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Probiotics role in general & oral health: A review

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Abstract

Probiotics are the good bacteria that are added or present in diet or are used as supplements to replace the colonization of the bad bacteria in gut, oral cavity, urogenital tract. Thus, by replacing the bad bacteria these probiotics have many health

benefits in general as well as oral health. And in this article, we are going to review these health benefits of these probiotics in human health.

Keywords: probiotics, oral cavity, gut, allergy, bacteria, IBS

Introduction

Like the pathogenic bacteria there are also non-pathogenic bacteria that are consumed along with diet or as supplements which are known as the probiotics and they are known to be good for the human health. Also, these probiotics kept the pathogenic microbes away from causing the disease. The term Probiotics introduced by Kollath in 1953 which has been derived from two Greek words, Pro meaning - for and bios meaning life - that is for life ^[1], so the basic principle in the usage of probiotics is competition between the good bacteria versus pathogenic bacteria. This article is a brief research on the role of probiotics in general as well as oral health.

Definition

According to a WHO/FAO report (2002), probiotics are 'Live micro-organisms which, when administered in adequate amount, confer a health benefit on the host'. Also, International Life Science Institute (ILSI) Europe suggests a definition according to which a probiotic is a live microbial food ingredient that, when ingested in sufficient quantities, exerts health benefits on the consumer ^[2].

Sources of probiotics

The common ways for the delivery of the probiotics to humans are ^[3]:

- Culture concentrate – Here the concentrated cultures of probiotics are added to a beverage or food like such as fruit juice, etc.
- Probiotics are inoculated into prebiotic fibres.
- Probiotics are inoculated in a milk-based dairy products such as milk, milk drink, yogurt.
- Non-dairy products – Probiotics are provided as dietary supplements in concentrated and dried cells packaged forms.

Microbes used as probiotics

Although there are many good microbes that are beneficial to human health, but the common microbial species are classified into two (4).

1. Bacteria
 - 1) Genus Lactobacillus: It include acidophilus, sporogenes, plantarum, rhamnosum, delbrueck, reuteri, fermentum, lactus, cellobiosus, brevis, casei, farciminis, paracasei, gasseri, crispatus.
 - 2) Bifidobacterium: It include bifidum, infantis, adolescentis, longum, thermophilum, breve, lactis, animalis.
 - 3) Streptococcus: It include the species like lactis, cremoris, alivarius, intermedius, thermophilis, diacetylactis.
 - 4) Leuconostoc mesenteroides.
 - 5) Pediococcus.
 - 6) Propionibacterium.
 - 7) Bacillus.
 - 8) Enterococcus.
 - 9) Enterococcus faecium.

2. Yeast and molds

These include *Saccharomyces cerevisiae*, *Saccharomyces boulardii*, *Aspergillus niger*, *Aspergillus oryzae*, *Candida parapsilosis*, *Saccharomyces boulardii*.

Probiotic mechanism of action

Although the exact mechanism by which probiotics exert their effects are largely unknown [4] but there are few research points are for their mechanism of action are as -

- Enhancement of the epithelial barrier.
- Modifying the gut pH
- Increased adhesion to intestinal mucosa and inhibition of pathogen adhesion.
- Competitive exclusion of pathogenic microorganisms.
- Modulation of the immune system - By altering the host immune response by increase IL-10, TGF- β , decrease TNF- α and increase the IgA production [5].
- Production of antimicrobial substances.

General health benefits of probiotics

1. Lactose intolerance

Lactose intolerance is a genetically determined disorder in which there is the beta-galactosidase deficiency which results in inability to hydrolyse lactose into the monosaccharides glucose and galactose. It has been studied by Kolars JC *et al.* in 1984 that lactose digestion improvement by using bacteria as starter culture in yogurt containing *Lactobacillus* and *S. thermophilus* is well recognized due to the presence of bacterial enzyme beta-galactosidase, and also there are several human studies has been demonstrated that show better lactose digestion with consumption of the fresh yogurts in comparison to the pasteurized product [5].

2. Diarrhea

O'Sullivan *et al.* conducted a study which shows that probiotics might prevent microbes that carry diarrhea by competing with pathogenic viruses or bacteria by preventing them from binding to epithelial cells [4]. The treatment and prevention of infectious diarrhea with the use of probiotics is widely accepted. It is proven that the prophylactic uses of probiotics including *Bifidobacterium bifidum*, *Streptococcus thermophilus* and *L. rhamnosus* strain are helpful in the prevention of acute diarrhea especially in infants [5].

3. H. pylori infection

H. pylori is the inhabitant of stomach which is associated with the gastritis, peptic ulcers & gastric cancer and there are evidence that probiotics may retard the gastric colonization of the *H. pylori* and Aiba *et al.* [4] also demonstrated that *Lactobacillus salivarius* are capable of producing high amounts of lactate, which can inhibit the growth of *H. pylori* *in vitro*.

4. IBS

IBS that is inflammatory bowel syndrome which is an intestinal chronic inflammatory condition with abdominal pain, flatulence, bloating and cramps and with diarrhea or

constipation. Brenner and Chey, Enck *et al.* & Whorwell *et al.* all demonstrated that use of probiotic bacteria strain like *Bifidobacterium infantis* 35624, *Escherichia coli* DSM17252 *Bifidobacterium infantis* 35624 could be helpful in treating the IBS [4].

5. Vaginal health

Probiotics may also be of use in maintaining urogenital health as probiotic treatment usually restores the balance of microflora that could be helpful for such common female urogenital problems as bacterial vaginosis, yeast infection, and urinary tract infection. Although there isn't enough evidence yet to recommend it over conventional approaches [6], but oral and vaginal administration of *Lactobacilli* may help in the treatment of bacterial vaginosis.

6. Allergy

Recent evidence suggests that exposure to bacteria in early life may exhibit a protective role against allergy and in this context, probiotics may provide safe alternative microbial stimulation needed for the developing immune system in infants. Probiotics play a substantial role in preventing allergies according to these studies [7]:

- a. The non-pathogenic *E. coli* was administered to infants to stimulate their immune systems. And age of at 10 years old and 20 years old these children suffered from significantly fewer allergic diseases.
- b. Prior to delivery, expecting mothers received probiotics or a placebo. Following delivery, the children who received probiotics continued dosage for 6 months. After 4 years, only 26% of the children on probiotics developed eczema while 46% of those without probiotics developed the condition.

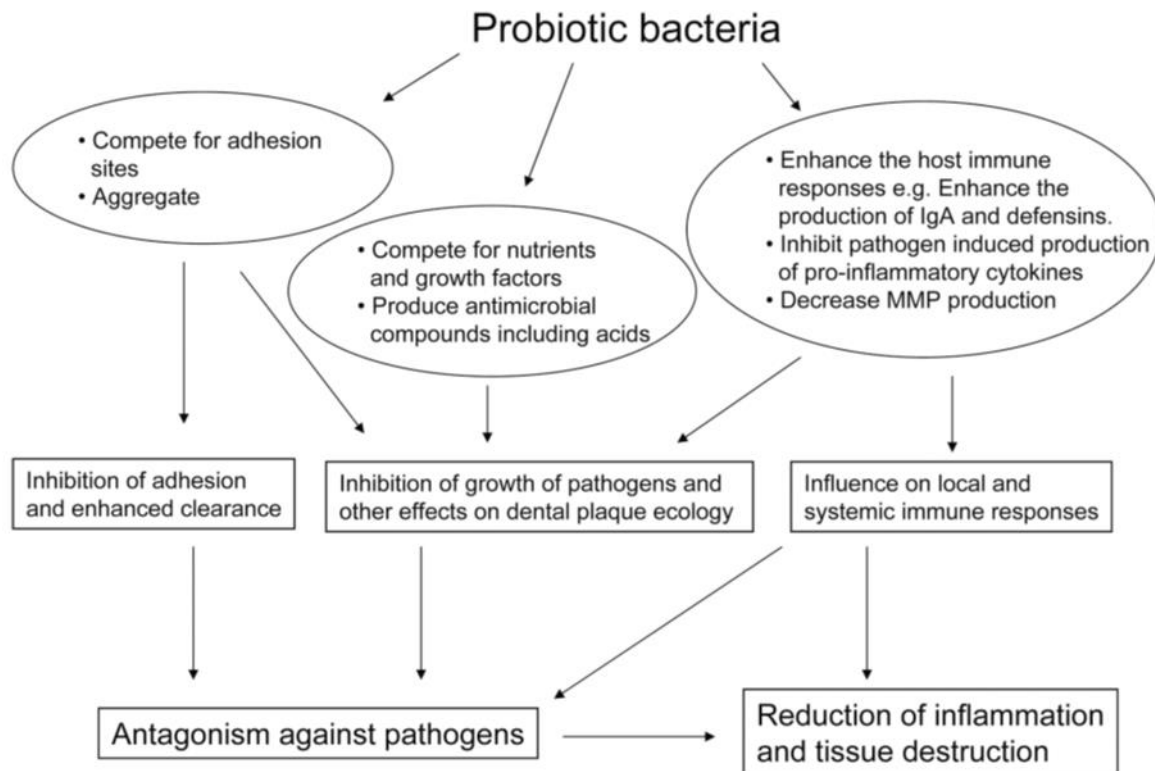
Thus, probiotics are useful in prevention of allergies.

7. Other benefits

There many other benefits of using probiotics like prevention from gastric cancer as probiotics inhibits the *H. pylori* besides this use of probiotics like Lactic acid bacteria strain are useful in colon cancer by comprising the modification of the metabolic activities of intestinal micro flora and alteration of physicochemical conditions in the colon as well as binding site, with biodegradation of potential carcinogens and production of anti-tumorigenic or mutagenic compounds due to ability to decrease the activity of enzyme called β glucuronidase and by increasing the host immune response and by alteration in pro-cancerous enzymatic activity of colonic microorganisms [8]. Use of different strains of bacteria used as probiotics helpful in different conditions like diabetes & obesity, blood pressure and cholesterol.

8. Oral health benefits

Apart from general health benefits, there various oral health benefits of using the probiotics like in periodontal diseases, dental caries and candidiasis. The potential mechanism by which the probiotics affects the oral health are given in the figure [9].



1. Dental caries

In dental caries there is an increase of acidogenic as well as aciduric microbes which are responsible for the change in the pH of the oral cavity and thus making tooth more susceptible to the dental caries and so the use of probiotics with molecular genetics is useful to replace and displace cariogenic bacteria with noncariogenic bacteria like in genetically modified probiotics with enhanced properties can be developed that is designer probiotics. For example, a recombinant strain of *Lactobacillus* that expressed antibodies targeting one of the major adhesions of *S. mutans* (antigen I/II) was able to reduce both the viable counts of *S. mutans* and the caries score in a rat model^[10]. Nowadays, even probiotics containing toothpastes are also being made that are promising in dental caries although 100% guarantee is not possible because the dental caries is a multifactorial disease and the probiotic bacteria like *Bacillus coagulans* act here by inhibiting the *S. mutans* that is the initiator in the smooth surface dental caries and also by preventing the drop in the pH of the oral cavity.

2. Candidiasis

Candida albicans is among the most common infectious agent for the oral candidiasis among individuals specially in immunocompromised patients like in HIV, diabetes; it is also known as the oral thrush with a creamy white lesion on buccal mucosa, tongue, roof of the mouth and gums. And the consumption of probiotic cheese containing *L. rhamnosus* GG and *Propionibacterium freudenreichii* ssp. *Shermanii* JS shown to decrease the *C. albicans* count in the oral cavity^[11] and thus helpful in the management of the oral thrush.

3. Periodontal diseases

A proposed mechanism of action of probiotics is strengthening the mucosal barrier via tropic effects on the epithelium, and stimulating both the innate and adaptive immune system. Use of mouth wash using selected strains of *L. reuteri* or tablets containing 6.7×10^8 colony forming units

of *L. salivarius* and Xylitol (280 mg/tablet) has been associated with the reduction in gingivitis and plaque accumulation^[11]. In other studies, it has been shown that 14-day intake of *L. reuteri* led to the establishment of the strain in the oral cavity and significant reduction of gingivitis and plaque in patients with moderate to severe gingivitis^[2].

4. Halitosis

Halitosis is also known as bad breath that is mainly due to the sulfur emitting microbes, a literature review thesis from the University of Connecticut shows the best way to get rid of offensive breath is to focus on replacing the bad microbes with good bacteria and in the study, it was found that the *Streptococcus salivarius* strain K12 can effectively reduce the bacterial growth associated with halitosis. Researchers gave test subjects K12 probiotic lozenges, and after one week, 85 percent of participants showed a significant reduction in volatile sulfur compounds^[12].

Conclusion

The idea of replacing the bad bacteria with good is attractive and very helpful in human health like in infectious diarrhea, IBS, etc. And also, probiotics are the cost-effective method in the management of various health issues, and their use is also getting popular in general health care sector, although in the oral health care its use is yet limited by the practitioners. So, the efforts should be made to aware the general dental practitioners also. Likewise, there is much more future studies are needed in probiotics along with molecular engineering that could be useful in combating or helpful in the management of many more systemic as well as oral health issues in future.

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