

7 DECADES OF RESEARCH

MFGM & its Components

1950
→ 1990



Advances in analytical methods led to recognition of MFGM & its components

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|---|---|
| 1950 Polonovski et al.
Extraction of xanthine dehydrogenase from milk | 1986 Zeisel et al.
PL and SM in HM, BM, IF |
| 1968 Morrison
PL levels in milks | 1986 Laegrid et al.
GG composition of HM and BM |
| 1972 Bracco et al.
Lipid composition of MFGM | 1988 Hundrieser and Clark
Method to separate and measure PL classes |
| 1984 Bitman et al.
PL levels over lactation | |

KEY GUIDE ■ Analytical ■ Pre-clinical ■ Clinical
SM: sphingomyelin; **PL:** phospholipid; **HM:** human milk;
BM: bovine milk; **GG:** ganglioside; **IF:** infant formula

Preclinical studies explore mode of action in the brain, gut, and immune system



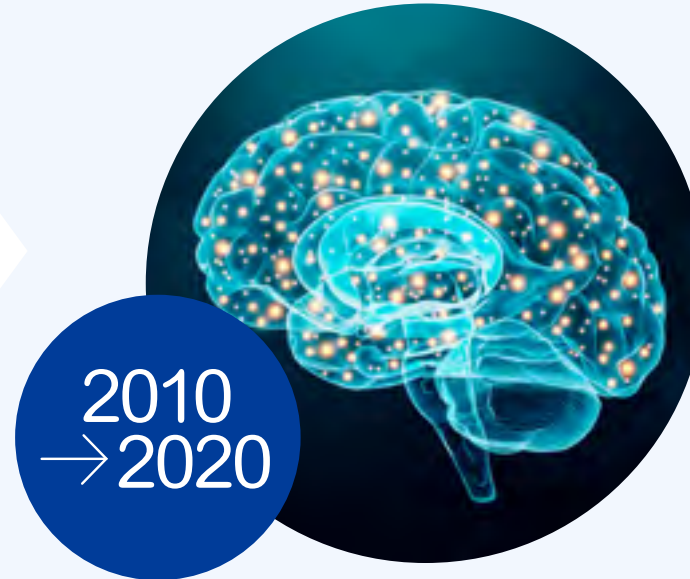
1990
→ 2010

- | | |
|--|---|
| 1993 Mei and Zheng
Exogenous GG on learning and memory in rats | 2007 Susuki et al.
GG, myelination and nerve function |
| 1997 Fong et al.
GG improves learning and memory in aged rats | 2008 Clare et al.
Antimicrobial functions of MFGM |
| 1998 Rueda
GG improves gut flora in preterm infants | 2008 Jung et al.
GG improves spatial learning and memory in rats |
| 1998 Carlson
Phospholipids reduced complications associated with prematurity | 2009 McJarrow et al.
A review on dietary GG and brain development |
| 2003 Oshida et al.
Dietary SM and myelination in rats | 2009 Schnabl et al.
GG can be taken up by intestinal cells |
| 2003 Wang, et al.
Brain GG in BF and FF infants | 2009 Vickers et al.
Complex milk lipid supplementation improves cognition in rats |



Over 2000 studies published on MFGM and its components and the evidence continues to grow...

Clinical evidence supports MFGM's role in cognition and immune health in early life



2010
→ 2020

- | | |
|---|---|
| 2011 Zavaleta et al.
MFGM enriched foods improve diarrhea in infants | 2018 Deoni et al.
MFGM components are associated with early myelination trajectories |
| 2012 Gurnida et al.
Complex milk lipids associated with cognitive development in 6 month infants | 2019 Li et al.
MFGM in infant formula supports normal growth and tolerance |
| 2012 Veereman-Wauters et al.
MFGM improves parent reported behavior regulation and febrile episodes in children | 2019 Li et al.
MFGM and Lactoferrin support cognitive development in infants |
| 2013 Tanaka et al.
SM-enriched formula improves multiple development measures in preterm infants | 2019 Norris et al.
Safety of maternal supplementation with GG-enriched complex lipids during pregnancy |
| 2014 Billeaud et al.
Safety and tolerance of MFGM enriched formulas | 2019 Nieto-Ruiz et al.
Long term follow-up after feeding infant formula with multiple functional ingredients, incl MFGM |
| 2014 Timby et al.
MFGM and neurodevelopments in infants | 2019 He et al.
Metabolome analyses of MFGM intervention trial |
| 2016 Ten Bruggencate et al.
MFGM and immune outcomes in adults | 2025 Ren et al.
MFGM and LCPUFA in infancy supported neurocognitive development measures |
| 2017 Timby et al.
MFGM and infant oral microbiota | |

Clinical evidence on long-term cognitive benefits to 5.5 - 6 year olds



2020
→ Now

- | | |
|---|--|
| 2021 Chichlowski et al.
Gut microbiota and metabolome of infants fed formula with MFGM and lactoferrin | 2023 Schneider et al.
MFGM components in infancy contributed toward myelination to 24 months of age |
| 2021 Xia et al.
GG-enriched complex lipid ingredient in formula and developmental milestones | 2023 Colombo et al.
5.5 years follow-up after feeding infant formula with MFGM+LF |
| 2022 Lazarte et al. [abstract]
13 years follow-up after feeding infants with complementary foods supplemented with MFGM | 2025 Deoni et al.
MFGM intake associated with enhanced brain myelination and motor skills |
| 2022 Nieto-Ruiz et al.
Follow-up of children at 6 years old, who were fed with a combination of functional components including MFGM and DHA during infancy | 2025 Algarin et al.
Surrogate measures of myelination at 2 years of age after infant formula with MFGM |

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