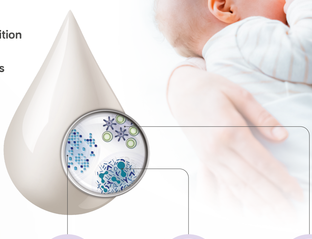
Based on the following paper:
Salminen S *et al.* Infant Formula Supplemented with Biotics: Current Knowledge and Future Perspectives.
Nutrients 2020, 12, 1952; doi:10.3390/nu12071952

THE WORLD OF INFANT FORMULA HAS BEEN REDEFINED

Inspired by the complexities of breastmilk

Breastmilk is the optimal form of infant nutrition and serves as a model for infant formulae – which provide nutritional solutions for infants unable to receive enough mother's milk.

Nutrition in the first 1,000 days (during pregnancy and first 2 years of life) is one of the most crucial factors in infant immune, gut and brain development. As an important step, the WHO guidelines recommend exclusive breastfeeding for the first 6 months of life and continue up to 2 years and beyond with gradual introduction of safe and suitable complementary feeding.



The unique composition of breastmilk – including its oligosaccharides, immune cells, bacteria, and bacterial metabolites – supports infant growth and development by promoting a healthy gut microbiota which is of significant importance during infancy.

One of the major factors enabling proper gut function and development is a balanced gut microbiota. Several prenatal and perinatal factors including mode of delivery, use of antibiotics, diet, and other environmental factors, including geographic region, may influence the microbial colonisation of the infant and in turn the maturation of the immune system.

HUMAN MILK OLIGOSACCHARIDES (HMOs)

- PREBIOTIC effect
- Direct effect on immune cells
- Blocking the route of infection
- Brain building blocks

BACTERIA AND THEIR METABOLITES

- PROBIOTIC and POSTBIOTIC effects, for gut and immune benefits

ANTIBODIES AND IMMUNE CELLS

Impact immune development and supports the development of a healthy gut microbiota

Direct protection

Breastmilk is best...but there may always be a need for infant formulae which seeks to mimic the composition and functionality of breastmilk as closely as possible, through the inclusion of biotics, for infants unable to receive breastmilk.

Biotics are nutritionally active compounds that can, when consumed, confer a health benefit on the host.

HiMOs
(Human-identical Milk Oligosaccharides)

Natural prebiotics, the 3rd most abundant component in breastmilk:

- Approx. 200 different structures exist in a 9:1 short and long chain ratio
- Candidate prebiotics, structurally identical to their counterparts in human milk
- Today only 2'-FL and LNnT commercially available for addition to infant formula

2'-FL – the most dominant HMO in breastmilk

2'-FL has gut and immune benefits including blocking growth of pathogens in the gut and parents reported fewer respiratory infections in infants.

When LNnT is used in combination with 2'-FL in infant formula parents reported lower morbidity and medication use.

2'-FL combined with scGOS/lcFOS (9:1) shows promising immune benefits in preclinical trials

3'-GL – naturally present in breastmilk

3'-GL benefits include improved intestinal barrier integrity/protection and reduced inflammatory response: more research is ongoing.

Since 3'-GL is a fermentation by-product, its safety is established through the long history of fermented infant formulae in France

HiMOs represent an interesting new field of study yielding promising results warranting further investigation.

PREBIOTICS

A substrate that is selectively utilized by host microorganisms conferring a health benefit

- Specifically designed to closely reflect the quantity, diversity (more than 100 different structures of short- and long-chain types in a ratio of 9:1) and functionality of HMOs in breast milk
- scGOS/lcFOS (9:1), the most studied mixture with proven prebiotic effect*
- In > 40 clinical studies, scGOS/lcFOS (9:1) has shown positive effects on gut microbiota, the immune system, infection rate reduction and stool softening

* as recognised by ISAPP.

PROBIOTICS

Live microorganisms which when administered in adequate amounts, confer a health benefit to the host

- Specific strains of *Lactobacillus* and *Bifidobacterium* are widely used as probiotics
- There is a wide variety of study outcomes on specific probiotics in infant formula, but health benefits are very strain and disease specific
- Certain probiotics can reduce the risk of NEC in premature infants

SYNBIOTICS

A mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host

- A synbiotic mixture of prebiotics (scGOS/lcFOS or scFOS/lcFOS in a ratio of 9:1) and the probiotic strain *Bifidobacterium breve* M-16V showed promising results for infants at high risk of allergy and infants with already developed allergy
- A synbiotic mixture of prebiotic scGOS/lcFOS (9:1) and probiotic *Bifidobacterium breve* M-16V compensated for delayed bifidobacteria colonisation and resulted in a lower proportion of potential pathogens (in infants delivered by caesarean section) leading to a significant decrease of atopic dermatitis (AD) score, less asthma-like symptoms and asthma medication use (in infants with AD)

POSTBIOTICS

Postbiotics are bioactive compounds produced by food-grade microorganisms (during a fermentation process) that, when administered in adequate amounts, promote health and well-being

- Most postbiotics derive from *Lactobacillus* and *Bifidobacterium* strains, being produced by fermentation. *Bifidobacterium breve* C50 and *Streptococcus thermophilus* 065 are the most commonly used bacterial strains and naturally deliver postbiotics
- Postbiotics benefits include gut maturity/permeability and reduced colic. However, specific benefits will depend on the fermentation process and strains used

A consensus definition on postbiotics – the newest member of the biotic family – is being developed by ISAPP.

MODULATE THE GUT MICROBIOTA
bringing it closer to that of a breast-fed infant

CLINICAL HIGHLIGHTS OF POSTBIOTICS

10 CLINICAL STUDIES

CLICK HERE for full review paper

Infant formula with postbiotics* showed:

- **Modulation of the gut microbiota with an increase of bifidobacteria**
- **Increased poliovirus-specific intestinal antibody response**
- **Enhanced thymus size**
- **Less severe GI infections (such as reduced severity of acute diarrhoea)**

Infant formula with postbiotics* in combination with prebiotic scGOS/lcFOS (9:1) showed:

- **Favourable gut environment and improved gut microbiota activity closer to breast-fed infants**
- **Increased levels of *Bifidobacterium* species and decreased *Clostridium difficile* occurrence**
- **Softer stool consistency**
- **Reduced investigator reported incidence of infantile colic**

*Derived from *Bifidobacterium breve* C50 and *Streptococcus thermophilus* 065

Breastfeeding is the natural and optimal way of feeding an infant, but for those infants who are not able to be (fully) breast-fed, the biotic family offers great and promising opportunities for infant formula aiming to more closely resemble the composition and functionality of breastmilk.

Danone Nutricia continues to leverage and support the latest research in bringing our infant formulae as close as possible to breastmilk