Probiotics in Oral Care

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Abstracts: Science is providing us the tools to diagnose and treat the infection before it causes damage. For some decades now, bacteria known as probiotics have been added to various foods because of their beneficial effects for human health. It comprises knowledge of the relationship between diet and health and the effects of food ingredients on physiological functions and health. Probiotics are commonly consumed as part of fermented foods with specially added active live cultures; such as in yogurt or as dietary supplements. The potential application of probiotics for oral health has recently been the focus of attention for various health researchers. The aim of this review is to examine potential mechanisms of probiotic bacteria in the oral cavity and summarize observed effects of probiotics with respect to oral health. [Nayak S et al NJIRM 2013; 4(1) : 106-111]

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Introduction: Antibiotic resistance, with the emergence of multi resistant strains, is an increasingly important global problem[1].This unfortunate development has led scientists to seek other means of combating infectious diseases. Looking back through the history, one forgottenconcept of using bacteria beneficial to health has been resurrected and has now come under intensive research using modern study designs and methods. The term probiotics, the antonym of the term antibiotics, was introduced in 1965 by Lilly & Stillwell as Substances produced by microorganisms which promote the growth of other microorganisms[2]. The concept behind probiotics was introduced in the early 20th century, when Nobel laureate Elie Metchnikoff, known as the "father of probiotics," proposed in The Prolongation of Life: Optimistic Studies that ingesting microorganisms could have substantial health benefits for humans. Microorganisms are invisible to the naked eye and exist virtually everywhere. Scientists continued to investigate the concept, and the term "probiotics"—meaning "for life"— eventually came into use. The importance of living cells in probiotics was emphasized by Fuller, in 1989, who defined probiotics as "A live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance"[3]. All the previous research helped the World Health Organization to predict the usefulness of probiotics as the next-most important immune defence system[4,5].Since then, several definitions of probiotics have been proposed. The currently used consensus definition of probiotics was put forward by the World Health Organization and by the Food and Agriculture Organization of the United States. They defined probiotics as "Live microorganisms which when administered in adequate amounts confer a health benefit on the host"[6].

Characteristics of ideal probiotics:

Fuller[7] in 1989 listed the following as features of a good probiotic.

1) It should be a strain, which is capable of exerting a beneficial effect on the host animal, e.g. increased growth or resistance to disease.

2) It should be non -pathogenic and non-toxic.

3) It should be present as viable cells, preferably in large numbers.

4) It should be capable of surviving and metabolizing in the gut environment e.g. Resistanceto low pH, organic acids acid and bile.

5) It should be stable under storage and field conditions and microorganism has to be microbiologically characterized and subjected to randomized clinical trials. Principally it has to be of human origin, scientifically demonstrating beneficial physiological effects and proving being safe for human use. In addition, it has to be effectively able to adhere to the target tissue[8].

Composition of probiotics: Probiotics can be bacteria, moulds, yeast. But most probiotics are bacteria. Among bacteria, lactic acid bacteria are more popular. Fuller[7] in 1989 listed the following

organisms as species used in probiotic preparation: Lactobacillus bulgaricus, Lactobacillus plantarum, Streptococcus thermophillus, Enterococcus faecium, Enterococcus faecalis, Bifidobacteriumspecies and Escherichia coli. With the exception of L. bulgaricus and S. Thermophilus, all the other organisms are all intestinal strains. A probiotic may be made out of a single bacterial strain or it may be a consortium as well (may contain any number up to eight strains). The advantage of multiple strain preparations is that they are active against a wide range of conditions and in a wider range of animal species[9].

Mechanism of probiotics: Several mechanisms have been proposed to explain how probiotics work. The general mechanisms of probiotics can be divided into three main categories [10,11].

Immune modulation - Probiotics interact with and support the immune system and help to prevent diseases

Competitive exclusion-Beneficial microbes directlycompete with the disease developing microbes fornutrition or enterocyte adhesion sites.

Direct interaction- Probiotics interact directly with the disease causing microbes, making it harder for them to cause the disease.

In oral cavity, probiotics tend to create a biofilm, acting as a protective lining for oral tissues against oral diseases. Such a biofilm keeps bacterial pathogens off oral tissues by filling a space which could have served as a niche for pathogens in future; and competing with cariogenic bacteria and periodontal pathogens growth[4].

Probiotics and general health:[12,13]Probiotics have traditionally been used to treat diseases related to the gastrointestinal tract.

Studies suggest that probiotics may be useful in treatment of patients with hypertension, urogenital infections, lactose intolerance, and elevated levels of cholesterol. Other areas of application include probiotic effects against Helicobacter pylori infections in the stomach, alcoholic liver disease, small bowel bacterial overgrowth, ulcerative colitis, and allergy to milk protein, juvenile chronic arthritis, anti-oxidative effects, asthma, hepatic encephalopathy and their use as vaccine delivery vehicles.

Probiotics and oral health: [13,14]An essential requirement for a microorganism to be an oral probiotic is its ability to adhere to and colonize surfaces in the oral cavity. Microorganisms generally considered as probiotics may not have oral cavity as their inherent habitat and, subsequently, their possibility to confer benefit on oral health is then questionable. Studies suggest that lactobacilli as members of resident oral microflora could play an important role in the micro-ecological balance in the oral cavity. The studies further demonstrated that lactobacilli strains with probiotic properties may indeed be found in the oral cavity. Yet there is no evidence whether these lactobacilli strains were detected due to the frequent consumption of dairy products leading to temporary colonization only, or if the oral environment is their permanent habitat. Possible mechanism of probiotics in the oral cavity is shown in figure 1[15]

Probiotics and dental caries:[10, 17,18]

Several studies suggest that consumption of products containing probiotic lactobacilli or bi-fidobacteria could reduce the number of mutans streptococci in saliva.The tendency toward a decreased number of mutans streptococci in the saliva seems to be independent of the product or strain used; however, such effect has not been observed in all studies.The discrepancies between results cannot be explained by only the use of different probiotic strains, as different results have also been obtained using the same strains. In most of these studies, the levels of salivary lactobacilli have also been measured. Unfortunately, with respect to dental caries, the study groups have mainly been relatively small, and the studies fairly short. Furthermore, it is important to realize that the salivary level of caries-associated microbes does not equate to dental caries. In fact, the mi-crobiota of unstimulated whole saliva

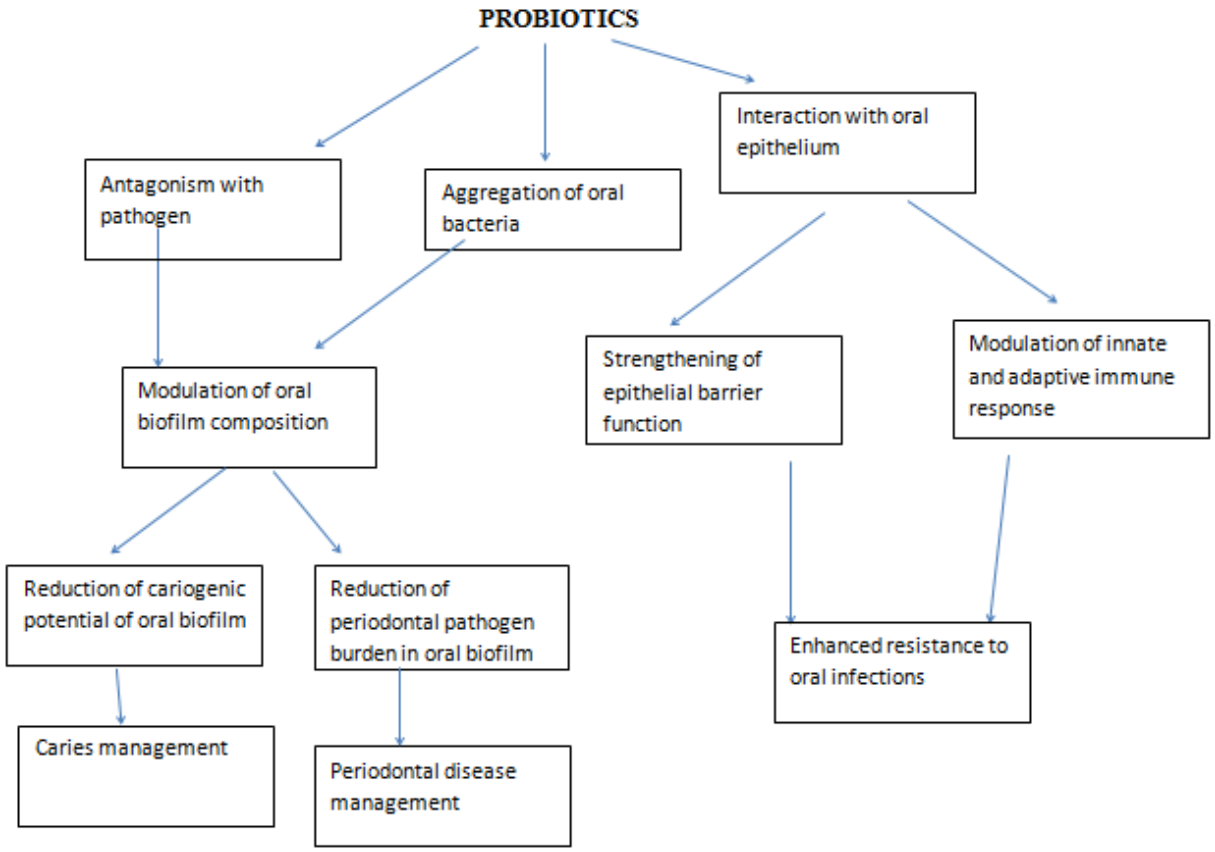

Figure 1: Possible probiotic activities in the oral cavity

resembles that of the tongue more than of dental plaque.Thus, no conclusive statement about the effects of probiotic bacteria on dental caries can be made.

Probiotics and periodontal disease: Despite considerable improvements in the oral health status of populations across the world, periodontal disease yet remains a significant social burden.The microorganisms residing in the periodontal pockets are responsible for periodontal disease. Approximately 500 taxa inhabit periodontal pockets, which provide a moist, warm, nutritious and anaerobic environment for microbial colonization and multiplication. The abundance and diversity of periodontal pocket microorganisms depend upon several factors, including effectiveness of oral hygiene procedures, pocket depth, flow of gingival crevicular fluid, type of interacting microbes and viruses, transmission rate of microbes from other individuals and the antimicrobial efficacy of the host immune response[19].The recent research has shown that taking tablets containing L. salivariusWB21 significantly reduced the periodontal pathogens in subgingival plaque [18] and improved the periodontal health in volunteers [20]. In another study L. reuterireduced the gingival index and bacterial plaque in the treated subjects[21]. When this bacteria was incorporated in chewing gum it also resulted in improvement of the gingival conditions manifested in reduction of the crevicular fluid volume and gingival bleeding, as well as the inflammatory mediators TNF-α and interleukin-8 level[22].

Probiotics and halitosis: Halitosis (malodor) is a common problem with multiple local and systemic etiological factors. The main local aetiologies include periodontitis, poor oral hygiene, deep dental caries, tongue coating and faulty restorations .It is caused by a number ofvolatiles, which originate from the oro-pharynx or from expired alveolar air. In halitosis, the sulphur

containing gases (hydrogensulphide, methyl mercaptan and dimethyl sulphide) which are derived from the bacterial degradation of sulphur – containing amino acids in the oropharynx, play a significant role. A diverse consortium of bacteria has been found to contribute to the problem. The current treatment focuses on the use of chemical or physical antibacterial regimes to reduce the numbers of these bacteria. However, most of these treatments exhibit only a temporary effect or are associated undesirable side-effects when used over a long period of time. To prevent the regrowth of odour causing organisms, pre-emptive colonization of oral cavity with probiotics might have a potential application as adjuncts for both the treatment and prevention of halitosis. Burton et al. investigated the effect of S.salivarius on oral malodour parameters. S salivarius was selected as an oral probiotic because it is an early colonizer of oral surfaces and is amongst the most numerically predominant members of the tongue microbiota of healthy individuals. The species have only limited ability to produce volatile sulphur compounds and is unlikely to contribute significantly to oral malodour. 85% of the patients in the experimental group had a substantial reduction in volatile sulphur compound scores[23]. A recent study has shown that patients with genuine physiologic or pathologic halitosis benefited significantly from two-week therapy with tablets containing L.salivariusWB21 in addition to a significant reduction in the level of the volatile compounds and gingival bleeding on probing from periodontal pockets[24]. Lactobacillus salivariusTI2711 bacteria was also able to reduce the count of the oral black pigmented bacteroides, the bacteria that is strongly associated with production of the volatile sulphur compounds responsible for halitosis[25].Weissellacibaria[26] and L. salivarius[27] were able toreduce the levels of volatile sulphide componentsby competing for colonization areas with volatile sulphide producing species.

Probiotics and oral yeast infections: Candida albicans, a normal inhabitant of the oral cavity, is the most common cause of oral fungal infections. Age, genetic, hormonal, iatrogenic, systemic and local factors predispose clinical manifestations of the disease. The incidence of yeast infections is higherat older age and under conditions of impaired immunity[28]. Hatakka et al were the first to perform a randomized, double-blind, placebo-controlled study on the effect of probiotics on the prevalence of oral candida. A decrease in the prevalence of C. albicans in the elderly after consumption of probiotic cheese containing L. rhamnosus GG and Propionibacteriumfreudenreichiissp. shermanii JS which was as an interesting observation in this randomized placebo-controlled trial[29]. Probiotic applications in the oral cavity may alleviate symptoms and reduce pathogenic potential of Candida species.

Conclusion: Probiotics denote an upcoming field of research in dental field. This concept prompts a new horizon on the relationship between diet and oral health. Today's new technological era would be the right time to change the way bacteria are treated. It still remains to be seen, the extent to which probiotics are applicable to promoting oral health. Although the results of past studies are encouraging, still much needs to be done for identification of the probiotics that are best suited to oral use, as well as the most appropriate vehicles for its delivery.Further studies are needed to find out the best probiotic / prebiotic and means of their administration.

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