

Fluoridated food on preventing dental caries in Latin American and Caribbean children and adolescents: a systematic review

Abstract

Dental caries is a significant global public health challenge, particularly among children and adolescents. It affects individuals' quality of life and can lead to various adverse outcomes, including pain, infection, and impaired school performance. Fluoride has been widely recognized as a key component in oral health improvement programs due to its ability to prevent tooth demineralization and promote remineralization.

This systematic review aimed to evaluate the existing literature on the effectiveness of fluoridated food interventions in preventing dental caries in Latin American and Caribbean children and adolescents. The study focuses on this specific region, which faces unique challenges such as limited access to dental care services, socioeconomic inequalities, and cultural practices that may influence oral hygiene and dietary habits.

The review follows the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines. A comprehensive search was conducted in multiple databases, including EMBASE, MEDLINE, Scielo, and Web of Science. The search strategy utilized relevant MeSH terms and Boolean phrases related to fluoridated food interventions and dental caries in children aged 12 years and younger.

After screening the articles based on predetermined inclusion criteria, no study met the eligibility criteria for inclusion in the systematic review.

Overall, the systematic review highlights the absence of high-quality available evidence specifically focused on the effectiveness of fluoridated food interventions on children and adolescents of the Latin American and the Caribbean, underscoring the importance of conducting further studies to inform evidence-based decisions regarding public health policies, resource allocation, and oral health promotion strategies in this population.

Keywords: fluoride, dental caries, children, water fluoridation, milk fluoridation, salt fluoridation

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Background

Oral health is a cornerstone of overall well-being, significantly impacting individuals' quality of life. Dental caries pose a significant global public health challenge, particularly during childhood and adolescence.¹ The World Health Organisation reports that carious lesions affect 60% to 90% of children and adolescents aged 5 to 15 across the globe.² The latest Global Burden of Disease Study indicated that, to date, caries in primary teeth affected around 532 million children, and the prevalence of untreated caries in primary teeth stands at 7.8%.³

Caries also affect education, with children facing higher risks of poor school performance and attendance, leading to potentially traumatic experiences and societal stigmatisation.⁴ In addition to potential long-term dental benefits, good oral health in childhood is pivotal for a child's overall health and development. Analogous to other health dimensions, oral health profoundly influences social and psychological well-being.^{5,6} Its consequences encompass pain and infection, hospitalisations, emergency room visits, increased treatment costs and time, stunted physical development, sleep disturbances, and weight loss (malnutrition).^{7,8}

Fluoride constitutes the foundation of oral health improvement programs.⁹ Fluoride's physiochemical capacity to prevent enamel demineralisation and promote remineralisation largely accounts for

its cariostatic effects.¹⁰ Fluoride is the most effective strategy in caries prevention when a low level of fluoride is continuously maintained in the oral cavity.^{11,12} In this context, common delivery methods for fluoride in the oral cavity and teeth encompass individual-level approaches (e.g., tooth brushing with fluoride dentifrices and the use of mouth rinses) and clinical-level interventions (e.g., varnish) have been implemented.¹² Fluoridated food – including water, milk, and salt – has also been implemented as a community-level approach to deliver fluoride to populations, particularly in regions with high caries levels. These strategies have been widely regarded as a cost-effective and equitable public health intervention, contributing to the decline in the prevalence and severity of dental caries in many countries.^{13,14}

Latin America and the Caribbean (LACCs) encompass 33 diverse countries with 650 million inhabitants with broad socioeconomic, cultural, and healthcare contexts, which may affect the implementation and effectiveness of fluoride programs. This region faces unique challenges in oral health, including limited access to dental care services, socioeconomic inequalities, and cultural practices that may influence oral hygiene and dietary habits. The prevalence of dental caries in primary dentition remains high in most LACCs, with more than 50% of the children population affected.¹⁵

Understanding the efficacy of fluoridated food interventions in this region is crucial for making evidence-based decisions regarding

public health policies, resource allocation, and oral health promotion strategies. Therefore, this systematic review aimed to synthesise the existing literature to evaluate the quality and relevance of evidence regarding fluoridated food for preventing dental caries in Latin American and Caribbean children and adolescents.

Methods

This systematic review was performed according to the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines 2020. The protocol is available on PROSPERO (ID protocol: CRD42023445161).

Data sources and search strategy

A systematic search was undertaken in July 2023 using the following databases: EMBASE, CENTRAL, MEDLINE, SciELO, and Web of Science. Relevant MeSH terms and Boolean phases were used for the search: milk fluoridation, water fluoridation, salt fluoridation, dental caries without time restriction and in children aged 12 years and younger only. The complete search strategy for each database is shown in the [Supplementary material](#).

Study selection

Cohort studies and randomised control trials that included children and adolescents ≤12 years with data available on dental

caries and any of the systemic fluorides mentioned above, published in English, Spanish or Portuguese and conducted in Latin America or the Caribbean region were the inclusion criteria established for this systematic review (ID protocol: CRD42023445161). Studies reporting other types of studies (for instance, follow-up in ecological or observational studies), using different exposures or outcomes, or conducted in hospitalised children or adolescents were excluded. If the study was deemed suitable, it progressed to the retrieval of the full text by two researchers (A.C and FP-R). Unfortunately, upon full suitability review by the two reviewers (A.C and FP-R) independently, no studies fully met these criteria. Therefore, no studies could be included in the synthesis and data extraction and quality assessment could not be carried out (Figure 1).

Results

Search results

The initial search identified 4,893 records. After removing duplicates (n=1,951), 2,942 titles and abstracts were screened. Of these, 77 were selected for a full-text review for the eligibility assessment (Figure 1). After applying the inclusion and exclusion criteria, the 77 studies were removed. Therefore, no study was finally included in this systematic review for synthesis and quality assessments (Figure 1).

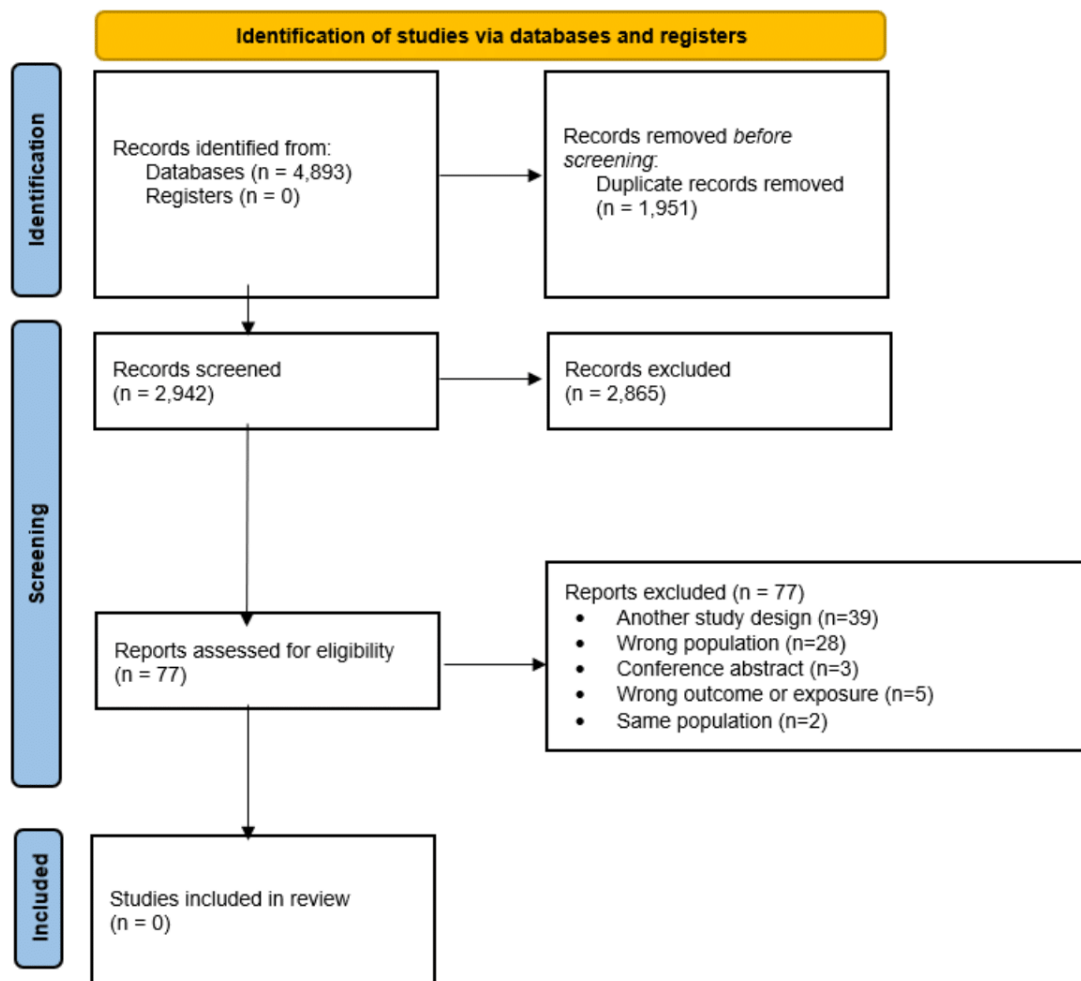


Figure 1 PRISMA flow diagram.

Discussion

Main results

No studies meeting the inclusion criteria for this review were identified. While the search strategy identified thousands of records, upon detailed examination none fulfilled the criteria of being a cohort study or randomized controlled trial directly investigating the impact of fluoridated food interventions on dental caries outcomes within LACCs children and adolescents. The criteria aimed to select the highest quality research designs capable of determining effectiveness and safety for policy and practice application. Unfortunately, though the topic has been studied globally,^{13,16,17} the specific type of robust evidence needed from LACCs contexts is currently lacking. Dental caries is a multi-factorial disease influenced by characteristics like access to dental care, oral hygiene practices, diet, and socioeconomic factors^{18,19} that may differ across LACC societies today and compared to other regions.

Comparison with other studies

77 records were initially identified as possible candidates to meet the inclusion criteria through an exhaustive search, yet none fulfilled them. This indicates the research question has not been thoroughly addressed through appropriately designed prospective investigation specifically targeted towards LACCs populations and contexts. While fluoride-based programs have been widely adapted globally based on evidence predominantly from mostly on high-income countries in North America and Western Europe rather than LACCs. Furthermore, evidence from other regions has primarily consisted of retrospective survey data, ecological studies, and database analyses^{13,16,17} that cannot prove causality due to a lack of randomisation and control groups.²⁰

Only a limited number of randomised controlled trials or prospective cohort studies under the condition that follow-up assessments were conducted on the same participants have evaluated community water, salt fluoridation and milk fluoridation specifically.^{13,16,17} Given the methodological limitations of observational designs for determining intervention effectiveness and safety, this paucity of high-quality experimental evidence from the target context represents a notable gap. For decision-makers considering large-scale community programs, the risks versus benefits need to be directly assessed through research adhering to the highest scientific standards possible within real-world settings.²¹

A key reason for the lack of eligible studies may relate to the inherent difficulties of carrying out randomized controlled trials and prospective cohort investigations of community-level fluoridation programs. Implementing fluoridated food interventions involves the manipulation and monitoring of environmental exposure factors on a large population scale over many years. This presents significant logistical and ethical obstacles to the rigorous methodological control and allocation concealment required for impact evaluations through randomized designs.²²

When entire communities are enrolled as the unit of analysis, contamination between intervention and control groups can be hard to prevent. Also, gaining consent and enforcing blinding protocols also poses challenges, especially in resource-constrained settings. Cohort retention over the long follow-up needed to detect caries outcomes introduces attrition threats to internal validity.²³ These complexity factors may partially explain why few randomized studies exist even in higher-income regions with more research infrastructure, let alone within diverse LACCs contexts facing their own implementation barriers

Implications

The findings of this review carry important implications for public health policy and practice in LACCs. While several LACCs have adopted national fluoridation programs based on the proposed cariostatic mechanisms and global evidence,¹² decisions have relied on observational evidence, natural experiments, or from evidence generated in other regions rather than local randomised trial data.²⁴ This emphasises the need for well-designed, prospective cohorts following the same participants in time and randomised controlled trials investigating fluoridation food strategies by directly evaluating dental caries outcomes within LACC's children and adolescents. Regionally specific evidence would allow for a more robust examination of how factors like access to dental care and preventive programs, climate, water chemistry, diet, and culture influence fluoride schemes impact on caries levels and inequalities in children and adolescents and possible risks or effects on health.²⁵

Without such evidence, uncertainty remains regarding how well findings from other regions and countries may translate to the oral health challenges and contexts presented across diverse LACCs. Policymakers require local effectiveness and safety data to properly assess whether long-term continued investment and scale-up of national fluoridation programs represents the best strategy compared to alternative fluoride delivery approaches or other preventive interventions.²⁴

Strengths and limitations

Strength of this review was its systematic and comprehensive approach following PRISMA guidelines 2018 to identify all published literature on this topic. The inclusion of three major languages from the region helped ensure coverage of non-English publications. However, the review was limited by the lack of proper cohort or randomised studies conducted within typical LACCs contexts prohibiting the derivation of quality assessment or pooled estimates from a meta-analysis.

More research employing methods like prospective cohort designs and cluster randomised trials adhering to Consolidated Standards of Reporting Trials guidelines are needed. Only then can confident evaluation and comparison of intervention impacts be made to serve policy and practice in LACCs better.

Conclusion

In conclusion, a notable absence of high-quality experimental research on the impact of fluoridated food on preventing dental caries on children and adolescents conducted within the contexts of LACCs was observed. Regionally situated randomised clinical investigation is warranted to generate scientifically robust data that can better inform sustainable oral health policies and programs tailored to the needs of LACCs populations and for the evaluation of existing fluoridation programmes to generate stronger scientific evidence for programme decision-making. International cooperation could assist in building local research capacity essential for addressing the region's distinctive oral health needs over the long term.

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None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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