

REVIEW ARTICLE

PROBIOTICS IN ORAL & SYSTEMIC HEALTH: A REVIEW

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ABSTRACT:

Keeping into consideration the oral as well as the systemic health of mankind, probiotic bacteria have been added as ingredients to various food products used daily. The most basic mechanism on which the probiotics work is their unconventional ability to compete with the microorganism for sites of adhesion and improve host immune response or antagonize these organisms. Food diet plays an extremely important role in optimizing oral and systemic health status. Since ages the use of probiotics have been considered only to be involved with the prevention of gastrointestinal pathology, however some very detailed studies have indicated that probiotics can be useful for both systemic as well oral health.

Keywords: Probiotics; Oral Health; Systemic Health; L. Acidophilus

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INTRODUCTION:

Studies have very clearly shown that micro-organisms are consumed in heavy quantities, especially bacteria, in day to day diet. Most of these micro-organisms enter the human body through the oral route in the form of food and water which includes products like yogurt and other dairy products as well as sausages. With the increased understanding of such micro-organisms and their useful applications, bacteria referred to as probiotics have been added to a lot of food products to enhance the human oral and systemic health.^[1] In the year of 1965, scientists named Lily and Stillwell used the terminology of “probiotic” for those microorganisms who secreted useful substances. They derived the term “probiotics” from Greek glossary which means “life”.^[2] Considering the entire group of probiotic bacteria, most of them are belonging to the genera Lactobacillus, Streptococcus and Bifidobacterium. In the year of 1905, bacteria named Lactobacillus bulgaricus was discovered by a Ukrainian biologist Ilya Metchnikoff. According to the theory he developed, lactobacillus bulgaricus which was added in yoghurt, could prevent putrefaction. This theory was also supported by the fact that the residents of Bulgaria had a better life expectancy than other

countries. His life was pretty much dedicated in explaining the relation between the long life expectancy and use of Lactobacillus bulgaricus. This led to the attention of the world on the positive effects of probiotics and led to revolution in the field of microbiology.^[3] Later on in the year of 1984, Hull identified the probiotic species which was named Lactobacillus acidophilus. Later in the year of 1991, Bifidobacterium bifidum was identified by Holcombh. Following the use of probiotics in the systemic health, research interest has been extended to study the implication of probiotics in oral health. Although a lot of food products include probiotic bacteria, the most commonly used food products include yogurt and fermented milk.

PROBIOTICS PRODUCTS:

Probiotics are provided in products in one of the four basic ways:

- 1) A culture of probiotic bacteria added to food beverages which includes juice.
- 2) In the form of probiotic fibers.
- 3) Additives in milk products. (Dairy products including milk and yoghurt)
- 4) In the form of dietary supplements (non-dairy products)

Table 1: Probiotic Activity in Systemic Health

Disease	Probiotic Organism	Effect observed	Reference
Allergies	L. rhamnosus, B. animalis	Reduction of cumulative prevalence of eczema	Wickens et al. [4]
Lactose intolerance	L. acidophilus NCFM	Alleviated symptoms	Montes et al [5]
Virus/microbes/Bacteria associated diarrhea	L. rhamnosus	Reduction of the risk of diarrhea	Ruszczyski et al [6]
Inflammatory disease	bowel B. breve, B. longum, L. casei	Reduction of symptoms of Crohn's disease in 7 out of 10 patients	Fujimori et al [7]

SUGGESTED MECHANISM OF ACTION OF PROBIOTICS IN SYSTEMIC HEALTH:

Major Probiotic mechanisms of action include enhancement of the epithelial barrier, increased adhesion to intestinal mucosa, and concomitant inhibition of pathogen adhesion, competitive exclusion of pathogenic microorganisms, production of anti-microorganism substances and modulation of the immune system. The suggested mechanisms of probiotic action on oral health are drawn entirely from gastrointestinal studies. Several mechanisms have been suggested to contribute to the probiotic action in systemic health.^[8] Regulatory T lymphocytes (Tregs) are thought to play a critical role in limiting inflammation in response to the nonpathogenic antigens, and defects in the T-cell subset have been implicated in the pathogenesis of few gastro-intestinal disorders. Several studies have indicated that enhancing the expression of genes involved in tight junction signaling is a possible mechanism to reinforce intestinal barrier integrity. For instance, lactobacilli modulate the regulation of several genes encoding adherence junction proteins, such as E-cadherin and β -catenin, in a T84 cell barrier model. Moreover, incubation of intestinal cells with lactobacilli differentially influences the phosphorylation of adherence junction proteins and the abundance of protein kinase C (PKC) isoforms, such as PKC δ , thereby positively modulating epithelial barrier function.^[9] Another class of pharmacologic agents, the histone/protein deacetylase inhibitors (HDACs), has recently been

shown to improve Treg function and increase Treg numbers in mice.

PROBIOTICS IN ORAL CAVITY: Streptococcus mutans has been implicated as a major cariogenic bacteria. Owing to its harmful effects on the tooth, considerable efforts have been made to affect its prevalence and effects in the oral cavity. A lot of clinical research and studies have been conducted with probiotic administration to decrease the levels of Streptococcus mutans bacteria in the oral cavity. After the conduction of the research, results indicated that the suppression of Streptococcus mutans and other oral bacteria which possess a cariogenic potential with oral probiotics have been positive.^[10-12]

The basic etiological factor responsible for the development of periodontal disease is the presence of supra and sub gingival bacteria. Thus the efforts having being directed towards improving the oral epithelial barrier as we as reduce the number of oral pathogens which would eventually lead to decrease in oral susceptibility to diseases. The major effects of the probiotic bacteria can be observed only if there are able to incorporate themselves in the biofilm of oral cavity subsequently leading to inhibition of pathogens. From the perspective of periodontitis it should be noted that the configuration of lactobacillus is way different in healthy patients as compared to those suffering from periodontitis. Obligately homofermentatives are less prevalent in chronic periodontitis.^[13]

Table 2: Suggested Mechanisms of Probiotic in the Oral Cavity

Direct interactions in dental plaque	<ul style="list-style-type: none"> • Effects on plaque formation • Binding of oral micro-organisms to proteins • Producing chemicals that inhibit oral bacteria
Indirect probiotic actions in the oral cavity	<ul style="list-style-type: none"> • Local Immunological defense mechanisms • Non-immunologic defense mechanisms • Mucosal permeability

PROBIOTICS AND CANCER: A lot of evidence is developed which suggests that probiotics must be interfering at various stages of carcinogenesis by interferences with damage to DNA. This anticancer effect of probiotics has been recognized now for a very long time but evidence in literature is minimal. The evidences for a very long time have suggested that the most common cause of colon-rectal cancer includes high consumption of animal protein and fats. The same diet has also been implicated in breast and prostate carcinoma which is believed to be the second most common cancer in males and females respectively after lung carcinoma. The postulated theory suggests that the micro flora of GI tract is involved in inducing carcinoma. Evidence suggests that probiotics have a critical role in the proliferation of cell and apoptosis which are very important for prevent colon-rectal adenocarcinoma.

PROBIOTIC AND HALITOSIS: Implication of probiotics in the effective treatment of oral halitosis has been documented in number of research studies. The probiotic organism most commonly involved includes *S. salivarius* K12. The bacteria are taken in the form of lozenge. However before using the lozenge, the oral cavity must be rinsed by a mouthwash. The results of using lozenge containing *S. salivarius* K12 turned out to be positive. The levels of Oral VSC reduced by approximately 85%.^[14] Another species implicated as an oral probiotic helping with halitosis includes *Weissella cibaria*.^[15] The contributing factor to decrease in halitosis due to *Weissella cibaria* is the ability of the micro-organism to co-aggregate with species responsible for the production of *F. nucleatum*, thus reducing the source for malodorous compounds in the oral cavity.^[16]

CONCLUSION: Probiotics have emerged as a revolution in the field of health and science for the last two decades. In spite of such advances, further research is still necessary to increase our knowledge about the appropriate use of probiotics. The data on probiotic effects in the oral and systemic health are accumulating and the results are pretty much certain that the probiotics may have more positive effects on the prevention as well treatment of certain diseases. The use of probiotics will soon be implicated in general clinical practice in the field of medicine. The most vital step would include the easy availability of such probiotics containing food products in most

remote areas as well as the underdeveloped and developing countries.

REFERENCES:

1. Parvez S, Malik KA, Ah Kang S, Kim HY. Probiotics and their fermented food products are beneficial for health. *J Applied Microbiology*. 2006;100(6):1171-85
2. Caglar et Al, Bacterial-therapy and probiotics' role on oral health. *Oral Dis*. 2005;11(3):131-7.
3. Meurman JH. Probiotics: do they have a role in oral medicine and dentistry? *Eur J Oral Sci*. 2005;113(3):188-96
4. Wickens K, Black PN, Stanley TV, Mitchell E, Fitzharris P, Tannock GW, Purdie G, Crane J. A differential effect of 2 probiotics in the prevention of eczema and atopy: A double-blind, randomized, placebo-controlled trial. *J Allergy Clin Immunol* 2008;122:788-794
5. Montes RG, Bayless TM, Saavedra GM, Perman JA. Effect of milks inoculated with *Lactobacillus acidophilus* or a yogurt starter culture in lactose-maldigesting children. *J Dairy Sci* 1995; 78:1657-1664.
6. Rusczycki M, Radzikowski A, Szajewska H. Clinical trial: Effectiveness of *Lactobacillus rhamnosus* (strains E/N, Oxy and Pen) in the prevention of antibiotic-associated diarrhoea in children. *Aliment Pharmacol Ther* 2008; 28:154-161.
7. Yli-Knuutila H, Snall J, Kari K, Meurman JH. Colonization of *Lactobacillus rhamnosus* GG in the oral cavity. *Oral Microbiol Immunol* 2006;21:129-13
8. Meurman JH. Probiotics: do they have a role in oral medicine and dentistry? *Eur J Oral Sci*. 2005;113(3):188-9
9. Hummel S, Veltman K, Cichon C, Sonnenborn U, and Schmidt MA: Differential targeting of the E-cadherin/ β -catenin complex by Gram-positive probiotic lactobacilli improves epithelial barrier function. *Appl Environ Microbiology* 2012; 78:1140-1147.
10. Stamatova I, Kari K, Meurman JH. In vitro evaluation of antimicrobial activity of putative probiotic lactobacilli against oral pathogens. *Int J Probiotics Prebiotics* 2007;2:225-232
11. Meurman JH, Antila H, Korhonen A, Salminen S. Effect of *Lactobacillus rhamnosus* strain GG (ATCC 53103) on the growth of *Streptococcus*

- sobrinus in vitro. Eur J Oral Sci 1995;103:253-258
12. Kang MS, Na HS, Oh JS. Coaggregation ability of Weissella cibaria isolates with Fusobacterium nucleatum and their adhesiveness to epithelial cells. FEMS Microbiology Lett 2005;253:323-32
 13. Koll-Klais P, Mandar R, Leibur E, Marcotte H, Hammarstrom L, Mikelsaar M. Oral lactobacilli in chronic periodontitis and periodontal health: Species composition and antimicrobial activity. Oral Microbiology Immunology 2005;20:354-361.
 14. 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; 100:754-764.
 15. Kang MS, Chung J, Kim SM, Yang KH, Oh JS. Effect of Weissella cibaria isolates on the formation of Streptococcus mutans biofilm. Caries Res 2006; 40:418-425.
 16. 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;33:226-232.

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