

Milk Fat Globule Membrane: Maintaining Bioactivity and Structure in Processing

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Abbreviations

CLSM, confocal laser scanning microscopy

CM, casein micelle

GA, golgi apparatus

GM, globule membrane

HPLC, high-pressure liquid chromatography

LPS, lipopolysaccharide

MFGM, milk fat globule membrane

SDS, sodium dodecyl sulfate

SFE, supercritical fluid extraction

SM, sphingomyelin

TLR, toll-like receptors

Expanded Commentary From the Faculty

Is the MFGM derived from cow's milk similar to the MFGM structure in human milk?

Yes, it is very similar. Biologically, they have the same function in the mammary gland. When Mother Nature designs something very well, it does not change.

Is the milk fat globule, whether it comes from human or cow's milk, working in the same way?

Yes, given that phospholipids are the same, and appear in the same proportions. We have observed that these components are essential to keep the health of the membrane of mammary cells performing optimally. This is similar to what happens with our skin when it gets dry, and we put cream on it. We notice a regeneration of the supple nature of the skin, and it fulfills its function much better and maintains the water inside the cells. Similarly, that is the role of the phospholipids, to maintain the health of the mammary cells.

How is high-performance liquid chromatography (HPLC) used when separating MFGM?

This is a process used to separate all the chemical components in a substance, such as milk fat globule membrane (MFGM). Using HPLC, individual proteins that are present in MFGM can be separated, not only by species but also quantitatively. We can say how much of each protein there is in our component. Chromatography is used to separate every phospholipid present in MFGM and to quantify them.

How long have we had the dairy processing technology to isolate the MFGM?

In 1982, ultrafiltration was a new technique. At that time, there was too much whey that had to be disposed of in the dairy industry. Dairy scientists pioneered the use of this ultrafiltration technique—filtering so we could recover water and concentrate the proteins, which are very useful. This technique is now state of the art, having evolved over the last 25 years and is used throughout the dairy industry. On a side note, the United States and other countries purify water using the same technique: removing salt from the sea water. It is this same technique that we use in separating the MFGM components from the aqua system in milk.

Is there another mammal source, other than bovine, that is used for additives to enrich formula like the MFGM?

We have not evolved enough to have a source for infant formula other than cow's milk. It must be stressed, however, that other mammals have exactly the same components in their milk as human milk. In milk from other mammals, such as goats and donkeys, these components appear in almost the same amount [as in human milk]. We have not industrialized other sources of milk in the same way. Because of hygiene and standards of identification, cow's milk is certified and inspected and is the best source for infant formula.

Discussion Guide

What are the clinical benefits to including MFGM in infant formula?

How does MFGM-enriched formula narrow the composition and functional gap between formula and breast milk?

What specific MFGM components found in human and bovine milk impact both brain function and immune defense?

How do we isolate and obtain MFGM for use in infant formula?

What is it about the structure of MFGM that allows it to remain intact and bioactive after processing?

Suggested Readings and Resources

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