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Probiotics as a Preventive Strategy in Pediatric Dentistry: A Narrative Review

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ABSTRACT

Dental caries is a common chronic disease in children. With a better understanding of the oral microbiome and the limitations of traditional antimicrobials, interest in probiotics as a preventive strategy is growing. Probiotics are live microbes providing health benefits, potentially preventing early childhood caries, gingival diseases, halitosis, and enamel demineralization. They work by modulating the oral microbiome, competing for adhesion sites, regulating biofilms, adjusting salivary pH, boosting the immune response, and inhibiting cariogenic bacteria such as S. mutans. Delivery formats include milk, yogurt, lozenges, and mouth rinses with Lactobacillus and Bifidobacterium. Probiotics may complement standard prevention, but more long-term trials are needed for clear clinical guidelines.

Keywords: Early Childhood Caries, Oral Microbiome, Pediatric Dentistry, Preventive Dentistry, Probiotics.

INTRODUCTION

Good oral health is crucial to overall health and quality of life in children. Early Childhood Caries (ECC) continues to be a major public health problem, especially in developing countries that are affected by poor oral hygiene practices, frequent sugar consumption, and limited access to dental services that increase disease burden. Dental caries affects nutrition, speech, growth, psychological development, and school performance in children.

Dental caries is a multifactorial disease that results from an imbalance between demineralization and remineralization at the tooth surface. The disease is closely associated with dysbiosis of the oral microbiome and an overpopulation of acidogenic microorganisms such as Streptococcus mutans and Lactobacillus species. Oral dysbiosis is defined as a disruption of the ecological relationship of the oral microbiome. According to the ecological plaque hypothesis, dental caries is not caused by a single pathogen, but by a dysbiotic microbial community that drives disease development. Fluoride therapy, dietary counseling, sealants, and oral hygiene measures have been shown to reduce the prevalence of caries; However, these methods, when used alone, may not be sufficient for the pediatric population at high risk. [7].

Recent advances in microbiome research have prompted a shift in preventive approaches from eradicating microorganisms to restoring microbial balance. Probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit. Probiotics are gaining much attention in medicine and dentistry. The most commonly used probiotics in dentistry include Lactobacillus rhamnosus, Lactobacillus reuteri, Bifidobacterium lactis, and Streptococcus salivarius. Probiotics help in reducing the count of cariogenic bacteria and improve oral health parameters in children. This narrative review aims to summarize the contemporary evidence on mechanisms, clinical uses, delivery systems, safety, and future directions of probiotics in pediatric dentistry.

MATERIALS AND METHODS

This manuscript was developed as a narrative review evaluating current evidence on the role of probiotics in pediatric dentistry. An extensive electronic literature search was conducted using PubMed, Scopus, Google Scholar, Web of Science, and ScienceDirect for articles published between 2000 and 2026.

The keywords Probiotics, Pediatric Dentistry, ECC, Oral Microbiome, Streptococcus mutans, Gingivitis, Orthopedic treatment, and Preventive Dentistry were used in combination for the search.

Included in the search were relevant clinical trials, randomized controlled trials, systematic reviews, meta-analyses, narrative reviews, and in vitro studies that focused on probiotics and pediatric oral health.

We excluded articles unrelated to pediatrics, duplicate publications, conference abstracts lacking data, and studies deemed not scientifically credible. Interpretive analysis was conducted on the collected data.

This study did not directly involve any human participants or laboratory animals, as it was a complete literature review. As a result, ethical approval and informed consent were not required.

RESULTS

The literature review showed growing evidence supporting the use of probiotics as a preventive adjunct in pediatric dentistry. According to results from various clinical trials and systematic reviews, there is a decrease in salivary Streptococcus mutans counts after using probiotic-containing products such as milk, yogurt, curd, lozenges, chewing gum, and mouth rinse.

Several studies assessing Lactobacillus rhamnosus, Lactobacillus reuteri, Bifidobacterium lactis, and Streptococcus salivarius have reported beneficial effects on oral microflora, plaque accumulation, gingival inflammation, and salivary pH. The administration of probiotics was also associated with a reduction in non-cavitated carious lesions across groups, thereby enhancing oral health parameters in preschool children and orthodontic patients.

Research with large sample sizes has suggested potential benefits of probiotic foods or drinks for oral health outcomes. In particular, there may be evidence supporting the use of dairy products and probiotic lozenges for better oral health.

The reviewed studies showed significant heterogeneity in probiotic strains, dosage regimens, and duration of administration, among other factors. The long-term evidence for the sustained colonization by probiotics and the prevention of caries remains limited.[17]

DISCUSSION

Probiotics and the Ecological Shift in Caries Prevention

The current narrative review outlines the growing evidence supporting the use of probiotics as a promising adjunct preventive strategy in pediatric dentistry. A more profound understanding of the oral microbiome and the ecological nature of dental caries has emerged, resulting in a shift from the simple elimination of microorganisms toward the restoration of microbial balance.[7]More contemporary concepts of oral health emphasize maintaining a symbiotic microbial ecosystem rather than simply suppressing oral microorganisms. As a result, probiotics are desirable biological agents for modulating oral microbial ecology and improving oral health in children.

Mechanisms of Action of Probiotics

Probiotics exert their beneficial effects through several interrelated biological mechanisms. Probiotic microorganisms mutually inhibit the growth and adhesion of cariogenic bacteria to oral mucosal surfaces and hard dental tissues. This prevents adhesion by Streptococcus mutans and other microorganisms responsible for dental caries.

Probiotics have also been shown to inhibit the growth of pathogenic bacteria that cause tooth decay, cavities, and gum disease. In particular, probiotics can reduce harmful bacteria associated with these diseases while increasing useful bacteria such as Streptococcus and Lactobacillus. This effect may occur through a variety of different mechanisms, according to recent studies. Growing evidence also indicates that probiotics enhance mucosal immunity by promoting salivary immunoglobulin A production, modulating inflammatory cytokines, and improving epithelial barrier function. Furthermore, stabilization of salivary pH and the restoration of microbial homeostasis create an optimal environment for enamel remineralization and long-term maintenance of oral health.

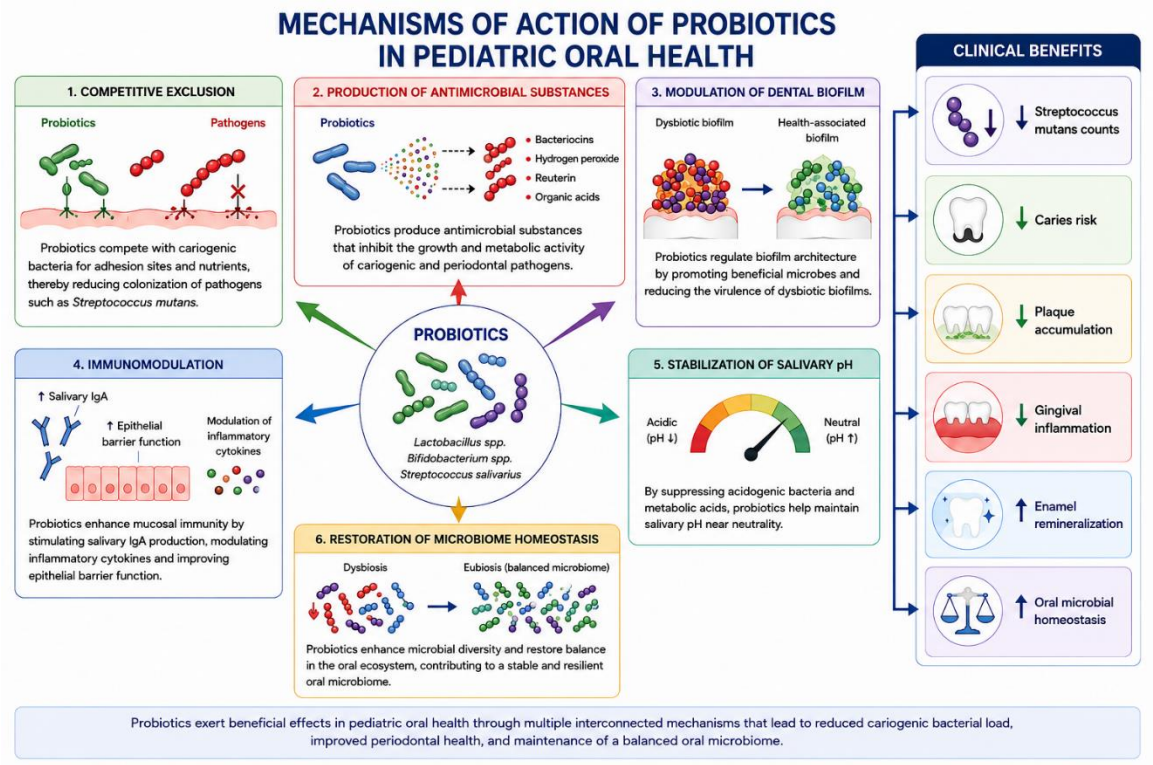

Figure 1. Mechanisms of action of probiotics in pediatric oral health.

Probiotics can promote oral health and hygiene through competitive exclusion, antimicrobial activity, biofilm modulation, immune regulation, salivary pH stabilization, and restoration of microbial homeostasis, and may ultimately reduce the cariogenic bacterial load.

Clinical Evidence for Caries Prevention

As reported in the literature, the clinical results described may be explained by the biological mechanisms presented above. In line with these mechanisms, many clinical trials and systematic reviews found that probiotics significantly decreased salivary Streptococcus mutans counts. Eliminating mutans, which are involved in dental caries, can reduce the risk of caries in children. As cited by Lin et al. [10], there was a significant reduction in cariogenic bacterial counts with probiotic supplementation, and a consistent reduction in mutans streptococci after probiotic supplementation, as reported by Laleman et al. [11]. The oral microbiome's ecological impact could be an effective caries-prevention strategy, as confirmed by scientific experiments and analysis reports.

Effects on Gingival Health, Orthodontic Patients, and Halitosis

Many probiotic strains can positively affect the oral microbial biofilm, plaque accumulation, and gum health. For instance, the probiotic strains Lactobacillus rhamnosus, Lactobacillus reuteri, Bifidobacterium lactis, and Streptococcus salivarius have been shown to enhance oral health. In addition to reducing the levels of bacterial strains associated with caries, probiotics may improve periodontal health by modulating inflammatory responses and promoting a beneficial oral microbiota. Such outcomes are especially relevant in children and adolescents, in whom plaque-induced gingival inflammation is very prevalent.

Patients undergoing orthodontic treatment might benefit from taking probiotics. Orthodontic fixed appliances facilitate caries-producing chronic inflammation and odontogenic inflammation, as well as the development of spot lesions when plaque-retentive niches appear. According to Cildir et al., orthodontic patients treated with probiotics exhibit lower levels of salivary mutans streptococci, suggesting a potential further role for probiotics during orthodontic treatment [randfonte14]. In addition, other probiotic strains, such as Streptococcus salivarius, have also shown positive effects on halitosis by suppressing microorganisms that produce volatile sulphur compounds.[13] These observations suggest that probiotics are clinically useful for more than just the prevention of caries, and may also serve other measures in paediatric oral healthcare.

Probiotics as an Adjunct to Conventional Preventive Strategies

In contrast to traditional methods that focus on tooth structure or plaque removal, probiotics work by modifying the balance of the oral ecosystem. Fluoride therapy, casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) plus nano-hydroxyapatite, mainly works by enhancing enamel remineralization and increasing resistance to acid dissolution. At the same time, probiotics primarily target the microbial factors that initiate the disease.5,7,15 Therefore, probiotics and traditional remineralizing agents are not to be regarded as competitive but to be complementary. Using antibiotics, fluoride, dietary advice, fissure sealants, and oral hygiene can provide a more comprehensive and biologically focused approach to caries prevention in high-risk groups and pediatric populations.

Natural Sources and Delivery Vehicles of Probiotics

It is possible that natural probiotic foods can increase the usefulness of probiotics in children. Yogurt, curd, kefir, buttermilk, and other dairy-based fermented foods have been the most widely researched probiotic delivery vehicles. Studies have shown that they can have favorable effects on oral microbial balance and caries prevention. Fermented foods such as kimchi, sauerkraut, miso, tempeh, kombucha, and fermented rice water contain diverse probiotic microbes that could offer myriad benefits to both the oral and body systems.[16][25] Food-based probiotic solutions are particularly appealing in children because they are affordable, culturally acceptable, and easy to integrate into daily diets. Although evidence for the oral health benefits of many traditional fermented foods is limited, there is still scope to investigate their potential as probiotics.

While naturally fermented foods are promising sources of probiotics, their clinical effectiveness in improving oral health requires further scientific evaluation.

Preparation, storage, fermentation time, and microbial composition all influence the concentration and viability of probiotic microorganisms found in yogurt, kefir, kimchi, kombucha, and fermented rice water. As a result, naturally fermented food may not contain the same concentrations or strains as those used in trials. On the other hand, standardized probiotic supplements contain defined strains and precise concentrations, allowing for more predictable results. Food-based probiotic interventions are nevertheless appealing for children because they are cost-effective, accessible, and can be used continuously.

A critical factor in understanding the relevant findings is the strain-specific nature of probiotics. Probiotics should not be treated as the same microorganisms, since different strains can vary widely in their biology and clinical effects. Certain probiotics have specific antimicrobial activities due to the production of antimicrobial compounds. Lactobacillus reuteri, for example, exhibits potent antimicrobial activity through the production of reuterin. Similarly, Streptococcus salivarius K12 has shown specific efficacy in reducing oral malodor by suppressing volatile sulfur compound (VSC)- producing bacteria. Same with Bifidobacterium species, it has been shown to enhance immunomodulatory and maintain microbial homeostasis. As a result, clinical recommendations must rely on evidence supporting probiotic strains rather than the assumption that probiotics are all the same. Future investigations should seek strain-specific mechanisms and develop standardized clinical application protocols.[19-21]

Other Potential Benefits of Probiotics

Beyond oral health, probiotics have shown numerous systemic benefits that can indirectly influence children's health. Improvement of gastrointestinal health, enhancement of intestinal barrier function, modulation of immune response, reduction of dysbiosis, and support for overall microbial diversity. Such systemic effects not only strengthen the case for probiotics in preventive health care but also emphasize the link between oral and systemic health.

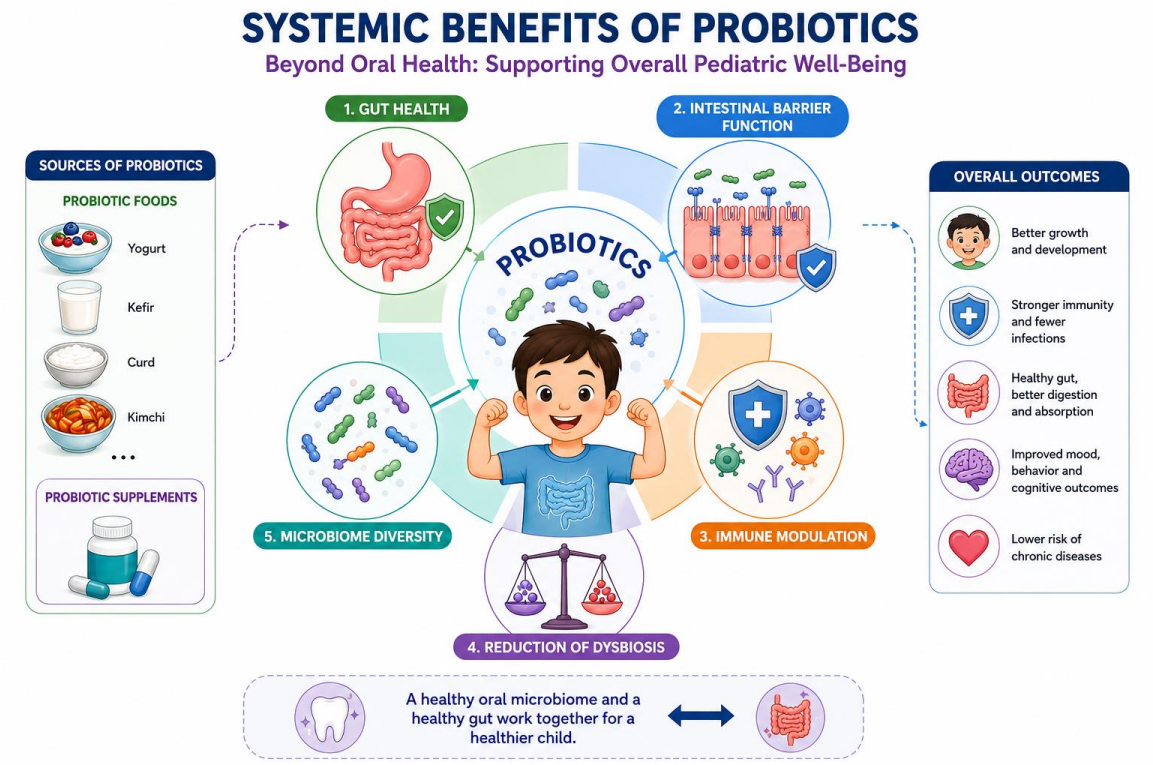

Figure 2. Systemic effects of probiotics relevant to pediatric health.

Probiotics have effects beyond the mouth. They improve gut function, strengthen the intestinal barrier, regulate immune responses, reduce microbial dysbiosis, and promote a diverse, balanced microbiota. These mechanisms may indirectly contribute to better oral and overall health in children.

Limitations of Current Evidence

Although the findings are promising, evidence on the benefit of probiotics remains heterogeneous. There are considerable differences in the probiotic strains administered, the frequency and duration of use, delivery systems, study populations, and outcome measures. Such heterogeneity precludes direct comparability and makes it difficult to formulate uniform clinical recommendations. Many research papers state that one strain cannot be generalized with another strain when it comes to clinical findings.

A further critical limitation is the prevalence of short-term clinical trials with small sample sizes.[15] A decrease in the cariogenic bacterial count has been noted in the trials. Long-term evidence that these reduce caries has yet to be established. Several studies have suggested that beneficial probiotics may transiently colonize the oral cavity and that the effect may wane after supplementation is stopped.18 More randomized controlled trials with better designs and longer follow-up are needed to find the best strain, dosage protocol, delivery system, and long-term safety in children.

Safety Considerations

The usefulness of probiotics in pediatric dentistry must also take safety into account. Based on current evidence, probiotics are generally safe and well-tolerated in healthy children. Reports of adverse effects were minimal. In immunocompromised patients, children with severe systemic disorders, and individuals with indwelling medical devices, caution may be warranted due to rare occurrences of bacteremia and sepsis linked to probiotics in medically vulnerable groups. While such complications are very rare, additional long-term safety studies are needed to ascertain the overall risk-benefit profiles for regular probiotics use in pediatric practice.

Future Directions

Advances in microbiome, oral saliva diagnostics, and personalized dentistry may further enhance the roles of probiotics in children's oral health care. Recent methods such as synbiotics, postbiotics, and personalized probiotic formulations may offer opportunities to modulate the oral microbiome [27]. If research in these areas continues, it may lead to evidence-based probiotic therapies that can enhance preventive strategies and improve oral health outcomes in children.

Overall, there is a fair amount of literature that suggests that probiotics are a plausible and clinically beneficial adjunctive preventive strategy in pediatric dentistry. Although they cannot substitute for well-established preventive modalities such as fluoride and oral hygiene, probiotics could play a major role in maintaining oral microbial homeostasis, reducing cariogenic bacterial activity, and enhancing oral health outcomes in children.

CONCLUSION

Probiotics are a novel adjunctive tool in pediatric dentistry due to their ability to modulate the oral microbiome and reduce the cariogenic bacteria activity. Evidence indicates they may help prevent early childhood caries, improve gingival health, reduce malodor, and prevent enamel demineralization during orthodontic treatment. While probiotics should not replace traditional preventive methods, including fluoride and oral hygiene practices, they may be helpful additions to pediatric oral care.

We need standardized long-term clinical trials to identify optimal strains and dosing protocols and to establish long-term safety in children.

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REFERENCES

1. Featherstone JDB. The continuum of dental caries—evidence for a dynamic disease process. *J Dent Res*. 2004;83(Spec Iss C):C39–C42.
2. Petersen PE. The burden of oral disease: challenges to improving oral health in the 21st century. Bull World Health Organ. 2005;83:3
3. Jose A, Subbiah GK, Rao A, Shenoy R. Early childhood caries prevalence in India: a systematic review and meta-analysis. Indian J Dent Res. 2022;33:157-64.
4. Fejerskov O, Kidd EAM. Dental Caries: The Disease and Its Clinical Management. 3rd ed. Oxford: Wiley Blackwell; 2015.
5. Loesche WJ. Role of Streptococcus mutans in human dental decay. Microbiol Rev. 1986;50:353-80.
6. Marsh PD. Are dental diseases examples of ecological catastrophes? *Microbiology*. 2003;149(2):279–294.
7. Buzalaf MAR, Levy SM. Fluoride intake of children: considerations for dental caries and dental fluorosis. Monogr Oral Sci. 2011;22:1-19.
8. Dzidic M, Collado MC, Abrahamsson T, et al. Oral microbiome development during childhood. ISME J. 2018;12:2292-306.
9. FAO/WHO. Guidelines for the Evaluation of Probiotics in Food. Report of a Joint FAO/WHO Working Group. London, Ontario, Canada; 2002.
10. Lin X, Chen X, Tu Y, Wang S, Chen H. Effect of probiotics on dental caries prevention in children: a systematic review and meta-analysis. Front Cell Infect Microbiol. 2023;13:1193487.
11. Laleman I, Detailleur V, Slot DE, et al. Probiotics reduce mutans streptococci counts in humans: a systematic review. Clin Oral Investig. 2014;18:1539-52.
12. Shi J, Tong Z, Xue Y, Deng D. Efficacy of probiotics against dental caries in children. BMC Oral Health. 2022;22:527.
13. Invernici MM, Salvador SL, Silva PHF, et al. Effects of Bifidobacterium probiotic on the treatment of chronic periodontitis. J Clin Periodontol. 2018;45:1198-210.
14. Cildir SK, Germec D, Sandalli N, et al. Reduction of salivary mutans streptococci in orthodontic patients. Eur J Orthod. 2009;31:407-11.
15. Haukioja A. Probiotics and oral health. Eur J Dent. 2010;4:348-55.
16. Rodríguez G, Ruiz B, Faleiros S, et al. Probiotic compared with standard milk for high-caries children. Caries Res. 2016;50:488-95.
17. Teughels W, Loozen G, Quirynen M. Opportunities to manipulate periodontal microbiota with probiotics. J Clin Periodontol. 2011;38:159-77.
18. Laleman I, Teughels W. Probiotics in dental practice: a review. Quintessence Int. 2015;46:255-64.
19. Homayouni Rad A, Pourjafar H, Mirzakhani E. A comprehensive review of the application of probiotics and postbiotics in oral health. *Front Cell Infect Microbiol*. 2023;13:1120995.

20. Tagg JR, Harold LK, Jain R, Hale JDF. Beneficial modulation of human health in the oral cavity and beyond using bacteriocin-like inhibitory substance-producing streptococcal probiotics. *Front Microbiol*. 2023;14:1161155.
21. Beattie RE. Probiotics for oral health: a critical evaluation of bacterial strains. *Front Microbiol*. 2024;15:1430810
22. Allaker RP, Stephen AS. Use of probiotics and oral health. *Curr Oral Health Rep*. 2017;4(4):309–318.
23. Gruner D, Paris S, Schwendicke F. Probiotics for managing caries and periodontitis: systematic review and meta-analysis. *J Dent*. 2016;48:16–25.
24. Marco ML, Sanders ME, Gänzle M, et al. The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on fermented foods. *Nat Rev Gastroenterol Hepatol*. 2021;18(3):196–208.
25. Hill C, Guarner F, Reid G, et al. Expert consensus document: The International Scientific Association for Probiotics and Prebiotics consensus statement on the scope and appropriate use of the term probiotic. *Nat Rev Gastroenterol Hepatol*. 2014;11(8):506–514.
26. Salminen S, Collado MC, Endo A, et al. The International Scientific Association of Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of postbiotics. *Nat Rev Gastroenterol Hepatol*. 2021;18(9):649–667.
27. Figures 1 and 2 were created using ChatGPT (OpenAI) based on author-designed prompts and adapted for scientific illustration.