Educational Forum

Probiotics in health and disease *Grewal N*¹, *Jassal B*², *Kumar R*³

¹Dr Nipunjot Grewal Assistant Professor ²Dr Baljit Jassal Assistant Professor baljitjassal@gmail.com Dr Rakesh Kumar Associate Professor bagharakesh@gmail.com

> Received: 23-10-2017 Revised: 29-10-2017 Accepted: 20-11-2017

Correspondence to:

Dr Baljit Jassal baljitjassal@gmail.com

ABSTRACT

Importance of normal microbial flora in human bodies to maintain optimal health cannot be under estimated. Probiotics or live microorganisms confer health benefit in various diseases. Thus potential of probiotics to maintain health and prevent many disorders without significant adverse effects has opened new options for treating various diseases.

Keywords: Live microorganism, disease, regulation, source, allergy

of MEDICA

Introduction

The concept behind probiotics was introduced in the early 20th century, when Nobel laureate Elie Metchnikoff, known as the "father of probiotics," consuming proposed that beneficial microorganisms could improve people's health. Researchers continued to investigate this idea, and the term "probiotics"—meaning "for life" eventually came into use. According to currently adopted definition of by FAO/WHO, probiotics are defined as live microorganisms, which when administered in adequate amounts confer a health benefit on the host. ^[1] In addition, non pathogenic species belonging to Saccharomyces, Streptococcus and Lactococcus are also used as probiotics. The human gastrointestinal system contains about 39 trillion bacteria, according to the latest estimate, most of which reside in the large intestine. In the past 15 years researchers have established that many of these commensal microbes are essential for health. During the period of stress, illness or antibiotic treatment, the gut flora is often changed in favour of harmful bacteria that may cause diarrhea and loss of appetite. Overgrowth of harmful bacteria and its subsequent invasion of the system led to inflammatory, immunological, neurological and endocrinal problems. So, one of the options to normalize health is to supplement viable bacteria

in the form of probiotics to replace pathogenic bacteria from the gut. A daily intake of 109-1010 colony forming units (CFU) viable cells has been shown to have positive effect on host heath.

According to a National Institutes of Health survey, the number of adults in the U.S. taking probiotics or their cousins, prebiotics (typically nondigestible fibers that favor the development of gut bacteria), more than quadrupled between 2007 and 2012, from 865,000 people to nearly four million. San Francisco–based business consulting firm Grand View Research estimates that the global probiotics market exceeded \$35 billion in 2015 and predicts that it will reach \$66 billion by 2024. ^[2] The requirements for an organism to be defined as effective probiotic are: ^[3,4]

- Probiotic should exert positive effects on host, should be acid resistant, bile resistant and contain a minimum of 30 X 109 CFU/gram.
- Probiotic should possess high survival rate, multiply faster and its adhesive capability must be firm and faster.
- It should reduce pathogenic adherence.

- Probiotics produce acids, peroxide and bacteriocins, antagonistic for growth of pathogens.
- They should be safe, non invasive, non carginogenic and non pathogenic and must coaggregate to form a normal balanced flora.
- Probiotics should be durable enough to withstand the duress of commercial manufacturing, processing, packing and distribution so it can be delivered alive to the intestine.

Sources of Probiotics

Most common source of probiotic is yoghurt that consists of milk fermented by bacteria which modifies lactose into lactic acid. Fermented milk and fortified fruit juice are other sources. Probiotics are also available in supplements consisting of freeze dried bacteria in tablets, capsules and powders.

Mechanism of action ^[5]

Probiotics compete with pathogenic organisms for limited substrates, prevent their adherence to host cells, can lead to release of cytokines and chemokines, releases gut protective metabolites like arginine, glutamine, short chain fatty acids and conjugated linoleic acid. Probiotics also act as antimicrobial by secreting products called bacteriocins.

Probiotics have the potential to modify the structure of potential antigens, reduce their immunogenicity, reduce intestinal permeability and generation of proinflammatory cytokines which are increased in patients of allergic disorders. Probiotics also possess antiarthritic and bone health supporting effect due to degradation of mineral complexing phytic acid, stimulation of calcium uptake by enterocytes.

Role of Probiotics in various diseases

Oral diseases: Probiotics reduce risk of high Streptococcus mutans level which is mainly involved in causation of dental caries. Bacteria administered in probiotic, competes with carcinogenic microbes for adhesion sites as well as for nutrients and growth factors leading to decreased levels of S mutans. ^[6] Also replacement of bactertia causing halitosis or bad breath with probiotic strains may be useful in adjunctive treatment for halitosis.

Gastrointestinal health: Probiotics have the potential to prevent diarrhea associated with use of antibiotics and also prevent acute diarrhea especially in infants. The daily intake of L reuteri in humans significantly reduced number of reported sick days due to common infections, and this effect is more pronounced in the shift workers. In addition to gastrointestinal diseases, probiotics possess anti allergic property also. Its use is also useful in patients of lactose intolerance. Several human studies have better lactose digestion and absorption in subjects that consumed fresh yoghurt (live yoghurt culture) in comparison with consumption of pasteurized product (heat killed bacteria).^[7] Improvement in symptoms like abdominal pain, bloating, flatulence and diarrhea has also been noted in patients of irritable bowel syndrome. Also growth of H pylori is known to be inhibited by some strains of lactic acid bacteria in vitro by several mechanisms (stimulating specific and non specific immune responses and producing antimicrobial substances) and prevents infection.

Genitourinary health: Oral/vaginal use of probiotics Lactobacillus rhamnosus GR-1 and lactobacillus fermentum RC-14 has shown to prevent recurrences of bacterial vaginosis which is the most common cause of vaginal discharge in child bearing age. When administered along with antibiotics, it shows significant improvement as compared to antibiotics alone. Use of probiotics has also shown results in urinary tract infection. Using one or two capsules vaginally per week reduced recurrence rate of UTI for a year with no side effects or yeast infections. ^[8]

Role in allergy: Use of probiotics has been associated with disappearance of food allergy manifestation with decrease in concentration of IgE in the serum and with a lower frequency of allergies. Probiotics also potentiate IgA response to potentially harmful antigens and IgA production in peyer's patches have been shown to be enhanced by Bifidobactetia and lactobacilli. ^[9] Efficacy of whey formula supplemented with

Lactobacillus GG in infants with atopic eczema and cow's milk allergy was extensively examined by majamaa and Isolauri. Significant improvement in clinical symptoms and markers of intestinal inflammation was seen in subjects receiving formula with Lactobacillus GG.^[10]

Role in systemic infections: Probiotics can be used in certain conditions where pathology occurs due to bacterial translocation like severe acute pancreatitis, sepsis, liver cirrhosis and multi system failure.

Risk and safety concerns

According to 2002 report jointly released by WHO and Food and Agriculture organization of United Nations, ^[11] 'probiotics may theoretically be responsible for four types of side effects': systemic infections, mild gastrointestinal side effects, deleterious metabolic activities, Excessive immune stimulation in susceptible individuals and Gene transfer. Therefore, WHO/FAO working group recommended that new probiotic strain should be evaluated for safety by testing for antibiotic resistance, toxin production and haemolytic potential, assessing metabolic activities such as D-lactate production and bile salt deconjugation, conducting human studies to evaluate side effects and post marketing surveillance of commercial consumers and ideally studving their use in immunocompromised animals to determine infectivity of probiotic organism in this type of host.

Regulatory status: Normally FDA does not challenge the labelling or safety of probiotic product except where product is mentioned as a drug (ie to treat, cure, prevent, mitigate or diagnose disease) and lacks approval as a drug. FDA regulations on probiotics depend on intended use of drug (mentioned on label). In FDA, there are 4 regulatory caregories for probiotics and each of these has different regulatory requirements. These are: ^[12,13]

- Drugs or biological products
- Dietary supplements
- Food or food ingredient
- Medical food

If probiotics are intended for use as drug, these are also considered as biological products and FDA regulations of biological products will also be applied on probiotics. If these are to be used as "dietary supplements", the manufactures may market it without any pre-approval. But manufacturer must notify FDA the claims of the product. And it will be treated as "new dietary ingredient". If it is launched to be used as food or food ingredient, the FDA only regulates its postmarket controls related to adulteration. If the product is launched as medical food, then no premarket clearance will be required. ^[12]

Probiotics have shown promising results in many diseases and can prove to be useful in maintaining optimal health of an individual. But more studies over longer periods are required. Standard treatment should not be replaced with probiotics and they must not be taken without advice from a consultant.

References

- Vineet A, Sonali K, Nimisha S. Role of Live Microoranisms (probiotics) in prevention of caries: Going on the natural way towards oral health. Ind J Multidisciplinary Dentistry 2012; 2(3):491-6.
- 2. The global probiotics market. Available at: https://www.scientificamerican.com/article/d o-probiotics-really-work.
- 3. Azizpour K, Bahrambeygi S, Azizpour A. History and Basic of Probiotics. Res J boil sci 2009;4:409-26.
- Behnsen J, Deriu E, Sassone-Corsi M, Raffatellu M. Probiotics: properties, examples, and specific applications. Cold Spring Harb Perspect Med 2013;3:a010074. doi:.10.1101/cshperspect.a010074
- 5. Hemaiswarya S, Raja R, Ravikumar R, Carvalho IS. Mechanism of action of Probiotics. Braziian archives of biology and technology 2013;56(1):113-9.
- Singh VP, Sharma J, Babu S, Rizwanulla, Singla A. Role of probiotics in health and diseases: A review. J Pak Med Assoc 2013;63:253-7.
- Dewit O, Pochart P, Desjeux JF. Breath hydrogen concentration and plasma glucose, insulin and free fatty acid levels after lactose, milk, fresh or heated yogurt ingestion by

healthy young adults with or without lactose malabsorption. Nutrition 1988;4:131–5.

- Reid G, Bruce AW, Taylor M. Instillation of Lactobacillus and stimulation of indigenous organisms to prevent recurrence of urinary tract infections. Microecology Therapy 1995; 23:32-45.
- Yasui H, Nagaoka N, Mike A. Detections of bifidobacterium strains that induce large quantities of IgA. Microb Ecol Health Dis 1992;5:155-62.
- 10. Majamaa H, Isolauri E. Probiotics: a novel approach in the management of food allergy. J Allergy Clin Immunol 1997;99:179–85.
- 11. Side effects of probiotics. Available at: http://www.fda.gov/ohrms/dockets/ 95s0316 /95s-0316-rpt0282-tab-03-ref-19-jointfaowho-vol219.pdf
- 12. Degnan FH. The US Food and Drug Administration and Probiotics: Regulatory Categorization. Clin Infect Dis 2008;46:133-6.
- 13. Hoffman FA, Heimbach JT, Sanders ME, Hibberd PL. Executive Summary: Scientific and Regulatory Challenges of Development of Probiotics as Foods and Drugs. Clin Infect Dis 2008;46:53-7.

Cite this article as: Probiotics in health and disease. Grewal N, Jassal B, Kumar R. Int J Med and Dent Sci 2018;7(1):1649-1652.

Source of Support: Nil Conflict of Interest: No