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COLLECTIVE HEALTH – SALT FLUORIDATION UNDER ANALYSIS

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Abstract: Study with the objective of identifying how the fluoridation of salt for human consumption can contribute to the health of the oral cavity. This is a qualitative, exploratory, systematic literature review. The results point to the concern in the world, in relation to the disease of dental caries, from the first half of the 20th century. Several countries in Europe and Latin America add fluoride to the table salt consumed by the population, to prevent the disease. In the 1970s, Brazil opted for fluoridation of public water, showing itself to be indifferent to the geographic reality of the national territory. Another aspect that draws attention is the formal failure of some states to comply with the legislation. It is concluded that the Brazilian State faces a crisis of legitimacy caused by numerous social problems, such as poverty and unemployment, even reflecting in the area of oral health.
Keywords: Fluoridation. Salt. Oral Health.

INTRODUCTION

Water fluoridation in the domestic consumption network is a method used in many countries around the world to reduce the prevalence of dental caries, a strategy that manages to reach practically the entire population and guarantee deciduous and permanent teeth less exposed to the disease.

The ingestion of fluoridated water, the use of toothpaste added with fluoride, the ingestion of foods that use fluoridated water during processing, among other fluoride consumption options, are indicated and must be adopted so that individuals receive the amount of fluoride ionic fluoride, ensuring healthy teeth. (HILAIRIE. 2016).

The *Environental Protection Agency* (EPA) is the environmental protection agency of the United States of America (USA), the agency has evaluated studies over the years on the addition of fluoride to public drinking water consumed by the population. The agency proposes adding 4 milligrams per liter (mg/l) of fluoride to drinking water, a measure questioned in the US and banned in several European countries. The questioning is based on the harmful effects of fluoride on the human body, such as fractures in children and joint pain in adults. (SOARES, 2016).

The US has been using community water fluoridation for 75 years, with results that show safety and benefits for the entire population. Individuals' teeth have remained healthy and strong, with a 25% reduction in cavities in children and adults. The country and the health system save annually with dental treatment, using a practical, efficient and economical method such as water fluoridation. (CDC, 2020).

The *Centers for Disease Control and Prevention* (CDC) believes that most of the water consumed by the population contains some percentage of fluorine, but it is still not enough to eliminate caries. The institutions *American Dental Association American Academy of Pediatrics, US Public Health Service* e *Wordl Health Organization* confirm and encourage the fluoridation of community water. (CDC, 2020).

Fluorine is a chemical element from the halogen family, easily found in the earth's crust, soil, oceans, water and food (beans, rice, egg yolk, black tea, spinach, among others). The ideal daily estimate of fluoride intake is around 1.5 mg to 4 mg. (SOARES, 2016).

Fluorine is absorbed by the tooth enamel even before birth, being able to repair tooth enamel, with the combination of fluorine with another chemical element, phosphorus. Foods such as meat, milk and derivatives, eggs, grains, oilseeds are good sources of phosphorus. (SOARES, 2016). Interestingly, cola-based soft drinks and beers are products with a high phosphorus content. (SBN, 2021).

Researchers have been studying other ways of introducing fluoride into the population's diet, so salt has been one of these options to be enriched with fluoridation.

Salt is the generic name for a group of substances with common chemical characteristics. Of all the salts, the most important for humans is sodium chloride (NaCl) or "table salt" or "common salt", its use is universal, consumed both in domestic use in the preparation of food, as well as in the food industry. (SILVA et al., 2020).

This characteristic of universality, associated with the fact that it is ingested regularly and in small amounts, recommended by the World Health Organization (WHO) is 2.00 g of sodium/day, makes salt an ideal vehicle for inserting essential elements for the human being. human. In almost all countries salt is used to add iodine, in others it is also used to convey fluorine. (SILVA et al., 2020; REIS et al., 2021).

The fluoridation of the water supply has been the method recommended by the W.H.O., making it a worldwide public health measure. The number of scientific studies involving fluoridated salt is much smaller when compared to studies on the use of fluoridated water. Conclusive evidence has been provided by countries that adopt this method of fluoridation, identifying fluoridated salt as having a strong topical effect in the oral cavity. (DALL'ONDER, 2016; RIBEIRO, 2018).

Thus, the research question is: How can the fluoridation of salt consumed by men help their oral health?

This fact makes it difficult to assess the contribution of salt to the prevention of dental caries.

Thus, this study aims to identify how salt fluoridation for human consumption can contribute to the health of the oral cavity. This is a qualitative, exploratory study, systematic literature review.

In the qualitative approach, the researcher intends to study the phenomena and their relationships with human beings, going to the field to capture the perspectives of those involved. All data collected is important and deserves treatment to emphasize relevant points of view. (GODOY, 1995).

In exploratory research, the researcher seeks to know the study variable, its meaning and the context in which it is found. It allows, therefore, to know the variable and its meanings in the reality where it is inserted. (PIOVESAN; TEMPORINI, 1995).

A search was used in the Virtual Health Library (BVS) Odontologia and in *Google* Academic, for articles published in Portuguese, available free of charge in the databases, based on the keywords: Salt Fluoridation; Salt; Collective Health.

Other materials found that did not correspond to the inclusion criteria of the study were excluded.

DEVELOPMENT

Dental caries accompanies man since ancient and medieval times, varying its presence according to the evolution of the human species. With the use and incorporation of refined sugar into man's diet from the 19th century onwards, a veritable army of toothless young adults was formed, since there was no treatment or prevention for caries disease. (MARTHALER, 2002).

In the 20th century, change began to take place in the 1940s, with the fluoridation of public drinking water consumed by the population to prevent caries. Since the 1950s, the Pan *American Health Organization (PAHO)* has monitored the fluoridation of table salt, another action taken by many countries to prevent dental caries.

SALT FLUORIDATION IN THE WORLD

In the 1920s, Swiss gynecologist and obstetrician Dr. Hans Jacob Wespi recommends that pregnant patients use iodized salt to prevent goiter. In 1946, Dr. Hans Jacob Wespi, then Director of the Gynecology and Obstetrics Clinic at the Cantonal Hospital of Aarau in Switzerland, adds fluoride to iodized salt, at a concentration of 90 mg/kg, and distributes it to pregnant patients. The doctor believed that soluble fluoride added to table salt could be effective in preventing tooth decay. (MARTHALER, 2002; FRANCO et al., 2003).

In 1956, fluoridated salt began to be marketed in Zurich, Switzerland, expanding its sale to other Swiss cantons. (CORDEIRO et al. 2001; MARTHALER, 2013).

There was no scientific evidence at the time to prove the success of preventive actions, but doctors were absolutely sure of the benefits of iodized salt and the addition of fluoride to salt. (MARTHALER, 2013). Recognition of the importance of fluoridated salt in oral health only took place in the 1970s, with studies proving the inhibition of dental caries. (CORDEIRO *et al.* 2001).

The first industrial experiment took place in Finland in 1953, with 90 mg/kg of potassium fluoride enriched with table salt. The routine consumption of fluoridated table salt by the Finns increased from the 1970s onwards. However, from 1978 onwards, the country suspended its use, since dental caries is under control. (PAHO, 2005).

Other European countries adopt the strategy of fluoridating table salt, at a rate of 90 mg/kg, for the prevention of dental caries, importing the product from other countries. Spain (1966, 1983), France (1986), Germany (1991), Austria (1982) and Hungary (1966). In the Americas, Costa Rica (1987), Jamaica (1987), Mexico (1988), Uruguay (1991), Peru (1990), Ecuador (1998), Cuba (2004) and Colombia (1965). (MARTHALER, 2002; DITTERICH et al., 2005; PAHO, 2005).

According to Gil et al. (1989 apud Ditterich et al., 2005, p. 232), "[...] for fluoridated salt to have the same effectiveness as fluoridated water (0.8 ppm) the dosage must be 250 mgF/k". The fluoride concentration recommended by the Pan-American Organization for Oral Health in salt for human consumption is 200-250 mgF/kg.

According to Franco et al. (2003), in Colombia, the first water fluoridation program takes place in 1953 in the city of Girardot, being later adopted in the cities of Manizales, Cali and Bogotá. The high-cost program achieved coverage of only 40% of the population, which led the Colombian government to opt for the salt fluoridation method. A calculation was then made of the average daily salt intake per person in 230 families in four communities. The results evaluated, regarding salt consumption, varied between 3 and 30 grams per day per person. The authors conclude that, in order to obtain the preventive effect on dental caries, it would be necessary to add 200 mg of potassium fluoride in each kg of salt (200 ppm). (FRANCO et al., 2003).

In 1989, the Colombian Ministry of Health approved Decree 2024, ordering the addition of 180-220 mgF/kg of the product to each kilogram of salt for human consumption in the country (FRANCO *et al*., 2003).

With the decision to adopt salt for fluoridation, the need arises to permanently monitor compliance with the decree. In 1996, the government agency responsible for the Vigilance of Medications and Food (INVIMA), after researching salt samples from brands consumed in Colombia, reports that only 43.6% complied with the legislation, 51.9% were below the norm, or that is, less than 180 ppm and 4.5% above 220 ppm. In

2000, new research shows that in 34.3% of the samples there was a concentration greater than 220 ppm and 21% less than 180 ppm. (FRANCO *et al*., 2003).

In 2000, in Colombia, INVIMA and the Instituto Colombiano de Bienestar Familiar (ICBF) carried out a new study on the concentration of potassium fluoride in table salt. of product quality by producers and surveillance and control bodies, or changes in the product during the marketing chain. (FRANCO et al., 2003).

In a study carried out in Mexico, 15 commercial brands of salt were evaluated, in 75 samples checked for the average concentration of potassium fluoride in table salt. The results point to an average value added between 266 ± 67 ppmF, ranging from 55-355 ppmF in most of the analyzed brands. (DITTERICH *et al.*, *200*5).

France, Germany and Switzerland use domestic salt with the addition of potassium fluoride at 250 mgF/kg. Hungary demonstrates, through comparative studies, a variation in the presence of the product in table salt around 350 mgF/kg and 250 mgF/kg. Studies carried out in Hungary point out that the concentration of 350 mgF/kg has shown better results in the prevention of dental caries. (MACPHERSON; STEPHEN, 2001). Since 1987, Jamaica has added 250 mgF/k to salt for human consumption. (JONES *et al.*, 2005).

The researchers Splieth and Flessa (2008), from the Department of Prevention and Pediatric Dentistry at the University of Greifswald in Germany, in a comparative study analyzing the effectiveness and cost between the different methods of fluoridation employed in the country, found that the use of fluoridated toothpastes reduces tooth decay by 20% at a cost of US$2.99 per *capita*/year. As for the use of fluoridated salt in Germany, Splieth and Flessa (2008) concluded a 50% reduction in dental caries at a cost of US$ 0.01 per *capita*/year. When combined, the two methods resulted in a 60% reduction in the caries index, at a price of US$ 3.00 per *capita*/ year.

The fluoridation of drinking water or salt, as analyzed by Splieth and Flessa (2008), proves the effectiveness of action in oral public health, within a social policy that aims to promote people's well-being. Efficacy has been observed for decades in several countries, through follow-up and scientific studies that corroborate this result.

The W.H.O. recommends the consumption of a maximum of 5g (a level teaspoon) of salt per person per day, equivalent to 2g of sodium. (PAHO, 2021). European countries are able to add a higher concentration of fluoride to table salt without causing serious problems related to toxicity. In general, Europeans consume less salt than Latin Americans. For example, in Costa Rica the daily consumption of salt per person is 10 grams, the same daily consumption value as in other Latin countries. (DITTERICH et al., 2005).

For Adam et al. (2005), the fluoridation of table salt implemented in France in 1980, continues to be presented as the main action within the French dental health program. Upon completing 10 years of the program, a survey carried out in 1991 evaluated the oral health of French children aged 6 years. The results show a significant increase (from 61.1% to 77.8%) in the number of children in the age group **no tooth decay experience.** France has been investing in other measures such as education, dental health, increased use of fluoridated toothpastes, use of fluoridated salt and actions to improve the level of oral hygiene of the population.

In the light of Marthaler's lecture (2002), studies carried out in Colombia and Hungary conclude that in children the cariostatic

effect of fluoridated salt, when adopted appropriately, is equivalent to fluoridated water. In Jamaica, DMF index results in 12-year-olds after the adoption of table salt fluoridation dropped from 6.7 in 1984 to 1.1 in 1995, and in 15-year-olds from 9.6 to 3.0, over the same period. In Costa Rica, there was a reduction in the DMFT index in 12-year-old children from 8.4 in 1988 to 4.9 in 1992. In Mexico, the index found was **4.39** in 1988, to 2.47 in 1997, corresponding to a reduction of 44%.

The addition of potassium fluoride to table salt presents excellent results for the elimination of dental caries, producing a migration of dentists to cosmetic dentistry.

However, dental caries remains a problem in lower socioeconomic strata in developing countries, including rich countries. The situation requires a new positioning of dental care in all countries, as caries is a socially unfair disease. (MARTHALER, 2002; ADAM *et al.*, 2005).

SALT FLUORIDATION IN BRAZIL

In Brazil, the standards and documents that serve as a reference for salt intended for human consumption are mainly Decree No. 75,697, of May 6, 1975, which establishes the identity and quality standards for the product. (BRASIL, 1975). RDC Resolution No. 130, of May 26, 2003, establishes the iodine content in salt. (ANVISA, 2003).

The documents refer to aspects of salt for human consumption and the addition of iodine, without any reference to salt fluoridation in the country. The need to control the industrial production of salt for human consumption, when adding a chemical agent such as iodine and/or fluorine, is necessary to prevent irregularities in the dosage of these elements.

In Brazil, the addition of potassium iodate to salt began in the 1950s, as a preventive action against diseases resulting from iodine deficiency. In 2013, the National Health Surveillance Agency (ANVISA) stipulated the amount of the product at 15 and 45 milligrams added per kilogram of salt. (BRASIL, 2013).

Iodine regulates human growth and development. Insufficient micronutrients in the body can lead to the appearance of a disease called "goiter", causing fatigue and apathy in adult human beings, and in children, problems related to growth and reduced ability to concentrate and learn. (SILVA; MELCHERT, 2019).

In Brazil, the body responsible for controlling the dosage of iodine in salt for human consumption is the Institute of Metrology, Standardization and Industrial Quality (INMETRO).

In 1958, the World Health Organization (WHO) recognized water fluoridation as an important public health strategy for caries prevention. The organization encourages member countries to promote the strategy in their territories, based on a promotion program created in 1975. (ROSSI *et al.,* 2020).

In 1974, the Brazilian federal government sanctioned Law No. 6,050/74, which regulated Decree Number 76,872/75, releasing funds and credits for states to implement water fluoridation in public supply systems. (ROSSI et al., 2020).

In 1977, the Public Health Special Service Foundation (FSESP) began conducting research on table salt fluoridation in Brazil. The researchers had the prospect of reaching the entire population with fluoridated salt, eradicating tooth decay in all social strata of the population. The institution had the support of the federal government, salineiras and sanitarians involved with oral health. (CORDEIRO et al. 2001).

The study's conclusions were promising, pointing to the effectiveness of fluoride

use and absorption by the human body, when offered both in drinking water and in table salt. However, it justified that the use of fluoridated salt must be used in regions where there is a lack of access to public drinking water and with permanent technical control. The formula for offering fluoride in Brazil continues to be the one traditionally used for decades, the fluoridation of public water, delivery of fluoride toothpaste to schoolchildren and fluoridated mouthwash in schools – used to reach children in rural areas and areas without treated water. (CORDEIRO et al. 2001).

Members of the Brazilian academic class, such as professors and researchers from federal universities supported the fluoridation of table salt. In 1989, the W. K. Kellog Foundation supports the creation of the Cedros Foundation, among its goals, the foundation established seven working groups, among them: salt fluoridation; water fluoridation and oral health in Local Health Systems (SILOS). (CHIANCA, 1992; ROSSI, 2018).

The fluoridation of table salt was discussed in the Brazilian media in the 1990s, the proposal presented was the fluoridation of table salt for the prevention of dental caries in regions of Brazil where there are no public water treatment plants. (ROSSI, 2018).

In 1990, the Minister of Health Alceni Guerra signed Ordinance No. 1,437, of December 14, 1990, creating the "National Program for the Control of Dental Caries". In 1991, through Ordinance No. 1, of February 6, 1991, signed by the president of the National Institute of Food and Nutrition (INAN) Marcos de Carvalho Candau and by the director of the National Division of Oral Health (DNSB) Sérgio de Carvalho Weyne the General Coordination of the National Dental Caries Control Program was created, which supported the method of adding potassium fluoride to table salt. (ROSSI, 2018).

In 1992, the salt company Perynas even developed the refined fluorinated and iodized salt Biosal and the refined fluorinated salt extra iodized MOC. Residents of the municipality of Cabo Frio, in the state of Rio de Janeiro, were the first to consume the fluoridated salt produced by the Perynas salt pan. (ROSSI, 2018).

In 1993, the kitchen salt fluoridation program was suspended, generating explanations to the Ministry of Health about the measure taken. Between 1994 and 1997, several projects were taken to the National Congress trying to make the fluoridation of table salt mandatory, however all the documents were archived. (ROSSI *et al.*, 2020).

The "definitive" suspension of fluoridated table salt in Brazil was supported by sanitarians and entities such as the Brazilian Movement for Dental Renovation (MBRO), participants in the National Meeting of Administrators and Technicians of the Public Dental Service (ENATESPO) and members of the Brazilian Association of Health Promotion Dentistry (ABOPREV), as well as dentists opposed to any method of fluoridation. (ROSSI et al., 2020).

In the year 2000, the anti-fluoride movement manages to send legislative articles requesting the suspension of fluoridation of any and all products for human consumption (water, toothpaste, among others) in the national territory. The Federal Council of Dentistry (CFO) manages to position itself strongly against this action, strengthening Brazilian oral public health and praising the role of fluoridation in the prevention of dental caries. (ROSSI et al., 2020).

The search **Coverage and Surveillance of Fluoridation of Public Water Supply in Brazil, 2010-2015**, or **Vigifluor Project,**

presented, in 2017, the results for the period regarding water fluoridation in municipalities with more than 50 thousand inhabitants located in the twenty-seven states of the Federation. The information obtained in the study presents an overview of inequalities and the degree of inequities in compliance with the Federal Law for the fluoridation of public drinking water. (NARVAI; FRAZÃO, 2017).

Approximately, 96.5 (68.3%) million people, residing in municipalities with more than 50,000 people, have access to fluoridated drinking water. The South Region has the best coverage with 88.7% and the North Region has the lowest coverage with 25.3%. (NARVAI; FRAZÃO, 2017).

When analyzing the coverage by state and ends of the national territory, the states of Paraíba (east), Acre (west) and Amapá (north) do not add fluoride to public water, violating federal legislation on the subject. The state of Rio Grande do Sul serves 89% of its population, benefiting and offering fluoridated drinking water practically in almost every state. (NARVAI; FRAZÃO, 2017).

Surveillance of the quality of water with fluoride for human consumption was also evaluated, the results point to the South and Southeast regions with the best quality surveillance services and the worst surveillance services in the other regions. (NARVAI; FRAZÃO, 2017).

The researchers suggest a second stage of the study, to evaluate the fluoridation of public water distributed in municipalities with less than 50,000 inhabitants.

The studies by Jones et al. (2005); Splieth and Flessa (2008), prove that the fluoridation of community water or the addition of fluorides to table salt, indicate similar results regarding the effectiveness of the action in the prevention of dental caries. The researchers point out the need for an adequate concentration of fluoride, which prevents hypofluoridation or hyperfluoridation in water and/or salt. The choice of method will depend on the best cost-benefit ratio for the population, but they indicate an insignificant cost and a high population contingent reached by the fluoridation of table salt.

From a safety point of view, both methods, when used at the recommended concentrations, pose no health risks.

FINAL CONSIDERATIONS

The use of potassium fluoride in the prevention of dental caries has been studied and used since the middle of the 20th century. Informally, the physician H. J. Wespi provided the pregnant women he assisted in his office with salt enriched with iodine and fluorine to be added to food, seeking to prevent goiter and dental caries.

In 1958, the World Health Organization (W.H.O.) recognized fluoridation as a strategy for preventing caries. Many countries in Europe and Latin America use the addition of fluoride to salt, achieving excellent results in preventing caries.

In the 1970s, Brazil established legislation to enrich public drinking water with fluoride. Several attempts have been made to definitively implement an official salt fluoridation program, but decades ago the country opted for public water fluoridation.

The results of the Vigifluor study carried out between 2010-2015 and published in 2017 highlighted the inequalities in the population's access to public fluoridated water.

A state of exclusion from access to basic social rights, such as employment, decent wage income, housing, health, adequate education, basic sanitation, has repercussions on the population in a poor quality of life. Thus, poor quality of life produces a totally negative result on oral health. Poor oral

health, therefore, represents a clear sign of a precarious living condition, as well as the social exclusion.

The results of our study point to the need for planning an operational plan to strengthen prevention in oral health, with the use of quality public fluoridated drinking water to be offered to the population, investigation of the source of fluorides offered by the public authorities in the municipalities with less than 50,000 inhabitants and the proposition of other forms of offering fluoride to vulnerable populations in relation to oral health.

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