



Probiotics in the Food Industry

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Probiotic foods are foods containing probiotic microorganisms: living microorganisms that impart health benefits to the host. These bacteria can help to maintain internal microbial balance and defend against harmful bacteria. The exact mechanisms of probiotics are complex; there is a delicate balance of gastrointestinal gut flora for which the interactions of the various bacteria, as well as their interaction with the rest of the human body, are not entirely understoodⁱ. There are a wide variety of bacteria that are currently being categorized as probiotics, but much research remains to be done to understand the exact mechanisms of probiotics and to provide hard scientific evidence for their use in food and health industries.

In order to characterize define probiotics, the Food and Agriculture Organisation of the United Nations and World Health Organisation met in October 2001 to create a set of guidelines. According to the FAO/WHO's *Guidelines for the Evaluation of Probiotics in Food*, probiotics are defined as "live microorganisms which when administered in adequate amounts confer a health benefit on the host". Prior to being categorized as probiotics, organisms should follow a process of testing, including strain identification by genotype and phenotype, functionalized characterization and safety assessment testing, and double-blind, placebo-controlled human trials to verify their health benefitsⁱⁱ.

The health benefits associated with probiotics vary widely depending on specific strains and circumstances. Certain types of probiotics have been shown to reduce diarrhea in infants as well as diarrhea caused by *C. difficile*, a common bacteria that proliferates when patients are given antibioticsⁱⁱⁱ. Other probiotics have improved eradication of *H. pylori*, which is known to cause peptic ulcers and gastritis³. Probiotic strains administered in the vagina also showed vast reduction in urogenital infections³. Studies have shown that probiotics, which normally pass through the GI tract quickly, colonise in the gut for longer periods in the presence of pathogenic bacteria such as *Salmonella* and inhibit pathogenic activity³; such research supports the claim that probiotics help to maintain intestinal flora balance and fight infection.

Probiotics are readily available to consumers in Canada. While probiotics can technically be any type of beneficial microorganism, certain bacteria are more commonly found on the food market. Commonly used food-grade probiotics in Canada today include lactic acid bacteria, such as *Lactobacillus acidophilus*, and *Bifidobacteria*. These fermentative bacteria can easily be added to traditionally fermented foods, such as cheeses, yoghurts and other dairy products. In Canada, probiotic bacterial cultures used in food are considered foods and are subject to regulation according to the *Food and Drugs Act*. This act ensures that the probiotic cultures are not toxic, and that products containing probiotics are properly labeled and advertised so as not to be misleading^{iv}. Probiotic strains can also be sold as natural health products administered through capsules, powders and other non-food-related media; the specific strains of bacteria used, their dosages and their means of ingestion are all regulated by *Natural Health Products Regulations* in Canada^v. The regulation of natural health products is more specific and

probiotic strains must be tested to prove their health benefits before being considered natural health products.

The current success of probiotic strains has led to the genetic modification of the strains to perform desired functions. For example, probiotics such as *Lactobacillus lactis* have been modified to produce specific antigens so that when introduced to the body, the immune system produces antibodies and raises immune protection^{vi}. The technology available for recombinant DNA and genetic modification, combined with food-grade probiotic vectors means that there exists a world of opportunity for probiotic health benefits. However, genetically modified organisms must be created carefully before use in food. The use of antibiotic resistance cassettes in the development of the probiotic strains could add to an already dramatic issue of antibiotic resistant strains of pathogenic bacteria⁶. Genetically modified probiotics are also subject to different legislation than naturally-occurring probiotic strains, and must comply with specific regulations for “Novel Foods” under the *Food and Drugs Act and Regulations*⁴. There is great potential for the genetic modification of probiotic bacterial strains, but care must be taken in their development and distribution in the food market.

Overall, probiotics are simply microorganisms that impart health benefits to the host. They are generally bacteria, such as *Lactobacillus* and *Bifidobacteria* strains. Regulation of probiotics is still a developing field; currently, naturally-occurring strains can be considered food and are regulated as foods, but testing must be done before the strain can be advertised as a health supplement. Probiotics are commonly found as dairy products, but are also sold as capsules and powders. The genetic modification of probiotics is a relatively new field of study that must be considered carefully. Probiotics still require much study, but the current research available indicates a promising future for the food and health industries.

ⁱ Goktepe, I., Juneja, V., and Ahmedna, M. Probiotics in Food Safety and Human Health. Boca Raton: CRC Press, 2006.

ⁱⁱ “Guidelines for the Evaluation of Probiotics in Food.” Food and Agriculture Organisation of the United Nations and World Health Organisation. London: 2002.

ⁱⁱⁱ Namoto, K. “Review: Prevention of Infections by Probiotics.” *Journal of Bioscience and Engineering*, 2005: 100, 6, 584-592.

^{iv} “Food and Drugs Act.” 17 Sept 2009. Department of Justice Canada. 17 October 2009. <<http://laws.justice.gc.ca/en/showdoc/cs/f-27/bo-ga:l I-gb:s 4/20091017/en#anchorbo-ga:l I-gb:s 4>>.

^v “Natural Health Products Monograph – Probiotics.” 11 February 2009. Health Canada: Drugs and Health Products. 17 October 2009. <http://www.hc-sc.gc.ca/dhp-mps/prodnatur/applications/licen-prod/monograph/mono_probioti-eng.php>.

^{vi} Steidler, L., and Neiryneck, S. “Genetically Modified Probiotics.” Probiotics and Prebiotics: Scientific Aspects. Ed. Tannock, G. UK: Caister Academic Press, 2005.