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Probiotic in Dentistry - A Narrative Review

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Abstract

The human mouth contains at any given time a plethora of microorganisms. In health, these organisms exist in relative harmony and equilibrium. This balance, being crucial to good oral health. When this equilibrium tips in the favor of pathologic bacteria, a cascade of oral diseases begin to appear.

The goal of any dental treatment aims to eliminate this disharmony. In the spectrum of arsenal that the dental practitioner has, one such is the Probiotics.

The International Scientific Association for Probiotics and Prebiotics have described Probiotics as live microorganisms that, when administered in adequate amounts, confer health benefits to the host.

Overall, probiotics have the potential to become a valuable adjunctive therapy in dentistry, that will help to maintain a healthy microbial balance, help in preventing dental diseases and promote overall oral health. Further research and clinical trials will help to establish their precise role in dental practice and provide evidence-based recommendations for their use.

Keywords: Probiotics; prebiotics; postbiotics; *Bifidobacterium*; *Saccharomyces boulardii*

Introduction to Probiotics

Probiotics, which are an antithesis to antibiotics, were made known in 1965 by Lilly & Stillwell as elements created by microorganisms that encourage the increase of different favourable microorganisms [1].

Its benefits for the overall health received importance only when, in 1907 Metchnikoff noted that microorganisms found in spoilt milk strived against bacteria that were detrimental to health [2].

The advent of probiotics started with its effect on the gastrointestinal system [3]. It is only recently that the focus shifted to involve the oral cavity.

Introduction of the gastrointestinal system begins with the oral cavity and it is safe to assume that the probiotics will have a favourable effect on the bacteria present there [4].

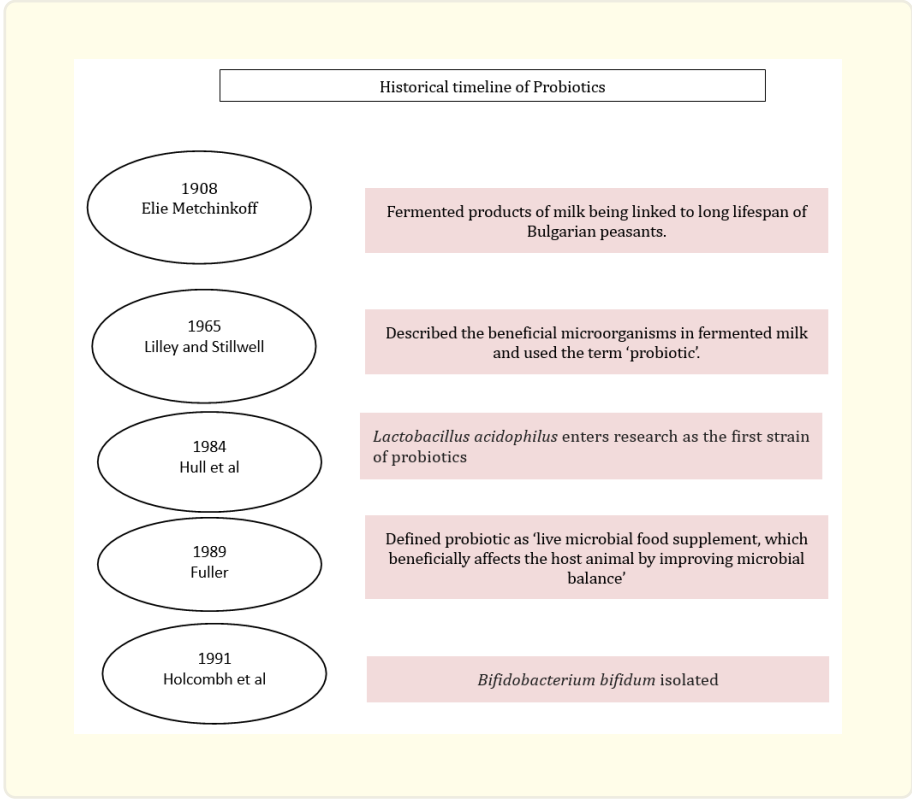
Probiotics have been gathering momentum in their applications. It is common knowledge that though dental decay is an interplay of multiple factors, microbiological factors and host immune factors also play an important part. It is proven with the backing of many studies that the predominant species seen in the mouth are *Corynebacterium*, *Prevotella*, *Actinomyces*, *Streptococcus*, *Haemophilus*, *Leptotrichia*, *Veillonella*, *Fusobacterium*, *Capnocytophaga*, *Rothia*, *Treponema*, *Selenomonas* [5] Evidence also hints that organic and fatty acids, antimicrobial peptides, hydrogen peroxide aid in the antimicrobial effects of probiotics [7]. This leads to the belief that,

bacteriotherapy shows potential future as an additional therapy to prevent diseases of oral cavity [6].

History

The footsteps of probiotics can be tracked back to Pasteur and his associate, Joubert, who noticed in 1877 that *anthrax bacilli* which when co-cultured along with regular bacteria (most likely *E.coli*) was repressed. This gave a promising glimpse into the future of medicine [8].

Ukrainian-born Nobel Prize winner Eli Metchinkoff, suggested in1907, a certain strain of *Lactobacillus bulgaricus* that was found in a certain yogurt, was capable of competing with the pathologic microbes of the gut.



Need for Probiotics

In 1994, World Health Organization forecasted that probiotics were the answer to the alarming rise in the antibiotic resistance in people. The increasing cases of antibiotic resistance in the past few years, created an opening for studying the use of these in oral health and medicine [9].

One of the main areas of interest for probiotics in dentistry is the prevention and management of dental caries and periodontal diseases. By introducing beneficial bacteria through probiotics, it is believed that the equilibrium of the oral microbiome can be restored, limiting the growth of pathogenic bacteria and promoting oral health.

Prebiotic, Probiotic, Postbiotics

The microorganisms can be altered in three ways by Prebiotics, Probiotics and Postbiotics.

Prebiotics	*Probiotics*	*Synbiotics/Postbiotics*
Acts as nutrition source for bacteria. Simultaneously has a positive effect on the host.	Have a direct effect on the gastrointestinal bacterial by specific transport of favorable bacteria.	Beneficial effects are because of inactive bacteria or some of the compounds that are bioactive.
Ex: Lactulose, inulin derivatives, Human milk oligosaccharides	These are the desirable as they aid in establishing a favorable equilibrium of microbiota in the gut.	These are byproducts of the probiotic bacteria through metabolic activity of prebiotics to release nutrients like Vitamin B, amino acids etc.
This term was given by Gibson and Roberfroid (1995)	Yeasts and other microorganisms can also have probiotic properties.	
"a substrate that is selectively utilized by host microorganisms conferring a health benefit (ISAPP)"		
These are the medium used by probiotic bacteria that include fiber-based sources. They can be natural or derived. Ex: chia seeds, flaxseeds, barley.		
Help in improving the count of probiotic lactic acid secreting bacteria in the gut to suppress the count of bacteria like *E.coli* and *Salmonella* species.		

Composition of Probiotics

The composition of probiotic can be just one bacterial strain or a combination. Probiotics are available in many forms like liquid, powder, paste, granules, gel.

The organisms that form Probiotics can be yeast, moulds or most common, live bacteria [10]. The composition of probiotics in dentistry can vary depending on the specific product and manufacturer. *Lactobacillus johnsonii*, *Lactobacillus rhamnosus*, *Lactobacillus del-brueckii Lactobacillus fermentum*, *Lactobacillus reuteri*, *Enterococcus faecalis*, *Enterococcus faecium*, *Saccharomyces boulardii*, *Bifidobacterium breve*, *B. longum*, *B. bifidum* and *Streptococcus thermophiles* are commonly used bacterial probiotics. Each probiotic product has different strains and their concentrations.

Selection of probiotics in dentistry

Probiotics and its application in dentistry has been a recent development. Research shows promising results in its part as an adjuvant to improving oral health. Following are some of the factors to consider when selecting probiotics for dental health:

1. ***Strain selection***: Each strain of probiotic bacteria have different outcomes on health. Probiotics that contain specific strains have been shown to be beneficial for oral health, such as *Streptococcus salivarius*, *Lactobacillus reuteri*, or *Lactobacillus paracasei*.
2. ***Oral survivability***: The probiotic strains must be able to survive and colonize in the oral cavity. The product needs to provide information on the survivability of the strains in the mouth. Some strains have better adherence and colonization abilities, which can increase their effectiveness in promoting oral health.

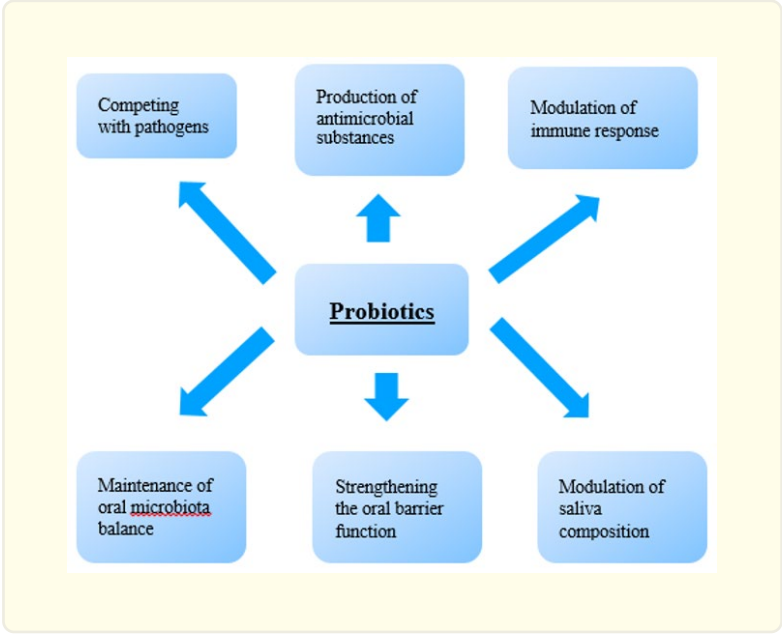
3. ***Scientific evidence***: Look for probiotics that have been studied in clinical trials specifically related to oral health. Scientific evidence is crucial to support the claims and effectiveness of a particular probiotic product.
4. ***Formulation***: Consider the formulation of the probiotic product which are in various forms such as lozenges, gums, or oral rinses. Choose a formulation that is practical and easy to incorporate into your oral hygiene routine.
5. ***Quality and reputation***: Select probiotic products that are third-party tested for quality, purity, and potency.

Additional ingredients

Additional ingredients in probiotics can enhance their effectiveness, such as prebiotics or other oral health-promoting compounds like xylitol.

Mechanism of Action of Probiotics on Oral Health

The various means by which probiotics work in a beneficial way in dentistry are still being studied. However, several mechanisms have been proposed based on current research. Below is a diagram showing the various potential ways in which probiotics acts:



1. ***Competition with pathogens***: The availability of substrate for nutrition and host factor (tooth) for attachment is competed for by the Probiotic bacteria against the pathogens. By occupying these sites, probiotics can prevent the attachment and proliferation of disease causing bacteria, thus reducing the risk of oral infections and diseases.
2. ***Production of antimicrobial substances***: the production of antimicrobial products such as organic acids, hydrogen peroxide and bacteriocins by some probiotic strains have the potential to decrease the multiplication of oral pathogenic flora. This can restore the equilibrium of the oral cavity.
3. ***Alteration of immunity reaction***: Probiotics work by reestablishing the balance in the immunity reaction. These also activate the defense cells in the oral cavity, they alter the immunity this decreasing inflammation and increasing their defense against oral infections.
4. ***Maintenance of oral microbiota balance***: Probiotics can help in controlling the configuration and variety of the oral microbial flora. Thus, controlling dysbiosis and promoting a more favorable oral microbiome.

5. ***Strengthening the oral barrier function***: Probiotics have been shown to enhance the integrity and function of the oral epithelial barrier. This can help in barring the entry of pathogenic bacteria into the underlying tissues, reducing the risk of oral infections and inflammation.
6. ***Modulation of saliva composition***: Some probiotics have been found to influence the composition and properties of saliva. This can impact oral health by promoting saliva's natural protective functions, such as buffering acids, re-mineralizing teeth, and clearing away harmful substances.

It is imperative to know that the specific actions of probiotics is related to the formulation and the type of probiotic strain used. Additionally, the benefits of this in dentistry will differ amongst patients and their specific oral health conditions. Future studies will help us to know the at the molecular level in which probiotics work and to modulate their use in dental applications [11].

Conclusion

Overall, probiotics have the potential to become a valuable adjunctive therapy in dentistry. While the research on probiotics in dentistry is relatively in its early stage compared to other fields of medicine, the potential benefits look promising. More studies and research on this material is the only way to get a better understanding regarding its dosages and outcomes in individuals. Will they need curating in each individual or can they be an over the counter product will only be confirmed in the future.

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