

## PROBIOTICS: AN EMERGING PROSPECT FOR THE PERIODONTAL PROBLEMS

<sup>1</sup>FARZEEN TANWIR, MPhil, PhD

<sup>2</sup>UMAIR AHMED, BDS, Corth

There has been an escalation of interesting studies on the advent of probiotics and its association with periodontal health. Probiotics offer an interesting package for the treatment of periodontal diseases by acting as an alternate mode of treatment to the customary antibiotic treatment regime. Although evidence that has surfaced as an outcome of studies on this topic open up exciting possibilities for potential research, statistics and studies still remain insufficient. This article focuses on the advantages and traits of probiotics and on recent studies performed elaborating the role played by probiotics in combating periodontal pathogenesis.

Microbial infections are mostly treated by the ever popular treatment modality-Antibiotics! Although the clinical significance of antibiotics cannot be disregarded, the dilemma of microbial resistance associated with the use of antibiotics has prompted researchers to explore auxiliary treatment modalities. One such strategy which has gained recent consideration is modifying the colony of "health-promoting" flora in the oral cavity so as to alter the typical microbial plaque to a 'favorable' biofilm. This biofilm opposes the usual route to the pathogenesis, hence the introduction of probiotics!

Probiotics can be defined as live microorganism(s) that impart a health benefit to the host, when administered in sufficient amounts. Of relevance to periodontal health, probiotics may serve to stop and/or possibly diminish the progression of periodontal diseases by influencing plaque and anaerobic microbial

accumulation. Probiotics comprise mostly of two genera *Lactobacillus* and *Bifidobacterium*. Other microorganisms include *Streptococcus*, *Propionobacterium* and *Aspergillus* spp. There have been several postulations regarding underlying mechanism of probiotic activity. One hypothesis suggests that a probiotic for instance *Lactobacillus* can 'co-aggregate' and stick to certain microbial species such as *Fusobacterium nucleatum*, after which it affects the pathogenic capacity of the microbe. *Lactobacillus paracasei* and *Lactobacillus rhamnosus* possess powerful capacity to bind to the salivary pellicle. Such strains of *Lactobacillus* prevent *F. nucleatum* to stick to the bio film by changing its composition. In a related study carried out by Grimaudo and Nesbitt, co-aggregation of the carbohydrate component of *Candida Albicans* with the protein component of almost all the *Fusobacterium* spp was observed.<sup>1</sup> It is also postulated that probiotics enhance immune function. Probiotics boost innate immunity by influencing the inflammatory process of the involved microbe via "toll-like receptors" present on Antigen presenting cells. The involved pathogen and its constituents are phagocytosed by T Helper cells. Thus probiotics impersonate the immune response while ensuring the healthy status of the periodontium. Fig 1 illustrates the underlying mechanism of action of probiotics.

Periodontal diseases comprise two inflammatory conditions- gingivitis and periodontitis. Both conditions affect tissues encircling and enclosing the tooth. The process is initiated with inflammation of the gum (gingivitis) and if untreated, slowly advances to involve fibers of periodontal ligament and alveolar bone surrounding the tooth (periodontitis). The oral cavity serves as a domain for a rich assortment of microbial species. It has been estimated that more than 600 microbial species reside in the oral cavity. This diverse community of bacteria is assimilated on oral tissues to

### <sup>1</sup> Corresponding Author

Director of Postgraduate Studies and Research Associate Professor & HOD of Periodontology Department Ziauddin University 4/B, Shahrah-e-Ghalib, Clifton, Karachi-76500

Tel: (9221) 35862937-9 Fax: 35862940 Cell: 0301-2229469

Email: farzeen.tanwir@zu.edu.pk, farzeen\_tanwir@yahoo.com

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form the oral 'bio film'. The bio film provides for complex interactions and intricate colonization of the microbial population. Thus the microbes become resilient to physical and antibacterial assaults paving the establishment for pathogenic bacteria. The prominent pathogenic bacteria in periodontal diseases are *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola* and *Aggregatibacter actinomycetemcomitans*. The virulent features of these pathogenic bacteria assist the colonization of such species in subgingival locations, thereby eluding the body's natural defense process. Generally, periodontal diseases are treated by mechanical debridement from subgingival locations. This helps to eliminate periodontal pockets switching the pathogenic flora to a lesser pathogenic one, though only for a short while. Local or systemic application of antibiotics and antiseptics do not impart any drastic effects. Hence researchers have been intrigued by the presence and sustenance of the lesser pathogenic bacteria or 'beneficial bacteria' in impeding the mushroom of the fore mentioned pathogenic bacteria. Recent studies have been conducted focusing on *Lactobacilli's* potential to retard the growth of such pathogenic microbes.<sup>2</sup> A relevant study carried out by Riccia and associates on *Lactobacillus brevis* highlighted the anti-inflammatory potency of *L. brevis*. 21 patients with chronic periodontitis were compared to 8 healthy controls.<sup>3</sup> Treatment comprised of sucking on lozenges with *L. brevis* for 4 days which led to enhanced clinical signs and symptoms in all patients. These included improvements in gingival and plaque indices and less bleeding on gentle probing. An evident decrease in levels of salivary prostaglandin E<sub>2</sub> (PGE<sub>2</sub>) and matrix metalloproteinases (MMPs) was seen. The beneficial results of *L. brevis* were accredited to presence of Arginine deaminase (AD) which prevented nitric oxide production thus inhibiting release of PGE<sub>2</sub> and MMPs. Shimauchi et al. conducted a double-blind randomized study to determine the outcome of periodontal health in a group of volunteers after being given *Lactobacillus salivarius* tablet for a period of eight weeks. The results showed improved periodontal parameters in subjects who were prone to periodontal disease in comparison to the control subjects.<sup>4</sup>

Krasse et. al carried out an interesting study to evaluate the effectiveness of *Lactobacillus reuteri* in treating gingivitis.<sup>5</sup> The patients were made to ingest

chewing gum containing the probiotic for a period of 2 weeks with instructions on how to brush and floss effectively during this period. After 2 weeks, *L. reuteri* had colonized the oral cavity of the subjects who had gingivitis. A reduced plaque index was also observed. Hence, *L. reuteri* was found to be efficacious against gingivitis and plaque. However, further investigations with a vast patient pool are required to firmly establish the efficacy of *L. reuteri* against gingivitis. Sunstar- a Swiss pharmaceutical firm recently marketed the first probiotic particularly for periodontal diseases. 'Gum PerioBalance' consist of a dual strain combination of *Lactobacillus reuteri* that works collectively against caries and periodontal diseases.

*Streptococcus sanguinis* and *Streptococcus uberis* have also emerged as effector strains. These species are thought to inhibit the growth of *A. actinomycetemcomitans*, which is the causal microbe in 'aggressive periodontal disease' (formerly called early onset periodontitis) and 'localized aggressive periodontitis' (formerly called localized juvenile periodontitis). Samples collected from subgingival locations in the oral cavity in such diseases do not contain significant strains of *S. sanguis* and *S. uberis* compared to samples collected from a healthy mouth which contrarily do contain significant amounts of *Streptococcus spp.* *S. sanguis* and *S. uberis* are postulated to inhibit the growth of *A. actinomycetemcomitans* via the production of hydrogen peroxide.

It also becomes imperative to analyze the role of probiotics in halitosis. Halitosis or bad breath can be an outcome of various factors (such as metabolic disorders, certain food items and infections of the respiratory tract). The specific cause in most cases is the production of 'volatile sulphur compounds'. These compounds are the result of metabolic activity of anaerobic microbes on food proteins to yield amino acids that are converted into these volatile sulphur compounds.<sup>6</sup> Kang et al. carried out a highly interesting study on *Weissella cibaria* isolates, which is a gram positive facultative anaerobe.<sup>7</sup> *W. cibaria* behaved like a probiotic agent by producing ample amounts of hydrogen peroxide. This led to suppression of the growth of *Fusobacterium nucleatum*. The same researchers performed in vitro and in vivo studies using *W. cibaria* as a mouth rinse. The result of the study was a significant reduction in

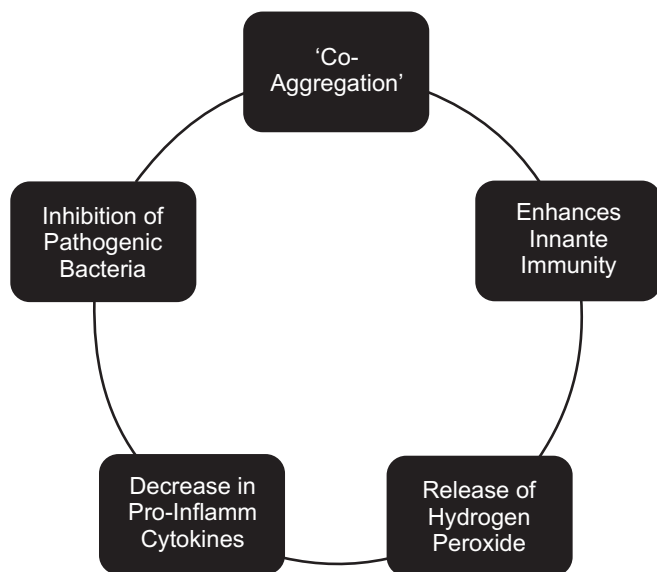


Fig 1: Underlying Mechanism of Action of Probiotics

halitosis. Hence it was hypothesized that *Weissella cibaria* was promising as a probable probiotic.

Probiotics, under FDA regulations are categorized under 'Generally Recognized as Safe' (GRAS). They are often classified as dietary supplements. However, concerns do exist over the long term usage of probiotics in specific risk groups although these groups have not been accurately established. A few cases of bacteremia have been observed in immune compromised individuals especially of gut diseases. Probiotics can be made available quite conveniently. They can be included in dairy products, yoghurt, vitamin supplements, chewing gum. Relevant studies have been conducted regarding the association of periodontal health and dairy products. Shimzaki et al carried out a dietary survey to explore the link of dairy product consumption (milk, cheese and yoghurt) and periodontal health.<sup>8</sup> The study concluded that subjects who consumed these food items on a daily basis had a lower Probing depth (PD) and Clinical attachment loss (CAL) compared to those who did not consume the afore mentioned food items. The benefit of incorporating probiotics into dairy products is further enhanced by the ability of dairy products to neutralize the acidic environment. This has been established with the ca-

capacity of cheese to prevent demineralization of the tooth. However, to be more efficacious, probiotics in the form of lozenges or chewing gum are more suitable because of their increased contact period with the oral tissues. Additionally, dosage regime needs further investigations to ensure adequate results with the use of probiotics.

Probiotics is a contemporary prospect for improved oral health and has gained priority from researchers in recent times. Research potential is immense and has captivated due attention as probiotics offer attractive traits as alternate treatment modality in terms of cost, safety, application and adeptness. Information available so far has been exciting and encouraging, but there is a dire need for further research with expansive study pools and large randomized trials to establish the efficacy of this 'friendly-bacteria' in combating periodontal diseases.

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