



PEDIATRIC SYRUPS AND THEIR IMPACT ON ORAL HEALTH: THE CORRELATION WITH DENTAL CARIES

XAROPES PEDIÁTRICOS E SEU IMPACTO NA SAÚDE BUCAL: A CORRELAÇÃO COM A CÁRIE DENTÁRIA

JARABES PEDIÁTRICOS Y SU IMPACTO EN LA SALUD BUCAL: LA CORRELACIÓN CON LA CARIES DENTAL

Pedro Guimarães Sampaio Trajano Dos Santos¹, Rosana Maria Coelho Travassos², Priscila Prosini³, Maria Regina Almeida de Menezes⁴, Mônica Maria de Albuquerque Pontes⁵, Josué Alves⁶, Vanessa Lessa Cavalcanti de Araújo⁷, William Jose Lopes de Freitas⁸, Kattyenne Kabbaz Asfora⁹, Gustavo Moreira de Almeida¹⁰, Maria do Socorro Orestes Cardoso¹¹, Luciano Barreto Silva¹²

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ABSTRACT

Objective: The objective of this narrative review article is to address how pediatric syrups that are used as a medicinal means can harm the oral health of children, contributing to the development of dental caries. **Methodology:** Since this article is a narrative literature review, a range of scientifically proven information was required to compose the work. Thus, to acquire this set of content, research was carried out on undergraduate, master's and doctoral theses, as

¹ Graduating in Dentistry, Faculdade de Odontologia do Recife, Recife, Pernambuco, Brazil.

E-mail: pedroguimaraessampaio@gmail.com Orcid: <https://orcid.org/0009-0001-5720-603X>

² Doctor in Endodontics and Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: rosana.travassos@upe.br Orcid: <https://orcid.org/0000-0003-4148-1288>

³ Doctor of Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: priscila.prosini@upe.br

⁴ Doctor of Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: regina.menezes@upe.br

⁵ Doctor of Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: monica.pontes@upe.br

⁶ Doctor of Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: Josue.alves@upe.br

⁷ Doctor of Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: vanessa.lessa@upe.br

⁸ Doctor of Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: profwilliamfreitas@gmail.com

⁹ Doctor of Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: kattyenne.asfora@upe.br

¹⁰ Doctor in Health Sciences, Universidade de Brasília (UNB), Brasília, Distrito Federal, Brazil.

E-mail: drgustavoalmeida01@gmail.com Orcid: <https://orcid.org/0000-0002-1404-099X>

¹¹ Doctor of Pediatric Dentistry, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: socorro.orestes@yahoo.com.br

¹² Doctor of Endodontics, Universidade de Pernambuco (UPE), Recife, Pernambuco, Brazil.

E-mail: lucianobarreto63@gmail.com

well as systematic and integrative review articles in conjunction with original articles derived from clinical trials. To obtain only quality, current and information-rich content, searches were carried out in the following databases: BVS/BIREME, PUBMED Central, Web of Science, PROSPERO, Scielo, The Cochrane Library in conjunction with Google Academy. Results: Pediatric syrups can harm the oral health of children, especially when they are prescribed for long-term use, due to their composition rich in sugars and acids, which promotes the development of dental caries. Conclusion: Pediatric syrups can indeed harm oral health when associated with other factors, and may contribute to the development of dental caries. It is extremely important that medicated syrups are created that do not contain sugar and have a reduced amount of acids so that they do not harm the dental structure.

Keywords: Pediatric Dentistry. Tooth Decay. Syrup. Dentistry.

RESUMO

Objetivo: O objetivo deste artigo de revisão narrativa é abordar como os xaropes pediátricos utilizados como medicamentos podem prejudicar a saúde bucal das crianças, contribuindo para o desenvolvimento de cáries dentárias. Metodologia: Por se tratar de uma revisão narrativa da literatura, foi necessária uma série de informações cientificamente comprovadas para compor o trabalho. Assim, para aquisição desse conjunto de conteúdo, foram realizadas pesquisas em dissertações de graduação, mestrado e doutorado, bem como artigos de revisão sistemática e integrativa em conjunto com artigos originais oriundos de ensaios clínicos. Para obter apenas conteúdo de qualidade, atual e rico em informações, foram realizadas buscas nas seguintes bases de dados: BVS/BIREME, PUBMED Central, Web of Science, PROSPERO, Scielo, The Cochrane Library em conjunto com o Google Academy. Resultados: Os xaropes pediátricos podem prejudicar a saúde bucal das crianças, principalmente quando prescritos para uso prolongado, devido à sua composição rica em açúcares e ácidos, que favorecem o desenvolvimento de cáries dentárias. Conclusão: Os xaropes pediátricos podem, de fato, prejudicar a saúde bucal quando associados a outros fatores, podendo contribuir para o desenvolvimento de cáries dentárias. É de extrema importância que sejam criados xaropes medicamentosos que não contenham açúcar e tenham uma quantidade reduzida de ácidos para que não prejudiquem a estrutura dentária.

Palavras-chave: Odontopediatria. Cárie Dentária. Xarope. Odontologia.

RESUMEN

Objetivo: El objetivo de este artículo de revisión narrativa es abordar cómo los jarabes pediátricos que se utilizan como medio medicinal pueden perjudicar la salud bucal de los niños, contribuyendo al desarrollo de caries dental. Metodología: Dado que este artículo es una revisión narrativa de la literatura, se requirió una variedad de información científicamente comprobada para componer el trabajo. Así, para adquirir este conjunto de contenidos se realizó una investigación sobre tesis de pregrado, maestría y doctorado, así como artículos de revisión sistemática e integradora en conjunto con artículos originales derivados de ensayos clínicos. Para obtener sólo contenidos de calidad, actuales y ricos en información, se realizaron búsquedas en las siguientes bases de datos: BVS/BIREME, PUBMED Central, Web of Science, PROSPERO, Scielo, The Cochrane Library en conjunto con Google Academy. Resultados: Los jarabes pediátricos pueden perjudicar la salud bucal de los niños, especialmente cuando se prescriben

para uso prolongado, debido a su composición rica en azúcares y ácidos, lo que favorece el desarrollo de caries dental. Conclusión: Los jarabes pediátricos pueden efectivamente dañar la salud bucal cuando se asocian con otros factores y pueden contribuir al desarrollo de caries dentales. Es de suma importancia que se creen jarabes medicinales que no contengan azúcar y tengan una cantidad reducida de ácidos para que no dañen la estructura dental.

Palabras clave: Odontopediatría. Cárie Dentária. Xaropo. Odontología.



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INTRODUCTION

With advances in medicine, more medications have been developed to treat problems that negatively impact the health of the elderly, adults, young people and children. Children are a group that uses a lot of medications. In Brazil, a study revealed that 65% of children aged 3 to 12 months use medications and that 54.7% of children aged 24 months also use medicinal products (Oliveira *et al.*, 2010), which shows that a large proportion of children use a lot of medications. Therefore, due to the high use of medications by children, industries and pharmacies have started to add sugars to pediatric medications in order to eliminate the bitter taste of the medicine, leaving a sweet flavor that is more attractive to children, facilitating the introduction of medications to children, making them accept them more easily (Marquezan *et al.*, 2007).

However, studies have shown that adding sugars to pediatric medications may be a factor responsible for the increase in dental caries in children, helping to create a more favorable environment for the development of caries, especially when it comes to a child who has chronic use of some medication of this type (Sousa *et al.*, 2010; Passos *et al.*, 2008; Passos *et al.*, 2010). Most pediatric syrups prescribed for children contain sucrose in their composition, a sugar that gives the syrup its sweet taste, but which can be used as fuel for bacteria, causing them to ferment, producing acids that will demineralize the teeth, where if there is an imbalance in the remineralization system (demineralization and remineralization) of the teeth, associated with other factors such as diet, susceptible host and hygiene, it may end up helping the development of dental caries (Costa, 2007; Tenuta & Oliveira, 2018; Rodrigues & Cury, 2015).

Thus, considering that most children in Brazil use pediatric syrups as a medicinal means, there is a clear need to discuss the topic, which may be associated with the prevalence of dental

caries in children. Therefore, the objective of this narrative review article is to address how pediatric syrups that are used as a medicinal means can harm the oral health of children, contributing to the development of dental caries.

METHODOLOGY

Since this article is a narrative literature review, a range of scientifically proven information was required to compose the work. Thus, in order to acquire this set of content, research was carried out on undergraduate, master's and doctoral theses, as well as systematic and integrative review articles in conjunction with original articles derived from clinical trials. In order to obtain only quality, current and information-rich content, searches were carried out in the following databases: BVS/BIREME, PUBMED Central, Web of Science, PROSPERO, Scielo, The Cochrane Library in conjunction with Google Academy. Gray literature was also used to compose the work, contributing with more data related to the topic addressed in the study. In addition, to achieve even greater precision, keywords were used in online searches, with the aim of ensuring that the search results were only studies related to the topic. As this is a narrative review article, it was necessary to use the work of Rother (2007), a study that addresses the composition of a narrative review, its approach, and its search methodology and use of the data obtained, thus serving as a guide for how this article should be developed and finalized.

RESULTS

Pediatric Syrups and Their Functions:

Due to the widespread use of pediatric medications, pharmaceutical industries began to produce in a different and completely strategic way, thus creating pediatric syrups. Pediatric syrups are formulated to facilitate the administration of medications to children, which in addition to ensuring dosage accuracy, will facilitate acceptance by children through palatable flavors, such as syrups with strawberry, grape, tutti-frutti, cotton candy flavors and other flavors that are attractive to people in this age group. These syrups are mostly used to treat respiratory conditions, allergies, infections and chronic diseases, such as asthma or epilepsy, problems that generally affect a large portion of children. However, their frequent and sometimes prolonged use raises

concerns about their impact on oral health (Silva *et al.*, 2019).

Studies show that more than 60% of pediatric formulations on the global market contain sucrose or other cariogenic sweeteners, which significantly increases the risk of cavities when this factor exists and is associated with a set of other factors. (Passos *et al.*, 2010).

Composition of Pediatric Syrups:

When it comes to Pediatric Syrups, which are a way of administering medication in a more attractive way for children, we must classify their composition as follows:

- **Active Pharmaceutical Ingredients (APIs):** Provide therapeutic effects, such as antipyretic, analgesic or antibiotic properties ().
- **Excipients:** Include sweeteners (sucrose, fructose or artificial substitutes), acids (citric or tartaric acid) and preservatives (parabens, sodium benzoate) to ensure stability and flavor enhancement (Passos *et al.*, 2008).
- **Sugar Concentration:** Sucrose is often used in concentrations greater than 50% to mask bitterness. This high sugar content provides a substrate for bacterial metabolism, promoting the production of acid that triggers enamel demineralization (Cury *et al.*, 2017).
- **Acidity:** Studies indicate that many syrups have a pH below 5.5, which is the critical threshold for enamel demineralization (Tenuta & Oliveira, 2018).

Tooth Decay

Tooth decay, also known as dental caries, is a prevalent chronic disease among children worldwide. It results from the interaction of cariogenic bacteria, dietary sugars, host factors, and time. Pediatric syrups, due to their high sucrose and acid content, play a significant role in increasing the risk of tooth decay. When these syrups are consumed frequently, especially without adequate oral hygiene, they provide an optimal substrate for bacteria like *Streptococcus mutans* and *Lactobacillus*. These microorganisms ferment sugars to produce acids, which lower the pH in the oral cavity, leading to demineralization of the enamel. Over time, this process creates cavities, further aggravated by the immature enamel in children's teeth and reduced salivary buffering capacity (Cury & Tenuta, 2017; Souza *et al.*, 2020).

Etiology of Dental Caries and its Susceptibility in children

Etiology of Dental Caries

Dental caries is a multifactorial disease resulting from the interplay of four primary factors: time, microorganisms, host, and diet. These components act together in a dynamic balance between demineralization and remineralization processes, influencing the development of tooth decay.

- **Microorganisms:** Cariogenic bacteria, primarily *Streptococcus mutans* and *Lactobacillus*, are essential in the caries process. These microorganisms metabolize fermentable carbohydrates, producing acids that lower the pH of dental biofilm. This acidic environment demineralizes enamel and favors the growth of acidogenic and aciduric bacteria, perpetuating the caries process (Souza *et al.*, 2020).
- **Time:** The duration of exposure to cariogenic factors is critical. Frequent and prolonged sugar exposure through diet or medications allows for repeated acid attacks on enamel, tipping the balance toward demineralization. Nighttime exposure is particularly damaging, as reduced salivary flow during sleep impairs natural buffering and cleansing mechanisms (Cury & Tenuta, 2017).
- **Host Factors:** The host's oral environment will be of great importance when we talk about the development of cavities, since for cavities to develop, a favorable environment is necessary, that is, an environment that has conditions that allow or even encourage demineralization caused by bacteria, such as a person who does not perform oral hygiene or does so incompletely, for example: a person who uses a fluoridated toothpaste but does not floss, leaving food remains and bacterial plaque between the teeth, which can be used as fuel by the cavity bacteria. The host and their lifestyle characteristics will have a positive or negative impact (Rodrigues & Cury, 2015).
- **Diet:** Diet is a primary contributor to caries development. Frequent consumption of fermentable sugars provides a constant substrate for bacterial metabolism. Sugars and carbohydrates contribute even more to enamel erosion and increase the cariogenic potential of the biofilm, as they serve as fuel for bacteria that will ferment these constituents, producing acids that will cause tooth erosion. (Souza *et al.*, 2020).

Susceptibility in Children

In children, in addition to diet, microorganism, host and time factors, we have other factors that will promote or even drive the development of dental caries in certain children.

- **Immature Enamel:** The enamel in primary and newly erupted permanent teeth is less mineralized, making it more prone to acid demineralization. This heightened vulnerability is compounded by the difficulty children may have in maintaining effective oral hygiene practices (Bhat *et al.*, 2017).
- **Frequent Use of Pediatric Syrups:** Many children require long-term medications in the form of syrups, which often contain high levels of sucrose and acids. These substances serve as a substrate for cariogenic bacteria, while the acidic pH of some formulations directly erodes enamel. The repeated exposure, particularly without adequate post-administration oral hygiene, exacerbates caries risk (Cury & Tenuta, 2017).
- **Salivary Function in Children:** Children's salivary systems are not as efficient as adults' in buffering acids or remineralizing enamel. Syrups with high sugar and acid content can overwhelm their limited salivary defenses, especially during nighttime doses when salivary flow naturally decreases (Souza *et al.*, 2020).
- **Behavioral Factors:** Parental supervision plays a critical role in mitigating caries risk. However, a lack of awareness about the importance of post-medication oral hygiene often results in prolonged retention of syrup residues on teeth. Encouraging rinsing or brushing after medication is essential but frequently overlooked (Bhat *et al.*, 2017).
- **Dietary Habits and Socioeconomic Factors:** Unbalanced diets, high in refined carbohydrates, combined with limited access to dental care, increase susceptibility in children from lower socioeconomic backgrounds. These children often have higher exposure to cariogenic substances and face barriers to preventive care and education (Rodrigues & Cury, 2015).

The Correlation of Pediatric Syrups with Dental Caries

The composition of pediatric syrups plays a major role, and may or may not harm oral health, and the following dangerous composition factors may be associated with it:

- **High Sucrose Content:** Sucrose is often added to syrups to mask the bitter taste of active pharmaceutical ingredients. However, its fermentable nature makes it a prime contributor to cariogenic bacterial growth. Prolonged exposure to sucrose creates an acidic environment that erodes enamel and promotes caries formation (Passos *et al.*, 2010).
- **Low pH Levels:** Many pediatric syrups have a pH below the critical threshold of 5.5, leading to direct enamel demineralization. The acidic nature, combined with frequent use, accelerates tooth decay, especially in children with poor oral hygiene (Tenuta & Oliveira, 2018).
- **Prolonged Exposure:** Nighttime administration of syrups, without subsequent oral hygiene, further exacerbates the risk. Reduced salivary flow during sleep limits the neutralization of acids and the remineralization of enamel (Cury & Tenuta, 2017).
- **Lack of Parental Awareness:** Many parents are unaware of the cariogenic potential of pediatric syrups and do not encourage post-medication rinsing or brushing, allowing residue to remain on the teeth for extended periods (Bhat *et al.*, 2017).

DISCUSSION

The findings of this narrative review highlight the significant impact of pediatric syrups on oral health, particularly their contribution to dental caries in children. The widespread use of these syrups, especially for prolonged periods, underscores the importance of addressing their composition and administration practices.

Pharmaceutical companies have a pivotal role in reformulating pediatric medications. Reducing or eliminating sucrose and acids in syrups, without compromising therapeutic efficacy, should be a priority. Alternatives such as non-cariogenic sweeteners (xylitol) and neutral pH formulations can mitigate the risk of dental caries. Healthcare professionals must also be vigilant in educating parents about the oral health implications of syrup medications. Simple practices, such as rinsing the mouth with water or brushing teeth after administering syrup, can significantly reduce caries risk. Additionally, prescribing sugar-free alternatives whenever possible can minimize exposure to cariogenic substances.

Parental supervision and awareness are crucial. Efforts to disseminate information about the importance of oral hygiene after medication, along with regular dental check-ups, can create a supportive environment for children's oral health.

The review also emphasizes the need for further research to develop pediatric formulations that are both effective and safe for oral health. Clinical trials focusing on sugar-free syrups with neutral pH levels can provide valuable insights into reducing the cariogenic potential of these medications.

CONCLUSION

Thus, it is clear that pediatric syrups, although they are a way to facilitate the medication of children, can be an aid in one aspect while also being a harmful factor to health, requiring an interprofessional relationship between dentists, pharmacists and pediatric doctors, aiming to create ways of administering medications that do not cause harm.

Thus, we can conclude that pediatric syrups can indeed harm oral health when associated with other factors, and may contribute to the development of dental caries. It is extremely important that medicated syrups are created that do not contain sugar and have a reduced amount of acids so that they do not harm the dental structure.

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