

# LACTOBACILLUS PARACASEI Lpc-37®

*Lactobacillus casei* subsp. *casei* (Texel® Dried LBC 81) referred to in Faria et al 2006, is a synonym of *Lactobacillus paracasei* Lpc-37. In Ding & Shah, 2007 & 2009 Lpc-37 is referred to as *Lactobacillus plantarum* Lpc-37 by error. In Santana da Silva, 2012, Lpc-37 is referred to as *Lactobacillus casei* by error. The strain *Lactobacillus paracasei* Lpc-37 has been deposited in the American Type Culture Collection ATCC safe deposit, not ATCC's safe deposit as: SD5275

## In vitro trials

### Probiotic selection, survival, stability, production

1. Morovic W, Roper JM, Smith AB, Mukerji P, Stahl B, Rae JC, Ouwehand AC. 2017. Safety evaluation of HOWARU® Restore (*Lactobacillus acidophilus* NCFM, *Lactobacillus paracasei* Lpc-37, *Bifidobacterium animalis* subsp. *lactis* Bl-04 and B. *lactis* Bi-07) for antibiotic resistance, genomic risk factors and acute toxicity. Food Chem Toxicol. 110: 316-324. doi: 10.1016/j.fct.2017.10.037.

Also listed under *Animal studies*

2. Forssten SD, Ouwehand AC. 2017. Simulating colonic survival of probiotics in single-strain products compared to multi-strain products. Microbial Ecology in Health and Disease, Vol. 28, 1378061.

3. Tang C, Xie B, Sun Z. 2017. Antibacterial activity and mechanism of B-type oligomeric procyanidins from lotus seedpod on enterotoxigenic *Escherichia coli*. Functional Foods 38;454-463.

### Prebiotic utilization/synbiotic

1. Alves CC, Waitzberg DL, de Andrade LS, dos Santos Aguiar L, Reis MB, Guanabara CC, Júnior OA, Ribeiro DA and Sala P. 2017. Prebiotic and Synbiotic Modifications of Beta Oxidation and Lipogenic Gene Expression after Experimental Hypercholesterolemia in Rat Liver. Front. Microbiol. 8: 2010. doi: 10.3389/fmicb.2017.02010.

2. Tagliari E, Campos AC, Costa-Casagrande TA, Salvalaggio PR. 2017. The impact of the use of symbiotics in the progression of nonalcoholic fatty liver disease in a rat model. ABCD Arq Bras Cir Dig Original Article 2017;30(3): 211-215. DOI: /10.1590/0102-6720201700030011.

3. Zhang S, Hu H, Wang L, Liu F, Pan S. 2018. Preparation and prebiotic potential of pectin oligosaccharides obtained from citrus peel pectin. Food Chem. Apr 1;244: 232-237. doi: 10.1016/j.foodchem.2017.10.071.

4. Mäkeläinen H, Saarinen M, Stowell J, Rautonen N and Ouwehand AC. 2010. Xylo-oligosaccharides and lactitol promote the growth of *Bifidobacterium lactis* and *Lactobacillus* species in pure cultures. Beneficial Microbes 1: 139-148.

5. Mäkeläinen H, Hasselwander O, Rautonen N, Ouwehand AC. 2009. Panose, a new prebiotic candidate. Lett Appl Microbiol. 49: 666-672.

### Oral health

1. Lin X, Chen X, Chen Y, Jiang W, Chen H. 2014. The effect of five probiotic lactobacilli strains on the growth and biofilm formation of *Streptococcus mutans*. Oral Dis. May 7. doi: 10.1111/odi.12257.

### Antipathogenic activity

1. Forssten SD, Rönttiö H, Hibberd AA, Ouwehand AC. 2015. The effect of polydextrose and probiotic lactobacilli in a *Clostridium difficile*-infected human colonic model. Microb Ecol Health Dis. Oct 13; 26: 27988.

### Genomics

1. Broadbent JR, Neeno-Eckwall EC, Stahl B, Tandee K, Cai H, Morovic W, Horvath P, Heidenreich J, Perna NT, Barrangou R, Steele JL. 2012. Analysis of the *Lactobacillus casei* supragenome and its influence in species evolution and lifestyle adaptation. BMC Genomics. Oct 5;13: 533.

## Animal trials

### Safety

1. Morovic W, Roper JM, Smith AB, Mukerji P, Stahl B, Rae JC, Ouwehand AC. 2017. Safety evaluation of HOWARU® Restore (*Lactobacillus acidophilus* NCFM, *Lactobacillus paracasei* Lpc-37, *Bifidobacterium animalis* subsp. *lactis* BI-04 and *B. lactis* Bi-07) for antibiotic resistance, genomic risk factors and acute toxicity. Food Chem Toxicol. 110: 316-324. doi: 10.1016/j.fct.2017.10.037.

### Anti-pain/Analgesic

1. Rousseaux C, Thuru X, Gelot A, Barnich N, Neut C, Dubuquoy L, Dubuquoy C, Merour E, Gebous K, Chamaillard M, Ouwehand A, Leyer G, Carcano D, Colombel JF, Ardid D, Desreumaux P. 2007. *Lactobacillus acidophilus* modulates intestinal pain and induces opioid and cannabinoid receptors. Nat Med. 13: 35-37.

## Human clinical studies

### Safety

1. Roessler A, Forssten SD, Gleis M, Ouwehand AC, Jahreis G. 2011. The effect of probiotics on faecal microbiota and genotoxic activity of faecal water in patients with atopic dermatitis: A randomized, placebo-controlled study. Clin Nutr. 2011 Sep 30.  
*Also listed under Gastrointestinal ecology.*

### Antibiotic associated diarrhea

1. Barker AK, Duster M, Valentine S, Hess T, Archbald-Pannone L, Guerrant R, Safdar N. 2017. A randomized controlled trial of probiotics for *Clostridium difficile* infection in adults (PICO). J Antimicrob Chemother. Nov 1;72(11): 3177-3180. doi: 10.1093/jac/dkx254

2. Ouwehand AC, DongLian C, Weijian X, Stewart M, Ni J, Stewart T, Miller LE. 2014. Probiotics reduce symptoms of antibiotic use in a hospital setting: a randomized dose response study. Vaccine. Jan 16;32(4): 458-63.

## Gastrointestinal ecology

1. Hemalatha R, Ouwehand AC, Saarinen MT, Prasad UV, Swetha K and Bhaskar V. 2017. Effect of probiotic supplementation on total lactobacilli, bifidobacteria and short chain fatty acids in 2-5-year old children. Microbial Ecology in Health and Disease. 28 (1).  
*Also listed under Gut function*

2. Hemalatha R, Ouwehand AC, Forssten SD, Geddan JJB, Mamidi RS, Bhaskar V and Radhakrishna KV. 2014. A Community-based Randomized Double Blind Controlled Trial of *Lactobacillus paracasei* and *Bifidobacterium lactis* on Reducing Risk for Diarrhea and Fever in Preschool Children in an Urban Slum in India. European Journal of Nutrition & Food Safety 4(4): 325-341.  
*Also listed under Gut function*

3. Forssten SD, Salazar N, López P, Nikkilä J, Ouwehand AC, Patterson Á, Ruas-Madiedo P, Suarez A, Gonzalez S and Gueimonde M. 2011. Influence of a Probiotic Milk Drink, Containing *Lactobacillus paracasei* Lpc-37, on Immune Function and Gut Microbiota in Elderly Subjects. European Journal of Food Research & Review. 1: 159-172.  
*Also listed under Immune system enhancement*

4. Roessler A, Forssten SD, Gleis M, Ouwehand AC, Jahreis G. 2012. The effect of probiotics on faecal microbiota and genotoxic activity of faecal water in patients with atopic dermatitis: A randomized, placebo-controlled study. Clin Nutr. 2011 Sep 30.  
*Also listed under Safety*

5. Engelbrektson AL, Korzenik JR, Pittler A, Sanders ME, Klaenhammer TR, Leyer G, Kitts CL. 2009. Probiotics to minimize the disruption of faecal microbiota in healthy subjects undergoing antibiotic therapy. J Med Microbiol. 58: 663-670.

6. Engelbrektson AL, Korzenik JR, Sanders ME, Clement B, Leyer G, Klaenhammer TR, Kitts CL. 2006. Analysis of treatment effects on the microbial ecology of the human intestine. FEMS Microbiol Ecol. 57: 239-250.

## Gut function

1. Hemalatha R, Ouwehand AC, Forssten SD, Geddan JJB, Mamidi RS, Bhaskar V and Radhakrishna KV. 2014. A Community-based Randomized Double Blind Controlled Trial of *Lactobacillus paracasei* and *Bifidobacterium lactis* on Reducing Risk for Diarrhea and Fever in Preschool Children in an Urban Slum in India. *European Journal of Nutrition & Food Safety* 4(4): 325-341.

*Also listed under Gastrointestinal ecology*

2. Hemalatha R, Ouwehand AC, Saarinen MT, Prasad UV, Swetha K and Bhaskar V. 2017. Effect of probiotic supplementation on total lactobacilli, bifidobacteria and short chain fatty acids in 2-5-year old children. *Microbial Ecology in Health and Disease*. 28 (1).

*Also listed under Gastrointestinal ecology*

## Synbiotic

1. Fernandes R, Beserra BTS, Mocellin MC, Kuntz MGF, da Rosa JS, de Miranda RCD, Schreiber CSO, Fröde TS, Nunes EA and Trindade EBSM. 2016. Effects of prebiotic and symbiotic supplementation on inflammatory markers and anthropometric indices after Roux-en-Y gastric bypass: A randomized, triple-blind, placebo-controlled pilot study. *Journal of Clinical Gastroenterology*. 50(3): 208-217.

2. do Rosario VA, Fernandes R, Kuntz M, Beserra BTS, Miranda RC, Schreiber CS and trindade EBSM. 2016. Effects of prebiotic and symbiotic supplementation on glycaemic and lipid homeostasis after Roux-en-Y gastric bypass: A randomized, triple-blind, placebo-controlled, human clinical trial. *BAOJ Microbiology*. 2(3).

3. Waitzberg DL, Logullo LC, Bittencourt AF, Torrinhas RS, Shiroma GM, Paulino NP, Teixeira-da-Silva ML. 2013. Effect of synbiotic in constipated adult women – A randomized, double-blind, placebo-controlled study of clinical response, *Clinical Nutrition* 32: 27-33.

## Immune system enhancement

1. Forssten SD, Salazar N, López P, Nikkilä J, Ouwehand AC, Patterson Á, Ruas-Madiedo P, Suarez A, Gonzalez S and Gueimonde M. 2011. Influence of a Probiotic Milk Drink, Containing *Lactobacillus Paracasei* Lpc-37, on Immune Function and Gut Microbiota in Elderly Subjects. *European Journal of Food Research & Review*. 1: 159-172.

*Also listed under Gastrointestinal ecology*

2. Paineau D, Carcano D, Leyer G, Darquy S, Alyanakian MA, Simoneau G, Bergmann JF, Brassart D, Bornet F, Ouwehand AC. 2008. Effects of seven potential probiotic strains on specific immune responses in healthy adults: a double-blind, randomized, controlled trial. *FEMS Immunol Med Microbiol*. 53: 107-13.

3. Roessler A, Friedrich U, Vogelsang H, Bauer A, Kaatz M, Hipler UC, Schmidt I, Jahreis G. 2008. The immune system in healthy adults and patients with atopic dermatitis seems to be affected differently by a probiotic intervention. *Clin Exp Allergy*. 38: 93-102.

## Cholesterol lowering

1. Trautvetter U, Ditscheid B, Kiehntopf M, Jahreis G. 2011. A combination of calcium phosphate and probiotics beneficially influences intestinal lactobacilli and cholesterol metabolism in humans. *Clin Nutr*. 2011 Oct 19.

## Product functionality

1. Sady M, Najgebauer-Lejko D, Domagała J. 2017. The suitability of different probiotic strains for the production of fruit-whey beverages. *Acta Sci Pol Technol Aliment*. Oct-Dec;16(4): 421-429. doi: 10.17306/J.AFS.0515.

2. Bielecka MM and Cichosz G. 2017. The influence of an adjunct culture of *Lactobacillus paracasei* Lpc-37 on the physicochemical properties of Dutch-type cheese during ripening. 83: 95-100.

3. Aljewicz M and Cichosz G. 2017. Influence of probiotic (*Lactobacillus acidophilus* NCFM, *L. paracasei* LPC37 and *L. rhamnosus* HN001) strains on starter cultures and secondary microflora in Swiss-and Dutch-type cheeses. *Journal of Food Processing and Preservation*. E13253.

4. Aljewicz M, Cichosz G, Nalepa B, Bielecka M. 2016. The effect of milk fat substitution with palm fat on lactic acid bacteria counts in cheese-like products. *LWT – Food Sci Technol*. Mar; 66: 348-354.

5. Mati M, Magala M, Karovicová J, Staruch L. 2016. Evaluation of technological properties of sausages fermented by addition of probiotic *Lactobacillus paracasei* Lpc-37. *Chemické listy* 110(1): 59-63. [In Slovak]

6. Aljewicz M, Cichosz G. 2015. Protective effects of *Lactobacillus* cultures in Dutch-type cheese-like products. *LWT - Food Science and Technology* Volume 63, Issue 1, September 2015, Pages 52-56.
7. Aljewicz M, Siemianowska E, Cichosz G, Tońska E. 2014. The effect of probiotics (*Lactobacillus rhamnosus* HN001, *Lactobacillus paracasei* Lpc-37 and *Lactobacillus acidophilus* NCFM) on the availability of minerals from Dutch-type cheese. *J Dairy Sci.* Jun 6. pii: S0022-0302(14)00403-2.
8. Srisuvor N, Chinprahast N, Prakitchaiwattana C and Subhimaros S. 2013. Effects of inulin and polydextrose on physiochemical and sensory properties of low-fat set yoghurt with probiotic-cultured banana puree. 51(1): 30-36
9. Ferdousi R, Rouhi M, Mohammadi R, Mortazavian AM, Khosravi-Darani K and Rad AH. 2013. Evaluation of Probiotic Survivability in Yogurt Exposed To Cold Chain Interruption. *Iranian J Pharmaceutical Res* 12 (supplement): 137-142 or 139-144.
10. Tamminen M, Salminen S and Ouwehand AC. 2013. Fermentation of Carrot Juice by Probiotics: Viability and Preservation of Adhesion. *International Journal of Biotechnology for Wellness Industries*, 2013, 2, 10-15.
11. Vieira ADS. 2013. Desenvolvimento de queijo caprino tipo petit-suisse simbiotico polpa de acai (*Euterpe oleracea Martius*). MSc dissertation, University of Sao Paulo. [Spanish]
12. Santana da Silva A, Honjaya ER, Massami Inay O, de Rezende Costa M, Batista de Souza CH, Walter de Santana EH, Hiroshi Suguimoto H and Aragon-Alegro LC. 2012. Viability of *Lactobacillus casei* in chocolate flan and its survival to simulated gastrointestinal conditions. *Semina: Agricultural Sciences.* 33(2).
13. Santini MSS, Koga EC, Aragon DC, Santana EHW, Costa MR, Costa GN and Aragon-Alegro LC. 2012. Dried tomato-flavored probiotic cream cheese with *Lactobacillus paracasei*. 77(11): M604-8.
14. Shah NP, Ding WK, Fallourd MJ, Leyer G. 2010. Improving the stability of probiotic bacteria in model fruit juices using vitamins and antioxidants. *J Food Sci.* 75: M278-82.
15. Aljewicz M, Cichosz G, Łaniewska-Trokenheim Ł, Danowska-Oziewicz M and Łukaszuk-Kępa W. 2009. Przeżywalność *Lactobacillus Paracasei* Lpc-37 W Serach Dojrzewających Typu Szwajcarskiego. *Żywność. Nauka. Technologia. Jakość.* 6: 7-15. [In Polish]
16. Ding WK, Shah NP. 2009. Effect of various encapsulating materials on the stability of probiotic bacteria. *J Food Sc.* 73: M100-M107.
17. Ding WK, Shah NP. 2007. Acid, bile and heat tolerance of free and microencapsulated probiotic bacteria. *J Food Sci.* 72: M446-M450.
18. Faria CP, Benedet HD, Le Guerroue JL. 2006. Assessment of fermented buffalo milk for *Lactobacillus casei* and supply with *Bifidobacterium longum*. *Semina: Ciências Agrárias, Londrina*, 27: 407-414. [LBC81 = Lpc-37; In Portuguese]

## Review

1. Ouwehand AC. 2017. A review of dose-responses of probiotics in human studies. *Benef Microbes.* Apr 26;8(2): 143-151. doi: 10.3920/BM2016.0140.

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