

Probiotics - A New Era in Eradication of Dental Caries

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ABSTRACT

Dental caries is a microbial disease caused by oral biofilm containing *Streptococcus mutans*, leading to destruction of tooth structure. Despite the use of age old conventional physical and chemotherapeutic methods for caries management, dental caries still continues to be the most prevalent form of oral infectious disease. With better understanding of the Ecology and microbiology of the oral cavity and with the advent of Minimal Invasive Dentistry, there has been a shift in the treatment modalities of caries. Probiotics have been recently introduced in dentistry and is one of the newer approaches in caries management. They have been used successfully for several years mainly for gastrointestinal disorders. Most probiotic strains belong to *Lactobacilli* or *bifidobacteria* group. The aim of this comprehensive review is to present an update about the recent advances in probiotic use for the prevention of dental caries.

Keywords: Dental caries, probiotics, *Lactobacillus*, *Streptococcus mutans*

INTRODUCTION

The World Health Organization estimates that about 50% of people suffer from dental diseases. About 2.4 billion people have dental caries and, 532 million children are having primary teeth decay. Oral health care is too costly, and in high-income countries, about 5% of the total health costs are spent

on oral health care. Tooth decay is a disease related to several different factors such as a cariogenic diet, poor oral health, high counts of cariogenic acid producing bacteria such as *Streptococcus* and *Lactobacilli*, dental plaque, decreased saliva, and reduced fluoride exposure.^{1,2}

Although the use of fluorides, chemoprophylactic agents and other preventive measures declined the incidence and prevalence of dental caries, the ability to control the actual infection has been limited. The concept of environmental factorial change i.e. the microbial change as a mechanism of preventing dental disease is an important era in dentistry. To reduce the wide spreading of cariogenic microflora, various efforts have been undertaken but complete eradication of caries-associated microorganisms has been futile⁴.

Probiotics are at present the subject of eager and extensive research, especially in the field of caries prevention. The replacement of pathogenic species with the administration of adequate number of nonpathogenic types is the basics behind probiotic.⁵ The term probiotic, meaning “for life,” is derived from the Greek language. Probiotics word was first introduced by Lilly and Stillwell to describe “substances secreted by one microorganism which stimulates the growth of another”. It can be defined as “Live microorganisms that when

administered in adequate amounts confer a health benefit on the host".⁶

Probiotics acts directly or indirectly to improve the oral health and has the ability to reduce the salivary pH and synthesize antioxidants that make use of the free electrons that are necessary for the mineralization of plaque, thus leading to the inhibition of plaque formation. The development of dental plaque and progression of dental caries can be thwarted by inhibiting the colonization of *S. mutans* on the tooth surface.⁵

Hence the present review was done mainly to reveal the action of probiotics in prevention of dental caries

Action of probiotics

Ideal properties of probiotics⁷

1. It should show a beneficial effect on the host
2. It should be non-pathogenic and non-toxic
3. It should Contain a large number of viable cells
4. it should survive and metabolize in the gut
5. it should be viable during storage and use
6. Have good sensory properties
7. Be isolated from the same species as its intended host

Micro-organisms commonly used as Probiotics^{8,6}:

<i>Lactobacillus</i>	<i>Acidophilus</i> <i>Casei</i> <i>Plantarum</i> <i>Delbreukii</i> <i>Bulgaricus</i> <i>Reuteri</i> <i>Gasseri</i> <i>Fermentum</i> <i>Salivarius</i> <i>rhamnosus</i>
<i>Pediococcus</i>	<i>Pentosaceus</i>
<i>Saccharomyces</i>	<i>Cerevisiae</i> <i>Boulardii</i>
<i>Bifidobacterium</i>	<i>Bifidum</i> <i>Lactis</i>
<i>Enterococcus</i>	<i>Faecium</i>
<i>Bacillus</i>	<i>Subtilis</i> <i>Cereus</i> <i>Coagulans</i> <i>Licheniformis</i>
<i>Aspergillus</i>	<i>Oryzae</i>

Approach in prevention of dental caries

- Dental caries is mainly caused due to the microorganism called *Streptococcus mutans*. It has ability to produce glucan, mutan, which facilitates the establishment of oral biofilm. Its acidogenic properties and rapid metabolism of sugars reduces the salivary pH which leads to causation of caries.
- clinical trials with probiotics like *Lactobacillus rhamnosus*, *Lactobacillus reuteri*, *Bifidobacterium* has shown reduction in *S. mutans* count due to the its ability modify the composition of salivary pellicle by binding and degrading proteins thereby preventing adhesion of *S. mutans* to the oral biofilm.
- Genetically modified *S. mutans* is the newer one, this modified mutans no longer produces acid and displaces the wild strain of *S. mutans* from the oral environment.
- Another method to remove pathogens is to develop targeted antimicrobials. They are capable of producing antimicrobial substances such as organic acids, hydrogen peroxide, mutacin, bacitracin, Lactase, bacteriocin, biosurfactants and fatty acids for antagonizing the pathogens.
- Probiotics also lower the peroxidase levels thus improving the antibacterial activity of saliva. They lead to changes in oral pH and redox potential.
- By neutralizing free electrons probiotics prevents plaque formation.
- Stimulate non-specific immunity and modulate humoral and cellular immune response
- Enhances host immune response by production of IgA and defensins. Decreases the production of matrix metalloproteinases, leading to inactivation of probiotic bacteria by mechanisms of Aggregation and coaggregation.⁹

New approaches to achieve probiotic effects.⁶

Interference with signaling mechanisms: quorum sensing mechanism involving Competence Stimulating Peptide (CSP) as the signaling molecule has capability to regulate various pathogenic properties of *S. mutans*. Addition of CSP can interfere with signaling events of *S. mutans* there by leading to the death of the bacterium, Targeted antimicrobial therapy via a novel STAMP technology-Specifically Targeted Anti-Microbial Peptides (STAMPs). A -STAMP is a fusion peptide with two moieties: a killing moiety made of a nonspecific antimicrobial peptide and a targeting moiety containing a species-specific binding peptide. The targeting moiety provides specific binding to a selected pathogen and facilitates the targeted delivery of an attached antimicrobial peptide

Safe probiotics

Organisms that are generally regarded as safe probiotics include lactobacilli, lactococci, Bifidobacterium, and yeast. Lactobacilli have a long history of safe use in foods and dairy products, Lactic acid bacteria have been used in fermented milks, by various societies for the treatment of intestinal disturbances. Rarely in immunocompromised hosts the lactic acid bacilli will cause infection which has manifested as either bacteremia or endocarditis. The other spore forming bacteria which are not generally regarded as safe but have been used as probiotics were Enterococcus, Bacillus and streptococci.¹⁰

CONCLUSION

The practical application of probiotic strain is a new tool in preventing caries along with the already available strategies, particularly among high-risk people. Probiotics have got immense potential in dealing with dental caries and was accepted globally that consumption of probiotics helps in leading a healthy life.

Declaration by Authors

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