

# PROBIOTICS: A NOVEL APPROACH IN DENTISTRY

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**Abstract:** Dental caries is one of the most common diseases worldwide, although a decline of the prevalence has been recorded in western countries. The World Health Organization has defined probiotics as "Live microorganisms which, when administered in adequate amounts, confer a health benefit on the host". These microorganisms belong to the natural human flora in order to survive in the acid environment during transit to the intestines. This paper aims to provide a systematic review of the caries-prevention effect of probiotics in human. The effect of probiotics on the development of caries lesion seems encouraging, but to date, Randomized Clinical Trials (RCT) on this topic are insufficient to provide scientific clinical evidence.

**Keywords:** Dental Caries, Probiotics, Microorganism, RCT

Dental caries is a multifactorial disease requiring the presence of a susceptible host, cariogenic microflora and a diet conducive to enamel demineralization.

The term probiotics, the antonym of the term antibiotics, was introduced in 1965 by Lilly & Stillwell as Substances produced by microorganisms which promote the growth of other microorganisms.<sup>1</sup> The term 'probiotics' has undergone several definitions arriving at the final one, officially adopted by the International Scientific Association for Probiotics and Prebiotics term, outlining the breadth and scope of probiotics as they are known today: 'Live microorganisms, which when administered in adequate amounts, confer a health benefit on the host'.<sup>2</sup> The idea of probiotics dates back to the first decade of 1900 when the Ukrainian bacteriologist and Nobel Laureate Ilya Metchnikof studying the flora of the human intestine developed a theory that senility is caused by poisoning of the body by the products of some

of these bacteria. To prevent the multiplication of these organisms he proposed a diet containing milk fermented by *lactobacilli* which produces a large amount of lactic acid and for a while this diet became widely popular. The most commonly used probiotic bacterial strains belong to the genera *Lactobacillus* and *Bifidobacteria*.

In the oral cavity, lactobacilli usually comprise 1% of the total cultivable bacteria, commonly isolated species include *L. paracasei*, *L. plantarum*, *L. rhamnosus*, *L. salivarius*.<sup>3</sup> Bifidobacterial species isolated from oral samples include *B. bifidum*, *B. dentium* and *B. longum*.<sup>4</sup> Species of *Lactobacillus* and *Bifidobacteria* may exert beneficial activity in the oral cavity by inhibiting cariogenic *Streptococci* and *Candida* spp.<sup>6</sup>

## PROBIOTICS AND DENTAL CARIES

The impact of oral administration of probiotics on dental caries has been studied in several experiments utilizing different test strains. *Lactobacillus rhamnosus* GG and *L. casei*<sup>7</sup> have proved their potential to hamper growth of these oral *streptococci*. Caglar et al registered definite *S. mutans* count reduction after a 2-week consumption of yoghurt containing *L. reuteri*.<sup>8</sup> A temporary

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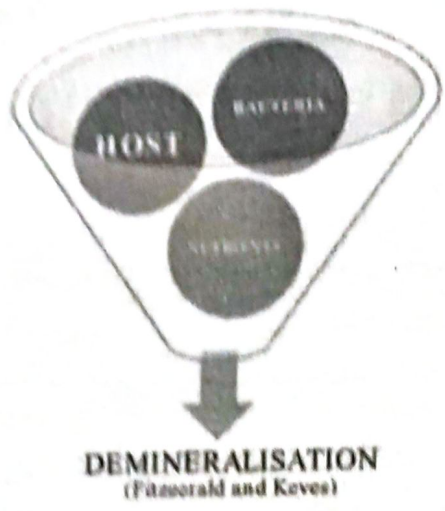


Fig 1

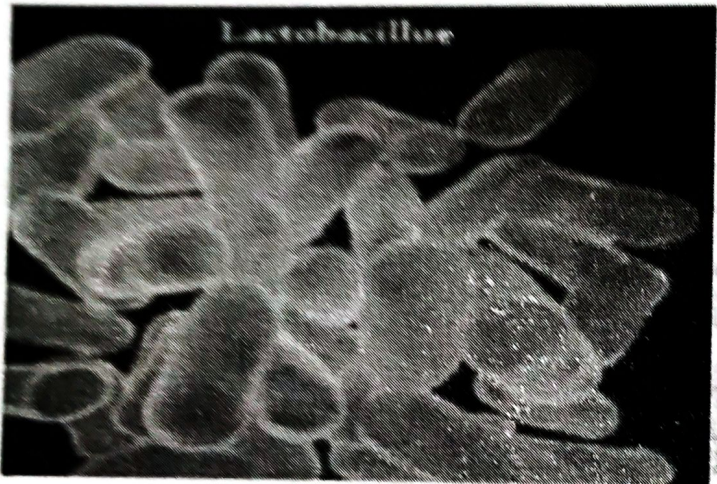


Fig:2 Lactobacillus

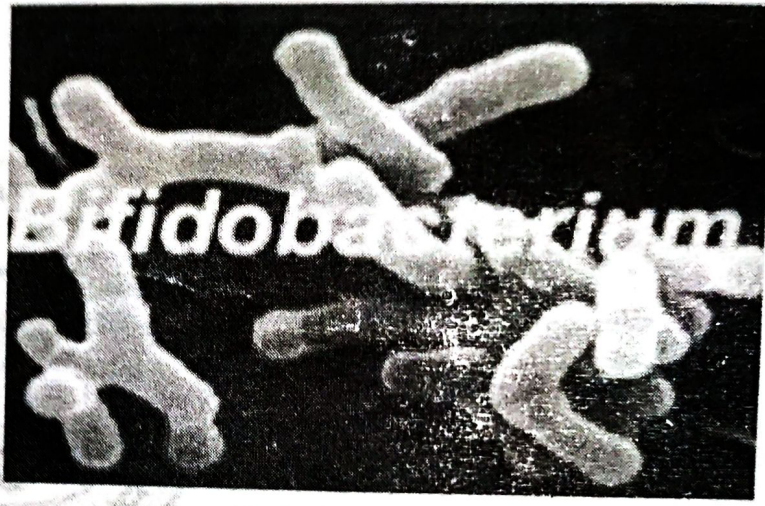
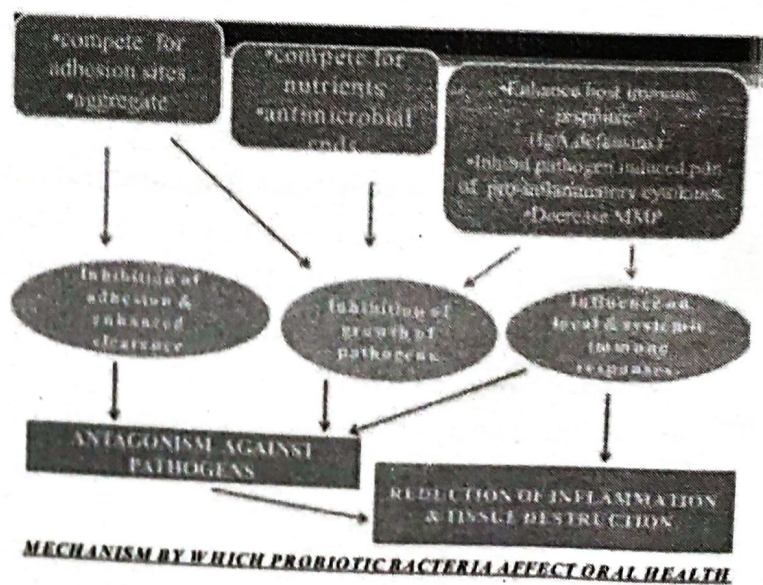


Fig:3 Bifidobacterium

CLINICAL EVIDENCE OF PROBIOTIC EFFECTIVENESS					
PROBIOTIC STRAIN	VEHICLE	DURATION	DOSE	CLINICAL EFFICACY	REFERENCE
L. Rhamnosus GG	Milk	7 months	-	Less dental caries and lower <i>S. mutans</i> levels	Niki et al.
L. Rhamnosus GG L. Rhamnosus LC 70?	Cheese	3 wks	5 x 15 g per day	Reduction of levels of <i>S. mutans</i> and caries risk reduction	Ahola et al.
B. Bifidobacterium mDN-1770 10	Yogurt	5 wks	500 g daily	Reduction of <i>S. mutans</i>	Caglar et al.
B. Lacto Bb-12	Ice-cream	10 days	50 g	Reduction of salivary <i>S. mutans</i>	Caglar et al.

Tab: 1 Clinical evidence of probiotic effectiveness.



MECHANISM BY WHICH PROBIOTIC BACTERIA AFFECT ORAL HEALTH

Fig 4 Mechanism By Which Probiotic Bacteria Affect Oral Health

reduction in *S. mutans* was observed during the period of yogurt intake and few days after cessation of consumption, indicating the necessity of continual administration of the probiotic in order to achieve an effect.

Little information is available about the relationship between probiotic *bifidobacteria* and counts of *S. mutans*. The only study addressing this study question tested *Bifidobacterium* DN-173 010.<sup>8</sup> A statistically significant reduction in salivary mutans streptococci was observed. Due to the limitations of the study protocol with *bifidobacteria*, however, further investigations are needed for drawing final conclusions.

Considering the growing body of evidence about the role of probiotics on caries pathogens, however, it has been suggested that the operative approach in caries treatment might be challenged by probiotic implementation with subsequent less invasive intervention in clinical dentistry.<sup>9</sup> However, more studies are definitely needed before this goal could be achieved.

### PROBIOTICS AND PERIODONTAL DISEASE

Chronic Periodontitis could also benefit from orally administered probiotics. The presence of periodontal pathogens could be regulated by means of antagonistic interactions. A decrease in gingival bleeding and reduced gingivitis has been observed by Krasse et al<sup>8</sup> with the application of *L. reuteri*. Koll-Klais et al reported that resident *lactobacilli* flora inhibits the growth of *P. gingivalis* and *Prevotella intermedia* (*P. intermedia*) in 82% and 65%, respectively.

Probiotic strains included in periodontal dressings at optimal concentration of 10<sup>8</sup> CFU/ml have been shown to diminish the number of most frequently isolated periodontal pathogens: *Bacteroides* sp., *Actinomyces* sp. and *S. intermedius*, and also *C. albicans*. These authors registered a 10- to 12-month remission period after periodontal treatment by application of the periodontal dressing that comprised collagen and *L. casei*. Grudianov et al reported that probiotics were effective in normalization of microbiota in periodontitis and gingivitis patients when compared with a control group. Recently, Teughels et al reported that the subgingival application of a bacterial mixture including *Streptococcus sanguinis*, *Streptococcus salivarius* (*S. salivarius*), and *Streptococcus mitis* after scaling and root planning significantly suppressed the re-colonization of *Porphyromonas gulae* (canine *P. gingivalis*) and *P. intermedia* in a beagle dog model. In a double-blind, randomized, placebo controlled

clinical trial in healthy volunteers without severe periodontitis conducted to evaluate whether the oral administration of probiotic tablets containing *L. salivarius* WB21 could change the clinical parameters of periodontal tissues and the expression of salivary inflammatory markers, it was found that probiotics could be used in the improvement of oral health in subjects at risk of periodontal disease.<sup>10</sup>

### PROBIOTICS AND IMBALANCED ORAL ECOSYSTEM

Halitosis, the oral malodor, is a condition normally ascribed to disturbed commensal microflora equilibrium. It has recently been positively affected by regular administration of probiotics. Kang et al have shown a definite inhibitory effect on the production of volatile sulfur compounds (VSC) by *F. nucleatum* after ingestion of *W. cibaria* both in vitro and in vivo. The possible mechanism in the VSC reduction is the hydrogen peroxide generated by *W. cibaria* that inhibits the proliferation of *F. nucleatum*. *S. salivarius*, also a possible candidate for an oral probiotic, has demonstrated inhibitory effect on VSC by competing for colonization sites with species causing an increase in levels of VSC.<sup>11</sup> Burton et al further reported that *S. salivarius* strain K12 produced two antibiotic bacteriocins, compounds that are inhibitory to strains of several species of gram-positive bacteria implicated in halitosis.<sup>12</sup>

### PROBIOTICS AND ORAL CANDIDA.

*Candida albicans* is a leading cause of infection in oral cavity of elderly and immunocompromised persons. Limited number of studies have been done to investigate the effects of probiotic bacteria on oral candida infection in a humans when a test group of elderly people consumed cheese containing *L. rhamnosus* strains GG and LC705 and *Propionibacterium freundereichii* ssp *shermanii* JS for 16 weeks, the number of high oral yeast counts decreased but no changes were observed in mucosal lesions. In a smaller study with younger subjects, no significant difference was observed between effects of probiotic and those of control cheese on salivary *Candida* counts. Lactobacillus strains suppressed growth of periodontal pathogens like *Aggregatibacter Actinomycetemcomitans*, *Porphyromonas gingivalis*, *Porphyromonas intermedia*, *Streptococcus mutans* but no inhibition was found of *Candida albicans* growth.

### ADMINISTRATION OF PROBIOTICS

Appropriate forms of administration of probiotic

strains have been discussed in several articles. Dairy products supplemented with probiotics are a natural means of oral administration and can be easily adopted in dietary regime. However, for the purposes of prevention or treatment of oral diseases, specifically targeted applications, formulas, devices, or carriers with slow release of probiotics might be needed.

Montalto et al administered probiotic mix both in capsules and in liquid form without observing statistically significant difference, however, in the *S. mutans* counts between the two test groups.<sup>13</sup>

### SAFETY ISSUES

The issue of safety is of special concern during the past few years due to the increased probiotic supplementation of different food products. From the safety point of view, the putative probiotic microorganisms should not be pathogenic, should not have any growth-stimulating effects on bacteria causing diarrhea, and should not have an ability to transfer antibiotic resistance genes. The probiotics should rather be able to maintain genetic stability in oral microflora.<sup>13</sup> The increased probiotic consumption inevitably leads to increased concentrations of these species in the host organism.

*Lactobacillus* bacteremia is a rare entity, and data on its clinical significance are mainly found through case reports. For the last 30 years there have been approximately 180 reported cases.<sup>14</sup> Clinical characteristics of *Lactobacillus* bacteremia are highly variable, ranging from asymptomatic to septic shock-like symptoms. Any viable microorganism is capable of causing bacteremia, however, especially in patients with severe underlying diseases or in immunocompromised state.

### CONCLUSION

Probiotics are emerging as a fascinating field in dentistry. This concept prompts a new horizon on the relationship between diet and oral health. Daily intake of probiotic supplements may control common oral and dental infections.

So lets hope that probiotic therapy may soon become a reality in dentistry in the near future

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