Probiotics in Dentistry- Beneficial or Baleful: A Review

Maryam Siddiqui, Kalpna Chaudhry, Chanchal Singh

1. Tutor, Dept. of Pedodontics, Jamia Millia Islamia, New Delhi, India.
2. Professor, Dept. of Pedodontics, Seema dental college, Rishikesh, India.
3. Professor, Dept. of Pedodontics, K. D. dental college, Mathura, India.

Corresponding Author: Kalpna Chaudhry

I. ABSTRACT

In this current modern era, the resistance caused by antibiotics is the major concern for the researchers and it is the prime cause for return to the pre-antibiotic dark ages. It is a breakthrough approach which utilizes natural bacteria to provide defense against various pathogenic bacteria. The aim of this research article summarizes the history, suggestive mechanism of action, with a brief overview of certain strains of probiotic bacteria which focuses on the prevention aspect against various diseases pertaining to dentistry.

KEY WORDS: Probiotics, Prebiotics, Streptococcus mutans.

Received 26 May, 2018; Accepted 11 June, 2018 © The Author(S) 2018. Published with open access at www.questjournals.org

II. INTRODUCTION

The widespread use of antibiotics and progressively increasing costs of health care system are the leading factors for the research and development in the area of functional foods. Hippocrates introduced the concept of functional foods long ago with their motto “let food be your medicine”. The scientific community all over the globe has started supporting the hypothesis that diet may play a significant role in modulation of physiological functions of the human body.1

To understand oral diseases there has been an exemplar shift towards an ecological and microbial community based approaches which includes the possibility of developing novel strategies through manipulation of the resident oral microbiota and modulation of host immune responses. The increased popularity of using probiotic bacteria supplements to improve gastrointestinal health has prompted interest in the utility of this approach for oral applications. Dental caries is one of the most frequently occurring preventable childhood disease, people are susceptible to this ailment throughout their lifetime. Various approaches including chemo prophylactic agents, antibiotics, caries vaccine, sugar substitutes, fluorides and restorative materials have been in use. Prevention of dental caries has been attempted with fluoride in different forms but it is considered as double edged sword as excess may lead to dental and skeletal fluorosis. The conventional prevention of dental caries is also focused on the removal of dental plaque by indiscriminate use of antibacterial mouth rinse but it may not be totally effective as it creates open, non-competitive surfaces for pathogens to repopulate the oral cavity. However, the anticaries effects of these approaches are still limited.2

The concept of probiotics focuses on the prevention aspect of the diseases, it can be effective in selectively inhibiting the oral pathogens. Hence, there is an emerging interest in the potential capacity of probiotic bacteria and its mechanism of action to prevent and combat oral diseases. The objective of this article is to review various strains of probiotics and their effects on oral health with their future perspective.

The term probiotics was derived from the Greek language, meaning ‘for life’. The concept of probiotics came into existence by Noble prize winner, Ukrainian bacteriologist Elie Metchnikoff. The term probiotic was first used in 1965 by Lilly and Stillwell.3 Various authors have given definitions of probiotics over many years based on various perspective.

Lilly & Stillwell in 1965 defined probiotics as “Substances produced by microorganisms that promote the growth of other microorganisms”.4 Parker et al in 1974 defined it as “Organisms and substances that contribute to intestinal microbial balance”.5 Fuller et al in 1989 defined it as “A live microbial feed supplement that beneficially affects the host animal by improving its intestinal microbial balance”.6 Havenaar & HuisInt Veld in 1992 defined it as “A viable monoculture or mixed-culture of microorganisms that, when applied to animal or human, beneficially affects the host by improving the properties of the indigenous microflora”.7

*Corresponding Author: Dr. Kalpna Chaudhry
Probiotics In Dentistry- Beneficial Or Baleful. A Review

Schaafsma et al in 1996 defined it as “Living microorganisms that, upon ingestion in certain numbers, exert health benefits beyond inherent basic nutrition”. Naidu et al. in 1999 defined it as “A microbial dietary adjuvant that beneficially affects the host physiology by modulating mucosal and systemic immunity, as well as by improving nutritional and microbial balance in the intestinal tract”. Schrezenmeir & de Vrese in 2001 defined it as “a preparation of, or a product containing, viable, defined microorganisms in sufficient numbers, which alter the microflora (by implantation or colonization) in a compartment of the host and as such exert beneficial health effects in this host”.

However, Till now the most acceptable definition of probiotics is “Live microorganisms that, when administered in adequate amounts, confer a health benefit to the host”. FAO / WHO report in 2001. Prebiotics are defined as non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacterial species already established in the colon, and thus in effect improve host health. Symbiotics are defined as mixtures of probiotics and prebiotics that beneficially affect the host by improving the survival and implantation of live microbial dietary supplements in the gastrointestinal tract of the host.

II. HISTORICAL BACKGROUND

In the beginning of the 20th century Elie Metchnikoff reported that Bulgarians lived longer than the other populations and he supposed that was due to the consumption of fermented milk products which contains viable bacteria. In 1907 he proposed that the lactic acid producing strain Lactobacillus bulgaricus has the ability to displace pathological intestinal bacteria by useful microbes. The first probiotic bacteria studied were lactic acid bacteria. Around the same time Henry Tissier, a French pediatrician suggested that 'bifid' bacteria (later on called bifidobacterium) could be administered to patients with diarrhea to help restore a healthy gut flora. Alfred Nissle, a German physician used one isolate (E. Coli stain) to treat chronic ulcerative colitis. In spite of all these positive effects, spectacular advent of antibiotics, suppressed the researches on bacteriotherapy but development of different resistant bacterial strain again pushed up the researches on probiotics.

Metchnikoff worked at the Pasteur Institute in Paris and discovered Lactobacillus bulgaricus, a strain he later introduced into commercial production of sour-milk products in France and throughout Europe. He devoted the last decade of his life to the study of lactic acid-producing bacteria as a means of increasing human longevity.

III. STRAINS OF PROBIOTICS

The most common probiotic strains belong to the genera Lactobacillus and Bifidobacterium. Probiotics can be varied, they can be yeast, bacteria or molds. But, most commonly bacterial species are predominant. They can be classified on the basis of microbiological classification.

The category of bacteria includes lactobacillus species includes Lactobacillus acidophilus, L. sporogenes, L. plantarum, L. rhamnosum, L. delbrueckii, L. reuteri, L. fermentum, L. lactis, L. cellobiosus, L. brevis. The Bifidobacterium species includes B. infantis, B. longum, B. thermophilum, and B. animalis. The Streptococcus species includes S. lactis, S. cremoris, S. salivarius, S. intermedius and the other species includes Leuconostoc spp, Pediococcus spp., Bacillus spp, Enterococcus spp.

The category of yeast and moulds includes Aspergillus cerevisiae, Aspergillus niger, Aspergillusoryzue, Candida pintolopensii, Saccharomyces boulardii.

Probiotics can also be classified on the basis of their capability of producing lactic acid.

1. Lactic acid-producing bacteria (LAB): Lactobacillus, Bifidobacterium, Streptococcus.
4. Nonspore forming and nonflagellated rod or coccobacilli.
5. Nonpathogenic strain of E. coli, Clostridium butyricum

An effective probiotic agent needs to be non-pathogenic, nontoxic, resistant to gastric acid, adhere to gut epithelial tissue and produce antibacterial substances. It should persistently influence metabolic activities in the GIT such as cholesterol assimilation, lactose activity, and vitamin production. The survival of probiotic organisms in the gut depends on the colonization factors which enable them to resist the antibacterial mechanisms that operate in the gut. The probiotic strain should be significantly resistant to the bile acid, e.g.

*Corresponding Author: Dr. Kalpna Chaudhry
Bifidobacteria strains proved significantly less acid-resistant than the Lactobacillus strains, when exposed to human gastric juice. The ideal features of good probiotics are- it should be a strain, which is capable of exerting a beneficial effect on the host, e.g. resistance to disease. It should be present as viable cells, preferably in large numbers. They should be capable of surviving and metabolizing in the gut environment e.g. resistance to low pH and organic acids and most importantly they should be capable of remaining viable for periods under storage and field conditions.

The mechanism of action of probiotics in oral cavity could be comparable to that of gut. Some of the hypothetical mechanism of probiotics action in the oral cavity.

Direct interaction in dental plaque- The direct mechanism of action involves binding oral microorganisms with the proteins and production of chemicals that inhibit the growth of oral bacteria. It acts on plaque formation and on its complex ecosystem by competing and intervening with bacterial attachments. Indirect probiotic actions: It comprises of regulating the systemic immune function, which in turn enhances the local immunity. They regulate the mucosal permeability and functions as antioxidants and also produce antioxidants. They have significant effect non-immunologic defence mechanisms eg. Production of bacteriocins to inhibit pathogens.

IV. PROBIOTICS IN ORAL HEALTH

Oral infections constitute to one of the most common diseases among humans. Oral cavity has a complex ecosystem which consist of diverse microbiota. Various studies proved that probiotics creates a protective shield against various microorganisms in the oral cavity.

Probiotics and dental caries:

Dental caries is a multifactorial disease which results in demineralization of the enamel. Streptococcus mutans plays a key role which ferments carbohydrates. During the process of bacterial interaction with carbohydrates, lactic acid is produced which ultimately results in decay. Probiotic bacteria interfere with the oral bacterial communities therefore it prevents the growth and further multiplication of pathogenic bacteria. Comelli and colleagues reported Streptococcus thermophiles and Lactobacillus lactis form biofilm on the hydroxyapatite surface and it interferes with growth and multiplication of Streptococcus sobrinus. It was demonstrated that isolates of Weissellaacebria has the capacity to inhibit biofilm formation both in vitro and in vivo by Streptococcus mutans and to prevent proliferation of this bacterial strain.

Nikawa et al reported a significant reduction in Streptococcus mutans in the saliva by up to 80% after consumption of yogurt containing Lactobacillus reuteri over a period of 2 weeks. Probiotics seem to be a natural way to maintain dental health, and that daily intake of probiotics in early childhood may result in less dental caries. Nase et al reported a significant reduction in dental caries among children who drank probiotic Lactobacillus rhamnosus GG-enriched milk. In a comparative study of the effects of several forms of probiotic administration on Streptococcus mutans reduction, Cagler et al showed a greater reduction of Streptococcus mutans in patients receiving probiotics in liquid or tablet forms.

Probiotics and Periodontal disease:

Periodontal disease are the most prevalent disease worldwide. Periodontitis is a multifactorial disease that results in destruction of the hard and soft tissues due to microbial colonization, inflammatory responses and adaptive immune responses. The complexity of the diseases process depends upon the type of bacteria and/or their products and virtually the status of the host response mechanisms.

Treatment of periodontal diseases in recent years has deviated from antibiotic/anti-microbial model of disease management. Probiotics might be a promising area of research in the treatment of periodontitis as it intercepts the disease process by decreasing the pH of the oral cavity which further prevents dental plaque and calculus formation. Probiotics produce antioxidants which prevents plaque formation by neutralizing the free electrons that are needed for the mineral formation. They are able to breakdown putrescence odors by fixating on the toxic gases (volatile sulfur compounds) and changing them to gases needed for metabolism.

Teughels et al reported that the subgingival application of a bacterial mixture including Streptococcus sanguis, Streptococcus salivarius and Streptococcus mitis after scaling and root planning significantly suppressed the re-colonization of Porphyromona gulae ( P. gingivalis) and P. intermedia. Pocket guided re-colonization approach may work as an alternative to the armamentarium of treatment options for periodontitis.

Probiotics and Halitosis:

Halitosis (bad breath) is believed to affect a large proportion of the population. It may reveal an underlying disease and it has a significant socio-economic impact too. Halitosis is caused by a number of

Corresponding Author: Dr. Kalpna Chaudhry

58 | Page
volatiles, which originate from the oropharynx or from expired alveolar air. In oral malodor, the sulphur containing gases (hydrogen sulfide, methyl mercaptan and dimethyl sulfide), which are derived from the bacterial degradation of sulphur containing amino acids in the oropharynx, play a significant role. Most of the pathology causing halitosis lies within the oropharynx (tongue coating, gingivitis, periodontitis, and tonsillitis).

Probiotics could also be used in the treatment of halitosis. Kang, et al.\textsuperscript{31} reported a significant reduction of volatile sulfur compounds after gargling twice daily with 15 ml Weissella cibaria CMU for 2 minutes.

### TABLE 1: VARIOUS SIGNIFICANT STUDIES THAT HAVE BEEN STUDIED SO FAR ALONG WITH THE CHARACTERISTICS, UTILISED PROBIOTICS STRAINS AND OUTCOMES ARE SUMMARISED BELOW.

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>YEAR</th>
<th>STUDY DETAILS</th>
<th>VEHICLE</th>
<th>TESTED STRAINS</th>
<th>CONCLUSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E Caglar et al.\textsuperscript{32}</td>
<td>2005</td>
<td>Examined the effect of short-term consumption of yogurt on the salivary levels of mutans streptococci and lactobacilli. (21 subjects; 4 weeks)</td>
<td>Yogurt containing Bifidobacteria</td>
<td>Mutans streptococci and lactobacilli</td>
<td>A statistically significant reduction (&lt;0.05) of salivary mutans streptococci was recorded.</td>
</tr>
<tr>
<td>Haukioja A et al.\textsuperscript{33}</td>
<td>2008</td>
<td>Investigated in vitro if the probiotic strains could affect the oral ecology (i) By preventing the adherence of other bacteria or (ii) By modifying the pellicle protein composition.</td>
<td>Four commercial probiotic products- L. rhamnosus GG (ATCC 53103), Lactobacillus casei Shirotai(Yakult, Yakult Honsha, Japan), L. reuteri SD2112 (DSM 20016, Rela, Ingman Foods, Finland, also known as ATCC 55730), and Bifidobacterium lactis Bb12 (Chr. Hansen, Denmark).</td>
<td>Streptococcus mutans and Streptococcus gordonii,</td>
<td>Results showed that probiotics may affect the oral ecology by specifically preventing the adherence of other bacteria and by modifying the protein composition of the salivary pellicle.</td>
</tr>
<tr>
<td>E Çaglar, et al.\textsuperscript{34}</td>
<td>2008</td>
<td>Examined whether the consumption of ice-cream can affect the salivary levels of mutans streptococci and lactobacilli. (24 subjects; 4 weeks)</td>
<td>Ice-cream containing bifidobacteria</td>
<td>Streptococci and lactobacilli</td>
<td>Significant reduction in the levels of caries-associated mutans streptococci in saliva.</td>
</tr>
<tr>
<td>E Çaglar, et al.\textsuperscript{35}</td>
<td>2008</td>
<td>Investigated the effect of the probiotic on the levels of salivary mutans streptococci and lactobacilli. (20 subjects; 10 days)</td>
<td>Probiotic Lactobacillus reuteri, delivered by a new medical device.</td>
<td>Mutans streptococci and lactobacilli</td>
<td>The short-term daily ingestion of lactobacilli-derived probiotics delivered via medical device containing probiotic lozenge reduced the levels of salivary mutans.</td>
</tr>
<tr>
<td>S Twetman et al.\textsuperscript{36}</td>
<td>2009</td>
<td>Investigated the effect of a chewing gum containing probiotic bacteria on gingival inflammation and the levels of selected inflammatory mediators in gingival crevicular fluid (42 subjects; 2 weeks)</td>
<td>Chewing gum containing Lactobacillus reuteri: ATCC 55730 and ATCC PTA 5289 (1x10^8 CFU/gum, respectively).</td>
<td>The reduction of pro-inflammatory cytokines in GCF may be proof of principle for the probiotic approach combating inflammation in the oral cavity.</td>
<td></td>
</tr>
</tbody>
</table>

*Corresponding Author: Dr. Kalpna Chaudhry*
**Probiotics In Dentistry- Beneficial Or Baleful. A Review**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>S K Cildir et al.</td>
<td>2009</td>
<td>Examined the short-term consumption of fruit yogurt containing probiotic bifidobacteria would affect the levels of salivary mutans streptococci and lactobacilli in patients with fixed orthodontic appliances. (24 subjects, 2 weeks)</td>
</tr>
<tr>
<td>Fruit yogurt containing probiotic bifidobacteria</td>
<td>salivary mutans streptococci and lactobacilli</td>
<td>Results demonstrated that daily consumption Bifidobacterium animalis subsp. Lactis DN-173010 could reduce the salivary levels of mutans streptococci.</td>
</tr>
<tr>
<td>Staab B et al.</td>
<td>2009</td>
<td>Determined the effect of a probiotic milk drink on gingival health and the development of experimental gingivitis. (50 subjects; 8 weeks)</td>
</tr>
<tr>
<td>Probiotic milk drink (Yakults, Homsha Co., Tokyo, Japan) daily, containing Lactobacillus casei strain Shirota.</td>
<td></td>
<td>The results showed a beneficial effect of the on gingival inflammation in non-immunocompromised subjects. Probiotics may have reversible immune modulating effect on plaque – induced inflammation of the gingiva.</td>
</tr>
<tr>
<td>Mayanagi G at al.</td>
<td>2009</td>
<td>Evaluated whether the oral administration of lactobacilli could change the bacterial population in supra/subgingival plaque. (66 subjects; 8 weeks)</td>
</tr>
<tr>
<td>Lactobacillus salivarius WB21 and xylitol in tablets.</td>
<td></td>
<td>Oral administration of probiotic lactobacilli reduced the numerical sum of five selected periodontopath bacteria and could contribute to the beneficial effects on periodontal condition.</td>
</tr>
<tr>
<td>Pamela Hasslof et al</td>
<td>2010</td>
<td>Investigated the ability of a selection of lactobacilli strains, used in commercially available probiotic products, to inhibit growth of oral mutans streptococci and C. albicans in vitro.</td>
</tr>
<tr>
<td>Eight strains of probiotic lactobacilli (L. plantarum299v, L. plantarum931, L. rhamnousuGG ATCC 53103, L. rhamnousuLB21, L. paracaseiF19, L. reuteriPTA 5289, L. reuteriATCC 55730, L. acidophilus La5).</td>
<td>Five strains of mutans streptococci (MS) including both laboratory reference strains (S. mutansNCTC 10449, S. mutansIngbritt, and S. sobrinusOMZ176) and clinical isolates (S. mutansP1:27 and S. mutansP2:29) and candida strains</td>
<td>The commercial probiotic lactobacilli could inhibit growth of reference strains and oral isolates of mutans streptococci and candida but the capacity differed significantly between the strains.</td>
</tr>
</tbody>
</table>

*Corresponding Author: Dr. Kalpna Chaudhry*
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Study Description</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mette Kirstine Keller et al.</td>
<td>2011</td>
<td>Investigated in vitro ability of selected commercial probiotic lactobacilli to co-aggregate and inhibit growth of oral mutans streptococci isolated from adults with contrasting levels of caries.</td>
<td>Eight commercially available probiotic lactobacillus strains, L. plantarum 931 (Essum, Umeå, Sweden), L. plantarum 299v (Probi AB, Lund, Sweden), L. paracasei F19 (Arla, Stockholm, Sweden), L. rhamnosus GG (Valio Ltd., Helsinki Finland), L. rhamnosus LB21 (Essum, Umeå, Sweden), L. reuteri DSM17938 (Biogaia, Stockholm, Sweden), L. reuteri ATCC PTA 5289 (Biogaia, Stockholm, Sweden) and L. acidophilus La5 (Arla, Stockholm, Sweden) Mutans streptococci They concluded that commercial lactobacilli-derived probiotic bacteria were able to co-aggregate with clinical isolates of mutans streptococci, but the ratio varied significantly between strains isolated from different subjects. The ability to inhibit growth was strain-specific, with no apparent relationship to the caries susceptibility of the subject.</td>
</tr>
<tr>
<td>G Jindal et al.</td>
<td>2011</td>
<td>Investigated the effect of oral probiotics on salivary MS count and to evaluate the relative efficacy of two commercially available probiotic preparations. (150 subjects; 14 days)</td>
<td>Darolac (Aristopharmaceuticals, India) containing 1.25 billion freeze dried bacterial combination, comprised of a mixture of, Lactobacillus rhamnosus, Bifidobacterium longum, and Saccharomyces cerevisae. Sporolac (Uni-Sankyo Ltd., India) containing 150 million Spores of Bacillus coagulans. Mutans streptococci Results showed a significant reduction of a cariogenic microorganisms, mutans streptococci.</td>
</tr>
<tr>
<td>E Çağlar et al.</td>
<td>2011</td>
<td>Conducted a study to determine the pH, titratable acidity of a selection of various probiotic yogurts, their buffering effects with emphasis on the pH range in which the buffer is efficient.</td>
<td>Probiotic yogurt (Activia®; Danone, Istanbul, Turkey) contained Bifidobacterium Buffering capacities of probiotic yogurt should be undermined and there was no significant differences observed between yogurts within any of the five groups compared as a whole with one another.</td>
</tr>
<tr>
<td>Mariella Vieira Pereira Leao et al.</td>
<td>2011</td>
<td>Conducted a study to evaluate the influence of consumption of probiotics on the presence of enterobacteria in the oral cavity and the specific secretary response against these microorganism. (112 subjects; 20 days)</td>
<td>Yakult LB8 (Yakult S/A Industria e Comercio, Lorena, Brazil) (Lactobacillus casei and Bifidobacterium). Enterobacter cloacae and Klebsiella oxytoca, Probiotic consumption reduced the prevalence of enterobacteria in the oral cavity, but did not affect enterobacterial counts or the specific immune secretary response against them.</td>
</tr>
</tbody>
</table>
**Probiotics In Dentistry- Beneficial Or Baleful. A Review**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Study Details</th>
<th>Microorganisms</th>
<th>Pathogens/Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iniesta M et al.</td>
<td>2012</td>
<td>Investigated the effects of an orally administered probiotic on the oral microbiota. (40 subjects; 8 weeks)</td>
<td>Lactobacillus reuteri</td>
<td>Prevotella intermedia and P. gingivalis</td>
</tr>
<tr>
<td>S K Cildir et al.</td>
<td>2012</td>
<td>Investigated the effect of the probiotic bacterium Lactobacillus reuteri on the levels of salivary mutans streptococci and lactobacilli. (19 subjects; 25 days)</td>
<td>Lactobacillus reuteri</td>
<td>Salivary mutans streptococci and lactobacilli.</td>
</tr>
<tr>
<td>Mette K Keller et al.</td>
<td>2012</td>
<td>Investigated the effect of probiotic lactobacilli on plaque lactic acid (LA) production in vitro and in vivo. (25 subjects; 2 weeks)</td>
<td>(L. reuteri DSM 17938, L. plantarum 299v)</td>
<td>Mutans streptococci (MS) and lactobacilli</td>
</tr>
<tr>
<td>Shiva Mortazavi et al.</td>
<td>2012</td>
<td>Evaluated the effects of conventional or probiotic cheese containing Lactobacillus casei on salivary Streptococcus mutans (SM) and Lactobacilli levels. (60 subjects; 2 weeks)</td>
<td>Lactobacillus casei</td>
<td>Salivary Streptococcus mutans (SM) and Lactobacilli levels.</td>
</tr>
<tr>
<td>Anita Khanafari et al.</td>
<td>2012</td>
<td>Compared the ability of ordinary and probiotic chocolate to induce or inhibit the growth of S. mutans.</td>
<td>Lactobacillus rhamnosus PTCC 1637, L. plantarum PTCC 1058 and L. acidophilus PTCC 1643</td>
<td>Streptococcus mutans (SM)</td>
</tr>
</tbody>
</table>

*Corresponding Author: Dr. Kalpna Chaudhry*
<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Study Description</th>
<th>Microorganism</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Juneja et al.</td>
<td>2012</td>
<td>Evaluated the changes in mutans streptococci counts in saliva after short term probiotic intervention (Lactobacillus rhamnosus hct 70) and its delayed effects on salivary mutans streptococci count. (40 subjects; 3 weeks)</td>
<td>Lactobacillus rhamnosus hct 70</td>
<td>Statistically significant reduction in salivary mutans streptococci counts immediately after consumption of probiotic Lactobacillus rhamnosus hct 70 containing milk suggest a beneficial effect of probiotic Lactobacillus rhamnosus hct 70 in the prevention of dental caries</td>
</tr>
<tr>
<td>Rajan Dhawan et al.</td>
<td>2013</td>
<td>Investigated commercially available combined probiotic formulation for its effect on plaque, gingivitis, and salivary Streptococcus mutans levels in subjects with chronic gingivitis. (36 subjects; 2 weeks)</td>
<td>Capsule Bifilac-Hp contains Lactobacillus sporogenes 100 million, Streptococcus faecalis T-110JPC 60 million, Clostridium butyrium 4 million, and Bacillus mesentericus 2 Million.</td>
<td>Mutans streptococci</td>
</tr>
<tr>
<td>Hamidreza Poureslameet al.</td>
<td>2013</td>
<td>Analyzed the effects of daily consumption of Espar on the number of salivary mutans streptococci and the level of calcium content. (50 subjects; 2 weeks)</td>
<td>Espar and yogut.</td>
<td>Streptococcus mutans</td>
</tr>
<tr>
<td>Wipapun Ritthagol et al.</td>
<td>2014</td>
<td>Investigated the effect of probiotic bacterium Lactobacillus paracasei SD1 on the level of salivary mutans streptococci and lactobacilli, and (2) the oral persistence of L. paracasei SD1 in orthodontically treated non-syndromic cleft lip and palate patients. (30 subjects; 4 weeks)</td>
<td>Probiotic milk powder containing L. paracasei SD1</td>
<td>salivary mutans streptococci and lactobacilli</td>
</tr>
<tr>
<td>Siddiqui M et al.</td>
<td>2016</td>
<td>Evaluated the Streptococcus mutans Levels in Saliva before and after Consumption of Probiotic Milk: A Clinical Study (20 subjects; 7 days)</td>
<td>Lactobacillus casei Shirota,</td>
<td>salivary Streptococcus mutans</td>
</tr>
</tbody>
</table>

**PRESCRIBED DOSAGE OF PROBIOTICS**

Probiotics are available in the form of capsules, powder, tablets, liquid, or are incorporated into food. The specific number of colony forming unit (CFUs) contained in a given dose or serving of food usually varies

*Corresponding Author: Dr. Kalpana Chaudhry*
among brands. Patients should be advised to read products label carefully to make sure that they are getting the right dose. Interestingly, probiotics are available over the counter and are not regulated by FDA but generally regarded as safe. Providers typically use half the adult dose for pediatric patients and a one-fourth dose for infants.55

K Suresh et al56 reported the recommended daily dosage for various probiotic strains- Lactobacillus species and Rhamnosus GG which are available in capsules, therapeutic yogurts, fermented milks are recommended in the dose of 10 billion CFUs. Bifidobacterium species which are available in therapeutic yogurts and fermented milks are recommended in the dose of 100 million to 35 billion CFUs. Saccharomyces Boulardii which are available in Capsules (Florastor) are recommended in the dose of 250-500 mg. Bacillus sp which are available in Powder (Bibactyl) are recommended in the dose of $10^7$-$10^9$ spores.

V. SUMMARY AND CONCLUSIONS

The research in oral probiotics has been growing during the last decades. Most of the studies have been conducted suggests the role of probiotic strains in maintenance of gut health, however, it is important to realize that results obtained from one probiotic strain cannot applied to the whole species instead every strain should be studied separately.

Probiotic bacteria seem to affect both oral microbiota and immune responses. On the other hand, the extent to which bacteria in food or in food ingredients can influence relatively stable oral microbiota is difficult to predict. Thus, both research to unravel the mechanisms of possible probiotic action and long-term clinical trials are needed to provide a new scientifically proven means of preventing or treating oral diseases by probiotics.

The ability of probiotics to prevent diseases and improving health at all ages is the prime factor for its progressively increasing market potential. The development of successful probiotic products depends on positive probiotic action as well as the maximum numbers of viable microorganisms survival at the time of consumption as well as at the time it reaches the colon. Internationally accepted methodologies like Pulsed Field Gel Electrophoresis, DNA-DNA hybridization or Randomly Amplified Polymorphic DNA should be carried out for identification and characterization of genus and species of probiotic organisms. The labelling of the products must have the basic details regarding the type of strains, dose which help in the awareness of the general population regarding the product.

The technological issues regarding the shelf life of the probiotic foods with the sufficient amount of viable bacteria throughout the shelf life of the product needs to be overcome. Current findings on the potential use of probiotics against oral conditions are very encouraging. More research is needed in this area, but the use of probiotics to manage the oral microflora is looking to be a very effective adjunct way to control oral conditions that affect so many people worldwide.

In spite of many health benefits of probiotics, the mechanisms by which the probiotic organisms exert their effects are still at nascent stage. Therefore, researches should focus on understanding the mechanisms of health-promoting effects of probiotic cultures for safe future of probiotics as functional food ingredients.

REFERENCES

5. Parker RB. Probiotics the other half of the antibiotic story. Anim Nutr Health 1974; 29:4-8.
Probiotics In Dentistry- Beneficial Or Baleful. A Review


*Corresponding Author: Dr. Kalpna Chaudhry*
Probiotics In Dentistry- Beneficial Or Baleful. A Review


Citation: Maryam Siddiqui, Kalpna Chaudhry, Chanchal Singh. "Probiotics in Dentistry- Beneficial or Baleful: A Review." Quest Journals Journal of Medical and Dental Science Research 5.3 (2018): 56-65.