








# HMOs: The Essence for Life

## Breast milk provides short and long term benefits

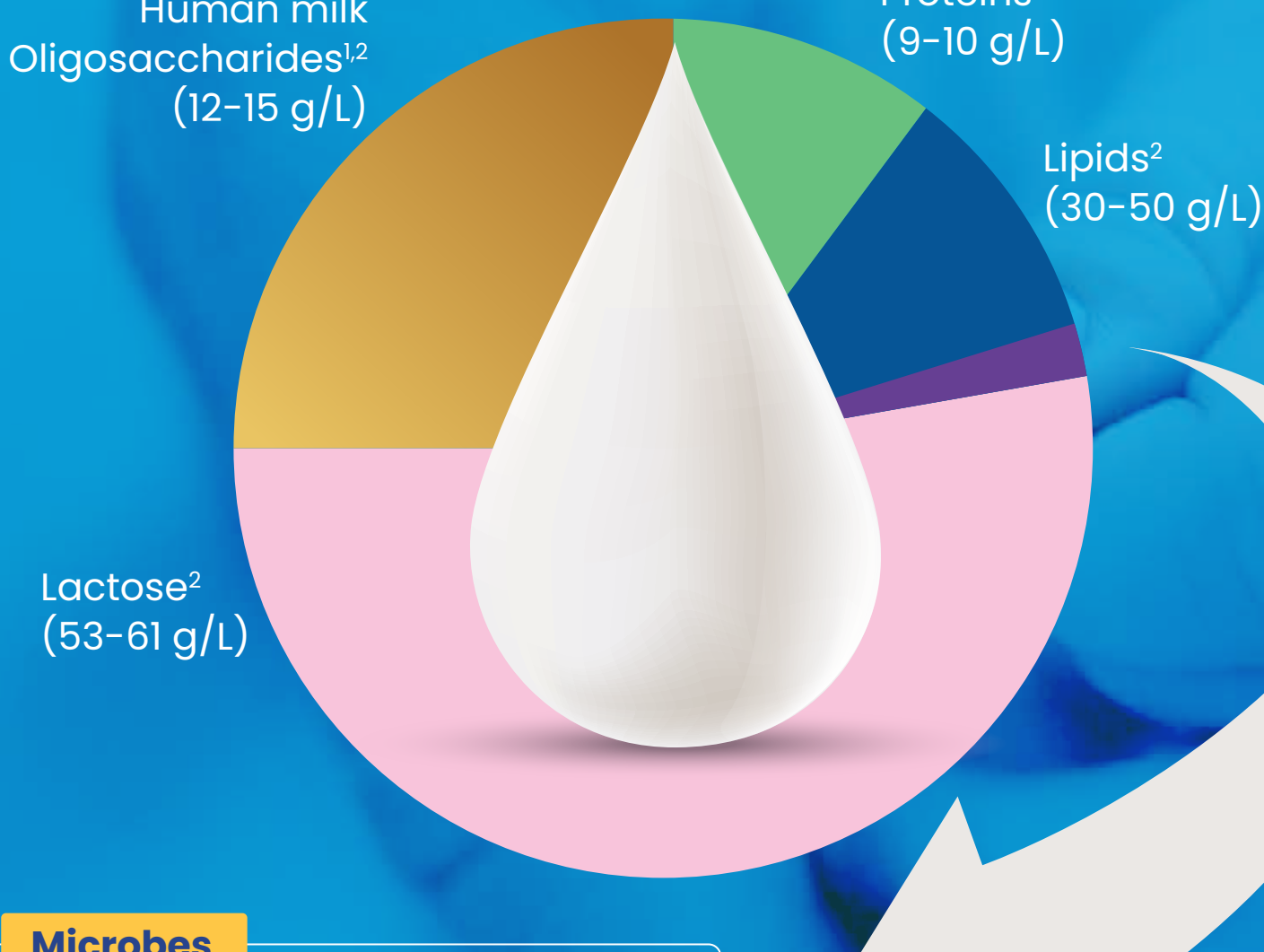
### Short-term benefits

- 
**Supports infant growth**  
Higher fat mass and percent body fat in the first 6-month interval<sup>1</sup>
- 
**Protects against medical conditions**  
Diarrhea, gastrointestinal infections, NEC, otitis media, asthma and atopic dermatitis<sup>1</sup>
- 
**Mortality**  
Protects against infection-related deaths and reduces risk of SIDS<sup>1</sup>
- 
**Microbiome**  
Supports healthy gut microbiome development<sup>1</sup>

### Long-term benefits

- 
**Reduces risk of obesity in adulthood<sup>1</sup>**
- 
**Decreases risk of type 1 and type 2 diabetes<sup>1</sup>**
- 
**Improves cognitive performance in children<sup>1</sup>**

## Components of Breast Milk



### Microbes

- Bifidobacteria<sup>1</sup>
- Staphylococcus<sup>1</sup>
- Lactobacillus<sup>1</sup>
- Streptococcus<sup>1</sup>

### Bioactive compounds

- Cytokines/Chemokines: IL-1, IL-2, IL-6, IL-8, IL-10, IL-17, TNF- $\alpha$ , and IFN- $\gamma$ <sup>1,2</sup>
- Immunoglobulins<sup>1,2</sup>
- Hormones: Leptin, adiponectin, ghrelin, and insulin<sup>1,2</sup>
- Antimicrobial peptides: Bacteriocin and lactoferrin<sup>1,2</sup>
- Growth factors: IGF-1, TGB- $\beta$ , and EGF<sup>1,2</sup>
- Antioxidants: Glutathione peroxidase and superoxide dismutase<sup>1,2</sup>

## HMOs are the 3<sup>rd</sup> largest solid component in human milk

HMOs are unique, structurally diverse and complex bioactive components

### HMOs are classified into 3 main categories

#### Fucosylated neutral HMOs<sup>3</sup>

- 35–50%
- 2'-Fucosyllactose (2'-FL)

#### Sialylated acidic HMOs<sup>3</sup>

- 12–14%

#### Non-fucosylated neutral HMOs<sup>3</sup>

- 42–55%

## 2'-FL: A predominant HMO

### Most abundant HMO (~30%)<sup>4</sup>

Aids normal growth and helps improve immune health<sup>4</sup>

Brings the gut microbiome closer to breastfed infants by improving gut health<sup>4</sup>

## Safety of HMOs addition to infant feeds has been well established

### EFSA

HMOs are considered **novel foods**<sup>5</sup>

Positive EFSA opinion on safety of 2'-FL has been adopted into EU regulation<sup>5</sup>

### US FDA

2'-FL categorized as **Generally Regarded As Safe (GRAS)**<sup>5</sup>

## Role of HMOs

Modulates **selective growth** of beneficial **bifidobacteria**<sup>4</sup>

Protects against **infections** and **inflammation**<sup>3,4</sup>

Act as decoy receptor and inhibit **pathogen binding**<sup>3</sup>

Modulates immune system<sup>4</sup>

Reduces risk of **NEC**<sup>6</sup>

Lowerners use of **antipyretics** and **antibiotics**<sup>7</sup>

Supports **brain development and cognition**<sup>3</sup>

## KEY TAKEAWAYS

- Breast milk is dynamic and complex with numerous short- and long-term benefits for infants.
- HMOs serve as a significant bioactive compound by supporting gut maturation, immune modulation and protection against infections.
- 2'-FL is the most abundant HMO and along with a few other HMOs has been approved by EFSA and the US FDA to be added to infant feeds.

### Abbreviations

HMOs: Human milk oligosaccharides; NEC: Necrotizing enterocolitis; SIDS: Sudden infant death syndrome; IL: Interleukin; TNF- $\alpha$ : Tumour necrosis factor  $\alpha$ ; IFN- $\gamma$ : Interferon-gamma; IGF-1: Insulin-like growth factor 1; TGB- $\beta$ : Transforming growth factor  $\beta$ ; EGF: Epidermal growth factor; HMO: Human Milk Oligosaccharides; 2 FL: 2'-Fucosyllactose; EFSA: European Food Safety Authority; EU: European Union; US FDA: The United States Food and Drug Administration

### References

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### IMPORTANT NOTICE: MOTHER'S MILK IS BEST FOR YOUR BABY

The World Health Organization (WHO)<sup>8</sup> has recommended that pregnant women and new mothers be informed of the benefits and superiority of breast-feeding. In particular, the fact that it provides the best nutrition and protection from illness for babies. Mothers should be given guidance on the preparation for and maintenance of lactation, with special emphasis on the importance of the well-balanced diet both during pregnancy and after delivery. Unnecessary introduction of partial bottle feeding or other foods and drinks should be discouraged since it will have a negative effect on breast-feeding. Similarly, mothers should be warned of the difficulty of reversing a decision not to breastfeed. Before advising a mother to use an infant formula, she should be advised of the social and financial implications of her decision. For example, if a baby is exclusively bottle-fed, more than one can (500g) per week will be needed, so the family circumstances and cost should be kept in mind. Mother should be reminded that breast milk is not only the best but also the most economical food for babies. If a decision to use infant formula is taken, it is important to give instruction on correct preparation methods, emphasizing that unboiled bottles, unsterilized bottles or incorrect dilution can lead to illness.

### Importance of Breastfeeding:

(i) Immediately after delivery, breast milk is yellowish and sticky. This milk is called colostrum, which is secreted during the first week of delivery. Colostrum is more nutritious than mature milk because it contains more protein, more anti-infective properties which are of great importance for the infant's defense against dangerous neonatal infections. It also contains higher levels of Vitamin A; (ii) breast milk (A) is a complete and balanced food and provides all the nutrients needed by the infant (for the first six months of life) (B) has anti-infective properties that protect the infants from infection in the early months; (C) is always available; (D) needs no utensils or water (which might carry germs) or fuel for its preparation; (E) breastfeeding is much cheaper than feeding infant milk substitutes as the cost of the extra food needed by the mother is negligible compared to the cost of feeding infant milk substitutes; (F) mothers who breast-feed usually have longer periods of infertility after child birth than non-feeding infants; (G) details of management of breast feeding, as under: (i) breast-feeding: (A) immediately after delivery enables the contraction of the womb and helps the mother to regain her "figure quickly"; (B) is successful when the infant suckles frequently and the mother wanting to breast-feed is confident in her ability to do so (i) in order to promote and support breast-feeding the mother's natural desire to breast feed should always be encouraged by giving, where needed, practical advice and making sure that she has the support of her relatives; (ii) adequate care for the breast and nipples should be taken during pregnancy; (iii) it is also necessary to put the infant to the breast as soon as possible after delivery; (iv) let the mother and the infant stay together after the delivery; the mother and her infant should be allowed to stay together (in hospital, this is called "rooming-in"); (v) give the infant colostrum as it is rich in many nutrients and anti-infective factors protecting the infants from infections during the few days of its birth; (vi) the practice of discarding colostrum and giving sugar water, honey water, butter or other concoctions instead of colostrum should be very strongly discouraged; (vii) let the infants suckle on demand; (ix) every effort should be made to breast-feed the infants whenever they cry; (x) mother should keep her body and clothes and that of the infant always neat and clean. Breast-feeding is the best form of nutrition for babies and provides many benefits to babies and mothers. It is important that, in preparation for and during breast-feeding, you eat a healthy, balanced diet. Combined breast and bottle-feeding in the first weeks of life may reduce the supply of your own breast-milk and reversing the decision not to breast-feed is difficult. Always consult your Healthcare Professional for advice about feeding your baby. The social and financial implications of using infant formula should be considered. Improper use of an infant formula or inappropriate foods or feeding methods may present a health hazard. If you use infant formula, you should follow manufacturer's instructions for use carefully - failure to follow the instructions may make your baby ill.

### IMPORTANT NOTICE

Breast milk is best for babies. At Danone, we support breast feeding and believe that breast milk is the best food for babies as the sole source of nutrition for the first 6 months of life and it is recommended to be continued until 2 years with the introduction of appropriate complementary foods after 6 months of age. IMPORTANT NOTICE: Breastfeeding is the best for babies and a healthy diet of maternal nutrition is important when breastfeeding. A decision not to breastfeed can be difficult to reverse. Infant formula is suitable from birth when babies are not breastfed. It is recommended that all formula milks be used on the advice of a doctor, midwife, health visitor, public health nurse, dietitian, pharmacist, or other professional responsible for maternal and child-care and the financial implications should be considered. All preparation and feeding instructions should be followed carefully as inappropriate preparation could lead to health hazards. For the use of healthcare professionals only, not for distribution to general public.

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