TPM Vol. 32, No. S5, 2025
ISSN: 1972-6325
https://www.tpmap.org/

Open Access

PROBIOTICS IN ORAL HEALTH – A REVIEW

[1] D. RAMYA
POST GRADUATE STUDENT, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY, SREE BALAJI DENTAL COLLEGE AND HOSPITAL, BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH (BIHER), BHARATH UNIVERSITY, CHENNAI, TAMIL NADU, INDIA.

[2]N. ARAVINDHA BABU
PROFESSOR & HEAD, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY, SREE BALAJI DENTAL COLLEGE AND HOSPITAL, BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH (BIHER), BHARATH UNIVERSITY, CHENNAI, TAMIL NADU, INDIA.

[3] L.MALATHI
READER, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY, SREE BALAJI DENTAL COLLEGE AND HOSPITAL, BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH (BIHER), BHARATH UNIVERSITY, CHENNAI, TAMIL NADU, INDIA.

[4] ANITHA N
READER, DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY, SREE BALAJI DENTAL COLLEGE AND HOSPITAL, BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH (BIHER), BHARATH UNIVERSITY, CHENNAI, TAMIL NADU, INDIA.

[5]M SANDHYAPRIYA
SAVEETHA MEDICAL COLLEGE, SAVEETHA INSTITUTE OF MEDICAL AND TECHNICAL SCIENCES.

Abstract
Probiotics are supplements that contain beneficial yeasts or bacteria. They are provided in different quantities to promote effective colonization. These compounds support both the reduction of pathologic colonization and disease transmission as well as the activation of flora that promote wellness. According to definitions, probiotics are "live bacteria that, when given in sufficient quantities, confer a health benefit on the host." Among other therapies, antibiotics, immunosuppressive drugs, and radiation may change the makeup and affect the gut flora. Therefore, reestablishing microbial balance and averting disease may be made easier by introducing beneficial bacteria species into the gastrointestinal tract. Probiotic use in dentistry has become increasingly important as oral infections have become the most common type of infections in humans.

Keywords: Oral probiotics, probiotics in caries, probiotics in oral health and probiotics.

INTRODUCTION

The term "probiotic," derived from the Greek word meaning "for life," refers to "live microorganisms that, when given in sufficient amounts, benefit the host," according to experts from the World Health Organization and the Food and Agriculture Organization. Historically, the primary aim of developing probiotics has been to alter the gut microbiota. A innovative strategy is to shift the microbial ecological balance from pathogenic to non-pathogenic. The mouth cavity is a complicated system with a diversified microbiota. The purpose of this review is to evaluate the role of probiotics, particularly in relation to oral health.

Probiotics strains in oral cavity

The most widely utilized probiotic bacterial strains are those belonging to the genera Lactobacillus and Bifidobacterium[1]. It is thought that these bacterial species make up a typical portion of the human microbiome. Species such as L. paracasei, L. plantarum, L. rhamnosus, and L. salivarius are frequently isolated using saliva samples. Breast milk contains bifidobacteria, which are among the earliest anaerobes in the mouth according to studies, suggesting early contact to these bacteria. Three different species of Bifidobacterium have been identified from oral samples: Bifidum bifidum, Bifidum dentium, and Bifidum longum.[2-4]

Most people consider bifidobacteria and lactobacilli to be safe, and since Metchnikoff's early writings, consuming more fermented foods has been associated with health benefits. Regarding their normal microbiota and dental health, lactobacilli isolated from people with active caries appear to be less able to suppress Streptococcus mutans in vitro than lactobacilli from healthy people. Furthermore, the Lactobacillus and Bifidobacterium microbiotas of

individuals with periodontitis and those in good periodontal health differ in species. However, bifidobacteria and lactobacilli are linked to dental cavities. Furthermore, it has been established that the lactobacilli and bifidobacteria connected to dental caries are opportunistic invaders that could have gotten into the body via food. Several research conducted in the past several years have revealed that probiotic microorganisms intended for gut health may also improve oral health.

PROBIOTIC ORAL BENEFITS' MECHANISMS

Probiotics can generally be categorized into three functions: metabolic effects, immune response modulation, and normalization of gut flora. The mechanisms by which probiotics operate in the oral cavity and the stomach may be similar. Figure 1 illustrates some potential effects of probiotics on dental health. Although probiotic therapy seems to have no significant impact on overall sIgA levels in saliva, the possibility of systemic effects cannot be entirely dismissed. Up until now, it has been believed that oral colonization by probiotic bacteria is required for them to demonstrate oral advantages.[5,6] It's interesting to note that breast milk composition appears to be impacted by the probiotic strains that mothers use[7]. Evidence suggests that commensal oral microorganisms might contain bacteria beneficial for identifying, managing, or preventing oral health issues. It has been proposed that rather than relying on just a few well-studied strains, many different species may offer specific probiotic benefits that are scientifically supported. The ecological plaque theory states that the balance between dental health and illness may change as a result of selection pressure in environmental conditions. The ecological plaque theory's description of environmental pressure may include bacterial contributions since bacteria have the ability to influence their surroundings and interact both synergistically and antagonistically in dental plaque. Second, it is commonly known that healthy bacteria guard against infection in the mouth cavity. Lastly, it appears that some bacterial species are linked to oral health and that others are linked to oral illnesses.[8,9] It is controversial to say whether or not bacteria consumed through food can change the normally stable dental microbiota, especially in adults.

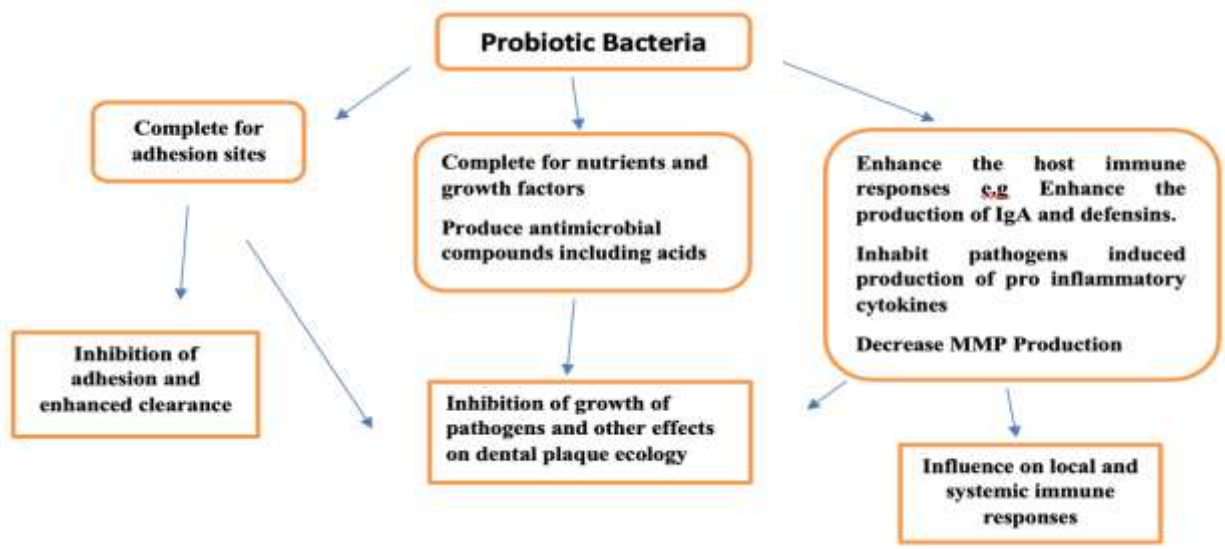

Fig 1: Potential effects of probiotics on oral health[5,6,7]

Probiotic Properties

The ideal probiotic formulation need to have the following qualities:[10]

- There is high cell viability.
- The probiotic strain's capacity to endure in the intestine in the event that it is unable to colonize there.
- The ability to engage and communicate with immune cells
- Adhesion to the intestinal epithelium to avert the flushing effects of peristalsis.
- They have to be human-made.
- It shouldn't be harmful.
- Resistant to processing.

Oral Health Benefits of Probiotics

Caries and Microbial Contributors

Generally, saliva shows lower amounts of mutans streptococci with the use of these products, although not all studies have consistently demonstrated this effect[11]. Variations in study results cannot be solely attributed to differences in probiotic strains, as inconsistent effects have been observed even with the same strains. Most studies

have also measured salivary lactobacilli, and evidence indicates an increase in salivary Lactobacillus with three different products. However, research on dental caries has often been limited. It is important to note that dental caries may not always be detectable in saliva, even when caries-associated bacteria are present. The microbiota found in unstimulated entire saliva actually resembles the tongue's more than dental plaque[12]. As such, it is difficult to get firm findings on the relationship between probiotic microorganisms and dental caries.

Gum conditions

The main emphasis of early studies on probiotics and dental health was periodontal inflammation. Patients with pregnancy-related gingivitis, periodontitis, and gingivitis received local treatments using a culture supernatant of an L. acidophilus strain; almost all of the patients reported notable improvements. Probiotics have gained attention recently as a possible therapy for periodontal disease. Bacillus subtilis, L. reuteri, L. brevis (CD2), L. casei Shirota, and L. salivarius WB21 are among the probiotic strains that were examined. Notably, better gingival health is indicated by reduced gum bleeding linked to L. reuteri and L. brevis14,16. In saliva, L. brevis was shown to decrease MMP (collagenase) activity and other inflammatory indicators; in gingival crevicular fluid (GCF), probiotic chewing gum containing L. reuteri ATCC 55730 and ATCC PTA 5289 decreased pro-inflammatory cytokine levels. Using Bacillus subtilis and L. casei Shirota, there were no appreciable variations in gingival bleeding or plaque index between the test and control groups. The group taking the probiotic supplement showed decreased MPO activity, which suggested that their gingival inflammation was decreased after four days of experimental gingivitis. Furthermore, L. casei Shirota was successful in reducing the activities of MMP-3 and PMN elastase in GCF. B. subtilis appears to lower the incidence of periodontal pathogens[18]. Especially in high-risk groups like smokers, the usage of L. salivarius WB21 tablets has been linked to decreases in periodontopathogen levels in plaque and gingival pocket depth[19,20]. Even Nevertheless, the majority of the studies have been somewhat brief, even with the encouraging outcomes that have been shown. Furthermore, even though statistically significant differences were discovered in numerous research, these changes were frequently relatively modest.

Oral candida

The impact of probiotic microorganisms on human oral Candida infections has only been examined in two studies21. The incidence of elevated oral yeast counts decreased as a result of this management, although mucosal lesions did not change.

Halitosis

Although oral conditions like periodontitis may be a contributing factor, approximately 90% of halitosis cases originate in the mouth. Probiotics are being explored as potential treatments for halitosis originating from both the mouth and stomach. However, evidence supporting the effectiveness of specific probiotic strains or formulations is limited. Clinical studies have investigated strains such as Weissella confusa, S. salivarius K12, E. coli Nisle 1917, and a lactic acid-producing bacterial blend. [22,23]

Anticipated Trends

The potential of oral lactic acid bacteria and bifidobacteria to cure tooth cavities, halitosis, and periodontal diseases has been investigated. Genetic engineering has introduced new approaches to probiotics, including the modification of pathogenic strains found in the oral cavity. One strategy involves reducing the harmful traits of these pathogens so that the modified strain can replace the original pathogen. One noteworthy instance is the development of a strain of S. mutans that has had the lactate hydrogenase open reading frame deleted, greatly lowering its carcinogenicity. [24,25,26]

CONCLUSION

In recent decades, oral probiotics have gained increasing attention. Additionally, different probiotic species may be needed to address various oral health goals; for instance, distinct properties might be necessary for gingival versus dental health. Many health benefits of probiotic microorganisms have been extensively studied[2,3]. Numerous studies have explored the potential health benefits of probiotics, with most research traditionally focusing on the gastrointestinal tract. Probiotic therapy has been used to address various conditions, including inflammatory, neoplastic, allergic, and infectious diseases. Nevertheless, careful consideration is required before incorporating probiotics into a regular regimen. To ensure reliability and quality, certain essential standards and criteria must be met. Therefore, further rigorously designed, double-blind studies with validated outcomes are needed to accurately assess the health benefits of probiotics.

REFERENCES

1.Saxelin M, Tynkkynen S, Mattila-Sandholm T, de Vos WM. Probiotic and other functional microbes: from markets to mechanisms. *Curr Opin Biotechnol.* 2005;16:204–211.
2.Maukonen J, Mätto J, Suihko ML, Saarela M. Intra-individual diversity and similarity of salivary and faecal microbiota. *J Med Microbiol.* 2008;57(Pt 12):1560–1568.
3.Crociani F, Biavati B, Alessandrini A, Chiarini C, Scardovi V. Bifidobacterium inopinatum sp. nov. and Bifidobacterium denticolens sp. nov., two new species isolated from human dental caries. *Int J Syst Bacteriol.* 1996;46:564–571.
4. Beighton D, Gilbert SC, Clark D, Mantzourani M, Al-Haboubi M, Ali F, et al. Isolation and identification of bifidobacteriaceae from human saliva. *Appl Environ Microbiol.*
5.Kekkonen RA, Lummela N, Karjalainen H, Latvala S, Tynkkynen S, Jarvenpaa S, et al. Probiotic intervention has strain-specific anti-inflammatory effects in healthy adults. *World J Gastroenterol.* 2008;14:2029–2036. [PMC free article] [PubMed] [Google Scholar]
6Paineau D, Carcano D, Leyer G, Darquy S, Alyanakian MA, Simoneau G, et al. Effects of seven potential probiotic strains on specific immune responses in healthy adults: a double-blind, randomized, controlled trial. *FEMS Immunol Med Microbiol.* 2008;53:107–113.
7.Rautava S, Kalliomaki M, Isolauri E. Probiotics during pregnancy and breast-feeding might confer immunomodulatory protection against atopic disease in the infant. *J Allergy Clin Immunol.* 2002;109:119–121.
8.Stingu CS, Eschrich K, Rodloff AC, Schaumann R, Jentsch H. Periodontitis is associated with a loss of colonization by Streptococcus sanguinis. *J Med Microbiol.* 2008;57(Pt 4):495–499
9.Riep B, Edesi-Neuss L, Claessen F, Skarabis H, Ehmke B, Flemmig TF, et al. Are putative periodontal pathogens reliable diagnostic markers? *J Clin Microbiol.* 2009;47:1705–1711.
10,Jung BG, Ko JH, Lee BJ. Dietary supplementation with a probiotic fermented four-herb combination enhances immune activity in broiler chicks and increases survivability against Salmonella gallinarum in experimentally infected broiler chicks. J Vet Med Sci 2010;72:1565-73.
11. Montalto M, Vastola M, Marigo L, Covino M, Graziosetto R, Curigliano V, et al. Probiotic treatment increases salivary counts of lactobacilli: a double-blind, randomized, controlled study. *Digestion.* 2004;69:53–56.
12. Mager DL, Ximenez-Fyvie LA, Haffajee AD, Socransky SS. Distribution of selected bacterial species on intraoral surfaces. *J Clin Periodontol.* 2003;30:644–654.
13. Kragen H. The treatment of inflammatory affections of the oral mucosa with a lactic acid bacterial culture preparation. *Zahnarztl Welt.* 1954;9:306–308.
14. Krasse P, Carlsson B, Dahl C, Paulsson A, Nilsson A, Sinkiewicz G. Decreased gum bleeding and reduced gingivitis by the probiotic Lactobacillus reuteri. *Swed Dent J.* 2006;30:55–60.
15. Della Riccia DN, Bizzini F, Perilli MG, Polimeni A, Trinchieri V, Amicosante G, et al. Anti-inflammatory effects of Lactobacillus brevis (CD2) on periodontal disease. *Oral Dis.* 2007;13:376–385.
16. Twetman S, Derawi B, Keller M, Ekstrand K, Yucel-Lindberg T, Stecksen-Blicks C. Short-term effect of chewing gums containing probiotic Lactobacillus reuteri on the levels of inflammatory mediators in gingival crevicular fluid. *Acta Odontol Scand.* 2009;67:19–24.
17. Staab B, Eick S, Knofler G, Jentsch H. The influence of a probiotic milk drink on the development of gingivitis: a pilot study. *J Clin Periodontol.* 2009;36:850–856.
18. Tsubura S, Mizunuma H, Ishikawa S, Oyake I, Okabayashi M, Katoh K, et al. The effect of Bacillus subtilis mouth rinsing in patients with periodontitis. *Eur J Clin Microbiol Infect Dis.* 2009;28:1353–1356.
19. Shimauchi H, Mayanagi G, Nakaya S, Minamibuchi M, Ito Y, Yamaki K, et al. Improvement of periodontal condition by probiotics with Lactobacillus salivarius WB21: a randomized, double-blind, placebo-controlled study. *J Clin Periodontol.* 2008;35:897–905.
20. Mayanagi G, Kimura M, Nakaya S, Hirata H, Sakamoto M, Benno Y, et al. Probiotic effects of orally administered Lactobacillus salivarius WB21-containing tablets on periodontopathic bacteria: a double-blinded, placebo-controlled, randomized clinical trial. *J Clin Periodontol.* 2009;36:506–513.
21. Hatakka K, Ahola AJ, Yli-Knuuttila H, Richardson M, Poussa T, Meurman JH, et al. Probiotics reduce the prevalence of oral candida in the elderly-a randomized controlled trial. *J Dent Res.* 2007;86:125–130.
22. Henker J, Schuster F, Nissler K. Successful treatment of gut-caused halitosis with a suspension of living non-pathogenic Escherichia coli bacteria-a case report. *Eur J Pediatr.* 2001;160:592–594.
23. Iwanicka-Grzegorek K, Lipkowska E, Kepa J, Michalik J, Wierzbicka M. Comparison of ninhydrin method of detecting amine compounds with other methods of halitosis detection. *Oral Dis.* 2005;11(Suppl 1):37–39.
24. Burton JP, Chilcott CN, Moore CJ, Speiser G, Tagg JR. A preliminary study of the effect of probiotic Streptococcus salivarius K12 on oral malodour parameters. *J Appl Microbiol.* 2006;100:754–764.
25. Kang MS, Kim BG, Chung J, Lee HC, Oh JS. Inhibitory effect of Weissella cibaria isolates on the production of volatile sulphur compounds. *J Clin Periodontol.* 2006;33:226–232.