Agricultural Reviews, 39(3) 2018: 251-254
Print ISSN:0253-1496 / Online ISSN:0976-0539

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

Probiotics conventional benefits and cautions in intake- A review

G. Priya Sugandhi*

Department of Foods and Nutrition, The Professor Jayashankar Telangana State Agricultural University, Krishi Vigyan Kendra, Wyra-507 165, Khammam, Telangana, India.

Received: 10-08-2017 Accepted: 31-08-2018 DOI: 10.18805/ag.R-1749

ABSTRACT

Probiotics are friendly bacteria benefit the health which occur naturally in the digestive tract of human beings. Prebiotics, act as 'food' for these beneficial probiotic bacteria, promoting their activity. *Lactobacillus* and *Bifidobacterium* are widely used probiotics which generally regarded as safe. They are adhesive to mucosal and epithelial surfaces and enhance immunity by preventing pathogen adhesion in the digestive system. Although infections with probiotics are very rare, few research studies have been reported in children and also in elderly suffering from diseases due to supplementation of few types of species which may be due to immunodeficiency and immunosuppression. The familiarity of probiotics is still uncertain in many and they doubt whether to consume or not. This review provides the information based on research studies and gives clarity on the intake of probiotics. However, caution need to be exercised in the selection of genus and strains of particular probiotics genera.

Key words: Benefits of probiotics, Cautions in intake of probiotics, Infections.

The definition of probiotics given by World Health Organization (FAO/WHO, 2001) as "live micro-organisms which, when administered in adequate amounts, confer a health beneût on the host". Probiotics not only aid the gut by increasing the number of beneficial bacteria and inhibiting harmful bacteria but also strengthen the body's immune response. Prebiotics, act as 'food' for these beneficial probiotic bacteria, promoting their activity. The combinations of pre- and probiotics are called *symbiotics* as both work together in a synergistic manner to enhance the probiotic benefits. Lack of knowledge and unfamiliarity of probiotic yoghurts has led to non-acceptability of the product by elderly despite exhibiting their health benefits (Sugandhi and Maheswari, 2016). Since the familiarity of probiotics' benefits is still uncertain in many people and developing countries with an apprehension for consumption. This review focus the health benefits and cautions of probiotics to give the clarity on consumption.

Lactobacillus and *Bifidobacterium* are widely used as probiotics. Probiotics are also be taken in supplement form as pills or capsules. Recently, other probiotic functional food products have been introduced which include probiotic fruit juice, cereal and probiotic fruit smoothies (non-dairy) etc. Dairy products play a significant role in the functional food market which carries probiotics, prebiotics and symbiotics.

One of the dairy probiotic product - yoghurt consum ption promotes not only the alteration of the microbial flora of the intestine but also contain probiotics that helps to recognize harmful microorganisms causing intestinal infections (Amanda, 2013). Research on probiotics has focused on various aspects such as growth, gut- disorders, heart diseases, allergic reactions, HIV and cancer. Modulation of the gut-brain by probiotics has been suggested as a novel therapeutic solution for anxiety and depression (Shi *et al.*, 2016). A probiotic treatment with *S. thermo phi lus* and *Enterococcus faecium* reduced low density level (LDL) "bad" cholesterol by about 8% in 70 overweight people in an 8-week, double-blind, placebo-controlled trial (Agerholm-Larsen, 2000). Several small-scale clinical trials have indicated that consumption of milk fermented with various strains of lactic acid bacteria may result in modest reduction in blood pressure. Many human trials have shown that the strains tested may exert anti-carcinogenic effects by decreasing the activity of an enzyme called â-glucuronidase, which generate carcinogens in the digestive system. Age-related changes in the gastrointestinal tract combined with changes in diet and immune system reactivity affect the composition of gut microbes, leading to increased numbers of facultative anaerobes, decreased number of beneficial organisms like anaerobic *Lactobacilli* and *Bifidobacteria*. Andersen and Baumgart, (2006) reported that probiotics have shown beneficial effects both in acute infectious diarrhoea and inflammatory bowel disease and thus presumably be of potential benefit in post-infectious irritable bowel syndrome (IBS). Since lactic acid bacteria (LAB) are general inhabitants of the human genital tract, they have been controlled by supplementation of probiotics (either orally

*Corresponding author's e-mail: priya.sugandhi777@gmail.com

or locally administrated) for urogenital infections (Oberoi, 2007). Bacterial vaginosis is considered as an overgrowth of anaerobic organisms. Daily oral intake of probiotic strains, resulted in asymptomatic bacterial vaginosis patients reverting to normal *Lactobacilli* dominated vaginal microflora (Menard, 2011).

Immune system: The sensitivity of the immune system decreases with age, a process known as immune-senescence (Wardwell *et al*., 2008), which is characterized by decreased proliferation of T-lymphocytes and impaired T-helper activity that may lead to impaired cell-mediated immune defense (Volkert, 2005). This can make the older people more susceptible to infections - the fourth most common cause of death in old age (Chandra, 2004), less ability to fight against the diseases that reduce the effectiveness of vaccination (Martin, 2000), while low cholesterol levels have been associated with improved immune function (Tufts, 2003), enable people to make dietary changes in health improvement.

Probiotics increase the immunity through targeting cells. Ying *et al*. (2001) reported that the degree of specific target cell lysis by NK cells increased significantly following consumption of HN001 in either low fat milk (LFM) or LFM-LH low fat milk and lactose-hydrolyzed LFM. Oral delivery of *L. rhamnosus* HN001 in a milk base can enhance indices of natural immunity in middle-aged and elderly consumers, but that delivery of the probiotic in an oligosaccharide-enriched milk base does not appear to strongly potentiate the immunomodulatory effects. The effect of probiotic supplementation of *L. salivarius* over 16-wk period with upper respiratory tract infection (URTI) symptoms in 54 highly active individuals showed significant effect for B-cells (CD3+ CD4+), with higher values on probiotic than placebo, but not for lymphocyte subset (T-, T-cytotoxic and B-cells) counts indicating strain specification effects (Gleeson *et al*., 2012). Whereas, significant increment of CD4 cells was observed with probiotics, prebiotics and symbiotics in HIV infected population (Ray and Vaidya, 2014). Oral administration of *Lactobacillus casei* DN-114001 alleviated colitis and increased the suppressive function of FOXP3 CD4 regulatory T-cells of colon lamina propria. These studies have a great bearing on the effects of probiotics with natural adjuvant on mucosal regulatory T-cells may represent a valuable approach to alleviate the colitogenic effect of Tcl-type CD8+ effectors (Rachinel *et al*., 2009).

Gastrointestinal tract: Age-related changes in the gastrointestinal tract combined with changes in diet and immune system reactivity affect the composition of gut microbes, leading to increased numbers of facultative anaerobes and decreased number of beneficial organisms (anaerobic *Lactobacilli* and *Bifidobacteria).* Bezkorovainy (2001) overviewed that an ideal probiotic can survive passage through the gastrointestinal tract, establish itself permanently in the small intestine and colon and provide a specific health benefits for the host by eliciting an immune response; sec retion, production, and synthesis of compounds such as short-chain fatty acids, lactic acid, and bacteriocins or another appropriate mechanism.

Irritable bowel syndrome: Probiotics have also been shown to exhibit a beneficial effect both in acute infectious diarrhea and inflammatory bowel diseases and thus could presumably be of potential benefit in post infectious irritable bowel syndrome (IBS) (Andersen and Baumgart, 2006). Adequate probiotic supplementation can improve the intestinal barrier function, redox hemostasis and low-grade inflammation in men, under sustained exercise stress (Lamprecht *et al.*, 2012).

Several clinical symptoms have been reportedly treated with probiotic supplementation. Diarrhea, gastro enteritis, irritable bowel syndrome and inflammatory bowel disease (IBD; Crohn's disease and ulcerative colitis) which are digestive tract infections. Inadequate lactase digestion, infant allergies, failure-to-thrive in children, hyper lipidemia, hepatic diseases, *Helicobacter pylori* infections, cancer and depressed immune function (Parvez, *et al.*, 2006) are treated with probiotics along with medication. Guyonnet *et al*. (2007) studied the effects of fermented milk containing *Bifidobacterium animalis* DN-173 010 and yoghurt strains on IBS. He found that decrease in bloating score at week 3 in the test *vs.* the control group and in those subjects with <3 stools/week, stool frequency increased ($P < 0.001$) over 6 weeks in the test *vs* control group. Gibson, *et al.* (2010) over reviewed that the probiotic field is currently dominated by gastrointestinal events.

Infections: Infections with probiotics are scanty based on research studies. Strains of the *Lactobacillus* and *Bifidobac terium* genera are usually regarded as safe following long-term use in human beings. Anuradha and Rajeshwari (2005) reviewed cases of infection due to *Lactobacilli* and *bifido bacterium* are extremely rare and estimated to represent 0.05 - 0.4% of cases of infective endocarditis and bactera emia not only that the risk of bacteraemia is < 1 case per million individuals but also virtually impossible to propose a risk of death because of the common association of infections involving lactobacilli with fatal underlying conditions or the presence of poly microbial infections. Weston *et al*. (2005) demonstrated that *Lactobacillus* species beneficial effects of decreasing severity of atopic dermatitis among children <2 yr old.

Leyer *et al*. (2009) conducted a study on a total sample size of 326 children for detection of a minimal difference of 20% to 40% in the incidence of influenza-like symptoms (fever, rhinorrhea and coughing) between the placebo group and either probiotic group and found subjects receiving probiotic products had significant reduction in days absent from group child care, compared with subjects

receiving placebo treatment. Daily probiotic dietary supp lementation during the winter months was a safe effective way to reduce episodes of fever, rhinorrhea and cough, the cumulative duration of those symptoms, the incidence of antibiotic prescriptions and the number of missed school days attributable to illness.

Increasing dietary fiber with the use of probiotic or prebiotic supplements or functional foods have been suggested to improve digestive and immune health in older people (Donini *et al.* 2009; Gage, 2009; Arthur, 2009). Allen *et al.* (2011) assessed the effect of probiotics in acute infectious diarrhea among infants and young children and found probiotics appear to be safe and have clear beneficial effects in shortening the duration and reducing stool frequency in acute infectious diarrhea.

Though more common probiotics from the genera of *Lactobacillus* or *Bifidobacterium* are generally regarded as safe, it should not be concluded that all members of *Bacillus* genera such as *Bacillus licheniformis* which is also been used in investigations can be used as probiotics. This is due to association of some strains of *Bacillus* genus with diseases such as *Bacillus cereus* which can cause food-borne illnesses (EFSA, 2007; Leuschner *et al.* 2011). The important area of concern with probiotic use is the risk of sepsis. Bacterial sepsis related to probiotic use in children has also been reported by Kunz *et al.,* (2004) in the cases of 2 premature infants with short gut syndrome who were fed via gastrostomy or jejunostomy and developed Lactobacillus bacteremia while taking LGG supplements. But LGG and other strains of *L.rhamnosus* can sometimes be found in the intestinal microbiota of healthy humans, so the source of infection in these cases is not conclusively proven (Boyle *et al*., 2006).

Studies reported in the case of a 74 yr old diabetic woman, who developed LGG liver abscess and pneumonia 4 months after daily LGG supplementation (Rautio *et al.*, 1999) and the development of *L. rhamnosus* endocarditis after a dental extraction in a 67 yr old man with mitral regu rgitation who was taking probiotic capsules daily (Mackay *et al.*, 1999). In 12-week study, *Lactobacillus GG* failed to prove more effective than placebo for the treatment of rheumatoid arthritis (Hatakka *et al*., 2003), stomach discomfort in children (Gawronska, 2007). Benefits were seen in large studies, in which probiotics combined with multivitamins and minerals helped prevent colds (or reduce their duration and severity) in adults (Tubelius *et al*.; de Vres *et al*.; and Winkler *et al*., (2005)). However, a smaller and shorter study failed to find any effect on respiratory infections (Weizman *et al*., 2005).

CONCLUSION

There is strong evidence for use of probiotics in preventing and treating some human diseases. Probiotics aid the gut by increasing the number of helpful bacteria but inhibiting the harmful bacteria by strengthening the immune response. They are introduced to the human body during birth which protects from infections, deficiencies. There are also cautions to select the genus and strains of particular pro- biotics genera and should be used after evidential trials because of the risk of sepsis. The probiotic approach, i.e. therapeutically consuming beneficial microorganism cultures of the healthy human microflora, holds great promise for the prevention and treatment of clinical conditions associated with impaired gut mucosal barrier functions and sustained inflammatory responses. However, more proven studies showed intake of probiotics gives health benefits with adequate, safety strains, species of probiotics.

REFERENCES

Agerholm-Larsen L, Raben A, Haulrik N, *et al.* (2000). Effect of 8 week intake of probiotic milk products on risk factors for cardiovascular diseases. *Eur J Clin Nutr.* **54:**288-297.

Allen, S. J., Martinez, E. G., Gregorio, G. V. and Dans, L. F. (2011). Probiotics for treating acute infectious diarrhoea. *Sao Paulo Medical Journal*, **129:** 1516-3180.

Amanda, P. (2013). Benefit of yoghurt. *www.fitnessmagazine/cona/recipes/healthyeating/ nutritionalhealth.*

Andresen, V. and Baumgart, C. D. (2006). Role of probiotics in the treatment of irritable bowel syndrome: Potential mechanisms and current clinical evidence. *International Journal of Probiotics and Prebiotics,* **1:**11-18.

Anuradha, S. and Rajeshwari, K. (2005). Probiotics in health and disease. *Journal Indian Academy of Clinical Medicine*, **6:** 67-72.

Arthur, C. O., Tiihonen, K., Saarinen, M., Putaala, H and Rautonen, N. (2009). Influence of a combination of *Lactobacillus acidophilus* NCFM and lactitol on healthy elderly: intestinal and immune parameters. *British Journal of Nutrition*, **101:** 367-375.

Bezkorovainy, A. (2001). Probiotics: determinants of survival and growth in the gut. *American journal of clinical Nutrition,* **73:** 399-405.

Boyle, R.J., Robins-Browne, R.M. and L.K Tang. M. (2006). Probiotic use in clinical practice: what are the risks? *American Journal of Clinical Nutrition*, **83:** 1256-64.

Chandra, R. K. (2004). Micronutrients, probiotics and the liver. *Journal of Gastroenterology and Hepatology,* **19** (s7): S398-S400.

De Vrese M, Winkler P, Rautenberg P, *et al.* (2005) Effect of Lactobacillus gasseri PA 16/8, *Bifidobacterium longum* SP 07/ 3, B. bifidum MF 20/5 on common cold episodes: A double blind, randomized, controlled trial. *Clin Nutr.*; **24:**481-491.

Donini, L. M., Savina, C. and Cannella, C. (2009). Nutrition in the elderly-the role of fiber. *Archives of Gerontology (Geriatrics Supplement*), **1:** 61-69.

EFSA (European Food Safety Authority) (2007). Opinion of the scientific committee on introduction of a qualified presumption of safety (QPS) approach for assessment of selected microorganisms referred to EFSA. *The EFSA Journal,* **5:**1–16.

FAO/WHO (Food and Agricultural Organization/World Health Organization Joint Report) (2001). Expert consultation on '*Evaluation of Health and Nutritional Properties of Probiotics in Food Including Powder Milk with Live Lactic Acid Bacteria'*, Corboda, Argentina. October 1-4, *http://www.fao.org/3/a-a0512e.pdf.*

Finegold, S. M., Zhaoping, Li., Summanen, P.H., Downes, J., Thames, G., Corbett, K., Dowd, S., Krak, M. and Heber, D. (2014). Xylooligosaccharide increases *Bifidobacteria* but not *Lactobacilli* in human gut microbiota, *The Royal Society of Chemistry.* **5:** 436–445.

Gage, J. (2009). Understanding the role of probiotics in supporting digestive comfort. *Nursing Standard*, **24:** 47-55.

Gawronska A, Dziechciarz P. and Horvath A. *et al*. (2007). A randomized double-blind placebo-controlled trial of *Lactobacillus GG* for abdominal pain disorders in children. *Aliment Pharmacol Ther.***25:**177-84.

Gibson, G. R., Scott, K. P., Rastall, R. A., Tuohy, K. M., Hotchkiss, A., Dubert-Ferrandon, A., *et al*. (2010). Dietary prebiotics: current status and new definition. *Food Science and Technology Bulletin: Functional Foods*, **7:** 1-19.

Gleeson, M., Bishop, N. C., Oliveira, M., McCauley, T., Tauler, P and Lawrence, C. (2012). Effects of a *Lactobacillus salivarius* probiotic intervention on infection, cold symptom duration and severity, and mucosal immunity in endurance athletes. *International Journal of Sport Nutrition and Exercise Metabolism,* **22:** 235 -242.

Guyonnet, D., Chassany, O., Ducrotte, P., Picard, C., Mouret, M., Mercier, C. H. and Matuchansky, C. (2007). Effect of a fermented milk containing *Bifidobacterium animalis* DN-173 010 on the health-related quality of life and symptoms in irritable bowel syndrome in adults in primary care: a multicentre, randomized, double-blind, controlled trial. *Alimentary Pharmacology and Therapeutics*, **26:** 475-86.

Hatakka K, Martio J, Korpela M, *et al*. (2003). Effects of probiotic therapy on the activity and activation of mild rheumatoid arthritis-a pilot study. *Scand J Rheumatol*. **32:** 211-215.

Kunz A.N., Noel J.M,, Fairchok M.P. (2004). Two cases of Lactobacillus bacteremia during probiotic treatment of short gut syndrome. *Journal of Pediatrics Gastroenterolology Nutrition*, **38:** 457– 8.

Lamprecht, M., Simon, B., Schippinger, G., Steinbaver.K., Fankhauser, F., Hallstroem, S., Scheretz. B. and Greilberger, J. F. (2012). Probiotic supplementation affects markers of intestinal barrier, oxidation, and inflammation in trained men; a randomized, double-blinded, placebo-controlled trial. *Journal of International Society of Sports and Nutrition*, **9:** 45.

Leuschner, R.G. K, Robinson, T. P, Hugas, M, Cocconcelli PS, Richard-Forget F, Klein G, *et al*. (2011). Corrigendum to Qualified presumption of safety (QPS): a generic risk assessment approach for biological agents notified to the European Food Safety Authority (EFSA). *Trends in Food Science and Technology* **1:** 51 - 52.

Leyer, G. J., Shuguang Li., Mubasher, M.E., Reifer, C. and Ouwehand, A. C. (2009). Probiotic effects on cold and influenza-like symptom incidence and duration in children. *Pediatrics*. **124:** e172-179.

Mackay, A.D., Taylor M.B., Kibbler, C.C., Hamilton-Miller, J.M. (1999). Lactobacillus endocarditis caused by a probiotic organism. *Clinical Microbiological Infection*, **5:** 290 -2.

Martin, C.A. (2000). EU-funded project on the elderly. *Nutrition and Food Science*. **3:** 279-282.

Menard (2011) Antibacterial treatment of bacterial vaginosis: current and emerging therapies. *Int J womens health*. **3:** 295-305.

Oberoi, A., Aggarwal, A. and Singh, N. (2007). Probiotics in health – A bug for what is bugging You. *Journal of Medical Education & Research*, **9:** 116-119.

Parvez, S., Malik, K. A., Ah Kang, S. and Kim, H. Y. (2006). Probiotics and their fermented food products are beneficial for health. *Journal of Applied Microbiology*, **100:** 1171-1185.

Rachinel, F. H., Nancey, S., Boschetti, G., Sardi, F., Doucet-Ladeveze. R., Durand, P.Y., Flourie, B and Kaiserlian, D. (2009). CD4+ cells and *Lactobacillus casei* control relapsing Colitis mediated by CD8+ Tcells. *The Journal of Immunology*, **183:** 5477-5486.

Rautio, M., Jousimies-Somer, H., and Kauma H. (1999). Liver abscess due to a Lactobacillus rhamnosus strain indistinguishable from *L. rhamnosus* strain GG. *Clinical Infectious Diseases*, **28:**1159-60.

Ray, S. and Vaidya, L. (2014). Role of functional probiotic food groups in enhancing CD4 cell profile of HIV infected population – A short systematic review. *International Journal of Engineering Science Invention*, **12:** 14-20.

Sugandhi, G. P. and Maheswari, U. K. (2016). Perception and effect of socio economic factors of indian elderly on synbiotic yoghurt. *Journal of Probiotics and Health*, **4:** 140. *doi:10.4172/2329-8901.1000140.*

Shi, L.H, Balakrishnan, K., Thiagarajah, K., Ismail, I. M. and Yin, O.S. (2016). Beneficial properties of probiotics. *Tropical Life Sciences Research*, **27:** 73-90.

Tufts, (2003). Yet another reason to lose excess weight: improved immune function. *Health and Nutrition Letter*, **21:** 1.

Tubelius P, Stan V, and Zachrisson A, *et al*. (2005) Increasing work-place healthiness with the probiotic Lactobacillus reuteri: A randomised, double-blind placebo-controlled study. *Environ Health*.

Volkert, D. (2005). Nutrition and lifestyle of the elderly in Europe. *Journal of Public Health*, **13:** 56-61.

Wardwell, L., Novakofski, C. K., Herrel, S. and Woods, J. (2008). Nutrient intake and immune function of elderly subjects. *Journal of the American Dietetic Association*, **108:** 2005-2012.

Weston, S., Halbert, A., Richmond, P and Prescott, S.L. (2005). Effects of probiotics on atopic dermatitis: a randomized controlled trial. *Archives of Disease in Childhood* , **90:** 892-897.

Weizman Z, Asli G, Alsheikh A, *et al*. (2005) Effect of a probiotic infant formula on infections in child care centers: comparison of two probiotic agents. *Pediatrics.***115:**5-9.

Winkler P, de Vrese M, Laue C, *et al*. (2005) of a dietary supplement containing probiotic bacteria plus vitamins and minerals on common cold infections and cellular immune parameters. *Int J Clin Pharmacol Ther.* **43:**318-26.

Ying-H, S., Bor-L, C., Ling-H, W., Chuh-K, L and Harsharnjit, S. G. (2001). Systematic immunity-enhancing effects in healthy subjects following dietary consumption of the lactic acid Bacterium *Lactobacillus rhamnosus* HN 001. *Journal of the American College of Nutrition*, **20:** 149–156.