



Probiotics in Periodontics: A Review

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Abstract

Probiotics are live micro-organisms that when administered in adequate amounts provide health benefits to the host. Studies suggest that probiotics act by direct inhibition of pathogenic micro-organisms, along with modulation of the mucosal immune system. Probiotic technology uses natural beneficial bacteria to provide a natural defense against the pathogenic bacteria species, thus maintain oral health. This review summarise the role of probiotics in periodontics.

Keywords: Bifi dobacterium; *Lactobacillus*; Probiotics

Introduction

According to FAO/WHO (The Food Agricultural Organization/World Health Organization), probiotics are living organisms, mainly bacteria that are safe for human consumption and when taken in sufficient quantities, have favourable effects on human health. First probiotic species found were *Lactobacillus acidophilus* and *Bifidobacterium bifidum* [1].

Microorganisms used as probiotics

More than 700 species of oral microbiota have been recognized in the human mouth and the oral microbiota of one individual may consist of 30-100 species [2]. For a microorganism to be an oral probiotic, it should be able to adhere and to colonize surfaces in the oral cavity [1] Probiotics as dietary supplements and foods consisting of yeast and bacteria [3] include

- Lactic Acid Producing Bacteria: *L. acidophilus*, *L. bulgaricus*, *L. casei*, *L. crispatus*, *L. reuteri*, *Streptococcus*.
- Non-Lactic Acid Producing Bacteria Species: *Bacillus cereus*, *Propionibacterium*, *Enterococcus faecalis*, *Enterococcus faecium*, *Escherichia coli* Nissle.
- Non-spore-forming and non-flagellated rod or Coccobacilli.
- Nonpathogenic yeast: *Saccharomyces*.

- *Bifidobacterium* species: *B. adolescentis*, *B. animalis*, *B. bifidum*, *B. breve*, *B. infantis*, *B. lactis*

Lactobacillus produces enzymes that help to digest and metabolize proteins and carbohydrates, aid in synthesis of vit. B and vit. K, facilitates breakdown of bile salts, enhance innate and acquired immunity and inhibit pro-inflammatory mediators.

Bifidobacterium metabolize lactose, produces lactic ions from lactic acid and synthesize vitamins, ferment indigestible carbohydrates and produce beneficial short chain fatty acids, prevent DNA damage and prevent or delay the onset of cancers.

Streptococcus thermophilus and *Lactobacillus bulgaricus* are primarily used as a culture in yogurt production. They metabolize lactose, improve lactose intolerance and antimicrobial activity.

Saccharomyces boulardii is a non-colonizing lactic acid producing yeast that breakdown bacterial enterotoxins and inhibits their binding to intestinal receptors by the secretion of proteases and other substances. They enhance vitamin production and decrease serum- cholesterol level [4].

Selection criteria of probiotics

For a microorganism to be used as a probiotic, following criteria have to be fulfilled [1]. It should be

- Have the potential of exerting a beneficial effect on the host, e.g., increased growth or resistance to disease.
- Human origin.
- Non-pathogenic and non-toxic.
- Able to interact or to transfer signals to immune cells.
- Have ability to influence local metabolic activity.
- Should be able to survive and metabolize in the gut environment e.g., resistance to low pH and organic acids.
- Stable and able to remain viable for longer time under storage and field conditions [1].
- Capable to withstand the oral environment conditions and defense mechanisms [3].

Mechanism of action

- **Direct interaction:** Binding of oral microorganism to proteins, inhibition of pathogen adhesion, colonization and biofilm formation, induction of cyto-protective proteins expression on host cell surfaces, and inhibition of collagenases.
- **Competitive exclusion:** Act on plaque and its ecosystem by competing and interfering with bacterial attachments and production of chemicals like organic acids, hydrogen peroxide and bacteriocins that inhibit oral bacteria.
- **Modulation of host immune response:** Effect on local immunity, leading to modulation in cell proliferation and cytokine induced apoptosis, regulating mucosal permeability, and hinder plaque induction by neutralizing the free electrons [5].

Commercially available probiotics

Probiotics are provided in the following ways

- A culture concentrate attached to a beverage or food (fruit juice, infant formulas, asparagus, soybeans)
- Inserted in prebiotic fibres
- Inserted in milk-based food (dairy products like milk, milk drinks, cheese, sour cream, smoothies, yoghurt)
- Concentrated and dried cells packed as dietary supplements (non-dairy products)
- Powder, capsule, gelatin tablets, sachets, gel, paste, granules [5].

Probiotics and periodontal diseases

Probiotic bacteria are utilized as oral replacement therapy, which adhere to dental tissues as part of the biofilm or plaque and compete with cariogenic and periodontal pathogens for colonization preventing caries, gingivitis and improving oral health [6].

- **Gingivitis:** Probiotics when administered in adequate amounts, may enhance the commensal flora and thus prevent the microbiological shift and colonization of true pathogens associated with gingival inflammation. Probiotics also modulate the mucosal immunity in the oral cavity [7].
- **Periodontitis:** *L. helveticus* forms short peptides that has an action on osteoblasts by increasing their activity in bone formation, thus reducing periodontitis associated bone resorption [8].
- **Prevention of halitosis:** *Streptococcus salivarius* generates bacteriocins, which leads to the reduction in the number of bacteria producing volatile sulphur compounds. This strain is commercially available as a probiotic protective against throat infections and oral malodour [1].
- **Guided pocket recolonization:** Subgingival application of a bacterial mixture including *S. sanguinis*, *S. salivarius*, and *S. mitis* after SRP depresses the re-colonization of pocket forming pathogens [9].

Safety aspects of probiotics

Probiotics are generally considered safe and well tolerated with bloating and flatulence occurring frequently, when they are taken orally [2]. Genes of some probiotic *Lactobacilli* and *Bifido* bacteria strains can cause sulfamethoxazole, gentamycin, polymyxin B and tetracycline resistance [3]. They can cause unhealthy metabolic activities, excessive stimulation of the immune system, or gene transfer. It can also lead to pathological infection, specifically in immunocompromised patients. *Lactobacillus* strains may cause bacteremia in patients with short-bowel syndrome. *Lactobacillus* preparations are contraindicated in lactose hypersensitivity persons. Precautions should be taken in patients with central venous catheters, as contamination could further lead to fungemia [5].

Conclusion

The use of probiotics has apparently come into view in the field of dentistry at present. Molecular, nano, biochemical, microbiological, immunological, and engineering sciences provides the key for future advances in the clinical application of probiotic products.

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