

DRINKING WATER AND SCHOOL HEALTH PROMOTION: ASSESSMENT OF WATER POTABILITY IN TWO PUBLIC SCHOOLS IN EUNÁPOLIS-BA

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Abstract: Access to drinking water is a fundamental human right and a key social determinant of health, particularly in the school environment, where the consumption of contaminated water can compromise academic performance and collective well-being. This study assessed the potability

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of water in two public schools located in Eunápolis, Bahia, based on the physical-chemical and microbiological parameters established by Ordinance MS No. 518/2004. Six water samples were collected from strategic points (drinking fountains, kitchens, and restrooms) at Horácio de Matos and Professor Roberto Santos Municipal Schools. Laboratory analyses were performed using the Alfakit kit at the Laboratory of the Pitágoras School of Medicine. Results showed that while Professor Roberto Santos School complied with all potability standards, Horácio de Matos School displayed nonconformities regarding pH and total coliforms. The study was conducted in accordance with ethical guidelines, with informed consent and formal authorization granted by school principals. As a pedagogical component, educational actions were carried out with the school community to promote awareness and encourage hygiene practices. The findings demonstrate that assessing water quality in schools is a crucial measure for sanitary surveillance and health promotion, particularly when combined with community-based educational strategies.

Keywords: Drinking water. School health. Water quality. Total coliforms. Sanitary education.

INTRODUCTION

Drinking water is an essential condition for the maintenance of life and one of the pillars for the full exercise of the right to health. Its safe and continuous access is considered a fundamental human right, as recognized by international organizations and implicitly provided for in the Brazilian legal system. The absence of quality water has a direct impact on morbidity and mortality indicators, being responsible for the spread of infectious, parasitic and gastrointestinal diseases, especially in vulnerable populations. In the school environment, this scenario takes on even more worrying contours, considering the high exposure of children and adolescents to the risks arising from the ingestion or use of contaminated water.

According to Von Sperling (1996), the potability of water is determined by a set of physical, chemical and biological parameters that, when outside the established standards, can compromise



its safety for human consumption. Microbiological parameters, such as the presence of coliforms, are particularly important because they are direct indicators of fecal contamination and the risk of transmission of pathogens. Thus, the periodic evaluation of the water consumed in collective spaces, such as schools, becomes an essential strategy for health surveillance and disease prevention.

The school is a privileged space for health promotion, being responsible not only for the formal educational process, but also for the construction of healthy habits among children and adolescents. For Moraes et al. (2018), ensuring the supply of drinking water in the school environment is an inseparable part of the institutional responsibility for the well-being of students. This is due to the fact that the school environment is considered the “second home” of students, requiring minimum standards of sanitary quality that ensure a safe and health-promoting environment.

Despite advances in water supply coverage in Brazil, the quality of the water offered is still a critical issue. According to the Instituto Trata Brasil (2024), about 35 million Brazilians still do not have regular access to treated drinking water, which highlights a scenario of structural inequalities in basic sanitation. In municipalities in the interior, such as Eunápolis-BA, even with significant percentages of service by distribution networks, local non-conformities persist, especially with regard to the maintenance of reservoirs, cleaning of water tanks and monitoring of points of use in public schools.

Lima et al. (2024), when analyzing water samples in schools in the municipality of Eunápolis, found non-conformities in several physical-chemical and microbiological parameters, such as pH outside the allowed range and the presence of total coliforms. These findings corroborate the hypothesis that the mere existence of a supply network does not guarantee, by itself, the quality of the water effectively consumed in school equipment. The absence of preventive maintenance, added to the low training of school teams in basic sanitation, can compromise the health of the entire community.

Silva et al. (2025), in turn, expand this debate by investigating the relationship between social vulnerability, environmental determinants, and water contamination in peripheral and school communities in the municipalities of Eunápolis and Porto Seguro. The authors identified the overlap



between structural precariousness and indicators of microbiological contamination, demonstrating that inequality in access to drinking water manifests itself as a direct reflection of socio-spatial conditions, aggravating the health risk among historically marginalized populations.

The literature also points out that frequent exposure to pathogens present in contaminated water can cause several diseases, such as gastroenteritis, worms, hepatitis, and bacterial infections, directly affecting school performance, cognitive development, and children's well-being (Araújo and Andrade, 2020; Menezes et al., 2012). The vulnerability of the age groups served by public schools requires, therefore, greater rigor in controlling the quality of the water used for drinking, washing hands, preparing food and sanitizing utensils.

From a normative point of view, MS Ordinance No. 518/2004 establishes strict criteria for the control and surveillance of the quality of water for human consumption, and it is the responsibility of local health authorities and supply systems to ensure its application. Failure to comply with these parameters in educational institutions constitutes a serious failure of management, in addition to representing a violation of the right to health and education in safe conditions. Ferreira (2011) and Júnior and Castro (2022) point out that, although the right to water is not expressly provided for in the 1988 Constitution, it logically stems from the guarantee of the existential minimum and the dignity of the human person.

In the public health scenario, studies such as those by Costa et al. (2024) and Xavier et al. (2022) point to the need to expand the monitoring of the quality of water consumed in collective spaces, including schools, daycare centers, and health units, where the vulnerability of the populations served requires even safer standards. Scientific production has shown that water quality control is a cost-effective strategy for disease prevention and that it can be integrated into health education and community health promotion programs.

It is in this context that the present study is inserted, whose focus falls on the analysis of the potability of water in two public schools in the city of Eunápolis-BA, with the objective of verifying the conformity of the physical-chemical and microbiological parameters with the standards established



by the current legislation. The proposal is anchored in a quantitative-qualitative approach, combining the collection and technical analysis of samples with the promotion of educational activities with the school community, respecting the ethical and pedagogical principles of health research.

The scientific relevance of this study lies in its ability to generate empirical data on water quality in school spaces in the extreme south of Bahia, contributing to the field of collective health, sanitary surveillance and school health promotion. By integrating technical analysis, legal foundation, and educational action, the research strengthens the debate on the right to safe water and promotes subsidies for the formulation of more effective local public policies.

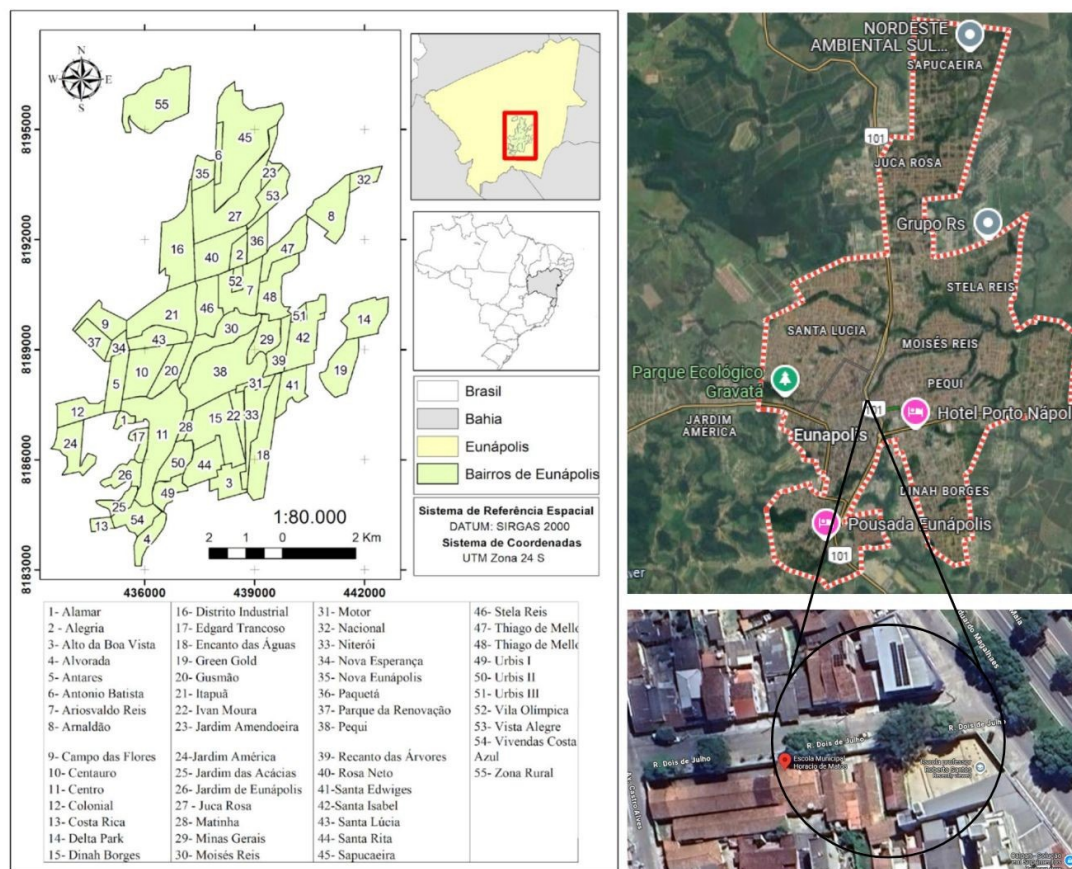
METHODOLOGY

It is a research of applied nature, with a quantitative-qualitative approach, of descriptive and exploratory character. The design is of the cross-sectional observational type, and the investigation is carried out in a single moment, focusing on the analysis of water quality in public educational institutions. The quantitative approach was present in the measurement and interpretation of the physical-chemical and microbiological parameters of the water samples, while the qualitative dimension was incorporated in the contextual analysis and in the application of the educational action with the school community.

The study was developed in the municipality of Eunápolis, located in the extreme south of the state of Bahia, with an estimated population of 120,000 inhabitants and partial coverage of supply and sewage services (Instituto Trata Brasil, 2024). The school units selected for the study were the Horácio de Matos Municipal School and the Professor Roberto Santos Municipal School, both located in urban areas with similar demographic and structural characteristics. The choice of schools occurred for convenience and operational feasibility, considering the interest of school administrations in participating in the research and the possibility of the team's extension action.



Figure 1: Map of the geographic disposition of the neighborhoods of Eunápolis – BA, and spatial location of the Horácio de Matos Municipal School and Professor Roberto Santos Municipal School.



Source: Google Maps, 2025.

Data collection took place in April 2025, through the extraction of water samples at three strategic points in each school: drinking fountain (water for direct consumption), kitchen (food preparation) and bathroom (personal hygiene), totaling six samples. The collection points were defined based on the guidelines of Ordinance MS No. 518/2004, which establishes the criteria for evaluating the potability of water intended for human consumption. The samples were collected in sterile vials, using disposable gloves and a thermal box for transport, in order to preserve the original properties until the moment of analysis.



Laboratory analyses were performed at the Microscopy Laboratory of the Pitágoras Medical School of Eunápolis, using the Alfakit kit, which allows the detection of multiple parameters, such as pH, residual chlorine, ammonia, hardness, alkalinity, color, chlorides, iron and the presence of total coliforms. The data were systematized in spreadsheets, compared to the maximum allowed values established by MS Ordinance No. 518/2004 and interpreted based on the technical references of Von Sperling (1996) and Xavier et al. (2022), especially with regard to the categorization of indicators into physical, chemical and biological parameters.

As a final stage of the research, a pedagogical feedback was carried out through educational actions in the two participating schools, aimed at students, teachers and employees. The intervention consisted of lectures and informative activities on the importance of drinking water, the health risks associated with the consumption of contaminated water and good hygiene practices in the use of drinking fountains and reservoirs. This action was exclusively educational, without collecting personal data, reinforcing the research's commitment to health promotion and the social transformation of the territories.

The inclusion criteria involved the participation of the school units with formal authorization from the directors, the availability to collect samples and the voluntary adherence to the educational action. Only members of the school community who, due to absence or lack of interest, did not participate in the pedagogical moment were excluded from the activity. As there was no collection of personal information or individual interviews, the study did not imply risk to the participants.

From an ethical point of view, the research was conducted in accordance with the principles of CNS Resolution No. 510/2016. The collection of samples and the carrying out of educational actions were authorized by the school directors through the signing of the Informed Consent Form (ICF) and the Letter of Consent. The proposal was previously submitted to the extension coordination and meets the criteria of mandatory feedback to the community, according to the guidelines of the Pitágoras Faculty of Medicine of Eunápolis for scientific initiation and extension projects. It is noteworthy that the educational activity had a formative and preventive character, not constituting experimentation or



invasive intervention, which reinforces its ethical legitimacy in the field of health promotion.

ANALYSIS AND DISCUSSION OF RESULTS

The analysis of water quality involves multiple theoretical references that allow the interpretation of physicochemical and microbiological parameters based on their relevance to public health. Among the main authors who support this reading, Von Sperling (1996) stands out, who proposes a technical classification of the parameters into three major groups: physical, chemical and biological, detailing the implications of each one on the potability of water and the associated health risk. Xavier et al. (2022), in an integrative literature review, reinforce the importance of parameters such as color, turbidity, pH, hardness, and coliforms in the evaluation of water for human consumption, systematizing the main indicators used in Brazilian scientific studies. Sant’Ana et al. (2003) and Sousa (2006) contribute to the microbiological conceptualization, by explaining the role of total and fecal coliforms as indicators of recent fecal contamination and the presence of pathogens. These theoretical bases are complemented by applied studies, such as those by Costa et al. (2024), Silva et al. (2025) and Lima et al. (2024), which analyze water in school and peripheral contexts, emphasizing the social, sanitary and territorial consequences of the precariousness of supply systems.

The laboratory evaluation carried out at the Horácio de Matos and Professor Roberto Santos Municipal Schools allowed us to identify not only the conformity or non-conformity of the measured parameters, but also to reflect on the origin of the problems detected, the risks involved and the strategies necessary for their mitigation. In all, eight parameters were analyzed: pH, residual chlorine, ammonia, total hardness, alkalinity, color, chlorides and total coliforms. Each of them has different implications for water quality and, when outside the standards established by MS Ordinance No. 518/2004, may pose a risk to human health, hydraulic infrastructure or the sensory acceptability of water.

Table 1 summarizes the results of the analyses at the three collection points of each school:



drinking fountain, kitchen and bathroom.

Table 1: Comparison of physicochemical parameters and microbiological indicators of the collection sites

MS Ordinance No. 518/2004		School 1(1)			School 2(2)		
Parameters	VMP	1	2	3	1	2	3
Alkalinity	-	10	10	10	10	0	0
Ammonia	1.5 mgL-1	0	0	0	0,1	0,75	0,1
Chlorine	5 mgL-1	0,25	2	2	0	0,1	0
Chlorides	250 mgL-1	40	40	50	40	40	40
Colour	15 uH	3	3	3	3	3	3
Total Hardness	500 mgL-1	20	20	20	20	20	20
Iron	0.3 mgL-1	0	0	0	0	0	0
ph	6,0 - 9,5	5	5	5	6	6	6
Total Coliforms	Absence in 100mL	19,2×10 ³	0	0	0	0	0

Source: Field Research, 2025.

(1) Horácio de Matos Municipal School.

(2) Professor Roberto Santos Municipal School.

1: Drinking fountain.

2: Kitchen.

3: Bathroom.

Regarding the physicochemical parameters, most of the samples presented values within acceptable limits. However, the Horácio de Matos Municipal School presented a pH equal to 5 in all samples, a value lower than the minimum required (6.0). This alteration does not configure, in isolation, an acute risk to health, but it compromises the chemical stability of the water and can indicate corrosion processes in the pipes, in addition to interfering with the effectiveness of disinfection (Von Sperling, 1996). According to Junior (2016), pH values below the recommended can increase the



solubilization of toxic metals, such as iron and lead, making the water potentially harmful in the long run.

Also with regard to pH, studies such as the one by Costa et al. (2024) identified similar variations in schools in the North and Northeast regions of the country, with values between 3.2 and 5.6 in eight of the nine samples analyzed. The authors attribute this acidity to the poor conservation of school reservoirs and the absence of continuous monitoring. In the present study, although the other chemical parameters such as alkalinity, hardness, ammonia and chlorides were in compliance, the persistently low pH suggests fragility in the school's internal infrastructure and the need to review the conditions of water storage and distribution.

The Professor Roberto Santos Municipal School, on the other hand, presented results entirely within the normative standards in all physical and chemical parameters. This difference between the two institutions, located in the same municipality and supplied by the same concessionaire (EMBASA), reinforces the findings of Silva et al. (2025), who identified sanitary inequalities between school territories in Eunápolis and Porto Seguro, explained not only by external supply factors, but also by local weaknesses, such as the absence of periodic cleaning of water tanks, failures in plumbing and misinformation about good sanitary practices.

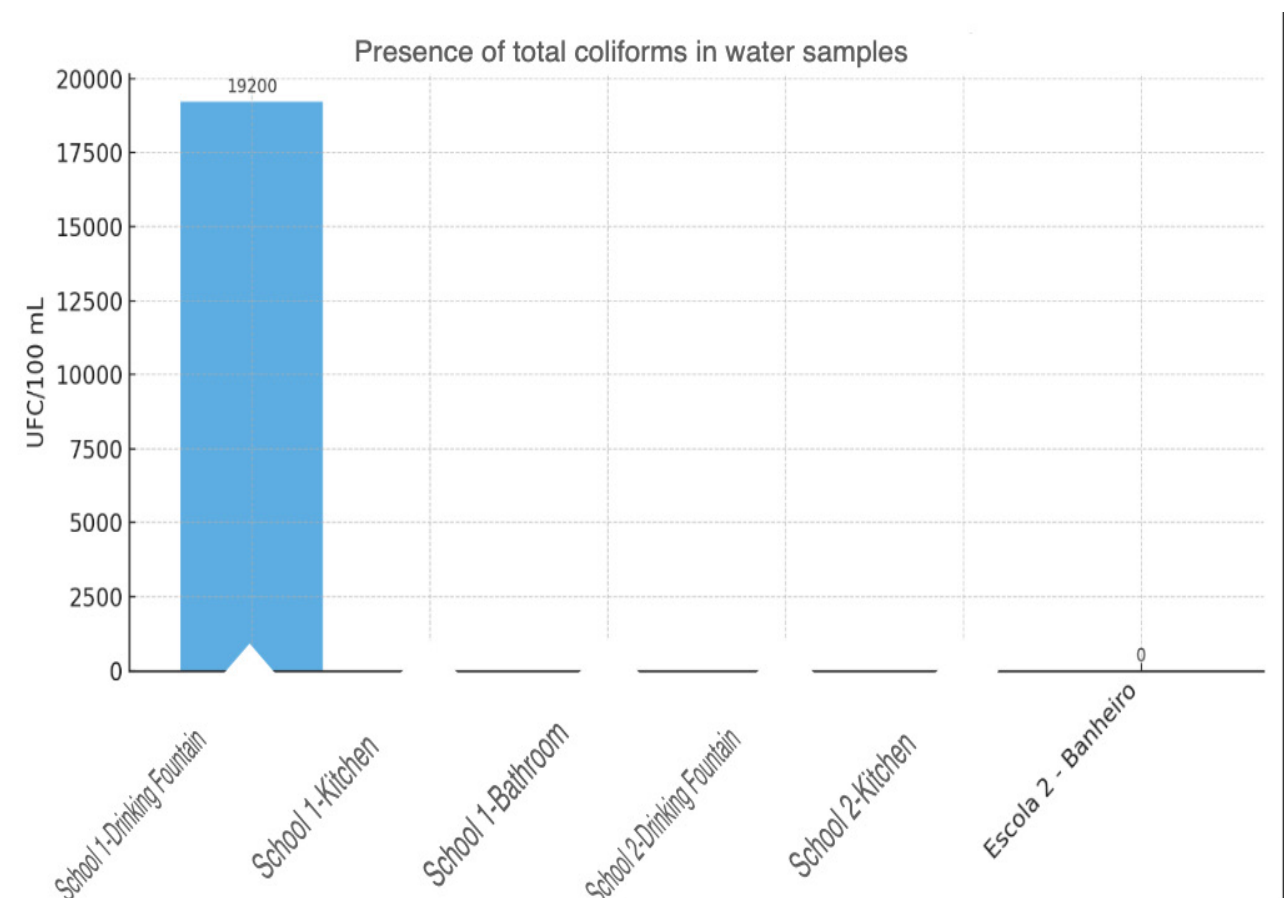
The discrepancy in pH data between the two schools investigated can be attributed to multiple factors, including water storage time, material and cleanliness of reservoirs, as well as exposure to environmental variations. According to Araújo and Andrade (2020), changes in pH can occur as a result of the degradation of organic matter, the presence of contaminants, and the absence of proper hygiene of water tanks. This chemical instability of the water directly impacts the quality of the liquid supplied, and can impair the integrity of the pipes and the action of disinfectant agents, such as chlorine.

The presence of total coliforms in the drinking fountain of the Horácio de Matos Municipal School is the most worrying data identified in the study. The recorded value: 19.2×10^3 CFU/100 mL, far exceeds the legal limit of absence required by Ordinance MS No. 518/2004, constituting a high



health risk for users of the collection point. According to Sant’Ana et al. (2003), total coliforms act as markers of fecal contamination and indicate the possible presence of pathogenic bacteria, such as *Escherichia coli*, *Salmonella* and *Shigella*, which can trigger outbreaks of gastroenteritis, hepatitis and other waterborne diseases.

Graph 1 – Presence of Total Coliforms in the samples at the collection points



Source: Field Research, 2025.

Von Sperling (1996) points out that the presence of these microorganisms in treated and distributed supply systems reveals flaws in the chlorination or recontamination procedures after the treatment process. In the case of schools, these factors may be associated with poor maintenance



of drinking fountains, lack of periodic cleaning of taps and inadequate handling by users. This last variable was described by Silva and Bitar (2022) in a study with public schools, in which the contamination of drinking fountains was attributed to the direct use of lips in taps, lack of hand hygiene after using the bathroom, and proximity between toilets and sources of consumption.

The literature shows that microbiological contamination of water is one of the main factors related to dropout and low school performance. Araújo et al. (2014) and Menezes et al. (2012) report that children exposed to the ingestion of contaminated water have a higher frequency of intestinal diseases, which compromises class attendance, school performance and neurocognitive development. Such diseases interfere with the absorption of nutrients, cause anemia, dehydration and gastrointestinal disorders, mainly affecting students in situations of socioeconomic vulnerability, for whom school meals represent the main meal of the day.

This scenario corroborates the data from the Human Development Report (UNDP, 2006), which points to contaminated water as one of the major causes of infant mortality in the world, especially in regions with a deficit of sanitary infrastructure. The association between water contamination and social inequality is reinforced by Silva et al. (2025), when they describe the overlap between territories with low sanitation coverage and indicators of waterborne diseases in schools and peripheral communities in southern Bahia. The authors argue that the absence of access to safe water constitutes one of the most perverse forms of exclusion, as it violates fundamental rights and compromises educational and health equity.

The presence of coliforms in the drinking fountain of the Horácio de Matos Municipal School, evidenced in Graph 1, raises reflections on the role of school health surveillance and the sharing of responsibilities between public entities and the internal management of educational institutions. Although the supply of the schools analyzed is carried out by the same public concessionaire, the difference in the results between the two institutions suggests that the contamination occurred after the delivery of the water, possibly as a result of local failures in storage, use and cleaning. As pointed out by Cruz (2018), school drinking fountains are often neglected in maintenance routines, becoming



critical points for the dissemination of infectious agents.

In addition to the physical infrastructure, behavioral and pedagogical factors also exert a significant influence on the sanitary quality of the points of consumption. The absence of educational routines aimed at hand hygiene, the proper use of drinking fountains and the control of periodic cleaning of water tanks can compromise the effectiveness of sanitation actions. Mota et al. (2024) point out that the use of laboratory kits in school activities can contribute to community awareness about water quality and the importance of prevention practices. The present study reinforces this perspective by combining technical analysis with a transformative educational action, promoted together with the two participating schools.

The approach adopted in the research, which combined quantitative laboratory methods with a qualitative educational intervention, is supported by Silva et al. (2025), who highlight the importance of intersectoral strategies between health and education to address structural inequalities in vulnerable territories. The feedback carried out by the team, with lectures and practical guidance, was well received by the school community and generated a space for critical reflection on daily health habits. This type of strategy is defended by Moraes et al. (2018) as fundamental for the construction of a school culture focused on collective health, especially in contexts of scarcity of structuring public policies.

The pedagogical action implemented aimed not only to inform about laboratory findings, but to foster a change in behavior among students, teachers and employees. According to Lima et al. (2024), one of the main gaps in school territories is not the absence of laws or parameters, but the lack of practical application and awareness of the population about the real risks of water contamination. Health promotion, in this context, should be understood as a permanent and participatory educational process, in which the community is the protagonist of the necessary changes to ensure the safety of the water consumed daily.

Finally, it is highlighted that the absence of coliforms in the samples of the Professor Roberto Santos Municipal School should be interpreted not as an isolated technical privilege, but as a probable



result of a set of good institutional practices. Although it was not the objective of the research to directly evaluate the internal management of schools, the comparison between the results suggests that the maintenance of water potability depends not only on the quality of the external supply, but also on the daily surveillance of the infrastructure and the sanitary culture built in the school environment. This finding is fundamental to guide public policies aimed at school health in municipalities in the interior.

The comparative analysis between the two schools also allows a critical reflection on the social and environmental determinants of health. Water contamination, as demonstrated in this study, is not only the result of the absence of technology or occasional operational failures, but of a broader scenario of structural inequality, which affects institutions located in territories with less presence of public power with greater intensity. As Rodrigues, Venson and Camara (2019) argue, access to essential services such as basic sanitation, health and education is unevenly distributed among Brazilian regions, reflecting historical and territorial disparities that perpetuate the health vulnerability of specific populations.

By addressing the potability of water as an expression of socio-environmental justice, the study by Silva et al. (2025) reveals that contamination points often coincide with marginalized communities, where poor basic sanitation is associated with high rates of preventable diseases. This relationship was also observed in the present research, in which the point of greatest non-conformity, the drinking fountain of the Horácio de Matos Municipal School, is located in a peripheral neighborhood, with a history of lack of assistance in urban infrastructure policies. Such evidence reinforces that water quality should be understood not only as a technical indicator, but as an expression of human dignity and the right to the city.

In this sense, health surveillance should be thought of as an intersectoral strategy, articulating the health, education, environment and social assistance sectors. The work of community health agents, pedagogical coordinators and school councils can be decisive in ensuring the periodicity of analyses, the maintenance of hydraulic installations and continuing education on hygiene and prevention practices. According to Cruz (2018) and Mota et al. (2024), the school is a privileged



territory for the articulation of these actions, as it concentrates institutional and community actors capable of mediating practical transformations in the daily lives of families.

The formation of a culture of social control and popular inspection should also be encouraged in the school environment. When community members know the parameters of water quality and understand the risks associated with water contamination, they become more able to demand from public authorities the proper provision of services. The UNDP report (2006) points out that the lack of transparency in information on water supply and treatment contributes to the invisibility of the problem and to the perpetuation of water exclusion in peripheral territories. By breaking with this logic, educational actions such as the one developed in this study fulfill an emancipatory role, by transforming technical knowledge into shared knowledge.

Another relevant point to be considered is the absence of systematic mechanisms for monitoring water quality in municipal public schools. Although Ordinance MS No. 518/2004 determines the mandatory control and surveillance of water for human consumption, in practice, most educational establishments do not carry out periodic tests, nor do they have defined protocols for the maintenance of drinking fountains, water tanks and pipes. This institutional omission contributes to the trivialization of risks and to the underreporting of diseases related to contaminated water. Costa et al. (2024) point out that, without continuous and systematized diagnosis, there is no way to develop effective interventions or measure the extent of health impacts in school communities.

In view of the evidence presented, it is recommended that municipalities systematically incorporate the assessment of water quality in public schools into the planning of sanitary surveillance and collective health actions. Periodic testing, accompanied by clear protocols for the maintenance of hydraulic structures, is essential to prevent the occurrence of health problems. The contamination of school water compromises not only the physical well-being of students, but also their permanence and performance in the educational environment, directly reflecting on the indicators of equity and health justice. The recognition of drinking water as an essential component of school life requires the strengthening of intersectoriality, institutional accountability and community action in monitoring



risks.

FINAL CONSIDERATIONS

The evaluation of the potability of water in public schools in Eunápolis-BA revealed important non-conformities in physical-chemical and microbiological parameters, with emphasis on the presence of total coliforms in the drinking fountain of one of the institutions investigated. The data point to a concrete health risk in the school environment, which reinforces the need for systematic actions to monitor the quality of water supplied to children and adolescents in the educational context. The contamination identified is not only a threat to the health of students, but a violation of fundamental rights, such as the right to safe education, health and basic sanitation.

The results obtained demonstrate that the simple guarantee of the supply of water by the public network does not ensure its quality up to the point of consumption. Factors such as inadequate storage, the absence of reservoir cleaning routines and the lack of internal surveillance protocols contribute to the degradation of water quality within the schools themselves. In view of this, it is imperative that municipal managers, in conjunction with the health, education and environment sectors, develop permanent programs for testing and controlling school water, ensuring transparency, periodicity and rapid response to any risks identified.

In addition to the technical diagnosis, the study also stands out for its educational and extension dimension. The holding of feedback and orientation workshops with school communities demonstrated the potential of research as a tool for social transformation and strengthening collective health awareness. The active participation of teachers, students and managers in guidance actions reinforces the importance of the school as a territory for health promotion, where scientific knowledge can be translated into daily care and prevention practices.

Another relevant aspect lies in the feasibility and replicability of the methodology used. The application of low-cost laboratory kits, in conjunction with health education actions, is an accessible



and effective strategy for municipalities with limited resources. The simplicity of the method, associated with its analytical robustness, allows other teaching and research institutions to adopt it as a reference for local diagnoses and community actions. In this sense, the present study contributes to the construction of territorial indicators and to the strengthening of evidence-based intersectoral public policies.

Finally, it is reiterated that the safety of water consumed in schools is not the exclusive responsibility of the health sector, but a collective commitment that requires inter-institutional articulation, social control and direct involvement of the school community. The report of the extension experience carried out reaffirms the importance of local, applied and replicable studies, capable of illuminating the daily health challenges and proposing viable, sustainable and humanized solutions. That each school can be, not only a space for learning, but also for health, equity and dignity for all.

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