Review Article

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Periodontal Health and Probiotics: A Review

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Abstract

Among various periodontal diseases, Periodontitis is considered to be most common chronic inflammatory diseases of periodontal origin. Numerous causative bacteria have been found causing disease such as Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis and Tannerella forsythus etc. In recent years, Probiotics has gained importance in dentistry. Treatment has changed from elimination of specific bacteria to altering bacterial ecology. This article highlights the potential role of probiotics in the management of periodontitis and shows its potential in curing the disease.

Keywords: Halitosis; Periodontitis; Periodontal health; Probiotics.

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Introduction

The term probiotics is derived from greek word, meaning "for life". Probiotics are living bacteria that are safe for human consumption and when consumed in adequate quantities have useful effects on human health, apart from basic nutrition [1]. Nowadays, probiotics are effectively used in medical field such as inflammatory bowel diseases, GIT disorders, cancer therapy, and urinary tract infection etc. and dental fields such as in caries reduction, reduction in halitosis and obtaining favourable periodontal health. Assessment of relative usefulness and risks are mandatory [2,3]. The definition of probiotics (2001) as given by WHO is live micro-organisms, which when administered in ample amounts grant health benefits to the host [4]

It was Metchnikoff (1907) who found that bacteria in the fermented milk competed with the microorganisms that are injurious to health. Probiotics have been used since the use of fermented milk. The term prebiotics is widely used for those dietary items that promote the growth of probiotics as compared to harmful bacteria. These comprised of non-digestible food items like fructo-oligosachharides, inulin and lactulose. The peculiar thing about these items is that these products promote bacterial bacteria but these itself cannot be digested by body. Similarly, symbiotic contains both prebiotics and probiotics. The present review article highlights the use of probiotics in dentistry.

History

Ukrainian Bacteriologist, Eli Metchnikoff in 1907

laid down the scientific foundation of probiotics at Pasture Institute of Paris. He formulated a theory in which he depicted that senility is due to poisoning which is result of these bacterias. The same was published in his book "Prolongation of life." It was formulated that utilization of fermented milk seed the intestine with harmless lactic-acid bacteria and which in turns reduce the pH of intestinal and ultimately hinders the growth of proteolytic bacteria [6].

The treatment of scour in pigs was done with the use of these probiotic products in 1950. It was Mann and Spoering (1974) who suggested the role of fermented yogurt in reduction of blood serum cholesterol. Hull (1984) recognized the first probiotic species, the lactobacillus acidophilus [3,8] Probiotics were described as most important defence products next to antibiotics by World Health Organization in year 1994. Similarly, few probiotics found to shorten the duration of acute watery diarrhea caused by rotavirus in children [9].

Criteria for Probiotics [1]

The ideal requirements of probiotics are as follows-

1. It should have human origin.
2. It should possess high cell viability.
3. It should show a useful effect on host.
4. It should be not be toxic and pathogenic.
5. It should be capable of interaction and sending signals to immune cells.

Composition

Probiotics can be bacteria, yeast or molds. Among bacteria most commonly occurring are *Lactobacillus casei*, *Lactobacillus lactis*, *Lactobacillus reuteri*, *Lactobacillus acidophilus*, *Lactobacillus helviticus*, *Lactobacillus salivarius*, *Lactobacillus bulgaricus*, *Lactobacillus rhamnosus*, *Lactobacillus johnsonii*, *Lactobacillus fermentum*, *Lactobacillus plantrum*, *Lactobacillus del-brueckii*, *Streptococcus thermophilus*, *Enterococcus faecium*, *Enterococcus faecalis*, *B. bifidum*, *Bifidobacterium breve*, *B. longum*, and *Saccharomyces boulardii* etc. The formation of probiotic includes single or multiple bacteria out of above. The choice of number of bacteria depends upon against which it is designed to act. The benefit of multiple strain preparations is that they can be used against multiple conditions and in a wider range of animal species [7,8,9]. Probiotics can be used in various formulations. The most commonly employed are as follows- It can be used in form of tablets, cheese, lozenges, yoghurt, capsule, mouth rinse or liquid.

It was first formulated in the form of Chewing gum "perio balance" and was actively used against periodontal diseases. Two strains of *L. reuteri* are present in it. It is beneficial against cariogenic bacteria and periodontopathogens. Studies have found that a single dosage of lozenge contains at least 2×10^8 living cells of *L. reuteri* prodentis.

It is advisable to use a single dose of lozenge every day. Some prefer to use it after a meal and some in the evening after brushing. This permits active spread of probiotics throughout the oral cavity and attach to the various dental surfaces. Recently, PerioBiotic™ tooth paste is widely used in dentistry which is found to have *Lactobacillus paracasei* probiotic. It is natural, fluoride-free oral hygiene supplement containing Dental-Lac.™ Their use have not been extensively studies [7,10].

Probiotic and Periodontal diseases

Among various periodontal diseases, gingivitis and periodontitis are the most common diseases. The causative bacteria affect periodontium. Periodontitis leads to progressive destruction of the supporting structures of the teeth. It is due to inflammatory responses to dental plaque in a susceptible host. Bacteria act by releasing enzymes and toxins resulting in potential damage.

The aim of periodontal therapy is complete removal of pathogenic bacteria. The management of periodontal diseases comprised of surgical and non-surgical procedures. Mechanical debridement and subsequent use of antibiotics is the best management. Probiotics play a active role in case of antibiotic resistance and prevents re-colonization pathogenic bacteria. It acts by hindering bacterial adhesion, where one microorganism can avert and or postpone the growth and colonization of another member of the same or different ecosystem.

Mechanism of action (Fig. 1 and Table 1) [1,11]

It acts by various means such as-

Inhibition of specific organisms

1. The process of prevention of attachment of pathogens, colonization and biofilm formation helps in probiotic function.
2. It also acts by preventing pathogens growth with the help of organic acids, hydrogen peroxide and bacteriocins.

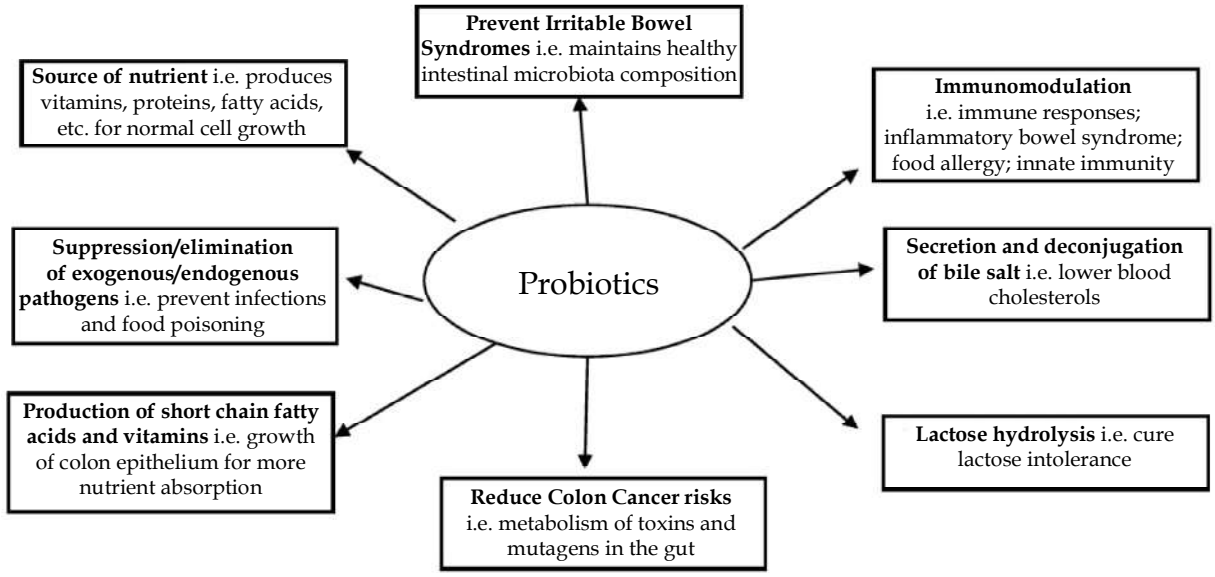

Fig. 1: Showing mechanism of action of probiotics

Table 1: Difference between probiotics and prebiotics

Probiotics	Prebiotics
• Live Micro-organism	• Non-living, non-digestible by human ingredient (carbohydrates)
• Bacteria or Yeast	• Serve as food for friendly bacteria within the gut
• Available as food supplements and in certain foods containing live cultures suah as yoghurt, kefir, aged cheese, kombucha, sauerkraut , or miso	• Available as food supplements and naturally occuring in certain foods, such as chicory root, jerusalem artichoke, onion, leek, garlic, raw oats , or banana
• Probiotics may support the treatment of diarrhea, irritable bowel syndrome, certain intestinal infections, prevnets or reduce the severity of colds and flu or aid digestion	• Prebiotics aid digestion and may support the treatment of several chronic digestive disorders or inflammatory bowl disease

Effects on host response

1. It is capable of altering host response by preventing formation of collagenases and decrease in inflammation associated molecules.
2. It also prevents expression of cytoprotective proteins on host cell surfaces.
3. It modulates pro-inflammatory pathways exerted by pathogens.
4. It inhibits cytokine-induced apoptosis.
5. It plays an important role in modulating host immune response.

Antagonistic interactions are capable of regulation of periodontal pathogens. It can be performed by decreasing gingival bleeding with the administration of *Lactobacillus reuteri* [12]. Kõll-Klais *et al.* [13] & others [14,15] in their study revealed the use of probiotics in the management of periodontitis. It has been found that periodontal inflammation can be reduced by the administration of two probiotic tablet forms Bifidumbacterina and Acilact.

In a study by Volozhin *et al.* (2004) it was found that a periodontal dressing containing *Lactobacillus casei*, strain 37 is effective in reducing the periodontal pathogens and extends remission

up to 10-12 months. A culture supernatant of a *L. acidophilus* strain found to be equally effective in cases of gingivitis, periodontitis and pregnancy gingivitis. A significant improvement was observed for almost every patient.

Kõll-Klais *et al.* (2005) in their study found that resident lactobacilli flora prevents the growth of *Porphyromonas gingivalis* by 82% and *Prevotella intermedia* to 65%. In another study by Teughels *et al.*, it was observed and postulated that recolonization of a gingival pocket after scaling and root planning might be modified by introducing microbes competent of preventing adhesion of common periodontal pathogens [12].

Replacement therapy is synonym for "probiotic therapy". Teughels *et al.* was first who introduced the idea of bacterial replacement. They performed a study on beagle dog model and observed that the subgingival application of a bacterial mixture including *Streptococcus sanguis, S. salivarius*, and *Streptococcus mitis* after scaling and root planning significantly reduced the re-colonization of *Porphyromonas gulae* and *P. intermedia*. In another study on beagle dog model by Nackaerts *et al.*, it was found that the subgingival application of beneficial oral bacteria prevents the recolonization by periodontal pathogens, reduction in inflammation and improvement of bone density and bone levels. This method may be proved useful and effective in management for periodontitis [15,16].

Treatment of halitosis

It was found that in patients with history and features of halitosis, there is predominance of bacterial species such as *Atopobium parvulum, Eubacterium sulci* and *Solobacterium moorei*, predominate on the dorsal surface of the tongue. Similarly *Streptococcus salivarius*, was another bacterial species found most often among people without halitosis and is hence is regarded as commensal probiotic of the oral cavity. *S. salivarius* produce bacteriocins, which could give rise to decreasing the number of bacteria that produce volatile sulphur compounds [17].

Another study gave information that S. salivarius K12 produces salivaricin which has inhibitory activity towards most Streptococcus pyogenes. *S. salivarius* K12 has been considered as a probiotic which is active against throat infections and oral malodour. The importance of strain selection for probiotic use is highlighted by the reality that some *S. salivarius* strains vary from K12 in some important activities; one strain amplified manufacture of malodorous products by promoting *P. gingivalis* metabolism of salivary mucins and another up-regulated IL-8 secretion by oral epithelial cells in contrast to the down-regulation seen in response to K12 [18].

Residence time of Probiotics

Çaglar *et al.* studied the residence time of probiotics in oral cavity after treatment withdrawal. A 2-weeks use of a *L. reuteri*-enriched yogurt found to reduced *S. mutans* level and for a few days after discontinuation. There was loss of *L. reuteri* colonization 2 months after probiotics use [19]. The latency time of probiotics has been evaluated in oral cavity areas. Probiotic may be found on different areas of oral cavity such as oral mucous membrane and tongue for more than 3 weeks and *S. salivarius* K12 had steadily decreased 8 days after treatment withdrawal. Few systemic infections found to occur with probiotics use. However, no serious drawback has been found. Probiotics can alter the immune response to vaccines. It is observed that some specific probiotics can modify monocyte and natural killer cell function in the blood. Probiotics can enhance antibody responses to oral and systemically administered vaccines. This area desires additional search.

Conclusion

Host can readily respond to probiotics as it is body's own resident flora. Probiotics may be fruitful in patients with gingivitis and periodontitis. However large scale studies are required to demonstrate useful beneficial effect in periodontal pathologies.

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