



## THE ROLE OF PROBIOTICS IN ORAL HEALTH

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### ABSTRACT

In the recent years, there is an increasing tendency among health care professionals to combat the various diseases using biological means without the use of chemical agents. It is in this regard, the role of probiotics gains significance. Probiotics are a group of bacteria, which change the ecosystem in localized areas of the body, thereby keeping the pathogenic bacteria under control. This review article highlights the applications of probiotics in dentistry in the prevention of dental caries, periodontal diseases, cancer .

**KEYWORDS:** Probiotics, caries prevention, oral cancer prevention



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## INTRODUCTION

The human body has an ecosystem, which is made up of a large number of bacteria. The ecosystem present with the gut consists of both beneficial bacteria, which help in the proper functioning of the human body and a few pathogenic species, they are kept under check by the beneficial bacteria. The source of these bacteria are from the dietary sources. When this balance is in favour of the beneficial bacteria, the human digestive system functions optimally.<sup>1-3</sup> Probiotics are those bacterial populations which are present in our dietary sources which when ingested promote the beneficial functions of the human body. An international life science institute Europe proposed a simple and widely accepted definition as "Probiotics-Viable microbial food supplements which beneficially influence the health of human"<sup>1-4</sup>. The use of probiotics constitutes a purposeful attempt to modify the relationship with our immediate microbial environment in ways that may benefit general health. With the evolution of the science of nutrition, research is now being directed towards improving the understanding of specific physiologic effects of the diet beyond its nutritional effect<sup>2</sup>. Probiotic bacteria have been shown to influence the immune system, prevention of dental diseases through several molecular mechanisms.<sup>4</sup> Looking at the historical perspective the use of probiotics have been noted in the Persian version of old Testament, it states that "Abraham owed his longevity to the consumption of sour milk". In 76BC the Roman historian Plinius recommended the administration of fermented milk products for treating gastroenteritis<sup>5</sup>. In 1907, Elie Metchnikoff postulated that consumption of Bulgarian yoghurt promotes good health. Lilley and Stillwell (1965) introduced the term probiotics.<sup>6</sup>

### **Mechanism of action:**<sup>5</sup>

The probiotics create a competitive environment with the other bacterial flora and eliminate them while establishing their individual place. The way these bacteria go about establishing their niche is not well understood, but several mechanisms have been suggested:

- a) Binding to the mucosal surface by a direct competition with the other bacteria
- b) Secretion of various substances such as bacteriocins, hydrogen peroxide and organic acids. These substances have an antibacterial role on the pathogenic species.
- c) Alteration of the microenvironment: They alter the redox potential, pH of the environment in a way that leads to destruction of the pathogenic species.
- d) Directly mediate the immune system of the body in a way that eliminates the pathogenic species. The role in immune modulation includes increased mucin production, modulation of inflammatory responses, alteration of the immunoglobulin production.<sup>5</sup>

### **Probiotic species**

The probiotic species to be used should have the following ideal characteristic of being of being beneficially useful without causing any harm to the patient. Further the ideal characters also includes the retentivity of the organism and the ease of administration of the agent. The species which are commonly used in humans are:

- a) Lactobacillus sps: They help in the production of enzymes which help in the digestion of proteins and carbohydrates. They are also involved in the synthesis of vitamin K and vitamin B12. The species of medical importance are: L. acidophilus, L. brevis, L. casei, L. rhamnosus, L. salivarius.
- b) Bifidobacterium sps: These help in the metabolism of lactic acid and also in the formation of short chain fatty acids from fermentable carbohydrates. Therapeutically this group of bacteria has been found to have a beneficial effect in the prevention of cancer and in reducing antibiotic induced diarrhea.
- c) Saccharomyces boulardii: This group also seems to be having beneficial effects on several of the diarrheas, that occur in the oral cavity.<sup>5-9</sup>

### **Role of probiotics in dental caries**

Dental caries is a multifactorial disease which is caused by microbes, with the co factorial role of carbohydrates. The microbes ferment

the carbohydrates and produce an acid, which causes demineralization of tooth. Hence, for a probiotic to be useful it must be capable of binding to the tooth and inhibit the adherence of cariogenic bacteria. Among the various bacteria evaluated as a probiotics for dental caries prevention is *Lactobacillus rhamnosus*. They compete with *Streptococcus* and establish a biofilm on the tooth.<sup>4</sup> These bacteria will have to be carried in suitable vehicles which are usually the dietary components. The ideal vehicles for carrying this probiotic organism are yoghurt, milk and cheese. These vehicles should have an adhesive property and get retained to the tooth surfaces for a length of time to exert its action. The other bacteria which have a preventive role are *Streptococcus thermophiles* and *Lactobacillus lactis*.<sup>5,10,11</sup> These bacteria were found to have a positive role in inhibiting the growth of *Streptococcus mutans*. The search of the literature revealed a study done by Nase et al in 2001, a group of 594 children aged 1-6 years were given milk supplements with *L.rhamnosus*. On a follow up of these children for a period of 7 months had significantly lower caries incidence than the normal children. This promising study suggests that there is a potential benefit in the usage of probiotics in the prevention of dental caries.<sup>9-12</sup>

#### ***Role in periodontal disease progression***

Periodontal diseases are broadly classified into two categories viz: gingivitis and periodontitis. The cardinal point of differentiation between gingivitis and periodontitis is that gingivitis is characterized by inflammation of the gingiva while periodontitis is a progressive disease where there is destruction of gingiva and the supporting structures of the tooth. The main pathogenic agents associated with periodontitis are *P. gingivalis*, *Treponemadenticola*, *Tannerella forsythia* and *Aggregatibacter actinomycetemcomitans*.<sup>5,13</sup> The management of the periodontal diseases is to bring out a reduction of the sub gingival microflora and recolonization of these bacteria with other useful bacter.<sup>3</sup> Research studies have shown *L.leuri* when used as a probiotic organism is found to have a protective role in the prevention of periodontal diseases.<sup>5,14</sup> In a study carried out by Teughels et al, the

application of *L.leuri* as a an adjunct to scaling and root planning was found to have a potential benefit when used in the management of pockets.<sup>12-15</sup>

#### ***Role of probiotics in halitosis***

Oral malodor or halitosis remains a socially embarrassing problem. There are several causes of halitosis such as the accumulation of local factors, respiratory diseases, or imbalance of oral microflora. The basic principle is that the anaerobic bacteria degrade the food products into volatile sulphur compounds like hydrogen sulphide and lead to the production of oral malodour.<sup>16,17</sup> A closer look at microbiology reveals that *F.nucleatum* is a bacterial species that is found in high quantities in people with halitosis. Further they have also noticed that there is a reduction in the count of *S.salivarius*. To alter the ecosystem in such a way that there is a decrease in *F.nucleatum* seems to be a favourable approach in the management of halitosis.<sup>18,19</sup> A study by Kang and colleagues<sup>5</sup> reported that there was a significant reduction in the *F.nucleatum* numbers when the patients used a gargling mouthwash of *W.cibaria*. The study further noted that there was a decrease in the sulphur compounds and methanethiol compounds when using mouthwash with *W.cibaria*. The literature also reveals using lozenges or sugar free chewing gums with *S.salivarius* found to have a protective role in the reduction of occurrence of halitosis. From these reports it becomes clear of the role of probiotics in altering the ecosystem of the oral cavity in reducing the occurrence of halitosis.

#### ***Role of probiotics in cancer***

Oral cancer accounts for the second most common malignancy in our country. The five year survival disease free rate remains at around 50% only for oral cancer. More than 80% of the oral cancers are due to the usage of tobacco related products. Several attempts have been made by researchers to find out methods to keep this disease under control. On perusing the literature, several in-vivo studies have demonstrated encouraging outcomes, mainly attributed to its antimicrobial effects against carcinogen-producing microorganisms, antimutagenic properties, and alteration of the tumor differentiation processes. Further, in humans it has been

observed that the ingestion of probiotics has lead to a reduction in the genotoxic components and products which induce DNA damage.<sup>1,20</sup> However conclusive evidence on the role of probiotics in oral cancer is lacking at the moment.

## CONCLUSION

From the discussion, we understand that the role of probiotics is wide and far fledged. A lot of recent research regarding the benefits of probiotics in oral health and disease has been undertaken which shows promising

results.<sup>1</sup> The role of probiotics as a passive local immunization against dental caries has been well established.<sup>2</sup> Research is directed at the reduction of severity and occurrence of mucosal lesions, specifically aphthous ulcers<sup>2,7,8</sup>. Though the early research studies pertaining to probiotics is promising, a complete understanding of its mechanism of action needs to be understood to exploit the full therapeutic potential of probiotics. Further looking at the clinical trials also, most studies lack a long term follow up, hence larger multi centric trials with long follow up would be required.

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