Potential Clinical Applications of Probiotics

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Probiotics - the Science

Microbial ecosystem and mucosal immunity

✓ The intestine contains extensive microbiota \((10^{10}\) bacteria cells), located mainly in the colon

✓ The small intestine has a larger bacterial load that consists of facultative anaerobes such as \textit{Lactobacilli, Streptococci} and \textit{Enterobacteria} as well as anaerobes such as \textit{Bifidobacterium, Bacteroides} and \textit{Clostridium} at levels of \(10^4\)-\(10^8\) cells/gm of contents
✓ The intestine is the body’s most important immune function–related organ
✓ 60% of the body’s immune cells are present in the intestinal mucosa
✓ The immune system controls immune responses against:
  ➢ Dietary proteins
  ➢ Prevention of food allergies
  ➢ Pathogenic microorganisms
  ➢ Viruses (Rotavirus, Poliovirus)
  ➢ Bacteria (Salmonella, Listeria, Clostridium etc.)
  ➢ Parasites (Toxoplasma)
Probiotics - Health Concept

- Probiotics health effects exerted by live and viable microorganisms
- Probiotics application is independent of the site of action and route of administration
- Probiotics application include sites such as the oral cavity, the intestine, the vagina and the skin
- In case of probiotic foods, the health effect is usually based on alteration of the gastrointestinal micro flora and therefore based on survival during gastrointestinal transit
Beneficial Effects of Probiotics

✓ Promote lactose digestion
✓ Build resistance to enteric pathogens
✓ Digest food and compete for nutrients with pathogens
✓ Produce bacteriocins to inhibit pathogens
✓ Modulate immune system
✓ Decrease blood lipids and aid in heart diseases
✓ Enhance intestinal barrier function
✓ Stimulate epithelial mucin production
✓ Scavenge superoxide radicals
✓ Compete for adhesion with pathogens
✓ Modify pathogen-derived toxins
Probiotics - Mode of Action

- Modification of microbial population
- Modifications of the structure and function of intestinal epithelium
- Competition for nutrients
- Aggregation with pathogenic bacteria
- Competitive adhesion to epithelial receptors
- Production of specific substances (Organic acids, bacteriocins, dipicolinic acid)

Tiwari et al, 2012
Probiotics - Clinical Applications

- Diarrhea
- Colon cancer
- Cardiovascular diseases
- Prevention of *Helicobacter pylori* infection
- Allergy
- Hepatic encephalopathy
- Inflammatory bowel disease (IBD)
- Irritable bowel syndrome (IBS)
- Lactose malabsorption
- Urogenital infections
### Meet the Healthy Microbes

These microorganisms have been shown to boost health in published scientific studies.

<table>
<thead>
<tr>
<th>STRAIN</th>
<th>BENEFITS</th>
<th>PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bifidobacterium animalis</em> DN-173 010</td>
<td>Gut health and faster digestion</td>
<td>Dannon Activia yogurt</td>
</tr>
<tr>
<td>(Bifidis regularis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bifidobacterium infantis</em> 35624</td>
<td>Digestive health; Alleviates symptoms of irritable bowel syndrome</td>
<td>Procter &amp; Gamble’s Align</td>
</tr>
<tr>
<td>(Bifantis)</td>
<td></td>
<td>dietary supplement</td>
</tr>
<tr>
<td><em>Bifidobacterium lactis</em> Bb-12</td>
<td>Helps immune system and digestive health</td>
<td>Yoplait Yoplus yogurt</td>
</tr>
<tr>
<td><em>Lactobacillus casei</em> DN-114 001</td>
<td>Helps immune system; lessens duration of colds and flus in older people; eases diarrhea in children and people taking antibiotics</td>
<td>Dannon DanActive dairy drink</td>
</tr>
<tr>
<td>(L. casei Immunitas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lactobacillus casei</em> Shirotta</td>
<td>Helps immune system and digestive health</td>
<td>Yakult fermented dairy drink</td>
</tr>
<tr>
<td><em>Lactobacillus rhamnosus</em> GG</td>
<td>Digestive health, infant diarrhea</td>
<td>Culturelle dietary supplement</td>
</tr>
<tr>
<td><em>Lactobacillus rhamnosus</em> GR-1 in combination with <em>Lactobacillus reuteri</em></td>
<td>Improved vaginal health; helps eradicate vaginal infections</td>
<td>RepHresh Pro-B and Fem-Dophilus, both dietary supplements</td>
</tr>
<tr>
<td><em>Lactobacillus reuteri</em> DSM 17938</td>
<td>Eases infant colic; helps immune system; lessons antibiotic-associated diarrhea. When blended with another strain, helps treat bleeding gums</td>
<td>BioGaia chewable tablets, drops, and lozenges</td>
</tr>
<tr>
<td><em>Saccharomyces boulardii</em> yeast</td>
<td>Helps prevent and treat antibiotic-associated diarrhea</td>
<td>Florastor dietary supplement</td>
</tr>
</tbody>
</table>

Johannes, 2012
Top 3 Immunity Benefits of Probiotics

Other Amazing Benefits of Using Probiotics Include:

- Aid in digestion
- Improve resistance to allergies
- Fight yeast & fungal infections
- Prevent constipation & diarrhea
- Help fight urinary tract infections
- Improve liver function
- Improve absorption of nutrients
- Alleviate bloating & heartburn
- Prevent skin problems
- Reduce accumulation of cholesterol & plaque in the arteries
- Improve lactose digestion
- Improve tolerance to antibiotics
- Maintain a balanced pH level
- Help maintain hormone balance
- Assist detoxification
- Enhance mental clarity
- Help regulate activity of the bowels
- Inhibit formation of tumors
- Enhance calcium metabolism, helping to prevent osteoporosis

+ Many More

URL: http://fermentingsolutions.files.wordpress.com/2014/03/probiotics-benefits.png?w=361&h=356
Probiotic strains *Lactobacillus reuteri, L. rhamnosus GG, L. casei* and *Saccharomyces cerevisiae (boulardii)* significantly decreases the duration of diarrhea in children.

Probiotics + Oral Rehydration Salts

Shortens the duration of acute diarrheal illness in children
Probiotics

- Modulation of gut microbiota
- Production of antimicrobial substances
- Competition for adhesion sites
- Stimulation of mucus secretion
- Modulation of immune response

Prevention of Diarrhea
Antibiotic Associated Diarrhea

Disease → Antibiotic treatment → Disturbance of gut microbiota → Probiotics → Balance Microbiota → Clostridium overgrowth produces toxins → Diarrhea
Probiotics and Cancer

Enzymes of Gut Flora
✓ Glycosidase
✓ β-glucuronidase
✓ Azoreductase
✓ Nitroreductase

Probiotics

Pre-carcinogens → Active carcinogens

- Oligofructose plus two probiotic strains (*L. acidophilus* and *L. casei*) supplementation in humans helped to decrease levels of these gut flora enzymes
Probiotics

- Binding/inactivation of mutagenic compounds
- Production of anti-mutagenic compounds
- Suppression of growth of pro-carcinogenic bacteria
- Reduction of the absorption of carcinogens
- Enhancement of immune function
- Influence on bile salt concentrations

Prevents Cancer Growth
Probiotics and Heart Diseases

- Assimilation of cholesterol by bacterial cells
- Deconjugation of bile acids by bacterial acid hydrolases
- Cholesterol-binding to bacterial cell walls
- Reduction of hepatic cholesterol synthesis
- Redistribution of cholesterol from plasma to liver
- Bacterial production of short-chain fatty acids

Reduction of blood cholesterol level
Helicobacter pylori Infection

Probiotics

- Production of antimicrobial substances
- Stimulation of the mucus secretion
- Competition for adhesion sites
- Stimulation of specific and non-specific immune responses

Prevention of Helicobacter pylori infection
Probiotics and Allergy

Probiotics

- Reverse increased intestinal permeability
- Enhance gut-specific IgA responses
- Promote gut barrier function
- Modulation of immune response
- Enhance IL-10 and cytokines production that promote production of IgE antibodies

Beneficial in Allergy and Atopic diseases
Decrease portal blood ammonia by reduced bacterial urease activity
Decrease portal blood pH due to less ammonia absorption
Decrease inflammation and oxidative stress due to reduced ammonia toxins
Reduce uptake of other toxins

Prevention of Hepatic Encephalopathy
Inflammatory Bowel Disease

- Probiotics
  - Modulation of immune response
  - Modulation of gut microbiota

Beneficial in Inflammatory Bowel Disease
Ulcerative colitis

- The probiotic strain *E. coli* Nissle strain may be equivalent to Mesalazine in maintaining remission of ulcerative colitis
- Probiotics have shown efficacy to induce and maintain remission in children and adults with mild-to-moderate ulcerative colitis
Reduction of intestinal gas production

Modulation of gut microbiota

Beneficial in Irritable Bowel Syndrome

- Probiotic strains *Bifidobacterium Infantis* in addition to *Lactobacillus reuteri* may improve *Colicky* symptoms within one week of treatment.
Lactose Malabsorption

Probiotics

Action of bacterial β-galactosidase on lactose

Relief from Lactose Indigestion

- *Streptococcus thermophilus* and *L. delbrueckii subsp. bulgaricus* improve lactose digestion and reduce symptoms related to lactose intolerance
Urogenital Tract Disorders

Probiotics

- Production of antimicrobial substances
- Competition for adhesion sites
- Competitive exclusion of pathogens

Relief from Urogenital Infection
Probiotics in Pregnancy

- **Bacterial vaginosis**, increases the risk of **preterm labour** and **infant mortality**

- Probiotics decrease the risk of **bacterial vaginosis** and maintain normal *Lactobacilli* vaginal flora

- *L. rhamnosus GG* and *B. lactis BB12* can be prevented atopic dermatitis of newborn babies in 50% of cases, if mothers ingest probiotics during pregnancy and newborns ingest them during the first 6 months of life
Probiotics in Skincare Products

- Probiotic skincare product NUDE Skincare® was first introduced in 2007 by NUDE Brands Ltd., UK/USA
- Probiotics help balance internal digestion and also stabilize microflora on the skin
- Yogurt increases certain probiotic strains in skin that protect skin from environmental stressors, soothes skin and improves moisture retention
The benefits of probiotics go way beyond gut health.

Probiotics

Neurotransmitter release

Inflammatory cytokines

Useful in Depression & Anxiety
Probiotics

Reduces pathogenic bacteria in the nasal passages
Balances microflora in the nasal cavity

Useful in Nasal Congestion & sinusitis
Probiotics

Inflammatory cytokines in skin

Useful in Acne, Psoriasis, Eczema and Dermatitis

Microbial flora in skin

Contd....
Probiotics

Development of new strains

Improves insulin sensitivity
Facilitates glucose transport
Reduces blood LDL level

Useful in Type-2 Diabetes & Obesity
Probiotics

Production of antibiotic that kills pathogenic microbes

Development of oral hygienic products

Probiotic strains incorporate into antiseptic powder and lotions
Conclusion

- Probiotics have clearly established as an adjuvant in the management of lactose malabsorption and acute diarrhea, particularly acute infant diarrhea.
- Probiotic agents appear promising for the management of *C. difficile* colitis, atopic disease, necrotizing enterocolitis and other gut conditions, such as inflammatory bowel disease.
- Further, well-designed clinical trials, involving large numbers of patients, are mandatory to achieve definite evidence of the preventive and curative role of probiotics in medical practice.
Thank you

for your attention!