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Review Article

Probiotic Era: An immunostimulatory kick to your salivary IgA levels

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***ABSTRACT*:**
Probiotic bacteria or friendly bacteria have created increased awareness within oral health care as a complementary way to prevent diseases caused by the oral microbial flora.They have shown to enhance the production of Salivary IgA levels. SIgA has shown an immunological control over dental caries by preventing adherence of cariogenic microorganisms to hard surfaces and inhibiting the activity of glucosyltransferases.
Key words: Salivary IgA, Probiotics, Glucosyl transferases.

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INTRODUCTION:

Guarner et al in 2005 defined probiotics as living microorganisms which when administered in adequate quantity are beneficial to the host. The term was adopted by INTERNATIONAL SCIENTIFIC ASSOCIATION FOR PROBIOTICS AND PREBIOTIC and proposed by Lilley and Stillwell in 1965.[1] Elie Metchnikoff in 1900 discovered Lactobacillus bulgarius which paved a way to the concept of probiotics and he reported that Bulgarians have a higher life expectancy due to consumption of yoghurt containing lactic acid and bacteria.

The hypothetical mechanism of action for probiotics are that they modify the oral environment by competing with the pathogens for nutrients at the binding sites , act as antioxidants by preventing plaque formation by neutralizing free electron and stimulate non specific immunity, humoral and cellular immune response.[2,3] The various vehicles used for administration of probiotics are lozenges, tablets, cheese, gelatin, powder, straw, yoghurt, mouth rinse and capsules.[4]

The most commonly seen probiotic species in saliva belong to Lactobacillus amongst which Lactobacillus acidophilus, Lactobacillus casei, Lactobacillus fermentum, Lactobacillus plantarum , Lactobacillus rhamnosus and Lactobacillus salivarus.

DISCUSSION:

Salivary Secretory IgA (SIgA) is the first line of defense produced by local plasma cells (PCs) which boost oral immunity by preventing microbial adherence, neutralizing enzymes, toxins, and viruses; or by acting in synergy with other factors such as lysozyme and lactoferrin, blocking the epithelial receptors and inhibiting the attachment of pathogenic bacteria, especially Streptococcus mutans to epithelial cells.[5-7] Migrating IgA positive B cells are seen in the salivary glands where they differentiate into plasma cells and release SIgA. SIgA has an immunomodulatory effect over caries by preventing the adherence of cariogenic microorganisms to hard surfaces by preven ting pellicle formation and by inhibiting the activity of glycosyl transferases.[8] It has an antibody that blocks the epithelial receptors and inhibits the attachment of pathogenic bacteria, especially Streptococcus mutans to epithelial cells.[9]

Ig A represents about 15 to 20% of immunoglobulins in the blood and mucus secreted in the stomach, lungs and intestines that prevents the microbes to bind to epithelial cells of the respiratory and digestive tract. The two forms of IgA : IgA1 (90%) found in serum and produced by bone marrow B cells and IgA2 (10%) produced by B cells located in the mucosae and

secretions of colostrum, maternal milk , tears and saliva differ in the structure.

The dimeric molecules of IgA produced by epithelial cells has a polypeptide of 1.5 kD called secretory chain and as shown in Figure 1 is linked by two additional chains.

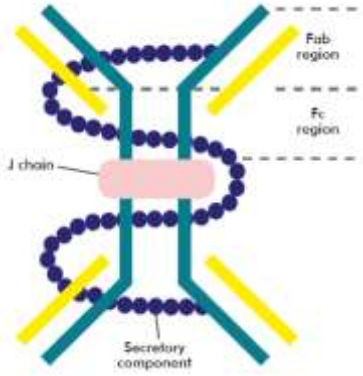

FIGURE 1

Probiotics prevent dental caries by forming a biofilm and thereby preventing proliferation of cariogenic bacteria by antagonizing, competing and leading to decreased acid production. Probiotics have shown to improve the body's immune system through its ability to induce SIgA formation, macrophage activation, modulation of pro-inflammatory cytokines, production of antioxidants like vitamins and lactic acid. The ability of probiotics to modulate the innate and adaptive immune defences has been well documented and probiotics have seen to release soluble factors which trigger signalling cascades in epithelial cells.[10]

Lactobacillus is one of the bacteria contained in probiotics which can increase the proliferation of SIgA producing cells e.g. Lactobacillus casei prevents caries by inhibiting the growth of pathogenic bacteria. Streptococcus mutans functions as barrier by strengthening the oral mucosal epithelium by binding to the epitope of the antigen I/II part of Streptococcus mutans, so that streptococcus mutans cannot colonize on the tooth surface.

The most common probiotic strains are Lactobacillus and Bifidobacterium amongst which L.rhamnosus GG, ATCC 53103 (LGG) is the most widely studied probiotic bacterium whose GG was named after Sherwood Gorbach and Barry Goldin on 17th April 1985 who patented it.[11]

Pahumunto, N et al reported consumption of milk powder with L. paracasei SD1 caused reduction of salivary MS and delayed development of new caries and the strain is safe for use in young children.[12]

Chung et al showed L.fermentum significantly inhibited formation of insoluble glucan produced by S.mutans and stopped its adherence onto cuvette walls.[13]

M.Stensson et al reported that 9 year old children receiving perinatal L.reuteri supplementation from birth to first year of life were caries free and had lower prevalence of approximal caries than those in the control group.[14] Stecksen –Blicks et al. compared two groups after 21 months for dental caries when L.rhamnosus was supplemented in milk and when fluoride was applied on enamel and noted statistically significant difference between 2 groups with preventive fraction of 75%.[15]

Comelli EM et al studied 23 dairy bacterial strains for prevention of dental caries and two strains namely S.thermophillus and L.lactis were capable of diminishing the colonization of Streptococcus oralis, Veillonella dispar, Actinomyces naaeslundii and Strep. sobrinus.[16]

Wattanarat et al. found increased levels of SIgA in saliva of children after probiotic administration while reduced salivary IgA levels was seen in athletes.[17]

Ericson et al used a probiotic chewing gum and found no significant impact of bacteria on the SIgA concentration in unstimulated whole saliva but were able to show a post treatment increase in total IgA% per protein after intake of L.reuteri.[4]

Caglar et al noted decreased level of S mutans level after 2 week use of L.reuteri enriched yoghurt and results were seen immediately during supplemention and for few days after discontinuation.[18]

Kotani et al stated oral intake of L.pentosus strain b240 for 12 weeks accelerated salivary IgA levels in elderly. An elevated SIgA secretion rate reached a plateau at week 4, elevating the rate of SIgA secretion during first month and rate remain stable from week 4 to 12 suggesting continuous daily intake of b240 may be efficacious for maintenance of increased of salivary SIgA in elderly.[5] The intake of fermented milk containing L.casei DN-114 001 has shown to induce nonspecific total SIgA in infant saliva by stimulating the gut mucosal immune system to enhance secretion of SIgA in saliva.[5]

G.S.Pinto et al concluded daily intake of yoghurt with or without B.animalis subsp.lactis for a period of 2 weeks was beneficial in reducing total microbial counts in dental plaque and saliva in orthodontic patients since mouth forms the first part of gastrointestinal tract.[19]

Probiotics have shown to enhance salivary HNP 1-3 levels however their action to reduce new pit and fissure caries involves microbial interactions. Tao et al demonstrated higher salivary HNP 1-3 levels in caries free children than in those experiencing caries. Increased production of salivary HNP 1-3 has been seen after augmentation of local host immunity after probiotic Lactobacillus paracasei SD1 supplementation. L.paracasei SD1 may exert immunostimulatory effect by enhanced production of HNP1-3 from ductal epithelial cells of submandibular salivary glands.[17]

Reduction in number of streptococcus mutans after ingestion of probiotics has been observed in number

of studies while no such correlation was seen in other studies. Nase et al enumerated caries preventive role in 594 children aged between 1 to 6 year old by showing significantly reduced dental caries after supplementation with L.rhamnosus for 7 months.[20] Significant low dental caries and low counts of S.mutans than controls in 3 to 4 year age group was seen.[20] It has also been well documented that higher titres of salivary IgA levels are seen in people with low dental caries.

Sookkhee and colleagues isolated 3790 strains of lactic acid bacteria and noted L.paracasei ssp.paracasei and L.rhamnosus had high capacity to antagonize important oral pathogens including Streptococcus mutans and Porphyromonas gingivalis.[21] Hackioja et al reported that consumption of yoghurt with L.rhamnosus probiotic on daily basis hosted this microorganism in the saliva for 3 weeks after stopping the intervention while as Yli-Knuuttila and his colleagues said that the same strain colonized the oral cavity temporarily and consistent consumption is needed for long term beneficial effect.[22,23]

Oral intake of fermented milk L.casei DN-114 001 has been shown to induce non specific total SIgA in infant saliva as seen by Tormo Carnicer R et al because oral intake of b240 stimulates the gut mucosal immune system to enhance secretion of SIgA in saliva.[5,24]

CONCLUSION:

Probiotics have an immunostimulatory effect which is measurable in saliva. It is seen that probiotic increases salivary IgA levels as long as the intervention is done however no long term effect is seen. Probiotic supplementation can temporarily decrease further caries progression.

REFERENCES

1. Harini Priya Vishnu. Probiotics and Oral Health Care-Pediatric, Research, Epidemiology and Clinical Practices; 2012
2. Laleman I, Detailleur V, Slot DE, Slomka V, Quirynen M, Teughels W. Probiotics reduce mutans streptococci counts in humans: A systematic review and meta-analysis. Clin Oral Investig. 2014;18(6):1539-52.
3. Mohanty R , Nazareth B, Shrivastava N. The potential role of probiotics in periodontal health RSBO.2012;9(1):85-8
4. Ericson D, Hamberg K, Bratthall G, Sinkiewicz-Enggren G, Ljunggren L. Salivary IgA response to probiotic bacteria and mutans streptococci after the use of chewing gum containing Lactobacillus reuteri. Pathog Dis. 2013;68(3):82-7.
5. Kotani Y, Shinkai S, Okamatsu H, Toba M, Ogawa K, Yoshida H, Fukaya T, Fujiwara Y, Chaves PH, Kakumoto K, Kohda N. Oral intake of Lactobacillus pentosus strain b240 accelerates salivary immunoglobulin A secretion in the elderly: A randomized, placebo-controlled, double-blind trial. Immun Ageing. 2010 ;7:11.
6. Pal S ,Mitra M, Mishra J, Saha S,Bhattacharya B. Correlation of total salivary secretory Immunoglobulin A(SIgA) and Mutans specific SIgA in children having different caries status .J Indian Soc Pedod Prev Dent 2013;31:270-4
7. Stensson M et al. Oral administration of Lactobacillus reuteri during the first year of life reduces caries prevalence in the primary dentition at 9 years of age. Caries Res.2014;48(2):111-7
8. Fukushima Y, Kawata Y, Hara H, Terada A, Mitsuoka T. Effect of a probiotic formula on intestinal immunoglobulin A production in healthy children. Int J Food Microbiol. 1998;42(1-2):39-44.
9. Hayati M, Herman H, Rezano A. . The effect of probiotic Lactobacillus casei supplementation on the secretory immunoglobulin A level in the saliva of wistar rats. Bali Medical Journal 2018;7(3): 727-731
10. Ahola AJ et al.Short-term consumption of probiotic-containing cheese and its effect on dental caries risk factors. Arch Oral Biol. 2002;47(11):799-804.
11. Segers ME, Lebeer S. Towards a better understanding of Lactobacillus rhamnosus GG--host interactions. *Microb Cell Fact*. 2014 Aug 29;13 Suppl 1(Suppl 1):S7. doi: 10.1186/1475-2859-13-S1-S7.
12. Pahumunto N, Piwat S, Chankanka O, Akkarachaneeyakorn N, Rangsitsathian K, Teanpaisan R. Reducing mutans streptococci and caries development by Lactobacillus paracasei sd1 in preschool children: a randomized Placebo-controlled trial. Acta odontolscand. 2018;22:1-7.
13. Chung J, Ha ES, Park HR, Kim S. Isolation and characterization of Lactobacillus species inhibiting the formation of Streptococcus mutans biofilm. Oral Microbiol Immunol. 2004 Jun;19(3):214-6.
14. Stensson M, Koch G, Coric S, Abrahamsson TR, Jenmalm MC, Birkhed D, Wendt LK. Oral administration of Lactobacillus reuteri during the first year of life reduces caries prevalence in the primary dentition at 9 years of age. Caries Res.2014;48(2):111-7.
15. Stecksén-Blicks C, Sjöström I, Twetman S. Effect of long-term consumption of milk supplemented with probiotic lactobacilli and fluoride on dental caries and general health in preschool children: a cluster-randomized study. Caries Res.2009;43(5):374-81.
16. Comelli EM, et al .Selection of dairy bacterial strains as probiotics for oral health.Eur J Oral Sci,2002;110(3) : 218-24
17. Wattanarat O et al. Enhancement of salivary human neutrophil peptide 1-3 levels By probiotic supplementation. Bmc oral health. 2015;15:19.
18. Caglar E, Sandalli N, Twetman S, Kavaloglu S, Ergeneli S, Selvi S. Effect of yogurt with Bifidobacterium DN-173 010 on salivary mutans streptococci and lactobacilli in young adults. Acta Odontol Scand. 2005;63(6):317-20
19. Pinto GS, Cenci MS, Azevedo MS, Epifanio M, Jones MH. Effect of yogurt containing Bifidobacterium animalis subsp . lactis DN-173010 probiotic on dental plaque and saliva in orthodontic patients. Caries Res. 2014;48(1):63-8.
20. Näse L, Hatakka K, Savilahti E, Saxelin M, Pönkä A, Poussa T, Korpela R,Meurman JH. 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 Nov-Dec;35(6):412-20.

21. Sookkhee S, Chulasiri M, Prachyabrued W. Lactic acid bacteria from healthy oral cavity of Thai volunteers: inhibition of oral pathogens. J Appl Microbiol, 2001; 90(2): 172-9
22. Haukioja A, Yli-Knuuttila H, Loimaranta V, Kari K, Ouwehand AC, Meurman JH, Tenovuo J. Oral adhesion and survival of probiotic and other lactobacilli and bifidobacteria in vitro. Oral Microbiol Immunol. 2006;21(5):326-32.
23. Yli-Knuuttila H, Snäll J, Kari K, Meurman JH. Colonization of Lactobacillus rhamnosus GG in the oral cavity. Oral Microbiol Immunol. 2006 ;21(2):129-31.
24. Tormo Carnicer R, Infante Piña D, Roselló Mayans E, Bartolomé Comas R. [Intake of fermented milk containing Lactobacillus casei DN-114 001 and its effect on gut flora]. An Pediatr (Barc). 2006;65(5):448-53.