Review Article

Oral Probiotics and Their Impact on Oral Health: Narrative Review

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Submission: August 13, 2025 Accepted: September 22, 2025 Published: September 30, 2025

Abstract

On the way to define the scientific literature on the practices then tender of probiotics. Probiotics are living germs existing in the oral cavity; gut by way of intestine and these are engaged by way of nutrition besides oral complements. There have been issued revisions recording on the inhibitor properties of probiotic microbes on the salivary heights of bacterial pathogens. However, there have not been but rare studies on the scientific profits of oral probiotic remedy. According to the research publications, strains including *Lactobaccillus* and *Bifidobacterium* shown beneficial effects in reducing bacterial plaque, including *S. mutans*, in various populations across both short- and long-term periods. Numerous readings have been showed concerning the practice of probiotics in dentistry. To find out more specifically which species support oral health, research using multiple bacterial species and delivery systems is required. Probiotics treat a variety of oral conditions, including periodontal diseases, dental cavities, and halitosis. The market today offers a wide variety of oral probiotic products, and both the more recent and similar items are in high demand. Understanding the impact of oral probiotics on oral fitness, hazard influences, protection, practice, incidence, and potential future uses is made easier by the oral probiotic study.

Keyword: Oral probiotics, Lactobacillus, Bifidobacterium, dental plaque, oral health

Introduction

Probiotics, whether found in food products or pills, have become the most popular ingredient in the era of functional foods. An essential element and lucrative endeavor for potential health benefits, Probiotics have been around for a while [1,2]. The term "probiotic" was first used by Werner Kollath in 1953. It is a term that combines the Latin pro and the Greek βιο, meaning "for life." According to Kollath, probiotics are active substances that play crucial functions in supporting a range of health characteristics [3]. The World Health Organization (WHO) and Food and Agriculture Organization (FAO) defined them as "live microbes that confer health benefits on host organisms when administered in adequate quantities" [4]. According to [1,5], a number of microbes from the categories *Pediocccus, Lactococus, Entrococcus, Streptococus, Propionbacterium, and Bacillus* are thought to stand prospective microorganisms for probiotic rank Table (1) show microorganisms accepted as probiotics.

Table1: Microbes that are recognized as probiotcs.

Lactobacilus sp.	*L. acidophlus, L. rhamnsus L. gaseri, L. casi L.reueri, L. planarm, L. salivarus L. johnsoni, L. galinarum, L. plantarum, L. fermntum L. helvticus, L. brevis L. murinus, L. crispats, L. amylovors*
Bifidobacterum sp.	*B. infantis, B. longum B. lactis, B. adolasentis B. bifidum, B. animalis B. breve, B. thermophlum B.pseudolngum*

Yeast	*S. bolardi, S. lactis, S. carlsbergnsis, Klyveromyces marxianu, S. cerevisae*
Other microorganisms	*B. subtils, B. lichniformis, Enterococus fecalis, E. fecium, Leuconostoc mesentroides L. lactis, L. citrum, Pediococus acidilactci, P. pentosacus, Proponibacterium freudenreichi, Streptococus salivaris*

Prior to using any microbial strain as a probiotic, safety and functionality requirements must be met. Genetic stability, bile and acid tolerance, adhesion to the intestinal lining, anti-genotoxic qualities, non-pathogenicity, lactic acid production, resistance to severe processing conditions, and reduced generation time are some of these requirements [6]. According to [7], probiotics work by strengthening the epithelial wall, encouraging bacterial linkage to the gastric mucosa although inhibiting pathogen bond, regulating the immune system, and producing biochemical that can inhibit the development of harmful microbes. These antibacterial substances have an active protein component and are referred to as bacteriocins. Additionally, these bacteria generate diacetyl, hydrogen peroxide (H_2O_2), and small series fatty acids (SCFAs), which alter the gastric microbiota and have beneficial health effects [8]. These bacteriocins can be produced by nearly any strain of *Lactobacilli* and *Bifidobacteria*. Studies reveal that *Lactobacilli* are the residential oral flora that may be crucial to maintaining the microbial balance in the oral cavity, despite the fact that the microorganisms commonly referred to as probiotics do not naturally inhabit the oral cavity [9]. It is unknown how often *Lactobacilli* are in the oral cavity naturally because they are frequently consumed, which causes colonies to form temporarily. People's health should benefit from a probiotic strain. It must be safe for humans and non-toxic [10]. As living cells, they must exist, talented of persisting and thriving in the physiological atmosphere and should be capable to last in both field and storage conditions. Additionally, probiotics can survive passage through the digestive tract colonize and adhere to intestinal epithelia. It should have the capacity to maintain strong viability [11]. It should consume the substrates and nutrients involved in a normal food. It must remain non-poisonous and non-pathogenic. It necessity have the capacity to positively impact the crowd. It must to be safe for the host, non-carcinogenic, and able to produce lactic acid. It should strengthen the host's immune system [12].These types of probiotics work naturally as a treatment to stop common mouth illnesses. Probiotic food items such as probiotic gums, yogurt, and Yakut, probiotic toothpastes to increase the number of probiotics in the oral cavity [13]. Probiotics work by creating bacitracin and small-chain fatty acids, lowering the pH of the gut, competing for nutrients to stimulate the function of the mucosal barrier, and immunomodulation [14]. In order to prevent the ensuing dental problems, probiotics often work by competing with the harmful bacterial strains [15]. As a result, probiotics may be used as therapeutic adjuncts or as an alternative to conventional treatments. This is a developing area of study where there is mounting proof of the effectiveness and safety of using these kinds of products. Figure (1) show possible ways that dental health may be impacted by probiotic bacteria [16].

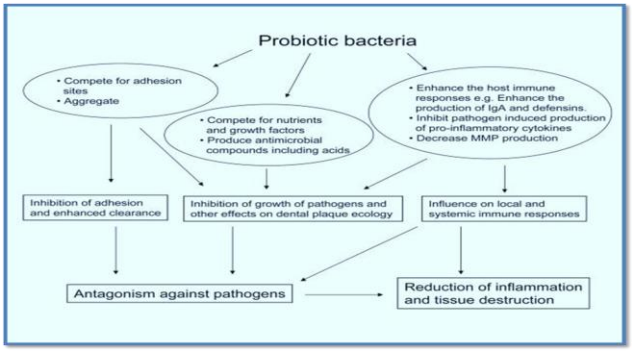

Figure1: Possible ways that dental health may be impacted by probiotic bacteria [17].

The Oral Microbiome

The patient's oral health status is determined by the oral cavity microbiome. Oral disorders are brought on by the bacteria that cause dysbiosis, which is caused by bacterial plaque in the mouth when there is an imbalance [18]. A colony of bacteria arranged in biofilms makes up the oral microbiome. These biofilms are intricately structured and functional polymicrobial communities that are affixed to the oral mucosa's soft and hard tissues and entrenched in an extracellular matrix. Dental conditions such caries, gingivitis, periodontia, and peri-implantitis can all be brought on by the development of pathogenic biofilms (19-21), Figure (2) show the special effects of PBs on oral health.

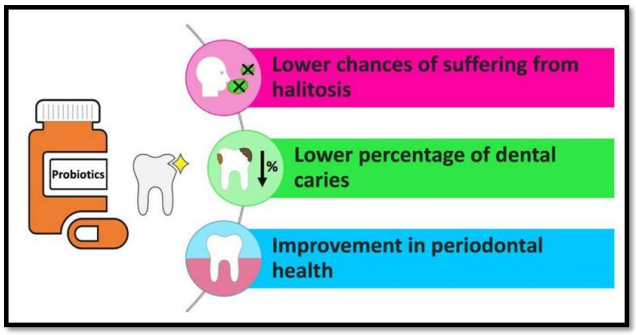

Figure 2: Special effects of PBs on oral health [22].

Oral and Biofilm Diseases

Because different ecological niches exist in altered portions of the oral cavity, biofilm organization differs as well. Grame-negativ, anarobic, and protolytic types are originate in the subgingval region, while facultatively anarobic, saccharolytic anaerobic bacteria from the genera *Actinomycs*, *Veillonelag*, *Granulicatlla*, *Streptococus*, and *Rothia* are the predominant species in the supragingival zone [20, 21]. Gram-negative, anaerobic, and proteolytic organisms can be identified in the subgingival area. Anaerobic and proteolytic microbes stand prevalent in the subgingival sector. It has been noted that the biofilm's organisms exist before a layer of macromolecules. At first, it was believed that salivary glycoproteins were the main source of this layer. Nonetheless, a recent study found that gingival crevicular fluid significantly contributed to the development of this layer [23]

Preventive Medications

According to numerous studies, probiotics are animate germs that, when assumed in adequate amounts, provide benefits for preserving or enhancing host health. One benefit of taking probiotics, for instance, is that they can control the host's immune response and prevent periodontal bacterial plaque [24, 25]. Consequently, they can aid in reducing periodontal inflammation, reversing dysbiosis, and improving biofilm control [26].

Dental caries Prevention and Probiotics

Changes in nutrition, poor oral hygiene practices, medication use that can modify salivary flow, and immune response variations are some of the predisposing variables that contribute to the development and spread of carious processes [27]. The most prevalent bacterial microbe that causes the deminralization of dental coating and the start of a carious development, *S. mutans*, therefore appears [28]. Probiotics can prevent periodontal disease and promote periodontal health.

Periodontal Health Probiotics

The lenient and firm tissues of the teeth, including the gingiva and periodontal tendon, are involved in the inflammatory process of chronic periodontitis, which is regarded as a mostly polymicrobial illness. However, if treatment is not received, it is linked to other systemic alterations [23]. Bacteria like *Lactobaccus* and *Lactobacterium* species. The capacity of certain

strains, including *Bifidobacterium* and *Lactobacillus*, to modify periodontal biofilm has been identified. When *Bifidobacterium anmalis* is tested, a decrease in biofilm gingival irritation and an upgrading in the pathogenic microorganisms of periodontal disorders were examples of virulence that was noted [29, 30]. These research' findings demonstrate that *Bifdobacterium animalis* is linked to a decrease in the biofilm's virulence as gingival inflammation and a reduction in the harmful microbes that cause periodontal illness.

Probiotics in Relative to Halitosis

Halitosis is a condition that canister negatively affect a person's social and professional life as well as their quality of life because of the disagreeable perfume that arises from their inhalation [31]. It can be initiated by a range of reasons, including food, deprived oral sanitation, ailments involving the periodontal region, sores, absence of salivary current, using prosthetics, and consuming toxic substances like alcohol and tobacco, midst others [32]. In order to healthier regulator halitosis, the patient should follow convinced usages or modify their conducts, such as using mouthwashes, periodontal management, and implementing probiotics. The use of mouthwashes, periodontal healing, and the usage of additions such interdental confrontations for improved cleanness and tongue coating washing are certain of the therapies or behavioral changes that the patient should undertake for better control of halitosis. Furthermore, halitosis can be fought using a variety of tools, including probiotics [33]. Numerous studies have demonstrated the potential of *Lactobacillus* strains, the active component of probiotics, to treat foul breath [34].

Orthodontics and Probiotics

According to earlier research, the implantation of fixed orthodontic appliances has been connected to higher levels of *S. mutans*, which are thought to be a significant risk factor for dental caries [35]. In dentistry, individuals undergoing orthodontic management or wearisome secure prostheses on dental grafts depend supplementary on probiotic or chemical washing to get rid of microbial plaque than on scrubbing or mouthwash [36].

Active Probiotic in the Oral Cavity

The oral cavity's microorganisms stand clustered into biofilms and carry out a variety of tasks, including immunity, digestion, detoxification, and homeostasis regulation. In spite of this, probiotics exist to support dental health [16]. Postbiotic lactic acid microbes stood demonstrated to decrease establishment of *A. actinomycetcomitans*, which is linked to periodontal illness, in an in vitro investigation [37]. According to other research, using the probiotic straining *Bifidobactrium lactis* HN019 topically guards in contradiction of the damage of connective tissue connection and alveolar bone caused by periodontitis [38]. Additionally, it has been demonstrated that using this strain in conjunction with periodontitis therapy results in additional clinical improvements, including decreased bleeding on probing, clinical attachment gain, and decreased probing pocket depth [39]. Furthermore, it has been demonstrated that using this strain in conjunction with periodontitis treatment outcomes in further experimental advantages such compact hemorrhage on penetrating, clinical attachment gain, and reduced penetrating portable depth.

Rinses Based on Probiotic and Chemical

The efficiency of mouthwashes like chlorhexidine has made them extremely popular. Other medicines to reduce *S. mutans* activity are being considered, nevertheless, due to negative consequences linked to their use [40]. However,

in order to assess its impact on individuals with periodontitis, research has been done on a probiotic rinse that contains *Lactobacllus salivaius* and *Lactobacilus reutri*. According toward the findings, using this mouthwash for 15 days in conjunction with a method for removing calculus and plaque can greatly lower the plaque index, improving dental health. According to the findings, using this mouthwash for 15 days in conjunction with a method for removing calculus and plaque will greatly lower the plaque index, supporting oral health [41].

Conclusion

The most tested and researched strains, inside the constraints of this works evaluation and rendering to the data referred, were *Lactobacillus* and *Bifidobacterium*; the majority of these strains demonstrated beneficial effects in reducing bacterial plaque, including *S. mutans*, in patients of all ages. Furthermore, their effectiveness was contrasted with probiotic-based mouthwashes, which similarly shown a decrease in biofilm. As a result, it promotes the patient's established dental hygiene and the eating of a sugar-free, balanced diet. In conclusion, a significant amount of research has been done on the use of probiotics in dentistry. To more precisely identify which species support oral health and to detect the arithmetical consequence of probiotic achievement in contradiction of oral illnesses, more thorough research involving various bacterial species, different delivery systems, and long-term follow-up is required

Conflict of interest

None

References

[1] Hamad GM, Amer A, el-Nogoumy B, Ibrahim M, Hassan S, Siddiqui SA, et al. Evaluation of the effectiveness of charcoal, Lactobacillus rhamnosus, and Saccharomyces cerevisiae as aflatoxin adsorbents in chocolate. Toxins. 2022;15:21.

[2] Sanz Y, Portune K, Gómez del Pulgar EM, Benítez-Páez A. Targeting the microbiota: considerations for developing probiotics as functional foods. In: The gut-brain axis. Oxford: Elsevier Science Ltd; 2016. p. 17–30.

[3] Gasbarrini G, Bonvicini F, Gramenzi A. Probiotics history. J Clin Gastroenterol. 2016;50:S116–S119.

[4] Munir A, Javed GA, Javed S, Arshad N. Levilactobacillus brevis from carnivores can ameliorate hypercholesterolemia: in vitro and in vivo mechanistic evidence. J Appl Microbiol. 2022;133:1725–1742.

[5] de Brito Alves JL, de Sousa VP, Cavalcanti Neto MP, Magnani M, Braga VA, da Costa-Silva JH, et al. New insights on the use of dietary polyphenols or probiotics for the management of arterial hypertension. Front Physiol. 2016;7:448.

[6] de Melo Pereira GV, de Oliveira Coelho B, Magalhães Júnior AI, Thomaz-Soccol V, Soccol CR. How to select a probiotic? A review and update of methods and criteria. Biotechnol Adv. 2018;36:2060–2076.

[7] Bermudez-Brito M, Plaza-Díaz J, Muñoz-Quezada S, Gómez-Llorente C, Gil A. Probiotic mechanisms of action. Ann Nutr Metab. 2012;61:160–174.

[8] Hawrelak JB. Probiotics. In: Pizzorno JE, Murray MT, editors. Textbook of natural medicine. 4th ed. Elsevier; 2013. p. 979–994.

[9] Meurman JH. Probiotics: do they have a role in oral medicine and dentistry? Eur J Oral Sci. 2005;113:188–196.

[10] Salminen S, Nybom S, Meriluoto J, Collado MC, Vesterlund S, El-Nezami H. Interac-

tion of probiotics and pathogens benefits to human health? Curr Opin Biotechnol. 2010;21:157–167.

[11] Fernández MF, Boris S, Barbes C. Probiotic properties of human lactobacilli strains to be used in the gastrointestinal tract. J Appl Microbiol. 2003;94:449–455.

[12] Kashwani R, Bahadur R, Sawhney H, Kumari A, Kumar S. What your tongue color can tell you: understanding your health. JCHR. 2023;13:10–18.

[13] Thomas B, Avadhani M, Bhat KM. Probiotics—a new mileu in periodontics. World J Pharm Res. 2015;4:923–942.

[14] Plaza-Diaz J, Ruiz-Ojeda FJ, Gil-Campos M, Gil A. Mechanisms of action of probiotics. Adv Nutr. 2019;10 (Suppl 1): S49–S66.

[15] Alok A, Singh ID, Singh S, Kishore M, Jha PC, Iqubal MA. Probiotics: a new era of biotherapy. Adv Biomed Res. 2017;6:1–8.

[16] Kilian M, Chapple IL, Hannig M, Marsh PD, Meuric V, Pedersen AM, et al. The oral microbiome: an update for oral healthcare professionals. Br Dent J. 2016;221:657–666.

[17] Haukioja A. Probiotics and Oral Health. Eur J Dent. 2010;4(3):348–355.

[18] Eick S. Oral biofilms. In: Lussi A, Buzalaf MAR, editors. Monographs in Oral Science. Basel: Karger Publishers; 2021.

[19] Haukioja A. Probiotics and oral health. Eur J Dent. 2010;4:348–355.

[20] Jiao Y, Tay FR, Niu LN, Chen JH. Advancing antimicrobial strategies for managing oral biofilm infections. Int J Oral Sci. 2019;11:28–30.

[21] Shaalan O, Gad HMA, Riad MI. Comparison of antibacterial effect of probiotic yogurt and xylitol-containing chewing gum in geriatric patients: a randomized controlled clinical trial. Acta Stomatol Croat. 2021;55:380–389.

[22] Inchingolo F, Inchingolo AM, Malcangi G, De Leonardis N, Sardano R, Pezzolla C, et al. The benefits of probiotics on oral health: systematic review of the literature. Pharmaceuticals. 2023;16:1313.

[23] Ghasemi E, Mazaheri R, Tahmourespour A. Effect of probiotic yogurt and xylitol-containing chewing gums on salivary S mutans count. J Clin Pediatr Dent. 2017; 41:257–263.

[24] Odanaka H, Obama T, Sawada N, Sugano M, Itabe H, Yamamoto M. Comparison of protein profiles of the pellicle, gingival crevicular fluid, and saliva: possible origin of pellicle proteins. Biol Res. 2020;53:2.

[25] Ikram S, Hassan N, Baig S, Borges KJJ, Raffat MA, Akram Z. Effect of local probiotic (Lactobacillus reuteri) vs systemic antibiotic therapy as an adjunct to non-surgical periodontal treatment in chronic periodontitis. J Investig Clin Dent. 2019;10:e12393.

[26] Costacurta M, Sicuro L, Margiotta S, Ingrasciotta I. Clinical effects of Lactobacillus reuteri probiotic in treatment of chronic periodontitis: a randomized controlled trial. Oral Implant. 2018;11:191–198.

[27] Amato M, di Spirito F, D'Ambrosio F, Boccia G, Moccia G, de Caro F. Probiotics in periodontal and peri-implant health management: biofilm control, dysbiosis reversal, and host modulation. Microorganisms. 2022;10:2289.

[28] Jurić H, Škrinjarić I, Bošnjak A. Effectiveness of different preventive procedures in the control of some caries risk factors. Acta Stomatol Croat. 2007; 41:39–48.

[29] Wu F, Fang B, Wuri G, Zhao L, Liu F, Zhang M. Metagenomic analysis reveals a mitigating role for Lactobacillus paracasei and Bifidobacterium animalis in experimental periodontitis. Nutrients. 2022; 14: 2125.

[30] Jäsberg H, Tervahartiala T, Sorsa T, Söderling E, Haukioja A. Probiotic intervention influences the salivary levels of matrix metalloproteinase (MMP)-9 and tissue inhibitor of metalloproteinases (TIMP)-1 in healthy adults. Arch Oral Biol. 2018; 85:58–63.

[31] Schumacher MG, Zurcher A, Filippi A. Evaluation of a halitosis clinic over a period of eleven years. Swiss Dent J. 2017; 127:846–851.

[32] Herman S, Lisowska G, Herman J, Wojtyna E, Misiolek M. Genuine halitosis in patients with dental and laryngological etiologies of mouth odor: severity and role of oral hygiene behaviors. Eur J Oral Sci. 2018;126:101–109.

[33] Patil S, Acharya S, Hathiwala S, Singhal DK, Srinivasan SR, Khatri S. Evaluation of the efficacy of G32 (commercially available ayurvedic preparation) in reducing halitosis: a randomized controlled trial. J Clin Diagn Res. 2017;11:79–83.

[34] Penala S, Kalakonda BR, Jayakumar A, Koppolu P, Lakshmi BV, Pandey R, et al. Efficacy of local use of probiotics as an adjunct to scaling and root planing in chronic periodontitis and halitosis: a randomized controlled trial. J Res Pharm Pract. 2016;5:86–93.

[35] Mummolo S, Nota A, Albani F, Marchetti E, Gatto R, Marzo G, et al. Salivary levels of Streptococcus mutans and Lactobacilli and other salivary indices in patients wearing clear aligners versus fixed orthodontic appliances: an observational study. 2020;15:2–10.

[36] Dehghani M, Abtahi M, Hasanzadeh N, Noori M, Noori M. Effect of propolis mouthwash on plaque and gingival indices over fixed orthodontic patients. J Clin Exp Dent. 2019;11:244–249.

[37] Ishikawa KH, Bueno MR, Kawamoto D, Simionato MR, Mayer MP. Lactobacilli postbiotics reduce biofilm formation and alter transcription of virulence genes of Aggregatibacter actinomycetemcomitans. Mol Oral Microbiol. 2021;36:92–102.

[38] Ricoldi MST, Furlaneto FAC, Oliveira LFF, Teixeira GC, Pischiotini JP, Moreira ALG, et al. Effects of the probiotic Bifidobacterium animalis subsp. lactis on the non-surgical treatment of periodontitis: a histomorphometric, microtomographic and immunohistochemical study in rats. PLoS One. 2017;12:e0179870.

[39] Invernici MM, Salvador SL, Silva PHF, Soares MSM, Casarin R, Palioto DB, et al. Effects of Bifidobacterium probiotic on the treatment of chronic periodontitis: a randomized clinical trial. J Clin Periodontol. 2018;45:1198–1210.

[40] Yousuf A, Nagaraj A, Ganta S, Sidiq M, Pareek S, Vishnani P, et al. Comparative evaluation of commercially available freeze-dried powdered probiotics on mutans streptococci count: a randomized, double-blind, clinical study. J Dent. 2015;12:729–738.

[41] İnce G, Gürsoy H, İpçi ŞD, Cakar G, Emekli-Alturfan E, Yılmaz S. Clinical and biochemical evaluation of lozenges containing Lactobacillus reuteri as an adjunct to non-surgical periodontal therapy in chronic periodontitis. J Periodontol. 2015;86:746–754.