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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებში.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи.** Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html. В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე, დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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EFFECTIVENESS OF XYLITOL TOOTHPASTE IN CARIES PREVENTION: A REVIEW ARTICLE

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Abstract.

Aim: This study aims to summarize the evidence of the effectiveness of xylitol toothpastes with a focus on caries, namely on its prevention and reduction.

Materials and methods: A thorough literature review was performed after conducting an electronic search through Medline, PubMed (Central), Scopus, Web of Science (Scielo), Google scholar, and the Cochrane Library (from 2000 to November 2022) to identify studies relevant to the effectiveness of xylitol toothpastes in caries prevention.

Results: The number of studies that have been found in the literature to meet the criteria for inclusion in this article has been limited. Number of studies have analyzed the effect of xylitol on vehicles such chewing gums, gummy bears, lozenges or candies and not on toothpastes. Eight papers have been found that have met the criteria for inclusion in this article so that their results could be compared and discussed. The results of these studies regarding the effectiveness of xylitol toothpastes in oral health were quite convenient

Conclusion: Positive proven properties of xylitol such as: biocompatibility with oral tissues, anti-caries effect, antibacterial effect, demineralization inhibitor and remineralization enhancer, makes xylitol an effective caries preventive and cariostatic agent and it should be part of a comprehensive strategy to prevent caries. Clearly can be concluded that xylitol should be consider as the most suitable sugar substitute in toothpastes.

Key words. Xylitol, Xylitol toothpaste, caries prevention.

Introduction.

Dental caries is the most common chronic disease. Mostly affects children, but also adults all over the world. Early childhood caries (ECC) is also a form of caries in young children, which is increasing in United States preschool-aged children, especially preschoolers from low-income families [1,2]. Dental caries is a multifactorial disease that often results from the interaction between cariogenic dental plaque and carbohydrates [3]. It has an impact on the quality of life and may be the reason that many children who need dental treatment undergo to general anesthesia [4]. Fortunately, caries can be prevented through good oral health habits such as brushing teeth regularly with toothpaste among others. Toothpastes are an essential component of everyday oral hygiene, and a key factor to achieving and maintaining excellent oral health [5]. They may have all the same basic ingredients, but all toothpastes are not the same. The main components of toothpastes are surfactants, abrasives, and active ingredients. Of these, the active ingredients dictate the therapeutic indications of the toothpaste and provide the main therapeutic benefits of toothpastes [6]. Modern formulations may contain one or several active ingredients which can be classified as anti-caries, anti-calculus/anti-tartar,

anti-erosion, anti-halitosis, anti-microbial, anti-plaque/anti-gingivitis, desensitizing, and whitening [6,7]. Currently, there is an increasing number of active ingredients being used in modern toothpastes. Fluoride is arguably the most effective known topical substance for arresting and preventing dental caries [8]. However, researchers and professionals continue to search and investigate other caries preventive measures such as xylitol [9].

Xylitol, a naturally occurring substance, was first introduced in Finland during World War II as a sugar substitute. In 1963, the Food and Drug Administration (FDA) approved the use of xylitol as a nutritional additive [9]. Xylitol is a five-carbon sugar alcohol that is widely distributed in plants; it is found in significant concentrations in plums, strawberries, and raspberries [10]. As well as providing an alternative to sugar, it has other properties that are thought to help prevent tooth decay. Xylitol is an unsuitable source of energy for many micro-organisms demonstrates the antimicrobial activity [11-13]. Although anti-and non-cariogenic properties of xylitol cannot be fully explained, the mechanism of action includes a reduction in streptococcus mutans (SM) count and reduction of lactic acid production by the bacteria. Xylitol increases the production of saliva and reduce the growth of bad bacteria in the mouth so that less acid is produced; as well as reduces the adhesiveness of SM, to tooth biofilms and inhibits the growth of SM, which is the most important bacterium in the development of dental caries [9,15-22]. Currently, more than 35 countries have approved the use of xylitol in foods, pharmaceuticals, and oral health products, principally in chewing gums, toothpastes, syrups, and confectioneries [23].

A recent study who compared the efficacy of different xylitol products concludes that chewing-gum is comparatively more effective than mouthwash and toothpaste. But he suggests that considering convenience and affordability, chewing gum may not always be preferred, and in that case, mouthwash or toothpaste can be used for the promotion of better oral health [24]. In addition, xylitol presents ability to form complexes with calcium ions on dental surface minimizing enamel demineralization [25].

The American Academy of Pediatric Dentistry (AAPD) endorses the use of xylitol as part of a comprehensive strategy to prevent caries but does not recommend xylitol toothpaste use because the research evidence is inconclusive [26].

In the literature there is the considerable evidence that xylitol is an effective caries preventive and cariostatic agent and many researchers suggest adding xylitol to the toothpaste [9,17,27].

This review aimed to find, evaluate and summarize contemporary literature about the efficacy of xylitol toothpaste in oral health with the particular focus on caries prevention and reduction.

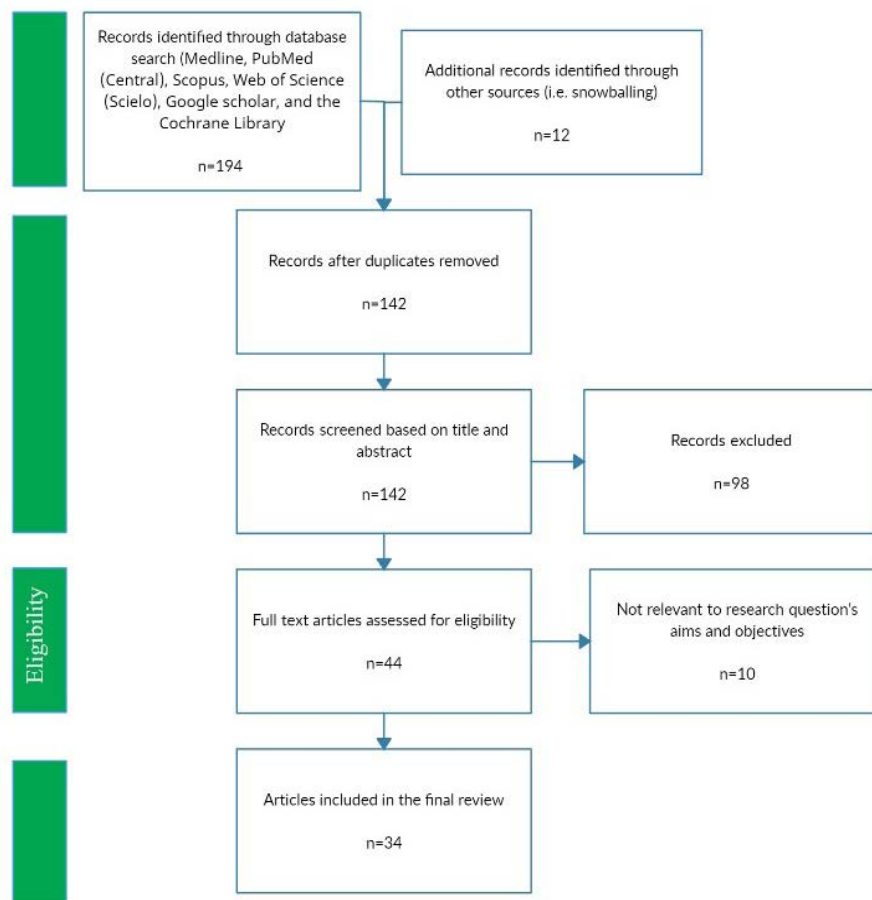


Figure 1. Flow chart of searching process.

Methodology.

Study design that has been used in this article is a narrative review. We have so far looked at different types of primary research which attempt to answer a specific review question which was the impact of xylitol toothpastes in oral health with the focus on the prevention and reduction of caries. The literature has been elaborated and discussed in several aspects such as: the antibacterial role of xylitol, its role in the caries prevention and reduction as well as demineralization and remineralization. A thorough literature search we have identified all articles related to the research question and ensure that no relevant article is left out. The search has included electronic databases such Medline, PubMed (Central), Scopus, Web of Science (Scielo), Google scholar, and the Cochrane Library (from 2000 to November 2022) to identify studies relevant to the effectiveness of xylitol toothpaste in caries prevention. The following keywords were used: “xylitol toothpaste,” “xylitol toothpaste AND caries prevention,” and “Xylitol toothpaste and oral health.”

In the discussion section, only the articles that have to do with the impact of xylitol toothpastes on the issues mentioned above were included. All articles that have to do with the presence of xylitol in other products (syrup, chewing gums, gummy bears, lozenges, candies) were excluded from the review/discussion. Likewise, only studies in humans with no restriction of ages were included, of which one was in vitro studies. The search was limited to studies published in the English language and studies performed on humans.

The material was reviewed, and the results of the research strategy were reported, extracting relevant data from includes studies.

Results.

The number of studies that have been found in the literature has been very limited, eight papers have been found that have met the criteria for inclusion in this article so that their results could be compared and discussed. The results of these studies regarding the effectiveness of xylitol toothpastes in oral health were quite convenient.

Discussion.

Biocompatibility: In addition to the actual requirements that toothpaste must fulfil, such as cleaning the teeth, releasing fluoride (F), and much more, toothpaste must also be well tolerated by the tissue surrounding the teeth. Consistent with these, a study through cell experiments tested the chemical and biological parameters of a newly formulated toothpaste (Airflow) in terms of its safety for oral mucosal tissues by comparing it with four other commercial toothpastes. Along with other ingredients, all the toothpastes contained fluoride above 1000ppm, while the comparison was made in two aspects on the one hand, erythritol and xylitol were added to the Airflow paste, which substances were not present in other toothpastes, and on the other hand, the effect of the surfactant sodium lauryl sulfate (SLS), which was not present in the Airflow toothpaste, but contained all the other toothpastes. Results showed that

toothpaste with erythrol and xylitol content showed excellent biocompatibility in cell tests and has high availability of free fluoride. This additional positive cell-protective function might be provided by the addition of both natural sweeteners erythritol and xylitol [28].

Reduction of SM: Although there is reliable evidence in the literature that xylitol tested in other products than toothpastes has been effective in reducing SM [18,20,21,29], however, the evidence of the effectiveness of xylitol toothpastes is not sufficient to prove the same effect. In relation to this, two papers were found which show contradictory results even though they differed a lot in terms of design, age group of the participants, the composition of the paste, etc.

A study of 155 university students with high SM levels compared three fluoridated dentifrices (toothpaste with or without triclosan, or triclosan plus 10% xylitol). Only the toothpaste with triclosan and xylitol showed significant reductions in plaque and saliva SM levels from the placebo at 6 months although the levels dropped in all the groups. Whether this reduction, which is in the order of 0.3–0.9 log CFU/ml saliva or per plaque sample, has any clinical relevance is still an open question [30].

A study conducted by Maden aimed to reveal the influence of fluoride, xylitol, or xylitol-probiotic on salivary SM and *Lactobacillus* levels of children. It was found that brushing with xylitol toothpaste is no more efficacious in reducing SM and *Lactobacillus* levels than a fluoride or xylitol-probiotic toothpaste in 13–15-year-old children [31].

Prevention and reduction of caries: our review in this regard has also found different results of the two researches. Study in school children (7–12 years) in a sample of 3,394 participants compared the long-term caries increment associated with the use of two dentifrices: a fluoride toothpaste with and without 10% xylitol. For both Decayed Filled Surfaces and Decayed Filled Teeth, the increments associated with the test dentifrice containing 10% xylitol were statistically significantly lower than those associated with the positive dentifrice without xylitol, with the observed reductions in caries increment exceeding 10% in for both parameters and this result can definitely be attributed to xylitol [32].

As long as a newer study reported the opposite results than previous one and provide their own explanations about it. Investigation that lasted 6 months included the 4–5-year-old children at high risk for caries, divided into two groups where the experimental group used 1,400 ppm F 31% xylitol toothpaste and the control group 1,450 ppm sorbitol toothpaste. This resulted in no therapeutic effects compared to an over-the-counter fluoride toothpaste in the two aspects of preventing ECC and reducing SM, but the author explains that this result may be due to the surfactant sodium lauryl sulfate used in toothpaste may interfere with xylitol uptake [2]. Therefore, they suggest the manufacturers to switch to other surfactants like sodium lauroyl sarcosinate and not to affect the efficiency of the toothpaste.

Demineralization: A study tested the toothpaste with a low concentration of fluoride (200), which also contains several other ingredients, sodium trimetaphosphate (TMP) and xylitol with erythrol, with the aim of testing the inhibition of enamel

demineralization, as well as its effect on the mineral composition and dental biofilm. The TMP was added since it is absorbed in the enamel thus reducing the acidic diffusion and loss of minerals, but despite this it does not show an antimicrobial effect. Therefore, xylitol and erythritol have been added to the toothpaste as an antimicrobial agent. The participants were volunteers aged 20–30 and had to brush their teeth three times a day. The author concluded that the addition of TMP, xylitol and erythritol in the toothpaste with low F concentration gave a greater protective effect against demineralization compared to the toothpaste containing 1,100ppm F. He confirms that the superior effect in reducing the production of extracellular polysaccharides was due to the presence of xylitol and erythritol [4].

Remineralization: Indicated that xylitol can induce the remineralization of deeper layers of demineralized enamel by facilitating Ca movement and accessibility. Sano in his study examined the effect of fluoride and xylitol containing toothpaste on the remineralization of human enamel using the Quantitative Light-induced Fluorescence method. The findings demonstrated that a slurry of toothpaste with 500 ppm F and 5% xylitol enhanced remineralization of early caries lesion for 14-day treatment period compared to toothpaste containing 500ppm F. He concluded that although it is not possible to directly correlate his findings to in vivo situations, toothpaste containing 500 ppm F and 5% xylitol might be beneficial, both with respect to its caries inhibiting effect [33].

Another in vitro experimental study with the aim to explore the remineralizing effect of toothpastes was carried out in an 18 human premolars sample, which were treated with one of the 3 evaluated toothpastes (Xylitol, *Camellia Sinensis* and *Juniperus Communis* added to dentifrices) and a control fluoride one. The atomic percentages of Ca and P were evaluated by Energy Dispersive X-ray Spectroscopy (EDS). In addition, the enamel surface of treated teeth was visualized by Scanning Electron Microscopy (SEM). It was concluded that Xylitol paste showed the highest remineralizing property, both in the EDS analysis and in the SEM images [34].

The dosages: The safety of xylitol has been studied and sort of consensus has been reached among researchers regarding daily doses of xylitol and that is dose of 6g/day [9,15–17].

Exceeding the daily dose of xylitol 10.32 g/day is not likely to increase effectiveness as well as, a dose of 3.44 g/day is not likely to show reductions in SM levels [15].

The safety of xylitol has also been studied extensively. While most studies reported few side effects, these occurred following high ingestion of xylitol, four to five times the recommended dose, reaching 50g per day, which included stomach disturbance and diarrhea. With the appropriate dose and frequency, xylitol was considered completely safe for everyone at a recommended dose of 6 g/day [9,15–17].

Conclusion.

The evidence we identified does not allow any firm conclusions to be drawn regarding the effects of xylitol toothpastes in oral health. What can clearly be concluded is that xylitol can be consider as the most suitable sugar substitute in toothpastes. Its positive proven properties such as: biocompatibility with oral tissues, anti-caries effect, antibacterial effect, demineralization inhibitor and remineralization enhancer, makes xylitol an

effective caries preventive and cariostatic agent and it should be part of a comprehensive strategy to prevent caries.

Despite the literature data related to xylitol, new researches, and further studies are needed to determine the efficacy of xylitol toothpastes on different parameters of oral health.

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Declaration of Conflicting Interests.

The Author declares that there is no conflict of interest.

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