanti; Lemos; Chrispino, 2012).

Teachers believe that students learn the content related to transmission mechanisms, breeding environments, as well as control and prevention measures. These acquired knowledge are stimulated by teaching methods, as these educators report using explanatory videos, classes with texts and readings, many of which involve debate. Multiple methods can be employed as strategies within schools to combat dengue. However, it is not a simple task and requires time, methods, and, most importantly, coordination between different participants. Access to information about how the healthcare system works and about health rights is not available to everyone, and this weakness is evident when there are no debates, a situation observed in several regions of Brazil. Health is important, and everyone needs access to this information and to know how and where to seek assistance (Pessoa, 2016).

Table 1 contains information about the questionnaire results regarding the approach to the topic, the materials and methods used, as well as other measures and projects developed on the topic of dengue.



Table 01. How 7th-grade Science teachers in Mutuípe-BA approach the topic of dengue.

Category	Details
How the topic is addressed	Informative texts: 80% (4/5) Slides: 40% (2/5) Books/films: 40% (2/5) Others: 20% (1/5)
Where dengue is addressed	Virus: 80% (4/5) Public health: 80% (4/5) Arthropods: 20% (1/5) Others: 20% (1/5)
Recursos utilizados no ensino da dengue	Videos: 100% (5/5) Books: 80% (4/5) Others: 40% (2/5)
Implemented interventions or projects	No: 80% (4/5) Yes: 20% (1/5)
Importance of the textbook on dengue	Clear ideas: 40% (2/5) Real-life experience: 40% (2/5) Simple and accessible language: 60% (3/5) Others: 20% (1/5)

Freitas, Azevedo, and Teixeira (2019) argue that, to enhance the teaching of the dengue topic, actions that can be understood and interpreted within schools are needed to achieve positive results. According to the questionnaire results, one teacher, to assist in delivering content and disseminating topics, creates pamphlets and informative texts to encourage students to read more. Thus, the use of different methods in the classroom contributes to the

teaching-learning process, stimulating understanding and comprehension of the content delivered by teachers to students. The development of practical activities, in addition to theoretical topics (which are crucial and indispensable), is essential to reinforce concepts and promote actions, which are useful pedagogical tools in combating the disease for both faculty and students and collaborators (Gonçalves et al., 2022).

According to the teachers, the teaching materials used by teachers in all schools require additional research sources. When students do not perceive clarity in the material, it can affect their understanding and assimilation of the content, making it important to consider strategies to render ideas more evident and easily comprehensible. Nélio, Miyazaki, and Haridoim (2022) argue that a connection between the materials used in class, with the help of the teacher, can facilitate the application of knowledge in everyday situations. The mention of research sources for students suggests an appreciation for diversifying information. This can be interpreted as a desire for materials that not only provide the main content but also offer additional references that broaden understanding and encourage independent student research. For better data visualization, Table 1 presents key elements related to the module (used in the private school) and the book (used in public schools).

Frame 1- Textbook and module from public and private schools, respectively, in the city of Mutuípe-BA.

Authors/Collection		Content length in the textbook	Presentation of the topic	Scientific name	Images/Figures	Parasite characteristics	Diseases	Infection mechanism	Prevention
Elementary Textbooks-module I	7th grade	Textbook : Leandro Pereira de Godoy ciências vida e universo	1/page	Presents the topic in a summarized form	Does not present	Present	Present	Present	Present
		Modueo: Authors not mentione d/ anos finais do fundamenteal II	0/5 pages	Presents the topic in a summarized form	Present	Present	Present	Present	Present

Batista and Lima (2022) discuss in their research the relevance of the educational process in people's lives, highlighting the development of young individuals within the classroom. For this to happen, the teaching-learning process must be accompanied by a sequence of activities and teaching materials that reinforce

pedagogical methods and the formulation of knowledge and skills in these individuals. However, not just any material or textbook can be applied, as there are specific criteria and requirements. For example, topics and approaches must correlate with reality, stimulate curiosity, provide textual clarity to



facilitate reading and interpretation, and ensure the organization and adequacy of ideas.

Authors such as Backes et al. (2020) emphasize the need to consider the socioeconomic aspects related to health in order to enable the formulation of more effective strategies by the Health Department and Epidemiological Surveillance. In this regard, Mohr (2002) recommends the inclusion of topics related to dengue in textbooks, both in public and private schools, especially in countries with a high incidence of the disease, such as Brazil.

The Health Department is primarily responsible for acting and investing in the treatment and prevention of disease transmission. In turn, schools need to implement more projects related to dengue, improving their role by correlating educational methods in the classroom with how this knowledge can be transferred to the community and taught to others. In this study, only one teacher reported carrying out an intervention project.

The aim was to determine the number of dengue cases recorded by the Health Department of Mutuípe-Bahia between 2019 and 2023. These data were made available through the Notifiable Diseases Information System (SINAN). The total number of dengue cases recorded during this period reached only 46, ranging from 1 case in 2021 and 2023 to 34 cases in 2020. This is a low number, considering the population of Mutuípe-BA, suggesting that the data may be underreported by the department that feeds the SINAN system.

According to Pessoa (2016), health departments have the responsibility to promote training events and various approaches to raise awareness and guide people on the different methods of combating dengue, integrating popular knowledge with the community's technical knowledge. This creates a strategic and effective environment from a health perspective, expanding the population's understanding and knowledge, resulting in benefits such as the attribution of a sense of individual responsibility, a crucial tool for aiding in the fight and control of dengue.

Table 2. Data provided by the Municipal Health Department of Mutuípe-BA

Notification year	SINAN	Number of cases in Bahia	Number of cases in Brasil
2019	8	67.519	1.543.665
2020	34	82.815	944.502
2021	1	25.089	531.804
2022	2	35.925	1.393.826
2023	1	47.705	1.517.551

Fonte: Datasus (2024).

According to the Arbovirus Monitoring Panel of the Ministry of Health, in Brazil, 0.78% of the population is affected by dengue for every 100,000 inhabitants, which means 780,000 people are impacted by the disease. In the case of Mutuípe-BA, applying this percentage to its population, the estimate is that 156 people per year would be affected by dengue. This reinforces the hypothesis that the data is underreported at the municipal level. In Bahia, between 2019 and 2023, there were 259,053 cases, ranging from 25,089 cases in 2021 to 82,815 in 2020. In Brazil, the total number of cases amounted to 5,931,348, with a range from 531,804 cases in 2021 to 1,543,665 in 2019.

FINAL THOUGHTS

It is possible to identify the initiative of some teachers in integrating education and health into their lessons. However, it is essential to rethink teaching, especially regarding topics that frequently affect the population and may not be discussed in the classroom, either due to a lack of planning or accurate information.

The importance of constantly revising textbooks to address public health topics more precisely and comprehensively is emphasized. Promoting health through educational strategies should be prioritized, as this could help in the control of parasitic diseases, reduce medication expenses, and improve improve the quality of life of the population. It is important to encourage continuous teacher training to achieve a more effective and comprehensive approach to dengue in educational contexts.

Educational approaches and practices aimed at combating diseases should be implemented from elementary school, empowering children and adolescents to understand and contribute to the development and formulation of actions in the pursuit of a healthier society in which they are embedded. There is an urgent need for joint actions involving the Health Department and schools, not only at the local level but also regionally, highlighting the importance of coordinated interventions in various regions for the control and prevention of dengue.



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