Review Article

Role of Probiotics in Oral Health - A Review

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Abstract

Probiotic is defined as "live microbial food ingredient that, when ingested in sufficient quantities, exerts health benefits on the consumer" (International Life Science Institute). Probiotic is derived from Greek language meaning "for life" and it was first used by Lilly and Stillman in 1965 to describe "substances secreted by one microorganism which stimulates the growth of another." The original observation of the positive role played by some selected bacteria was scientifically investigated by Eli Metchnikoff who proposed that lactic acid-producing strain *Lactobacillus bulgaricus* (contained in the Bulgarian yogurt) is able to displace pathological intestinal microbiota. Probiotics' role for treatment of general diseases like intestinal diseases, lactose intolerance, diabetes, etc., has been documented in literature. During the past few years, extensive research has been done to know the role of dietary as well as oral probiotics for treatment of oral diseases. Present article documents health benefits of probiotics for maintainence of oral health.

Keywords: Streptococcus mutants, Dental caries, Halitosis, Periodontitis.

Introduction

Oral infections represent some of the most familiar and expensive form of infections in human beings with dental caries and periodontal diseases occurring in every race and part of the world.[1] Various advancements in preventive strategies like fluorides, diet councelling, individual caries risk assessment, sealants, etc., have led to reduction in prevalence of oral diseases, especially dental caries, but researchers still are not able to control the actual infection.[1]

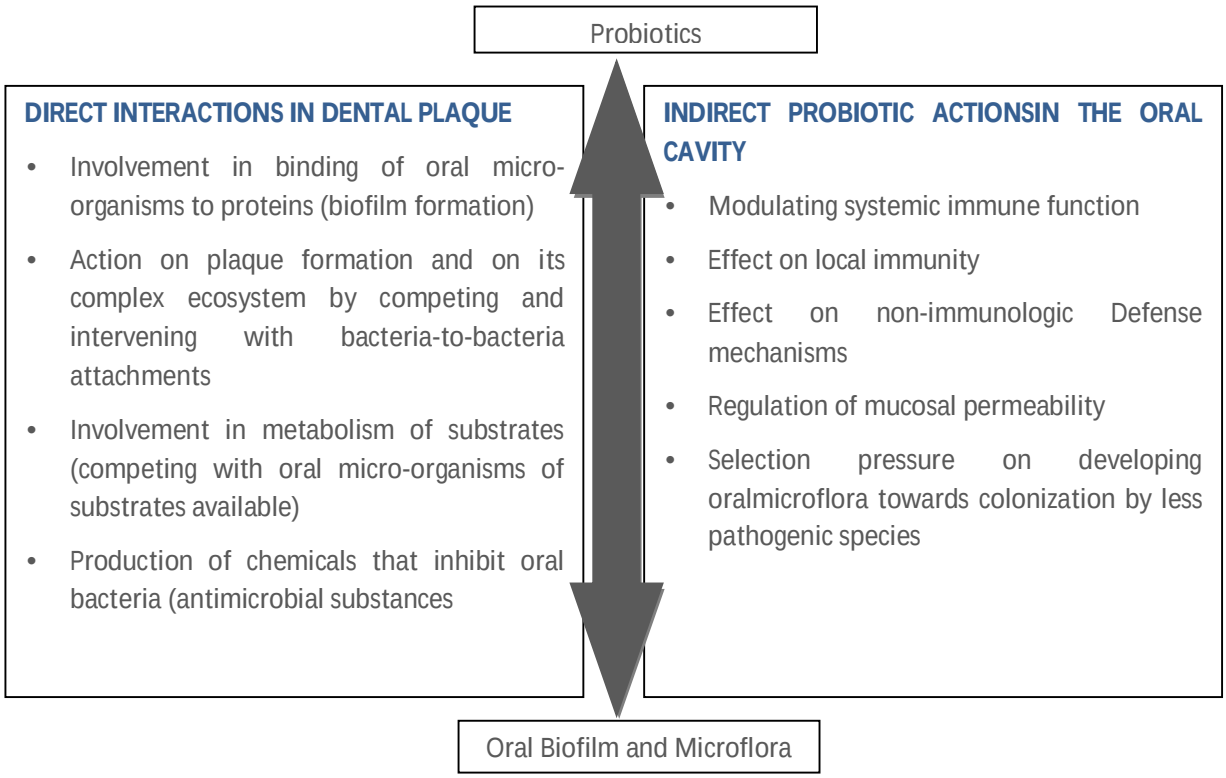
The oral cavity involves a convulated environment having diverse aerobic and anaerobic microorganisms whose composition is affected by environmental changes like illness, debility, behavior, diet or medication, etc., leading to endogenous infections or susceptibility to exogenous infections.[2] Thus it can be stated that dental disease may be a consequence of changes in the ecology stated above.

Researchers of various disciplines of healthcare fraternity are doing research to develop alternative antimicrobial approaches in order to combat global threat of antimicrobial resistance. Therefore, in order to achieve it various health promoting bacteria have been developed which have beneficial effects on general and oral health.[3] WHO/ FAO in 2011 had stated the importance of probiotics in oral health and had defined it as "Live micro-organisms which, when administered in adequate amounts, confer a health benefit on the host." Oral healthcare workers are mainly confronted with dietary probiotics on regular basis and these products usually contain streptococci, lactobacilli or bifidobacteria.[4]

Mechanism of Action of Probiotics

Various modes of action of probiotics are enumerated as-"a) modulation of host immune response, b) Probiotics help in selective digestion of lactose and help in stimulation of the intestinal mucosal lactose activity. This mode of action is used for treatment of diarrhea. c) Antimicrobial metabolites, such as ammonia, hydrogen peroxide are produced by certain probiotic bacteria which are used to extend the shelf

life of food and to suppress food borne pathogens in dairy products. d) Certain probiotics can modify and block toxin mediated pathology. e) Probiotics also help in inhibition of colonization of pathogenic micro organisms by competitive inhibition for microbial adhesion sites. Table 1 depicts hypothetical mechanisms of probiotic action in the oral cavity."[5-7]



Adapted from Meurman and Stamatova[5]

Table 1.Mechanism of Action of Probiotics

Role of Probiotics in the Treatment of Gingivitis and Periodontitis

Gingivitis is inflammation of the gingival tissues and is caused by accumulation of bacteria in the gingival crevices causing an inflammatory reaction. Gingivitis, if not treated, can lead to periodontitis (inflammation of periodontium) in most of cases. The first measure for treating gingivitis is to improve the patient's oral hygiene either by mechanical cleaning or by using antiseptic rinses.[8]

The anecdotal data and various extensive studies have led to speculate that daily ingestion of the probiotic *L. Reuteri* may positively affect the oral microflora, which could be of benefit in terms of reduced gingivitis and gum bleeding.[8] It mainly acts by producing anti-microbial substance *reuter* in which has anti-inflammatory effect by inhibiting wide range of pathogenic bacteria. Also secondly strains of *L. reuteri* have demonstrated an ability to block binding of pathogenic bacteria to host tissue.[9]

Periodontitis painlessly destroys the supporting tissues around the teeth and results in pocket formation and bone loss around teeth. Studies done by Tugler et al. and Craser et al. showed that strains of bacteria which were studied as probiotics included *Streptococcus sanguinis* (ATCC 49297), *Streptococcus salivarius*, *and Streptococcus mitis* had resulted in significant reduction in pocket depth and attachment level gain.[8-10]

Role of Probiotics in Caries Management

According to WHO, caries is defined as a "localized post-eruptive pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity."[11]

To overcome the limitations of the traditional disease management strategies for prevention of dental caries, a number of researchers are developing "probiotic model" to treat the caries causing infections.[12] In this model, probiotics are used as mechanisms to selectively remove only the (odonto) pathogen while leaving the remainder of the oral ecosystem intact.[12]

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The well-publicized of these efforts is a substitution strategy developed by Hillman and colleague.[13] They have genetically modified a *Streptococcus mutants* organism so that it no longer produces acid while competing aggressively for the ecologic niche where the wild type *S. mutants* is found. In theory and in laboratory animals, once this substitute organism is introduced, it entirely displaces the disease causing wild type *S. mutants*. Not only does this stop the disease process, it also precludes the re-emergence of the disease causing organism and eliminates re-infection because the ecologic "inn is full."[13-15]

Role of Probiotics in the Prevention of Halitosis

Oral malodor also known as halitosis is a widespread problem, which is believed to affect a large proportion of the population The volatile sulphur compounds (VSC) which include hydrogen sulphide and methyl mercaptan (CH_3SH), both of which comprise about 90% of the VSC contents in the breath, have generally been used as indicators for halitosis.[16] Many studies have demonstrated that many oral bacteria *Fusobacterium nucleatum* produce copious VSC. F. nucleatum has been isolated in cases of skin ulcers, peritonsillar abscesses, septic arthritis and endocarditis and is also naturally present as a mirofloral component in the mouths of healthy or humans with diseases.[17] This micro-organism is not only predominant in terms of its numbers in the oral cavity, but also possesses the capacity to form aggregates with other bacteria and to function as a bridge between the primary and secondary settlers on the surfaces of the teeth.[18] Among the variety of known oral anaerobic bacteria, *F. nucleatum* has been known to posess a powerful ability to coaggregate with other oral bacteria, and to contribute substantially to VSC production in the oral cavity.[19]

This coaggregation ability may constitute an important factor in the establishment and maintenance of a healthy oral fluid system because of the production of micro-environment around *F. nucleatum*, in which the inhibiting substances generated by the coaggregated bacteria would be affected. The ability of the *Weisella cibaria* isolates to coaggregate was found to be at its highest in reactions with *F. nucleatum* among all of the tested anaerobic bacterial strains.[20] Study done by Kang showed that "*W. Cibaria* CMU and *W. Cibaria* CMS_2 completely (99.9%) inhibited the production of hydrogen sulfide (H_2S) and reduced methyl mercaptan (CH_3SH) production by approximately 99 and 91% respectively."[21] *W. Cibaria* CMS_3 also reduced the production of H_2S and CH_3SH by approximately 72 and 79% respectively,[20] leading to the conclusion that the substances generated from *W. Cibaria* isolates exerted reducing effects on VSC production by inhibiting *F. nucleatum* proliferation.[21,22]

Conclusion

The use of probiotics is an interesting emerging, and not to be neglected, field in general and oral healthcare. Based on the currently available clinical data, it seems that dietary probiotics do not confer a major risk for oral health. No negative effects of probiotic use on oral health have been reported till date. This can probably be attributed to the only temporary oral colonization and the vehicle (milk, yoghurt), in which most of the probiotics are consumed.

However, great care is still warranted because it is uncertain that there is not a "window of infectivity" either naturally occuring in a growing child or induced by antibiotics, antiseptics, immune suppression or mechanical removal of the indigenous oral microbiota, in which a patient can be permanently colonized. Even without a permanent colonization, it can be anticipated that the repeated daily use of probiotic products over a long period of time will support an increased level of lactic acid bacteria in the oral cavity.

Thus it can be concluded that probiotics have made their way into oral healthcare and are more likely to be our friend than our enemy. Keeping in view the FAO/ WHO guidelines and recommendations, there is scope for further studies and standardizations of probiotic therapies which can definitely open up a new era of various disease prevention at affordable prices where common man can reap the benefits of probiotics

Conflict of Interest: None

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