



Probiotics in Health – A Bug for What is Bugging You

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Introduction

Probiotics are defined as preparation of alive microorganisms of specific genus and species in sufficient numbers to alter the microflora (by implantation or colonisation), and by doing so exert beneficial effects in the host(1). They consist of either yeast or bacteria. The microorganisms most commonly used as probiotics are lactic acid bacteria such as lactobacilli and bifidobacteria(2). Their effects are often strain specific and can be direct or indirect through modulation of the endogenous flora or of the immune system. Probiotics are effective in prevention of diarrhoea(3,5) and respiratory infections(6) as well as in the treatment of antibiotics associated diarrhoea(7,8) and allergic diseases(9,10)

In contrast to probiotics which are a live microbial additions, a prebiotic is a nonviable component of the diet that reaches the colon in an intact form and is selectively fermented by colon bacteria. Evidence from the in vitro and vivo studies have suggested that non digestible oligosaccharides, in those that contain fructose, are suitable probiotics. The feeding of 15g/ day fructooligosaccharides to healthy volunteers causes bifido bacteria to become numerically predominant in faeces. Their possible effects on the following are as discussed below.

Probiotics as Modulators of Gut Flora

Probiotics can be recommended as a preventive approach to maintain the balance of the intestinal microflora. Probiotics vary in their efficacy and results are species specific.

Those strains who can survive to the harsh physiochemical conditions in gut eg. gastric acid, bile secretions, and competes with the resident microflora are proved to be most efficient. The strain specific ability of some probiotics to adhere to the gut epithelium may enhance the chances for exclusive competition of immune modulation(11).

Mechanisms of effect are likely to include the excretion of acids(lactate, acetate), Competition for nutrients and gut receptor sites, immunomodulation and the formation of specific anti-microbial agents. Buts et al(12) reported that the oral intake of yeast

Saccharomyces boulardi(1g/day for 2 weeks) resulted in a significant increase in jejunal lactase, sucrose and maltase activities. Several studies have also shown immuno- modulating properties of rhamnose strain GG and of *L.acidophilus* strain LA1 in man. Schiffirin et al(13) reported an enhanced phagocytic activity of granulocytes in subjects consuming fermented milk containing bifidobacteria or *L.acidophilus* strain LA1.

Role of Probiotics in Allergy Management

There is good evidence that all babies are born with a weakly Th-2 (allergic) based immune response as a consequence of placental immune modulation of maternal immune responses to foetoparental antigens(14). It has been suggested that intestinal microorganisms may be important in the normal immune modulation of the neonate. The use of probiotics (*Lactobacillus* GG) reduced the prevalence of atopic dermatitis in high risk neonates followed upto 2 years(15).

Probiotics in Irritable Bowel syndrome(IBS)

Irritable bowel syndrome(IBS) is a multifactorial gastrointestinal condition affecting 8-22% of the population, with a higher prevalence in women and accounting for 20-50% of referrals to gastroenterologists. It is characterized by abdominal pain, excessive flatus, variable bowel habit and abdominal bloating with no evidence of organic disease.

The intestinal microflora in IBS has been shown to be abnormal. Faecal microflora of IBS patients harbour low number of lactobacilli and bifido bacteria and higher numbers of facultative organisms, such as *Klebsiella*

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sp. and enterococci. The role of probiotics in IBS perhaps will be in prevention rather than cure(16).

Role of Probiotics in Cancer Risk Reduction

The endogenous flora and the immune system play a role in the modulation of carcinogenesis. Both may be influenced by probiotics. Some epidemiological studies have shown that consumption of fermented dairy products may have some protective effect against breast cancer and large colon adenomas (17,18). Two studies performed by Aso et al suggest that oral administration of *L. hamnose* (biolactis powder) decreased the recurrence of superficial bladder tumours. Outside Japan, the anti tumour activity and the effect on tumour cell proliferation of lactic acid bacteria have mainly been studied by using fermented milk products(19,20).

Role of Probiotics in Inflammatory Bowel Disease

If bacteria do play a role in the life of the gut then logically they must be involved in the debilitating inflammatory bowel disorders, such as ulcerative colitis and Crohn's disease.

Probiotics could reduce the need for steroids in Crohn's patients. Lactobacilli have shown some beneficial effect in Crohn's disease. Morteau reported on some successful trials using probiotics to treat Crohn's patients who had part of their colon removed and had been left with an internal 'pouch' which often becomes re-infected. The result showed a relapse rate of 40% on both a placebo and drug vs 10 to 20% with probiotics. On the other hand, probiotics are not much effective in Ulcerative colitis. Lactobacillus GG has been reported to be effective in improving the clinical status of children with Crohn's disease(21). Borruel et al(22) observed that probiotics interact with immuno competent cells using the mucosal interface and modulate locally the production of proinflammatory cytokines.

Role of Probiotics in Constipation

According to a recent study, probiotics could be an effective cure for one of the most common gut problem, constipation. In a randomized, double blind, placebo controlled trial, it was shown that a probiotic drink containing a live lactobacillus caseishirota was significantly effective at reducing constipation compared

to a placebo. 89% of the test group reported a positive effect(23).

Role of Probiotics in H.pylori Infection

H. pylori is a gram negative bacterium that infects more than half of the world's human population(24). Probiotics reduce bacterial colonisation and gastric inflammation in *H. pylori* infected mice(25). *L. acidophilus* ROO 52 & *L. rhamnosus* ROO1 improved *H. pylori* eradication(25-27). Fernandez et al(28) demonstrated that probiotics have the ability to directly inhibit *H. pylori* growth. Wu et al (29) have reported that the administration of probiotics along with triple therapy for *H. pylori* infection helps to reduce the side effects and increases drug compliance in patients. This study also showed that administration of probiotics enhanced the restoration of normal bacterial flora during triple therapy of *H. pylori* eradication. In vitro studies using live lactobacillus species indicate that administration of either single or mixed species of probiotics have the ability to stimulate the immune system(30). In addition, lactobacilli display bactericidal and anti microbial effect against pathogens including *H. pylori*(31). The mechanism is that probiotics competitively exclude enteropathogenic *Escherichia coli* and Enterohaemorrhagic *E. coli* 0157-H7 from binding, thereby preventing attachment and effacing lesions(32). Probiotics also maintain host barrier integrity in presence of these pathogenic *E. coli*(33).

Role of Probiotics in Lactose Intolerant Patients

Lactose intolerant subjects tolerate fermented dairy products very well, even when they contain lactose. Since lactose intolerance is due to lactose maldigestion (about one sixth of maldigestors are intolerant) it was hypothesised that lactose from yoghurt was better digested than lactose from milk. Several studies confirmed this hypothesis(34,35). A role for variable lactic acid bacteria (LAB) was speculated as pasteurisation reduced the observed digestibility.

Probiotics as Potential Hypocholesterolaemic Action

Several trials have shown a decrease in serum cholesterol during consumption of very large doses (680 to 5000 ml/day) of fermented dairy products(36). Fermented products contained *Enterococcus faecium* and 2 strains



of *Streptococcus thermophilus*. Serum cholesterol and LDL were significantly reduced in the group receiving the fermented milk (0.3&0.42 m mol/L) respectively while no change was observed in the control group.

Probiotics during Intestinal Disturbances

Open trial suggest that some probiotics may help to eradicate pathogens in chronic carriers of *Salmonella*, *Campylobacter* or *Clostridium difficile*(17). One trial showed that feeding bifidobacterium bifido and *S.thermophilus* to infants admitted to hospital significantly reduced the risk of diarrhoea and shedding of rotaviruses.

Probiotics for Prophylaxis of Urogenital Infections

Lactic acid bacteria (LAB) are normal inhabitants of the human genital tract. Several controlled trials have suggested some potential for probiotics (either orally or locally administrated) for urogenital infections. The results of some are encouraging(17).

Probiotics can also be used to stop chronic helitosis.It is the recommendation that they may be helpful in the prevention and treatment of acute diarrhoea in adults and children, the prevention of antibiotic associated diarrhoea in adults and children and also the maintenance of remission and prevention of pouchitis.

Conclusion

Drug resistance is becoming such a significant problem that there are bacteria for which most antibiotics no longer work. Experts have begun to discuss the "post-antibiotic era". Wide and indiscriminate use of antibiotics in the last century has led to the emergence of drug resistant mutants, so by the use of probiotics this menace can also be checked to some extent.

As probiotics have multifactorial effects on digestive, urogenital and immune system of the body with negligible side effects, so these bugs can be used for what is bugging you.

References

1. Schrezenmeir J, de vrese M. Probiotics, prebiotics, and synbiotics –approaching a definition. *Am J Clin Nutr* 2001;73 (2 Suppl): 361S-64S.
2. Rana S V.Role of proboitics and prebiotics in health. *Gastroentology Today* 2005; 9:138-44.
3. Saavedra JM, Bauman NA, Oung I, Perman JA, Yolken RH. Feeding of Bifidobacterium bifidum and *Streptococcus thermophilus* to infants in hospital for prevention of diarrhoea and shedding of otavirus. *Lancet* 1994;344 (8929):1046-49.

4. Szajewska H, Kotowska M, Mrukowicz JZ, Armanska M, Mikolajczyk W. Efficacy of *Lactobacillus GG* in prevention of nosocomial diarrhoea in infants. *J Pediatr* 2001;138(3):361-65.
5. Oberhelman RA, Gilman RH, Sheen P, Taylor DN, Black RE, Cabrera L Lescano *Lactobacillus GG* to prevent diarrhoea in undernourished Peruvian children. *J Pediatr* 1999;134(1):15-20.
6. Hatakka K, Savilahti E, Ponka et al. Effect of long term consumption of probiotics milk on infections in children attending day care centers: double blind, randomized trial. *BMJ* 2001;322:1-5.
7. Arvola T, Laiho K, Torkkeli S et al. Prophylactic *Lactobacillus GG* reduces antibiotic- associated diarrhoea in children with respiratory infections a randomized study. *Pediatrics* 1999;104:64.
8. D'Souza AL, Rajkumar C, Cooke J, Bulpitt CJ. Probiotics in prevention of antibiotic associated diarrhoea: meta-analysis. *BMJ* 2002;324:1361-64.
9. Isolauri E, Arvola T, Sutas Y. Moilanen E, Salminen S. Probiotics in the management of atopic eczema. *Clin Exp Allergy* 2000;30(11):1604-10.
10. Kalliomaki M, Salminen S, Arvilommi H, Kero P, Koshinen P, Isolauri E. Proboitics in primary prevention of atopic disease: a randomized placebo-controlled trial.*Lancet* 2001;375(9262):1076-79.
11. Marteau P. Impact of ingested lactic acid bacteria on the immune response in man.In:*Lactic acid bacteria, actes du colloque Lactic 94, Caen 7-9 September 1994. Presses Universitaires de Caen: Caen: 1995;31-42.*
12. Buts JP, Bernasconi P, Van Craynest MP, et al. Response of human and rat small intestinal mucosa to oral administration of *Saccharomyces boulardii*. *Pediatr Res* 1986;20:192-96.
13. Schiffrin EJ, Rochat F, link-Amster H, Aeschliman JM, Donnet-Hughes A. Immunomodulation of human blood cells following the ingestion of lactic acid bacteria. *J Dairy Sci* 1995;78:491-97.
14. Jones CA, Holloway JA, Warner JO.does atopic disease start in foetal life? *Allergy* 2000;55(1):2-10.
15. Flouch, Martin H, Madsen, Karen K. et al. Recommendations for Probiotic use. *J Clin Gastroentrol* 2006; 40 (3) : 275-78.
16. Madden J. The role of gut flora in IBS and the effects of probiotics. Abstracts of 13th –14th Sept 2001,Royal college of physicians, London.
17. Marteau P, Rambaud JC. Potential of using lactic acid bacteria for therapy and immunomodulation in man. *FEMS Microbiol Rev* 1993;12(1-3):207-20.
18. van't Veer P, Dekker JM, Lamers JW, et al. Consumption of fermented milk products and breast cancer: a case-control study in The Netherlands. *Cancer Res* 1989;49(14):4020-23.



19. Reddy GV, Shahani KM, Banerjee MR. Inhibitory effect of yogurt on Ehrlich Ascites tumor-cell proliferation. *J Natl Cancer Inst* 1973;50(3):815-17.
20. Shahani KM, Friend BA, Bailey PJ. Antitumor activity of fermented colostrums and milk. *J Food Prot* 1983;46:385-86.
21. Guandaiini S. Use of *Lactobacillus* –GG in paediatric Crohn's disease. *Dig Liver Dis* 2002;34(Suppl 2):S63-65.
22. Borruel N, Carol M, Casellas F, et al. Increased mucosal tumor necrosis factor alpha production in Crohn's disease can be downregulated ex vivo by probiotic bacteria. *Gut* 2002;51(5):659-64.
23. Hoffman A. The effect of a probiotics beverage on gastrointestinal symptoms and general well being in patients with chronic constipation. Liveissue @ yakult. Co.uk, Spring 2002.
24. Suerbaum S, Michetti P. *Helicobacter pylori* infection. *N Engl J Med* 2002;347(15):1175-86.
25. Johnson-Henry KC, Mitchell DJ, Avitzur Y Galindo-Mata E, Jones NL, Sherman PM. Probiotics reduce bacterial colonization and gastric inflammation in *H.pylori* infected mice. *Dig Dis Sci* 2004;49:1095-1102.
26. Bielanski W, Ziemniak W, Plonka M, Dobrzanska MJ, Kaminska A, Konturek SJ. Improvement of anti-*Helicobacter pylori* therapy by the use of commercially available probiotics. *Gut* 2002;51(11): A98.
27. Hamilton–Miller JM. The role of probiotics in the treatment and prevention of *Helicobacter pylori* infection. *Int J Antimicrob Agents* 2003;22:360-366.
28. Fernandez MF, Boris S, Barbes C. Probiotic properties of human lactobacilli strains to be used in the gastrointestinal tract. *J Appl Microbiol* 2003 ; 94 (3) : 449-455.
29. Sheu BS, Wu JJ, Lo CY, et al. Impact of supplement with *Lactobacillus* and *Bifidobacterium* containing yogurt on triple therapy for *helicobacter pylori* eradication. *Ailment Pharmacol Ther* 2002;16:1669-1675.
30. Dieleman L, Goerres M, Arends A, et al. *Lactobacillus* GG prevents recurrence of colitis in HLA-B27 transgenic rats after antibiotic treatment. *Gut* 2003; 52(3):370-6.
31. Chatterjee A, Yasmin T, Bagchi D, Stohs S. The bactericidal effects of *Lactobacillus acidophilus*, garcinol and Prototyping compared to clarithromycin. On *Helicobacter pylori*. *Mol cell Biol* 2003;243:29-35.
32. Johnson-Henry K, Tompkins TA, Sherman PM. *Lactobacillus* species inhibit adherence of enteropathogenic *Escherichia coli* and enterohemorrhagic *E.coli* to host epithelial cells, Annual meeting of the Danone Symposium of Fermented Food, Fermentation and Intestinal Flora, New York,2000
33. Johnson-Henry K, Tompkins T, Sherman P. Effect of *lactobacillus* on enterohemorrhagic *Esherichia coli* induced alterations in intestinal epithelial cell permeability. *Annu Meet Am Soc Microbiol Orlando FL abstr B-188, 2001.*
34. Kolars JC, Levitt MD, Aouji M, Savaiano DA. Yogurt: an auto-digesting source of lactose. *N Engl J Med* 1984;310:1-3.
35. Marteau P, Flourie B, Pochart P, Chastang C, Desjeux JF, Rambaud JC. Effect of the microbial lactase(EC3.2.1.23) activity in yoghurt on the intestinal absorption of lactose: an in vitro study in lactase deficient humans. *Br J Nutr* 1990;64:71-79.
36. Pettoello Mantovani M, Guandalini S, Ecuba P, Corvino C, di Martino L. Lactose malabsorption in children with symptomatic *Giardia lamblia* infection:feasibility to yoghurt supplementation. *J Pediatr Gastroentrol Nutr* 1989;9:295-300.
37. Agerbaek M, Gerdes LU, Richelsen B. Hypocholesterolaemic effect of fermented milk product in healthy middle aged men. *Eur J Clin Nutr* 1995; 49:346-52.

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