

Prebiotics

Prebiotics, found in various plant foods, are a group of non-digestible fibrous carbohydrates. Prebiotics are fermented by microorganisms in the gastrointestinal tract, known as gut microbiota, and promote a healthy microbial profile, which is associated with several health benefits.

What are probiotics?

Probiotics are beneficial live organisms found in dietary supplements and fermented foods such as cultured yogurt. Prebiotics support and improve the activity of probiotics by providing the microorganisms residing in our digestive tracts with a source of energy, essentially acting like the “food” for probiotics. As prebiotics and probiotics work synergistically to support the health of the gut microbiota, they are often called synbiotics.

Probiotics



Live beneficial microorganisms

+

Prebiotics



Nondigestible carbohydrates fermented by probiotics

=

Synbiotics



A combination that works synergistically by increasing probiotic survival and growth



Health benefits of prebiotics

Studies have shown that different prebiotics may provide benefits for health conditions such as:

- Atopic dermatitis
- Cardiovascular disease
- Digestive conditions (e.g., [constipation](#), Crohn's disease, [diarrhea](#), [irritable bowel syndrome](#) (IBS))
- Hyperlipidemia (elevated blood lipids)
- Hyperthyroidism
- Lactose intolerance
- [Type 2 diabetes](#)
- Overweight and obesity
- [Polycystic ovary syndrome](#) (PCOS)

Special considerations

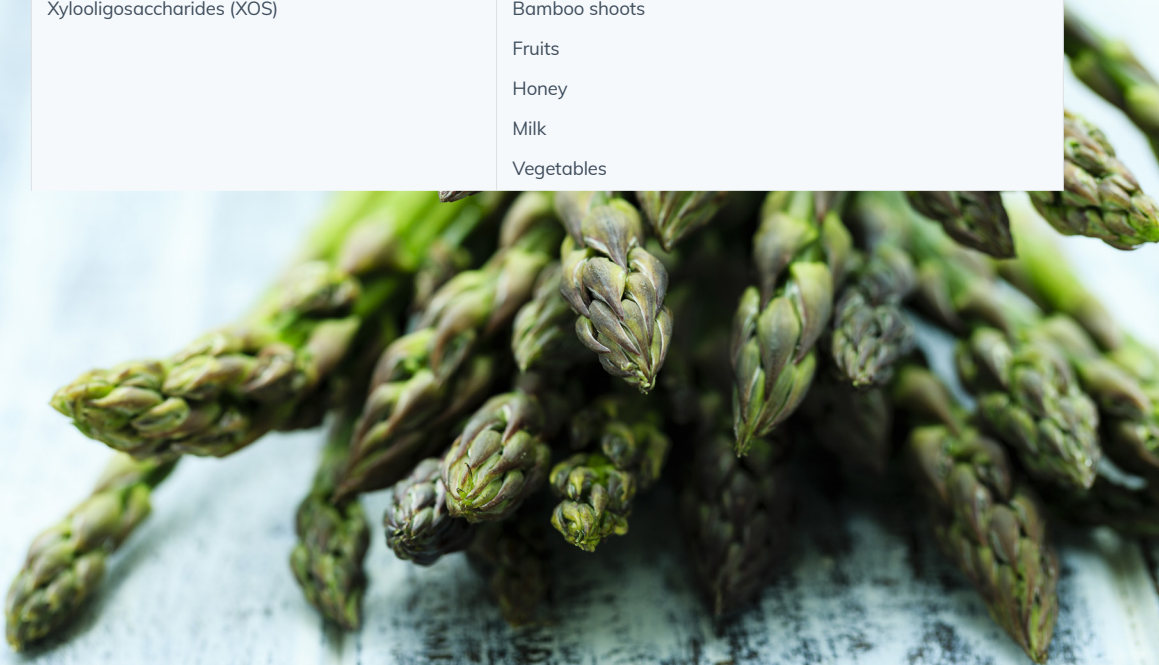
Despite being generally safe and healthy for most individuals, specific prebiotics may aggravate certain digestive conditions, such as IBS. Further, high doses may result in flatulence and diarrhea. Be sure to speak with your integrative healthcare provider about how best to consume prebiotic foods and supplements.



Dietary sources of prebiotics

Type of prebiotic	Dietary sources
Arabinogalactan	<ul style="list-style-type: none"> Carrot Certain medicinal herbs (e.g., <i>Angelica acutiloba</i>, <i>Baptisia tinctoria</i>, <i>Curcuma longa</i>, <i>Echinacea</i> spp.) Leek seed Maize Pear Radish Tomato Wheat
Beta-glucans	<ul style="list-style-type: none"> Certain grains (e.g., barley, oats) Mushrooms Seaweeds Yeast
Fructans	<ul style="list-style-type: none"> Allium vegetables (e.g., garlic, onion, scallions, shallots) Artichoke Barley Broccoli Brussels sprouts Cabbage Chicory root Pistachio Wheat
Fructooligosaccharides (FOS)	<ul style="list-style-type: none"> Artichoke Asparagus Banana Barley Chicory Garlic Honey Onion Tomato Wheat

Type of prebiotic	Dietary sources
Galactooligosaccharide (GOS)	Mammalian milk
Glucomannan	Konjac (glucomannan)
Human milk oligosaccharides (HMOs)	Human breast milk
Inulin	Allium vegetables (e.g., garlic, leek, onion) Asparagus Banana Certain grains (e.g., barley, rye, wheat) Chicory root Dandelion greens Globe artichoke Jerusalem artichoke
Isomaltooligosaccharide (IOS or IMO)	Fermented foods (e.g., soy sauce, miso, sake) Honey
Mannan	Coffee beans
Pectins	Apples Citrus fruit Gooseberries Plums Quince
Xylooligosaccharides (XOS)	Bamboo shoots Fruits Honey Milk Vegetables



Prebiotic supplements

Prebiotics are available on their own and added to probiotic supplements, where they improve probiotic lifespan and ability to thrive in the small intestine. Common forms of prebiotics found in supplements include:

- Arabinogalactan
- Beta-glucans
- Fructans
- Fructo-oligosaccharides (FOS)
- Galactooligosaccharide (GOS)
- Glucomannan or mannan
- Human milk oligosaccharides (HMOs)
- Inulin
- Isomaltooligosaccharide (IOS or IMO)
- Oligosaccharide (MOS)
- Xylooligosaccharides (XOS)



References

1. Aachary, A.A., & Prapulla, S.G. (2011). Xylooligosaccharides (XOS) as an emerging prebiotic: Microbial synthesis, utilization, structural characterization, bioactive properties, and applications. *Comprehensive Reviews in Food Science and Food Safety*, 10(1), 2-16.
2. Azeqli, A.D., Bayraktaroglu, T., & Orhan, Y. (2007). The use of konjac glucomannan to lower serum thyroid hormones in hyperthyroidism. *Journal of the American College of Nutrition*, 26(6), 663-8.
3. Azpiroz, F., Dubray, C., Bernalier-Donadille, A., Cardot, J.M., Accarino, A., Serra, J., ... & Dapoigny, M. (2017). Effects of scFOS on the composition of fecal microbiota and anxiety in patients with irritable bowel syndrome: A randomized, double blind, placebo controlled study. *Neurogastroenterology & Motility*, 29(2).
4. Barile, D., & Rastall, R.A. (2013). Human milk and related oligosaccharides as prebiotics. *Current Opinion in Biotechnology*, 24(2), 214-9.
5. Belorkar, S.A., & Gupta, A.K. (2016). Oligosaccharides: A boon from nature's desk. *AMB Express*, 6, 82.
6. Bode, L. (2012). Human milk oligosaccharides: Every baby needs a sugar mama. *Glycobiology*, 22(9), 1147-1162.
7. Brighenti, F. (2007). Dietary fructans and serum triacylglycerols: A meta-analysis of randomized controlled trials. *Journal of Nutrition*, 137(11 Suppl), 2552S-2556S.
8. Carlson, J. L., Erickson, J. M., Lloyd, B. B., & Slavin, J. L. (2018). Health effects and sources of prebiotic dietary fiber. *Current Developments in Nutrition*, 2(3), nzy005.
9. Chung, W. S. F., Meijerink, M., Zeuner, B., Holck, J., Louis, P., Meyer, A. S., ... & Duncan, S. H. (2017). Prebiotic potential of pectin and pectic oligosaccharides to promote anti-inflammatory commensal bacteria in the human colon. *FEMS Microbiology Ecology*, 93(11).
10. Collado Yurrita, L., San Mauro Martín, I., Ciudad-Cabañas, M.J., Calle-Purón, M.E., & Hernández Cabria, M. (2014). Effectiveness of inulin intake on indicators of chronic constipation; A meta-analysis of controlled randomized clinical trials. *Nutricion Hospitalaria*, 30(2), 244-52.
11. Drakoularakou, A., Tzortzis, G., Rastall, R.A., & Gibson, G.R. (2010). A double-blind, placebo-controlled, randomized human study assessing the capacity of a novel galacto-oligosaccharide mixture in reducing travellers' diarrhoea. *European Journal of Clinical Nutrition*, 64(2), 146-52.
12. De Leo, V., Tosti, C., Cappelli, V., Morgante, G., & Cianci, E.A. (2014). Combination inositol and glucomannan in PCOS patients. *Minerva Ginecologica*, 66(6), 527-33.
13. Devaraj, R.D., Reddy, C.K., & Xu, B. (2018). Health-promoting effects of konjac glucomannan and its practical applications: A critical review. *International Journal of Biological Macromolecules*, 126, 273-281.
14. Dion, C., Chappuis, E., & Ripoll, C. (2016). Does larch arabinogalactan enhance immune function? A review of mechanistic and clinical trials. *Nutrition & Metabolism*, 13, 28.
15. Fedewa, A., & Rao, S.S.C. (2014). Dietary fructose intolerance, fructan intolerance and FODMAPs. *Current Gastroenterology Reports*, 16(1), 370.
16. Gibson, G.R., & Roberfroid, M.B. (1995). Dietary modulation of the human colonic microbiota: Introducing the concept of prebiotics. *The Journal of Nutrition*, 125(6), 1401-1412.
17. Gourineni, V., Stewart, M. L., Icoz, D., & Zimmer, J. P. (2018). Gastrointestinal tolerance and glycemic response of isomaltooligosaccharides in healthy adults. *Nutrients*, 10(3), 301.
18. Ho, H.V., Sievenpiper, J.L., Zurbau, A., Blanco Mejia, S., Jovanovski, E., Au-Yeung, F., ... & Vuksan, V. (2016). A systematic review and meta-analysis of randomized controlled trials of the effect of barley β -glucan on LDL-C, non-HDL-C and apoB for cardiovascular disease risk reduction-iv. *European Journal of Clinical Nutrition*, 70(11), 1239-1245.
19. Holtzappple, M.T. (2003). Hemicelluloses. *Encyclopedia of Food Sciences and Nutrition*, 3060-3071.
20. Keithley, J. K., Swanson, B., Mikolaitis, S. L., DeMeo, M., Zeller, J. M., Fogg, L., & Adamji, J. (2013). Safety and efficacy of glucomannan for weight loss in overweight and moderately obese adults. *Journal of Obesity*, 2013, 610908.
21. Kolida, S., & Gibson, G.R. (2007). Prebiotic capacity of inulin-type fructans. *The Journal of Nutrition*, 137(11), 2503S-2506S.
22. Liu, F., Prabhakar, M., Ju, J., Long, H., & Zhou, H. W. (2017). Effect of inulin-type fructans on blood lipid profile and glucose level: A systematic review and meta-analysis of randomized controlled trials. *European Journal of Clinical Nutrition*, 71(1), 9-20.

23. Lindsay, J. O., Whelan, K., Stagg, A. J., Gobin, P., Al-Hassi, H. O., Rayment, N., ... & Forbes, A. (2006). Clinical, microbiological, and immunological effects of fructo-oligosaccharide in patients with Crohn's disease. *Gut*, 55(3), 348–355.
24. Macfarlane, S., Macfarlane, G.T., & Cummings, J. H. (2006). Review article: Prebiotics in the gastrointestinal tract. *Alimentary Pharmacology and Therapeutics*, 24(5), 701-714.
25. Markowiak, P., & Śliżewska, K. (2017). Effects of probiotics, prebiotics, and synbiotics on human health. *Nutrients*, 9(9), 1021.
26. Moro, G., Arslanoglu, S., Stahl, B., Jelinek, J., Wahn, U., & Boehm, G. (2006). A mixture of prebiotic oligosaccharides reduces the incidence of atopic dermatitis during the first six months of age. *Archives of Disease in Childhood*, 91(10), 814–819.
27. Moshfegh, A. J., Friday, J. E., Goldman, J. P., & Chug Ahuja, J. K. (1999). Presence of inulin and oligofructose in the diets of Americans. *The Journal of Nutrition*, 129(7), 1407S–1411S.
28. Nakashima, A., Yamada, K., Iwata, O., Sugimoto, R., Atsuji, K., Ogawa, T., ... & Suzuki, K. (2018). β -Glucan in foods and its physiological functions. *Journal of Nutritional Science and Vitaminology*, 64(1), 8-17
29. Rahmani, J., Miri, A., Černevičiūtė, R., Thompson, J., de Souza, N. N., Sultana, R., ... & Hekmatdoost, A. (2019). Effects of cereal beta-glucan consumption on body weight, body mass index, waist circumference and total energy intake: A meta-analysis of randomized controlled trials. *Complementary Therapies in Medicine*, 43, 131-139.
30. Sabater-Molina, M., Larqué, E., Torrella, F., & Zamora, S. (2009). Dietary fructooligosaccharides and potential benefits on health. *Journal of Physiology and Biochemistry*, 65(3), 315-28.
31. Savaiano, D. A., Ritter, A. J., Klaenhammer, T. R., James, G. M., Longcore, A. T., Chandler, J. R., ... & Foyt, H. L. (2013). Improving lactose digestion and symptoms of lactose intolerance with a novel galacto-oligosaccharide (RP-G28): A randomized, double-blind clinical trial. *Nutrition Journal*, 12, 160.
32. Srivastava, P., & Malviya, R. (2011). Sources of pectin, extraction and its applications in pharmaceutical industry: An overview. *Indian Journal of Natural Products and Resources*, 2(1), 10-18.
33. Walton, G., Rastall, R. A., Martini, M. C., Williams, C. E., Jeffries, R. L., & Gibson, G. R. (2010). A double-blind, placebo controlled human study investigating the effects of coffee derived manno-oligosaccharides on the faecal microbiota of a healthy adult population. *International Journal of Probiotics and Prebiotics*, 5(2), 75-83.



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