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Interfacial behavior of milk polar lipids and their influence on gastric lipase adsorption: a natural effective delivery system

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The polar lipids in human milk fat globule membranes condition the accessibility and enzymatic digestibility of milk lipids. Their substitution by bovine polar lipids to produce infant formulas biomimetic of human milk has been suggested. However a comparison of the interfacial behavior of bovine and human polar lipids and of their interaction with the first enzyme involved in fat digestion, gastric lipase, is lacking.

Such comparison is here undertaken using complementary biophysical tools: tensiometry, ellipsometry, Brewster angle and atomic force microscopy, in the presence or in the absence of gastric lipase. Polar lipids extracts were obtained from a pool of human milk (n=5) or bovine butterserum and analyzed using GC and HPLC.

Human milk polar lipids (HMPL) presented a higher compressibility than bovine milk polar lipids (BMPL). Despite the presence of liquid condensed domains in both extracts, their morphological aspect and growth differed in relation with the lipid composition. Lipid phase separation impacted on gastric lipase adsorption in both extracts with an exclusive adsorption onto the liquid expanded phase. Despite differences in their physico-chemical properties, both polar lipid extracts share close interfacial reactivity in gastric conditions. This biophysical characterization will be broadened to other milk polar lipids interesting for human milk substitution.