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Situational diagnosis of policies in Latin American and Caribbean countries for the use of fluoride and reduction of sugar consumption

Abstract: Policy evaluation and guidance on fluoride use and sugar consumption in Latin American and Caribbean countries (LACC) may provide a scientific evidence basis for policymakers, dental professionals, civil society organizations and individuals committed to improving public oral health. A cross-sectional study was conducted to evaluate the extent of implementation of policies/guidelines on fluoride use, and sugar consumption in LACC. The study had two stages. First a questionnaire covering four major areas was developed: fluoridation of public water supplies; salt fluoridation; fluoride dentifrices, and sugar consumption. Then, the questionnaire was applied to collect data among representative participants in public oral health from LACC. Ninety-six participants from 18 LACC answered the questionnaire. One-hundred seventy documents were attached, and 285 links of websites were provided by the respondents. Implementation of policies and guidelines on water and table salt fluoridation and processed and ultra-processed food consumption were found in most countries, with some issues in the consensus and coverage. Thus, differences were identified in the extent of implementation of public oral health strategies on sugar consumption and fluoridation among the countries. There is no consensus on the policies in LACC to reduce sugar consumption and for the use of fluoride. A few policies and guidelines were applied in isolated countries, with a variety of strategies and standards. For future actions, it will be important to encourage the development of strategies and public policies within countries, and to evaluate the effectiveness of existing policies in reducing dental caries and in improving oral health in LACC.

Keywords: Dental Caries; Caribbean Region; Latin America; Sugar; Fluorides.

Introduction

Managing and controlling dental caries continues to be a challenge for Latin American and Caribbean countries (LACC), with a high prevalence of the disease.^{1,2} The oral health challenges in these countries are reflections of persistent inequality, poverty, high levels of corruption,



and overburdened public healthcare systems.³ Moreover, the sugar industry represents a significant amount of the LACC economy, with sugar produced in LACC accounting for approximately 40% of the global sugar output.⁴

Individual and context-driven health strategies such as controlled sugar consumption and regular contact with fluoride effectively prevent dental caries across all ages.⁵ Controlling sugar consumption may be achieved by reducing the amount of sugar in products or by reducing of the frequency of consumption of sugar-containing products.⁵ Although policies on fluoride use were adopted in some LACC, others show limited strategies targeting increased accessibility and affordability of fluoride use.⁶ Public health policies used to reduce the prevalence of dental caries in LACC must tackle the historical and cultural aspects of the disease burden in addition to its social determinants, avoiding discontinuity of the strategy across time.³

Furthermore exploration of the extent of implementing policies and guidelines on fluoride use and sugar consumption in LACC may provide a deeper understanding of how oral health has been faced in these countries, and may provide important information for the next steps.⁶ Therefore, the aim of the present study was to carry out a situational diagnosis of policies in LACC to reduce sugar consumption and to guide the use of fluorides.

Methodology

Study design

A cross-sectional study was conducted with the aim of evaluating policies and guidelines on the use of fluoride, sugar consumption and health surveillance in LACC. The study was divided into two major stages. The first part involved the development of a questionnaire that addressed the key points for data collection. In the second part, the questionnaire developed was applied among the representatives/managers in each LACC, including health professionals (*e.g.*, dentists, physicians, nutritionists etc.), government representatives, researchers, university professors and others. This study received approval from the Human

Research Ethics Committee (certificate number: 58623922.2.0000.5149) from Universidade Federal de Minas Gerais and was conducted in accordance with the Declaration of Helsinki.

Questionnaire development

A pragmatic questionnaire was developed to assess policies and guidelines on fluoride use, sugar consumption and health surveillance in LACC. Three dentists with experience in Pediatric Dentistry and Public Health analyzed the theoretical framework based on official LACC documents and literature reviews regarding the proposed objectives. The questionnaire covered four major areas: public water supplies fluoridation; salt fluoridation; fluoride dentifrices, and sugar consumption. The questionnaire was comprised of open-ended and multiple-choice items. Furthermore, the participants were invited to attach documents and links referring to policies and guidelines. Eventual disagreements about an item were solved by discussion and consensus between dental surgeons and the board of the Latin American Oral Health Association Cariology Group (LAOHA). After the development of the first version, a board of eleven members of the LAOHA, from six countries, reviewed the instrument. The consensus had a Content Validity Index (CVI) higher than 0.80.

Data collection

After this step, the questionnaire was applied online using the Google Forms platform (Google Inc., Menlo Park, United States of America). The questionnaire was presented and shared in events sponsored by LAOHA. Additionally, individual e-mails were sent to key representative persons in public oral health from LACC suggested by LAOHA members. Secondary documents submitted by participants had to encompass policies and guidelines for sugar consumption and fluoride use in LACC. The documents were in the public domain given the purpose. Data organization and descriptive analysis were performed using the Statistical Package for Social Sciences software (IBM SPSS Statistics for Windows, version 22.0, Armonk, IBM Corp.). Since all variables analyzed were categorical, relative frequencies (percentages) were reported.

Results

A total of 96 participants from 18 countries from LACC answered the questionnaire (Figure 1). The majority of the participants were female (64,6%) from Higher Education Institutions (84,4%). A total of 170 documents were attached to the forms and 285 links were provided (Table 1).

The results about the extent of implementing policies and guidelines on fluoride use in LACC are presented on Table 2. According to participants,

less than one-quarter of the population had access to fluoridated water (38,5%) and 55,2% reported that there were no policies that regulated water fluoridation for public supply. The majority of participants (57,3%) reported that there was a public policy that regulated table salt fluoridation, and 61,5% reported that non-fluoridated table salt could be found on the market. Most countries had guidelines/ recommendations for the fluoride concentration in toothpaste (79,2%), usually developed by the Ministry of Health (88,9%). However, only 66,3% of the participants reported



Figure 1. Countries in Latin America and the Caribbean that responded to the survey are colored on the map.

Table 1. Description of respondents' information.

Respondents' information	Frequency (%)
Country	
Argentina	07 (07.3)
Bolivia	02 (02.1)
Brazil	16 (16.7)
Chile	05 (05.2)
Colombia	27 (28.1)
Costa Rica	03 (03.1)
Ecuador	03 (03.1)
El Salvador	01 (01.0)
Guatemala	02 (02.1)
Mexico	10 (10.4)
Nicaragua	01 (01.0)
Panama	01 (01.0)
Paraguay	02 (02.1)
Peru	06 (06.3)
Puerto Rico	01 (01.0)
Dominican Republic	02 (02.1)
Uruguay	04 (04.2)
Venezuela	03 (03.1)
Respondent's sex	
Male	34 (35.4)
Female	62 (64.6)
Type of institution where the respondent works*	
Public institutions (ministries, state or municipal departments; regulatory agencies)	17 (17.7)
Professional associations	17 (17.7)
Scientific or technical associations	06 (06.3)
Higher education institutions (universities, colleges, etc.)	81 (84.4)
Other institutions	05 (05.2)
Attachments	
Documents	170 (37.4)
Links	285 (62.6)

* Respondents could work in more than one type of institution.

that there were guidelines that differentiated the recommendations on fluoride concentrations by age group. Differently from the access to water fluoridated, there was broader access to fluoridated toothpaste (62.5%) according to the participants.

Interventions to regulate sugar consumption on LACC based on participants' reports are presented in Table 3. The majority of participants reported

that there were some public policies that regulated the sale of processed and ultra-processed foods (64.6%), sometimes supported by guidelines (46.9%). Although the participants reported a low level of knowledge about the per capita consumption of sugar among the countries (76.0%), they mentioned that there were policies/ guidelines that reinforced the non-introduction of sugar into the diet of children

Table 2. Policies and guidelines on fluoride use in LACC based on respondents' knowledge.

Fluoride variables	Frequency (%)
The country has public policies that regulate water fluoridation for public supply	
Yes	41 (42.7)
No	53 (55.2)
Sphere of government that developed water fluoridation policy	
Federal	34 (85.0)
State	01 (02.5)
Municipal	00 (00.0)
Federal and Municipal	02 (05.0)
Federal, State, and Municipal	03 (07.5)
Percentage of the population with access to fluoridated water	
Less than 25%	37 (38.5)
Between 25% and 50%	08 (08.3)
More than 50%	24 (25.0)
Does not know	27 (28.1)
The country has an epidemiological surveillance policy to control water fluoridation for public supply	
Yes	40 (41.6)
No	42 (43.8)
Does not know	14 (14.6)
The country has a public policy that regulates table salt fluoridation	
Yes	55 (57.3)
No	33 (34.4)
Does not know	08 (08.3)
Sphere of government in which table salt fluoridation policy was developed	
Federal	53 (84.1)
State	00 (00.0)
Municipal	00 (00.0)
Does not know	10 (15.9)
Non-fluoridated table salt can be found at the market	
Yes	59 (61.5)
No	18 (18.7)
Does not know	19 (19.8)
The country has an epidemiological surveillance policy to control table salt fluoridation	
Yes	40 (41.7)
No	33 (34.4)
Does not know	23 (24.0)
The country has regulations for the concentration of fluoride in toothpaste	
Yes	58 (60.4)
No	28 (29.2)
Does not know	10 (10.4)

Continue

Continuation	
Organization that established public policies for the concentration of fluoride in toothpaste	
Health ministry or another ministry	56 (88.9)
State health surveillance agencies	06 (09.5)
Municipal secretary	01 (01.6)
The country has guidelines/ recommendations for the concentration of fluoride in toothpaste	
Yes	76 (79.2)
No	13 (13.5)
Does not know	07 (07.3)
Organization that developed guidelines/recommendations for the concentration of fluoride in toothpaste	
Health ministry	25 (53.2)
Professional associations	02 (04.2)
Scientific or technical associations	06 (12.8)
Higher education institutions (universities, colleges, etc.)	07 (14.9)
Other institutions	07 (14.9)
The guidelines differentiate recommendations for fluoride concentration in toothpaste by age group	
Yes	55 (66.3)
No	18 (21.7)
Does not know	10 (12.0)
The guidelines/recommendations mention the amount of toothpaste that children should use	
Yes	67 (80.7)
No	09 (10.8)
Does not know	07 (08.4)
Percentage of the population with access to fluoride toothpaste	
Less than 25%	00 (00.0)
Between 25% and 50%	15 (15.6)
More than 50%	60 (62.5)

under two years of age (52.1%), to prevent and control childhood obesity (66.7%), eating disorders (52.1%), dental caries (55.2%), diabetes (62.5%), and cardiovascular disease (45.8%), all focusing on controlling sugar consumption.

Based on the information extracted from the documents and links provided by participants from the 18 countries (Table 4), 55,6% of LACC had access to community fluoride either by water fluoridation (16,7%) and/or table salt fluoridation (38,9%). The concentration of fluoride varied across countries (Figure 2). The majority of countries had regulations/ guidelines differentiating the amount/ concentration of fluoride by age group (61,1%) and had public policies that regulated the sale of processed

and ultra-processed foods (61,1%). Labelling law providing information about excessive amounts of sodium, sugar and fats was the most prevalent policy across LACC (Figure 3).

Discussion

Dental caries is one of the most prevalent conditions among all diseases worldwide, affecting individuals of all ages.⁷ In most LACC, over half of the child population experience dental caries, and over 85% of adults are affected.³

Sugar consumption is a modulator factor for dental caries, exhibiting a dose-effect relationship.^{8,9} Therefore, its consumption should be limited and

Table 3. Policies and guidelines on sugar consumption in LACC based on respondents' knowledge.

Sugar consumption variables	Frequency (%)
The country has public policies that regulate the sale of processed and ultra-processed foods	
Yes	62 (64.6)
No	20 (20.8)
Does not know	14 (14.6)
The country has guidelines to control the sale of processed and ultra-processed foods	
Yes	45 (46.9)
No	28 (29.1)
Does not know	23 (24.0)
Knows the consumption of sugar in the country	
Yes	23 (24.0)
No	73 (76.0)
The country has policies/ guidelines to reinforce the non-introduction of sugar into the diet of children under two years of age	
Yes	50 (52.1)
No	28 (29.2)
Does not know	18 (18.8)
The country has policies/ guidelines to prevent and control childhood obesity	
Yes	64 (66.7)
No	14 (14.6)
Does not know	18 (18.7)
The country has policies/ guidelines to prevent and control eating disorders	
Yes	50 (52.1)
No	15 (15.6)
Does not know	31 (32.3)
The country has policies/ guidelines to prevent and control dental caries focusing on controlling sugar consumption	
Yes	53 (55.2)
No	33 (34.4)
Does not know	10 (10.4)
The country has policies/ guidelines to prevent and control diabetes focusing on controlling sugar consumption	
Yes	60 (62.5)
No	13 (13.5)
Does not know	23 (24.0)
The country has policies/ guidelines to prevent and control cardiovascular disease focusing on controlling sugar consumption	
Yes	44 (45.8)
No	16 (16.7)
Does not know	36 (37.5)
Organization that established public policies/ guidelines for the control of sugar consumption	
Public institutions (ministries, state or municipal departments; regulatory agencies)	11 (36.7)
Professional associations	03 (10.0)
Scientific or technical associations	01 (03.3)
Higher education institutions (universities, colleges, etc.)	01 (03.3)
Other institutions	01 (03.3)
Does not know	13 (43.4)

Table 4. Policies and guidelines on fluoride and sugar consumption based on documents and links provided by participants.

Variables	Frequency (%)
The population has some access to fluoride by means of water fluoridation and/or table salt fluoridation (based on documents provided)	
Yes	10 (55,6)
No	08 (44,4)
The country has water fluoridation for public supply (based on documents provided)	
Yes	03 (16,7)
No	15 (83,3)
The country has table salt fluoridation (based on documents provided)	
Yes	07 (38,9)
No	11 (61,1)
The country has regulations and/or guidelines regarding the concentration of fluoride in toothpaste/paste (based on documents provided)	
Yes	06 (33,3)
No	12 (66,7)
The country has guidelines/ recommendations differentiating the amount/ concentration of fluoride by age group (based on documents provided)	
Yes	11 (61,1)
No	07 (38,9)
The country has public policies that regulate the sale of processed and ultra-processed foods (based on documents provided)	
Yes	11 (61,1)
No	07 (38,9)
The country has policies/ guidelines for the prevention and control of diseases focused on sugar consumption (based on documents provided)	
Yes	09 (50,0)
No	09 (50,0)

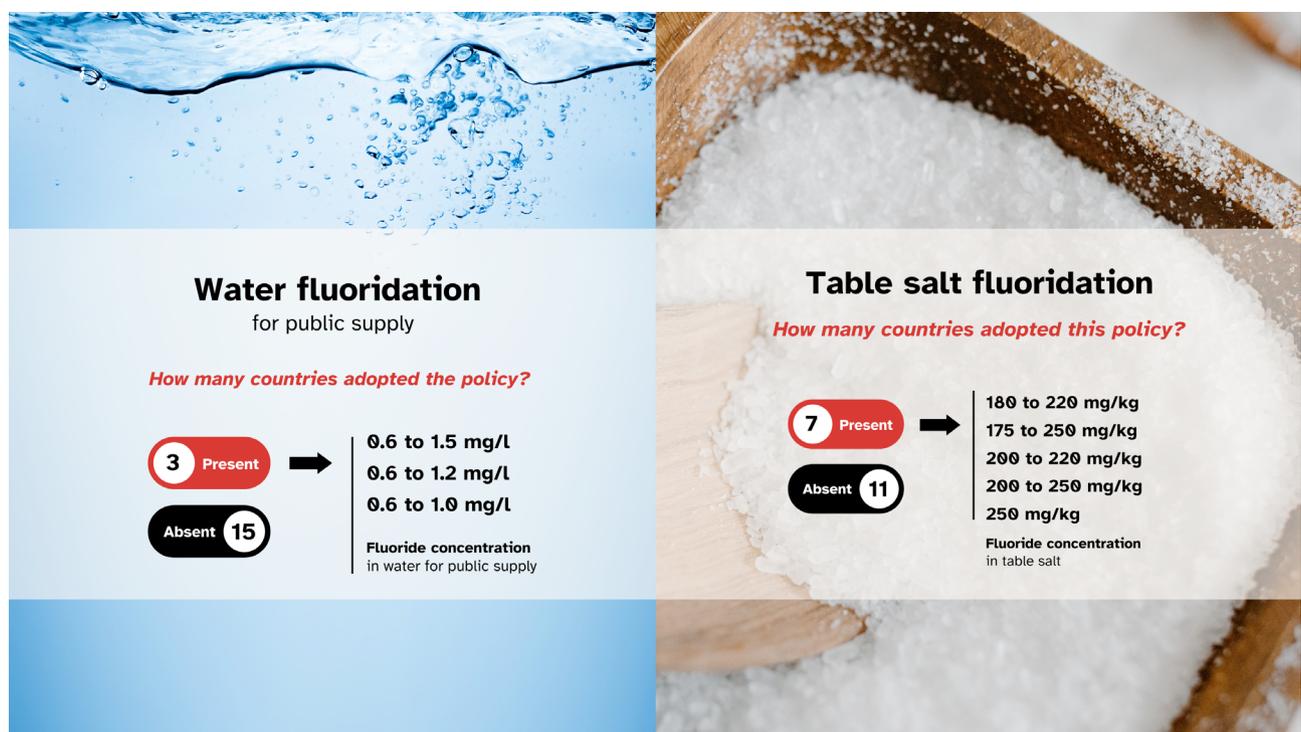


Figure 2. Concentration of fluoride in water from public supply and in table salt, based on the documents and links provided.

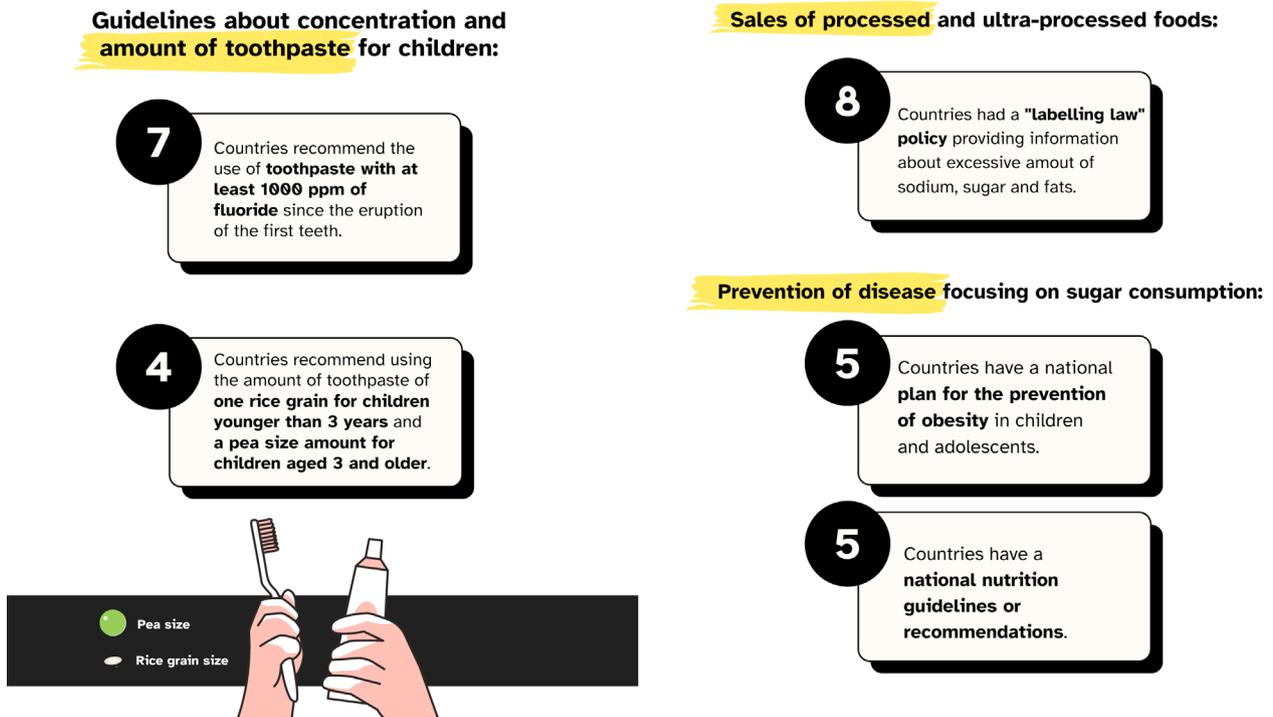


Figure 3. Frequent regulations, policies and guidelines about fluoride concentration and amount of toothpaste, sales of processed foods and prevention of diseases focused on sugar consumption of participating Latin American and Caribbean countries.

avoided. The World Health Organization (WHO) recommends that free sugar intake should not exceed 10% of daily total energy intake,⁹ which was a goal largely unmet in most LACC. Based on assessment of the current situation, many countries in Latin America and the Caribbean lacked policies or guidelines addressing this issue. Sugar intake in foods and drinks should be limited and free sugar should be avoided by children under 2 years of age, as recommended by the International Association of pediatric Dentistry.⁸ High sugar consumption during childhood leads to an increase in caries risk throughout the life course¹⁰, and higher sugar consumption over life determines a higher caries increment.¹¹ Therefore, policies focusing on reducing and avoiding sugar intake in early life as a preventive strategy should be encouraged in LACC.

Based on the documents and links provided by the participants, some policies and guidelines have been implemented to control and regulate sugar and ultra-processed food consumption in LACC. However, there was no consensus on the specific policies and

strategies, and only a few were adopted in more than one country. One common policy was the “labelling law”, which made it mandatory for the labels of processed products to include information about excessive amounts of sugar, sodium, and fats. The aim of this policy is to inform consumers about unhealthy or excessive ingredient levels, thereby educating them and encouraging healthier food choices.³ Strategies and policies that enhance knowledge, such as the inclusion of information on food labels, can have a positive impact on individuals’ health.³ Moreover, higher levels of oral health literacy were associated with a positive oral health status, including lower prevalence of dental caries and higher frequency of seeking dental treatment.¹²

The most prevalent strategies for the prevention of diseases related to sugar consumption in the participating LACC were centered around obesity prevention and nutritional guidelines. Excessive intake of free sugar can lead to various health problems, including dental caries, obesity, diabetes, and cardiovascular disease, with the latter two

being mediated by risk factors such as overweight, obesity, and others.⁹ The high cost of treating dental and chronic disease could place a significant burden on LACC, exacerbating inequalities, poverty and overloading public healthcare systems.³ Dental caries and high sugar consumption also negatively affected the nutrition of individuals. Untreated caries could result in episodes of pain, difficulty in chewing and sleeping, impacting on the quality of life and productivity.⁷ In severe cases, untreated caries with pulp inflammation could contribute to underweight in children.⁷ Additionally, excessive consumption of free sugar also threatened the nutrient quality of the diet, as sugar provides a significant source of energy without essential nutrients.⁹ Unfortunately, a detailed analysis of the content of guidelines was not possible. Nevertheless, a consensus on those strategies was encouraged, following the recommendations on sugar consumption and considering the cultural and socioeconomic aspects of LACC.

The role of fluoride in oral health has a long history, first documented in the late 1800s and recognized by dentists in the 1930s.¹³ Community water fluoridation is outstanding as a major achievement in public health, leading to the development of various strategies to deliver fluoride, such as in toothpaste, gels, tablets and table salt.^{14,15} All of these strategies have been designed to prevent dental caries at a community and individual level. Water fluoridation and table salt fluoridation are particularly significant policies in low- and middle-income countries, as they ensure access to fluoride access by the entire population, irrespective of their socioeconomic status. Unfortunately, not all countries in LACC had a community-level fluoridation policy. Those who had such programs faced challenges, such as discrepancies in the areas covered, unequal access, and a need for surveillance programs.³

A concern about the use of a community-based method to deliver fluoride is the occurrence of dental fluorosis. However, studies have shown that, at the appropriate concentration, the risk of developing dental fluorosis was outweighed by its effectiveness in preventing caries. Having access to water fluoridation decreased the experience of dental caries by 35% in the deciduous dentition and by 26% in the permanent

dentition. The concentration of 0.7 ppm of fluoride was responsible for only 12% of fluorosis cases that affected patients' esthetic appearance.¹⁴ The fluoride concentration in water and table salt varied slightly across the countries included, emphasizing the importance of vigilance policies to ensure that the population was provided with an effective amount of fluoride. According to the participants' responses, not all countries had policies focused on vigilance.

The majority of the countries included had guidelines or recommendations that differentiated the amount or fluoride concentration required for different age groups. However, no consensus was identified in the documents and links provided. The recommendation of toothpaste with a minimum of 1000 ppm of fluoride was the most common. This concentration was in accordance with the recommendations of the List of Essential Medicines from WHO,¹⁶ which included toothpastes with a concentration ranging from 1000 to 1500 ppm fluoride, acknowledging its proven effectiveness in preventing dental caries.¹⁷ To be effective for preventing dental caries, fluoride must be constantly available in the oral cavity. Hence, daily brushing with toothpaste containing the necessary minimum concentration of fluoride is essential. To avoid fluorosis, young children should use the appropriate amount of toothpaste. The literature suggests that for children under three, a smear or rice-sized amount of fluoridated toothpaste is sufficient, while children aged three to six should use no more than a pea-size amount of fluoridated toothpaste.¹⁸ Good habits established in early life can perdure throughout life course.¹³ It is important for children's teeth to be brushed twice daily with the appropriate amount of toothpaste, right from the time of eruption of the first teeth.⁸ Policies and guidelines to regulate the concentration and amount of fluoride based on age groups are important. Equally significant are policies that provide access to fluoridated toothpaste. Conducting epidemiological evaluations is encouraged for the purpose of assessing the level of access to fluoride among all LACC' populations.

The authors consider it important to emphasize that data collection was based on participants' reports and the provided documents and links. Although an

extensive search through the documents and links was performed to confirm all the information provided, it is possible that not all the policies, guidelines and strategies implemented by the countries were included. The majority of respondents worked in higher education institutions, public institutions, or professional associations, which could help mitigate this bias. Considering that some participants were unfamiliar with certain aspects of the questionnaire, it might be beneficial not only to establish new policies and guidelines, but also to highlight the importance of those that have already been established in the LACC. For future actions, it is important to have a situational diagnosis and analysis of the other countries in Latin America and the Caribbean that were not included in this research.

This paper, together with two others published in this volume, highlight the importance of a consensus when dealing with dental caries in LACC. There was no consensus on the policies in Latin America and the Caribbean to reduce sugar consumption and on the use of fluoride. A few policies and guidelines were applied in isolated countries, with a variety of strategies and standards. Unfortunately, there is a lack of knowledge relative to how effective those policies and guidelines were in reducing dental caries, due to insufficient epidemiological data in the region,³ and lack of longitudinal studies evaluating their methods of implementation and results. Some LACC had clear and established policies on the use of fluoride and sugar intake, but others did not. Understanding the impact of these policies on the population's oral health by means of epidemiological surveillance would be a means to provide support for implementing similar and effective strategies throughout all LACC.

Recommendations

Establish Consistent Policies

Encourage the establishment of clear and consistent policies across all LACC regarding fluoride use and sugar consumption. This could be achieved by a consensus encompassing guidelines on fluoride levels recommended, sugar intake and strategies to reduce free sugar consumption, in addition to related health education.

Encourage Research and Data Collection

Promote and support research initiatives in LACC focused on gathering comprehensive epidemiological data relative to oral health, sugar consumption patterns, fluoride use, and ongoing policies, recommendations and guidelines. This data should be used to refine existing policies and design new ones.

Promote Collaboration and Knowledge Sharing

Multicentric collaboration and knowledge sharing among LACC to exchange best practices, successful policy implementations, epidemiological data, and research findings. Encourage regular regional meetings or conferences to foster collaboration and shared knowledge.

Promote Public Awareness and Education

Develop captains to educate individuals about the impact of excessive sugar consumption on oral and general health and the benefits of appropriate fluoride use. Utilize media channels and community outreach to disseminate information about the importance of policies implemented. Advocate for stricter enforcement to empower consumers to make informed, healthier choices.

Tailor Age-Specific Policies

Promote policies and guidelines in all LACC to address age-specific needs, especially children. Provide clear recommendations for fluoride concentrations and emphasize the proper amount of toothpaste for different age groups.

Enhance Implementation of Existing Policies

Strengthen the implementation of ongoing policies in some countries and expand them to all LACC.

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