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A Review On Probiotics– A New Paradigm In Periodontal Health

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Abstract

Periodontitis is a multifactorial, polymicrobial disease that affects the teeth and the structures that support them. The three primary elements that cause plaque-induced gingival and periodontal diseases are a sensitive host, pathogenic bacteria, and a reduction or absence of helpful bacteria. Using host modulation agents and antibiotics, various researchers have found strategies to control / modify the first two parameters in the past. Few people have paid attention to the third aspect, which is boosting the growth of good microorganisms.Probiotics have changed the pharmaceutical world in this regard, as they have been shown to be more useful than antibiotics, as well as assisting in the reduction or elimination of antibiotic side effects. As a result, the goal of this literature review is to emphasise the key characteristics of probiotics and their involvement in periodontal disease.

Keywords: Probiotics, microorganisms, beneficial bacteria, periodontitis.

I. Introduction

A high burden of pathogenic bacteria in the subgingival environment characterises periodontitis, a polymicrobial illness. Antibiotic resistance and microbial recolonization of the pocket forced the development of a new therapeutic paradigm, which resulted in the discovery and usage of probiotics. Probiotics promote the growth of beneficial bacteria while also reducing harmful microorganisms. Commensal bacteria are important because they bind to mucosal areas and prevent pathogenic strains from binding there, as well as inhibiting the first step of pathogenicity, adhesion.[1]The expression of cellular mediators is also influenced by commensal organisms, which strengthens the immune system, restores normal haemostatic systems, and modulates the inflammatory response.

Probiotics have been defined by a number of authors and governing bodies, with the World Health Organization's 2002 definition being the most widely accepted. They described a probiotic as live bacteria that, when given in sufficient proportions, provide a host with health benefits.[1] Probiotics are life-promoting bacteria that stem from the Latin or Greek words pro: before, forward, and bios: life. Lactobacilli and Bifidobacteria are the most frequent forms of helpful bacteria.

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II. History of Probiotics

Various pioneering researchers have shared their knowledge about probiotics in their studies.[2] The evolution of probiotics is depicted in Figure 1.

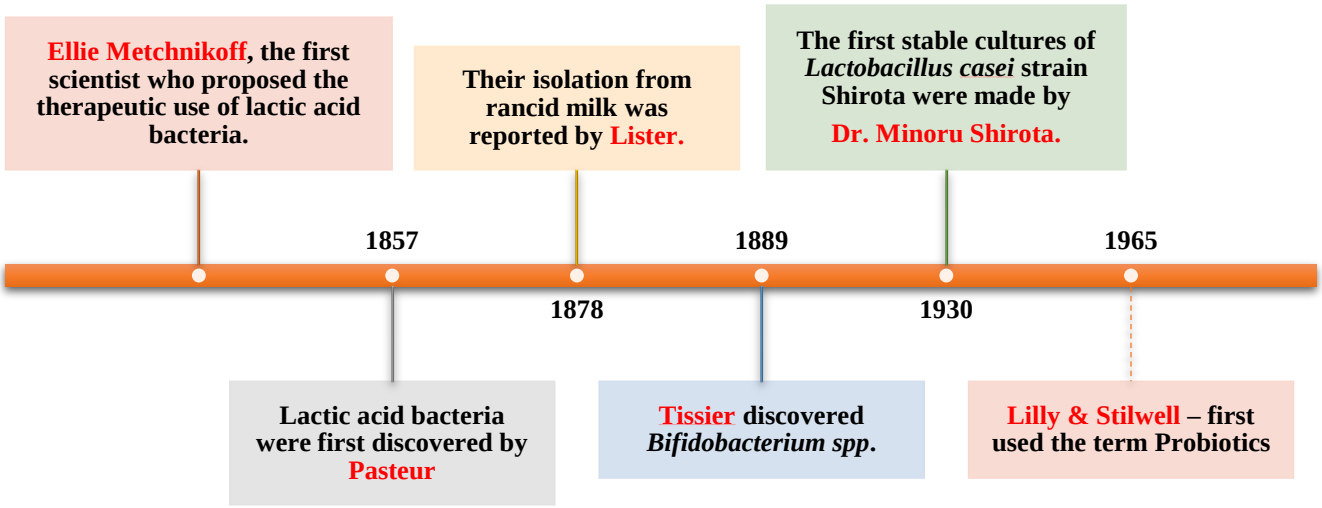

Figure 1 – Evolution of Probiotics

III. Ideal candidates for Probiotic usage

Probiotics are generally prescribed for:[2]

People with yeast infections of any kind, including athlete's foot, jock itch, vaginal yeast infections, and nail fungus, people with weakened immune systems, frequent respiratory infections and congestion, people with food or respiratory allergies, and people with inflammatory bowel disorders, constipation, or intestinal infections are all at risk.

IV. Characteristics of an Ideal Probiotic

The following are qualities of an excellent / ideal probiotic. It should be able to travel through the digestive system undamaged. Capable of attaching to and colonising the gut epithelium, able to maintain a high level of vitality having the ability to utilise the nutrients and substrates found in a typical diet, non-pathogenic and toxin-free capable of having a positive impact on the host, to the host's safety, there should be no pathogenic or harmful effects. Hydrochloric acid, bile, and pancreatic juice resistance it must have anti-carcinogenic properties. Lactic acid should be produced. It should be able to keep its viability while being stored and used. It should boost the body's immunological system, and it should have the ability to colonize the gastrointestinal tract.

V. Organisms used as Probiotic agents

Various bacteria have been described in the literature as having probiotic qualities. Lactobacillus and Bifidobacterium are two of these bacteria. Other bacteria, as well as yeasts like Saccharomyces boulardii, can be utilised as probiotics. [3]

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Lactobacilli improve innate and acquired immunity, suppress the creation and activity of pro-inflammatory mediators, aid in the synthesis of vitamin B and vitamin K, and facilitate bile salt breakdown.[4]

Bifidobacterium metabolizes lactose, generates lactic ions from lactic acid and synthesize vitamins. They also help to ferment indigestible carbohydrates and produce beneficial short chain fatty acids.[4]Lactobacillus bulgaricus and Streptococcus thermophilus metabolise lactose, improving lactose tolerance and antibacterial activity. Proteases and other chemicals secreted by Saccharomyces boulardii break down bacterial enterotoxins and prevent them from binding to intestinal receptors. They also aid in the improvement of immunological function. [4]

VI. Mechanism of action of Probiotics

There are 3 proposed mechanisms of action of probiotics:

Direct interaction

Probiotics work directly on plaque formation and its complex ecology by competing and intervening with bacteria to bacteria attachment, interfere with substrate metabolism (competition with oral microorganisms for available substrates), and create antimicrobial compounds. [5]

Competitive Exclusion

Beneficial microbes directly compete with the disease developing microbes for nutrition or enterocyte adhesion sites.

Modulation of Host Immune response

Probiotics interact with the immune system and aid in the expression of Th1 and Th2 cells, modulate pathogen-induced inflammation through toll-like receptors on dendritic cells, modulate host immunity both systemically and locally, modulate host immunity both systemically and locally, modulate host immunity both systemically and locally, modulate pathogen-induced inflammation through toll-like receptors on dendritic cells, modulate pathogen-induced inflammation through toll-like receptors on dendritic cells A Th1 reaction causes intracellular pathogens to be phagocytosed, while a Th2 response causes extracellular pathogens to be phagocytosed.[6]

VII. Natural sources and Commercial preparations of Probiotics

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Milk, tofu, sour cream, butter milk, yoghurt, idlis, dosas, dhoklas, vada, and khadi are all high in probiotics. They can also be recommended as supplements under the brand names LA – 5, Floraster, Biocodex, Bion, Yakult, BioGaia, G-Norm, ProBiora, and EcoVag. Chewable tablets and syrups are both available. Probiotics and prebiotics are available in powder sachets, gelatine capsules, or suspension form. Lactobacillus acidophilus and Lactobacillus rhamnosus spores total 0.48 billion in the commercially available "BION" (combination of pre- and pro-biotic). [2,7]

VIII. Probiotics in periodontal disease

Porphyromonas gingivalis, Aggregatibacter actinomycetemcommitans, Tannerella forsythus, and Treponema denticola are well-known periodontopathogens that fall into the red and green colour coding of Socransky. As an adjuvant to scaling and root planing, the use of chosen beneficial bacteria could aid to prevent periodontal-pathogen recolonization of periodontal pockets and therefore attain and maintain periodontal health. Probiotics defend the epithelial barrier by maintaining tight junction protein expression, which is comparable to that of a pathogen but without the periodontal damage.[6] *Lactobacillus paracasei and Lactobacillus rhamnosus* have a great ability to combat infections such as Streptococcus mutans and Porphyromonas gingivalis in the mouth. [6-9] Weissella cibaria is a gram-positive facultative anaerobic lactic acid bacterium isolated from humans that is found in fermented foods and is thought to be a potential probiotic. W. cibaria secretes a large amount of hydrogen peroxide as well as bacteriocin, a gram-positive bacteria-killing substance. This bacterial species has the ability to attach to epithelial cells and co-aggregate with Fusobacterium nucleatum. These characteristics may help W. cibaria colonise the oral cavity successfully.

Role of probiotics in gingivitis

L. reuteri and L. brevis are two species that can have a favourable impact on gingivitis and plaque composition. Secretion of bacteriocins such as reuterin and reutricyclin, which inhibit the growth of a wide range of pathogens, adherence of L. reuteri to host tissues and competition with pathogenic bacteria, and anti-inflammatory effects of L. reuteri leading to inhibition of pro-inflammatory cytokines are three plausible mechanisms for their actions. [11]

Role of probiotics in chronic periodontitis

In the past, there have been few attempts to boost the growth of beneficial bacteria. The addition of probiotics to the treatment of chronic periodontitis increases the number of helpful bacteria, reduces periodontopathic species, and improves the immune response. Socransky and colleagues (1970) made the first attempt, collecting subgingival plaque samples that revealed organisms capable of suppressing the growth of A. actinomycetemcomitans. P. gingivalis and P. intermedia, which are keystone pathogens in chronic periodontitis, are inhibited by L. salivarius, according to studies.

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Role of probiotics in aggressive periodontitis

A. actinomycetemcomitans is the most significant organism in aggressive periodontitis. S. sanguis, a probiotic bacteria, has been proven to be more efficient against this periodontopathic bacterium. It creates hydrogen peroxide, which causes A. actinomycetemcomitans to die.

IX. Commercially available probiotic products to treat periodontal disease

Gum PerioBalance: The first probiotic specifically formulated to fight against periodontal disease. It contains a patented combination of two strains of *L. reuteri* specially selected for their synergistic properties in fighting cariogenic bacteria and periodontopathogens.

PeriBiotic: This toothpaste is an all-natural, fluoride-free oral hygiene supplement containing Dental-Lac, a functional *Lactobacillus paracasei* probiotics not found in any other toothpaste.

Bifidumbacterin, Acilact, Vitanar: This probiotics preparation of a complex of five live lyophilized lactic acid bacteria is claimed to improve both clinical and microbiologic parameters in gingivitis and mild periodontitis patients

Wakamate D: This probiotic tablet contains 6.5×10^8 CFU per tablet of *L. salivarius* WB21, and xylitol (280 mg/tablet) was originally prepared to contribute for the intestinal microbial balance by providing acid-tolerant *L. salivarius* WB21.

Prodentis: This probiotic lozenge is a blend of two *L. reuteri* species containing a minimum of 1×10^8 CFU of two strains of the bacterium.

X. Possible Adverse Effects of Probiotics

Although probiotics have many useful effects, some side effects of these agents have also been documented in literature[12-15]. The most common among them are:

a) **Probiotic sepsis** – Patients with underlying immunological impairment, chronic illness, or debilitation have developed probiotic bacteraemia or fungemia. The majority of cases are resolved with the use of antimicrobials. Lactobacillus endocarditis has been recorded in a patient receiving *Lactobacillus rhamnosus* following dental treatment.

b) **Deleterious metabolic activities** –Many metabolic functions, such as complex carbohydrate digestion, lipid metabolism, and glucose homeostasis, are influenced by the gut flora. As a result, there is a theoretical danger of deleterious metabolic effects from using probiotics to manipulate the microbiota.

XI. Conclusion

Probiotics are an emerging topic of study that investigates the strong links between dental health and our everyday diet. It is a natural way to maintain health and protect oral tissues

from disease, and research suggests that the potential advantages grow with a young child's participation. The extent to which probiotics can be used to promote dental health is yet to be determined. Although the findings of previous research are encouraging, there is still much work to be done in terms of identifying the probiotics that are most suited for oral administration, as well as the optimal vehicles for their delivery.Given that periodontitis is a polymicrobial illness in which pathogenic strains predominate in the tissues, it would be extremely beneficial if these germs could be inhibited without causing antibiotic resistance. Probiotics have shown to be quite effective in this regard. Many infections in the oral cavity may be eliminated in the near future with the use of probiotic techniques.

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