

Review Article

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Probiotics

Arjun MR^{1*}, Subair K¹, Abhijith Babu², Adarsh Udayakumar² and Vishnu CT²

¹Department of Periodontics and Implantology, Mahe Institute of Dental Sciences and Hospital, India

²Final Year Student, Mahe Institute of Dental Sciences and Hospital, Pondicherry, India

ABSTRACT

In the last two decades probiotics have become popular and a trend among healthy individuals which enhances their health. Recently probiotics are incorporated into various products in the market specifically dairy products which are fermented. These probiotics are being studied and promoted for their use in enhancing human health. There is strong scientific evidence to support the benefits of probiotics. This paper is a literature focusing on the benefits of probiotics.

*Corresponding author

Arjun MR, Department of Periodontics and Implantology, Mahe Institute of Dental Sciences and Hospital, India.

Received: September 29, 2023; **Accepted:** October 07, 2023; **Published:** October 17, 2023

Introduction

Bacteria known as probiotics are added to foods because of their beneficial effects on human health. Upon research Tisser observed that breastfed infants have more bifid bacteria in their gut microbiota [1]. This was further supported by various studies but they were poorly designed. Later on the development of functional food concepts were introduced to enhance the relationship between health and nutrition creating a supporting environment for the development of food concepts. Probiotics also plays a major role in human health, nutrition and regulation of different abnormalities. Different studies emphasise the benefaction of probiotic's for improving health and nutrition optimisation [2]. Probiotics generally fall under food ingredients, dietary supplements, or drugs. Probiotics can be incorporated into fermented or non-fermented dairy products. Adding probiotics to dairy products enables them to obtain unique quality characteristics such as improved aroma, taste, flavour, texture, and nutritional value, along with numerous health-promoting properties compared to non-dairy products [3, 4].

History

The chronicle of probiotics commenced with the consumption of fermented foods. Ancient Greeks and Romans were the first to consume this. In 1907, Ellie Metchnikoff, a Nobel Prize winner, first suggested the advantages of probiotic microorganisms on the mortal health. He supposed that Bulgarians were healthy and lived long because of the consumption of instigated milk products which consists of rod-shaped bacteria [5]. In 1953 German scientist Werner Kollath first proposed the word "Probiotics" and defined it as active substance that are essential for a healthy development of life. After a few years in 1965 Lilly and Stillwell came up with a different context that is substance secreted by one organism which stimulate the growth of another [6].

Application

There's adding substantiation in favor of the claims of salutary effects attributed to probiotics, involving enhancement of intestinal health, improvement of response, reduction of serum cholesterol, and cancer forestallment. there's substantial evidence to support probiotic use in the treatment of acute diarrheal conditions, forestallment of antibiotic-associated diarrhea, and enhancement of lactose metabolism, but there's inadequate substantiation to recommend them for use in other clinical conditions. Many microbial species exert good probiotic properties out of which lactic acid bacteria are the most significant and genera *Lactococcus* and *Bifidobacterium* are most important among them [7]. The improvement of intestinal health by the regulating the microbiota. Stimulation and development of the immune system. Also synthesizing and enhancing the bioavailability of nutrients, reducing symptoms of lactose intolerance and reducing the risk of certain other diseases. Several studies have documented probiotic effects on a variety of gastrointestinal and extraintestinal disorders, including prevention and alleviation symptoms of traveller's diarrhea and antibiotic associated diarrhea, inflammatory bowel disease, lactose intolerance, protection against intestinal infections, and irritable bowel syndrome. Probiotics can be found in a wide variety of commercial dairy products including sour and fresh milk, yogurt, cheese, etc. Dairy products play important role in delivering probiotic bacteria to human, as these products provide a suitable environment for probiotic bacteria that support their growth and viability. Several factors need to be addressed for applying probiotics in dairy products such as viability of probiotics in dairy, the physical, chemical and organoleptic properties of final products, the probiotic health effect, and the regulations and labelling issues [8].

Source of Probiotics

People take probiotics as supplement or as foods and beverages like yogurt and drinks which have live cultures added to them. Some fruits also contain probiotics because they are rich in minerals, vitamins, dietary fiber, antioxidants. Fermented foods naturally have beneficial bacteria. These foods are miso, kimchi and kombucha [9]. Food manufacturers may also call probiotics “live culture” or “active cultures.” Many fermented products contain probiotics, which means the bacteria in them are still living. Examples of ways to add probiotic foods to a healthful diet include: Enjoying a breakfast of probiotic yogurt with berries, flax seeds, and nuts. The Academy of Nutrition and Dietetics has a recipe for black bean soup with miso and ginger. Drinking probiotic-rich beverages, such as kefir or kombucha, a mid-morning snack. Serving sauerkraut as a side dish to main meals. It is essential to keep in mind that certain foods, especially yogurt, may contain added sugars. Look for foods that have minimal artificial sweeteners, sugars, and other artificial flavourings [10].

Desirable Properties of Probiotics

The acid and bile tolerance it is crucial for oral administration. Also has adhesion to mucosal and epithelial surface is an important property for immune modulation, exclusion of pathogens and prevention of pathogen adhesion. And has antimicrobial activity against pathogenic bacteria. And has antimicrobial activity against pathogenic bacteria. Probiotics are non-pathogenic, non-toxic and non-allergic. Capable of surviving and metabolizing in upper G.I. tract. It is resistant to low pH, acids, bile juice and saliva. it is also able to modulate immune response and provide resistance to disease through improved immunity or by the production of antimicrobial substance in the guts [11]. Probiotic bacteria interact with and influence all cells within the gut. Mechanisms of probiotic actions include effects on luminal microbial ecology, modulation of immune function, and enhancement of epithelial barrier function. Probiotic bacteria exhibit host-specific and strain-specific differences in their actions, and also in their resistance to acid and bile, ability to colonize the gastro- intestinal tract, and clinical efficacy [12].

Probiotics and Food Products

The food products having probiotics is wide and new food products are added to the list daily. The main food products available are dairy based which include milk, cheese, ice cream, buttermilk, milk powder and yogurt. Also, there are non-dairy food products which are soy based, nutrition bars, cereals and juices which provide adequate delivery to consumer [12]. Probiotics are live microorganisms which when administered in adequate amounts confer a beneficial health benefit on the host. Probiotics have been used for centuries in fermented dairy products. However, the potential applications of probiotics in non-dairy food products and agriculture have not received formal recognition. In recent times, there has been an increased interest to food and agricultural applications of probiotics, the selection of new probiotic strains and the development of new application has gained much importance. The uses of probiotics have been shown to turn many health benefits to the human and to play a key role in normal digestive processes and in maintaining the health [13].

Health benefits of Probiotics

Probiotics has increasing evidence in favour of their beneficial effects including intestinal health, increased immune response, serum cholesterol reduction, prevention of cancer. They are also used in treatment of acute diarrhoeal disease, prevention of antibiotic associated diarrhoea and improvement of lactose

metabolism. Also improves immune functions, protect against the hostile bacteria to prevent various infections, improve ingestion and also the absorption of food and certain nutrients [13]. They acts on gut-beneficial bacteria that create a physical barrier against unfriendly bacteria. They also help offset the bacterial imbalance caused by taking antibiotics. Some of the antibiotics kill good bacteria along with the harmful ones often leading to cramping or diarrhea. There are various potential benefits of probiotics which have been seen in the treatment or prevention of many conditions such as Irritable Bowel Syndrome, Ulcerative Colitis and Cohn's disease. The understanding of the function of probiotics in the maintenance of health and their importance in preventing disease serves to enhance the overall health of patients. With increasing understanding that beneficial microbes are required for health maintenance and disease prevention, probiotics may be commonly used as a therapeutic tool by health care practitioners in the not-too-distant future. This article presents a review of probiotics in health maintenance and disease prevention [14].

Clinical significance of Probiotics

Clinical health benefits of probiotics are still a fascinating area of research. Some of the most important properties of probiotics are Anti-pathogenic, Anti-diabetic, Anti-inflammatory and Anti-allergic [15].

Anti-pathogenic Activity of Probiotics

One of the most beneficial effect of probiotics is anti pathogenicity. Research on anti pathogenic activity of probiotic or probiotic mixture are still going on. On the investigation of Tejero - Sarinena et al it was proven that probiotics inhibit pathogen activity in the gut. Another mechanism is by inhibiting pathogen activity by competing for pathogen binding and receptor sites [15]. This study was done on Salmonella enterica, Seroovar typhimurium and Clostridium difficile in and in-vitro model and postulated that probiotics inhibit pathogens by production of short chain fatty acid. Antipathogenic activity is proposed as one beneficial effect of probiotics. Salmonella enterica is a Gram-negative, facultative intracellular pathogen which causes four major syndromes following oral infection: enteric fever (typhoid), enterocolitis/diarrhea, bacteraemia and chronic asymptomatic carriage. Restoration of the altered microbiota or preservation of a healthy microbial balance with probiotics could protect against pathogen invasion and/or colonization, as well as help improve gut health and wellbeing. Currently, there is considerable interest in the relative efficacy of using single strains of probiotics and mixtures of different genera and species [16].

Anti-diabetic Activity of Probiotics

International Diabetes federation (IDF) of South East Asia shows that 425 million people have diabetes worldwide. By 2045 it is expected to rise to 629 million. There is no definitive cure for diabetes it can only be managed by multiple medication. Larsen et al on research postulated the connection between intestinal microbiota and metabolic disease. This connection was brought about by 16S RNA gene sequencing and quantitative real time PCR fluorescent in-situ hybridisation. Probiotics helps in enhancing the beneficial microbiota hence neutralising the disorder [17]. Probiotics have beneficial effects on glycaemic controls, as all human studies showed significant reductions in at least one of the primary outcome endpoints which were the levels of fasting plasma glucose, postprandial blood glucose, glycated haemoglobin, insulin, insulin resistance and onset of diabetes; similarly, all the animal reports, except for two, documented significant changes in these parameters [18].

Anti-inflammatory Activity of Probiotics

The most chronic inflammatory disease of GIT is Crohn's Disease (CD) and Ulcerative Colitis (UC) and are collectively called as IBD. When a patient is affected by CD the affected parts of GIT are mucosa, submucosa and serosa. And a more severe condition leads to spread of inflammation throughout GIT. UC involves the large bowel specifically mucosa and submucosa. Upon research an imbalance in gut microbiota plays an important role in positive regulation of IBD. This disorder can be altered by supplementation of probiotics. Release of anti-inflammatory cytokines from probiotics demonstrates immune modulation. Probiotics exert a number of effects on host and immune system [19]. During inflammation, excessive and/or prolonged production of pro-inflammatory cytokines is related with various inflammatory diseases and cancer. Several probiotics have been reported as playing a role in suppressing the level of pro-inflammatory cytokines, as the human body attempts to recover itself [20].

Probiotics in Dentistry

An essential part of human microbiome is the oral environment. When probiotic products are consumed the oral microbiota is improved and also risk of disease is reduced. Consumption of probiotic dairy products improve oral health. Pharmaceutical formulas and dairy products are the most used route of probiotic administration [21]. Some important benefits of probiotic dairy products are: modify the oral microbiota, prevents caries development and periodontal disease in children, Improve gingival health. Some examples of probiotic dairy products are milk, cheese and curd. From a dental perspective, Lactobacillus and Bifidobacterium are acidogenic and aciduric. They are generally considered cariogenic and could be considered a risk for dental health. However, the buffering capacity of dairy products containing these bacteria counteracts their acidity. In addition, several studies have shown that Lactobacillus are late mediators in the progression of carious lesions due to their poor adhesion properties. Therefore, they do not increase the incidence of new lesions, although little is known about the effect they could have on pre-existing lesions. Additionally, several species of Lactobacillus have been isolated from healthy mouths. However, not all strains of Lactobacillus or Bifidobacterium are probiotics [22].

Probiotics in Periodontics and Management of Periodontitis

It is defined as inflammatory disease of supporting tissue of teeth caused by specific microorganism or a group of specific microorganisms resulting in progressive destruction of periodontal ligament and alveolar bone with pocket formation recession or both [Newman and Carranza's Clinical Periodontology: Third South Asia Edition]. It is also a chronic inflammatory disease. Due to the overuse of antibiotics drug resistant microorganism are formed in the oral cavity which disturbs the beneficial bacteria such as lactobacilli. For this reason, fermented milk has been suggested as substitute for antibiotic that reduces periodontitis [23]. Prevention of infectious diseases in the oral cavity such as halitosis and periodontitis can be effectively prevented by probiotics. It can also reduce the development of dental caries. Probiotics can help prevent and treat disease through several mechanisms including direct interaction, competitive exclusion and modulation of host immune response. The treatment strategies conferred by probiotics against periodontal diseases are anticipated to be either by inhibition of specific pathogens or by altering the host immune response. Studies on probiotics and periodontal disease are particularly sparse and at present few clinical studies have evaluated the efficacy of probiotic species from a periodontal disease perspective [24].

Management of Halitosis

Halitosis can be of two types oral and non-oral. Most probiotics are very effective in treatment if GIT disorder and various studies have shown that probiotics show satisfactory result in prevention of disease. The most useful microorganisms are Lactobacillus, Streptococcus and Weissella which are used as probiotics in treatment or prevention of halitosis in oral cavity [25]. Probiotic emerges as a cardinal tool and serves as a replacement to antibiotics in solving diseases like dental caries, periodontal diseases, and halitosis. Direct interaction, indirect interaction, and competitive exclusion ability explain the possible mechanism of probiotics in the treatment of these diseases in the oral cavity. Direct interaction results in inhibition or pathogen adhesion, colonization. component of oral malodour and biofilm formation. Release of chemicals like hydrogen peroxide, the holistic approach and treatment plan for halitosis is accompanied by appropriate diagnosis based on the patient history. Management of both mouth-related and gut-related halitosis can be achieved by probiotics. Efficacious probiotics strains or bacteriocin producing microorganisms are considered to be effective agents against halitosis [26].

Management of Dental Caries

Probiotics may be effective in treatment or prevention of caries. Probiotics helps in controlling the growth of Streptococcus mutants. Various studies are being conducted but current evidence is insufficient to recommend probiotics as a preventive measure for dental caries. The surgical route has been the predominate mode of caries management for the last 150 years. Dentistry has, however, in recent times shifted toward an antibiotic/ antimicrobial model of disease management. To overcome the challenges inherent in an antibiotic/ antimicrobial approach, probiotic methods are currently under study as means of caries management. Genetically modified Streptococcus mutants and targeted antimicrobials are used. Probiotic supplementation alters oral microbiota composition and could decrease the danger or treat oral cavity diseases, similar as dental caries, which are regarded a public health problem. Most of the studies estimated bacteria of the genus Lactobacillus. The main therapeutic effects are related to the reduction of the Streptococcus mutans oral count, increased Lactobacillus oral count, and reduction in the prevalence of caries. administered probiotics without conventional treatments, such as fluoride. The therapeutic effects are more noticeable when probiotic and fluoride are applied together [27].

Conclusion

Most of our basic nutritional and clinical supplementation could be full filled by the use of probiotics. Some of the disease and disorders that could be prevented on the use of probiotics are as follows: diarrhoea associated with rota virus, IBS and food allergies. Prevention and treatment of diabetes, obesity, cancer and disease related to pathogenic microbes by probiotics is a rapidly advancing area of research. Probiotics can also be incorporated into non-dairy fermented food products which helps in developing advantageous source in the process of evaluating a new probiotic strain. There is a need of establishing probiotics as a food component to a international level with emphasis on efficacy, safety and validation of health claims on food labels. By the next few decades, we will witness a significant increase in role of probiotics in nutrition and medicine, while the replication in prevention and treatment of various disorders should be considered by medical professionals. This is only possible if the food industries come up with different promotions on probiotics. Scepticism and respect to the consumer must be a prime concern [25,27].

References

1. Kechagia M, Basoulis D, Konstantopoulou S, Dimitriadi D, Gyftopoulou K, et al. (2013) Health benefits of probiotics: a review. *ISRN Nutr* 2013: 481651.
2. Ravinder Nagpal, Ashwani Kumar, Manoj Kumar, Pradip V (2012) Behare, Shalini Jain, Hariom Yadav, Probiotics, their health benefits and applications for developing healthier foods: a review, *FEMS Microbiology Letters* 334: 1-15.
3. Ume Roobab, Zahra Batool, Muhammad Faisal Manzoor, Muhammad Asim Shabbir, Moazzam Rafiq Khan, et al. (2020) Sources, formulations, advanced delivery and health benefits of probiotics, *Current Opinion in Food Science* 32: 17-28.
4. Singh VP, Sharma J, Babu S, Rizwanulla, Singla A (2013) Role of probiotics in health and disease: a review. *J Pak Med Assoc* 63: 253-257.
5. Cristofori F, Dargenio VN, Dargenio C, Miniello VL, Barone M, et al. (2021) Anti-Inflammatory and Immunomodulatory Effects of Probiotics in Gut Inflammation: A Door to the Body. *Front Immunol* 12: 578386.
6. Ciorba MA (2012) A gastroenterologist's guide to probiotics. *Clin Gastroenterol Hepatol* 10: 960-968.
7. Stanton C, Gardiner G, Meehan H, Collins K, Fitzgerald G, et al. (2001) Market potential for probiotics. *American Journal of Clinical Nutrition* 73: 476-483.
8. Mercenier A, Lenoir-Wijnkoop I, Sanders ME (2008) Physiological and functional properties of probiotics. *International Dairy Federation* 429: 2-6.
9. Saarela M, Mogensen G, Fondén R, Mättö J, Mattila-Sandholm T (2000) Probiotic bacteria: safety, functional and technological properties. *Journal of Biotechnology* 84: 197-215.
10. Medina IM, Jordano R (1994) Survival of constitutive microflora in commercially fermented milk containing bifidobacteria during refrigerated storage. *Journal of Food Protection* 56: 731-733.
11. Kehagias C, Koulouris S, Arkoudelos J, Samona A (2006) Viability and biochemical activity of bifidobacteria in association with yoghurt starter cultures in bifidus milk and bio-yoghurt during storage at 4°C. *Egyptian Journal of Dairy Science* 34: 151-158.
12. Ng SC, Hart AL, Kamm MA, Stagg AJ, Knight SC (2009) Mechanisms of action of probiotics: Recent advances. *Inflammatory Bowel Dis Inflammation Bowel Dis* 15: 300-310.
13. Granato D, Branco GF, Nazzaro F, Cruz AG, Faria JA (2010) Functional foods and nondairy probiotic food development: trends, concepts, and products. *Comprehensive Reviews in Food Science and Food Safety* 9: 292-302.
14. Toma MM, Pokrotnieks J (2006) Probiotics as functional food: microbiological and medical aspects. *Acta Universitatis* 710: 117-129.
15. Ziemer CJ, Gibson GR (1998) An overview of probiotics, prebiotics and synbiotics in the functional food concept: perspectives and future strategies. *International Dairy Journal* 8: 473-479.
16. Saarela M, Mogensen G, Fondén R, Mättö J, Mattila-Sandholm T (2000) Probiotic bacteria: safety, functional and technological properties. *Journal of Biotechnology* 84: 197-215.
17. Kosin B, Rakshit SK. Criteria for production of probiotics. *Food Technology and Biotechnology*.
18. Tejero-Sariñena S, Barlow J, Costabile A, Gibson GR, Rowland I (2013) Antipathogenic activity of probiotics against *Salmonella Typhimurium* and *Clostridium difficile* in anaerobic batch culture systems: is it due to synergies in probiotic mixtures or the specificity of single strains? *Anaerobe* 24: 60-65.
19. Kesika P, Sivamaruthi BS, Chaiyasut C (2019) Do Probiotics Improve the Health Status of Individuals with Diabetes Mellitus? A Review on Outcomes of Clinical Trials. *Biomed Res Int* 2019: 1531567.
20. Isolauri E, Arvola T, Sutas Y, Moilanen E, Salminen S (2000) Probiotics in the management of atopic eczema. *Clinical and Experimental Allergy* 30: 1604-1610.
21. Wheeler JG, Shema SJ, Bogle ML, Shirrell MA, Burks AW, et al. (1997) Immune and clinical impact of *Lactobacillus acidophilus* on asthma. *Annals of Allergy, Asthma and Immunology* 79: 229-233.
22. Chopra R, Mathur S (2013) Probiotics in dentistry: A boon or sham. *Dent Res J* 10: 302-306.
23. Shivamanjunath RG (2011) Benefits of live microorganisms (probiotics) in periodontal health. *Int J Contemp Dent* 2: 97-100.
24. Reddy JJ, Sampathkumar N, Aradhya S (2010) Probiotics in dentistry: Review of the current status. *Rev Clin Pesq Odontol* 6: 261-267.
25. Stamatova I, Meurman JH (2009) Probiotics: Health benefits in the mouth. *Am J Dent* 22: 329-338.
26. Lee Y, Yoon Y, Choi KH (2021) Probiotics-Mediated Bioconversion and Periodontitis. *Food Sci Anim Resour* 41: 905-922.
27. Bustamante M, Oomah BD, Mosi-Roa Y, Rubilar M, Burgos-Díaz C (2020) Probiotics as an Adjunct Therapy for the Treatment of Halitosis, Dental Caries and Periodontitis. *Probiotics Antimicrob Proteins* 12: 325-334.

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