

FOOD FOR BENEFICIAL BACTERIA: 2'-FL A HUMAN MILK OLIGOSACCHARIDE



What is 2'-Fucosyllactose?

2'-Fucosyllactose (2'-FL) is a human milk oligosaccharide (HMO), which serves as a prebiotic in the human digestive system. HMOs are the first prebiotic compounds that a breastfed newborn will encounter, the prebiotic designed by nature, for humans. Discovered in the 1950s, 2'-FL is the most abundant HMO found in breast milk, making up 30 percent of all breast milk HMOs.

All HMOs are prebiotics, but not all prebiotics are HMOs.

HMOs avoid metabolism by digestive enzymes until they reach the lower GI, which allows beneficial microorganisms like Bifidobacteria to then break them down through fermentation. 2'-FL is a unique prebiotic in that only certain species, primarily Bifidobacteria, can metabolize it. Thus, 2'-FL is a selective feeding source for Bifidobacteria. Other gut microbes, including opportunistic pathogens, have to rely on non-2'-FL sources of nourishment.

Babies are born with a limited number of microbes encompassing their GI microbiome. When HMOs are fed to infants through breastfeeding, they facilitate the growth of a GI tract dominated by Bifidobacteria. Mothers that secrete more 2'-FL in breast milk will in turn produce larger populations of Bifidobacteria for their babies. Microbiomes of infants fed breast milk are also able to retain higher proportions of Bifidobacteria as the microbial population develops, and infants are continually exposed to new microbes from the environment.

HMOs support the barrier in the lower GI.

Healthy gut function relies on a proper GI barrier between the body and the interior space that makes up the digestive tract, called the lumen. The GI barrier is made up of many layers:

- A luminal mucosal barrier
- Microbial inhabitants lining cells in the lumen
- A layer of mucus produced by goblet cells
- A chemical barrier
- A physical barrier of intestinal epithelial cells held together by tight junctions
- An immunological barrier

Stress, microbial invaders, antibiotic use, and development of chronic conditions can disrupt the intestinal lining. HMOs like 2'-FL stimulate the development and maintenance of a well-functioning GI barrier, both during development and in cases of GI inflammation.

2'-FL is similar in structure to certain binding sites on cells of the lower GI. Because of this similarity, 2'-FL molecules can act as binding decoys to biological toxins and external microorganisms that are known disruptors of the GI to prevent them from binding surface-bound sugars. This activity minimizes the amount of external microorganisms such as norovirus, *Campylobacter jejuni*, and enterotoxigenic *E. coli* launching infections and triggering the inflammatory response.

In breastfed infants, this binding decoy mechanism works as an extension of the GI immune system. Thus, it is not surprising that there are lower markers for inflammation in infants fed formula with added HMOs compared to a more traditional formula with prebiotics from cow's milk.

In addition to acting as an important component of a newborn's microbiome and healthy GI tract, 2'-FL also works as a targeted prebiotic for adults due to its unique tie to Bifidobacteria. For adults, 2'-FL supports short-term feeding of beneficial Bifidobacteria in times of GI stress and for individuals deficient in Bifidobacteria populations looking to increase microbiome diversity.