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Power of probiotics in periodontal disease

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Abstract---Probiotics, or health-beneficial microbes, have been around since the early twentieth century. In recent years, it has piqued the curiosity of researchers. The therapeutic paradigm has shifted from particular bacterial eradication to probiotics modifying bacterial ecology. Probiotics may be a viable field of investigation in periodontal care, especially with the rise in antibiotic resistance. Probiotics have considerable data to support their role in dental caries; however there is less evidence for their impact in periodontal disease. Thus, simply adding probiotic items to one's diet can halt, slow, or even dramatically delay the progression of periodontal

illnesses, supporting a healthy lifestyle to combat periodontal infections. As their position in periodontics is still in its infancy, several issues have been raised about the benefits of probiotic supplementation. To assess their long-term repercussions for oral health and disease, a thorough understanding of the extensive ecological changes they cause in the mouth is required. The evidence for using probiotics to maintain oral health and prevent periodontal disease is reviewed in this research.

Keywords---probiotics, periodontal disease, lactobacilli, bifidobacterium.

Introduction

“Leave your drugs in the chemist’s pot if you can cure the patient with food”, the age old saying by Hippocrates is the ideology of today’s health conscious population. Periodontitis is most prevalent and usually recognised as the second most common disease in dentistry. Approximately 700 different bacterial species have been identified in the oral microbiota, among which only a small group of 10 to 15 species has been recognized as being significantly associated with the initiation and progression of periodontitis ^[1]. The most common bacteria linked to periodontitis are Porphyromonas Gingivalis, Aggregatibacter Actinomycetemcomitans, Tannerella Forsythus, Treponema Denticola. Antibiotic resistance has exploded as a result of the rise of multiresistant bacteria, prompting scientists to devise new ways to combat infectious diseases. Not only is it more important to reduce antibiotic use and create novel non-antibiotic-based treatments, but it is also more important to enhance the prominence of disease prevention ^[2]. Probiotics are live microorganisms that have good health benefits on the host when given in sufficient doses. Orally administered probiotics may improve oral health by inhibiting the growth of pathogenic bacteria or modifying mucosal immunity in the mouth.^[3] The earliest probiotic organisms identified were Lactobacillus acidophilus by Hull et al in 1984 and Bifidobacterium bifidum by Holcomb et al in 1991.^[4] L. paracasei, L. plantarum, L. rhamnosus, and L. salivarius are some of the most common species isolated from saliva samples. According to culture-based research, bifidobacteria are among the earliest anaerobes in the oral cavity. ^[5]

History

1990s - Probiotics were first discovered by Ukrainian bacteriologist Elie Metchnikoff.

1965- Lilly and Stillwell coined the term "probiotics."

2001- Probiotics were later described as "living microorganisms that bestow benefit to the host's health when provided in suitable amounts" by the World Health Organization / FAO

1908- this Nobel Laureate linked the longevity of several Balkan towns to the regular eating of Lactobacillus-fermented dairy, which lowered the toxins produced by intestinal bacteria, enhancing health and extending life.^[6]

1907- *Lactobacillus bulgaricus* was discovered by the Ukrainian-born biologist and Nobel laureate Louis Pasteur. He developed the theory that Lactic acid bacteria (current Bulgarian yoghurt) in the gastrointestinal tract could prolong life by preventing purification. His reasoning was based on the fact that Bulgarians lived longer than other people. [7]

Probiotics

Probiotics, according to Fuller, are "a live microbial feed additive that benefits the host animal by enhancing its gut microbial balance." The term 'probiotic' comes from the Greek language and means 'for life.' It was coined in 1953 by Kollath.^[8] to refer to a variety of organic and inorganic supplements that were thought to help malnourished people regain their health. *Lactobacillus* and *Bifidobacterium* are the most common probiotic genera. Probiotics are broadly classified into two genus *Lactobacillus* and *Bifidobacterium*. The genus *Lactobacillus* includes *L. acidophilus*, *L. johnsonii*, *L. casei*, *L. rhamnosus*, *L. gasseri* & *L. reuteri*. Similarly the *Bifidobacterium* strains include *B. bifidum*, *B. longum* & *B. infantis*. *Delolobrio vibrio bacteriovorus* is a relatively recent probiotic strain that was released a few years ago.

These bacteria are classified as generally recognised as safe (GRAS) because they can live in the human body without harming it and, on the other hand, they are beneficial to human health. Probiotics have recently gained popularity as a result of their increased potential for developing strains that are genetically engineered to produce anti-inflammatory cytokines such as IL-10,^[9] trefoil factor family proteins to aid wound healing, or the 2D-CD4 receptor to reduce HIV infectivity.

Rationale

The reason for their usage in oral health is based on the growing body of research that backs up their claims of health benefits for a variety of disorders. [10-12]

- Prevent colonisation resistance.
- Protect against pathogen colonisation, overgrowth, and translocation.
- The emergence of antibiotic resistance and the severity of the condition
- Recovery from hemorrhagic shock, cholesterol reduction, protection from coronary heart disease, impacts on breast cancer cells, liver disorders, skin infections, promotion of bone health, and obesity reduction are all being researched.
- Probiotics can help patients with diarrhoea, gastroenteritis, inflammatory bowel diseases (Crohn's disease and ulcerative colitis), immunodepressive states, paediatric allergies, growth retardation, hyperlipidemia, and other medical conditions disorders of the liver, infections of the genitourinary system, and others

Some Novel probiotics (Saulnier et al. 2009): *F. prausnitzii* derived from Agar and alginate of seaweed *Gelidium* CC223 and *L. plantarum* derived from Roots of traditional Chinese medicine *Morinda officinalis* or Indian mulberry. Test Strains considered probiotics in the oral cavity: *L. rhamnosus* GG, *L. acidophilus*, *L. casei*, *L. casei* Shirota, *W. cibaria*, *Bifidobacterium* DN-173010, *L. rhamnosus* GG,

L. acidophilus, *L. rhamnosus*, *L. paracasei*, *L. johnsonii*, *L. reuteri*, *S. salivarius*, *L. rhamnosus* GG, *Propionibacterium freudenreichii* ssp, *Shermanii* JS

Guidelines for use of Probiotics

In 2002, the FAO/WHO published recommendations for evaluating probiotics for use in food products.

- The probiotic organism must be a living organism.
- Up to the species level, the organism must be identified.
- It should have a track record of safety.
- Must have a physiological effect on the host when employed in a prescribed value and delivery mechanism.
- Must be physiologically and genetically stable when employed as a food additive.
- It should be cost-effective.
- It should have long-term storage stability (adequate shelf life).
- It should be nonpathogenic and nonhazardous at the same time.
- It should be able to alter metabolic activity in the immediate area.

Food Products With Probiotics

Probiotics are included in products in four ways in terms of microbial preparation and functional food: 1. Culture concentrate (e.g., fruit juices) added to beverage ; 2. Added to probiotic fibres as an inoculants; 3. Vaccinated against milk-based foods (dairy products, yoghurt, biodrinks, and kefir); 4. In the form of dietary supplements (non-dairy goods like as tablets, gelatin, and capsules) ^[13] Probiotics are delivered in a variety of ways, including: Powder / Lozenge / Gel / Straw, tablet / Capsule of Cheese Rinse Solution / liquid Yogurt Drink. Some commercially available Probiotics for periodontal disease management are Gum PerioBalance, PeriBiotic, Bifidumbacterium, Acilact, Vitanar, Wakamate D, Prodentis.

Probiotics Effect on Periodontal Health

P. gingivalis, *A. actinomycetemcomitans*, *T. forsythia* and *T. denticola* are the main periopathogens of the Socransky's red and green complex. *S. oralis* and *S. uberis* in both laboratory and animal settings, they have been shown to limit pathogen development. Tissues become more susceptible to periodontal disease when these bacteria are absent. ^[14]

1985 - Hillman and Socransky ^[14] reported that *Streptococcus oralis* and *Streptococcus uberis* have been shown to limit pathogen growth in both laboratory and animal settings. They are signs of a healthy periodontal condition. When these bacteria are missing from periodontal tissues, they make those areas more susceptible to periodontal disease.

1993- Pozharitskaia *et al* ^[15] were the first to examine it clinically, and they reported that *L. acidophilus* contained in a tablet named Acilact improved clinical parameters in periodontitis patients.

2002- Grudiamov *et al* ^[16] The usage of probiotics, such as Azilact and bifidumbacterin, when taken orally as tablets normalised the microbiota and reduced the indications of gingivitis and periodontitis, according to the study.

2003-Volozhin *et al.*^[17] reported that a collagenous periodontal dressing containing *L.casei* 37 has been found to lower the number of periodontal pathogens and extend remission times by up to 10-12 months. This could be related to probiotics' inhibitory influence on pathogen growth, affecting the makeup of oral biofilm.

2006- Matsuka *et al.* ^[18] found a reduction in bleeding on the day after surgery probing and a decrease in the number of *P.gingivalis* in the individuals who ate *Lactobacillus salivaris*-containing tablets 2711 T1

2007- Hojo *et al.* ^[19] reported that *Lactobacillus salivarius*, *Lactobacillus gasseri*, and *Lactobacillus fermentum* are among the most common species in the mouth, however there is a considerable variation in their numbers between healthy and periodontitis patients. He also claimed that *Bifidobacterium* suppressed some black pigmented anaerobes by competing for the key growth nutrient vitamin K.

2008- Shimazaki *et al.* ^[20] reported that an epidemiological investigation discovered that a higher intake of lactic acid/fermented foods was associated with significantly lower mean pocket depth and attachment loss, although cheese, milk, and other dairy foods had no such relationships.

2012- Taipale T *et al.* ^[21] reported that *B.Lactis* (Bb-12)/ Tablets result in no significant differences in the incidence of dental caries

2015- Lee JK *et al.*^[22] used *L. Brevis*/ Tablets and the usage of probiotics retards the development of gingivitis.

2016- Morales A *et al.* ^[23] reported that the use of *L. Rhamnosus*/ 1 Sachet in 150 ml of water in first step of periodontal therapy represents the same improvement as surgical treatment alone. Gum chewing "PERIO BALANCE" is the world's first probiotic gum designed exclusively to combat periodontal disease. It's a hybrid of two *L. reuteri* strains chosen for their synergistic abilities to combat cariogenic bacteria and periodontopathogens. Each lozenge dose contains at least 2108 *L. reuteri* prodentis live cells. To allow probiotics to disseminate and adhere to various oral surfaces, the lozenge must be used daily after a meal or in the evening after brushing teeth.

Designer Probiotics

Sletor and Hill introduced the term "Patho-Biotechnology"^[24] it comprises of 3 basic approaches

- Use of attenuated bacterial pathogens as vaccine
- Isolation and purification of pathogen specific immunogenic protein for direct application
- Providing probiotic bacteria with the genetic elements required to cope with stress both outside and inside the host, as well as to combat invading pathogens

Third approach is what is termed as “designer probiotics”. The third method is known as "designer probiotics." This method uses probiotics that have been genetically modified to express receptor-like structures on their surfaces. Designer probiotics have been used to treat HIV infection and as an unique vaccine delivery vehicle. Improving the stress tolerance profile of probiotic cultures enhances their tolerance to processing stress and increases their survival time during storage. As a result, a far higher proportion of the probiotics provided reach the desired area (e.g., periodontium) in a bioactive form [25].

Antibiotic versus Probiotics in periodontal therapy

Non-surgical scaling and root planing may remove subgingival *Campylobacter rectus*, but it is ineffective against *P. gingivalis*, *Prevotella intermedia*, *T. forsythus*, and enteric rods, and may not significantly reduce the number of *A. actinomycetemcomitans* or *Peptostreptococcus* [26]. Metronidazole, the tetracyclines, clindamycin, ciprofloxacin and amoxicillin are the antibiotics most widely used.

Systemic antibiotics used in conjunction with scaling and root planing may have potential advantages over scaling and root planing alone in terms of decreasing probing depth and clinical attachment level, according to Herrera et al. [27]. Another study by Haffajee et al. found that giving systemic antibiotics as an adjuvant to surgical mechanical debridement in deep pockets resulted in improved attachment level gain. In comparison, the presence of high amounts of *A. actinomycetemcomitans* and/or *P. gingivalis*, bacteria that have the ability to penetrate periodontal tissues, is commonly associated with aggressive periodontitis. The adjunctive use of antibiotics in this situation is sufficient to eliminate and kill such pathogens. Probiotics have resurfaced as a means of restoring and boosting the beneficial microorganisms in the mouth. The rise in interest in this sector is timed to match with the necessity. to supplement or replace antibiotics with unfavourable side effects due to medication resistance, their efficacy is dwindling. Evidence suggesting probiotic strains can reduce the need for antibiotic therapy As a result, in order to avoid the negative effects of antibiotics, beneficial bacteria in the form of probiotics can be given to people. Periodontitis therapy could be a good alternative.

Conclusion: The concept of probiotics opens up a whole new world of possibilities when it comes to the relationship between nutrition and oral health. The use of probiotics in dental care applications is becoming more popular. A growing body of research suggests that using existing probiotic strains can improve oral health. More research is needed to determine the capacity of probiotic bacteria to live, thrive, and have a therapeutic effect when used for therapy or added to foods, as well as the doses and schedules of probiotic administration. Furthermore, well

designed, long term follow up studies are needed to assess the oral health risk of probiotic use over time. The importance of probiotics in numerous domains must be underlined and implemented appropriately.

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