Infant formulas with improved lipid absorption for enhanced brain maturation in infants–INFANTBRAIN

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Aim

To develop infant formulas that ensures maximal absorption of lipids necessary for the infant brain development. This will be done by optimizing the composition of the interface of the lipid-particles (using milk phospholipids and potentially other lipids) in the formula to maximize the activity of the lipases that are active in the new-born gut.

Description

Fat absorption is substantially less efficient in new-borns fed infant formula than in breast fed babies. Since optimal absorption of polyunsaturated fatty acids is essential for appropriate brain development during the first year of life, a reduced fat absorption may lead to sub-optimal brain maturation and hence, reduced cognitive development. Hydrolysis of dietary triacylglycerol in the gut of new-borns is catalysed by gastric lipase in the stomach, combined with bile-salt stimulated lipase and pancreatic lipase-related protein 2 in duodenum. We will therefore optimize the structure of the fat-particles in infant formula to achieve maximal activities of these enzymes, and hence maximal fat absorption. We will initially use two different in vitro systems to test different formulations with modified lipid/water interfaces, which better mimic the natural milk-fat globular membrane composition. First we will screen a large number of compositions in small-scale static system; the most promising of these will be further studied in a dynamic gastric-model. Based on the results from these studies we will select the formulations that induce highest hydrolytic activity and test their ability to improve brain maturation and LC-PUFA and sphingomyelin accretion in different domain of the brain in rat pups, which have an intense brain development between day 12 to 22. The model formula with the best performance in the rat will then be compared with a standard prenatal formula in a preterm piglet model. Preterm pigs are highly sensitive to optimal milk composition and are used to investigate cognition and incorporation of brain lipids. A stepwise approach to tests in this model is used to optimize resource allocation and reduce costs.