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Consumption Patterns of Human Milk Oligosaccharides by 1-Month-Old Infants

Introduction

Human milk oligosaccharides (HMOs), as the third most abundant solid component in human breastmilk, is health-beneficial for newborns. There are more than a hundred different structures of HMOs identified, all composed of the five monosaccharides: glucose, galactose, *N*-acetylglucosamine, fucose and sialic acid. The presence and abundancy of HMOs in milk is highly variable and strongly depends on the genetic profile of the mother.

HMOs are indigestible by infants, but instead will enter the gut and be fermented by the gut microbiota. HMOs stimulate the growth of health-beneficial bacteria, mostly Bifidobacterium species. In the meantime, HMOs are (selectively) utilised as substrates by the gut bacteria, and the metabolisation products and the remaining HMOs will be secreted in the infant faeces.

Previous research mainly focused on the HMOs composition of breast milk, or *in vitro* fermentation of HMOs by specific bacteria culture. However, the consumption patterns of HMOs by infants are not fully understood yet.

Samples

Milk and infant faecal samples from 146 mother-infant dyads were provided by the KOALA (Kind, Ouders en gezondheid: Aandacht voor Leefstijl en Aanleg) cohort, from Maastricht University.

Samples were collected when infants were 33± 5 days old.

Methods

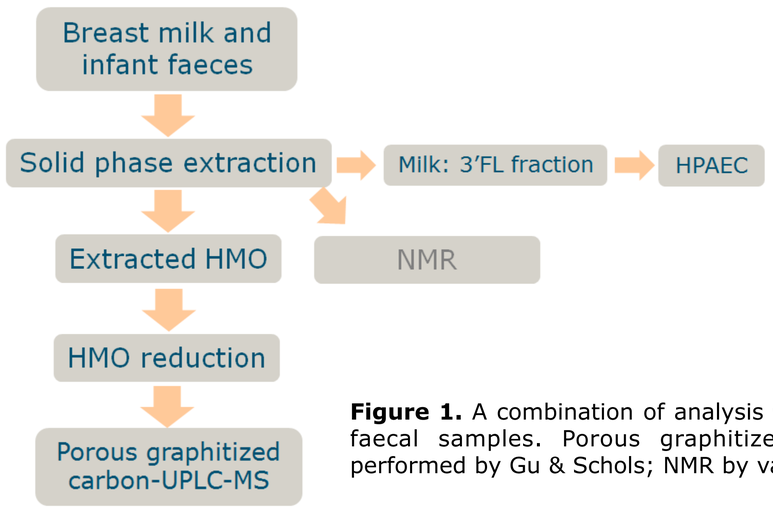

Figure 1. A combination of analysis was used on the milk and faecal samples. Porous graphitized carbon-UPLC-MS was performed by Gu & Schols; NMR by van Leeuwen & Kate.

Objective

-To qualify and quantify the HMOs compositions in mother milk and corresponding infant faecal samples.

-To investigate the consumption patterns of HMOs by the 1-month-old infants, in order to correlate the utilization of HMOs with gut microbiota composition in further research.

Results

The milk oligosaccharide compositions varied among mothers, depending on mothers'genetic profiles. Figure 2 showed the PGC-UPLC-MS results of milk samples from four mothers who had different Lewis and Secretor genetic profiles. The Lewis and Secretor genes controls the expression of different fucosyltransferases, which are responsible for synthesizing specific fucosyl structures. Therefore, mothers with different Lewis and Secretor status had different HMOs compositions in their milk.

By comparing the HMOs profiles of milk and corresponding infant faecal samples, the utilization of individual HMOs by infants can be determined, as shown in Figure 3.

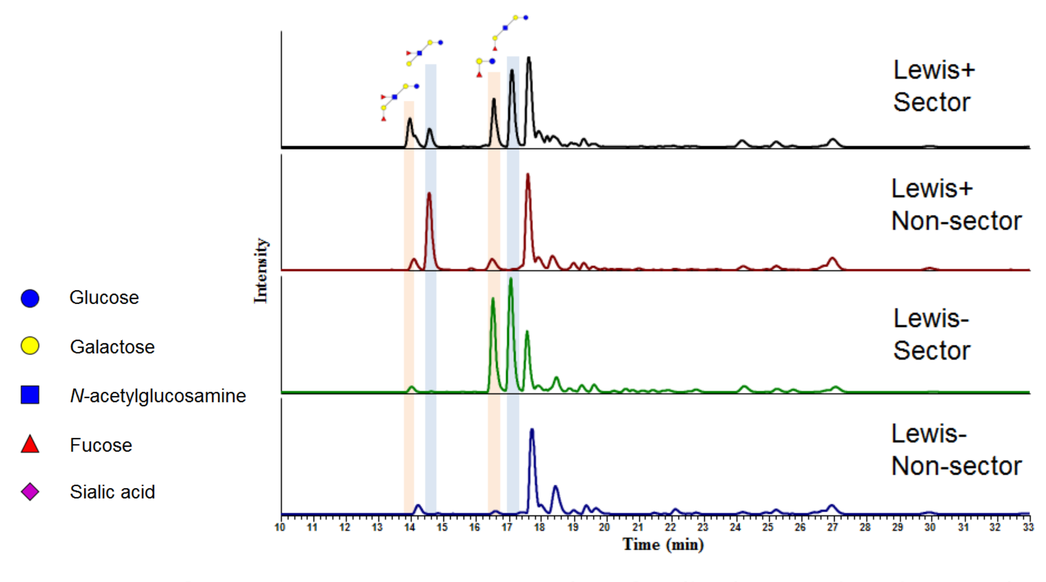

Figure 2. PGC-UPLC-MS results of milk oligosaccharide samples from mothers of different Lewis Secretor types. The presence of fucosylated HMOs are different among different groups.

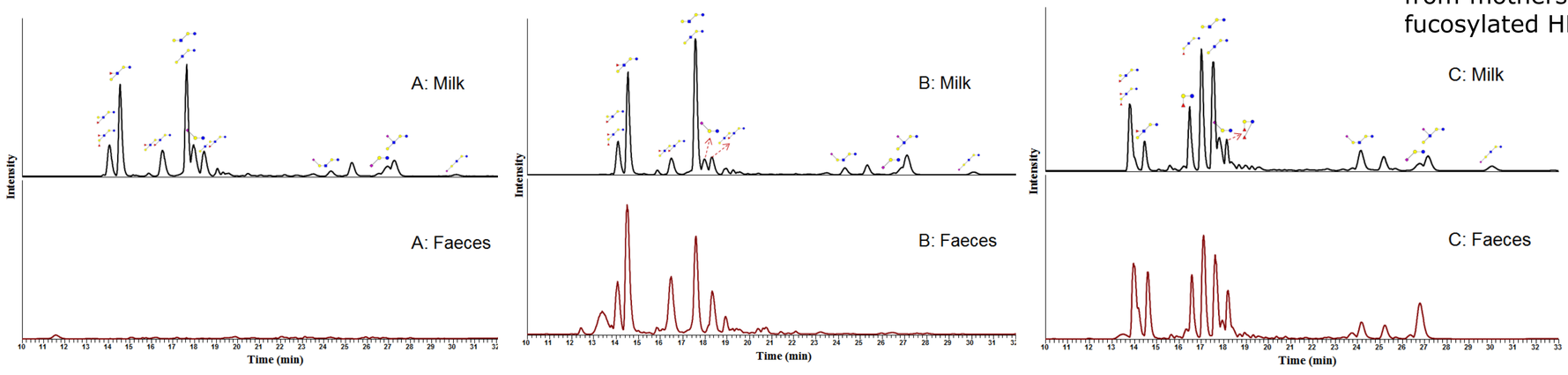

Figure 3. Three examples of different consumption patterns of human milk oligosaccharides by 1-month-old infants, as analyzed by PGC-UPLC-MS. A: complete consumption of all human milk oligosaccharides; B: HMOs selectively utilized, in this case, sialylated HMOs haven been predominantly utilized; C: faecal HMOs profile comparable to that of milk and high concentrations of HMOs still present

Conclusions

- Inter-individual differences were found in the HMO composition among different mother milk samples, as well as in the HMO profiles remaining in corresponding infant's faecal samples.
- The consumption patterns can be clustered according level and selectivity of HMO utilization, and will be correlated with microbiota results.

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