COMPLEX LIPID COMPOSITION IN THE BREAST MILK FROM CHINESE AND MALAYSIAN MOTHERS


Introduction

Complex lipids – gangliosides (GA) and phospholipids (PL) – are part of the milk fat globule membrane (MFGM) in human milk. The diversity of the sialic acid containing GA derives from the variety of glycosylation and fatty acids (Figure 1). PL are a class of phosphorus-containing polar lipids that include phosphatidyl ethanolamine (PE), phosphatidyl choline (PC), phosphatidyl serine (PS), phosphatidyl ethanololamine (PE) and sphingomyelin (SM), (Figure 2). Complex lipids play important roles in brain development and function. GA have important roles in neurological development, while PL, such as those from human breast milk (HBM), may have a range of benefits, so understanding their concentration and variation is important.

Study objective

To use a validated high-performance liquid chromatography-mass spectrometry (HPLC-MS) method to determine the ganglioside and phospholipid classes and concentrations in breast milk from a cross section of Chinese and Malaysian mothers throughout an eight- and 12-month lactation period, respectively.

Results

Ganglioside concentration across lactation

GMS is the dominant HBM ganglioside class in mature milk, increasing from 65.56% to 90.81% of total GA (TGA = GMS + GDS) across the course of lactation for Chinese and Malaysian mothers’ HBM respectively (Figure 3).

TGA was highest in colostrum (26.8 ± 16.4 mg/L) and transition milk (18.3 ± 6.1 mg/L). Over the mature milk period, both populations showed an increase in average total ganglioside concentration, from 11.3 ± 6.7 mg/L to 22.9 ± 9.9 mg/L, and from 14.8 ± 8.0 to 23.5 ± 15.7 mg/L for Chinese and Malay mothers respectively (Figure 3).

Trimmed means of 18.5 ± 7.7 mg/L and 18.5 ± 10 mg/L were measured for Chinese and Malaysian mothers respectively with no significant difference between cohorts.

Phospholipid concentration across lactation

TPL concentrations were highest during the colostrum-transitional milk period (266–131 mg/L). In the Malaysian mature milk samples, the average total PL concentration increased gradually over the lactational period from 170 ± 80 mg/L, (at 30 days) to 220 ± 92 mg/L (365 days). (Figure 5b) but was not observed in Chinese-HBM where the levels fluctuated from 173 ± 41 mg/L to 250 ± 65 mg/L (Figure 5a).

TPL ranged from 217 ± 47 mg/L to 377 ± 44 mg/L, (trimmed mean of 304 ± 50 mg/L) and 32 mg/L, to 418 ± 50 mg/L (trimmed mean of 181 ± 75 mg/L) for the solely breast feeding period from 1 to 6 months for Chinese and Malaysian HBM respectively with no significant difference between cohorts.

Phospholipid classes

The relative distribution of the individual PL classes (SM, PS, PC, PE, PI, lysophosphatidylcholine and lyso-PC) were relatively consistent (Figure 6). SM and PE were the two major PL classes present in mature HBM. They made up 12–19% and 27–42%, of the total PL respectively (Figure 6). Only trace levels of lyso PE and lyso PC were observed.

Colostrum and transitional milk however displayed a very different PL class relative distribution with significantly higher concentration of PS at 36–17% of TPL than mature milk (Figure 6a).

Conclusions

- For mature milk, the average Chinese and Malaysian TGA and TPL results were not significantly different.
- There were large, between mother variations in TGA and TPL concentrations. The correlation between complex lipid concentration and HBM fat concentration means diet could have an impact on TGA and TPL.
- There is a lactational trend for TGA and the individual ganglioside classes.
- The lactational trend for PL is not clear but the distribution of the individual PL classes appears to be conserved throughout lactation.

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