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The panorama of the fluoridation of public water supplies in Belém, Pará State, Brazil

O panorama da fluoretação das águas de abastecimento público da cidade de Belém, estado do Pará, Brasil

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ABSTRACT

INTRODUCTION: Community water fluoridation is a public health strategy to control dental caries and is one of the most important measures ever implemented. Since the mid-twentieth century, fluoride has been used in water supplies, and several studies have demonstrated its effectiveness in controlling caries. Given this scenario, it is observed that when an interruption of fluoridation occurs or when fluoride levels are below the intake recommendations, benefits may be lost, and the prevalence of caries increases. OBJECTIVE: To analyze the fluoridation situation in Belém, Pará State, focusing on the aspects of fluoride ion, the consolidation of water fluoridation in Brasil and worldwide, and the monitoring of fluoride levels. METHODS: Reports generated by the Department of Public Health of Pará, containing fluoride levels from 2005 to 2006, and documents exchanged between the Faculty of Dentistry at Universidade Federal do Pará and the water treatment company of Belém. RESULTS: The data showed that fluoridation in the municipality was not being adequately performed during the years studied, and it was interrupted in 2010, which caused a significant increase in the DMFT index at that time. CONCLUSION: The urgency of reactivating fluoridation by the water company is undeniable and efficient monitoring of the fluoride levels supplied to the population through fluoridated water.

Keywords: Public Health; Fluoridation; Fluoride; Dental Caries; Water Supply.

RESUMO

INTRODUÇÃO: A fluoretação da água de abastecimento público é uma estratégia em saúde pública no controle da cárie dentária, sendo uma das mais importantes medidas já promovidas. Desde a metade do século XX, o flúor vem sendo utilizado na água de abastecimento e diversos estudos têm demonstrado sua eficácia no controle da cárie. Diante desse cenário, observa-se que quando há a interrupção da fluoretação, ou quando os teores de flúor ficam abaixo do recomendado, os benefícios podem ser perdidos e a prevalência de cárie aumenta. OBJETIVO: Realizar um estudo sobre a conjuntura da fluoretação na cidade de Belém, estado do Pará, tendo como foco aspectos importantes do íon flúor, a consolidação da fluoretação no Brasil e no mundo e a vigilância dos teores de flúor. MÉTODOS: Foi realizada a análise dos laudos gerados pela Secretaria de Saúde Pública do Pará dos teores de flúor de 2005 e 2006 e da documentação trocada entre a Faculdade de Odontologia da Universidade Federal do Pará e a empresa responsável pelo tratamento de água do município de Belém; além de levantamentos bibliográficos em bases de dados eletrônicas. RESULTADOS: Os dados evidenciaram que a fluoretação no município não estava sendo realizada de maneira adequada durante os anos pesquisados e foi interrompida em 2010, com flagrante aumento do índice CPO-D no período. CONCLUSÃO: É inegável a urgência da reativação da fluoretação pela concessionária, bem como uma vigilância eficiente relacionada aos teores de flúor fornecidos à população por meio do abastecimento da água fluoretada.

Palavras-chave: Saúde Pública; Fluoretação; Flúor; Cárie Dentária; Abastecimento de Água.

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INTRODUCTION

From the 20th century, Dentistry began to understand the origin of dental caries, as the prevalence was relatively high in the United States of America (USA) and most developed countries, affecting populations worldwide. Dental caries, therefore, was considered a public health problem[1].

Observational studies found a relationship between fluoride and dental caries; however, before discovering its benefits for dental health, research revealed its influence in causing an adverse effect, called dental fluorosis. The following studies were essential because they estimated the optimal fluoride values in water capable of promoting the maximum benefit against dental caries and the minimum risk of dental fluorosis[2].

The fluoridation of public water supplies is the controlled addition of a fluoride compound to drinking water and was an essential measure for the decline in dental caries during the mid-twentieth century[3]. In Brazil, this measure caused significant reductions in the experience of caries where it was adopted, mainly between 1986 and 2003. Fluoridation has been legally mandated for over 40 years and has been effective in several locations. In addition, such preventive measure is of great importance due to its social aspect in reducing inequalities in public health, since it is a strategy that reaches the population extensively and regularly[4].

Based on the above, the initiative to fluoridate water supplies is a measure that promotes oral health, especially in Brazil, which has extreme social inequality. In addition, this strategy is often the primary mechanism to obtain fluoride for a large part of the population without access to other preventive means, such as fluoridated toothpaste[4].

Several studies have shown that the fluoridation of public water supplies effectively prevents dental caries. Thus, this study aims to carry out a critical review, addressing the chemical aspects of the fluoride ion, the legislation on fluoridation in Brazil, the impact of this measure on public health, and the current panorama of fluoridation in the city of Belém, Pará State, Brazil.

RESEARCH METHODS

A documentary analysis of the fluoride levels reports generated by the Department of Public Health of Pará (SESPA) in 2005 and 2006 was performed. The documentation exchanged between the Faculty of Dentistry of the Federal University of Pará (UFPA) and the Pará Sanitation Company (COSANPA), responsible for water treatment in Belém, was also analyzed. Moreover, a bibliographic survey was carried out in the databases PubMed, Scientific Electronic Library Online, Biblioteca Virtual em Saúde (Bireme), Periódicos Capes and Literatura Latino-Americana e do Caribe em Ciências da Saúde, corresponding to the period from 1987 to 2020, using the search terms "fluoride", "fluoridation", "water fluoridation" and "dental caries".

THE CHEMICAL FLUORINE ELEMENT

Fluorine is present in water, air, and soil, having an enormous capacity to react with other elements and form organic and inorganic compounds[5]. Among the negatively charged ions, fluorine is the most reactive element. In nature, it is not found alone but in compounds called fluorides[6].

When available in its free form, fluorine is highly corrosive[7]. Fluoride has different concentrations when incorporated into the soil, air, and water, depending on its location., Its concentration is approximately 1.0 ppm in seawater, but it can vary between 0.8 and 1.4 ppm[5].

With proof of the effects of fluoride in caries control, fluorides were added to water supplies, oral hygiene products (dentifrices and mouthwashes), foods, and medicines[8]. It is noteworthy that the primary means of obtaining fluoride are fluoridated toothpaste and fluoridated water.

Water has undeniable importance for public health policies; however, it has inadequate fluoride levels that do not support the prevention of dental caries. Therefore, it is proposed to adjust the levels to an ideal concentration for each location, observing the temperature[9]. Such levels must respect principles that aim to establish the benefits of preventing and reducing caries with a minimum risk of dental fluorosis[2].

Dental caries is an infectious and multifactorial disease that causes the demineralization of the tooth structure due to the action of acids derived from the metabolism of carbohydrates in the bacterial plaque[5,10]. However, after the correlation between fluoride and dental caries, in the early 20th century, several epidemiological surveys have provided data proving that adding fluoride to drinking water reduces the rate of dental caries[3].

It is through a chemical imbalance that dental caries is originated, and a dynamic process of loss and gain of minerals between saliva and tooth structure begins. Mistakenly, it was believed that the action of fluorine in the caries process would demonstrate its lowest incidence when incorporated in the form of fluorapatite (FA). However, fluoride ingestion during tooth formation does not form FA, as only approximately 10% is incorporated, which is insufficient to make the enamel more resistant to acid attack from bacterial metabolism. The presence of fluoride in the oral environment (saliva, bacterial plaque) is an essential factor in the dynamics of the demineralization-reminera lization (des-re) process, activating remineralization and reducing demineralization[11].

The dental mineral structure depends on the oral environment, being related to pH variations. The decrease in bacterial plaque pH, caused by the release of an acid derived from bacterial metabolism, causes the dissolution of hydroxyapatite (HA), releasing phosphate and calcium into the oral environment. However, the presence of fluoride in the oral environment will cause the deposition of the mineral fluorapatite, compensating for the mineral loss and interfering with the development

of caries. In addition to this factor, the simple presence of fluoride activates the saliva's remineralization ability when the pH returns to its normality, intensifying the responsiveness to replenish lost minerals[3].

Thus, having fluoride in the oral environment is essential for its preventive effect against caries throughout the individual's life. However, it is known that fluoride alone does not prevent the disease, and there is a need to maintain the control of bacterial plaque and balance in the cariogenic diet so that the preventive effect is manifested in its entirety[5].

Early research suggested that the preventive property of fluoride resulted from its ingestion during the period of tooth development, culminating in a tooth structure that is more resistant to dental caries. However, it is currently known that the preventive power of fluoride is due to its constant presence in the oral environment, being made available through the ingestion of fluoridated water (systemic) or topical means such as the topical application of fluoride, mouthwash, and fluoridated toothpaste[2]. After ingestion of fluoridated water or consumption of foods made with fluoridated water, there is an increase in the bioavailability of fluoride in blood plasma, mainly in saliva, enabling the reduction of mineral loss and the reversal of the progress of caries[12].

Water fluoridation is the addition and control of levels of a predetermined value of fluoride in public water supplies to promote preventive effects on the population, such as the prevention and control of dental caries[9]. In Brazil, it is regulated the use of sodium fluoride (NaF), calcium fluoride (CaF_2), fluorosilicic acid (H_2SiF_6), and sodium fluorosilicate (Na_2SiF_6) for the fluoridation of public water supplies[13]. However, sodium fluorosilicate and fluorosilicic acid are the most used[14]. The fluoridating of the water supply was one of the most important measures in public health and one of the ten most relevant achievements in public health in the 20th century[3,4].

The effectiveness of water fluoridation was demonstrated through studies carried out in several North American cities in the 1940s. After 13 years of observations, the results showed a reduction in caries from 50 to 70% in children living in cities that adopted water fluoridation[1].

In Brazil, municipalities that included fluoridation in the public water supply system significantly reduced the prevalence of dental caries. Even though there were other methods of obtaining fluoride, water fluoridation became the best collective means of caries prevention, significantly impacting the community and standing out for its satisfactory cost-benefit[9].

HISTORY OF FLUORIDATION WORLDWIDE AND IN BRAZIL (LEGISLATION)

The first step towards water fluoridation occurred through the observations of dental professionals, who noticed the presence of stained enamel on the permanent teeth of several patients[5]. After years of research, dental surgeon Dr. Frederick S. McKay proposed that an agent present in drinking water would cause stained enamel[1]. McKay was also the pioneer in associating that children with enamel problems had less susceptibility to dental caries[5].

After years of study, McKay's hypothesis was confirmed by the chemist H. V. Churchill, who, using a new analysis method, detected high fluoride concentrations in drinking water[1]. In 1931, Dr. H. Trendley Dean investigated the association of fluoride with stained enamel[3]. Dean concluded that children living in regions with fluoride in the water were less susceptible to dental caries and proposed a fluoride concentration that produced maximum preventive effect against caries and minimum risk for staining the enamel, which he later named dental fluorosis[5].

In 1945, after years of study, Grand Rapids, Michigan, USA, became the first to fluoridate its water supplies artificially. This datum was part of a study that had Muskegon as its non-fluoridated control city. Other USA and Canadian cities also participated in the study[15].

After 13–15 years of study, it was concluded that there was a 50 to 70% reduction in caries among children living in cities with fluoridated water[1]. In the USA, water fluoridation became an official policy in the 1950s, and, in 2006, around 60% of the population was covered[2]. The USA fluoridation policy has progressed over the years, reaching 74.4% of the population in 2012, totaling approximately 210 million citizens[16].

The first recommendation to fluoridate public water supplies in Brazil was in 1952, at the 10th Brazilian Hygiene Congress (X Congresso Brasileiro de Higiene) held in Belo Horizonte, Minas Gerais State. The fluoridation process began in 1953[5].

The initial steps for adding fluoride to public water supplies occurred with implementing the fluoridation system in the municipality of Baixo Guandu, in Espírito Santo State. The Public Health Services Foundation (FSESP) of the Brazilian Ministry of Health (MS) implemented the system on October 31, 1953[3]. The fluoride levels for the region were around 0.8 ppm, and the chemical used was sodium fluorosilicate[3,17,18]. Before the implementation of the system, a preliminary epidemiological survey was carried out on the prevalence of caries in schoolchildren from 6 to 14 years old, and, after seven years, there was another epidemiological survey, finding a reduction of 64% in the rate of decayed, missing, and filled teeth (DMFT)[13].

In October 1958, Curitiba, Paraná State, implemented the system and was the first capital to fluoridate its waters[19]. Several cities started to adopt water fluoridation from 1950 to 1980. On June 12, 1957, Rio Grande do Sul State established the mandatory fluoridation of its water supplies[5].

As of 1974, water fluoridation in treatment plants became mandatory in Brazil. Federal Law n° 6,050, of May 24, 1974, provides water fluoridation in public water supplies where there is water treatment[3]. Federal Decree n° 76,872, established in 1975, regulated the Law n°. 6,050 of 1974 and determined the mandatory

nature of fluoridation. Still in 1975, Ordinance nº. 635/BSB, of December 26, 1975, was established, which dictated norms and standards to stipulate adequate concentrations according to the average temperature of the place and recommended chemical compounds for proper fluoridation[2,3].

Although the federal law was established in 1974, its effects were gradually expanding, and the measure took place slowly, with several regional differences, depriving municipalities in the interior of the country of this benefit[4]. The Federal Government started to promote financial resources, placing Brazil among the countries that invest in fluoridation of public water supplies as a public health measure[20].

After the 1974 Law, programs were established to encourage fluoridated drinking water to a larger population. The first measure, conducted by the FSESP, was carried out by the MS in partnership with the National Institute of Food and Nutrition in 1975. After a decade, the Social Investment Fund (Finsocial), through the National Housing Bank, released resources for water treatment companies to add fluoride to the water[21].

Several professional entities in the dental field defended the fluoridation of public water supplies in Brazil, and it was recommended by the I, II, and III National Conference on Oral Health in 1986, 1993, and 1994, respectively[14].

Water fluoridation is the guiding principle of the National Oral Health Policy, called "Brasil Sorridente", and has been encouraging the implementation of fluoridation in municipalities with water treatment. From 2003 to 2007, 206 new systems were implemented in eight Brazilian states, covering 2.4 million people[3,22].

Several entities in the health area have advocated that the fluoridation of water supplies has a preventive, efficient, and safe character in the control of caries and that this measure must be implemented and maintained[23]. On the other hand, discontinuing the method leads to loss of benefits and may increase the prevalence of caries[3].

According to epidemiological surveys on oral health carried out in 2003 and 2010 by the Ministry of Health, there was a decrease in the values of the DMFT index in capitals that adopted water fluoridation compared to capitals that did not carry out or discontinued it, culminating in an increase in the index of 12.8% in the 12-year-old population[24].

According to the 2010 epidemiological survey on oral health (SB Brasil 2010), the North (3.16), Midwest (2.63), and Northeast (2.63) Regions had the highest rates of dental caries in 12-year-old teenagers. In many cities from those regions, the absence of fluoridation increased the population's experience of caries[25].

SURVEILLANCE OF FLUORIDE LEVELS IN WATER SUPPLIES

With the growth of water fluoridation in the world, especially in Brazil, the surveillance of fluoride levels in drinking water becomes of the essence due to its social aspects of great interest to public health. The inexistence or inefficiency of fluoride monitoring in water can lead to an increased risk of fluorosis, in cases of excessive levels, or the impairment of the benefits of fluoride in preventing dental caries due to less-than-ideal levels[26].

Although there has been a considerable change in the epidemiological picture for dental caries in Brazil, data confirm that there is an improvement in oral health in places where the water is fluoridated and regularly monitored, requiring an optimal concentration of fluoride, which can vary from 0.7 to 1.0 ppm, depending on the average temperature. Regions with lower temperatures should have higher fluoride levels, while regions with higher temperatures should have lower levels[27].

Since 1975, with Ordinance nº. 635/BSB, water fluoridation started to be regulated by norms and standards that aimed to determine the ideal concentration for each region, even recommending the ideal chemical compound for the implementation of fluoridation. However, the standards have changed over time and, currently, the GM/MS Ordinance nº. 2.914, of December 12, 2011, is in force, which determines the fluoride concentration values, following the Ordinance nº. 635/1975, which defines that the ion concentration cannot exceed the maximum allowed value (MAV) of 1.5 mg/L[28].

In 2000, the MS implemented the National Environmental Health Surveillance Program related to the quality of drinking water (VIGIAGUA), responsible, since then, for the surveillance of water quality in Brazil. The monitoring of fluoride levels in public water supplies is an integral part of the Program, monitoring fluoride levels to comply with current standards and regulations. As a result, to ensure the information on water quality, a Drinking Water Quality Surveillance Information System (SISAGUA) was created[27].

SISAGUA is an information system that records data related to water quality. In this system, there are fields where it is possible to record the fluoride levels based on the analysis of public water supplies collected in municipalities with fluoridation. Thus, this system has an essential role in health, as, through the analysis of these data, it is possible to promote actions to control health problems for public health[22].

Surveillance of fluoride levels in water supplies is a vital strategy that aims to analyze cases of excessive or inadequate concentrations of fluoride, which can damage to the population that consumes it. The company that operates the production, treatment, and distribution of water supplies must monitor the fluoride levels by analyzing water samples periodically. However, it is crucial to carry out the heterocontrol by those who do not belong to the responsible company and compare the data to verify the effectiveness of water fluoridation[28].

In the Pará State, in 1987, the State Group for the Control of Fluoridation of Pará (GECOF) was created to monitor and evaluate the norms and standards established for the fluoridation of public water supplies

in the State. The group was composed of representatives of the dental professional bodies (Brazilian Association of Dentistry – Pará Section, Regional Council of Dentistry of Pará, Pará Dentistry Union), UFPA, Centro Universitário do Estado do Pará, Pará State Secretariat of Health (Division of Oral Health and Health Surveillance), Municipal Secretariat of Health of Belém, Municipal Secretariat of Health of Ananindeua, National Health Foundation, Paraense Academy of Dentistry, COSANPA, Water Supply and Sanitary Sewage Service (SAAEB), Army, Navy, and Air Force. GECOF exercised the heterocontrol over the fluoridation of water supplies in Pará effectively until 2009, when it stopped holding monthly meetings.

WATER FLUORIDATION IN BELÉM: CURRENT PANORAMA

The fluoridation of public water supplies is an essential health promotion measure that implies a decline in the prevalence of dental caries. In Brazil, this measure is supported by law and norms, being mandatory in cities with a water treatment plant (WTP).

The city of Belém, capital of Pará State, is divided into 71 neighborhoods, distributed in eight administrative districts. According to Belém city hall, the districts comprise neighborhoods with similar characteristics, and they are divided into the Administrative District of Belém (DABEL), Administrative District of Guamá (DAGUA), Administrative District of Sacramenta (DASAC), Administrative District of Entroncamento (DAENT), Administrative District of Benguí (DABEN), Administrative District of Icoaraci (DAICO), Administrative District of Outeiro (DAOUT), and Administrative District of Mosqueiro (DAMOS)[29]. The municipality has 1,499,641 of inhabitants and occupies approximately 1,059,466 km^2, according to estimated data from the Brazilian Institute of Geography and Statistics (IBGE) for 2020[30].

COSANPA is the concessionaire that manages and operates the production, treatment, and distribution of water to serve the population. The water distributed by the supply network is collected from the Água Preta and Bolonha lakes, located in an environmental protection area. Currently, around 90% of the Metropolitan Region of Belém is covered by water from the Concessionaire[31].

The water fluoridation in Belém began in 1985, under the responsibility of COSANPA. The first WTP to start the fluoridation process were WTP São Braz, WTP 5º Setor, and WTP Bolonha. After 11 years of implementation, in 1996, the percentage of the population covered by fluoridated water corresponded to 82%[13].

In 2003, a survey was carried out to assess the concentration of fluoride in public water supplies with samples collected in ten randomly chosen neighborhoods in Belém: Marambaia, Telégrafo, Nazaré, São Braz, Canudos, Guamá, Benguí, Val-de-Cans, Souza, and Pedreira. The Benguí neighborhood was selected as a control, as it was not covered by fluoridation at the time. After the sample analysis performed at the Geochemistry Laboratory of UFPA, it was found that 78% of the samples had an unacceptable average fluoride level, with an acceptability parameter of 0.6 to 0.8 ppm, with the ideal concentration being 0.7 ppm for the Belém region. Only 22% of the samples from two neighborhoods (Nazaré and Souza), had acceptable fluoride levels, with concentrations of 0.62 and 0.74 ppm[32].

Through GECOF, SESPA carried out, in 2005 and 2006, analyzes of fluoride levels in public water supplies in several locations in Belém and Mosqueiro district for the heterocontrol of water fluoridation. The chosen locations were preferably public (community schools and taps) to facilitate collection. The data obtained after analysis (Table 1) allowed to identify that the samples had inadequate fluoride ion concentrations, according to the determination of Ordinance GM/MS nº. 635/1975, which establishes fluoride concentration ranges according to temperature to reach the minimum acceptable levels for the prevention of caries[33].

In 2014, the city hall of Belém prepared the Municipal Basic Sanitation Plan for Water Supply and Sanitary Sewage of Belém based on the situation of water supplies and sanitary sewage in Belém at the time. According to the document, the water supply service was provided by COSANPA, managing the water supply of most of Belém, Ananindeua, and Marituba, and by SAAEB, which administered seven regions in Belém, in addition to the districts of Mosqueiro, Outeiro, and Icoaraci. Currently, COSANPA started to operate in regions previously served by SAAEB[34].

The Surveillance of the Fluoridation of Public Water Supplies was carried out by the Collaborating Center for Oral Health Surveillance of the Brazilian Ministry of Health, of the Faculty of Public Health, São Paulo University, from 2010 to 2015, to verify the coverage and surveillance of fluoridation of public water supplies in Brazil. According to the research, 60% of Belém was covered by water treatment; however, no fluoride levels were found in the water available to the population. In Pará, only the cities Cametá, Dom Eliseu, Oriximiná, and Paragominas had any fluoride level[16].

The fluoridation of public water supplies in Belém has not been done since 2010, although this measure was implemented in the 1980s by COSANPA[35]. It is known that the interruption of such measure can lead to polarization of caries and, in places where the population does not benefit from fluoridated water, the DMFT index tends to be higher[24].

By analyzing the context of Belém in the first decade of the 21st century, more specifically between 2003 and 2010, it is possible to notice the lack of monitoring of the concentration of fluoride in drinking water. The results of the analyzes carried out during this period showed that the surveillance of adequate fluoride levels in the water supplied to the municipality was inadequate, resulting in most samples being at levels below those recommended by the MS. Also, Narvai et al.[24] emphasized an increase in the DMFT index in the same period.

Table 1 – Fluoride levels in public water supplies of locations from Belém from 2005 and 2006

Sample site	Year	Fluoride level (mg/L)	Evaluation
Paes de Carvalho School	2005	0,2	Inadequate
Faculdade Pan Amazônica	2005	0,2	Inadequate
E.E.E.F.M. Tiradentes II	2005	0,1	Inadequate
Ideal JR. School	2005	0,2	Inadequate
E.E.E.F.M. Adalberto Klautau	2006	0,3	Inadequate
Residential Complex Raimundo Jinkings	2006	0,0	Inadequate
E.E.E. M.M. Antonieta Serra Freire	2006	0,0	Inadequate
Residential Complex Angelim	2006	0,0	Inadequate
E.E.E.F.M. Honorato Figueiras	2006	0,2	Inadequate
E.E.E.F.M. Dr. Freitas	2006	0,2	Inadequate
E.E.E.F. Prof. Waldemar Ribeiro	2006	0,1	Inadequate
E.E.E.F.M. Vilhena Alves	2006	0,3	Inadequate
E.M. Benvinda de França Messias	2006	0,2	Inadequate
E.M.E.F. Prof. João Nelson Ribeiro	2006	0,2	Inadequate
E.E.E.F.M. Augusto Montenegro	2006	0,2	Inadequate
E.E.E.F.M. Jarbas Passarinho	2006	0,4	Inadequate
E.M.E.F. Prof.ª Alzira Pernambuco	2006	0,4	Inadequate
E.E.E.F.M. Maroja Neto	2006	0,4	Inadequate
E.E.E.F.M. Justo Chermont	2006	0,3	Inadequate
E.E.E.F. Graziela Ribeiro	2006	0,4	Inadequate
E.E.E. Prof.ª Rosalina Alves	2006	0,3	Inadequate

Source: SESPA, 2005–2006.

A study conducted with adolescents in Belém, from 2012 to 2014, concluded that the prevalence of dental caries was high[36], above the national and regional averages, as verified in the last national oral health survey carried out in 2010. In this research, the index of decayed deciduous teeth, with indicated extraction and filled (DEF) at 5 years of age was 2.14; and the DMFT index was 2.45 at 12 years old, 4.88 for the 15 to 19 years old group, 15.87 for 35 to 44 years old, and 27.62 for 65 to 74 years old[25]. In addition, the data found indicated that the decayed was the most prevalent among the other components of the DEF index at 5 years of age (91.6%) and of the DMFT index at 12 years of age (77.1%) and between 15 and 19 years old (59.0%). In the age groups corresponding to adults and elderly, the predominant component of the index was related to missing teeth, 57.0% in adults and 92.2% in the elderly[25]. These data indicated the great need for oral health measures for the region, such as the reactivation of the water supplies' fluoridation system and better access to dental services[25,36].

Besides the lack of monitoring of the fluoride levels in drinking water and the interruption of fluoridation in Belém in 2010, the non-compliance with the federal legislation in force in the country, which establishes the mandatory nature of fluoridation where there is a WTP, stands out, and Municipal Law nº 7,530 of 1991, which regulates the assessment and control of water treated and conserved with fluoride. As a result, non-compliance with these measures is alarming, and it is an example of omission by the government and lack of social control of the population in essential aspects that affect their health.

The cost of fluoridating water supplies is low. Studies have shown that the per capita value ranged from R$ 0.08 in São Paulo[14], R$ 0.60 in Pernambuco[27], and R$ 1.43 in Sorocaba[37]. It is an investment that considerably reduces the population's dental care costs, both public and private health systems.

In early 2018, a meeting held between the national director of the Brazilian Association of Sanitary and Environmental Engineering, COSANPA, and members of the Municipal Regulatory Agency for Water and Sewage of Belém and of the Instituto Federal do Pará, dealt with the shutdown of fluoridation in Belém and the need to reactivate this measure. Despite this, the director argued that it was essential to carry out an epidemiological survey of caries experience between the period when there was fluoridation and the current one. Even though, until December 2020, Belém continued without fluoridation in public water supplies[38].

CONCLUSION

Through the data explained in this study, the water treatment company's inefficiency in controlling adequate fluoride levels was found during the first decade of the 21st century, with the stoppage of fluoridation in 2010 in Belém, remaining disabled to the present day. The caries experience indexes observed in the epidemiological surveys carried outgrew during this same time frame, reinforcing that the resumption of the fluoridation in the city, with strict control over fluoride levels, is an important means to positively change the incidence of dental caries and minimize the risk of fluorosis.

Thus, it is considered that the fluoridation of drinking water supplies is an essential strategy for promoting the health of the population since health is a right for everyone, and its institution benefits all sectors of society, especially the lower socioeconomic status.

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CONFLICTS OF INTEREST

There were no conflicts of interest in this study.

AUTHORS' CONTRIBUTION

ABTR contributed to data research and writing; MSLM, in the initial review and data research; DTE, in writing and critical review; RFFB, in critical review; HHCP, in the study design; and MVAA, in the study design, writing, and critical review.

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