

Probiotics and Dentistry: A Review

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Abstract

The term “probiotics” literally means “for life” and was coined for the first time in the 1960s. According to the report of the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) (2002), probiotics are “live microorganisms which when administered in adequate amounts confer a health benefit on the host” In modern era, probiotics have been used to promote oral health. The Time has come to shift the paradigm of treatment from elimination of specific bacteria to altering bacterial ecology by using probiotics. Probiotics are dietary supplements which contain

potentially beneficial bacteria or yeasts. They help in stimulating health promoting flora and also suppressing pathogens which cause and spread diseases. The Probiotic approach has shown promising results in the oral health with respect to control of chronic disease such as dental caries, periodontitis, and recurring problems like candidal infections and halitosis. Thus, the aim of present literature is to focus on the role of Probiotics in oral health.

Keywords: Probiotics, Dentistry, Oral health

Introduction

The oral cavity consists of more than 700 bacterial species or phylotypes, of which over 50% have not been

cultivated. For the past several decades, some of the non pathogenic bacteria called probiotics have been added to food products because of their beneficial effect to human health, thus proving.¹

The term probiotics is derived from Greek, meaning “for life.” Probiotics thus are microorganisms proven to exert health promoting influences in humans and animals. In 1994, the World Health Organisation (WHO) stated probiotics as the next most important immune defence system when commonly prescribed antibiotics are rendered useless by antibiotic resistance. The Food and Agricultural Organisation of the United Nations (FAO)/WHO in 2001 defined probiotics as “live microorganisms, when administered in adequate amounts, confer a health benefit to the host.”²⁻⁴

Probiotics have emerged as a fascinating scientific area, health-related and commercial target for the last two decades. There is a long history of health claims concerning living microorganisms in food, particularly lactic acid bacteria. Commonly, most of the species ascribed as having probiotic properties belong to the genera *Lactobacillus* and *Bifidobacterium*. Those bacteria are generally regarded as safe because they can reside in the human safe body causing no harm and also they are involved in milk fermentation and food preservation and used as such since long ago.²

The promising results of probiotics in oral and general health have shown their wide spread application. Thus, the aim of present literature is to focus on the role of Probiotics in oral health.

History of Probiotics

The idea of probiotics dates back to the first decade of 1900s when the Ukranian bacteriologist and Nobel Laureate Metchnikof (1908) studying the flora of the human intestine developed a theory that senility in humans

is caused by poisoning of body by the products of some of these bacteria.^{5,6} In 1950, a probiotics product was used as a drug among pigs in the treatment of scour. Lilley and Stillwell in 1965 introduced the term probiotics as an antonym to antibiotics. In 1974 Mann and Spoering observed that the fermented yogurt reduced blood serum cholesterol. Hull in 1984 identified the first probiotic species, the *Lactobacillus bionum*. Several clinical studies have proven their beneficial effect in treatment of cancer and dental caries.⁷

Micro-organisms commonly used as Probiotics

Probiotics can be varied. They can be yeast, bacteria or moulds. But most commonly, bacterial species are predominant. Some of these species are;⁸

Table no. 1 Micro-organisms commonly used as Probiotics	
Lactic acid producing bacteria	<i>Lactobacillus</i> , <i>bifidobacterium</i> , <i>streptococcus</i>
Non lactic acid producing bacterial species	<i>Bacillus</i> , <i>propionibacterium</i>
Non pathogenic yeasts	<i>Saccharomyces</i>
Non spore forming and non flagellated rod or coccobacilli	

Role of Probiotics in Oral Health

Probiotics and Periodontitis: Periodontitis is a multifactorial disease that encompasses the hard- and soft-tissue, microbial colonization (with or without invasion), inflammatory responses and adaptive immune responses.⁹ *Porphyromonas gingivalis*, *Aggeratibacter actinomycetem comitans*, *Tanirella forsythus*, and *Treponema denticola* are established periopathogens covering red and green complex of Socransky colour coding. *Streptococcus oralis* and *Streptococcus uberis* have reported to inhibit the growth of pathogens both in the laboratory and animal

models. They are indicators of healthy periodontium. When these bacteria are absent from sites in the periodontal tissues, those sites become more prone to periodontal disease.¹⁰

Recently, various studies have reported lactic acid inhibition of oral bacteria suggesting a promising role in combating periodontal diseases. *Lactobacillus reuteri* was evaluated by Krasse et al. in recurrent gingivitis case. A parallel, double-blind, randomized, placebo-controlled study with 59 patients having moderate-to-severe gingivitis were taken up. *Lactobacillus reuteri* strains were administered via chewing gum twice a day for 2 weeks at a concentration of 1×10^8 CFU (colony forming unit) along with Scaling and root planning. After 2 weeks, the clinical parameters were improved in group consuming probiotics chewing gum.¹¹

Treatment of periodontal diseases in recent years has moved towards an antibiotic/anti-microbial model of disease management. Probiotics might be a promising area of research in the treatment of periodontitis. Probiotics decrease the pH of the oral cavity so that plaque bacteria cannot form dental plaque and calculus that causes the periodontal disease. They make excellent maintenance product because they produce antioxidants. Antioxidants prevent plaque formation by neutralizing the free electrons that are needed for the mineral formation.¹²

Probiotics and Dental Caries: Dental caries is an infectious disease that affects most of the population. This multifactorial and complex disease process occurs along the interface between the dental biofilm and enamel surface. Several methods may be used to alter the cariogenicity of the biofilm which is responsible for dental caries. Probiotic and molecular genetic techniques have been used to replace cariogenic organisms such as mutans streptococci and *Lactobacillus* species with strains of

bacteria that are not cariogenic. Several studies suggest that consumption of products containing probiotic lactobacilli or bifidobacteria could reduce the number of mutans streptococci in saliva.^{13,14}

Probiotics and Orthodontic treatment: Enamel demineralization clinically visible as white spot lesions are one of the most common adverse effects of orthodontic treatment and can have lasting negative effects on dental esthetics. When basic oral hygiene is poor, orthodontic appliances create areas of plaque stagnation, especially around brackets, bands, wires, and other attachments; this facilitates the development of white spot lesions. Levels of acidogenic bacteria, present in the plaque, notably *Streptococcus mutans*, are higher in orthodontic patients than in nonorthodontic patients. This causes demineralization around the brackets and leads to White spot lesion.¹⁵ A study by Cildir et al, in which the effect of probiotic yogurt was evaluated on *S. mutans* counts in the saliva of orthodontic patients, showed that the number of subjects with high *S. mutans* counts decreased from 63 to 21% after 2 weeks of consumption.¹⁶

Probiotics and Candida infection: Oral candidiasis (OC) is an increasing health problem due to the introduction of new drugs, population aging, and increasing prevalence of chronic illness. Probiotics properties suggested their use for the treatment and prevention of many medical conditions (diarrhea, constipation, inflammatory bowel disease, irritable bowel syndrome, allergic disease), sometimes with excellent results.¹⁶ In addition, probiotics also showed an antifungal action and were successfully used in mucosal candidiasis, as reported in an in vivo study by Wagner in 1997.¹⁷ Sookkhee et al., in 2001, studied the effects on *Candida albicans* growth of different lactic-acid bacteria isolated from the oral cavity of volunteers and

found that two strains, *Lactobacillus paracasei* and *Lactobacillus rhamnosus*, had the strongest effect on the yeast.¹⁹

Probiotics and Halitosis: Halitosis has many causes (including consumption of particular foods, metabolic disorders, respiratory tract infections), but in most cases it is associated with an imbalance of the commensal microflora of the oral cavity. Halitosis is primarily caused by anaerobic bacteria associated with periodontal disease. The common organisms involved in halitosis are *Fusobacterium nucleatum*, *P. gingivalis*, *P.intermedia* and *Treponema denticola*. These organisms degrade aminoacids, which are in turn transformed into volatile sulphur compounds which cause halitosis. Kang and colleagues reported that various strains of *Weissella cibaria* have the capacity to coaggregate with *fusobacterium nucleatum* and to adhere to epithelial cells and these bacteria produce hydrogen peroxide as well as a bacteriocin which inhibited the proliferation of *F. nucleatum*. These properties could enable *W. cibaria* to effectively colonize the oral cavity and limit the proliferation of *F. Nucleatum* and thus can prevent halitosis.²⁰

Discussion

Treating the oral infection by reducing the number of pathogenic oral microorganisms and establishing a favourable oral environment to promote predominantly remineralization of tooth structure over time will stop the disease process. Probiotic technology represents a breakthrough approach to maintain oral health by utilizing the natural beneficial bacteria commonly found in healthy mouth to provide natural defence against those bacteria thought to be harmful to teeth and gums.²¹

Several mechanisms have been proposed regarding action of probiotics. These bacterial strains acts by secreting

various antimicrobial substances such as, organic acids, hydrogen peroxide and bacteriocines. Furthermore, they compete with pathogenic agents for adhesion sites on mucosa. Probiotics can also modify the surrounding environment by modulating the pH and/or the oxidation reduction potential, which may compromise the ability of pathogen to become established. Finally they provide beneficial effects by stimulating nonspecific immunity and modulating the humoral and cellular immune response.¹

With the slow progress of isolating new antibiotics coupled with the increase of emerging resistant pathogenic bacteria, it has become imperative to try and enhance the use of living therapeutics. Probiotics form the cornerstone of such biotherapy. The selection of probiotics should be based on products that have been tested clinically for any disorders that could eventually cause. However, even if the use of probiotic products in healthy patients is safe, they are not recommended in patients with specific risks, such as immunocompromised patients or patients suffering from diseases of the cardiac valves. Before using probiotic for oral health, it is necessary to perform a proper protocol of prophylaxis, as it is amply demonstrated that it is difficult to destroy a biofilm already acquired. It is also important to clarify that probiotics are an additional tool, not a substitute for the classic oral hygiene methods.²²

With the limitation of available data it can be said that the more research should be carried out in this direction to identify where probiotics are expected to play an important therapeutic and/or preventive role in the development of oral diseases.

Conclusion

Probiotics is defined as live micro-organisms which, when administered in adequate amounts, confer a health benefit on the host. Various studies have come up in recent past

exploring probiotics in fields of caries, periodontal diseases and few other areas and the results showed the beneficial effects of probiotics on oral health and on whole body in general.

Probiotics for the oral health are still a promising new field of research. Obviously, further research is necessary to demonstrate the effects of probiotics in the prevention and treatment of dental caries, periodontal disease and bad breath.

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