

# Recent Studies and Publications on Probiotics and Health Benefits

## STUDIES

### 1. Effects Of Probiotics, Prebiotics, And Synbiotics On Polycystic Ovary Syndrome: A Systematic Review And Meta-Analysis

This meta-analysis of randomized controlled trials (RCTs) was performed to summarize the effects of probiotics, prebiotics, and synbiotics on insulin resistance (IR), lipid profiles, anthropometric indices, and C-reactive protein (CRP) level for polycystic ovary syndrome (PCOS).

In this review article researchers have searched 8 databases from their inception until 1st October, 2020.

The meta-analysis demonstrates that probiotic, prebiotic, or synbiotic administration is an effective and safe intervention for modifying IR and lipid profiles.

*Source: Guicheng Xia, Affiliated Hospital Of Nanjing And Nanjing University Of Chinese Medicine, Nanjing, China. Effects Of Probiotics, Prebiotics, And Synbiotics On Polycystic Ovary Syndrome: A Systematic Review And Meta-Analysis. Critical Reviews In Food Science And Nutrition, Volume 63, 2023, Issue 4, Pages 522-538. DOI: <https://doi.org/10.1080/10408398.2021.1951155>.*

### 2. Probiotic Cultures As A Potential Protective Strategy Against The Toxicity Of Environmentally Relevant Chemicals: State-Of-The-Art Knowledge

This review summarizes the state-of-the-art knowledge regarding the potential protective effects of different probiotic strains against environmentally relevant toxic substances (mycotoxins, polycyclic aromatic hydrocarbons, pesticides, perfluoroalkyl and polyfluoroalkyl substances, phthalates, bisphenol A and toxic metals etc.).

*Source: Katarina Baralić, University Of Belgrade, Faculty Of Pharmacy, Vojvode Stepe, Belgrade, Serbia. Probiotic Cultures As A Potential Protective Strategy Against The Toxicity Of Environmentally Relevant Chemicals: State-Of-The-Art Knowledge. Food and Chemical Toxicology, Volume 172, 2023, 113582. DOI: <https://doi.org/10.1016/j.fct.2022.113582>.*

### 3. Effects Of Probiotic And Selenium Co-Supplementation On Lipid Profile And Glycemia Indices: A Systematic Review And Meta-Analysis Of Randomized Clinical Trials

The purpose of this current systematic review and meta-analysis was to evaluate the effects of selenium and probiotic co-supplementation on lipid profile and glycemia indices of the adult population using randomized controlled clinical trials (RCTs).

This review showed that co-supplementation with probiotic and selenium reduces fasting plasma glucose, insulin, homeostatic model assessment for insulin resistance, quantitative insulin sensitivity check index, total cholesterol, low-density lipoprotein cholesterol, and triglyceride. Further clinical trials are required.

*Source: Beth L. Mallard, School Of Health Sciences, Massey University, PO Box 756, Wellington, New Zealand. Effects Of Probiotic And Selenium Co-Supplementation On Lipid Profile And Glycemia Indices: A Systematic Review And Meta-Analysis Of Randomized Clinical Trials. Nutr Rep 12, 167-180 (2023). DOI: <https://doi.org/10.1007/s13668-023-00448-1>.*

### 4. Probiotic Supplementation In Neonates And Long-Term Gut Colonisation: A Systematic Review Of Randomised Controlled Trials

This systematic review evaluates whether oral probiotic supplementation in the neonatal period results in sustained gut colonization with probiotic bacteria at or beyond 6 months after its cessation.

Low certainty of evidence suggests that probiotic supplementation in the neonatal period may result in sustained gut colonization 6-12 months post-cessation, but not at 24 months. Further, well-designed RCTs with strain-specific assays are needed in this area.

*Source: Ravisha Srinivasjois, Specialist Medical Centre West, Joondalup Health Campus, Perth. Probiotic Supplementation In Neonates And Long-Term Gut Colonisation: A Systematic Review Of Randomised Controlled Trials. Journal Of Paediatrics And Child Health, Volume 59, Issue 2, February 2023, Pages 212-217. DOI: <https://doi.org/10.1111/jpc.16318>.*

### 5. A Systematic Review On Selection Characterization And Implementation Of Probiotics In Human Health

In this review researchers studied the current literature on the fundamental idea of probiotic bacteria, their medical benefits, and their selection, characterization, and implementations.

*Source: Vinoth Kumar Vaidyanathan, Integrated Bioprocessing Laboratory, Department Of Biotechnology, School Of Bioengineering, SRM Institute Of Science And Technology (SRM IST), Kattankulathur, India. A Systematic Review On Selection Characterization And Implementation Of Probiotics In Human Health. Food Sci Biotechnol 32, 423-440 (2023). DOI: <https://doi.org/10.1007/s10068-022-01210-z>.*

## **6. The Effect Of Probiotics On Postsurgical Complications In Patients With Colorectal Cancer: A Systematic Review And Meta-Analysis**

This review synthesizes the best available evidence on the effects of the use of probiotics or synbiotics on pre-, peri-, and post-operative complications of CRC surgical resection.

In total, 2518 studies were identified, out of which 16 were included in the qualitative synthesis and 13 in the meta-analysis.

Overall, probiotic supplementation reduced the incidence of ileus, diarrhea, abdominal collection, sepsis, pneumonia, and surgical site infection. The results of the subgroup analysis indicated that lower dose, higher duration of supplementation (>14 days), and being administered ≤5 days before and >10 days after surgery was more effective at reducing the incidence of surgical site infection.

*Source: Patricia Borges Botelho, Graduate Program In Human Nutrition, Department Of Nutrition, University Of Brasília, Brasília, Federal District, Brazil. The Effect Of Probiotics On Postsurgical Complications In Patients With Colorectal Cancer: A Systematic Review And Meta-Analysis. Nutrition Reviews, Volume 81, Issue 5, May 2023, Pages 493–510. DOI: <https://doi.org/10.1093/nutrit/nuac069>*

## **7. Effects Of Probiotic And Synbiotic Supplementation On Ponderal And Linear Growth In Severely Malnourished Young Infants In A Randomized Clinical Trial**

This study shows that young severe acute malnutrition (SAM) infants had a higher rate of weight gain when supplemented with probiotic alone, compared to their counterparts with either synbiotic or placebo.

*Source: S. M. TafsirHasan, Nutrition And Clinical Services Division, International Centre For Diarrhoeal Disease Research, Bangladesh (Icddr,B), ShaheedTajuddin Ahmed Sarani, Mohakhali, Dhaka, Bangladesh. Effects Of Probiotic And Synbiotic Supplementation On Ponderal And Linear Growth In Severely Malnourished Young Infants In A Randomized Clinical Trial. Sci Rep 13, 1845 (2023). DOI: <https://doi.org/10.1038/s41598-023-29095-w>.*

## **8. The Effect Of Probiotic And Synbiotic Supplementation On Lipid Parameters Among Patients With Cardiometabolic Risk Factors: A Systematic Review And Meta-Analysis Of Clinical Trials**

This systematic review and meta-analysis determined the effect sizes of probiotics on blood lipid parameters more coherently. Meta-analysis of data from 40 RCTs (n = 2795) indicated a significant decrease in serum/plasma triglyceride, total cholesterol (with high heterogeneity), LDL-C, and HDL-C (with high heterogeneity) following receiving probiotic/synbiotic supplements.

The current preliminary evidence supports the effectiveness of probiotics/synbiotics in improving dyslipidaemia and various lipid parameters more prominently among subjects with hyperlipidaemia, diabetes, and metabolic syndrome. Further, large and well conducted RCTs are required.

*Source: Marjan Mahdavi-Roshan, Cardiovascular Diseases Research Center, Department Of Cardiology, Heshmat Hospital And Department Of Clinical Nutrition, School Of Medicine, Guilan University Of Medical Sciences, Rasht, Iran. 8. The Effect Of Probiotic And Synbiotic Supplementation On Lipid Parameters Among Patients With Cardiometabolic Risk Factors: A Systematic Review And Meta-Analysis Of Clinical Trials. Cardiovascular Research, Volume 119, Issue 4, April 2023, Pages 933–956. DOI: <https://doi.org/10.1093/cvr/cvac128>*

## **9. Modulating the Early-Life Gut Microbiota Using Pro-, Pre-, and Synbiotics to Improve Gut Health, Child Development and Growth**

In children exposed to poor hygiene and sanitation, invasion of the gut by pathogenic microbes can result in a subclinical enteropathy termed “environmental enteric dysfunction” (EED) that contributes to undernutrition, growth faltering, and impaired organ development. EED may already be present by age 6–12 weeks; therefore, interventions that can be started early in life, and used alongside breastfeeding, are needed to prevent or ameliorate EED.

A healthy gut microbiota is critical for intestinal development and repair, nutrient digestion and absorption, and resisting colonization or overgrowth by pathogens. However, its development can be impaired by several environmental factors. Hence, *dietary supplementation with pro-, pre-, or synbiotics is a safe and pragmatic approach to build gut microbiota resilience against adverse environmental factors and prevent future environmental enteric dysfunction.*

*Source: Benjamin Momo Kadia, Department Of Clinical Sciences, Liverpool School Of Tropical Medicine, Liverpool, United Kingdom. Modulating the Early-Life Gut Microbiota Using Pro-, Pre-, and Synbiotics to Improve Gut Health, Child Development and Growth. Nutrition Reviews, 11 May 2023; nuad050. DOI: <https://doi.org/10.1093/nutrit/nuad050>.*

## 10. **Limosilactobacillus Fermentum CECT5716: Clinical Potential Of A Probiotic Strain Isolated From Human Milk**

Breastfeeding provides the ideal nutrition for infants. Human milk contains a plethora of functional ingredients which foster the development of the immune system. The human milk microbiota predominantly contributes to the protective effect. This is mediated by various mechanisms, such as an antimicrobial effect, pathogen exclusion and barrier integrity, beneficial effects on the gastrointestinal microbiota, vitamin synthesis, immunity enhancement, secreted probiotic factors, and postbiotic mechanisms. Therefore, human milk is a good source for isolating probiotics for infants who cannot be exclusively breastfed. One such probiotic which was isolated from human milk is *Limosilactobacillus fermentum* CECT5716.

This review gives an overview of available interventional studies using *Limosilactobacillus fermentum* CECT5716 and summarized preclinical trials in several animal models of different pathologies, which have given first insights into its mechanisms of action. This review presents several randomized clinical studies, which have been conducted to investigate the clinical efficacy of the *Limosilactobacillus fermentum* CECT5716 strain in supporting the host's health.

*Source: Metehan Ozen, School Of Medicine, Acibadem Mehmet Ali Aydinlar University, Istanbul, Türkiye. Limosilactobacillus Fermentum CECT5716: Clinical Potential Of A Probiotic Strain Isolated From Human Milk. Nutrients 2023, 15(9), 2207. DOI: <https://doi.org/10.3390/nu15092207>.*

## 11. **Probiotics And Polycystic Ovary Syndrome: A Perspective For Management In Adolescents With Obesity**

The aim of this narrative review is to present a non-systematic analysis of the available literature on the topic of probiotics and Polycystic ovary syndrome (PCOS) in adolescents with obesity in order to revise the beneficial effects of probiotics/symbiotic supplementation on hormonal and metabolic profiles and inflammatory conditions.

The literature suggests that probiotic/symbiotic supplementation may ameliorate hormonal profiles, inflammatory indicators, and lipid metabolism disturbances caused by PCOS. This review also shows that improvement in weight, BMI, insulin, and HOMA-IR plays a potential role in protecting fertility. Further, studies are required.

*Source: Valentina Fabiano, Pediatric Department, Buzzi Children's Hospital And Department Of Biomedical And Clinical Science, University Of Milano, Milan, Italy. Probiotics And Polycystic Ovary Syndrome: A Perspective For Management In Adolescents With Obesity. Nutrients 2023, 15(14), 3144. DOI: <https://doi.org/10.3390/nu15143144>.*

## 12. **The Gut Microbiome, Mild Cognitive Impairment, And Probiotics: A Randomized Clinical Trial In Middle-Aged And Older Adults**

Advancing age coincides with changes in the gut microbiome and a decline in cognitive ability. Psychobiotics are microbiota-targeted interventions that can result in mental health benefits and protect the aging brain.

This study investigated the gut microbiome composition and predicted microbial functional pathways of middle-aged and older adults that met criteria for mild cognitive impairment (MCI), compared to neurologically healthy individuals, and investigated the impact of probiotic *Lactobacillus rhamnosus* GG (LGG) in a double-blind, placebo-controlled, randomized clinical trial.

A total of 169 community-dwelling middle-aged (52–59 years) and older adults (60–75 years) received a three-month intervention and were randomized to probiotic and placebo groups. Participants were further subdivided based on cognitive status into groups with intact or impaired cognition and samples were collected at baseline and post supplementation.

Through microbiome analysis researchers identified *Prevotella ruminicola*, *Bacteroides thetaiotaomicron*, and *Bacteroides xylanisolvens* as taxa correlated with MCI. Differential abundance analysis at baseline identified *Prevotella* as significantly more prevalent in MCI subjects compared to cognitively intact subjects. A decrease in the relative abundance of the genus *Prevotella* and *Dehalobacterium* in response to LGG supplementation in the MCI group was correlated with an improved cognitive score.

*Source: M. Andrea Azcarate Peril, Department Of Medicine, School Of Medicine, University Of North Carolina Chapel Hill, USA. The Gut Microbiome, Mild Cognitive Impairment, And Probiotics: A Randomized Clinical Trial In Middle-Aged And Older Adults. Clin Nutr., 2023 Nov;41(11):2565-2576. DOI: <https://doi.org/10.1016/j.clinu.2022.09.012>.*

## 13. **Gut Microbiota And Critically Ill Patients: Immunity And Its Modulation Via Probiotics And Immunonutrition**

This review article discusses the literature on gut microbiota composition, its derangement in critically ill patients, its pathophysiological role, and also describes the emerging opportunities arising from its modulation.

*Source: Ludovico Abenavoli, Department Of Health Sciences, University "Magna Graecia", Catanzaro, Italy. Gut Microbiota And Critically Ill Patients: Immunity And Its Modulation Via Probiotics And Immunonutrition. Nutrients 2023, 15(16), 3569. DOI: <https://doi.org/10.3390/nu15163569>.*

## 14. Outcome-Specific Efficacy Of Different Probiotic Strains And Mixtures In Irritable Bowel Syndrome: A Systematic Review And Network Meta-Analysis

Irritable bowel syndrome (IBS) is a common gastrointestinal disease. This network meta-analysis aimed to compare and rank the outcome-specific efficacy of different probiotic strains or combinations in adults with IBS. Randomized controlled trials (RCTs) that evaluated the efficacy of probiotics in IBS were included. In this study total, 9253 participants from 81 RCTs were included.

Researchers found that four probiotic strains and five mixtures were significantly superior to placebo in improving IBS Symptom Severity Scale, among which *Lactobacillus acidophilus* DDS-1 ranked first. A mixture containing five probiotics (SUCRA, 100%) ranked first in improving the IBS-Quality of life. *Bacillus coagulans* MTCC 5856 (SUCRA, 96.9%) and *Bacillus coagulans* Unique IS<sub>2</sub> (SUCRA, 92.6%) were among the most effective probiotics for improving abdominal pain.

Three probiotic strains and two mixtures were effective in alleviating abdominal bloating. Four probiotic strains and a mixture were significantly superior to placebo in reducing the bowel movement frequency in diarrhea-predominant IBS (IBS-D). *Bacillus coagulans* MTCC 5856 (SUCRA, 99.6%) and *Saccharomyces cerevisiae* CNCM I-3856 (SUCRA, 89.7%) were among the most effective probiotics for improving the Bristol stool form scale of IBS-D. Only some probiotics are effective for particular outcomes in IBS patients. This study provides the first ranking of outcome-specific efficacy of different probiotic strains and combinations in IBS. Further studies are needed to confirm these results.

Source: Lishou Xiong, Department Of Gastroenterology, The First Affiliated Hospital Of Sun Yat-Sen University, Guangzhou, China. Outcome-Specific Efficacy Of Different Probiotic Strains And Mixtures In Irritable Bowel Syndrome: A Systematic Review And Network Meta-Analysis. *Nutrients* 2023, 15(17), 3856. DOI: <https://doi.org/10.3390/nu15173856>.

## 15. Effects Of Probiotic Administration On Overweight Or Obese Children: A Meta-Analysis And Systematic Review

This review showed that probiotics might have a role in regulating high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), adiponectin, leptin and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) in overweight or obese children. Further this systematic review yielded that probiotics might regulate lipid metabolism and improve obesity associated symptoms by some paths.

Source: Lili Wu, Key Laboratory Of Health Cultivation Of Traditional Chinese Medicine, The Ministry Of Education, Beijing University Of Chinese Medicine, Beijing, China. Effects Of Probiotic Administration On Overweight Or Obese Children: A Meta-Analysis And Systematic Review. *J Transl Med* 21, 525 (2023). DOI: <https://doi.org/10.1186/s12967-023-04319-9>.

## 16. Probiotics: Mechanism Of Action, Health Benefits And Their Application In Food Industries

This review discusses the recent advances in the health benefits of probiotics and the emerging applications of probiotics in the food industry.

Source: Tuba Esatbeyoglu, Department Of Human Nutrition And Dietetics, School Of Food And Agricultural Sciences, University Of Management And Technology, Lahore, Pakistan And State Key Laboratory Of Food Science And Technology, Jiangnan University, Wuxi, China. Probiotics: Mechanism Of Action, Health Benefits And Their Application In Food Industries. *Front. Microbiol.* 14:1216674. DOI: 10.3389/fmicb.2023.1216674.

## 17. Probiotics With Low Dose Vitamin C Reduce Antibiotic Prescriptions In Children: A Secondary Analysis Of A Multicentre Randomised Double-Blind Placebo-Controlled Trial

As part of a randomised, double-blind, placebo-controlled study in children looking at the impact of a combination of a multistrain probiotic and vitamin C on upper respiratory tract infection symptoms, recently researchers explored antibiotic prescription during the study. Antibiotic usage in children for acute respiratory tract infections is quite widespread. In this study the incidence rates for oral antibiotic prescriptions were significantly reduced in the Lab4 probiotic/vitamin C group compared to the placebo; children had a lower risk of being prescribed antibiotics. These data suggest that supplementation with the probiotic/vitamin C may help to reduce antibiotic prescriptions in children.

Source: Jana Muchová, Nstitute Of Medical Chemistry, Biochemistry And Clinical Biochemistry, Faculty Of Medicine, Comenius University, Slovakia. Probiotics With Low Dose Vitamin C Reduce Antibiotic Prescriptions In Children: A Secondary Analysis Of A Multicentre Randomised Double-Blind Placebo-Controlled Trial. *Journal of Functional Foods*, Volume 106, July 2023, 105625. DOI: <https://doi.org/10.1016/j.jff.2023.105625>.

## 18. Designer Probiotics: Opening The New Horizon In Diagnosis And Prevention Of Human Diseases

This review provides an overview of the *different functional aspects* of the designer probiotics and their effectiveness on different diseases and also emphasizes their limitations and future implications.

Source: Ashok K. Yadav, Centre For Molecular Biology, Central University Of Jammu, Samba, Jammu And Kashmir (UT), India. Designer Probiotics: Opening The New Horizon In Diagnosis And Prevention Of Human Diseases. *Journal Of Biotechnology And Bioengineering*, Volume121, Issue1, January 2024. DOI: <https://doi.org/10.1002/bit.28574>

## 19. A Review On The Benefits Of Probiotics As Fermented Food Against Several Diseases

Fermentation is a natural process when microorganisms such as yeast and bacteria convert carbohydrates such as starch and sugar into alcohol or acid. Some fermented products from microorganisms can be processed into foods that can be consumed and provide good health effects for the body.

Fermented foods such as kefir, tempeh, natto, and kimchi are foods that produce probiotic bacteria, which are good bacteria that have a beneficial effect on the host when consumed in sufficient quantities (about 10<sup>8</sup>–10<sup>11</sup> CFU/mL). If probiotics are consumed in combination with prebiotics, they will have a synergistic effect called "synbiotics" and will increase the benefits of probiotics. Several in vitro, in vivo, and clinical studies have shown that probiotics can help with diseases like diarrhea, high cholesterol, diabetes, colon cancer, and dyslipidemia.

*Source: Nasri Nasri, Department Of Pharmacy, Sekolah Tinggi Ilmu Kesehatan (Stikes) Senior Medan. A Review On The Benefits Of Probiotics As Fermented Food Against Several Diseases. J. Functional Food & Nutraceutical, 5(1), 2023, pp.41-52. DOI: 10.33555/jffn.v5i1.110.*

## 20. Probiotic Potential Of Fermented Foods And Their Role In Non-Communicable Diseases Management: An Understanding Through Recent Clinical Evidences

This review aims to cumulate the current research and development carried out on fermented foods, probiotic potential, and their mechanism in managing selected Non-communicable diseases (NCDs).

*Source: Sourav Misra, Chemical Engineering Department, Indian Institute Of Technology Madras, Chennai, Tamil Nadu India. Probiotic Potential Of Fermented Foods And Their Role In Non-Communicable Diseases Management: An Understanding Through Recent Clinical Evidences. Food Chemistry Advances, Volume 3, December 2023, 100381. DOI: <https://doi.org/10.1016/j.focha.2023.100381>.*

## 21. Association Of Habitual Intake Of Probiotic Supplements And Yogurt With Characteristics Of The Gut Microbiome In The Multiethnic Cohort Adiposity Phenotype Study

Consumption of probiotics and/or yogurt could be a solution for restoring the balance of the gut microbiota. This study examined associations of regular intake of probiotic supplements or yogurt with the gut microbiota among a diverse population of older adults (N=1,861; 60–72 years).

Compared to non-yogurt consumers (N=1,023), regular yogurt consumers ( $\geq$ once/week, N=818) had greater *Streptococcus* and lower *Odoribacter* abundance. The associations were consistent across the five ethnic groups (Japanese Americans, African Americans, Native Hawaiians, Latinos and White) but stronger among Japanese Americans.

Regular intake of probiotic supplements was not associated with microbial characteristics (i.e., alpha diversity and the abundance of 152 bacteria genera). *Streptococcus* is one of the predominant bacteria genera in yogurt products, which may explain the positive association between yogurt consumption and *Streptococcus* abundance. This study suggests that changes in *Odoribacter* were independent of changes in *Streptococcus* abundance. Future, studies are required.

*Source: Weiwen Chai, Department Of Nutrition And Health Sciences, University Of Nebraska-Lincoln, Lincoln, NE, USA. Association Of Habitual Intake Of Probiotic Supplements And Yogurt With Characteristics Of The Gut Microbiome In The Multiethnic Cohort Adiposity Phenotype Study. Gut Microbiome. 2023;4:e14. DOI:10.1017/gmb.2023.10.*

## 22. Synergy And Oxygen Adaptation For Development Of Next-Generation Probiotics

The human gut microbiota has gained interest as an environmental factor that may contribute to health or disease. The development of next-generation probiotics is a promising strategy to modulate the gut microbiota and improve human health; however, several key candidate next-generation probiotics are strictly anaerobic and may require synergy with other bacteria for optimal growth. *Faecalibacterium prausnitzii* is a highly prevalent and abundant human gut bacterium associated with human health, but it has not yet been developed into probiotic formulations.

This study describes the co-isolation of *F. prausnitzii* and *Desulfovibrio piger*, a sulfate-reducing bacterium, and their cross-feeding for growth and butyrate production. To produce a next-generation probiotic formulation, researchers adapted *F. prausnitzii* to tolerate oxygen exposure, and, in proof-of-concept studies, they demonstrated that the symbiotic product is tolerated by mice and humans and is detected in the human gut in a subset of study participants.

This study describes a technology for the production of next-generation probiotics based on the adaptation of strictly anaerobic bacteria to tolerate oxygen exposures without a reduction in potential beneficial properties. The technology may be used for the development of other strictly anaerobic strains as next-generation probiotics.

*Source: Fredrik Bäckhed, Wallenberg Laboratory, Department Of Molecular And Clinical Medicine, Institute Of Medicine, University Of Gothenburg, Gothenburg, Sweden. Synergy And Oxygen Adaptation For Development Of Next-Generation Probiotics. Nature 620, 381–385 (2023). DOI: <https://doi.org/10.1038/s41586-023-06378-w>.*

### 23. Safety Assessment And Probiotic Potential Comparison Of Bifidobacterium Longum Subsp. Infantis BLI-02, Lactobacillus Plantarum LPL28, Lactobacillus Acidophilus TYCA06, And Lactobacillus Paracasei ET-66

*Bifidobacterium longum subsp. infantis BLI-02, Lactobacillus paracasei ET-66, Lactobacillus plantarum LPL28, and Lactobacillus acidophilus TYCA06*, isolated from healthy breast milk, miso, and the healthy human gut, were assessed for safety in this study.

BLI-02, LPL28, TYCA06, and ET-66 exhibited no antibiotic resistance and mutagenic activity in the Ames test at the highest dosage (5000 µg/plate). No genotoxicity was observed in micronucleus and chromosomal aberration assays in rodent spermatogonia at the maximum dosage of 10 g/kg body weight (BW). No acute and sub-chronic toxicity occurred in mice and rats at the maximum tested dosage of 10 g/kg BW and 1.5 g/kg BW, respectively. The lyophilized powder of these strains survived a low pH and high bile salt environment, adhering strongly to Caco-2 cells. Unique antimicrobial activities were noted in these strains, with BLI-02 demonstrating the best growth inhibition against *Vibrio parahaemolyticus*, LPL28 exhibiting the best growth inhibition against *Helicobacter pylori*, and ET-66 showing the best growth inhibition against *Aggregatibacter actinomycetemcomitans*.

The present study shows that the lyophilized powder of these four strains appears to be a safe probiotic supplement at tested dosages.

Source: Hsieh-Hsun Ho, Research Product Department; Functional Investigation Department And Process Department, R&D Center, Glac Biotech Co., Ltd., Taiwan. Safety Assessment And Probiotic Potential Comparison Of Bifidobacterium Longum Subsp. Infantis BLI-02, Lactobacillus Plantarum LPL28, Lactobacillus Acidophilus TYCA06, And Lactobacillus Paracasei ET-66. *Nutrients* 2024, 16(1), 126. DOI: <https://doi.org/10.3390/nu16010126>

### 24. Efficacy Of Bifidobacterium Animalis Subsp. Lactis BL-99 In The Treatment Of Functional Dyspepsia: A Randomized Placebo-Controlled Clinical Trial

Current treatment for *functional dyspepsia (FD)* has limited and unsustainable efficacy. Probiotics have the sustainable potential to alleviate FD. This randomized controlled clinical trial assigned 200 FD patients to receive placebo, positive-drug (rabeprazole), or *Bifidobacterium animalis subsp. lactis* BL-99 (BL-99; low, high doses) for 8-week.

The CRR in FD score for the BL-99\_high group [45 (90.0%)] was significantly higher than that for placebo [29 (58.0%),  $p=0.001$ ], BL-99\_low [37 (74.0%),  $p=0.044$ ] and positive\_control [35 (70.0%),  $p=0.017$ ] groups after 8-week treatment. This effect was sustained until 2-week after treatment but disappeared 8-week after treatment. Further metagenomic and metabolomics revealed that BL-99 promoted the accumulation of short chain fatty acids (SCFA)-producing microbiota and the increase of SCFA levels in stool and serum, which may account for the increase of serum gastrin level. *This study supports the potential use of BL-99 for the treatment of FD.*

Source: Fazheng Ren, Key Laboratory Of Functional Dairy, Co-Constructed By Ministry Of Education And Beijing Government, Department Of Nutrition And Health, China Agricultural University, Beijing, China. Efficacy Of Bifidobacterium Animalis Subsp. Lactis BL-99 In The Treatment Of Functional Dyspepsia: A Randomized Placebo-Controlled Clinical Trial. *Nat Commun* 15, 227 (2024). DOI: <https://doi.org/10.1038/s41467-023-44292-x>.

### 25. Effect Of Probiotic Supplementation On Intestinal Permeability In Overweight And Obesity: A Systematic Review Of Randomized Controlled Trials And Animal Studies

This systematic review aimed to summarize findings from both animal and clinical studies that evaluated the effect of probiotic supplementation on obesity-induced impairment in intestinal permeability.

A literature search was conducted using PubMed (Medline), Web of Science, and CAB Direct from origin until August 2023 using keywords of intestinal permeability, overweight or obesity, and probiotic supplementation.

Out of 920 records, 26 eligible records were included, comprising 12 animal and 14 clinical studies. Clinical trials ranged from 3 to 26 week and were mostly parallel-arm ( $n = 13$ ) or crossover ( $n = 1$ ) design. In both animal and clinical studies, plasma/serum lipopolysaccharide (LPS) was the most common measure of intestinal permeability.

*Eleven of 12 animal studies reported a positive effect of probiotic supplementation in reducing intestinal permeability.* However, results from clinical trials were inconsistent, with half reporting reductions in serum LPS and half reporting no differences after probiotic supplementation. *Bifidobacterium, Lactobacillus, and Akkermansia* emerged as the most common genera in probiotic formulations among the animal and clinical studies that yielded positive results, suggesting that specific bacteria may be more effective at reducing intestinal permeability and improving gut barrier function. However, better standardization of strain use, dosage, duration, and the delivery matrix is needed to fully understand the probiotic impact on intestinal permeability in individuals with overweight and obesity.

Source: Connie J Rogers, Department Of Nutritional Sciences, College Of Family And Consumer Sciences, University Of Georgia, Athens, Ga, United States. Effect Of Probiotic Supplementation On Intestinal Permeability In Overweight And Obesity: A Systematic Review Of Randomized Controlled Trials And Animal Studies. *Advances In Nutrition*, Volume 15, Issue 1, January 2024, 100162. DOI: <https://doi.org/10.1016/j.advnut.2023.100162>.

## 26. Association Between Nonfood Pre- Or Probiotic Use And Cognitive Function: Results From NHANES 2011–2014

In this study, researchers collected data from the National Health and Nutrition Examination Survey (NHANES) for the years 2011–2014. Multiple linear regression and logistic regression were used to analyse the association between nonfood pro- or prebiotic use and cognitive function among elderly Americans.

Study result shows that male participants who used nonfood pro- or prebiotics tended to have higher comprehensive cognitive function with a  $\beta$ -coefficient of 0.64. Probiotics or prebiotics may be a protective factor against cognitive impairment in males, with an odds ratio of 0.08. Furthermore, the average treatment effect for the treated (ATT) with nonfood pro- or prebiotics (0.555) on sum.z in males was statistically significant. This study revealed that nonfood pre- or probiotic use was an effective method to improve cognitive function in elderly men from the USA.

*Source: Jingyi Chen, Institute Of Precision Medicine, The First Affiliated Hospital Of Shantou University Medical College, Shantou And Department Of Clinical Pharmacology, Xiangya Hospital, Central South University, Changsha, China. Association Between Nonfood Pre- Or Probiotic Use And Cognitive Function: Results From NHANES 2011–2014. Nutrients 2023, 15(15), 3408. DOI: <https://doi.org/10.3390/nu15153408>.*

## 27. Lactate Limits CNS Autoimmunity By Stabilizing HIF-1 $\alpha$ In Dendritic Cells

This study used single-cell and bulk transcriptional and metabolic analyses in combination with cell-specific gene perturbation studies, they identified a regulatory loop of negative feedback that operates in Dendritic Cells (DCs) to limit immunopathology.

*Researchers found that lactate, produced by activated DCs and other immune cells, boosts the expression of NDUFA4L2 through a mechanism mediated by hypoxia-inducible factor 1 $\alpha$  (HIF-1 $\alpha$ ). NDUFA4L2 limits the production of mitochondrial reactive oxygen species that activate XBP1-driven transcriptional modules in DCs that are involved in the control of pathogenic autoimmune T cells.*

*Scientists also engineered a probiotic that produces lactate and suppresses T cell autoimmunity through the activation of HIF-1 $\alpha$ –NDUFA4L2 signalling in DCs. Investigators team identified an immunometabolic pathway that regulates DC function, and developed a synthetic probiotic for its therapeutic activation.*

*Source: Francisco J. Quintana, Ann Romney Center For Neurologic Diseases, Harvard Medical School, Brigham And Women's Hospital, Boston And Broad Institute Of MIT And Harvard, Cambridge, MA, USA. Lactate Limits CNS Autoimmunity By Stabilizing HIF-1 $\alpha$  In Dendritic Cells. Nature 620, 881–889 (2023). DOI: <https://doi.org/10.1038/s41586-023-06409-6>.*

## 28. Potential Antitumor Effect Of Functional Yogurts Formulated With Prebiotics From Cereals And A Consortium Of Probiotic Bacteria

In this study various types of functional yogurts were obtained from normalized milk (with normalized lipid content) and a standardized probiotic consortium of probiotic bacteria named ABY3. All the types of yogurts obtained contained prebiotics from black or red rice; malt of barley, rye, wheat; or wheat bran.

The physico-chemical analyses of all the functionalized products obtained shows that all of them met the quality standard for yogurt products. However, the sensorial analyses shows that the products obtained from black and red rice were of very good quality. The biological analyses indicated that all the types of products contained live probiotic bacteria, but wheat bran and red rice could increase their numbers.

Further tests performed on tumor cell line Caco-2 with corresponding postbiotics revealed that cytotoxicity was greater than 30% after 48 h of exposure in the case of yogurts obtained from milk with 0.8% lipid content and red rice or blond malt of barley whereas in the case of yogurts derived from milk with 2.5% lipid content shows that only the variants that contained blond malt of rye or wheat became cytotoxic against the Caco-2 cell line.

*Source: Nicoleta Radu, Faculty Of Biotechnology, University Of Agronomic Sciences And Veterinary Medicine Of Bucharest And Department Of Biotechnology, National Institute Of Chemistry And Petrochemistry R&D Of Bucharest Romania, Bucharest, Romania. Potential Antitumor Effect Of Functional Yogurts Formulated With Prebiotics From Cereals And A Consortium Of Probiotic Bacteria. Foods 2023, 12(6), 1250; <https://doi.org/10.3390/foods12061250>.*

## 29. Probiogenomic Analysis Of Lactiplantibacillus Sp. LM14-2 From Fermented Mussel (Hoi-Dong), And Evaluation Of Its Cholesterol-Lowering And Immunomodulation Effects

*Lactiplantibacillus sp. LM14-2*, isolated from Thai-fermented mussel (Hoi-dong), showed attractive probiotic properties. This strain was identified as *Lactiplantibacillus plantarum* based on its phenotypic, chemotaxonomic, and genetic characteristics including whole-genome sequencing (WGS). This study suggested that *L. plantarum* LM14-2 is considered safe with potential probiotic properties and health-promoting impacts, which could facilitate its probiotic application.

*Source: Somboon Tanasupawat, Department Of Biochemistry And Microbiology, Faculty Of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand. Probiogenomic Analysis Of Lactiplantibacillus Sp. LM14-2 From Fermented Mussel (Hoi-Dong), And Evaluation Of Its Cholesterol-Lowering And Immunomodulation Effects. Probiotics & Antimicro. Prot. 15, 1206–1220 (2023). DOI: <https://doi.org/10.1007/s12602-022-09977-7>.*

### 30. Development of Thermotolerant Lactobacilli Cultures with Improved Probiotic Properties Using Adaptive Laboratory Evolution Method

This study aimed to develop thermotolerant strains of *Lacticaseibacillus casei* N (N) and *Lactobacillus helveticus* NRRL B-4526 (H) by acclimatizing the wild-type strains to the higher temperature of 45 °C by adaptive laboratory evolution.

Researchers observed a two-fold increase in biomass in both acclimatized strains up to the 200th generation, which subsequently remained stable after 500 generations. The morphological change of these acclimatized strains was observed under scanning electron microscopy. Also, there was an increase in probiotic attributes of these acclimatized strains compared to their wild-types.

Among two acclimatized strains, *L. casei* N-45 showed higher tolerance in the acidic pH 3.0 (89.31%), the bile of 0.3% (84.45%), simulated gastric juice (79.12%), and simulated intestinal juice (73.86%). There was also an increase in salt tolerance (NaCl), radical scavenging activity, autoaggregation, coaggregation, and hydrophobicity of these adapted strains.

The total protein profiling using 2D gel electrophoresis revealed the differences in protein expressions between wild-type and acclimatized strains. Specific protein spots from acclimatized strains of H-45 and N-45 were further subjected to MALDI-TOF MS/MS. Some of the identified proteins were recognized to play a role in RNA chaperones and protein synthesis during stress conditions.

*Source: Somashekar Devappa, Microbiology And Fermentation Technology Department, CSIR-Central Food Technological Research Institute, Mysore, Karnataka, India. Development of Thermotolerant Lactobacilli Cultures with Improved Probiotic Properties Using Adaptive Laboratory Evolution Method. Probiotics & Antimicro. Prot. 15, 832-843 (2023). DOI: <https://doi.org/10.1007/s12602-021-09892-3>.*

### 31. Encapsulation Of Probiotics With Poly-Γ-Glutamic Acid Alters Gut Microbiota And Short-Chain Fatty Acid Content By Maintaining Cell Viability In The Gastrointestinal Tract

The present study demonstrates that *poly-γ-glutamic acid* (*γ-PGA*) encapsulation maintains the *viability of probiotics in the gastrointestinal tract of the host*, while providing beneficial effects on changes in the gut microbiota and short-chain fatty acids (SCFA) content.

*Source: Jong Min Lee, Department Of Biotechnology, Pukyong National University, South Korea. Encapsulation Of Probiotics With Poly-Γ-Glutamic Acid Alters Gut Microbiota And Short-Chain Fatty Acid Content By Maintaining Cell Viability In The Gastrointestinal Tract. Journal Of Food Hydrocolloids, Volume 147, Part A, February 2024, 109328. DOI: <https://doi.org/10.1016/j.foodhyd.2023.109328>.*

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