Probiotics mean “for life” and are defined as “living microorganisms which upon ingestion in certain numbers exert health benefits in humans and animals beyond inherent basic nutrition”.

Probiotic bacteria with documented health benefits include members of the *Lactobacillus* and *Bifidobacterium* genera, although strains of *Enterococcus*, *Propionibacterium* and the yeast, *Saccharomyces*, have been identified. There is also evidence that starter cultures like *Lactobacillus delbrueckii* spp. *bulgaricus*, *Streptococcus thermophilus* and *Lactococcus*—species commonly used by industry for their ability to rapidly produce the desired organoleptic qualities in cultured dairy products—positively affect human health even though they cannot grow in the intestine.

Health benefits are derived from specific strains of bacteria with proven clinical efficacy. For example, probiotic strains used in the popular Japanese product “Yakult” have over 100 published studies supporting their efficacy. Studies are showing the health status of the host is as important to probiotic efficacy as the microbial strain. New research shows that a combination of different probiotics strains reduces the ability of potentially pathogenic bacteria to adhere to and colonize the gut more than single strains, thus reducing risk of infection.
The most compelling evidence for use of probiotics is in reducing the duration of infectious infant viral diarrhea, a frequent cause of infant morbidity in developing countries. Usually managed by rehydration therapy, there is growing evidence to support the use of probiotics as a complementary therapy. Specific probiotic strains or mixtures have been shown to reduce the disease time frame by as much as two days, a significant effect.

A generally accepted health benefit of yogourt is improved digestion of lactose in lactose-intolerant people. This may be due to the presence of the enzyme β-galactosidase produced by probiotics and starter cultures that break down lactose or the physical characteristics of yogourt.

Areas of future interest for the application of probiotics include colon and bladder cancers, diabetes, and rheumatoid arthritis. Although scientific literature reports some conflicting data, the importance of strain, viable cell populations, matrix, host health status and method of production of the probiotic have been identified as critical to functionality and efficacy. Ongoing clinical trials to test the efficacy of probiotic products are occurring across Canada.

The Food and Agriculture Organization/World Health Organization (FAO/WHO) Expert committee on probiotics proposed guidelines to assess probiotic microorganisms. Probiotics should:

- Be able to survive passage through the digestive tract
- Be able to grow in the gut
- Be gram positive. Organisms included, but not necessarily limited to the two genera, are *Lactobacillus* and *Bifidobacterium*
- Show a specific health benefit measured by defined tests (in vitro, animal and/or human)
- Have defined dosage regimes and durations of use

### Examples of Probiotic Bacteria

<table>
<thead>
<tr>
<th>Lactobacillus species</th>
<th>Bifidobacterium species</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. acidophilus</td>
<td>B. lactis</td>
</tr>
<tr>
<td>L. paracasei</td>
<td>B. animalis</td>
</tr>
<tr>
<td>L. casei</td>
<td>B. bifidum</td>
</tr>
<tr>
<td>L. johnsonni</td>
<td>B. breve</td>
</tr>
<tr>
<td>L. rhamnosus</td>
<td></td>
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</tbody>
</table>

### Health Benefits

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Applications

In today’s market, probiotics are commercially available in three ways:

• A culture concentrate added to dairy-based, fruit and cereal foods and beverages
• An ingredient added to a milk- or soy-based food and permitted to grow to high levels as a fermented food
• As concentrated, dried cells packaged as powders, capsules or tablets

Traditionally most probiotics are associated with cultured dairy products because consumers expect the presence of live cultures in these foods. Proteins in dairy products provide a buffering effect as the probiotic moves through the harsh digestive system. Refrigeration prolongs stability and shelf life of probiotics.

Probiotics are extremely sensitive to heat and other processing conditions. New technologies, like microencapsulation and immobilized cell technologies, offer additional protection to probiotic organisms and new ways to include probiotics in foodstuffs. The range of probiotic products is expanding to include cheese, ice cream, frozen yogurt, and non-dairy foods and beverages.16

Manufacturers are commercializing new probiotic delivery vehicles like straws and bottle caps that when punctured or broken, deliver therapeutic doses of probiotics to a food product.

“Synbiotics”, blends of probiotic organisms or combinations of probiotics with specific prebiotic ingredients, are being developed to further enhance gut health, reinforce the immune system and increase disease resistance.17 Prebiotics are non-digestible food ingredients (i.e. β-glucans, inulin, pectin, gums and resistant starch) that promote growth of beneficial organisms in the colon, while inhibiting the growth and activity of pathogenic organisms.

Canadian Research Expertise

**Agriculture and Agri-Food Canada**

Food Research and Development Centre
St. Hyacinthe, QC

- Production, preservation and use of lactic acid bacteria (C. Champagne)
- Fermented foods, probiotics and GI health (E. Farnworth)
- Development of mixed starters (including probiotics) (T. Savard)
- Production of prebiotic oligosaccharides and enzymes (B. Lee)
- Determination of the composition and structure of probiotic EPS (M.-R. Van Calsteren)

**Dairy and Swine Research Development Centre**

Sherbrooke (Lennoxville Sector), QC

- Use of probiotics in animal feeds (M. Lessard)

**University of Alberta**

Canada Research Chair in Food Microbiology and Probiotics
Edmonton, AB

- Genetic characteristics of lactic acid bacteria strains, metabolic properties, and performance as probiotic bacterial cultures or as starter cultures in food fermentations (M. Gaenzle)

**University of Guelph**

Guelph, ON

- Effect of probiotics on poultry immune systems (S. Sharif)

**Université Laval**

Canada Research Chair in Lactic Culture Biotechnology for Dairy and Probiotic Industries
Quebec, QC

- Function, control, and investigation of probiotics and health benefits (D. Roy)

**Institute of Functional Foods and Nutraceuticals (INAF)**

Quebec, QC

- In-vitro (simulated GI system, animal cell cultures) and in-vivo determination of probiotic effects (I. Fliss)

**University of Moncton**

Moncton, NB

- Effects of probiotics on health (immune system, cancer) (C. Matar)

**University of Ontario Institute of Technology**

Oshawa, ON

- Effects of probiotics on immune system (J. Green-Johnson)

**University of Western Ontario**

Canadian Research and Development Centre for Probiotics
London, ON

- Microbial ecology, proteomics, genetics, biofilm studies, cell-signalling, immunology and population health of lactobacilli and bifidobacterium (G. Reid)
The Canadian Advantage in the Global Marketplace

**Natural Resources** • Canada’s abundant natural resources are proven building blocks for a high tech industry that produces an array of high quality agri-food products.

**World-Class Standards** • Canada’s regulatory and food inspection systems are internationally recognized, resulting in world-class standards and products that are safe, nutritious and high quality.

**Innovative Research** • Canada has developed a strong network of research facilities across the country where scientific innovators are focused on developing leading-edge products and new technologies.

**Collaborative Teamwork** • Collaboration among governments, health institutions, universities and industry has helped this vibrant sector prosper by encouraging innovation and manufacturing of diverse agri-food products with proven health benefits.

References

To learn more about Canada’s functional food and natural health products industry, visit: [www.agr.gc.ca](http://www.agr.gc.ca)

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AAFC NO. 10076E