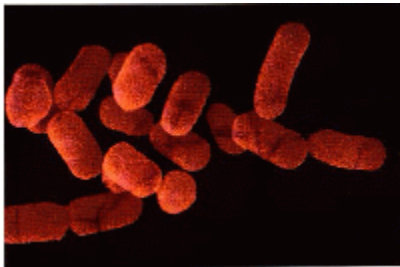




Lactobacillus plantarum

University of Ottawa iGEM 2009

Lactobacillus plantarum is a non-pathogenic gram-positive bacterium naturally existing in human saliva and gastrointestinal tract. As a member of the lactic acid bacteria, it is commonly used in food fermentation. Being used as a probiotic, its biotherapeutic applications have been increasingly recognized.



Bacterial Fermentation Pty Ltd, 2008-2009
(<http://www.bacferm.com.au/silac/micro/micro.html>)



ASM MicrobeLibrary.org

(<http://www.microbelibrary.org/ASMOOnly/details.asp?id=2566&Lang>)

Structure

L. plantarum is rod-shaped. Its genome is the largest among all lactic acid bacteria and has been fully sequenced.

Metabolism

L. plantarum is a facultative anaerobic bacterium meaning it can grow both in the presence and absence of oxygen. In the presence of oxygen, it can convert oxygen into hydrogen peroxide in a manganese-dependent way, which gives itself a high hydrogen peroxide tolerance. On the other hand, when oxygen is absent, it is able to undergo fermentation and turn sugars into lactic acid or alcohol (heterofermentative). The lactic acid produced is a combination of D- and L-isomers. As well, it is able to liquefy gelatin.

Food Production

L. plantarum is commonly used for food fermentation. Examples of food containing *L. plantarum* include yogurt, cheese, pickles, kimchi, sauerkraut, Nigerian ogi, sourdough, and stockfish. The wide use of *L. plantarum* in food makes it suitable for probiotic development.

A Probiotic

L. plantarum can survive low pH of the stomach and duodenum, resisting the effects of bile acids in the upper small intestine when ingested, and temporarily colonizing the gastrointestinal tract by binding to the intestinal and colonic mucosa. Its use as a treatment for irritable bowel syndrome has been tested, and accumulated evidence seems to suggest its effects in reducing pain, abdominal distension and flatulence.^[1] Furthermore, Nissen L. et al. showed in vitro that *L. plantarum* can enhance the intestinal integrity, metabolic activity of intestinal cells and stimulate immune responses.^[2] As well, a comparative study showed that *L. plantarum* can induce a pro-inflammatory response to prevent an inflammatory outcome and to induce a higher immune alertness in intestinal epithelial cells.^[3] Also, the intake of *L. plantarum* is shown to reduce certain gastrointestinal symptoms during treatment with antibiotics.^[4] Moreover, in a randomized controlled trial conducted by Karlsson's group in Sweden, the ingestion of live *L. plantarum* in patients with cardiovascular disease increased bacterial diversity in colon.^[5] In another study conducted by Danone Research Center in the Netherlands, a mouse model of ovalbumin-allergic asthma was used to test the effects of oral treatment with *L. Plantarum*, which was shown to inhibit the response to methacholine, to reduce the number of eosinophils in the bronchoalveolar lavage fluid and to reduce both ovalbumin-specific IgE and IgG1.^[6] Additionally, it has been shown that *L. plantarum* can protect epithelial cells from E.coli-induced damage by preventing changes in host cell morphology, attaching lesion formation, monolayer resistance and macromolecular permeability.^[7] As a probiotic, *L. plantarum* has great potential.

^[1] Bixquert J. M. Treatment of irritable bowel syndrome with probiotics: an etiopathogenic approach at last. *Rev Esp Enferm Dig.* 2009 Aug; 101(8): 553-564.

^[2] Nissen L., Chingwaru W., Sgorbati B. et al. Gut health promoting activity of new putative probiotic/protective *Lactobacillus* spp. Strains: a functional study in the small intestinal cell model. *Int J Food Microbiol.* 2009 Nov 15; 135(3):288-94. Epub 2009 Sep.

^[3] Cammarota M., De Rosa M., Stellavato A., et al. In vitro evaluation of *Lactobacillus plantarum* DSMZ 12028 as a probiotic: emphasis on innate immunity. *Int J Food Microbiol.* 2009 Oct 31;135(2):90-8. Epub 2009 Aug 26.

^[4] Lonnermark E., Friman V., Lappas G., et al. Intake of *Lactobacillus plantarum* reduces certain gastrointestinal symptoms during treatment with antibiotics. *J Clin Gastroenterol.* 2009 Sep 1. [Epub ahead of print]

^[5] Karlsson C., Ahrne S., Molin G., et al. Probiotic therapy to men with incipient arteriosclerosis initiates increased bacterial diversity in colon: a randomized controlled trial. *Atherosclerosis.* 2009 Jun 18. [Epub ahead of print]

[6] Hougee S., Vriesema A. J., Wijering S. C., et al. Oral treatment with probiotics reduces allergic symptoms in ovalbumin-sensitized mice: a bacterial strain comparative study. *Int Arch Allergy Immunology*. 2009 Sep 15; 151(2): 107-117.

[7] Qin H., Zhang Z., Hang X. et al. *L.plantarum* prevents enteroinvasive *Escherichia coli*-induced tight junction protein changes in intestinal epithelial cells. *BMC MicrobioJ*. 2009 Mar 31;9:63.