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Probiotics and Their Role in Periodontal Health

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ABSTRACT

Probiotics were first introduced as a functional ingredient in dairy products, breakfast cereals and snacks. Unknown to many, probiotics offer health benefits that go beyond the scope of supporting digestive health. Research continues to emerge, supporting the use of different probiotic strains in a variety of gastrointestinal dysfunction including diarrhea,as well as immune system and conditions such as allergy, in children , in adults and in the oral cavity. This article summarizes the currently available data on the potential benefits of probiotics for periodntal health.

Keywords: probiotics, periodontal health, lactobacillus,bifidobacterium

Introduction

Every human being ingests a large number of living micro-organisms, predominantly bacteria. Although these organisms are naturally present in food and water, they can also be deliberately added during the processing of foods such as sausages, cheese, yoghurt and fermented milk products. For several decades now, bacteria called probiotics have been added to some foods because of their beneficial effects for human health. The bacteria in yoghurt and fermented milk products constitute the most important source of probiotics for humans. The vast majority of probiotic bacteria mostly belong to the genera Lactobacillus, Bifidobacterium, Propionibacterium and Streptococcus (Bonifait, Chandad and Grenier 2009)1. Studies have demonstrated the effectiveness of certain probiotics in the treatment of systemic and infectious diseases such as acute diarrhea and Crohn's disease. Probiotics may also prove useful in addressing problems arising from the excessive use of antibiotics, specifically the appearance of bacterial resistance. To date, however, the potential beneficial effects of probiotics for oral diseases have had only limited study (Bonifait .et al 2009)[1].

The term Probiotic is derived from Latin word "pro"-for and Greek word "biotic"- life (Singh, Kallali, Kumar and Thaker 2011).2. Probiotics are defined as living microorganisms, principally bacteria,that are safe for human consumption and, when ingested in sufficient quantities, have beneficial effects on human health, beyond basic nutrition. This definition has been approved by the United Nations Food and Agriculture Organization (FAO) and the World Health Organization (WHO) (Bonifait .et al 2009).[1]

The idea of probiotics dates back to the first decade of 1900 when the Ukrainian bacteriologist and Nobel Laureate Ilya Metchnikof studying the flora of the human intestine developed a theory that senility is caused by poisoning of the body by the products of some of these bacteria. To prevent the multiplication of these organisms he proposed a diet containing milk fermented by lactobacilli which produces a large amount of lactic acid and for a while this diet became widely popular. (Agarwal , Bajaj , Guruprasad , Naik and Pradeep 2011) [3]

Properties of an ideal probiotic

Fuller 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 nonpathogenic 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. resistance to low pH, organic acids acid and bile. 5) It should be stable under storage and field conditions. (Singh.et al 2011)[2]

How Probiotics Work

Several mechanisms have been proposed to explain how probiotics work. For example, these bacteria secrete various antimicrobial substances such as organic acids, hydrogen peroxide and bacteriocins. In addition, they compete with pathogenic agents for adhesion sites on the mucosa. Probiotics can also modify the surrounding environment by modulating the pH and/or the oxidation–reduction potential, which may compromise the ability of pathogens to become established. Finally, probiotics may provide beneficial effects by stimulating nonspecific immunity and modulating the humoral and cellular immune response. A combination of probiotic strains is often used to increase these beneficial effects. (Bonifait .et al 2009)[1]

Probiotics can be bacteria, moulds, and yeast. But most probiotics are bacteria. Among bacteria, lactic acid bacteria are more popular in the listed organisms as species used in probiotic preparation. Lactobacillus bulgaricus (L. bulgaricus), Lactobacillus plantarum. Streptococcus thermophillus (S. thermophillus), Enterococcus faecium, Enterococcus faecalis, Bifidobacterium species, and Escherichia coli were listed. Bifidobacterium strains include B. bifidum, B. longum, and B. infantis (Agarwal. et. al 2011) 3

Probiotics and oral health

Various mechanisms have been proposed to understand the action of probiotics on the oral cavity. This may be through:

- Direct interaction in dental plaque
- Involvement in binding of oral micro-organisms to proteins
- Action on plaque formation and on its complex ecosystem by competing and intervening with bacterial attachments.
- Involvement in metabolism of substrate and production of chemicals that inhibit oral bacteria

Indirect probiotic actions can be through:

1. Modulating systemic immune function.
2. Effect on local immunity.
3. Effect on non-immunologic defense mechanisms.

4. Regulation of mucosal permeability.
5. Probiotics as an antioxidants and produce antioxidants.
6. Prevent plaque formation by neutralizing the free electrons (Saraf,Shashikanth,Priya,Sultana and Chaitanya 2010)[4].

Probiotics and periodontal health

Probiotics for periodontal therapy have not been extensively studied. Clinical studies where probiotic species have been investigated specifically from a periodontal disease perspective are sparse.

The main pathogenic agents associated with periodontitis are P. gingivalis, Treponema denticola, Tannerella forsythia and Aggregatibacter actinomycetemcomitans. These bacteria have a variety of virulent characteristics allowing them to colonize the subgingival sites, escape the host's defence system and cause tissue damage. The persistence of the host's immune response also constitutes a determining factor in progression of the disease. In a recent study, the prevalence of lactobacilli, particularly Lactobacillus gasseri and L. fermentum, in the oral cavity was greater among healthy participants than among patients with chronic periodontitis (Koll-Klais, Mändar, Leibur, Marcotte, Hammarström and Mikelsaar 2005)5. Various studies have reported the capacity of lactobacilli to inhibit the growth of periodontopathogens, including P. gingivalis, Prevotella intermedia and A. actinomycetemcomitans. Together, these observations suggest that lactobacilli residing in the oral cavity could play a role in the oral ecological balance.

Krasse , Carlsson , Dahl , Paulsson , Nilsson , Sinkiewicz (2006) 6 assessed the beneficial effect of L. reuteri against gingivitis. After 14 days of ingesting the probiotic incorporated into chewing gum, the oral cavity of patients with a moderate to severe form of gingivitis had been colonized by L. reuteri and the plaque index had been reduced. Although the exact mechanisms of action of L. reuteri remain to be elucidated, previous studies have suggested at least 3 plausible possibilities: first, L. reuteri is known for its secretion of 2 bacteriocins, reuterin and reutericyclin, that inhibit the growth of a wide variety of pathogens; second, L. reuteri has a strong capacity to adhere to host tissues, thereby competing with pathogenic bacteria; and third, the recognized anti-inflammatory effects of L. reuteri on the intestinal mucosa, leading to inhibition of secretion of proinflammatory cytokines, could be the foundation for a direct or indirect beneficial effect of this bacterium on people with periodontal disease. However, additional studies with larger patient cohorts are needed to confirm the long-term potential of L. reuteri in preventing and/or treating gingivitis.

Riccia ,Bizzini, Perilli, Polimeni, Trinchieri and Amicosante G (2007)7 studied the anti-inflammatory effects of Lactobacillus brevis in a group of patients with chronic periodontitis. The treatment, which involved sucking on lozenges containing L. brevis over a period of 4 days, led to improvements in the targeted clinical parameters (plaque index, gingival index, bleeding on probing) for all patients. In the study, a significant reduction in salivary levels of prostaglandin E2 (PGE2) and matrix metalloproteinases (MMPs) was also observed. The authors suggested that the beneficial anti-inflammatory effects of L. brevis could be attributed to its capacity to prevent the production of nitric oxide and, consequently, the release of PGE2 and the activation of MMPs induced by the nitric oxide. Shimazaki, Shirota , Uchida , Yonemoto , Kiyohara and Iida (2008) 8 used epidemiological data to assess the relationship between periodontal health and the consumption of dairy products such as cheese, milk, and yoghurt. The authors found that individuals, particularly nonsmokers, who regularly consumed yoghurt or beverages containing lactic acid exhibited lower probing depths and less loss of clinical attachment than individuals who consumed few of these dairy products. By controlling the growth of the pathogens responsible for periodontitis, the lactic acid bacteria present in yoghurt would be in part responsible for the beneficial effects observed. Longitudinal studies are required however to clarify the observed relationship between regular consumption of products containing probiotics and periodontal health.

Kang, Chung , Kim , Yang and Oh (2006)9 reported the capacity of various strains of W. cibaria to inhibit the production of volatile sulphur compounds by F. nucleatum. They concluded that this beneficial effect resulted from the production of hydrogen peroxide by W. cibaria, which inhibited the proliferation of F. nucleatum. The authors also found that gargling with a solution containing W. cibaria was associated with a net reduction in the production of hydrogen sulphide and methanethiol and consequently a reduction in bad breath.

Streptococcus salivarius, was detected most frequently among people without halitosis and is therefore considered a commensal probiotic of the oral cavity. (Kazor , Michell , Lee , Stokes , Loesche and Dewhirst 2003) 10 S. salivarius is known to produce bacteriocins, which could contribute to reducing the number of bacteria that produce volatile sulphur compounds.(Hyink , Wescombe , Upton , Ragland , Burton and Tagg 2006)11. The use of gum or lozenges containing S. salivarius K12 (BLIS Technologies Ltd., Dunedin, New Zealand) reduced levels of volatile sulphur compounds among patients diagnosed with halitosis.

The first probiotic specifically formulated to fight periodontal disease was marketed by Sunstar (Etoy, Switzerland). Gum PerioBalance contains a patented combination of 2 strains of L. reuteri specially selected for their synergetic properties in fighting cariogenic bacteria and periodontopathogens. Each dose of lozenge contains at least 2 X 108 living cells of L. reuteri Prodentis. Users are advised to use a lozenge every day, either after a meal or in the evening after brushing their teeth, to allow the probiotics to spread throughout the oral cavity and attach to the various dental surfaces. (Bonifait .et al 2009)[1]

Conclusions

Probiotics represent a new area of research in periodontics, the examination of the close relationships between food and oral health. Preliminary data obtained by various research laboratories have been encouraging, but numerous randomized clinical studies will be required to clearly establish the potential of probiotics in preventing and treating oral infections. Such studies will allow identification of the probiotics that are best suited to oral use, as well as the most appropriate vehicles: food products (cheese, milk, yoghurt) or supplements (chewing gum, lozenges). The existence of probiotics in the indigenous oral microflora of humans warrants exploration because these bacteria offer the advantage of being perfectly adapted to the human oral ecosystem.

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