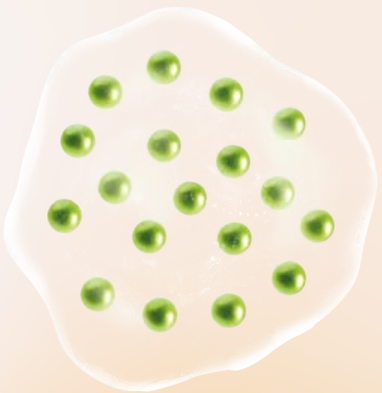
EDA Biotic®

Sinergia Probiótica

Prebióticos Inulina y FOS

Inulina

FOS



TECNOLOGÍA
PROBIÓTICA EUROPEA

El concepto de prebiótico ha evolucionado, pero un consenso actual lo define como un sustrato que es selectivamente utilizado por microorganismos del huésped y confiere un beneficio para la salud [53]. No todos los carbohidratos dietarios cumplen este criterio; deben resistir la digestión en el tracto gastrointestinal superior, llegar intactos al colon y ser fermentados por bacterias específicas como *Bifidobacterium* o *Lactobacillus*, generando metabolitos como los ácidos grasos de cadena corta (SCFA) que tienen efectos beneficiosos locales y sistémicos [54]. Entre los prebióticos aceptados formalmente por la Asociación Científica Internacional de Probióticos y Prebióticos (ISAPP por sus siglas en inglés) se encuentran los fructanos tipo inulina (ITF), los galactooligosacáridos y la lactulosa [55].

Para que un compuesto sea considerado un prebiótico debe cumplir con varios criterios bien establecidos. En primer lugar, debe resistir la digestión gástrica y en el intestino delgado, de manera que llegue intacto al colon [56]; además, debe ser fermentado selectivamente por la microbiota colónica, favoreciendo el crecimiento de microorganismos beneficiosos [57]. Otro requisito fundamental es la producción de metabolitos con efectos positivos, como los ácidos grasos de cadena corta (SCFA), que contribuyen a la salud intestinal y sistémica [57]. Finalmente, es necesario que se demuestren efectos beneficiosos en estudios realizados en humanos, lo cual asegura la relevancia clínica de su acción [58].

Dentro de las alternativas de prebióticos se encuentra la inulina, un polisacárido de la familia de los fructanos, constituido por cadenas lineales de unidades de fructosa con un extremo terminal de glucosa, enlazadas principalmente por uniones β(2->1), como puede verse en la Figura 7 [59].

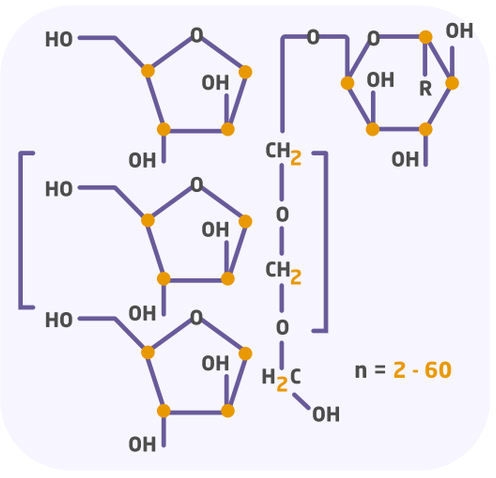


Figura 7. Estructura química de la inulina (fructanos tipo inulina), estructura elaborada con base en la información [59].

Su grado de polimerización (DP) varía entre 2 y 60, alcanzando hasta 100 según la fuente vegetal [60]. Según la longitud de la cadena se distinguen: oligofructosa (DP <10), inulina nativa (DP 2-60) e inulina HP (DP >10) [58].

Esta estructura química le otorga propiedades funcionales como solubilidad diferencial, capacidad de formar geles, resistencia a la hidrólisis enzimática y estabilidad térmica, lo que la hace útil como fibra dietaria, reemplazo de azúcares y grasas en la industria alimentaria [57].

La inulina se encuentra en más de 30,000 especies vegetales, especialmente en raíces, tubérculos y bulbos [61], entre ellas las más representativas se muestran en la Figura 8. Las principales fuentes vegetales de inulina incluyen la achicoria (*Cichorium intybus*), cuya raíz contiene entre 15 y 20% de este fructano y es ampliamente utilizada a nivel industrial [62]. Otra fuente destacada es el topinambur o alcachofa de Jerusalén (*Helianthus tuberosus*), un tubérculo que aporta entre 14 y 18% de inulina [63].

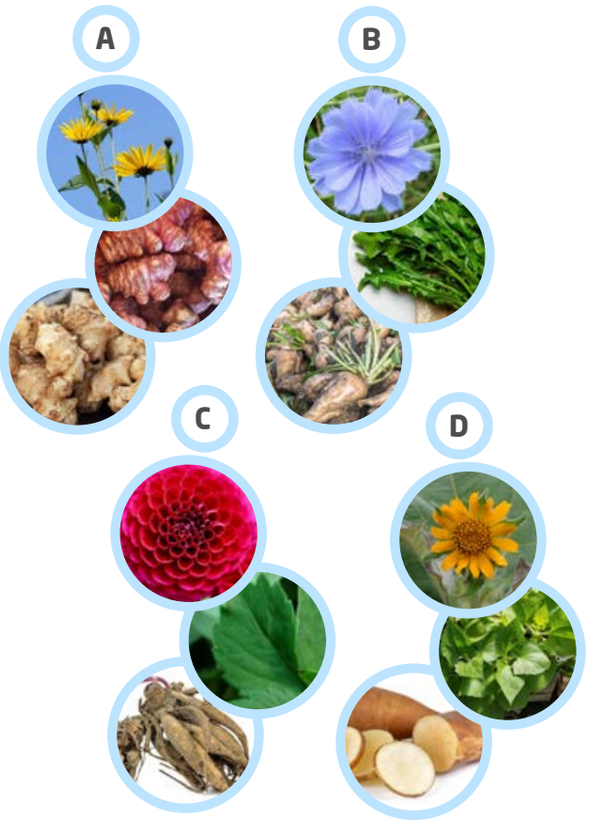


Figura 8. Principales fuentes vegetales comerciales de inulina. Alcachofa de Jerusalén (a), Achicoria (b), Dalia (c), Yacón (d) [60].

Asimismo,dalia (*Dahlia pinnata*) constituye un tubérculo con más del 10% de inulina, empleado incluso en aplicaciones farmacéuticas [57]. Finalmente, el Yacón (*Polymnia sonchifolia*), originario de Sudamérica, se distingue por sus raíces con un contenido de inulina que oscila entre 13 y 14%

Otros alimentos comunes que aportan inulina en la dieta diaria son ajo, cebolla, puerro, espárrago, trigo, cebada, centeno, plátano y alcachofa [60].

Las fibras dietarias como la inulina son productos naturales de las plantas que pueden extraerse mediante la disgregación del producto vegetal intacto, acumulando el material deseado y seguido de otros procesos externos y químicos. La inulina o los polímeros de fructosa, junto con otros carbohidratos como la glucosa, están encapsulados por la pectina, la celulosa y la hemicelulosa de la pared celular vegetal. Se encuentran rodeados por una red compleja [65]. Por lo tanto, la separación de la inulina del material completo requiere un conocimiento adecuado de su localización y de la metodología a aplicar, que permita degradar los componentes no deseados y lograr así el aislamiento del producto requerido [57]. La localización de la inulina en el producto vegetal se muestra en la Figura 9.

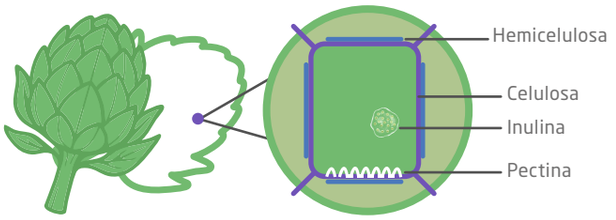


Figura 9. Localización de la inulina [57].

La evidencia en humanos y modelos animales respalda a la inulina como uno de los prebióticos más efectivos. Diversos ensayos clínicos muestran que su consumo puede inducir cambios significativos en las proporciones de la población microbiana después de la suplementación prebiótica durante 2 semanas (3 a 5 g/día de inulina), tal como lo muestra la Figura 10 [60]. Adicionalmente, se conoce que la inulina ejerce múltiples efectos benéficos como prebiótico. En primer lugar, modula la microbiota intestinal, favoreciendo el crecimiento de géneros como *Lactobacillus y Faecalibacterium prausnitzii* [55]. Estos cambios se asocian con mejoras en parámetros metabólicos, entre ellos, la sensibilidad a la insulina, el perfil lipídico y la reducción de triglicéridos [55].

Asimismo, la inulina ha mostrado potenciar la absorción de minerales como calcio y magnesio, lo que repercute positivamente en la salud ósea [57]. Finalmente, contribuye a la saciedad y al control del peso corporal, ya que la fermentación colónica produce ácidos grasos de cadena corta (SCFA) capaces de estimular hormonas reguladoras del apetito como GLP-1 y PYY [57].

Por su parte, los fructooligosacáridos (FOS) constituyen uno de los prebióticos más estudiados y se caracterizan por ser carbohidratos de bajo contenido calórico, solubles en agua y resistentes a la digestión en el intestino delgado [66]. Su estructura se basa en una unidad de glucosa unida a dos o más residuos de fructosa mediante enlaces β (2-1) o β (2-6), con ejemplos representativos como 1-kestosa, nistosa y fructofuranosil-nistosa [67].

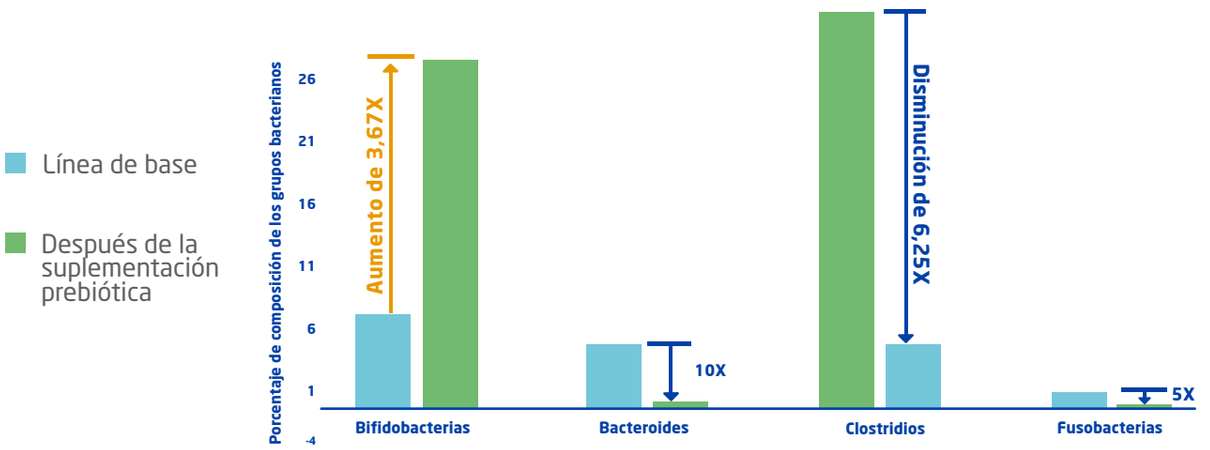


Figura 10. Cambios en las proporciones de la población microbiana después de la suplementación prebiótica durante 2 semanas (3 a 5 g/día de inulina): Regulación a la baja de *Bacteroides, Clostridia* y *Frusobacteria* y regulación al alta de *Bifidobacterias* [60].

Una vez alcanzan el colon, son fermentados por la microbiota intestinal generando ácidos grasos de cadena corta, lactato y otros metabolitos con efectos beneficiosos para la salud [68]. Estos compuestos promueven el crecimiento selectivo de bacterias como *Bifidobacterium* y *Lactobacillus*, inhiben la proliferación de microorganismos patógenos y se han asociado a mejoras en parámetros metabólicos y gastrointestinales, incluyendo la reducción de colesterol, la absorción de minerales como calcio y magnesio y la regulación del tránsito intestinal [66,69]. Diversos estudios han documentado su utilidad en la prevención y manejo de enfermedades como la obesidad, la diabetes tipo 2, las enfermedades cardiovasculares, el cáncer de colon y los trastornos inflamatorios intestinales [70].

Entre sus fuentes naturales destacan especies vegetales como trigo, cebolla, ajo, centeno, tomate, espárrago, achicoria, plátano y topinambur; gracias a estas propiedades, los FOS se emplean comercialmente como ingrediente funcional en la industria alimentaria [70]. Su inclusión en fórmulas infantiles, productos lácteos y panificados responde tanto a su capacidad prebiótica como a su contribución tecnológica, dado que mejoran la textura, el perfil sensorial y la retención de agua, a la vez que proporcionan un dulzor moderado equivalente al 30–40% del de la sacarosa [69].

Bibliografía

[1] M. Kumar Yadav, I. Kumari, B. Singh, K. Kant Sharma, and S. Kumar Tiwari, "MINI-REVIEW Probiotics, prebiotics and synbiotics: Safe options for next-generation therapeutics", doi: 10.1007/s00253-021-11646-8/Published.
[2] G. Olveira and I. González-Molero, "ENDOCRINOLOGÍA Y NUTRICIÓN An update on probiotics, prebiotics and symbiotics in clinical nutrition," 2016. [Online]. Available: www.elsevier.es/endo
[3] E. Metchnikoff, The prolongation of life: Optimistic studies, GP Putnam and sons. London y UK, 1907.
[4] D. M. Lilly and R. H. Stillwell, "Probiotics: Growth-Promoting Factors Produced by Microorganisms," Science (1979), vol. 147, no. 3659, pp. 747–748, Feb. 1965, doi: 10.1126/SCIENCE.147.3659.747.
[5] R. Fuller, "History and development of probiotics," Probiotics, pp. 1–8, 1992, doi: 10.1007/978-94-011-2364-8_1.
[6] R. F. AFRC, "Probiotics in man and animals," 1989. doi: 10.1111/j.1365-2672.1989.tb05105.x.
[7] "INFORME Consulta de Expertos FAO/OMS sobre Evaluación de las Propiedades Saludables y Nutricionales de los Probióticos en los Alimentos, incluida la Leche en Polvo con Bacterias Vivas del Ácido Láctico Córdoba, Argentina 1-4 de octubre de 2001 Organización de las Naciones Unidas para la Agricultura y la Alimentación Organización Mundial de la Salud."
[8] G. R. Gibson and M. B. Roberfroid, "Dietary Modulation of the Human Colonic Microbiota: Introducing the Concept of Prebiotics," J Nutr, vol. 125, no. 6, pp. 1401–1412, Jun. 1995, doi: 10.1093/JN/125.6.1401.
[9] X. Lou, J. Xue, R. Shao, C. Mo, F. Wang, and G. Chen, "Postbiotics as potential new therapeutic agents for sepsis," 2023, Oxford University Press. doi: 10.1093/burnst/tkad022.
[10] L. A. Whyte and H. R. Jenkins, "Pathophysiology of diarrhoea."
[11] OMS, "fact sheets diarrhoeal disease OMS."
[12] G. Vasco et al., "Identifying etiological agents causing diarrhea in low income Ecuadorian communities," American Journal of Tropical Medicine and Hygiene, vol. 91, no. 3, pp. 563–569, Sep. 2014, doi: 10.4269/ajtmh.13-0744.
[13] C. E. Peñaherrera Lozada, "Enfermedad Diarreica aguda en Ecuador en el periodo 2017-2022. Revisión sistemática," in Investigación en Ciencias de la Salud desde la academia. Tomo 2, Red Editorial Latinoamericana de Investigación Contemporánea, 2023. doi: 10.58995/lb.redlic.11.98.
[14] J. D. Miller, M. Belén Ocampo Ordóñez, I. Headley, H. Wasser, and A. L. Thompson, "Poor water quality and food insecurity in Ecuador: Disparities in exposure and associations with young child feeding practices," J Acad Nutr Diet, Jul. 2025, doi: 10.1016/j.jand.2025.06.274.
[15] M. Arumugam et al., "Enterotypes of the human gut microbiome," Nature, vol. 473, no. 7346, pp. 174–180, May 2011, doi: 10.1038/nature09944.
[16] G. A. Weiss and T. Hennet, "Mechanisms and consequences of intestinal dysbiosis," Aug. 01, 2017, Birkhauser Verlag AG. doi: 10.1007/s00018-017-2509-x.
[17] S. R. Gill et al., "Metagenomic Analysis of the Human Distal Gut Microbiome\r10.1126/science.1124234," Science (1979), vol. 312, no. 5778, pp. 1355–1359, 2006, [Online]. Available: http://www.sciencemag.org/cgi/content/abstract/312/5778/1355
[18] S. Monira et al., "Short-chain fatty acids and commensal microbiota in the faeces of severely malnourished children with cholera rehydrated with three different carbohydrates," Eur J Clin Nutr, vol. 64, no. 10, pp. 1116–1124, Oct. 2010, doi: 10.1038/ejcn.2010.123.
[19] M. J. García Mansilla et al., "Exploring Gut Microbiota Imbalance in Irritable Bowel Syndrome: Potential Therapeutic Effects of Probiotics and Their Metabolites," Jan. 01, 2025, Multidisciplinary Digital Publishing Institute (MDPI). doi: 10.3390/nu17010155.
[20] S. E. Winter et al., "Gut inflammation provides a respiratory electron acceptor for Salmonella," Nature, vol. 467, no. 7314, pp. 426–429, Sep. 2010, doi: 10.1038/nature09415.
[21] M. Hensel, A. P. Hinsley, T. Nikolaus, G. Sawers, and B. C. Berks, "The genetic basis of tetrathionate respiration in Salmonella typhimurium," Mol Microbiol, vol. 32, no. 2, pp. 275–287, 1999, doi: 10.1046/j.1365-2958.1999.01345.x.
[22] M. Pop et al., "Diarrhea in young children from low-income countries leads to large-scale alterations in wintestinal microbiota composition," Genome Biol, vol. 15, no. 6, Jun. 2014, doi: 10.1186/gb-2014-15-6-r76.
[23] L. Capurso, "Thirty Years of Lactobacillus rhamnosus GG A Review," Mar. 01, 2019, Lippincott Williams and Wilkins. doi: 10.1097/MCG.0000000000001170.
[24] P. , H. C. & R. R. Cotter, "Bacteriocins: develo-

ping innate immunity for food. Nat Rev Microbiol 3, 777–788 (2005)".
[25] S. I. Patzer, M. R. Baquero, D. Bravo, F. Moreno, and K. Hantke, "The colicin G, H and X determinants encode microcins M and H47, which might utilize the catecholate siderophore receptors FepA, Cir, Fiu and IronN," Microbiology (N Y), vol. 149, no. 9, pp. 2557–2570, Sep. 2003, doi: 10.1099/mic.0.26396-0.
[26] S. Kommineni et al., "Bacteriocin production augments niche competition by enterococci in the mammalian gastrointestinal tract," Nature, vol. 526, no. 7575, pp. 719–722, Oct. 2015, doi: 10.1038/nature15524.
[27] M. Papagianni and S. Anastasiadou, "Pediocins: The bacteriocins of Pediococci. Sources, production, properties and applications," 2009, BioMed Central Ltd. doi: 10.1186/1475-2859-8-3.
[28] D. Yu et al., "Bifidobacterium longum subsp. infantis as widespread bacteriocin gene clusters carrier stands out among the Bifidobacterium," Appl Environ Microbiol, vol. 89, no. 9, Sep. 2023, doi: 10.1128/aem.00979-23.
[29] E. Le Chatelier et al., "Richness of human gut microbiome correlates with metabolic markers," Nature 2013 500:7464, vol. 500, no. 7464, pp. 541–546, Aug. 2013, doi: 10.1038/nature12506.
[30] E. Le Chatelier et al., "Richness of human gut microbiome correlates with metabolic markers," Nature, vol. 500, no. 7464, pp. 541–546, 2013, doi: 10.1038/nature12506.
[31] H. Chung The and S. N. H. Le, "Dynamic of the human gut microbiome under infectious diarrhea," Apr. 01, 2022, Elsevier Ltd. doi: 10.1016/j.mib.2022.01.006.
[32] M. A. Engevik et al., "Rotavirus infection induces glycan availability to promote ileum-specific changes in the microbiome aiding rotavirus virulence," Gut Microbes, vol. 11, no. 5, pp. 1324–1347, Sep. 2020, doi: 10.1080/19490976.2020.1754714.
[33] L. A. David et al., "Gut microbial succession follows acute secretory diarrhea in humans," mBio, vol. 6, no. 3, pp. 1–14, May 2015, doi: 10.1128/mBio.00381-15.
[34] M. E. P. M. Hunyady B, "Gastrointestinal immunology: cell types in the lamina propria--a morphological review," Acta Physiol Hung, 2000.
[35] D. S. Donaldson, K. J. Else, and N. A. Mabbott, "The Gut-Associated Lymphoid Tissues in the Small Intestine, Not the Large Intestine, Play a Major Role in Oral Prion Disease Pathogenesis," J Virol, vol. 89, no. 18, pp. 9532–9547, Sep. 2015, doi: 10.1128/jvi.01544-15.
[36] K. Liu, "Dendritic Cells," in Encyclopedia of Cell Biology, vol. 3, Elsevier Inc., 2016, pp. 741–749. doi: 10.1016/B978-0-12-394447-4.30111-0.
[37] P. Serek and M. Oleksy-Wawrzyniak, "The effect of bacterial infections, probiotics and zonulin on intestinal barrier integrity," Nov. 01, 2021, MDPI. doi: 10.3390/ijms222111359.
[38] E.-S. A. Y. S. D. M. G. SS. Adel M, "Effect of Potential Probiotic Lactococcus lactis Subsp. lactis on Growth Performance, Intestinal Microbiota, Digestive Enzyme Activities, and Disease Resistance of Litopenaeus vannamei," Probiotics Antimicrob Proteins, 2017.
[39] K. Vijay, "Toll-like receptors in immunity and inflammatory diseases: Past, present, and future," Jun. 01, 2018, Elsevier B.V. doi: 10.1016/j.intimp.2018.03.002.
[40] C. Mazziotta, M. Tognon, F. Martini, E. Torreggiani, and J. C. Rotondo, "Probiotics Mechanism of Action on Immune Cells and Beneficial Effects on Human Health," Jan. 01, 2023, MDPI. doi: 10.3390/cells12010184.
[41] C. Caballero-Franco, K. Keller, C. De Simone, K. Chadee, and D. C. Simone, "The VSL#3 probiotic formula induces mucin gene expression and secretion in colonic epithelial cells The VSL#3 probiotic formula induces mucin gene expression and secre-tion in colonic epithelial cells," Am J Physiol Gastrointest Liver Physiol, vol. 292, pp. 315–322, 2007, doi: 10.1152/ajpgi.00265.2006.-Several.
[42] C. M. Galdeano and G. Perdigón, "Role of viability of probiotic strains in their persistence in the gut and in mucosal immune stimulation," J Appl Microbiol, vol. 97, no. 4, pp. 673–681, 2004, doi: 10.1111/j.1365-2672.2004.02353.x.
[43] S. Collinson et al., "Probiotics for treating acute infectious diarrhoea," Dec. 08, 2020, John Wiley and Sons Ltd. doi: 10.1002/14651858.CD003048.pub4.
[44] L. V Mcfarland, "Epidemiology, Risk Factors and Treatments for Antibiotic-Associated Diarrhea Antibiotic complications Antibiotic-associated diarrhea Clostridium difficile Epidemiology Diarrhea, risk factors," 1998. [Online]. Available: http://www.karger.com
[45] F. Barbut, "Managing antibiotic associated diarrhoea," BMJ, vol. 324, no. 7350, pp. 1345–1346, Jun. 2002, doi: 10.1136/bmj.324.7350.1345.
[46] Turck D, "Incidence and risk factors of oral antibiotic-associated diarrhea in an outpatient pediatric population," J Pediatr Gastroenterol Nutr. , Jul. 2003.

[47] McFarland LV., "Meta-analysis of probiotics for the prevention of antibiotic associated diarrhea and the treatment of Clostridium difficile disease," Am J Gastroenterol., 2006.
[48] Pant C, "Rising Incidence of Clostridium difficile Related Discharges among Hospitalized Children in the United States.," Infect Control Hosp Epidemiol, Jan. 2016.
[49] L. Beaugerie and J.-C. Petit, "Antibiotic-associated diarrhoea", doi: 10.1053/ybega.2004.439.
[50] C. Ubeda and E. G. Pamer, "Antibiotics, microbiota, and immune defense," Sep. 2012. doi: 10.1016/j.it.2012.05.003.
[51] A. Chung, M. Sehgal, C. Gavrilita, S. Falkos, and R. Vidal, "Lactobacillus GG in the Prevention of Antibiotic-Associated Diarrhea in the Pediatric Intensive Care Unit: A Prospective Randomized, Double-Blind Placebo Controlled Intervention," Journal of Pediatric Pharmacology and Therapeutics, vol. 30, no. 1, pp. 47–51, 2025, doi: 10.5863/1551-6776-30.1.47.
[52] J. Cai, C. Zhao, Y. Du, Y. Zhang, M. Zhao, and Q. Zhao, "Comparative efficacy and tolerability of probiotics for antibiotic-associated diarrhea: Systematic review with network meta-analysis," Mar. 01, 2018, SAGE Publications Ltd. doi: 10.1177/2050640617736987.
[53] G. R. Gibson et al., "Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics," Aug. 01, 2017, Nature Publishing Group. doi: 10.1038/nrgastro.2017.75.
[54] F. Yang, J. Yang, Z. Ruan, and Z. Wang, "Fermentation of dietary fibers modified by an enzymatic-ultrasonic treatment and evaluation of their impact on gut microbiota in mice," J Food Process Preserv, vol. 45, no. 4, Apr. 2021, doi: 10.1111/jfpp.15337.
[55] R. L. Hughes, D. A. Alvarado, K. S. Swanson, and H. D. Holscher, "The Prebiotic Potential of Inulin-Type Fructans: A Systematic Review," Mar. 01, 2022, Oxford University Press. doi: 10.1093/advances/nmab119.
[56] J. Slavin, "Fiber and prebiotics: Mechanisms and health benefits," Apr. 22, 2013, MDPI AG. doi: 10.3390/nu5041417.
[57] A. Bhanja, P. P. Sutar, and M. Mishra, "Inulin-A polysaccharide: Review on its functional and prebiotic efficacy," Dec. 01, 2022, John Wiley and Sons Inc. doi: 10.1111/jfbc.14386.
[58] M. B. Roberfroid, "The Journal of Nutrition Inulin and Oligofructose: Health Benefits and Claims-A Critical Review Inulin-Type Fructans: Functional Food Ingredients 1,2," 2007.
[59] C. E. Beneke, A. M. Viljoen, and J. H. Hamman, "Polymeric plant-derived excipients in drug delivery," Jul. 2009. doi: 10.3390/molecules14072602.
[60] T. F. Teferra, "Possible actions of inulin as prebiotic polysaccharide: A review," Dec. 01, 2021, John Wiley and Sons Inc. doi: 10.1002/-fft2.92.
[61] A. C. Apolinário, B. P. G. De Lima Damasceno, N. E. De Macêdo Beltrão, A. Pessoa, A. Converti, and J. A. Da Silva, "Inulin-type fructans: A review on different aspects of biochemical and pharmaceutical technology," 2014, Elsevier Ltd. doi: 10.1016/j.carbpol.2013.09.081.
[62] W. Ahmed and S. Rashid, "Functional and therapeutic potential of inulin: A comprehensive review," Jan. 02, 2019, Taylor and Francis Inc. doi: 10.1080/10408398.2017.1355775.
[63] W. Lingyun et al., "Studies on the extracting technical conditions of inulin from Jerusalem artichoke tubers," J Food Eng, vol. 79, no. 3, pp. 1087–1093, Apr. 2007, doi: 10.1016/j.jfoodeng.2006.03.028.
[64] J. Lachman, E. C. Fernández, and M. Orsák, "Yacon [Smallanthus sonchifolia (Poepp. et Endl.) H. Robinson] chemical composition and use - A review," Plant Soil Environ, vol. 49, no. 6, pp. 283–290, Jun. 2003, doi: 10.17221/4126-pse.
[65] M. L. Puhlmann and W. M. de Vos, "Back to the roots: Revisiting the use of the fiber-rich cichorium intybus L. Taproots," 2020, Oxford University Press. doi: 10.1093/ADVANCES/NMAA025.
[66] V. Bali, P. S. Panesar, M. B. Bera, and R. Panesar, "Fructo-oligosaccharides: Production, Purification and Potential Applications," Crit Rev Food Sci Nutr, vol. 55, no. 11, pp. 1475–1490, Sep. 2015, doi: 10.1080/10408398.2012.694084.
[67] T. Casci and R. A. Rastall, "2 Manufacture of Prebiotic Oligosaccharides."
[68] R. W. Hutkins et al., "Prebiotics: Why definitions matter," Feb. 01, 2016, Elsevier Ltd. doi: 10.1016/j.copbio.2015.09.001.
[69] S. P. Singh, J. S. Jadaun, L. K. Narnoliya, and A. Pandey, "Prebiotic Oligosaccharides: Special Focus on Fructooligosaccharides, Its Biosynthesis and Bioactivity," Appl Biochem Biotechnol, vol. 183, no. 2, pp. 613–635, Oct. 2017, doi: 10.1007/s12010-017-2605-2.
[70] D. A. Flores-Maltos, S. I. Mussatto, J. C. Contreras-Esquivel, R. Rodríguez-Herrera, J. A. Teixeira, and C. N. Aguilar, "Biotechnological production and application of fructooligosaccharides," Mar. 03, 2016, Taylor and Francis Ltd. doi:

10.3109/07388551.2014.953443.
[71] R. Martin et al., "Early-Life events, including mode of delivery and type of feeding, siblings and gender, shape the developing gut microbiota," PLoS One, vol. 11, no. 6, Jun. 2016, doi: 10.1371/journal.pone.0158498.
[72] S. A. Lee et al., "Comparison of the gut microbiota profile in breast-fed and formula-fed Korean infants using pyrosequencing," Nutr Res Pract, vol. 9, no. 3, pp. 242–248, 2015, doi: 10.4162/nrp.2015.9.3.242.
[73] C. Zhang, Z. Yu, J. Zhao, H. Zhang, Q. Zhai, and W. Chen, "Colonization and probiotic function of Bifidobacterium longum," Feb. 01, 2019, Elsevier Ltd. doi: 10.1016/j.jff.2018.12.022.
[74] P. J. Looijesteijn, L. Trapet, E. De Vries, T. Abee, and J. Hugenholtz, "Physiological function of exopolysaccharides produced by Lactococcus lactis a a a b," 2001. [Online]. Available: www.elsevier.nl/locate/ijfoodmicro
[75] Z. T. Yu, C. Chen, and D. S. Newburg, "Utilization of major fucosylated and sialylated human milk oligosaccharides by isolated human gut microbes," Glycobiology, vol. 23, no. 11, pp. 1281–1292, Nov. 2013, doi: 10.1093/glycob/cwt065.
[76] Y. J. Choi, S. H. Shin, and H. S. Shin, "Immunomodulatory Effects of Bifidobacterium spp. and Use of Bifidobacterium breve and Bifidobacterium longum on Acute Diarrhea in Children," J Microbiol Biotechnol, vol. 32, no. 9, pp. 1186–1194, Sep. 2022, doi: 10.4014/jmb.2206.06023.
[77] C. Alcántara et al., "Study of the biosynthesis and functionality of polyphosphate in Bifidobacterium longum KABP042," Sci Rep, vol. 13, no. 1, Dec. 2023, doi: 10.1038/s41598-023-38082-0.
[78] Y. Qi et al., "Pediococcus pentosaceus: Screening and Application as Probiotics in Food Processing," Dec. 16, 2021, Frontiers Media S.A. doi: 10.3389/fmicb.2021.762467.
[79] S. Jiang, L. Cai, L. Lv, and L. Li, "Pediococcus pentosaceus, a future additive or probiotic candidate," Dec. 01, 2021, BioMed Central Ltd. doi: 10.1186/s12934-021-01537-y.
[80] H. Yin et al., "In vitro probiotic properties of Pediococcus pentosaceus L1 and its effects on enterotoxigenic Escherichia coli-induced inflammatory responses in porcine intestinal epithelial cells," Microb Pathog, vol. 144, Jul. 2020, doi: 10.1016/j.micpath.2020.104163.
[81] T. Masuda, M. Kimura, S. Okada, and H. Yasui, "Pediococcus pentosaceus Sn26 Inhibits IgE production and the occurrence of ovalbumin-induced allergic diarrhea in Mice," Biosci Biotechnol Biochem, vol. 74, no. 2, pp. 329–335, 2010, doi: 10.1271/bbb.90656.
[82] K. Asadullah, W. Sterry, and H. D. Volk, "Interleukin-10 therapy - Review of a new approach," 2003, American Society for Pharmacology and Experimental Therapy. doi: 10.1124/pr.55.2.4.
[83] A. de Moreno de LeBlanc et al., "Importance of IL-10 Modulation by Probiotic Microorganisms in Gastrointestinal Inflammatory Diseases," ISRN Gastroenterol, vol. 2011, pp. 1–11, Feb. 2011, doi: 10.5402/2011/892971.
[84] H. Hua et al., "Probiotic lactic acid bacteria alleviate pediatric IBD and remodel gut microbiota by modulating macrophage polarization and suppressing epithelial apoptosis," Front Microbiol, vol. 14, 2023, doi: 10.3389/fmicb.2023.1168924.
[85] X. Bian et al., "Pediococcus pentosaceus LI05 alleviates DSS-induced colitis by modulating immunological profiles, the gut microbiota and short-chain fatty acid levels in a mouse model," Microb Biotechnol, vol. 13, no. 4, pp. 1228–1244, Jul. 2020, doi: 10.1111/1751-7915.13583.
[86] J. Santas, M. C. Fuentes, R. Tormo, R. Guayta-Escolies, E. Lázaro, and J. Cuñé, "Pediococcus pentosaceus CECT 8330 and bifidobacterium longum CECT 7894 show a trend towards lowering infantile excessive crying syndrome in a pilot clinical trial," Int J Pharma Bio Sci, vol. 6, no. 2, pp. P458–P466, 2015.
[87] K. Chen et al., "Infantile Colic Treated With Bifidobacterium longum CECT7894 and Pediococcus pentosaceus CECT8330: A Randomized, Double-Blind, Placebo-Controlled Trial," Front Pediatr, vol. 9, no. September, pp. 1–9, 2021, doi: 10.3389/fped.2021.635176.
[88] E. Astó et al., "Probiotic Properties of Bifidobacterium longum KABP042 and Pediococcus pentosaceus KABP041 Show Potential to Counteract Functional Gastrointestinal Disorders in an Observational Pilot Trial in Infants," Front Microbiol, vol. 12, Jan. 2022, doi: 10.3389/fmicb.2021.741391.
[89] S. Doron, D. R. Snydman, and S. L. Gorbach, "Lactobacillus GG: Bacteriology and clinical applications," Sep. 2005. doi: 10.1016/j.gtc.2005.05.011.
[90] M. Alander, R. Korpela, M. Saxelin, T. Vilpponen-Salmela, T. Mattila-Sandholm, and A. Von Wright, "Recovery of Lactobacillus rhamnosus GG from human colonic biopsies," 1997.
[91] S. Lebeer et al., "Functional analysis of lactobacillus rhamnosus GG pili in relation to adhesion and immunomodulatory interactions

with intestinal epithelial cells," Appl Environ Microbiol, vol. 78, no. 1, pp. 185–193, Jan. 2012, doi: 10.1128/AEM.06192-11.
[92] M. E. Segers and S. Lebeer, "Towards a better understanding of Lactobacillus rhamnosus GG - host interactions," Microb Cell Fact, vol. 13, Aug. 2014, doi: 10.1186/1475-2859-13-S1-S7.
[93] J. Reunanen, I. von Ossowski, A. P. A. Hendrickx, A. Palva, and W. M. de Vosa, "Characterization of the SpaCBA pilus fibers in the probiotic Lactobacillus rhamnosus GG," Appl Environ Microbiol, vol. 78, no. 7, pp. 2337–2344, Apr. 2012, doi: 10.1128/AEM.07047-11.
[94] N. J. Nilsen et al., "Cellular trafficking of lipoteichoic acid and Toll-like receptor 2 in relation to signaling; role of CD14 and CD36," J Leukoc Biol, vol. 84, no. 1, pp. 280–291, Jul. 2008, doi: 10.1189/jlb.0907656.
[95] I. J. Claes et al., "Lipoteichoic acid is an important microbe-associated molecular pattern of Lactobacillus rhamnosus GG," 2012. [Online]. Available: http://www.microbialcellfactories.com/content/11/1/161
[96] F. Yan, H. Cao, T. L. Cover, R. Whitehead, M. K. Washington, and D. B. Polk, "Soluble Proteins Produced by Probiotic Bacteria Regulate Intestinal Epithelial Cell Survival and Growth," Gastroenterology, vol. 132, no. 2, pp. 562–575, 2007, doi: 10.1053/j.gastro.2006.11.022.
[97] P. Van Baarlen et al., "Human mucosal in vivo transcriptome responses to three lactobacilli indicate how probiotics may modulate human cellular pathways," Proc Natl Acad Sci U S A, vol. 108, no. SUPPL. 1, pp. 4562–4569, Mar. 2011, doi: 10.1073/pnas.1000079107.
[98] E. Isolauri, M. Kaila, W. H. Ling, and S. Salminen, "Oral Bacteriotherapy for Viral Gastroenteritis," 1994.
[99] R. Francavilla et al., "A randomized controlled trial of lactobacillus GG in children with functional abdominal pain," Pediatrics, vol. 126, no. 6, Dec. 2010, doi: 10.1542/peds.2010-0467.
[100] Richard A. Oberhelman, "A placebo-controlled trial of Lactobacillus GG to prevent diarrhea in undernourished Peruvian children," 1999.
[101] H. Szajewska, M. Kotowska, J. Z. Mrukowicz, M. Armánska, and W. Mikolajczyk, "Efficacy of Lactobacillus GG in prevention of nosocomial diarrhea in infants," Journal of Pediatrics, vol. 138, no. 3, pp. 361–365, 2001, doi: 10.1067/mpd.2001.111321.
[102] E. Salazar-Lindo, P. Miranda-Langschwager, M. Campos-Sanchez, E. Chea-Woo, and R. B. Sack, "Lactobacillus casei strain GG in the treatment of infants with acute watery diarrhea: A randomized, double-blind, placebo controlled clinical trial [ISRCTN67363048]," BMC Pediatr, vol. 4, Sep. 2004, doi: 10.1186/1471-2431-4-18.
[103] R. B. Canani et al., "Probiotics for treatment of acute diarrhoea in children: Randomised clinical trial of five different preparations," Br Med J, vol. 335, no. 7615, pp. 340–342, Aug. 2007, doi: 10.1136/bmj.39272.581736.55.
[104] S. Basu, D. K. Paul, S. Ganguly, M. Chatterjee, and P. K. Chandra, "Efficacy of High-dose Lactobacillus rhamnosus GG in Controlling Acute Watery Diarrhea in Indian Children A Randomized Controlled Trial," 2009.
[105] Francisco Guarner, Mary Ellen Sanders, Hania Szajewska, and Henry Cohen, "World Gastroenterology Organization Global Guidelines Probiotics and prebiotics," J Clin Gastroenterol, vol. 42, no. Supplement 3, pp. S126–S129, Sep. 2008, doi: 10.1097/MCG.0b013e31816fc2f6.
[106] H. Szajewska and M. Kołodziej, "Systematic review with meta-analysis: Lactobacillus rhamnosus GG in the prevention of antibiotic-associated diarrhoea in children and adults," Nov. 01, 2015, Blackwell Publishing Ltd. doi: 10.1111/apt.13404.
[107] M. Lazzerini and H. Wanzira, "Oral Zinc for treating diarrhoea in children," Dec. 20, 2016, John Wiley and Sons Ltd. doi: 10.1002/14651858.CD005436.pub5.
[108] U. Dhingra et al., "Lower dose Zinc for childhood diarrhea: a randomized, multicenter trial," New England Journal of Medicine, 2020.

EDA Biotic®

Sinergia Probiótica

Caja x 10 VIALES

TECNOLOGÍA PROBIÓTICA EUROPEA

Sabor a Pera

1. Santas J, Fuentes MC, Tormo R, et al. Pediococcus Pentosaceus CECT 8330 and Bifidobacterium Longum CECT 7894 Show a Tren Towards Lowering Infantile Excessive Crying Syndrome in a Pilot Clinical Trial, Int J Pharm Bio Sci 2015
2. Astó E, Huedo P, Altadill T, Aguiló García M, Sticco M, Perez M and Espadaler-Mazo J (2022) Probiotic Properties of Bifidobacterium longum KABP042 and Pediococcus pentosaceus KABP041 Show Potential to Counteract Functional Gastrointestinal Disorders in an Observational Pilot Trial in Infants. Front. Microbiol. 12:741391. doi: 10.3389/fmicb.2021.741391
3. Lazarus RP, John J, Shanmugasundaram E, Rajan AK, Thiagarajan S, Giri S, Babji S, Sarkar R, Kaliappan PS, Venugopal S, Praharaj I, Raman U, Paranjpe M, Grassly NC, Parker EPK, Parashar UD, Tate JE, Fleming JA, Steele AD, Muliyil J, Abraham AM, Kang G. The effect of probiotics and zinc supplementation on the immune response to oral rotavirus vaccine: A randomized, factorial design, placebo-controlled study among Indian infants. Vaccine. 2018 Jan 4;36(2):273-279. doi: 10.1016/j.vaccine.2017.07.116. Epub 2017
4. Diarrhoea Treatment Guidelines Including new recommendations for the use of ORS and zinc supplementation for Clinic-Based Healthcare Workers, WHO-UNICEF 2005
5. WGO Global Guideline Probiotics and prebiotics, 2023
6. Dhingra U, Kisenge R, Sudfeld CR, Dhingra P, Somji S, Dutta A, Bakari M, Deb S, Devi P, Liu E, Chauhan A, Kumar J, Semwal OP, Aboud S, Bahl R, Ashorn P, Simon J, Duggan CP, Sazawal S, Manji K. Lower-Dose
7. Zinc for Childhood Diarrhea - A Randomized, Multicenter Trial. N Engl J Med. 2020 Sep 24;383(13):1231-1241 Aggarwal S, Upadhyay A, Shah D, Teotia N, Agarwal A, Jaiswal V. Lactobacillus GG for treatment of acute childhood diarrhoea: an open labelled, randomized controlled trial. Indian J Med Res. 2014 Mar;139(3):379-85.