

VARIATION IN OLIGOSACCHARIDE COMPOSITION OF HUMAN MILK: TEMPORAL AND INDIVIDUAL VARIATIONS

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Human milk contains significant amounts of oligosaccharides, especially in the colostrum phase, with up to 18 g/L compared with 70 g/L of lactose. Cow's milk and cow's milk-based formulas contain very little. Increasing evidence suggests that the oligosaccharides in human milk play a protective role against bacterial infections of the gastrointestinal, urinary and respiratory tracts. However, little is known about the variation in oligosaccharide concentrations throughout lactation or differences between women.

We studied the temporal and individual variations in oligosaccharide composition in milk of eight healthy full-term and two pre-term mothers during the first three months of lactation. The human milk oligosaccharides contain from 3 to 11 monosaccharide residues consisting of sialic acid, fucose, galactose, glucose and N-acetylglucosamine (Glc-NAc). The de-fatted milk samples were hydrolysed to yield the monosaccharide components from the oligosaccharides. Sialic acid and Glc-NAc were found to decrease significantly ($P < 0.05$) from 1 week to 13 weeks postnatally. On average, sialic acid decreased three-fold, Glc-NAc two and a half-fold but fucose decreased by only 35% (see table). There were also large differences among the women, particularly with respect to fucose. Fucose was three times higher in some women at the beginning of lactation compared to others. In all women, there was a slight but significant increase in the concentration of free lactose over the first three months of lactation.

	Sialic Acid *	Glc-NAc	Fucose	Lactose
	mg/L	mg/L	mg/L	mg/L
Full-Term Wk1	879 ± 157	1459 ± 282	660 ± 192	55373 ± 4179
Wk13	256 ± 82	646 ± 214	432 ± 180	64934 ± 2280
Pre-Term Wk1	1424 ± 90	1991 ± 273	1045 ± 332	45320 ± 4243
Wk5	1017 ± 197	1087 ± 482	755 ± 233	53486 ± 2121

* Mean concentration ± SEM

These findings indicate that, unlike fat, protein and lactose, there is much greater variation in the concentration of oligosaccharide components in milk during the first three months of lactation. The biological significance of this variation may be due to a change in demand by the infant for certain of these components. Sialic acid is thought to be incorporated into gangliosides in the brain of the infant at two main stages during their early development: before birth and during the first month postnatally. The higher concentrations of sialic acid at week 1 and also the higher concentrations observed in the pre-term milk would support this hypothesis. However, it is not known whether the oligosaccharides in human milk can be digested and absorbed in the small intestine. The enzymes which are necessary are not present in the intestinal brush border.