

## REVIEW ARTICLE

### Probiotics in Dentistry- Review and Outlook

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#### ABSTRACT

**The field of probiotics is an evolving field. Time has come to shift the paradigm of treatment from specific bacteria elimination to altering bacterial ecology by probiotics. Probiotics are dietary supplements containing potentially beneficial bacteria or yeasts. Probiotics have been found to be beneficial to the host health by improving the endogenous flora. Traditionally, probiotics have been associated with gastrointestinal tract, however recently several investigators have suggested use of probiotics for oral health.**

**Keywords - Probiotics, Oral health, Lactobacillus.**

#### INTRODUCTION

Administration of antibiotics and antimicrobials can only suppress oral infection but not eliminate it. Probiotics were therefore introduced in dentistry to overcome the limitations of these traditional disease management strategies.<sup>1</sup> The term probiotic, meaning 'For Life' was first coined in the 1960s, by Lilly and Stillwell.<sup>2</sup>

Probiotics are defined as nonpathogenic live microorganisms that, when administered in adequate amounts in food or as dietary supplements, confers benefits to the host's health.<sup>3</sup>

The basic rationale behind the tautology of probiotics was that the human body lives in a heavily contaminated environment associated with millions of bacteria and probiotics can be utilised by replacing pathogenic microorganisms with healthy ones.<sup>4</sup>

#### HISTORY

The concept of probiotics probably dates back to 1908, when Noble Prize winner Eli Metchnikoff suggested that the long life of Bulgarian peasants resulted from their consumption of fermented milk products.<sup>5</sup> The concept of probiotics was thus born and a new field of bacteriology was thus opened. In 1984, Hull identified the first probiotic species, the *lactobacillus acidophilus*. Later in 1991, Holcomb identified *bifidobacterium bifidum*. These incidences paved way for a new concept of probiotics in medicine and dentistry.<sup>5,6</sup>

## COMPOSITION OF PROBIOTICS

Probiotics can be bacteria, molds or yeast. However, most are bacteria. Among bacteria, lactic acid bacteria are more popular. *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus lactis*, *Lactobacillus helveticus*, *Lactobacillus salivarius*, *Lactobacillus plantrum*, *Lactobacillus bulgaricus*, *Lactobacillus rhamnosus*, *Lactobacillus johnsonii*, *Lactobacillus reuteri*, *Lactobacillus fermentum*, *Lactobacillus delbrueckii*, *Streptococcus thermophilus*, *Enterococcus faecium*, *Enterococcus faecalis*, *B. bifidum*, *Bifidobacterium breve*, *B. longum*, and *Saccharomyces boulardii* are commonly used bacterial probiotics. A probiotic may be made out of a single bacterial strain or it may be a consortium as well. Probiotics can be in powder form, liquid form, gel, paste, granules or available in the form of capsules, sachets, etc.<sup>7</sup>

## PROPERTIES OF PROBIOTICS

1. Should be non toxic and non pathogenic preparation
2. Produce beneficial effect
3. Should withstand gastrointestinal juice
4. Should have good shelf life
5. Should replace and reinstate the intestinal microflora.

## POTENTIAL MECHANISMS OF PROBIOTICS IN THE ORAL CAVITY

The general mechanisms of probiotics can be divided into three main categories: normalization of the intestinal microbiota, modulation of the immune response, and metabolic effects.<sup>8</sup> The mechanisms of probiotic action in the oral cavity could be analogous to those described for the intestine. Thus far oral colonization by probiotic bacteria has often been considered essential for them to exert oral effects; however, the possibility of systemic effects cannot be excluded, although the total sIgA levels in saliva seem unaffected by probiotic use.<sup>9</sup>

## ROLE OF PROBIOTICS IN THE ORAL CAVITY

### 1. Probiotics and dental Caries

Dental caries is an infectious disease that affects most of the population. This multifactorial and complex disease process occurs along the interface between the dental biofilm and enamel surface.

Several studies suggest that consumption of products containing probiotic *lactobacilli* or *bifidobacteria* could reduce the number of mutans streptococci in saliva.<sup>10-13</sup>

Using randomized controlled trials, Meurman and colleagues demonstrated that long term consumption of milk containing the probiotic *Lactobacillus rhamnosus GG* strain reduced initial caries in kindergarten children.<sup>14</sup> Nase et al.<sup>15</sup>, Caglar et al.<sup>16</sup> also showed that administration of probiotic bacterium *Lactobacillus reuteri ATCC 55739* or *Bifidobacterium DN-173 010* induced significant reduction of cariogenic *S. mutans* in saliva.<sup>15</sup> Oral probiotics may help fight tooth decay, since acid production from sugar is detrimental to teeth, care must be taken not to select strains with high fermentation capacity.

### 2. Probiotics and periodontitis

Periodontitis is a multifactorial disease that encompasses the hard- and soft-tissue, microbial colonization (with or without invasion), inflammatory responses and adaptive immune responses.

The probiotic strains reported to be used for periodontal diseases include *L.reuteri* strains, *L.brevis* (CD2), *L.casie Shiota*, *L.salivarius WB 21* and *Bacillus subtilis*.<sup>17</sup> *L.reuteri* and *L.brevis* have improved gingival health as measured by decreased gum bleeding.<sup>18</sup>

The use of probiotic chewing gum containing *L. reuteri* ATCC 55730 and ATCC PTA 5289 also decreased levels of pro-inflammatory cytokines in GCF<sup>19</sup> and the use of *L. brevis* decreased MMP (collagenase) activity and other inflammatory markers in saliva.<sup>20</sup>

Riccia and colleagues in 2007 also studied the anti-inflammatory effects of *Lactobacillus brevis* in a group of patients with chronic periodontitis. Anti-inflammatory effects of *L. brevis* could be attributed to its capacity to prevent the production of nitric oxide and consequently the release of PGE2 and activation of MMPs induced by nitric oxide.<sup>5</sup>

### 3. Probiotics and Halitosis

Halitosis (bad breath) is a discomfort rather a disease. Probiotics could also be used in the treatment of halitosis. Kang, *et al.* reported a significant reduction of volatile sulfur compounds after gargling twice daily with 15 ml *Weissella cibaria* for 2 min.<sup>21</sup> The effect could be due to hydrogen peroxide production by *W. cibaria* causing *Fusobacterium nucleatum* inhibition. Burton, *et al.* reported significant reductions in volatile sulfur compounds for the probiotic group compared to the placebo group when probiotic *Streptococcus* was used.<sup>22</sup>

### 4. Probiotics and oral candidiasis

*Candida* species constitute part of the commensal oral flora in about 50% of healthy subjects, but are able to cause a clinically apparent lesion if the immune defenses are breached either on the local or systemic level. Only two studies have investigated the effects of probiotic bacteria on oral candida infection in humans. When a test group of elderly people consumed cheese containing *L. rhamnosus* strains GG and LC705 and *Propionibacterium freudenreichii* ssp. *Shermanii* JS for 16 weeks, the number of high oral yeast counts decreased but no changes were observed in mucosal lesions.<sup>10</sup>

### 5. Probiotics in orthodontic treatment

Fixed orthodontic appliances are considered to jeopardize dental health due to accumulation of microorganisms that may cause enamel demineralization, clinically visible as white spot lesions.

Cildir *et al.* in 2009 conducted a clinical study with probiotics and found out that daily consumption of fruit yogurt with *Bifidobacterium animalis* subsp. *Lactis* DN -173010 could reduce the salivary levels of mutans streptococci in orthodontic patients with fixed appliances.<sup>23</sup>

## CONCLUSION

The use of probiotics for use in oral care applications is gaining momentum day by day. There is increasing evidence that the use of existing probiotic strains can deliver oral health benefits. Probiotics play an important role in combating issues with overuse of antibiotics and antimicrobial resistance. Today's new technological era would be the right time to change the way bacteria are treated. Hence further studies to understand the ability of probiotic bacteria to survive, grow, and have a therapeutic effect when used for treatment or when added to foods, to fix the doses and schedules of administration of probiotics are needed.

## REFERENCES

1. Kaur MS, Pannu PK, Galhotra V. Probiotics- A new way to maintain oral health. *Ind J Dent* 2012; 3(2):77-80.
2. Choudhari S, Mopgar V, Sakhare S, Patil N. Probiotic way of dental caries prevention. *Int. J Contemp Dent* 2011; 2:59-64.
3. Amez MS, Lopez JL, Devesa AE, Montero RA, Salas EJ. Probiotics and oral health. *Med Oral Patol Oral Cir Bucal* 2017 May 1;22(3):e282-8.

4. Jindal G, Pandey RK, Agarwal J, Singh M. A comparative evaluation of probiotics on salivary mutans streptococci counts in Indian children. *Eur Arch Paediatr Dent* 2011; 12:211-6.
5. Narwal A. Probiotics in dentistry- a review. *J Nutr Food Sci* 2011;1(5):1-4.
6. Patil MB, Reddy N. Bacteriotherapy and probiotics in dentistry. *KSDJ* 2006;2:98-102.
7. Suvarna VC, Boby VU. Probiotics in human health: A current assessment. *Curr Sci.* 2005;88:1744–8.
8. Parvez S, Malik KA, Ah Kang S, Kim HY. Probiotics and their fermented food products are beneficial for health. *J Appl Microbiol* 2006;100:1171-1185.
9. Paineau D, Carcano D, Leyer G, Darquy S, Alyanakian MA, Simoneau G, et al. Effects of seven potential probiotic strains on specific immune responses in healthy adults: a double-blind, randomized, controlled trial. *FEMS Immunol Med Microbiol* 2008;53:107-113.
10. Näse L, Hatakka K, Savilahti E, Saxelin M, Ponka A, Poussa T, et al. Effect of long-term consumption of a probiotic bacterium, *Lactobacillus rhamnosus* GG, in milk on dental caries and caries risk in children. *Caries Res* 2001;35:412-420.
11. Ahola AJ, Yli-Knuutila H, Suomalainen T, Poussa T, Ahlstrom A, Meurman JH, et al. Short-term consumption of probiotic-containing cheese and its effect on dental caries risk factors. *Arch Oral Biol* 2002;47:799-804.
12. Caglar E, Cildir SK, Ergeneli S, Sandalli N, Twetman S. Salivary mutans streptococci and lactobacilli levels after ingestion of the probiotic bacterium *Lactobacillus reuteri* ATCC 55730 by straws or tablets. *Acta Odontol Scand* 2006;64:314-318.
13. Cildir SK, Germec D, Sandalli N, Ozdemir FI, Arun T, Twetman S, et al. Reduction of salivary mutans streptococci in orthodontic patients during daily consumption of yoghurt containing probiotic bacteria. *Eur J Orthod* 2009;31:407-4011.
14. Meurman JH. Probiotics : do they have a role in oral medicine and dentistry?. *Eur J Oral Sci* 2005; 113:188-96.
15. Nase L, Hatakka K, Savilahti E, Saxelin M, Pönkä A and Poussa T et al. Effect of long-term consumption of a probiotic bacterium, *lactobacillus rhamnosus* GG, in milk on dental caries and caries risk in children. *Caries Res* 2001; 35:412–20
16. Caglar E, Cildir SK, Ergeneli S, Sanndalli N, Twetman S. Salivary mutans streptococci and lactobacilli levels after ingestion of the probiotic bacterium *Lactobacillus reuteri* ATCC 55730 by straws or tablets. *Acta Odontol Scand* 2006; 64:314-8.
17. Krasse P, Carlsson B, Dahl C, Paulsson A, Nilsson A, Sinkiewicz G. Decreased gum bleeding and reduced gingivitis by the probiotic *Lactobacillus reuteri*. *Swed Dent J* 2006; 30:55–60.
18. Bhardwaj SB. Probiotics and oral health : an update. *IJCD* 2010;1(3):116-118.
19. Della Riccia DN, Bizzini F, Perilli MG, Polimeni A, Trinchieri V, Amicosante G, et al. Antiinflammatory effects of *Lactobacillus brevis* (CD2) on periodontal disease. *Oral Dis* 2007;13:376-385.
20. Twetman S, Derawi B, Keller M, Ekstrand K, Yucel-Lindberg T, Stecksén-Blicks C. Short-term effect of chewing gums containing probiotic *Lactobacillus reuteri* on the levels of inflammatory mediators in gingival crevicular fluid. *Acta Odontol Scand* 2009;67:19-24.
21. Kang MS, Kim BG, Chung J, Lee HC, Oh JS. Inhibitory effect of *Weissella cibaria* isolates on the production of volatile sulphur compounds. *J Clin Periodontol.* 2006;33:226–32.
22. Burton JP, Chilcott CN, Moore CJ, Speiser G, Tagg JR. A preliminary study of the effect of probiotic *Streptococcus salivarius* K12 on oral malodour parameters. *J Appl Microbiol.* 2006;100:754–64.

23. Cildir SK, Germec D, Sandalli N, Ozdemir FI, Arun T, Twetman S. Reduction of salivary mutans streptococci in orthodontic patients during daily consumption of yoghurt containing probiotic bacteria. *Eur J Orthod* 2009; 31:407–11.