



(REVIEW ARTICLE)



Newer oral probiotics in children

Das T¹, Bhattacharyya Sayan^{2,*} and Datta S³

¹ MSc. Applied Nutrition student, All India Institute of Hygiene and Public Health (AIIH and PH), Kolkata, India. ² Department of Microbiology, AIIH and PH, Kolkata, India.

³ Department of Biochemistry and Nutrition, AIIH and PH, Kolkata, India.

GSC Biological and Pharmaceutical Sciences, 2023, 22(03), 024–027

Publication history: Received on 20 January 2023; revised on 01 March 2023; accepted on 04 March 2023

Article DOI: <https://doi.org/10.30574/gscbps.2023.22.3.0089>

Abstract

Probiotics are live microorganisms used in small amounts for health benefits. Nowadays they are used orally also, especially in children in order to combat dental caries. However, of late they have also found many new applications. This article summarizes the applications of such oral probiotic supplements in various forms in children.

Keywords: Probiotics; Bacteria; Oral health; Dental caries

1. Introduction

Live microorganisms that are beneficial when administered in adequate amounts, and they also confer a health benefit on the host. This is the widely accepted scientific definition of probiotics (1). This definition is given by defined by International Scientific Association for Probiotics and Prebiotics. (1). The natural oral microbiota also plays a vital role in the activities of probiotics (2,3,4). Live microorganisms are administered in sufficient quantities to boost the immunity of the host. These live microorganisms are a part of the natural gastroenteric microbiota that aids to maintain a healthy gastrointestinal tract (GIT).

Traditionally, probiotics were developed to affect the change the Gut microbial flora. Since oral cavity forms the first part of GIT, it can be quite possible for probiotics to influence the oral microbial flora as well.

To eliminate or prevent antibiotics resistance, the nutritional supplement industry has been profitable to increased use of its products, as they can be inexpensive than presently available drugs. Probiotic bacteria can be formulated as pharmaceutical products or as dietary supplements and also beneficial for treating necrotizing enterocolitis, diarrheal diseases and bacterial vaginosis (5,6,7,8).

Oral biofilm formation plays a crucial role in microbial adhesion. Due to the changes of pH, dental caries can occur, which is primarily initiated in the oral cavity, leading to the development of a biofilm, mainly containing unwanted bacteria that can lead to tooth decay. Due to negative interconnection between commensal bacteria and cariogenic bacteria and also other host factors, a cascade of events may ensue, which may lead to dental caries. Oral diseases are very common worldwide, especially dental caries and periodontal infections, that can pose unwanted health complications. They are very common in children also. In these pathological conditions, antibiotics can be used to cure the disease, but which can also lead to gastrointestinal side effects. This can promote the emergence of antibiotic resistance and also severe allergic reactions.(6,7). Also, healthy or probiotic bacteria form biofilms and protect themselves from amylase and lysozyme of saliva, which is also important to note.

* Corresponding author: Bhattacharyya S; Email:drsayanb@aiihph.gov.in

1.1. Periodontal Diseases

The inflammation around the periodontium which are group of inflammatory pathologies (periodontitis and gingivitis) called periodontal disease, it can leads to loss of teeth due to dysregulated, immune-mediated destruction of the periodontal ligaments and tooth supporting structures(9,10). Dysbiosis is often defined as an “imbalance” in the gut microbial community that is associated with disease and a dysbiotic oral microbiota is associated with periodontitis. The most common forms of periodontitis are, chronic and aggressive periodontitis which is thought to play a vigorous role in the pathogenesis by encouraging chronic dysregulated inflammation which in turn can endure the dysbiotic microbial ecology (11,12). Due to the colonization and biofilm formation of pathogenic microorganisms in the oral cavity, periodontal infections mainly occur, which further disturb the equilibrium of typical oral microbiome. Probiotics can helps to reduce pathogenic bacterial biofilms and microbial accumulations which may lead to decrease the levels of pro-inflammatory factors like cytokines, collagenases, elastases and prostaglandin E₂ by producing constituent like lactic acid, hydrogen peroxide, and bacteriocins(13).

1.2. Dental caries

Probiotic microorganisms can displace cariogenic microorganisms from the oral cavity. They also produce many antimicrobial compounds that affect detrimentally the cariogenic microorganisms. Dairy products are known to be particularly helpful for treating dental caries(14).

1.3. Halitosis

Halitosis or bad smell are the condition referring to an unpleasant or annoying odour that emerge from the oral cavity. Due to the social isolation, halitosis has a considerable psychological effect it produced, being one of the conditions for which people seek dental care, after caries and periodontal disease. Halitosis is a public health problem and can result in social isolation (15, 16). The genera *Lactobacillus*, *Streptococcus* and *Weisella* are useful for treatment of halitosis or bad breath also, which may occur due to the caries or periodontitis. They may be useful for this purpose in all age groups and also in children. Probiotics, especially *Lactobacillus* species has been identified for treating of halitosis, as it has the capability to diminished the bacterial colonization (17).

1.4. Probiotics and oral cancer

Probiotics has well known since last two decades for therapeutic used of oral cancer. In this last two decades probiotics are used as anticancer therapy whereas it does not has any side effects. Probiotics can reinstate the equilibrium and function of oral microbiome by altering the oral microflora of cancer patients, after its destruction over the course of a cancer treatment. By using probiotics, dysbiosis in the oral cavity can be manageable without causing any complication(13).

1.5. Chewing gums

Oral probiotic bacteria have been tried in chewing gum. A not very recent patent application from China has found that healthy bacteria in chewing gum has got an effect on preventing and treating oral diseases such as gingivitis, periodontitis, pulpitis, periapical periodontitis, acute necrotizing ulcerative periodontitis, stomatitis and similar effects can be achieved by dint of the antagonistic action of oral probiotic bacteria on oral pathogenic bacteria(18).

1.6. Need of oral probiotics in children

The prevention of the plaque-related diseases, dental caries and the periodontal diseases, normally involves the nonspecific control of dental plaque because this is the initiating factor. This is carried out in order to maintain levels of dental plaque that match with health. It can thus prevent the breakdown of microbial homeostasis (dysbiosis) concomitant with disease risk.

1.7. Probiotic preparations in children can thus be used as

1.7.1. As paste

Emerging research has found that a benefit of regular use of probiotics is a reduction in several dental and oral problems in children, such as cavities, tooth decay, gum disease and bad breath. The balance of bacteria in the mouth is delicate, and so many factors can affect it. When it comes to these brands, their diet, overall health and brushing habits all come into play in keeping those good bacteria thriving (19).

1.7.2. As lozenges

Many companies have now launched probiotic lozenges for children, that contain any of the beneficial bacterial strains like *Streptococcus oralis* KJ3, *Streptococcus uberis* KJ2 and *Streptococcus rattus* JH145 (20).

1.7.3. Probiotic chewing tablet

They are beneficial for health and can be taken by mouth before or after a meal. However they are most effective in the gut (21).

1.7.4. Probiotic pacifiers

Mineral oil-infused probiotic pacifiers can be used also in very small children and help build a healthy oral microbiome.

1.8. Other sites in children where probiotics are used

Along with gut and oral cavity, probiotics can be used in inner ear, nose and throat (22).

1.8.1. How do oral probiotics work

Lactobacillus acidophilus can inhibit cariogenic bacteria by production of organic acids, hydrogen peroxide, diacetyl, bacteriocins, carbon peroxide, low molecular weight antimicrobial substances, and adhesion inhibitors against *Streptococcus* spp (22).

Administration of probiotic (LGG) to kindergarten children (1–6-year old) can result in reduction of mutans streptococci counts, risk of developing caries and also initial caries development. The effect can be particularly pronounced for the 3–4-year old children (23).

It has been noted that *L. rhamnosus* strains LGG (ATCC 53103) have shown inhibitory effect on the growth of *Streptococcus sobrinus* in agar overlay technique. The *L. rhamnosus* strains, *L. paracasei* F19 and *Lactobacillus reuteri* do not ferment sucrose and thus are relatively safe probiotic strains in the viewpoint of prophylaxis of caries (23). *L. rhamnosus* and *L. salivarius* are very useful in chronic periodontitis and *L. plantarum* and *L. reuteri* in gingivitis.

1.9. New information and new preparations

Most of the naturally occurring probiotics are seen in fermented dairy products. Milk acts as an efficient buffer to the acid produced. Milk also itself contains Calcium, calcium lactate and many other organic and inorganic compounds which are documented to be anticariogenic(23). Nowadays, in very small children probiotic-infused pacifiers are also there, that can be incorporated in a mineral oil base also and help to build a healthy oral microbiome in children.

2. Discussion

Thus, dental caries and periodontitis in children can be prevented by oral probiotics in various forms. Probiotics are helpful in this way and have found a novel use as probiotic. Thus oral probiotics as lozenges, pacifiers and other forms better overall oral health in children. These effects are increasingly being noted and studied across the world. More studies are needed in these aspects of public health and nutrition that also encompass paediatric dentistry.

3. Conclusion

Hence oral probiotics are finding new applications in the field of pediatric dentistry, especially to tackle teeth and gum problems in children, like dental caries and periodontitis which are so common problems in children.

Compliance with ethical standards

Acknowledgments

Authors would like to acknowledge all the authors whose work have been cited in this article.

Disclosure of conflict of interest

All the authors hereby declare that they have no conflicts of interest or competing interests.

References

- [1] Kaur S, Nekkanti S, Madiyal M, Chaudhary P. Effect of Chewing Gums Containing Probiotics and Xylitol on Oral Health in Children: A Randomized Controlled Trial. Effect of chewing gums containing probiotics and xylitol on oral health in children: A randomized controlled trial. *J Int Oral Health* 2018, 10:237-43.
- [2] Schwendicke F, Horb K, Kneist S, Dörfer C, Paris S. Effects of heat-inactivated *Bifidobacterium* BB12 on cariogenicity of *Streptococcus mutans* in vitro. *Arch Oral Biol* 2014, 59(12):1384-90. doi: 10.1016/j.archoralbio.2014.08.012.
- [3] Bosch M, Nart J, Audivert S, Bonachera MA, Alemany AS, Fuentes MC, Cuñé J. Isolation and characterization of probiotic strains for improving oral health. *Arch Oral Biol*. 2012 May, 57(5):539-49. doi: 10.1016/j.archoralbio.2011.10.006. Epub 2011 Nov 3. Erratum in: *Arch Oral Biol*. 2013 May, 58(5):558-9. PMID: 22054727.
- [4] Samot J, Badet C. Antibacterial activity of probiotic candidates for oral health. *Anaerobe*. 2013 Feb, 19:34-8. doi: 10.1016/j.anaerobe.2012.11.007.
- [5] de Simone C. The Unregulated Probiotic Market. *Clin Gastroenterol Hepatol*. 2019 , 17(5):809-817. doi: 10.1016/j.cgh.2018.01.018.
- [6] Wang Y, Wu Y, Wang Y, Xu H, Mei X, Yu D, Wang Y, Li W. Antioxidant Properties of Probiotic Bacteria. *Nutrients*. 2017 May 19, 9(5):521. doi: 10.3390/nu9050521. PMID: 28534820, PMCID: PMC5452251.s
- [7] Vandenplas Y, Huys G, Daube G. Probiotics: an update. *J Pediatr (Rio J)*. 2015 Jan-Feb, 91(1):6-21. doi: 10.1016/j.jpeds.2014.08.005. Epub 2014 Oct 23. PMID: 25458874.
- [8] Masdea L, Kulik EM, Hauser-Gerspach I, Ramseier AM, Filippi A, Waltimo T. Antimicrobial activity of *Streptococcus salivarius* K12 on bacteria involved in oral malodour. *Arch Oral Biol*. 2012 Aug, 57(8):1041-7. doi: 10.1016/j.archoralbio.2012.02.011. Epub 2012 Mar 10. PMID: 22405584.
- [9] Chapple IL, Bouchard P, Cagetti MG, Campus G, Carra MC, Cocco F, et al. Interaction of lifestyle, behaviour or systemic diseases with dental caries and periodontal diseases: consensus report of group 2 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *J Clin Periodontol*. 2017 Mar, 44 Suppl 18:S39-S51. doi: 10.1111/jcpe.12685. PMID: 28266114.
- [10] Hajishengallis G. Periodontitis: from microbial immune subversion to systemic inflammation. *Nat Rev Immunol*. 2015, 15(1):30–44.
- [11] Hajishengallis G, Darveau RP, Curtis MA. The keystone pathogen hypothesis. *Nat Rev Microbiol*. 2012, 10(10):717–25.
- [12] Nibali L. Aggressive Periodontitis: microbes and host response, who to blame? *Virulence*. 2015, 6(3):223-8. doi: 10.4161/21505594.2014.986407. PMID: 25654663, PMCID: PMC4601283.
- [13] Mishra S, Rath S, Mohanty N. Probiotics-A complete oral healthcare package. *J Integr Med*. 2020 Nov, 18(6):462-469. doi: 10.1016/j.joim.2020.08.005. Epub 2020 Aug 19. PMID: 32907783..
- [14] Amargianitakis M, Antoniadou M, Rahiotis C, Varzakas T. Probiotics, Prebiotics, Synbiotics and Dental Caries. New Perspectives, Suggestions, and Patient Coaching Approach for a Cavity-Free Mouth. *Appl. Sci*. 2021, 11(12):5472, <https://doi.org/10.3390/app11125472>
- [15] Kursun S, Acar B, Atakan C, Oztas B, Paksoy CS. Relationship between genuine and pseudohalitoses and social anxiety disorder. *J Oral Rehabil*. (2014) 41:822–8. 10.1111/joor.12206 [PubMed] [CrossRef] [Google Scholar]
- [16] Rayman S, Almas K. Halitosis among racially diverse populations: an update. *Int J Dent Hyg*. (2008) 6:2–7. 10.1111/j.1601-5037.2007.00274.x [PubMed] [CrossRef] [Google Scholar]
- [17] Role of Probiotics in Halitosis of Oral Origin: A Systematic Review and Meta-Analysis of Randomized Clinical Studies
- [18] <https://patents.google.com/patent/CN104382949A/en>. Last accessed 01.02.23.
- [19] <https://littlegnashies.com.au/blogs/news/why-you-need-to-give-your-kids-probiotic-toothpaste>. Last accessed 01.2.23.
- [20] <https://www.nutritioninsight.com/news/probiora-health-launches-oral-care-probiotic-lozenges-for-children-fighting-bad-breath-and-dental-cavities.html>. Last accessed 02.02.23.
- [21] <https://www.drugs.com/cdi/probiotic-chewable-tablets.html>. Last accessed 01.2.23.
- [22] <https://www.pdhre.org/best-oral-probiotic-for-kids/>. Last accessed 02.2.23.
- [23] Jindal G, Pandey RK, Singh RK, Pandey N. Can early exposure to probiotics in children prevent dental caries? A current perspective. *J Oral Biol Craniofac Res*. 2012 , 2(2): 110–115.