

The Use of Probiotics in Dental Medicine

Ana Mikulicic¹, Danko Bakarcic^{2*}, Natasa Ivancic Jokic¹, Sandra Hrvatin², and Toni Culav³

¹Department of Paediatric Dentistry, Faculty of Medicine of the University of Rijeka, Clinical Hospital Center Rijeka, Croatia

²Associate Professor, Department of Paediatric Dentistry, Faculty of Medicine of the University of Rijeka, Clinical Hospital Center Rijeka, Croatia

³Student of Dental Medicine, Faculty of Medicine of the University of Rijeka, Croatia

Article Info

***Corresponding author:**

Danko Bakarcic

Associate Professor

Department of Paediatric Dentistry

Faculty of Medicine of the University of Rijeka

Clinical Hospital Center Rijeka, Croatia

E-mail: danko.bakarcic@medri.uniri.hr

Received: March 4, 2017

Accepted: March 9, 2017

Published: March 14, 2017

Citation: Mikulicic A, Bakarcic D, Jokic NI, Hrvatin S and Culav T. The Use of Probiotics in Dental Medicine. *Madridge J Dent Oral Surg.* 2017; 2(1): 44-46.

doi: 10.18689/mjdl-1000111

Copyright: © 2017 The Author(s). This work is licensed under a Creative Commons Attribution 4.0 International License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Published by Madridge Publishers

Abstract

The term probiotic was first used in 1965. And it literally holds a meaning "for life" to describe "a matter that microorganisms secret to stimulate the growth of other" thus giving the contrast to the term antibiotics. Probiotics are living microorganisms which reside in gastrointestinal and urogenital mucosa that benefit the health and boost vitality. Most commonly used genera of bacteria are *Lactobacillus* and *Bifidobacteriae*. The probiotics most recognized role is in restoring the balance in oral microflora in the situation when pathogen species of bacteria start to surmount. They accomplish that by competing for the adherent space, and for the source of food with pathogen bacteria and by changing oral cavity conditions. Also, they possess antimicrobial and immunomodifying characteristics.

They prove great results fighting periodontal disease, halitosis, candidiasis as well as in preventing caries. Most of commercially available genera of probiotics (yogurt, milk shakes, pills etc.) are considered safe, but there is a certain part of population at risk.

Keywords: Probiotics; Caries; Halitosis; Candidiasis; Parodontitis.

Introduction

The main purpose of this review is a brief update about use of probiotics in dental medicine in the fields of caries prevention and treatment of oral diseases like parodontitis, candidiasis and halitosis. There are many strains that offer health benefits (table 1.) The term probiotic was first used by Lilly and Stillwell in 1965. And it literally holds a meaning "for life" to describe "a matter that microorganisms secret to stimulate the growth of other" thus giving the contrast to the term antibiotics [1].

Table 1. The most common probiotics

<i>Lactobacillus</i> species	<i>Bifidobacterium</i> species	other strains
<i>L. acidophilus</i>	<i>B. bifidum</i>	<i>Saccharomyces boulardii</i> (yeast)
<i>L. casei</i>	<i>B. breve</i>	<i>Streptococcus salivarius</i>
<i>L. paracasei</i>	<i>B. infantis</i>	<i>Weissella cibaria</i>
<i>L. gasseri</i>	<i>B. longum</i>	<i>Streptococcus intermedius</i>
<i>L. rhamnosus</i>	<i>B. lactis</i>	<i>Enterococcus faecium</i>
<i>L. reuteri</i>	<i>B. adolescentis</i>	
<i>L. plantarum</i>		
<i>L. johnsonii</i>		

According to the definition of the World Health Organization the probiotics are "live microorganisms which when administered in adequate amounts confer a health benefit on the host" [2].

We can differentiate probiotics, prebiotics and synbiotics. Probiotic is a non-digestible food ingredient that promotes the growth of beneficial microorganisms in the intestines. Those are carbohydrates that do not get digested in the upper part of gastrointestinal tract (inulin, fructooligosaccharides, glucooligosaccharides and others). Synbiotics refer to food ingredients or dietary supplements combining probiotics and prebiotics in a form of synergism [1].

The functioning process of probiotics still remains fairly unknown, but there are several possible options. Probiotics produce organic acids which enter the bacterial cell and disrupt the regular metabolism. They also produce the hydrogen peroxide (H₂O₂) which causes rupture of cell wall and bacteriocins which inhibit production of DNA and other protein structures [3]. Attaching to the places of adherence in oral cavity, they overrun probable sites of pathogens adherence. They also compete with pathogens for carbohydrates needed for metabolism. Probiotics stimulate non-specific immunity or modulate humoral (immunoglobulins A i G) or cell immunity (NK cells) [1-2,4]. By producing the fatty acids with toxic effect they remove the gram negative bacteria from organism [3].

Caries prevention

Streptococcus mutans has the highest cariogenic potential and enables colonization of other bacterial sorts in biofilm [1,4]. The most studied probiotic is *Lactobacillus rhamnosus* because it doesn't ferment saccharose so consequently there is no production of acids and caries lesion formation is inhibited.

Several studies showed the results of statistically lower level of various *Streptococcus* species in the groups which consumed the dairy products with probiotics *Lactobacillus rhamnosus* [5-8]. Taipale et al. concluded that *Bifidobacteriae animalis* that they used has no apparent effect on the caries formation except if not used constantly [9].

Halitosis

There are different types of halitosis: physiological, intraoral (spicy food, specific type of food, smoking, alcohol etc.) and extraoral (most often from respiratory tract or stomach) and pseudohalitosis [10].

The main cause of halitosis (more than 85%) is disbalance in oral microflora. Bacteria degrade proteins from saliva, blood and retained food pieces and as a result make volatile sulphuric compounds [4,11,12]. Most often appearing bacteria are: *Atopobium parvulum*, *Eubacterium sulci*, *Fusobacterium periodonticum*. Rarely are found: *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Treponema denticola* [4,12,13]. Studies show that consumption of probiotics won't permanently prevent the growth of bacteria responsible for halitosis, but it could give enough time for the ecosystem to restore to balance [4,13,14].

Candidiasis

Candida albicans is part of the normal flora of the oral cavity and it is the most common fungal infection. Predisposing factors for infection are: older age, xerostomia, weak immune system, use of medicines, mobile prosthesis, increased quantity of yeast etc [2,4].

It is proved that daily consumption of probiotics decreases the quantity of yeast and keeps the microflora balanced. Probiotics stimulate cell and humoral factors that protect mucosa [15].

It is noticed a decline in prevalence of *Candida albicans* after the consumption of products containing probiotics in older patients and enhancement of specific immune reaction to yeast but without changes in mucosa lesions [16-17].

Parodontitis

Porphyromonas gingivalis, *Treponema denticola*, *Tannarella forsythia* i *Aggregatibacter actinomycetemcomitans* are the most common pathogens that cause periodontal disease. Probiotics release reuterin and reuterin (bacteriocins) which prevent dissemination of pathogens or they change the way the immune system reacts [12].

Decreased gingiva bleeding and reduction of gingivitis are noticed when taking the probiotics [18-19].

The consumption of dairy products on a daily basis results in smaller gaps in periodontal pockets and slower decline in epithelial attachment [18].

Riccia et al. shown an anti-inflammatory effect of *Lactobacillus brevis* probiotics on a group of patients with chronic parodontitis [20]. *Lactobacillus helveticus* creates short peptides which stimulate osteoblasts to grow bones, so that it has his role in bones resorption connected with parodontitis [21].

Koll- Kleiss et al. found out that the resident *Lactobacillus flora* inhibits the growth of *Porphyromonas gingivalis* for 82% and *Prevotella intermedia* for 65% [22].

Comercial Availability

Probiotics are regulated as dietary supplements, not as a pharmacological or biological products, and has no legitimate cause for a review of their credibility, purity and potential before the marketing and distribution of the product. They are commercially available in various forms: yogurts, milk shakes, pills etc [2].

Risks from use of Probiotics

Probiotics have a positive influence on human health and on balance of the microflora. Their use was proven safe for consumption in most of the patients [1,2,4,21].

Most of commercially available genera of probiotics are considered safe, but there is a certain part of population at risk. Major threat during the consumption is the development of infection, or rather sepsis [23].

High risk factor involves children with premature birth or immunodeficiency (including malignancies and weakened state of organism) and elderly. Lower risk factor involves: patients with central venous catheter, weakened intestinal epithelial barrier, jejunostoma and gastrostoma, probiotic resistance to wide spectre of prescribed antibiotics, probiotics with substantial mucosa adherence or known pathogen and heart disease (only for *Lactobacillus*) [23-27].

Conclusion

Probiotics have a positive impact on health and balance of the oral microflora, while also considered safe for consumption relative to a high number of patients that use them without side effects.

There is a certain group of patients at risk with whom we have to be careful when recommending the probiotic therapy, especially with prematurely born and children with immunodeficiency (risk of developing sepsis).

Conflicts of Interest: The authors declare no conflicts of interest with this submission.

References

- Bhushan J, Chachra S. Probiotics - Their Role in Prevention of Dental Caries. *J Oral Health Comm Dent*. 2010; 4(3): 78-82.
- Glazar I, Ivancic Jokic N, Bakarcic D, Misković I, Kuis D. Probiotics in dental medicine. *Medicina fluminensis*. 2014; 3: 306-310.
- Suskovic J et al. The mechanism of action of probiotic lactic acid bacteria. *Dairy*. 1997; 47(1): 57-73.
- Agarwal E, Bajaj P, Guruprasad CN, Naik S, Pradeep AR. Probiotics: a novel step towards oral health. *AOSR*. 2011; 1(2): 108-115.
- Glavina D, Gorseta K, Skrinjaric I, Vranic DN, Mehulic K, Kozul K. Effect of LGG yoghurt on *Streptococcus mutans* and *Lactobacillus* spp. Salivary counts in children. *Coll Antropol*. 2012; 36(1): 129-132.
- Juneja A, Kakade A. Evaluating the effect of probiotic containing milk on salivary mutans streptococci levels. *J Clin Pediatr Dent*. 2012; 37(1): 9-14. doi: 10.17796
- Twentman S. Are we ready for caries prevention through bacteriotherapy? *Braz Oral Res*. 2012; 26: 64-70. doi: 10.1590/S1806-83242012000700010
- Burton JP, Drummond BK, Chilcott CN, Tagg JR, Thomson WM, Hale JD. Influence of the probiotic *Streptococcus salivarius* strain M18 on indices of dental health in children: a randomized double-blind, placebo-controlled trial. *J Med Microbiol*. 2013; 62: 875-884. doi: 10.1099/jmm.0.056663-0
- Taipale T, Pienihakkinen K, Salminen S, Jokela J, Soderling E. Administration of *Bifidobacterium animalis* subsp. *Lactis* BB-12 in early childhood: a post-trial effect on caries occurrence at four years of age. *Caries Res*. 2013; 47(5): 364-72. doi: 10.1159/000348424
- Tangerman A. Halitosis in medicine: A review. *Int Dental J*. 2002; 52: 201-6. doi: 10.1002/j.1875-595X.2002.tb00925.x
- Barlow J. The use of probiotics for oral health. *The Clinical Use of Probiotics. Protexin Health Care*. 2010: 36-40.
- Elavarasu S, Jayapalan P, Murugan T. Bugs that Debugs: Probiotics. *J Pharm Bioallied Sci*. 2012; 4: 319-322. doi: 10.4103/0975-7406,100286.
- Kazor CE, Mitchell PM, Lee AM, Stokes LN, Loesche WJ, Dewhirst FE, et al. Diversity of bacterial populations on the tongue dorsa of patients with halitosis and healthy patients. *J Clin Microbiol*. 2003; 41: 558-63. doi: 10.1128/JCM.41.2.558-563.2003
- 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. doi: 10.1111/j.1600-051X.2006.00893.x
- Elahi S, Pang G, Clancy A, Clancy R. Enhanced clearance of *Candida albicans* from the oral cavities of mice following oral administration of *Lactobacillus acidophilus*. *Clin Exp Immunol*. 2005; 141: 29-36. doi:10.1111/j.1365-2249.2005.02811.x
- Hatakka K, Ahola AJ, Yli-Knuutila H, Richardson M, Poussa T, Meurman JK. Probiotics reduce the prevalence of oral *Candida* in the elderly - a randomized controlled trial. *J Dent Res*. 2007; 86: 125-130. doi: 10.1177/154405910708600204
- Mendonca FHBP, Santos SSF, Faria IS, Silva CRG, Jorge AOC, Leao MVP. Effects of probiotics bacteria on *Candida* presence and IgA Anti-candida in the oral cavity of elderly. *Braz Dent J*. 2012; 23: 534-58. doi: 10.1590/S0103-64402012000500011
- Shizamaki Y, Shirota T, Uchida K, Yonemoto K, Kiyohara Y, Iida M, et al. Intake of dietary products and periodontal disease: the Hisayama study. *J Periodontol*. 2008; 79: 131-7. doi: 10.1902/jop.2008.070202
- 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(2): 55-60.
- Riccia DN, Bizzini F, Perilli MG, Polimeni A, Trinchieri V, Amicosante G, et al. Anti-inflammatory effects of *Lactobacillus brevis* (CD2) on periodontal disease. *Oral Dis*. 2007; 13(4): 376-85. doi: 10.1111/j.1601-0825.2006.01291.x
- Bonifant A, Chandad F, Grenier D. Probiotics for Oral Health: Myth or Reality? *JCDA*. 2009; 75(8): 585-90
- Koll-Klais P, Mändar R, Leibur E, Marcotte H, Hammarström L, Mikelsaar M. Oral lactobacilli in chronic periodontitis and periodontal health: species composition and antimicrobial activity. *Oral Microbiol Immunol*. 2005; 20(6): 354-61. doi: 10.1111/j.1399-302X.2005.00239.x
- Boyle RJ, Robins-Browne RM, Tang MLK. Probiotic use in clinical practice: what are the risks? *Am. J Clin Nutr*. 2006; 83: 1256-64.
- Wagner RD, Warner T, Roberts L, Farmer J, Balish E. Colonization of congenitally immunodeficient mice with probiotic bacteria. *Infect Immun*. 1997; 65: 3345-51.
- Rautio M, Jousimies-Somer H, Kauma H, et al. Liver abscess due to a *Lactobacillus rhamnosus* strain indistinguishable from *L. rhamnosus* strain GG. *Clin Infect Dis*. 1999; 28: 1159-60. doi: 10.1086/514766
- Mackay AD, Taylor MB, Kibbler CC, Hamilton-Miller JM. *Lactobacillus* endocarditis caused by a probiotic organism. *Clin Microbiol Infect*. 1999; 5: 290-2. doi: 10.1111/j.1469-0691.1999.tb00144.x
- Kunz AN, Noel JM, Fairchok MP. Two cases of *Lactobacillus* bacteremia during probiotic treatment of short gut syndrome. *Pediatr Gastroenterol Nutr*. 2004; 38: 457-8.