Lipids in Infant formula and onwards
Agenda

1. Human Milk
2. Raw materials used in infant formula
3. Processing of vegetable oils
4. Infant formula blends
5. Closer to human milk fat
6. Lipids in Baby Food
Marketing of “breast-milk substitutes”

*Breastfeeding is best*

“Aggressive marketing of breast-milk substitutes continues to undermine efforts to improve breastfeeding rates. In May 1981, the World Health Assembly (WHA) adopted the International Code of Marketing of Breast-milk Substitutes to limit inappropriate marketing practices. [...] The Code and the relevant WHA resolutions are the world’s first real attempt to tackle the harmful effects of marketing of breast-milk substitutes, feeding bottles and teats on a global scale.” *(WHO Status report, 2016)*
There is no “standard” human milk

- The composition of breast milk develops during lactation and is further influenced by the mother’s diet
- The genetic variation in the fatty acid-converting enzymes further contributes to differences in the composition of breast milk
Composition of human milk fat

Human Milk

- Fat 26%
- Protein 12%
- Carbon hydrates 58%
- Nutrients 4%

Human Milk fat
- Triglycerides > 98%
- 0.4% Cholesterol
- ~0.3-1% Phospholipids
- 0.1-0.8% DHA &
- 0.2-1% AA of total FA

* Source ingredients for the world infant formula market 2004
Fats for infant nutrition

Fat is a substantial ingredient of infant formula:
- As an energy source
- As the source of essential FAs
  - Linoleic C18:2 (omega 6)
  - Linolenic C18:3 (omega 3)

How to copy human milk fat
- Fatty acid composition

Which raw materials are used?
- Rapeseed, soybean and sunflower oil
- Palm oil
- Palm kernel and coconut oil
Plants have a unique ability to synthesize a wide range of fatty acids

Compositions of oils depend on species, growth conditions, season, genetic variety, etc.

The Co-Development Company
Structure of triglycerides, fatty acid positions

Glycerol

Saturated fatty acid

Monounsaturated fatty acid

Polyunsaturated fatty acid

Outer position, sn-1

Mid position, sn-2, beta, β

Outer position, sn-3
Processing of vegetable oils
Interesterification

- Fatty acids change place

\[ E + E \xrightarrow{\text{Catalyst/Enzyme}} E + E \]

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Infant nutrition blends

- Specified Fatty Acid profile
  Natural variation of the raw materials

- Specified Quality
  Oxidation parameters, legislation demands

- Security from start to finish
  Contaminant standard
Fatty acid profiles

- Fatty acid profile for human milk from mothers having a western diet and mothers having a non-western diet.
- Coping the FAC profile below in an infant formula.

Jensen et al. Lipids in Human Milk 1999
As close as possible to human milk fat

- Fatty acid you can match with natural vegetable oils

- Triglyceride structure differ
  In human milk fat C16 is predominantly in sn-2 position. Vegetable fat mostly in sn-1 and 3 position

- Infat enriched with high level of C16 in sn-2 position. Enzymatic interesterification process
Human Milk vs Vegetable Oil Triglyceride Digestion

Human milk:
- TG
- Lipase
- Free unsaturated fatty acid
- Absorbed
- Absorbed

Vegetable oil:
- Lipase
- Free long saturated fatty acid
- Excreted as calcium soaps
Baby Food

- Health claim (EU)
  ‘Essential fatty acids are needed for normal growth and development of children’
  A daily intake of 1 % of total energy for linoleic acid (18:2) and 0.2 % of total energy of α-linolenic acid (18:3)

- A growing demand for toddler formula.
  Driven by convenience
  Make sure that the child gets all the nutrients required.
Summary

- Infant formula’s goal is to copy human milk.
- Vegetable oils are blended to meet the human milk fat’s FAC
- Sn 2 Palmitate can be used to also resemble the human milk fat’s structure
- Toddler formula more focus on essential fatty acid levels and balance between omega 3 and omega 6.
Thank you for your attention!

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