Product information
Leaflet

GlyCare™ 3FL

Human Milk Oligosaccharides brought to you by dsm-firmenich, at the forefront of HMO innovation

Early life nutrition innovation from dsm-firmenich

Providing the best infant nutrition is vital for all families. That's why dsm-firmenich is proud to offer GlyCare™ HMOs. These compounds are developed with science-backed quality and safety at their core. As a fully integrated manufacturer with one of the broadest HMO offerings, dsm-firmenich can reliably provide ease-of-scale no matter the size of your business. Partner with us to get your products one step closer to what nature intended.

Partner with dsm-firmenich for access to our broad portfolio of products, customized solutions, and expert services aimed at supporting your entire product life cycle, from concept to consumption.

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Human Milk Oligosaccharides (HMOs): delivering the benefits nature intended

Uniquely human

- HMOs are complex carbohydrates found in human breastmilk
- No other mammal has near the concentration and complexity of structures in their milk[1-6]

Abundance and diversity in human milk

- 3rd largest component of human milk[7]
- >200 different HMOs identified in human milk, a diversity not seen in other animal milks[4-6]
- Variation in concentration and diversity occurs over lactation period, by maternal genetics, geographic region, and ethnicity[8,9]

Complex structures with potential functional benefits

- Help establish a balanced early-life microbiota[10,11]
- Growing evidence suggests a link between the gut microbiota and the immune system[12,13]
- Contribute to immune system support[14-18]

3-fucosyllactose (3-FL): A fucosylated HMO detected in the milk of most mothers[19]

- 3-FL has been identified in amniotic fluid and cord blood, suggesting a critical role in early development[20-21]
- Unlike many other HMOs, levels of 3-FL have been shown to increase during lactation[19,22-24]

HMO functionality is structure-specific: not all HMOs serve the same purpose[25,26]

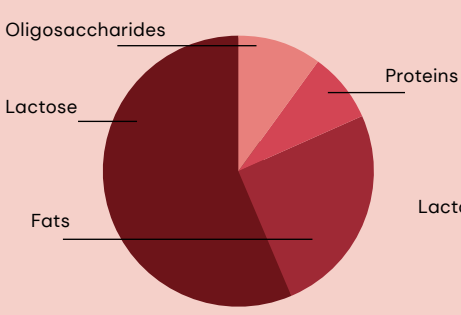
Potential functional benefits of GlyCare™ 3FL, as demonstrated primarily in pre-clinical studies

- Stimulates the growth of beneficial bacteria, including bifidobacteria[27-29]
- A potential role in regulating normal gut motility is being explored[30,32]

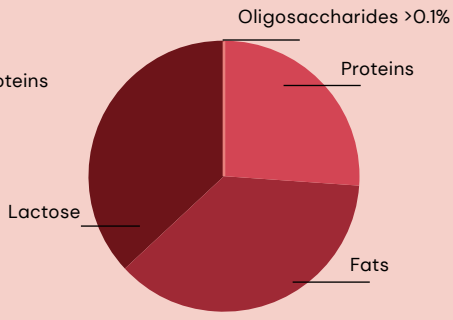
- Supports immune health. Emerging data suggest 3-FL may deflect undesirable microbes from adhering to cell walls[33]
- Reported to support the gut wall and gut barrier function[32,34]

Breastmilk – the gold standard

Breastmilk provides nutrients that are vital for an infant's growth and development and sets the standard in infant feeding.[35,36] Human milk oligosaccharides (HMOs) are the third largest solid component of human milk after lipids and lactose and a key differentiating feature between human milk and cow's milk. The unique structure, concentration, and variety of oligosaccharides in human milk sets them apart from those found in cow's milk.[37,38] Differences in health outcomes between breastfed and formula-fed infants may partly be explained by these features.[8,37,39,40]



Composition of human milk[41,42]



Composition of cow milk[41,42]

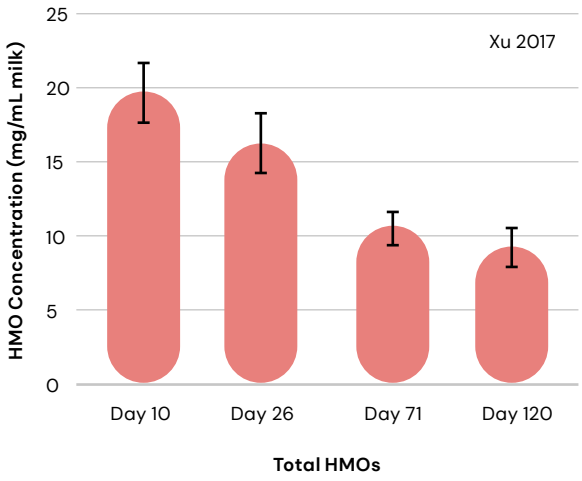
HMOs stimulate the growth of beneficial bacteria

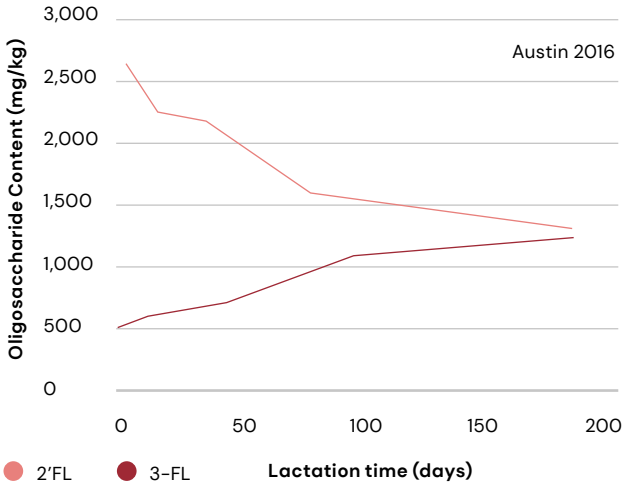
- While the concentration of most HMOs declines over the course of lactation, levels of 3-FL have been shown to increase.[19,22,23,43-46]
- In a study that tested the concentrations of 24 HMOs during lactation, only 3-FL levels increased from birth through approximately 5 months of lactation.[22] Another study showed a 10-fold increase in 3-FL between 1 and 24 months of lactation.[23]
- The unique pattern of 3-FL levels in human milk may correlate to a specific function, yet further study is needed.

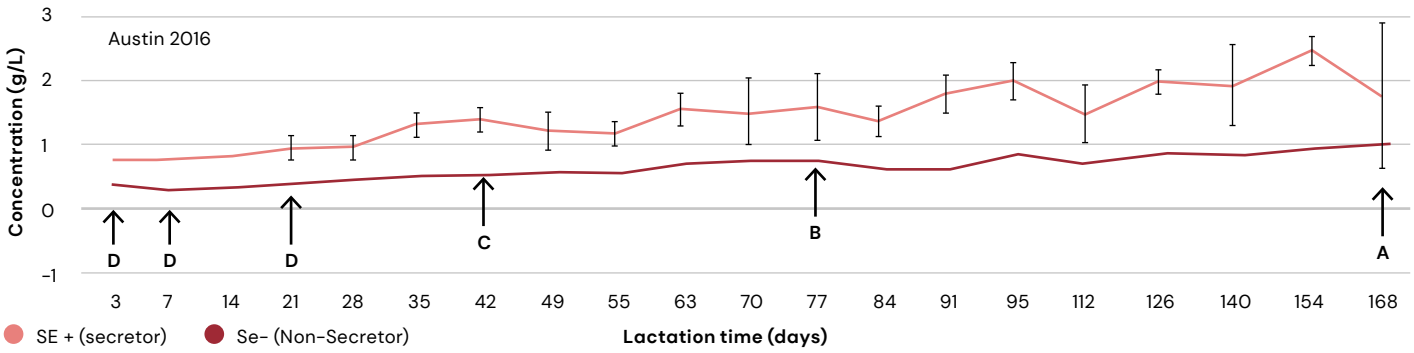
GlyCare™ 3FL product information

- 5 years of shelf life from production date
- Purity levels from 87%
- White to off-white, homogenous, amorphous powder with a neutral to slightly sweet taste
- Contains up to 5% lactose§
- Manufactured without contact to latex, bisphenol A, or phthalates
- This product is free from: Animal derived ingredients (ADI), Allergens (except milk),§ Genetically modified organisms (GMO)¥

§ according to EC regulation 1169/2011 annex II
¥ according to EC regulation 1829/2003 and 1830/2003







Broad product portfolio and a leading HMO innovator

Proven, reliable supply that scales with you

Highest safety and quality standards

Largest global market access: 160+ countries*

* We are continuously expanding our global approval footprint across application areas. For more details, please ask for our Regulatory Overview.

For more information, get in touch with your dsm-firmenich representative, or visit www.dsm-firmenich.com/health-nutrition-care

dsm-firmenich GlyCare™ HMOs are produced to the highest quality of certifications, approvals, and procedures

ISO 9001:2015

FSSC 22000

SMETA

Halal

Kosher

The full GlyCare™ HMO portfolio

- GlyCare™ 2FL
- GlyCare™ LNnT
- GlyCare™ 2FL/DFL
- GlyCare™ 6SL
- GlyCare™ 3SL
- GlyCare™ LNT
- GlyCare™ 3FL
- GlyCare™ LNFP I

References

1. T. Urashima, T. Saito, T. Nakamura, and M. Messer, "Oligosaccharides of milk and colostrum in non-human mammals," Glycoconjugate Journal, vol. 18, no. 5. Springer, pp. 357–371, 2001, doi: 10.1023/A:1014881913541.
2. D. S. Newburg et al., "Milk oligosaccharides across species," Pediatr. Res., vol. 45, no. 5, pp. 745–745, May 1999, doi: 10.1203/00006450-199905010-00044.
3. S. Albrecht et al., "A comparative study of free oligosaccharides in the milk of domestic animals," Br. J. Nutr., vol. 111, no. 7, pp. 1313–1328, Apr. 2014, doi: 10.1017/S0007114513003772.
4. N. Tao et al., "Evolutionary glycomics: Characterization of milk oligosaccharides in primates," J. Proteome Res., vol. 10, no. 4, pp. 1548–1557, 2011, doi: 10.1021/pr1009367.
5. T. Urashima, S. Asakuma, F. Leo, K. Fukuda, M. Messer, and O. T. Oftedal, "The Predominance of Type I Oligosaccharides Is a Feature Specific to Human Breast Milk," Am. Soc. Nutr. Adv. Nutr., vol. 3, pp. 473S–482S, 2012, doi: 10.3945/an.111.001412.
6. P. Gagneux et al., "Human-specific Regulation of α2-6-linked Sialic Acids," J. Biol. Chem., vol. 278, no. 48, pp. 48245–48250, 2003, doi: 10.1074/jbc.M309813200.
7. Hegar, B., Wibowo, Y., Basrowi, R. W., Ranuh, R. G., Sudarmo, S. M., Munasir, Z., Atthiyah, A. F., Widodo, A. D., Supriatmo, Kadim, M., Suryawan, A., Diana, N. R., Manoppo, C., & Vandenplas, Y. (2019). The Role of Two Human Milk Oligosaccharides, 2'-Fucosyllactose and Lacto-NNeotetraose, in Infant Nutrition. Pediatric gastroenterology, hepatology & nutrition, 22(4), 330–340. https://doi. org/10.5223/pghn.2019.22.4.330
8. Vandenplas, Y., Berger, B., Carnielli, V. P., Ksiazyk, J., Lagström, H., Sanchez Luna, M., Migacheva, N., Mosselmans, J., Picaud, J., Possner, M., Singhal, A., & Wabitsch, M. (2018). Human Milk Oligosaccharides: 2'-Fucosyllactose (2'-FL) and Lacto-NNeotetraose (LNnT) in Infant Formula. Nutrients, 10(9)10.3390/nu10091161
9. Soyyılmaz, Buket, et al. "The Mean of Milk: A Review of Human Milk Oligosaccharide Concentrations throughout Lactation." Nutrients, 2021, doi:10.3390/nu13082737
10. Berger, Bernard, et al. "Linking Human Milk Oligosaccharides, Infant Fecal Community Types, and Later Risk to Require Antibiotics." MBio, vol. 11, no. 2, 2020, pp. 1–18, doi:10.1128/mBio.03196-19.
11. Bezirtzoglou, Eugenia, et al. "Anaerobe Microbiota pro Fi Le in Feces of Breast- and Formula-Fed Newborns by Using Fl Uorescence in Situ Hybridization (FISH)." Anaerobe, vol. 17, no. 6, Elsevier Ltd, 2011, pp. 478–82, doi:10.1016/j.anaerobe.2011.03.009.
12. Illiano P, Brambilla R, Parolini C. The mutual interplay of gut microbiota, diet and human disease. Febs j. 2020;287(5):833-855.
13. Altveş S, Yildiz HK, Vural HC. Interaction of the microbiota with the human body in health and diseases. Biosci Microbiota Food Health. 2020;39(2):23-32.
14. Zhang, Bin, et al. "Human Milk Oligosaccharides and Infant Gut Microbiota: Molecular Structures, Utilization Strategies and Immune Function." Carbohydrate Polymers, vol. 276, no. October 2021, Elsevier Ltd, 2022, p. 118738, doi:10.1016/j.carbpol.2021.118738.
15. Zuurveld, Marit, et al. "Immunomodulation by Human Milk Oligosaccharides: The Potential Role in Prevention of Allergic Diseases." Frontiers in Immunology, vol. 11, no. May, 2020, doi:10.3389/fimmu.2020.00801.
16. Derya, S. M., Spiegel, H., Hanisch, F. G., Morozov, V., Schroten, H., Jennewein, S., & Parschat, K. (2020). Biotechnologically produced fucosylated oligosaccharides inhibit the binding of human noroviruses to their natural receptors. Journal of Biotechnology, 318(November 2019), 31–38. https://doi.org/10.1016/j.jbiotec.2020.05.001
17. Koromyslova, A., Tripathi, S., Morozov, V., Schroten, H., & Hansman, G. S. (2017). Human norovirus inhibition by a human milk oligosaccharide. Virology, 508(April), 81–89. https://doi.org/10.1016/j.virol.2017.04.032
18. Yang, B., Chuang, H., & Yang, K. D. (2009). Sialylated glycans as receptor and inhibitor of enterovirus 71 infection to DLD-1 intestinal cells. Virology Journal, 6, 1–6. https://doi.org/10.1186/1743-422X-6-141
19. Austin S, De Castro CA, Bénet T, et al. Temporal Change of the Content of 10 Oligosaccharides in the Milk of Chinese Urban Mothers. Nutrients. 2016;8(6).
20. Wise A, Robertson B, Choudhury B, et al. Infants Are Exposed to Human Milk Oligosaccharides Already in utero. Front Pediatr. 2018;6:270.
21. Hirschmugl B, Brandl W, Csapo B, et al. Evidence of Human Milk Oligosaccharides in Cord Blood and Maternal-to-Fetal Transport across the Placenta. Nutrients. 2019;11(11).
22. Wu J, Wu S, Huo J, et al. Systematic Characterization and Longitudinal Study Reveal Distinguishing Features of Human Milk Oligosaccharides in China. Curr Dev Nutr. 2020;4(8):nzaa113.
23. Plows JF, Berger PK, Jones RB, et al. Longitudinal Changes in Human Milk Oligosaccharides (HMOs) Over the Course of 24 Months of Lactation. J Nutr. 2021;151(4):876-882.
24. Soyyılmaz, Buket, et al. "The Mean of Milk: A Review of Human Milk Oligosaccharide Concentrations throughout Lactation." Nutrients, 2021, doi:10.3390/nu13082737
25. Bode L, Jantscher-Krenn E. Structure-function relationships of human milk oligosaccharides. Adv Nutr. 2012b;3(3):383s-391s.
26. Jantscher-Krenn E, Bode L. Human milk oligosaccharides and their potential benefits for the breast-fed neonate. Minerva Pediatr. 2012;64(1):83-99.
27. Yu ZT, Chen C, Newburg DS. Utilization of major fucosylated and sialylated human milk oligosaccharides by isolated human gut microbes. Glycobiology. 2013;23(11):1281-1292.
28. Wiese M, Khakimov B, Nielsen S, Sørensen H, van den Berg F, Nielsen DS. CoMiniGut-A small volume in vitro colon model for the screening of gut microbial fermentation processes. PeerJ. 2018;2018(1).
29. Ashida H, Miyake A, Kiyohara M, et al. Two distinct alpha-L-fucosidases from Bifidobacterium bifidum are essential for the utilization of fucosylated milk oligosaccharides and glycoconjugates. Glycobiology. 2009;19(9):1010-1017.
30. Asakuma S, Hatakeyama E, Urashima T, et al. Physiology of consumption of human milk oligosaccharides by infant gut-associated bifidobacteria. J Biol Chem. 2011;286(40):34583-34592.
31. Bienenstock J, Buck RH, Linke H, Forsythe P, Stanisz AM, Kunze WA. Fucosylated but not sialylated milk oligosaccharides diminish colon motor contractions. PLoS One. 2013;8(10):e76236.
32. Kong C, Elderman M, Cheng L, de Haan BJ, Nauta A, de Vos P. Modulation of Intestinal Epithelial Glycocalyx Development by Human Milk Oligosaccharides and Non-Digestible Carbohydrates. Mol Nutr Food Res. 2019;63(17):e1900303.
33. Weichert S, Jennewein S, Hüfner E, et al. Bioengineered 2'-fucosyllactose and 3-fucosyllactose inhibit the adhesion of Pseudomonas aeruginosa and enteric pathogens to human intestinal and respiratory cell lines. Nutr Res. 2013;33(10):831-838.
34. Cheng L, Kong C, Walvoort MTC, Faas MM, de Vos P. Human Milk Oligosaccharides Differently Modulate Goblet Cells Under Homeostatic, Proinflammatory Conditions and ER Stress. Mol Nutr Food Res. 2020;64(5):e1900976.
35. Lessen R, Kavanagh K. Position of the academy of nutrition and dietetics: promoting and supporting breastfeeding. J Acad Nutr Diet. 2015;115(3):444-449.
36. Johnston M., Landers S., Noble L., Szucs K., L. V. Breastfeeding and the use of human milk. Pediatrics. 2012;129(3):e827-841.
37. Urashima T, Taufik E, Fukuda K, Asakuma S. Recent advances in studies on milk oligosaccharides of cows and other domestic farm animals. Biosci Biotechnol Biochem. 2013;77(3):455-466.
38. Bode L. Human milk oligosaccharides: every baby needs a sugar mama. Glycobiology. 2012a;22(9):1147-1162. 5. Vandenplas Y, Berger B, Carnielli VP,
39. Chouraqui JP. Does the contribution of human milk oligosaccharides to the beneficial effects of breast milk allow us to hope for an improvement in infant formulas? Crit Rev Food Sci Nutr. 2020:1-12.
40. Cheng L, Akkerman R, Kong C, Walvoort MTC, de Vos P. More than sugar in the milk: human milk oligosaccharides as essential bioactive molecules in breast milk and current insight in beneficial effects. Crit Rev Food Sci Nutr. 2020:1-17.
41. Ballard O, Morrow AL. Human milk composition: nutrients and bioactive factors. Pediatr Clin North Am. 2013;60(1):49-74.
42. Haug A, Høstmark AT, Harstad OM. Bovine milk in human nutrition--a review. Lipids Health Dis. 2007;6:25. 10. Thurl S, Munzert M, Boehm G, Matthews C, Stahl
43. Thurl S, Munzert M, Boehm G, Matthews C, Stahl B. Systematic review of the concentrations of oligosaccharides in human milk. Nutr Rev. 2017;75(11):920-933.
44. Ferreira AL, Alves R, Figueiredo A, et al. Human Milk Oligosaccharide Profile Variation Throughout Postpartum in Healthy Women in a Brazilian Cohort. Nutrients. 2020;12(3).
45. Thurl S, Munzert M, Henker J, et al. Variation of human milk oligosaccharides in relation to milk groups and lactational periods. Br J Nutr. 2010;104(9):1261-1271.
46. Xu G, Davis JC, Goonatilleke E, Smilowitz JT, German JB, Lebrilla CB. Absolute Quantitation of Human Milk Oligosaccharides Reveals Phenotypic Variations during Lactation. J Nutr. 2017;147(1):117-124.

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