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Probiotics: Eat What You Like And Let The Food Fight It Out Inside

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Abstract

Probiotics are live nonpathogenic microorganisms which provide health benefits by adding "good" microbes to fight against "bad" microbes. When effective, the good microbes reduce the bacterial threat of the bad microbes associated with caries, periodontal diseases and halitosis. Probiotics can benefit dental patients who have comorbidities such as type 1 diabetes, rheumatoid arthritis or high cholesterol etc. This article reviews the role of probiotics for management of periodontal diseases and explores its potential effectiveness as a novel treatment strategy.

Key-words: Probiotics, Periodontal Disease, Lactobacillus, Bifidobacterium.

Introduction

The term probiotic is derived from the Greek word, meaning "for life".(1) It was introduced in 1965 by Lilly & Stillwell as substances produced by microorganisms which promote the growth of other microorganisms. First probiotic species to be introduced in research was Lactobacillus acidophilus by Hull et al. in 1984; followed by Bifidobacterium bifidum by Holcomb et al. in 1991.(2,3)

Probiotics are classified by the United States Food and Drug Administration as dietary supplements or foods that can be extracted from plant or animal tissues. According to the currently adopted definition by FAO/WHO (The Food Agricultural Organization/World Health Organization), probiotics are living organisms, principally bacteria that are safe for human consumption and when ingested in sufficient quantities, have beneficial effects on human health, beyond the basic nutrition.(4)

The majority of microorganisms found in probiotics, are often delivered in noninvasive capsules, tablets or powder form, and are contained in various fermented foods, most commonly yogurt or dairy drinks. They are bacteria-based, but can also include molds and yeasts. There are at least six known strains from bacteria and one known strain from yeast. Each strain can have multiple species, such as bacteria-based *Lactobacillus*, which has at least 11 species. The effects of probiotics are benefit-specific, and two strains from the same species may not provide the same outcome in a patient. The rationale for using probiotics involves restoring microbial balance. Certain types of probiotics produce lactic acid, which is capable of suppressing the growth of different pathogenic microbes. Probiotics, most commonly belong to the genera - *Lactobacillus* and *Bifidobacterium*.

Lactobacillus species from which probiotic strains have been isolated include *L. acidophilus*, *L. johnsonii*, *L. casei*, *L. rhamnosus*, *L. gasseri*, and *L. reuteri*. *Bifidobacterium* strains include *B. bifidum*, *B. longum*, and *B. infantis*. (5)

Studies have shown that to be able to exert probiotic properties in the oral cavity it is essential for the micro-organisms. (6)

- To resist the oral environmental conditions and defences mechanisms
- To adhere to the saliva coated surfaces
- To colonize and grow in the mouth
- To inhibit oral pathogens and
- To be safe for the host.

Mechanism of Action of Probiotics

The treatment strategies conferred by probiotics against periodontal diseases are mainly anticipated to be either by inhibition of specific pathogens or by altering the host immune response through the following multiple factors: (7, 8, 9)

Inhibition of Specific Organisms

- Inhibition of pathogen adhesion, colonization and biofilm formation.
- Inhibition of pathogen growth by various substances such as organic acids, hydrogen peroxide and bacteriocins against oral pathogens.

Effects on Host Response

- Inhibition of collagenases and reduction of inflammation associated molecules.
- Induction of expression of cytoprotective proteins on host cell surfaces.
- Modulation of pro-inflammatory pathways induced by pathogens.
- Prevention of cytokine-induced apoptosis
- Modulation of host immune response.

Clinical Evidence of Probiotic Effectiveness In Periodontal Diseases

Streptococcus oralis and *Streptococcus uberis* are indicators of healthy periodontium. When these bacteria are absent from sites in the periodontal tissues, those sites become more prone to periodontal disease.(10)

Riccia et al. studied the anti-inflammatory effects of *Lactobacillus brevis* in a group of patients with chronic periodontitis. Anti-inflammatory effects

of *L. brevis* could be attributed to its capacity to prevent the production of nitric oxide and, consequently the release of PGE2 and the activation of MMPs induced by nitric oxide.(11)

Shimazaki and colleagues, in an epidemiological study found that individuals, particularly nonsmokers, who regularly consumed yogurt or beverages containing lactic acid exhibited lower probing depths and less loss of clinical attachment than individuals who consumed few of these dairy products. A similar effect was however not observed with milk or cheese. (12)

Krasse et al. found that intake of *L. reuteri* for a period of 14 days led to the establishment of the strain in the oral cavity and significant reduction of plaque in patients with moderate to severe gingivitis.(13)

According to Narva et al, during the fermentation process in milk, *Lactobacillus helveticus* produces short peptides that act on osteoblasts and increase their activity in bone formation. These bioactive peptides could thereby contribute in reducing bone resorption associated with periodontitis.(14)

Van Essche et al. have reported that *B. bacteriovorus*, attack and kill *A.actinomycetemcomitans*, thus suggesting a potential scope for the role of *B.bacteriovorus* in the prevention and treatment of periodontitis.(15)

A study done by Vivekananda MR, using Prodentis lozenges showed plaque inhibition, anti-inflammatory, and antimicrobial effects of Prodentis. The study proposed that probiotics could serve as a useful adjunct or alternative to periodontal treatment when SRP might be contraindicated.(16)

Shimauchi et al. demonstrated that the oral administration of a tablet containing *L.salivarius* WB21 decreased plaque index significantly and pocket probing depth markedly in smokers and reduced salivary lactoferrin at the end of 8-week trial.(17)

Twetman et al. used *L. reuteri*-containing chewing gum in 42 healthy patients and assessed its effects on crevicular fluid volume, cytokine (interleukin-1 β , interleukin-6, interleukin-10, and TNF- α) levels, and bleeding on probing. Crevicular fluid volume, as well as TNF- α and interleukin-8 levels, and bleeding were significantly reduced.(18)

Commercially Available Probiotics for Management of Periodontal Diseases

The worldwide treatment strategy applied for periodontal diseases is to make a reduction in the subgingival microflora but recolonization of these bacteria after treatment is possible. So, restoring these reduced numbers of beneficial bacteria via probiotic might be a considerable interest in the treatment of plaque-related periodontal disease. Probiotics might not only suppress the emergence of endogenous pathogens or prevent the superinfection with exogenous pathogens, they might also protect us through the promotion of a beneficial host response.

Gum PerioBalance (marketed by Sunstar, Etoy, Switzerland)

This is probably the first probiotic specifically formulated to fight periodontal disease. It contains a patented combination of two strains of *L.reuteri* specially selected for their synergistic properties

in fighting cariogenic bacteria and periodontopathogens. Each dose of lozenge contains at least 2×10^8 living cells of *L. Reuteri*. Users are advised to use a lozenge every day, either after a meal or in the evening after brushing their teeth, to allow the probiotics to spread throughout the oral cavity and attach to the various dental surfaces.(19)

Peri Biotic (Designs for Health, Inc)

This toothpaste is an all-natural, fluoride-free oral hygiene supplement containing Dental-Lac, a functional *Lactobacillus paracasei* probiotic not found in any other toothpaste.(19)

Bifidumbacterin, Acilact , Vitanar (marketed by Alfarm Ltd, Moscow, Russia)

This probiotic preparation of a complex of five live lyophilized lactic acid bacteria, is claimed to improve both clinical and microbiologic parameters in gingivitis and mild periodontitis patients. After routine mechanical debridement, 2 tablets, three times a day for 20-30 days is required for improved outcome.(20)

Wakamate D (Wakamoto Pharmaceutical Co , Tokyo, Japan)

This probiotic tablet contains 6.5×10^8 colony forming units (CFU) per tablet of *Lactobacillus salivarius* WB21 and xylitol (280 mg/ tablet). It was originally prepared to contribute for the intestinal microbial balance by providing acid tolerant *L. salivarius* WB21.(17)

Prodentis (BioGaia, Stockholm, Sweden)

This probiotic lozenge is a blend of two *Lactobacillus reuteri* strains containing a minimum of 1×10^8 colony forming units (CFU) for each of the strains DSM 17938 and ATCC PTA 5289. (16)

Summary

Good oral flora is the key to maintain oral health, as it actively reduces the risk of caries, periodontal diseases and halitosis. For these reasons, oral health care researchers generally agree the mechanism of probiotics deserve greater illumination. Probiotics offer an option for preserving oral health which, when used correctly, is safe, effective and noninvasive. Taken orally, probiotics are considered generally safe to use. Many probiotics appear on the market, but only products that have been tested in controlled human studies should be recommended. It is important to remember that the overall risk of developing an infection from ingested probiotics is very low particularly when used by generally healthy individuals. This literature review shows that the use of oral probiotics is associated with improvement in periodontal health. There is no doubt that with further significant progress, probiotics will definitely have an important role to play in the periodontal therapy.

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