Choosing a High Quality Probiotic

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Probiotics such as Lactobacillus and Bifidobacterium are microorganisms that inhabit the gut, supporting gut immunity and general gastrointestinal health. Probiotics have been used for many years to support a healthy balance of intestinal microflora. One of the primary considerations when buying a probiotic is to choose a strain that can establish itself and survive under the conditions encountered in the intestinal environment. The human strains that Nutri use are recognised for their exceptional high quality as well as their ability to survive in the presence of bile or stomach acid and adhere to the intestinal wall.

The Intestinal Microflora

Establishment of the intestinal microflora begins at birth and continues throughout life. The complex ecosystem contains hundreds of different bacterial strains, both good and bad. Some bacterial species that colonise the gut are not desirable in high numbers, as they disrupt the optimal balance of the gut flora and compromise the integrity of the gut lining. Colonisation by these bacteria often occurs as a result of:

- Antibiotic use
- High fat/low fibre diet
- Gastric acid inhibitors
- Contaminated food and water
- Foreign travel

There are many types of "friendly bacteria" that can be found in the intestinal tract, including *Lactobacillus acidophilus* and *Bifidobacterium*. These two are the most prolific beneficial bacteria in the GI tract. Necessary for colonic cell growth and repair[37], these friendly indigenous bacteria also provide resistance to colonisation by unwanted pathogenic organisms. They do this in several different ways:

- By supporting the integrity of the intestinal barrier
- By supporting mucosal response to pathogens
- By competing with pathogenic bacteria for attachment to epithelial cells

By supporting the production of short chain fatty acids (SCFAs) and thus lowering the pH of the gut, indigenous friendly bacteria create an unfavourable environment to pathogenic organisms. SCFAs can serve many other functions. Butyric acid for example may also guard against inflammatory conditions.[37]

The 'Irritable' Bowel

Irritable Bowel Syndrome (IBS) is a disorder that interferes with the normal functions of the colon and is diagnosed by its symptoms and by the presence of other diseases. Think "ABC" – Abdominal pain, bloating and cramping without any pathology (no conclusive evidence on cause or how it develops).

Great Smokies Diagnostic Laboratory is renowned for its expertise in gastrointestinal testing and can perform digestive stool analyses that evaluate gastrointestinal function. These assays pinpoint imbalances, provide clues about current symptoms and warn of potential problems should the imbalances of IBS progress.

Although functional GI complaints have not been traced to a single cause, research suggests that altered levels of intestinal bacteria play a very significant role. A daily dose of highly potent and specific, identity-certified probiotics of *L.acidophilus NCFM*® and *B.lactis* have shown to substantially reduce the severity and frequency of IBS symptoms in sufferers. A healthy bowel has 3-4lbs of beneficial bacteria, which help to complete digestion, improve assimilation of nutrients, make vitamins and kill off bad bacteria, viruses, fungi and parasites. If pathogenic bacteria are allowed to proliferate the stool becomes sour from putrefaction and a great deal of gas is formed and this causes much bloating and discomfort.

The NCFM® strain of *Lactobacillus acidophilus*

Isolated from human faeces, the unique *L.acidophilus* NCFM® is perhaps the most extensively tested and proven probiotic strain available today, with over 60 research studies confirming its many health benefits.[1-26]

Intestinal Adherence

The ability to adhere to the intestinal mucosa is a critical selection criterion because adhesion is considered to be a prerequisite for colonisation.[27] Many lactobacilli products do not appear to live up to claims regarding human GI adherence.[7] In fact, NCFM® is only one of a limited number of strains that have actually been shown in vitro to adhere.[18-21]

Acid and Bile Tolerance

Bile tolerance is considered to be an important characteristic of *L.acidophilus* that enables it to survive, grow, and exert its

action in the lower small intestine and colon.[16,22,27] Although the degree of bile tolerance required for maximum growth is not known, it is important to select one having a high degree of bile resistance. Studies have shown that the NCFM® strain is capable of growing in bile concentrations of up to 3%[8,16,17,22,23] and an in vivo study demonstrated that the NCFM® strain survives human gastric juice.

Antimicrobial Activity
L. acidophilus has strong antibacterial and antimicrobial properties and can act as a potent inhibitor of *Candida albicans*.[33] In a crossover trial involving 33 patients, *Candida* colonisation significantly decreased when patients began consuming yoghurt containing *L. acidophilus*.[34]

The ability to competitively exclude or inhibit pathogenic intestinal bacteria through antimicrobial action is a major benefit attributed to *L.acidophilus*, and is an important consideration when selecting strains.[24] The NCFM® strain has demonstrated antagonistic activity against food-borne disease agents, *Staphylococcus aureus*, *Salmonella typhimurium*, enetropathogenic *E.coli*, and *Clostridium perfringens*, among others.[6,7,9]

Additionally, *L. acidophilus* was tested for efficiency in digesting lactose, and because of its microbial activity and ability to break beta-galactose bonds, it was found to "dramatically improve digestion".[35]

Anti-carcinogenicity
Bacterial metabolism of various dietary constituents results in the production of many compounds, some of which may be carcinogenic. Altering the composition of the intestinal flora with probiotics may have a major effect on the production rate of these compounds.[1,5,11,25]

Small Bowel Bacterial Overgrowth
Significant reductions in serum DMA levels have been demonstrated in several controlled studies, as well as a reduction in a potent carcinogen.[2,14]

Immune Function
Approximately 70% of the immune system is localised in the GI tract and the intestinal mucosa provides a protective host defence against the constant presence of antigens from food and microrganisms. In addition to supporting the intestine's permeability barrier, probiotics have been shown to enhance immune responses, particularly immunoglobulin A, and thereby promote the intestine's immunologic barrier. For instance, *B.animalis*, *L.acidophilus* NCFM®, and 2 other lactobacilli species were shown to protect immuno-deficient mice colonised with *Candida albicans* from the mucosal and systemic candidiasis and prolong survival.[3]

Probiotics may down-regulate hypersensitivity reactions and hold promise in the prevention and treatment of conditions associated with gut barrier dysfunction and sustained inflammatory responses, such as IBD.[28]

Assimilation of cholesterol
Among 13 isolates of *L.acidophilus*, the NCFM® strain ranked first in cholesterol assimilation over 16 hours of growth. Furthermore, NCFM® exhibited cholesterol uptake in the presence of bile and in the absence of oxygen, conditions that exist in the intestinal tract.[29]

The Health Benefits of *Bifidobacteria*

Bifidobacterium is a major group of carbohydrate-metabolising bacteria in the intestines, established by numerous research studies conducted over the past two decades. Species of bifidobacteria, such as *B.lactis*:

- Comprise 95% of the total gut microflora of newborns and 25% in healthy adults
- Are an excellent compliment to *L.acidophilus* due to the way they work together to improve overall intestinal health.
- Are of human origin and have proven effectiveness as immunosupportive agents that enhance host resistance.[30, 31]
- Produce strong acids (e.g., acetic, lactic) that positively affect intestinal pH thereby playing a critical role in modulating ammonia, phenol, steroidal, and other toxin levels to maintain health and support intestinal microbial balance.[32]
- May be the best marker of human intestinal flora stability.
- *B. bifidum* has also been shown to prevent colonisation of the gut by pathogenic *Enterobacter*.[36]

What is the benefit of taking *Bifido* with *Lactobacilli*?

Lactobacilli and *bifidobacteria* constitute the two most important probiotic groups under consideration for probiotic therapy due to their recognition as members of the indigenous human flora, their history of safe use, and the body of evidence that supports their roles.[3,30,32,42-44] *Lactobacilli* and *bifidobacteria* produce and restrict different compounds and support the host in different ways. They also work synergistically to support the immune function. For instance, a recent animal study showed that the combined intake of *L.acidophilus* and *bifidobacterium* enhanced mucosal and systemic immunoglobulin A (IgA) responses.[43] Thus, supplementation with both organisms may offer enhanced support overall and better reflects the natural bacterial composition of the gut.

Prebiotics

The term "prebiotics" refers to food ingredients that are not digested or absorbed by humans, but instead travel to the intestines where they selectively stimulate the growth of

friendly bacteria by serving as an energy source. Fructooligosaccharides (FOS) are a prebiotic that promote the growth of bifidobacteria and some lactobacilli, including the NCFM® strain.

Complementary proteins

Secretory IgA is the predominant immunoglobulin antibody the body manufactures and releases in external secretions, such as saliva, tears, and milk. It is also transported through the epithelial cells lining the intestine out to the lumen, where it plays a major role in defence on the surface of the intestines. The benefit of IgA and other biocactive immune proteins can be experienced when given orally, such as in mothers milk.[38] Through the modern science of immunology, these proteins can now be derived from the milk of hyper-immunised cows. These whey-derived globulin proteins support intestinal immunity, thereby protecting the intestinal tract.[39]

Using Probiotics

Probiotic formulations supply extra intestinal microorganisms to re-establish microflora balance. They are useful for people whose bacterial balance has been disrupted in order to bring gut dysbiosis back into balance.

L.acidophilus NCFM®
✓ Is the most extensively researched *L.acidophilus*, backed by over 60 scientific publications.
✓ Has been proven to be safe and effective in animal and human testing and by over 25 years of commercial use.
✓ Has been proven to adhere to cells of the intestinal tract. (Only a limited number of lactobacilli have been shown to adhere).
✓ Has research to verify its ability to inhibit unhealthy bacteria through antimicrobial action.
✓ Promotes urinary and genital health as well as intestinal health.
✓ Survives gastric transit
✓ Helps control intestinal pathogens and bacterial overgrowth
✓ Supports intestinal health maintenance
✓ Promotes balance of the gut immune system
✓ Enhances natural immune defences
✓ Improves lactose digestion
✓ Reduces harmful intestinal enzyme levels
✓ Reduces the harmful effect of small bowel bacterial overgrowth
✓ Decreases blood levels of toxic amines generated from bacterial overgrowth of the small bowel
Bifidobacteria
✓ Are one of the most abundant and important bacteria in humans as established by numerous research studies conducted over the past two decades.
✓ Comprise 95% of the total bacterial population in the gut of newborns and 25% in healthy adults, owing to their importance in intestinal health.
✓ Are an excellent complement to *L.acidophilus* due to the way they work together to improve overall intestinal health. They live "symbiotically" in the large intestines, meaning in a mutual give-and-take relationship.
✓ Well suited for intestinal survival
✓ Promotes a balanced immune system
✓ Creates an unfavourable environment for pathogens
✓ Maintain natural immune defences
✓ Helps reduce gastrointestinal disturbances

What Makes a Good Probiotic?

Probiotics are of no use to the GI tract if they do not survive the digestive process. To do this, the bacteria must be able to tolerate bile, gastric juices and acids. They need to be **VIABLE, i.e. alive and active when you consume them, and able to exist or grow in particular conditions**.

The viability of your probiotic should not be taken for granted. In one study, researchers analysed 11 different probiotic preparations claiming to contain *L. acidophilus*. Not only did 9 of the products not even contain *L. acidophilus* but some were also contaminated with strains of *Enterococcus* and *Clostridium.*[40,41]

It is vital that a probiotic meets the criteria for survival, establishment and viability in the intestinal tract. When choosing your probiotic you should ask yourself the following questions:

- Are the bacteria resistant to stomach acid?
- Are the bacteria stable in bile acid?
- Are they able to adhere to the intestinal mucosa (enabling them to establish and flourish)?
- Have they been isolated from human flora?
- Has their viability been maintained throughout processing, packaging and storage?
- Are they safe for human use?

Naturally, Nutri can guarantee that all their probiotics meet these strict criteria, and more. How much do you know about the probiotics you are currently using?

REFERENCES

[1] Rao CV, Sanders ME, Indranie C, et al. Prevention of colonic preneoplastic lesions by the probiotic *Lactobacillus acidophilus* NCFM® in F344 rats. *Int J Oncol* 1999; 14(5): 939-44.

[2] Dunn SR, Simonhoff ML, Ahmed KE, et al. Effect of oral administration of freeze-dried *Lactobacillus acidophilus* on small bowel bacterial overgrowth in patients with end stage kidney disease: reducing uremic toxins and improving nutrition. *Int Dairy J* 1998; 8:545-53.

[3] Wagner RD, Pierson C, Warner T, et al. Biotherapeutic effects of probiotic bacteria on candidiasis in immunodeficient mice. *Infect Immun* 1997; 65(10): 4165-72.

[4] Reid G. In vitro testing of *Lactobacillus acidophilus* NCFM as a possible probiotic for urogenital tract. *Int Dairy J* 2000; 10:415-19.

[5] Goldin BR, Swenson L, Dwyer J, et al. Effect of diet and *Lactobacillus acidophilus* supplements on human faecal bacterial enzymes. *J Natl Cancer Instit* 1980; 64:255-61.
[6] Gilliland SE, Speck ML. Antagonistic action of *Lactobacillus acidophilus* toward intestinal and food borne pathogens in associative cultures. *J Food Protection* 1977; 40(12):820-23.
[7] Schauss AG. *Lactobacillus acidophilus*: method of action, clinical application, and toxicity data. *J Adv Med* 1990; 3(3):163-78.
[8] Lin MY, Savaiano D, Harlander S. Influence of nonfermented dairy products containing bacterial starter cultures on lactose maldigestion in humans. *J Dairy Sci* 1991; 74:87-95.
[9] Barefoot SF, Klaenhammer TR. Detection and activity of lactacin B, a bacteriocin produced by *Lactobacillus acidophilus*. *Appl Environ Microbiol* 1983; 45:1808-15.
[10] Barefoot SF, Chen YR, Hughes TA, et al. Identification and purification of a protein that induces production of the *Lactobacillus acidophilus* bacteriocin lactacin B. *Appl Environ Microbiol* 1994; 60:3522-28.
[11] Goldin BR, Gorbach SL. The effect of milk and *Lactobacillus* feeding on human intestinal bacterial enzyme activity. *Amer J Clin Nutr* 1984; 39:756-61.
[12] Goldin BR, Gorbach SL. Alterations of the intestinal microflora by diet, oral antibiotics, and *Lactobacillus*: decreased production of free amines from aromatic nitro compounds, azo dyes, and glucuronides. *J Natl Cancer Instit* 1984; 73:689-95.
[13] Goldin BR, Gorbach SL. Effect of *Lactobacillus acidophilus* dietary supplements on 1,2-dimethylhydrazine dihydrochloride-induced intestinal cancer in rats. *J Natl Cancer Instit* 1980; 64:263-65.
[14] Simonhoff ML, Dunn SR, Zollner GP, et al. Biomodulation of the toxic and nutritional effects of small bowel bacterial overgrowth in end-stage kidney disease using freeze-dried *Lactobacillus acidophilus*. *Miner Electrolyte Metab* 1996; 22:92-96.
[15] Kim GS, Gilliland SE. *Lactobacillus acidophilus* as a dietary adjunct for milk to aid lactose digestion in humans. *J Dairy Sci* 1983; 66:959-66.
[16] Walker DK, Gilliland SE. Relationships among bile tolerance, bile salt deconjugation, and assimilation of cholesterol by *Lactobacillus acidophilus*. *J Dairy Sci* 1993; 76:956-61.
[17] Gilliland SE, Walker DK. Factors to consider when selecting a culture of *Lactobacillus acidophilus* as a dietary adjunct to produce a hypocholesterolemic effect in humans. *J Dairy Sci* 1990; 73:905-11.
[18] Kleeman EG, Klaenhammer TR. Adherence of *Lactobacillus* species to human foetal intestinal cells. *J Dairy Sci* 1982; 65:2063-69.
[19] Conway PL, Gorbach SL, Goldin BR. Survival of lactic acid bacteria in the human stomach and adhesion to intestinal cells. *J Dairy Sci* 1987; 70:1-12.
[20] Greene JD, Klaenhammer TR. Factors involved in adherence of lactobacilli to human caco-2 cells. *Appl Environ Microbiol* 1994; 60:4487-94.
[21] Gilliland SW, Speck ML, Nauyok DF, et al. Influence of consuming nonfermented milk containing *Lactobacillus acidophilus* on faecal flora of healthy males. *J Dairy Sci* 1978; 61:1-10.
[22] Sanders ME, Walker DC, Walker KM, et al. Performance of commercial cultures in fluid milk applications. *J Dairy Sci* 1996; 79:943-55.
[23] Klaenhammer TR, Kleenman EG. Growth characteristics, bile sensitivity, and freeze damage in colonial variants of *Lactobacillus acidophilus*. *Appl Environ Microbiol* 1981; 41:1461-67.
[24] Klaenhammer TR. Microbiological considerations in selection and preparation of *Lactobacillus* strains for use as dietary adjuncts. *J Dairy Sci* 1982; 65:1339-49.
[25] Goldin B, Gorbach SL. Alterations in faecal microflora enzymes related to diet, age, *Lactobacillus* supplements, and dimethylhydrazine. *Cancer* 1977; 40:2421-26.
[26] Kaplan H, Hutkins RW. Fermentation of fructooligosaccharides by lactic acid bacteria and *bifidobacteria*. *Appl Environ Microbiol* 2000; 66(6):2682-84.
[27] Tuomola E, Crittenden R, Playne M, et al. Quality assurance criteria for probiotic bacteria. *Am J Clin Nutr* 2001; 73(suppl):393S-98S.
[28] Isolauri E, Sutas Y, Kankaanpaa, et al. Probiotics: effects on immunity. *Am J Clin Nutr* 2001; 73(suppl):444S-50S.
[29] Gilliland SE, Nelson CR, Maxwell C. Assimilation of cholesterol by *Lactobacillus acidophilus*. *Appl Environ Microbiol* 1985; 49:377-81.
[30] Gill HS, Rutherford KJ, Cross ML, et al. Enhancement of immunity in the elderly by dietary supplementation with the probiotic *Bifidobacterium lactis* HN019. *Am J Clin Nutr* 2001; 74(6):833-39.
[31] Wagner RD, Pierson C, Warner T, et al. Biotherapeutic effects of probiotic bacteria on candiasis in immunodeficient mice. *Infect Immun* 1997; 65(10):4165-72.
[32] Modler HW, McKellar RC, Yaghuchi M. *Bifidobacteria* and bifidogenic factors. *Can Inst Food Sci Technol J* 1990; 23(1):29-41.
[33] Jack M, et al. Evidence for the involvement of thiacyanate in the inhibition of *Candida albcians* by *Lactobacillus acidophilus*. *Microbios* 1990; 62(250):37-46.
[34] Hilton E, Isenberg HD, Alperstein P, France K, Borenstein MT. Ingestion of yogurt containing *Lactobacillus acidophilus* as prophylaxis for candidal vaginitis. *Ann Intern Med* 1992; 116(5):353-7.
[35] Martini, M. Strains and species of lactic acid bacteria in fermented milks (yogurt): effect on *in vivo* lactose digestion. *Am J Clin Nutr* 1991; 54: 1041-6.
[36] Ducluzeau R. Development, equilibrium and role of microbial flora in the newborn. *Ann Pediatr Paris* 1993; 40(1):13-22.
[37] Livesey G, Wilkinson JA, Roe M, Faulks R, Clark S, Brown JC, Kennedy H, Elia M. Influence of the physical form of barley grain on the digestion of its starch in the human small intestine and implications for health *Am J Clin Nutr* 1995; 61:75-81.
[38] Hanson LA, Winberg J. Breast milk and defence against infection in the newborn. *Arch Dis Childh* 1972; 47:845-48.
[39] Brussow H, Hilpert H, Walther I, et al. Bovine milk immunoglobulins for passive immunity to infantile rotavirus gastroenteritis. *J Clin Micro* 1987; 25(6):982-86.
[40] Hughes VL, Hillier SL. Microbiologic characteristics of *Lactobacillus* products used for the colonisation of the vagina. *Ostet Gynecol* 1990; 75:244-48.
[41] Percival M. Choosing a probiotic supplement. 1997; 6(1): *Clinical Nutrition Insights*.
[42] Klaenhammer TR, Kullen MJ. Selection and design of probiotics. *Int J Food Microbiol* 1999; 50(1-2):45-57.
[43] Tejada-Simon MV, Lee JH, Ustonal Z, et al. Ingestion of yoghurt containing *Lactobacillus acidophilus* and *Bifidobacterium* to potentiate immunoglobulin A responses to cholera toxin in mice. *J Dairy Sci* 1999;82(4):649-60.
[44] Mutai M, Tanaka R. Ecology of *Bifidobacterium* in the human intestinal flora. *Bifidobacteria Microflora* 1987; 6(2):33-41.

BIBLIOGRAPY

Rowntree R. Proven Therapeutic Benefits of High Quality Probiotics. 2002. *Applied Nutritional Science Reports*.