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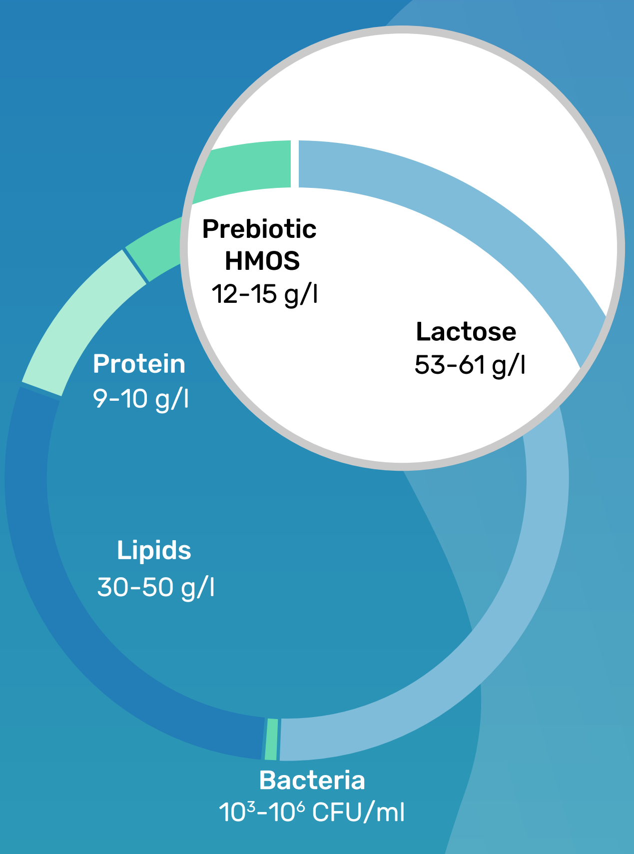
Carbohydrates in breastmilk



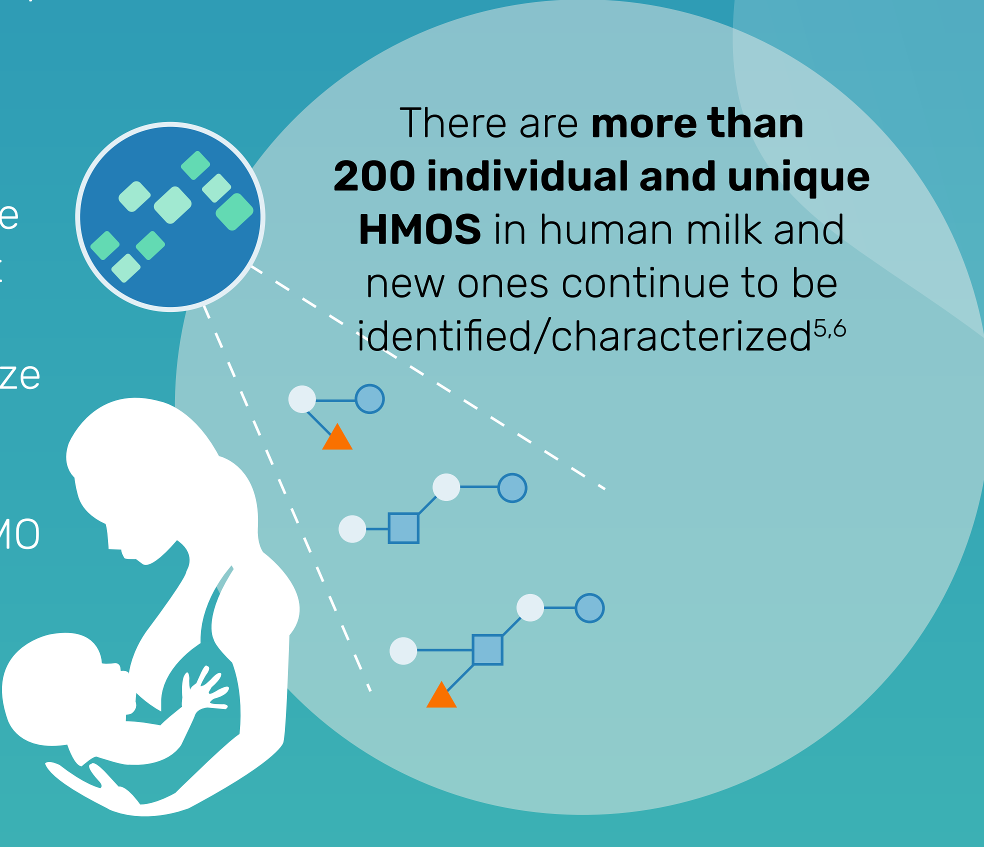
What are carbohydrates in breastmilk?

Carbohydrates represent the largest group of macronutrients in breastmilk, and include lactose and Human Milk Oligosaccharides (HMOS)[1]

Lactose is a **digestible** carbohydrate consisting of glucose and galactose, and is digested by an enzyme called lactase[2,3]

HMOS are complex, **undigestible** carbohydrates, which are made up of five different sugars and range from 3 to 32 sugars in size Differences in linkages of these sugars and sizes result in unique HMO structures[1,3,4]

There are **more than 200 individual and unique HMOS** in human milk and new ones continue to be identified/characterized[5,6]



Why are **carbohydrates** important in breastmilk?

LACTOSE

Serves as an **energy source**: breastmilk lactose provides around 40% of total energy[2]

Supports the **absorption of minerals**, such as calcium[2]

Is important to maintain a constant **osmotic pressure** in milk, therefore in water regulation[2]

Impact the **sensorial properties** of breastmilk (sweetness)

HMOS

Function as **prebiotics**, by selectively encouraging the growth and activity of beneficial bacteria in the gut[7]

Stimulate **intestinal barrier** functions/epithelial cell modulators[8]

Have a direct effect on **immune cells**/ immune cell modulators[9–11]

Block the **route of infections/** anti-adhesive, antimicrobials against pathogens[10–13]

Are **anti-inflammatory**[14]

Provide **building blocks** for the brain[15]

Do carbohydrates vary in breastmilk?

Among the macronutrients, **lactose** is the least variable in breastmilk[2]; oligosaccharides are more variable

Studies have reported that **carbohydrates** in breastmilk vary:

OVER THE COURSE OF ONE FEEDING: foremilk (the initial milk of a feed) may contain higher lactose concentrations than hindmilk (the last milk of a feed)[2,3]

OVER GESTATIONAL AGE: lower levels of lactose and higher levels of HMOS have been found in milk produced for preterm infants, compared to term infants[16–18]

OVER LACTATIONAL STAGES: lactose concentration generally increases, and HMOS decrease from colostrum till mature milk[1,4,16,19,20]

OVER GEOGRAPHICAL REGIONS: HMO concentrations have been found to vary over geographical regions. Genetic and lifestyle factors are thought to cause these variations[4,21,22]

DEPENDING ON GENETICS: mothers produce specific structures of HMOS in their milk as a result of genetic differences like blood group types. **Four HMO milk groups** can be assigned among mothers[4,5,16,23]

DEPENDING ON MATERNAL BMI: studies have suggested that the HMO composition is affected by maternal BMI[24]

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