Making a Niche as Promising Health Supplements and Complementary Medicines
Charanjit Kaur1, Amit Sharma1, Ashish K Garg2, Junaid Niazi3, Rajesh Kumar*1

Abstract
Hippocrates once quoted, “Let food be thy medicine and medicine be thy food,” this ancient statement has certainly become a belief in today’s scenario. The live microbial food supplements, called as Probiotics (known to have beneficial effects on human health in various ways) are widely used now a days. Owing to their potential as alternative or complementary therapeutic agent in combating large number of pathological conditions and ability to enhance immune response, an overwhelming interest have developed for probiotics in medical field. Probiotics, being widely used around the globe by consumers and in clinical practice, a thorough understanding of the risks and benefits related to their use are of vital importance. This review addresses the concept of probiotics, historical development, their sources and probable mechanisms of action, clinical applications along with associated risks and contraindications related to the use of probiotics.

Keywords: Health, GIT, microflora, infants, immunity.

Introduction
The human gastrointestinal tract has long been considered for their main functions of digestion and absorption of nutrients and excretion of their waste products. However, GIT also fulfills many other functions which are essential to our sound health. GI mucosa poses a barrier, excluding and eliminating various antigens entering the GIT from external environment. [1,2]
The human GIT has got a vast number of microbes and harbors, many of which live in symbiotic relationship with host. This mutual beneficial relationship is termed as host-microbes cross-talk. [3,4]. However few of these bacteria also contribute to the development of various diseases by a variety of mechanisms [5,6]. Disturbance in the existing balance between host and friendly microbes can lead to various GI complications by stimulating the host immune system. A few of methods by which intestinal microflora can be altered are: administration of antibiotics, dietary supplements which enhance physiological functions and thus growth of health friendly bacteria (prebiotics, which act an alternative for probiotics or their cofactors e.g. lactulose, galactooligosaccharides, inulin and its hydrolysates etc.) and probiotics. [7]

History
Microbial cultures have been a niche in food and alcoholic fermentations and for the past few decades have undergone great scientific scrutiny for their ability to cure a variety of diseases. A Nobel laureate Russian biologist, also known as father of modern immunology, Dr. Ellie Metchnikoff in the year 1908 postulated the prolongation of life with the consumption of large quantities of cultured food especially yoghurt on the basis of growth of lactic acid bacteria which could lead to displacement of the disease causing microbes in the intestine [8]. In 1915, cultured food therapy was also found to be beneficial in urogenital infections [9-11]. However, this therapy was ignored over 7-8 decades due to growing interest in antibiotics. In 1965, Lilly and Stillwell coined the term “probiotic” for the substances secreted by one organism which stimulate the growth of another. The term probiotics was derived from Greek word meaning “for life”. Marteul et al. in 2002, redefined them as “microbial preparations or components of microbial cells that have a beneficial effect on health and well being” [12-13]. WHO defines probiotics as “live microorganisms” which when administered in adequate amounts confer a health benefit on the host [14-15]. A breakthrough came in the field of probiotics with the evolution of friendly bacteria such as lactobacilli, bifidobacteria in various dosage forms like powders, tablets, liquid suspensions and lyophilized powder filled capsules [16].

Source of Probiotics
Approximately 500 different microbial species have been reported in the GIT amongst which 20 genera predominate, a few of which are namely Bacteroides, Lactobacillus, Clostridium, Fusobacterium, Bifidobacterium, Eubacterium, Peptococcus, Peptostreptococcus, Escherichia, and Veillonella. Out of these, bifidobacteria and lactobacilli were reported to have beneficial properties [17-19]. In the neonates, the microbiota starts developing immediately after the birth and is dependant mainly on the maternal microbiota, mode of delivery, birth environment and
sometimes on genetic factors [20-21]. The vaginal and intestinal flora of mother constitutes the source of bacteria by colonizing the intestine of newborn dominating strains being facultative anaerobes such as enterobacteria, lactobacilli and coliforms. Once the child starts taking stuff other than mother's milk, the composition of intestinal microflora gradually start altering to resemble to that of adult's microflora [1].

Criteria for being Probiotic

For an organism to be considered as probiotic, it should possess the following properties:
- It should be host friendly
- It should not have pathogenic and toxic potential
- It should be able to survive through the entire length of GIT
- It must retain its viability for long periods during storage
- The source species should be same as that of intended host
- It must have capacity to influence local metabolic activity
- It must be able to persist in the intestine even in the absence of gut colonization by probiotic strain [1,3,13]

Table 1. List of Microorganisms used as probiotics [3,7,13]

<table>
<thead>
<tr>
<th>Lactobacillus species</th>
<th>Bifidobacterium species</th>
<th>Streptococcus species</th>
<th>Saccharomyces species</th>
<th>Others</th>
</tr>
</thead>
</table>

Clinically beneficial effects of Probiotics
Table 2. The clinically beneficial effects of probiotics are listed below.

<table>
<thead>
<tr>
<th>Intestinal effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Promotes recovery from diarrhea induced by rotavirus and antibiotics</td>
</tr>
<tr>
<td>• Produces lactase and thus alleviates symptoms of lactose intolerance and mal absorption</td>
</tr>
<tr>
<td>• Helps in relieving constipation</td>
</tr>
<tr>
<td>• Beneficial in the treatment of colitis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Immune system effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Probiotics enhance immune response (both specific and non-specific)</td>
</tr>
<tr>
<td>• They reduce the chances of infection from pathogenic microorganisms like Salmonella and Shigella</td>
</tr>
<tr>
<td>• They are helpful in inhibiting pathogenic growth and translocation</td>
</tr>
<tr>
<td>• Probiotics also stimulate gastrointestinal immunity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Detoxification of carcinogens and thus reduced risks of colon and bladder cancer</td>
</tr>
<tr>
<td>• Suppression of tumors</td>
</tr>
<tr>
<td>• Lowering of serum cholesterol level</td>
</tr>
<tr>
<td>• Treatment of food allergies</td>
</tr>
<tr>
<td>• Enhances nutrient bioavailability</td>
</tr>
<tr>
<td>• Improves urogenital health</td>
</tr>
<tr>
<td>• Reduces blood pressure</td>
</tr>
<tr>
<td>• Synthesis of nutrients like vitamin B₂, B₃, B₆, B₉ and B₁₂</td>
</tr>
</tbody>
</table>

**Mechanism of action**

Probiotics act in several ways to protect the host organism.

**Competitive inhibition:**
Probiotics competitively inhibit the binding of pathogens to the enteric epithelial surface. A good example of this mechanism is inhibition of adhesion and invasion of (enteroinvasion) *E.coli* by streptococcus *thermophilus* and *lactobacillus acidophilus* in human intestinal cell lines [23].

**Competitive consumption of nutrients:**
Probiotics prevents the growth of pathogens by competitively consuming the nutrients and thus not allowing the pathogens to...
grow. Probiotics, by consuming the monosaccharides, prevent the growth and development of *Clostridium difficile* [24].

**Working through reduction of luminal pH**

Several investigations have shown that probiotics like lactobacillus exert antagonistic action against intestinal pathogens and related organisms. Organic acid such as acetic acid and lactic acid are the byproducts of bacterial metabolism. These acids inhibit the growth of many pathogens including pathogenic gram negative types [25] and lower pH value also potential the activity of these acids because undissociated forms are more bacterial than the dissociated ones [26].

**Through stimulation of immune response to pathogens**

Probiotics are shown to promote the endogenous host defense mechanism which is characterized by stabilization of the gut microflora [27].

a) Probiotic bacteria have been shown to enhance humoral immune responses and thereby promote the intestine's immunological barrier [28,29].

b) Probiotic bacteria have been shown to stimulate non-specific host resistance (proinflammatory cytokines TNF and IL6) to microbial pathogens and thereby facilitate the exclusion of pathogens in the gut [30,31].

c) Probiotics modulate the host's immune responses to potentially harmful antigens with potential to down regulate hypersensitivity reactions [32,33].

d) Probiotics exhibit protective mechanism by association with gut intestinal colonization suppression of pathogens growth and/or invasion

e) Probiotics enhance and modulate innate and adaptive immune responses in the host.

f) Probiotics modulate the immune activity and epithelial function in both large as well as small intestine [34].

g) Oral intake of probiotics such as *Lactobacillus casei* and *Lactobacillus bulgaricus* activate the production of macrophages and administration of *L. casei* and *L. acidophilus* activates phagocytosis [35].

h) Specific strains of probiotics such as *Bifidobacterium* and *Lactobacillus* give promising results in the treatment and/or prevention of eczema in infants and children by alteration of colonization [34].

**Integrity of GI mucosa**

Probiotics (*Streptococcos faecalis* and *Clostridium butyricum*), by the synthesis of glutamine in presence of ammonia and glutamic acid, maintain integrity of GI mucosa. Therefore, it is postulated that the probiotics administered to humans can have positive effect in cases such as diarrhea, constipation, colitis, and recolonization by pathogens, immunostimulation [36].

**By producing inhibitory substances**

Probiotic bacteria produce a variety of inhibitory substances include organic acids, hydrogen peroxide and bacteriocins which are inhibitory to both gram positive and gram negative bacteria. It may reduce not only the number of viable cells but may also affect bacterial metabolism or toxin production [37].

Degradation of toxin receptor

By the degradation of the toxin receptor on the intestinal mucosa, probiotics (e.g. *Saccharomyces boulardii*) protects the intestine from disease causing microbes (e.g *C. difficile*) [25,38].

**Clinical Applications**

**Role of probiotics on faecal water-induced DNA damage in human colon adenocarcinoma cells**

Probiotics may have protective effects against the early stages of colon cancer, although there are many studies in laboratory animals indicating that administration of probiotics and/or prebiotics reduces the incidence of tumours and precancerous lesions in the colon [39-44], but there was no evidence clinically. A recent study on human volunteers has suggested that in comparison to conventional yoghurt, the strains of *Lactobacillus acidophilus* and *Bif. longum* has demonstrated a reduction in faecal water genotoxicity [45]. Thus, *Lact. plantarum* and *Bif. Bb12* have intrinsic antigenotoxic potential and probiotics certainly are worthy of further evaluation in *in vivo* assays for anti carcinogenic effects.

**Probiotics in infants**

One of the fatal intestinal disorder; necrotizing enterocolitis, which is known to occur in 10-25% of premature infants and very low birth weight babies and has a high mortality of 20-30% [1]. Bacterial colonization or intestinal infection aggravates the risks of necrotizing enterocolitis. Modification of the intestinal flora by increasing the predominance of specific nonpathogenic bacteria would seem a reasonable means of attaining a prophylactic or therapeutic effect against enteropathogens. A combination of increased bifidobacterial counts and decreased concentrations of other enterobacteria and luminal host factors may play a role in protecting premature babies and newborns from enterocolitis. Trials showing reduction of necrotizing enterocolitis in population of premature newborns given supplements of Lactobacillus GG daily compared with historical control subjects have been reported. These findings suggested a correlation between the reduction of lactobacilli and the increased risk of necrotizing enterocolitis [46,47].

Wang Y et al. conducted a double blind randomized controlled trial on 100 full term infants with critical illness according to scores of neonatal acute physiology. Out of them, 50 infants received Probiotics three times a day after birth for 8 days and remaining 50 were kept on placebo. The incidence of sepsis, multiple organ dysfunction syndrome (MODS), nosocomial pneumonia and necrotizing enterocolitis were recorded. Prognosis of probiotic treatment was determined on the basis of rate of recovery and hospitalization days. Serum IgA, IgG and IgM concentrations were measured on days 4 and 8. Infants receiving Probiotics showed significantly reduced rate of nosocomial pneumonia and MODS (due to increase in the level of IgA) compared with the placebo group of infants [48].
Role of Probiotics on Cold and Influenza-Like Symptoms, Incidence and Duration in Children

Daily dietary supplementation of probiotics during the winter months was a safe effective way to reduce episodes of fever, rhinorrea, and cough, the cumulative duration of those symptoms, the incidence of antibiotic prescriptions. L. acidophilus alone was effective. There was a broader protective effect with the combination of L. acidophilus and B. lactis Bi-07 [15].

Probiotics in pregnancy

Probiotics have been shown to decrease the risks of bacterial vaginosis (which has been suggested as a factor that increases the risk of preterm labour and infant mortality) and maintain normal lactobacilli vaginal flora [49,50]. These strains were found to be safe in pregnant animal studies and improving the health of mothers and newborns [51]. Prevention of allergic reactions by probiotics taken during pregnancy is another area of interest. Ingestion of probiotics like L. rhamnosus GG and B. lactis BB12 during pregnancy and in newborns during first 6 months of birth was found to prevent atopic dermatitis (a condition that causes severe skin rashes in up to 15% of babies) in 50% cases [52].

Role of Probiotics in Lowering of serum cholesterol level in hypercholesterolemia

Lactobacillus acidophilus is the natural inhabitant of intestine and possesses bile-salt hydrolase activity and possibly can be used for the manufacture of acidophilus milk and thus recommended as a source for reducing cholesterol level. Anderson and Gilliland et al. (1985) in their study reported that Lactobacillus acidophilus reduces the blood cholesterol by direct breakdown of cholesterol and deconjugation of bile salt. In the year 1999, they also examined effects of consumption of one daily serving of yoghurt on serum lipids in two controlled clinical studies and in those studies it was concluded that regular intake of fermented milks containing an appropriate strain of L. acidophilus has the potential of reducing risk for coronary heart disease by 6 to 10%. L. acidophilus showed highest deconjugation ability and BSH activity towards bile mixtures that resembled the human bile in a study done by Liong and Shah in which they screened eleven strains of lactobacilli and analyzed bile salt deconjugation ability, bile salt hydrolase activity (BSH) and co-precipitation of cholesterol with deconjugated bile. Lactobacillus acidophilus strains had higher deconjugation ability than L. casei strains. Cholesterol co-precipitation with deconjugated bile increased with decreasing pH [53].

Lactobacillus bulgaricus is an acid-producing bacterium and in general, it occurs in dairy products and some plant products. A study conducted on fifty four volunteers in a randomised cross over trial; revealed reductions of between 5-10% in serum cholesterol levels after several weeks of moderate consumption of yoghurt fermented with Lactobacillus bulgaricus and S. thermophilus [54].

Use of Bacillus coagulans (Probiotics) as an attractive alternative to drug therapy in case of hypercholesterolemia

Bacillus coagulans, formerly known as Lactobacillus Sporogenes, is a shelf stable, nonpathogenic Gram positive spore-forming bacteria that produces L(+)-lactic acid (dextrorotatory) in homofermentation conditions. In particular, B. coagulans strains were used to reduce serum cholesterol in certain formulations (Mohan, 1990). Seok, (1987) concluded that L. sporogenes lowers LDL cholesterol by eliminating it directly from inside the intestines before it can be absorbed into the blood stream. In another clinical study, L. sporogenes not only lowered total serum cholesterol and LDL cholesterol in humans, it also improved the ratio of “good” HDL cholesterol to total cholesterol. US patent was given to a therapeutic composition including Bacillus coagulans, in combination with bifidogenic oligosaccharides or other cholesterol-reducing agents for use in reducing LDL cholesterol and serum triglycerides (US patent 7232571). This unique microorganism proved effective in lowering cholesterol by 104 points in a three-month study performed at the G.B. Pant hospital in New Delhi, India. There was a highly significant reduction in the LDL cholesterol levels, and a small but significant increase in HDL cholesterol levels [55].

Other products without prescription. Lack of awareness about the risk factors associated with probiotics needs regulation. Generally probiotics are safe however some rarely observed side effects associated with probiotics vary from strain to strain individually such as bacteremia or sepsis from lactobacilli [28], fungemia with saccharomyces in immune compromised patients or ICU patients [60,61]. Some cases of liver abscess [62], Lactobacilllemia [63,64] and S. boulardii fungemia [65,66] have been reported in such patients. On the other hand, S. boulardii has been used without complications to treat chronic diarrhea in AIDS patients [67,68].

Another reason of concern is the risk of transfer of resistance via probiotic agents as these agents have to be resistant to the antibiotics because they are to be used alongside. In fact, a study has demonstrated transfer of plasmid pM6b1, from L. reutri to E. faecium and from E. faecium to E. Faecalis in mouse intestinal tract [69].

In long term study, in children for 1 year, consumption of 10^6-10^9 CFU of Lactobacilli and Bifidobacteria daily did not only result in any adverse effect but also showed that Probiotics taken over a long time improve gastrointestinal function and reduce the incidence of diaper rash [70].

Many lactobacillus strains are resistant to vancomycin naturally; however, it has been revealed in conjugation studies that these resistant genes are non-transferrable [54].
Table 2. Probiotics associated fungal sepsis cases in human beings

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Age</th>
<th>Risk factors</th>
<th>Probiotic</th>
<th>Form of Sepsis</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30 months</td>
<td>Cystic fibrosis, Central venous catheter, poor nutritional state, intestinal surgery</td>
<td>Saccharomyces boulardii 750 mg/dl</td>
<td>Fungemia</td>
<td>Hermemquin et al.</td>
</tr>
<tr>
<td>2</td>
<td>56 y</td>
<td>HIV infection, CVC, diarrhea</td>
<td>Saccharomyces boulardii 1.6 g/d</td>
<td>Fungemia</td>
<td>Cassone et al.</td>
</tr>
<tr>
<td>3</td>
<td>47 y</td>
<td>Antibiotic associated diarrhea, Upper GI surgery for malignancy</td>
<td>Saccharomyces boulardii 2 g/d</td>
<td>Septic shock</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>78 y</td>
<td>Peptic ulcer, chronic renal failure, pneumonia, COPD</td>
<td>Saccharomyces boulardii 1.5 g/d</td>
<td>Fungemia</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>54 y</td>
<td>CVC, ICU</td>
<td>No direct treatment</td>
<td>Fungemia</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>48 y</td>
<td>CVC, ICU</td>
<td>No direct treatment</td>
<td>Fungemia</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>75 y</td>
<td>CVC, ICU</td>
<td>No direct treatment</td>
<td>Fungemia</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>55-62 y</td>
<td>Acute urinary infection ICU with respiratory failure, CVC</td>
<td>Saccharomyces boulardii 1.5-3 g/d</td>
<td>Fungemia</td>
<td>Lherm et al.</td>
</tr>
<tr>
<td>9</td>
<td>51 y</td>
<td>Immunosuppression, Clostridium difficile associated diarrhea, CVC</td>
<td>Saccharomyces boulardii 1 g/d</td>
<td>Fungemia</td>
<td>Rastelli et al.</td>
</tr>
<tr>
<td>10</td>
<td>42 y</td>
<td>Kidney and pancreas transplant, Immunosuppression, C. difficile associated diarrhea</td>
<td>Saccharomyces boulardii 1 g/d</td>
<td>Fungemia</td>
<td>Riquem et al.</td>
</tr>
<tr>
<td>11</td>
<td>42 y</td>
<td>HIV, diarrhea</td>
<td>Saccharomyces boulardii 750 mg/dl</td>
<td>Fungemia</td>
<td>Perngoch et al.</td>
</tr>
<tr>
<td>12</td>
<td>40 months</td>
<td>CVC, diarrhea, parenteral nutrition</td>
<td>Saccharomyces boulardii 200 mg/dl</td>
<td>Fungemia</td>
<td>Fedemucci et al.</td>
</tr>
<tr>
<td>13</td>
<td>8 months</td>
<td>Acute myeloid leukemia, CVC, neutropenia</td>
<td>Saccharomyces boulardii</td>
<td>Fungemia</td>
<td>Cesario et al.</td>
</tr>
<tr>
<td>14</td>
<td>89 y</td>
<td>C. difficile associated colitis, gastomy</td>
<td>Saccharomyces boulardii 300 mg/d</td>
<td>Fungemia</td>
<td>Cheni et al.</td>
</tr>
<tr>
<td>15</td>
<td>88 y</td>
<td>Malignancy, immune compromise, mucositis, diarrhea, parenteral nutrition</td>
<td>Saccharomyces boulardii</td>
<td>Fungemia</td>
<td>Henry et al.</td>
</tr>
<tr>
<td>16</td>
<td>78 y</td>
<td>Antibiotic associated diarrhea, ICU</td>
<td>Saccharomyces boulardii 1.5 g/d</td>
<td>Fungemia</td>
<td>Nault et al.</td>
</tr>
</tbody>
</table>

Note: CVC- central venous catheterCOPD- chronic obstructive pulmonary disease GI- gastrointestinal 250 mg S.boulardii = 5.425 X 10^13 live cells
Table 3. Probiotics associated risks and contraindications

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Major risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Immune compromisation resulting in debilitated state or malignancy</td>
</tr>
<tr>
<td>2.</td>
<td>Premature infants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minor risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Central venous catheter</td>
</tr>
<tr>
<td>2. Diarrhea and intestinal inflammation due to impairment of intestinal epithelial barrier</td>
</tr>
<tr>
<td>3. Administration of probiotics by jejunostomy</td>
</tr>
<tr>
<td>4. Co-administration of probiotic resistant antibiotics</td>
</tr>
<tr>
<td>5. Probiotics with known pathogenic potential</td>
</tr>
</tbody>
</table>

Problems associated with the use of Probiotics

Viability of Probiotics

The maintenance of viability associated with use of probiotics is a major issue. The Probiotics need to survive in several environments including processing treatments, storage conditions and human body conditions especially gastric acidity and action of bile salts. The ability to survive through stressful acidic conditions and bile solutions in the body vary among the strains of probiotic bacteria.

Only those Strains which tolerate these adverse conditions better, should be preferred. The viability of Probiotics may also be improved by using a medium, nutrient and temperature, which supports their survival.

Viability of *Lactobacilli* has been enhanced by Encapsulation in artificial sesame oil for storage and in simulated high gastric or bile salt conditions as compared to free cells [71]. Storage at 4°C temperature is reported to be a most important factor in keeping probiotic *Bifidobacterium* viable during 4 weeks storage time [72].

The use of prebiotics like isomalt-oligosaccharides has been found to be associated with higher levels of Probiotics like *Lactobacillus* and *Bifidobacterium* after 1 month storage [73].

The issue of viability of Probiotics from the stage of processing till it is used by consumer to produce benefits still remains a fertile field for more research [74].

Commercially available Probiotics (single and multiple strains)

The optimal use of one or more strain cannot be precisely determined. While it seems intuitive that a combination of strains might be convenient to suite a range of indications and individual variation, this is dependent on the optimal probiotic bacterial numbers in different situations and assuming that the probiotic constituent of any cocktail are not mutually antagonistic which requires further study. Furthermore, the activities of individual components require definitions and optimization before firm recommendations can be made.

Single-strain- *Saccharomyces boulardii* (Laboratories Biocodex, Montrouge, France) is commonly given in doses of 2 capsules containing 250 mg morning and evening, equivalent to approximately 10 billion live organisms/d. The nonpathogenic *E coli* serotype O6:K5:H1 (Mutaflor, Ardeypharm GmbH, Herdecke, Germany) is referred to as Nissle 1917 is commonly given in doses of less than 10 billion LAB/d. *Lactobacillus* GG (LGG) (Valio, Helsinki, Finland) is commonly given in doses of 1 to 5 billion LAB/d. *L acidophilus* LA1 (LA1) (Nestle, Vevey, Switzerland) is commonly given in doses of less than 5 billion LAB/d (sometimes <1 billion LAB/d).

Multistrain- The probiotic cocktail VSL#3 (Sigma-Tau, Pomezia, Italy, and VSL Pharmaceuticals, Fort Lauderdale, Florida) is the only multistrain probiotic tried so far. It consists of four *Lactobacillus* strains (*L. acidophilus, L. casei, L. delbruecki* subsp *bulgaricus, and L. plantarum*), three *Bifidobacterium* strains (*B. longum, B. infantis, B. breve*), and *S. salivarius* ssp *thermophilus* (5.1011 cells/g). It is commonly given in high doses usually 1800 billion LAB and more recently up to 3600 billion LAB/d [1].

Conclusion

Probiotics are gaining popularity in consumers for their health benefits and are recommended by many health care professionals too. Prebiotic, probiotic and synbiotic treatment is still in its infancy but is rapidly moving into the mainstream. Several probiotic preparations seem to have promise in prevention or treatment of various conditions. Normalization of the properties of unbalanced indigenous microflora of the intestinal tract by ingestion of specific
strains of the healthy microflora forms the rationale of probiotics therapy. There exists quite a good number of evidences for the therapeutic use of probiotics in infectious diarrhea in children, recurrent Clostridium difficile induced infections and post-operative poulchitis. Evidence is also emerging for the use of probiotics in other gastrointestinal infections, irritable bowel syndrome and in ulcerative colitis and Crohn’s disease. However, most studies have been in small number of patients and many have important methodological limitations, making it difficult to make unequivocal conclusions regarding efficacy, especially when compared with proven therapies. Furthermore, considerable differences exist in composition, doses and biologic activity between various commercial preparations and one consistent feature is that not all probiotic bacteria have similar therapeutic effects. The enthusiasm for probiotics has perhaps outpaced scientific support for these therapeutic approaches. They are generally regarded as safe, but physicians should monitor their use in high-risk patients. However, when used appropriately, probiotics represent a potentially beneficial adjunct to other proven therapies and with more controlled and larger studies clear data may emerge in the future.

References


