

Infant & Young Child Feeding n Nutrition in Perspective

透視嬰幼兒餵哺與營養



Baby Friendly Hospital Initiative Hong Kong Association

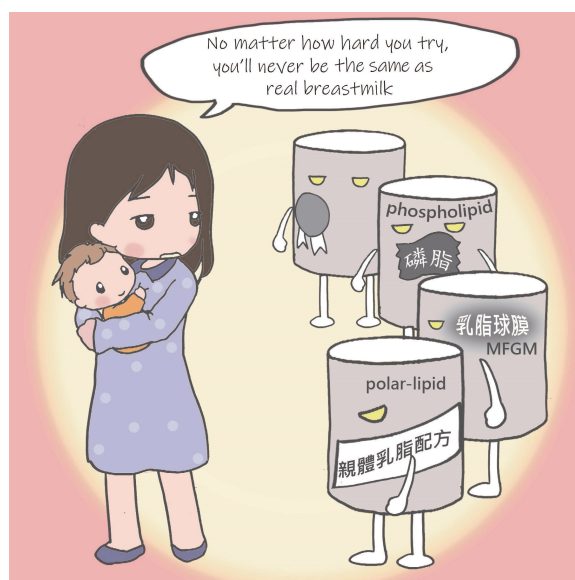
Oct 2019

The Additives in Vogue: MFGM and Polar Lipids

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Breastmilk is the preferred food for all infants to support their optimal growth and development. The composition of breastmilk changes continuously to suit the infant's circumstances (e.g. prematurity, at times of infection) whereas that of infant formula remains unchanged over time. Yet formula milks are often promoted as having a composition close to human milk, implicitly suggesting that they function like the latter. Recently, manufactures are promoting **claims that the addition of complex lipids (originated from cow milk) in formula milk would mimic human milk in improving brain (cognitive) functions.**



Examples of Claimed Benefits of Additives in Formula Milk*

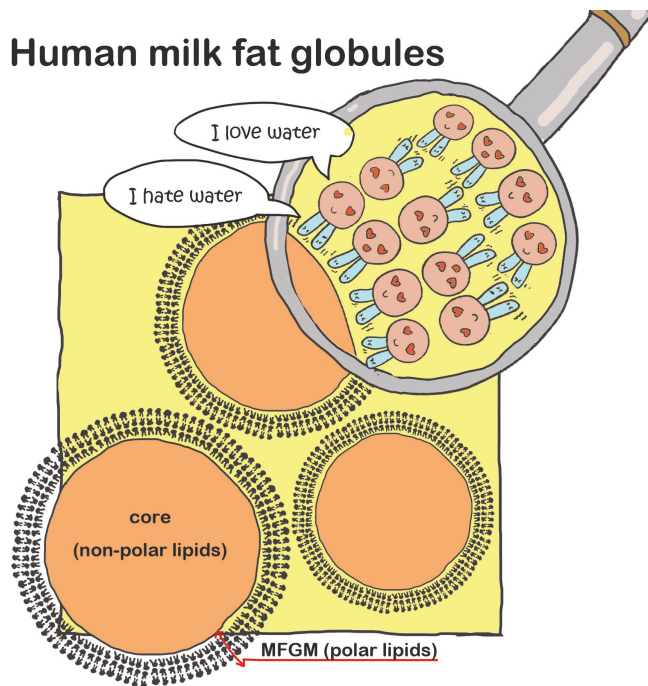
- (1) “ALPHA-LIPIDS is a unique ingredient scientifically shown to help speed-up brain connections by up to 100x faster through myelination. It contains the 5 major phospholipids, including Sphingomyelin which has been shown by recent observational studies to impact myelination across all the regions of the brain.”
- (2) “S-Lipids (神經鞘磷脂)- 磷脂是腦細胞膜的主要成份，對於髓鞘形成十分重要，髓鞘有效加快訊息傳遞。髓鞘形成支持腦部連接，有助打好學習及認知基礎。”
- (3) “星級親體乳脂配方乳脂球膜(MFGM)含豐富的極性脂質 (Polarlipids) ，親和寶寶，促進寶寶腦部發展，腸道健康及提升抵抗力。”
- (4) “Polarlipids 有助支持大腦神經圓的髓鞘形成，促進腦內訊息傳遞，提升寶寶認知力。”

(Note: “Alpha-lipids” and “S-Lipids” are Phospholipids which are Polar Lipids. Milk fat globule membrane (MFGM) contains mainly Polar Lipids.)

Human Milk Lipids

Lipid is the second largest component of breastmilk. Human milk lipids are essential for growth and development. They are a major source of energy (supplying about 50% of total calories) and provide essential nutrients such as essential fatty acids (EFAs) and polyunsaturated fatty acids (PUFAs) as well as lipid soluble vitamins. They have specific roles to support gastrointestinal functions, neurodevelopment and immunity.^{1, 2}

Human milk fat globules



Human milk is an emulsion of milk fat globules in an aqueous liquid. Milk fat globules contain a core of nonpolar lipids (triacylglycerols and cholesterol) coated with a tri-layer membrane. This milk-fat-globule membrane (MFGM) comprises phospholipids (a polar lipid), e.g. sphingomyelin, phosphatidylethanolamine and phosphatidylcholine; cholesterol and proteins. The MFGM is highly bioactive. The polar lipids in the MFGM are made up of hydrophobic tails and hydrophilic heads which enable the membrane to keep the fat globules from merging together, hence stabilise the emulsion.^{1, 2} It also

contains proteins and glycolipids which can bind to pathogens and be excreted in the stool, thereby protecting the infant's intestinal epithelium from invasion.³

Functional Claims with respect to the Addition of Lipids

In 2009, the European Food Safety Authority (EFSA) issued a Scientific Opinion on the substantiation of health claims related to phospholipids. The scientific panel concluded that a cause and effect relationship has not been established between the consumption of phospholipids and normal memory, learning capacity and concentration, and normal function of the nervous system.⁴

Recent evidence on the Addition of MFGM and Complex Lipids in Breastmilk Substitutes and Improved Cognitive Functions

During the manufacturing of breast milk substitutes (BMS), bovine fat is often replaced by vegetable oil blends to provide the polyunsaturated fatty acids, linoleic acid (LA) and alpha-linolenic acid (ALA), which are insufficient in cow milk. Yet some preclinical studies suggest that the absorption of calcium and palmitic acid may be reduced due to the low proportion of palmitic acid in sn-2 position in vegetable fat triacylglycerides.³ With more scientific understanding on human milk MFGM and complex lipids, there are increasing research interests on the potential benefits of supplementing BMS with dairy lipid fractions including MFGM from bovine origin.

Several clinical trials have reported short-term benefits of adding bovine lipids to infant formula on neurobehavioural outcomes. A small pilot randomised controlled trial (RCT) on Japanese preterm infants (n=24) fed with infant formula fortified with sphingomyelin (intervention) versus control group (preterm infants fed with standard infant formula) had reported short-term neurobehavioural benefits.⁵ A small pilot RCT examined normal healthy Indonesia infants (n=59) fed with infant formula supplemented with complex milk lipids containing gangliosides (intervention), compared with infants fed with standard infant formula (control). Improved hand and eye coordination, performance and general developmental quotient at 6 months of age had been reported.⁶ Another Swedish RCT evaluated infants fed with infant formula added with bovine MFGM and reduced energy and protein content (MFGM intervention) versus control (infants fed with standard formula) as well as a breastfed reference group (BFR). The MFGM group showed higher cognition scores with the Bayley test at 12 months of age compared to the control, but no difference compared to the BFR group.⁷ Researchers opined that while the recent RCTs suggested supplementing infant formula with MFGM appeared safe, there was still limited evidence regarding its health effects. Further research is needed to identify the potential long-term health benefits and to explore the appropriate composition of MFGM preparations in formula milk.^{2, 3, 8}

In sum, there is insufficient scientific evidence from RCT on the long-term health benefits on infants fed with infant formula supplemented with bovine MFGM, compared with breastfed infants. Moreover, the findings of these trials are limited by small sample sizes and potential commercial conflicts of interest.

Can Formula Milk be ‘Close’ to Breastmilk?

In 2014, the EFSA conducted an independent review and issued the Scientific Opinion on the Essential Composition of Infant Formula and Follow-on Formula. It states that while “human milk composition can provide guidance for the composition of infant formula, formula milk having composition similar to human milk is not the only appropriate indicator to show its safety and nutritional suitability... The mere presence of a substance in human milk does not necessarily indicate a specific benefit of this substance for the infant... because absorption efficiency of certain nutrients differ between breastmilk and formula.”⁹

Given the unique biochemical structures of human milk and its myriad bioactive constituents, it is virtually impossible for formula milk to imitate breastmilk in functions. Nurturing an environment conducive to breastfeeding for families remains a public health priority. For parents who cannot or opt not to breastfeed their child, they should be given adequate and unbiased information on the choices and safe use of formula milk products from credible sources.

Key messages:

- Human milk lipids are essential for infants' growth and development. They are a major source of energy and provide essential fatty acids (EFAs), polyunsaturated fatty acids (PUFAs) and lipid soluble vitamins.
母乳中的脂質對寶寶的生長和發育非常重要。脂質為寶寶的主要熱量來源，並且提供必需脂肪酸、多元不飽和脂肪酸以及脂溶性維生素。
- In human milk, milk fat globules are coated with a membrane composed of polar lipids (phospholipids). This milk-fat-globule membrane (MFGM) is highly bioactive in supporting gastrointestinal functions, neurodevelopment and immunity.
母乳中的乳脂球由極性脂質(磷脂)組成的膜覆蓋。這乳脂球膜具有高生物活性，有助腸道吸收和腦部發育，及增強免疫能力。
- Currently, there is **limited scientific evidence** from Randomised Controlled Trials on the health benefits of supplementing infant formula with bovine MFGM, compared with breastfeeding.
根據隨機對照試驗結果，現時只有**有限的科學證據**顯示相對母乳餵哺，喝添加牛乳脂或乳脂球膜的配方奶能為嬰兒帶來健康的好處。
- Given the unique biochemical structures of human milk and its myriad bioactive constituents, it is virtually impossible for formula milk to imitate breastmilk in functions. Parents should be given adequate and unbiased information on the choices and safe use of formula milk products from credible sources.
由於母乳具有獨特的生化結構及含多種高活性因子，配方奶根本不可能模仿母乳的功能。家長應從可靠來源得到足夠和不偏頗的資訊，讓他們選擇和安全地使用配方奶產品。

Further reading:

Early Nutrition eAcademy. Focus Module "The Milk fat Globule and Its Membrane". Link:

<https://www.early-nutrition.org/en/enea/>

First Steps Nutrition Trust. Infant formula – An overview. June 2019. Link:

<https://www.firststepsnutrition.org/composition-claims-and-costs>

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Views expressed in this article are the author's and do not necessarily reflect the opinion or position of the BFHIHKA.

作者在本文表達的見解，未必代表愛嬰醫院香港協會的意見或立場

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P.5



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