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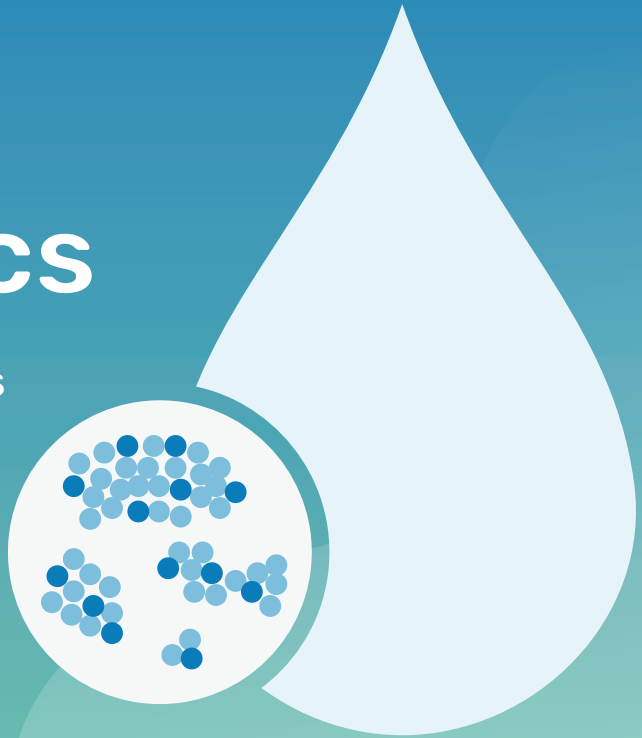
Simply biotics

A guide to understanding biotics



Infants need a strong immune system[6–8]

As infants grow and develop, they are exposed to many new experiences and environments – from the challenge of climbing on a chair to playing in the mud after it has been raining. These experiences are valuable as they provide infants with learning opportunities to build their physical and emotional resilience.

To be resilient, infants need a strong immune system[2]

'Resilience', in this case, means the ability of a system to withstand changes in its environment while still functioning properly.[2] The immune system develops during early life. Immune resilience is important for infants as it **reduces the risk** and/or **incidence of allergies, infections, and certain diseases** in later life.[6,9,10]

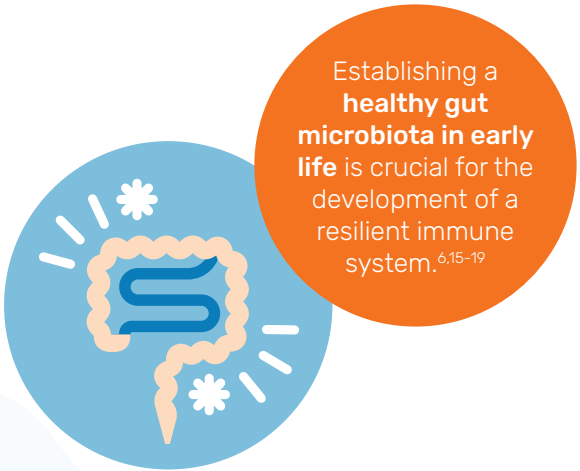
Did you know?

The immune system is a complex network of specialized organs, cells and molecules that help protect against diseases caused by bacteria, viruses, and toxins.[2,11,12]

Infants' immune systems and the gut[13]

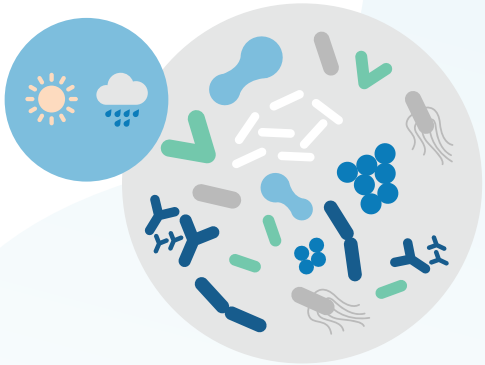
The gut is the largest immune organ[14]

It hosts 70-80% of the human body's immune cells and therefore, the gut microbiota plays a critical role in immune functioning and development.[14,15]



A healthy gut microbiota is a balanced one[20]

The gut microbiome is a delicately balanced ecosystem between commensal beneficial bacteria and potentially harmful (pathogenic) ones. Maintaining this balance is important as dysbiosis (imbalance) is associated with the development or pathogenesis of many long-term diseases.[2,20]



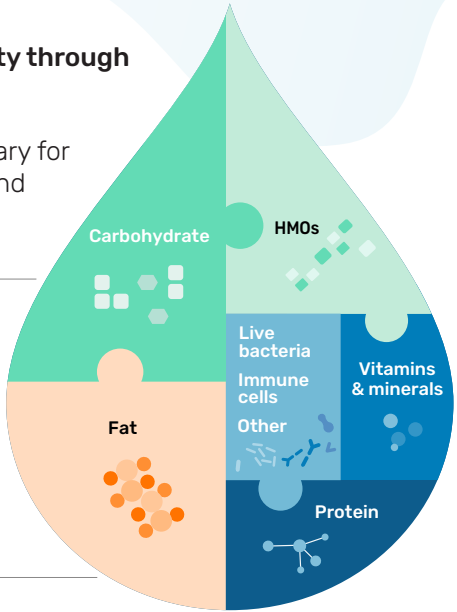
Breast milk helps build immunity through the gut[21,22]

Breast milk is the source of inspiration for infant formula as it builds immunity through the gut and is widely recognized as the gold standard of infant nutrition.[21-23]

It provides all the essential nutrients and protective bioactive substances necessary for optimal development.[24] These components interact with each other in a unique and dynamic way that is specifically tailored to infants' needs over time.[2,23–25]

Breast milk comprises of **88% water** and **major components** such as:

- **Lactose**
- **Lipids**
- **Human milk oligosaccharides (HMOs)**
- **Proteins** (8–10 g/L)
- **Immune cells, stem cells, bacteria, vitamins, minerals,** and other **bioactive components** are also present in breast milk as minor components.



Breastfeeding is highly recommended – the WHO and UNICEF recommend that infants are exclusively breastfed for their first 6 months of life.[26] However, it may not always be possible to exclusively do so. Infant formula is an alternative that can provide adequate nutrition when (exclusive) breastfeeding is not possible.

Breast milk helps build immunity through the gut[21,22]

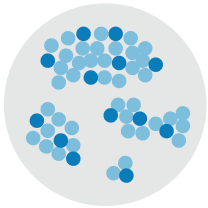
It is important that the composition of infant formula mimics the composition and functionality of breast milk as much as possible,[1,24] and this is where biotics come in.

As mentioned, biotics are nutritionally active components that can, when consumed, provide a health benefit to the host.[3]

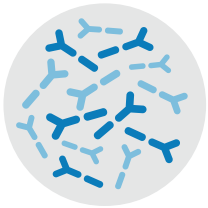
Did you know?

The term 'biotic' is, in fact, derived from the Greek word *biōtikós*, meaning 'pertaining to life', and essentially refers to the biological ecosystem made up of living organisms (i.e. bacteria) together with their physical environment.[27]

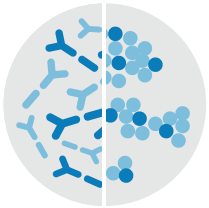
There are four types of biotics:[1,2,3,27]



Prebiotics
(including human-identical milk oligosaccharides (HiMOs*))



Probiotics

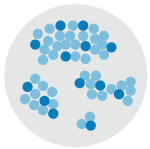
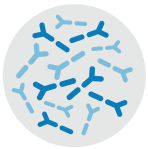


Synbiotics
(a combination of pre- and probiotics)

Postbiotics

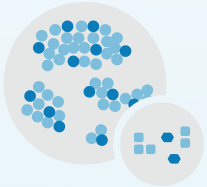
*Read more about HiMOs on page 8.

Biotics: what we know

	Prebiotics	Probiotics	Synbiotics	Postbiotics
ISAPP definition[28]	A substrate that is selectively utilized by host microorganisms conferring a health benefit	Live microorganisms which when administered in adequate amounts, confer a health benefit to the host	A mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit to the host	Preparation of inanimate microorganisms and/or their components that confers a health benefit to the host
Concept	 **Food for 'good bacteria'**	 **'Good bacteria'**	 **Food for 'good bacteria' + 'good bacteria'**	 **Components created by 'good bacteria'**
Example	scGOS/lcFOS	*Bifidobacterium breve* M-16V	scGOS/lcFOS and *Bifidobacterium breve* M-16V	3'-GL (which is also an HiMO*)

ISAPP (The International Scientific Association for Probiotics and Prebiotics) is a widely recognized, independent, objective, science-based authority in the field of biotics. ISAPP communicates the latest scientific information about biotics primarily through meetings and publications.[29]

*Read more about HiMOs on page 8.



Prebiotics and HiMOs

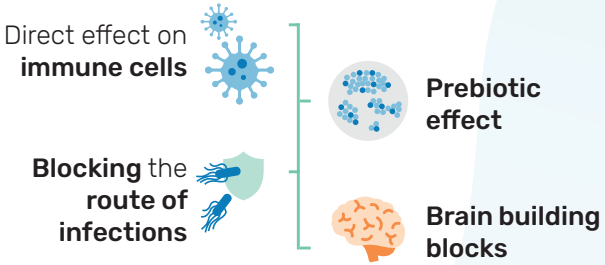
Prebiotics are substrates which are selectively utilized by host microorganisms thereby conferring a health benefit.[28]

While there are various prebiotics suitable for use in infant formula, the prebiotic mixture of scGOS/lcFOS is the most studied (in over 40 clinical studies and 90 publications).[2,30,31]

The mixture of scGOS/lcFOS:[2,4,32,33]

- Reflects the **quantity, diversity,** and **functionality** of oligosaccharides in breast milk
- **Modulates the gut microbiota** closer to that of breastfed infants
- **Softens the stool**
- **Reduces infections** and **fever episodes**

Human-identical milk oligosaccharides or **HiMOs** are natural prebiotics which are present in or have been added to infant formulas.[34] They have been described to have:[2]



The **HiMO 2'-FL** is the **most abundant HMO** in breast milk and its benefits have been linked to gut health and immunity.[2] **HiMO 3'-GL** is linked to improved gut barrier function as well as a reduced inflammatory response.[2]

More HiMOs are commercially available and although results are promising, future studies are needed to further explore the potential benefits of infant formulas with HiMOs.

Probiotics

Probiotics are live microorganisms which when administered in adequate amounts, confer a health benefit to the host.[28]

Probiotic products may contain one or more bacterial strains.

The **two most frequently studied** bacterial probiotic genera in infants are:[2,30,35]

- *Bifidobacterium*
- *Lactobacillus*

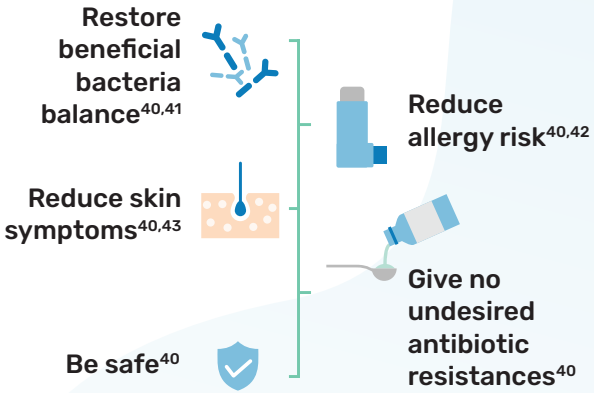
While health benefits are strain and disease specific, there are many potential common benefits such as:[2,35-37]

Protection against **pathogen colonization** and **infection**

Benefits to the **immune system**

Bifidobacterium breve is one of the **most commonly isolated** bifidobacterial species from breast milk and is naturally present in the gut of breastfed infants.[38,39]

Bifidobacterium breve M-16 V is a notable strain that has been shown to:



Synbiotics

Synbiotics are a mixture comprising live microorganisms and substrate(s) which are selectively utilized by host microorganisms and confer a health benefit.[28]

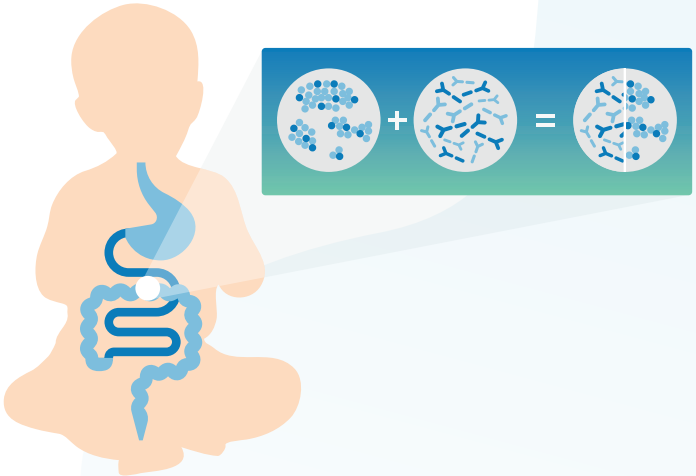
The reason for combining pre- and probiotics is to achieve **stronger positive effects** than could be achieved by either component alone.[1,2,44]

Therefore, working together:[2]

Prebiotics can help **improve the survival of probiotics** during their transit through the upper intestinal tract

Prebiotics **stimulate** the **growth of probiotics** and/or **activate their metabolism**

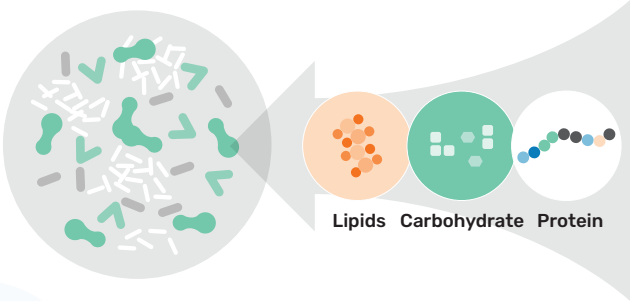
Various combinations of synbiotics are available in infant formula. The **prebiotic mixture** of **scGOS/lcFOS** and ***Bifidobacterium breve* M-16V** in healthy infants has been shown to create a gut environment closer to that of breastfed infants, and in C-section born infants it has been shown to rebalance the gut microbiota similar to those of vaginally born infants.[2]



Postbiotics

Postbiotics are a preparation of inanimate microorganisms and/or their components that confer a health benefit to the host.[28]

Postbiotics can consist of different components, such as **lipids, carbohydrates** (including HiMOs e.g. 3'-GL), **complex molecules, proteins, bacterial cells** and more.[2] They show relative stability during storage and are unaffected by emerging antibiotic resistance.[2]

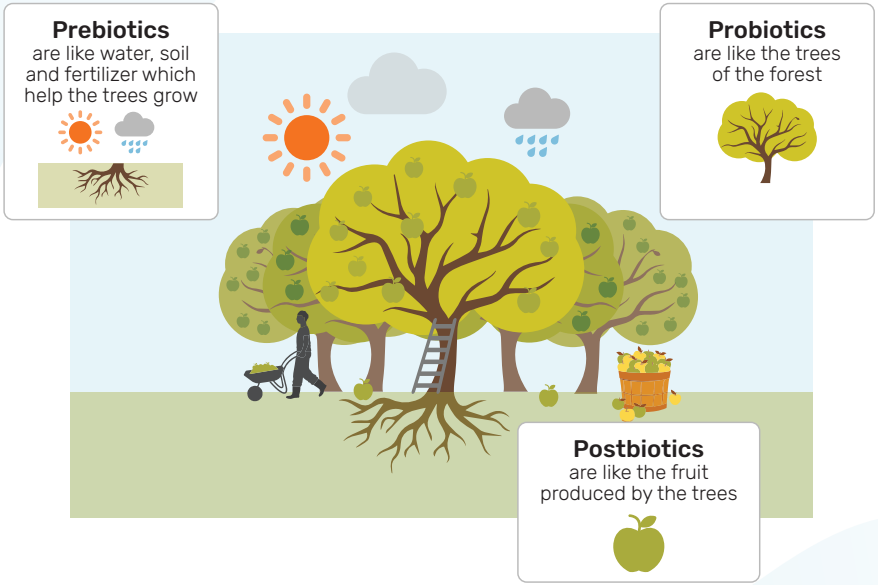


Postbiotics in infant formula produced during fermentation of *Bifidobacterium* and *Lactobacillus* – in particular, the *Bifidobacterium breve* C50 and *Streptococcus thermophilus* 065 strains have been shown to:

- **Help modulate** the **gut microbiota** and **immune system capabilities**[45,46]
- **Reduce diarrhea severity**[47]
- **Lower incidence of potential allergic adverse events**[48]
- **Promote higher proportions of bifidobacteria**[46]

The gut microbiome can be thought of as a thriving, dynamic forest

The gut microbiome can be thought of as a **forest**, with the community of trees (representing the community of 'good' gut bacteria) needed to bring health to the planet (or infant). The forest has many important parts, such as the **soil** and **nutrients** which nurture and maintain the growth of the trees, while preventing the invasion of weeds (i.e. harmful, pathogenic bacteria).



Whilst breast milk is the optimal infant nutrition,[21–23] biotics offer a way to modulate the gut microbiota of non-exclusively breastfed infants.

Biotics may help further optimize their health outcomes and help to reduce the risk of disease in later life.[2]

As the research into the roles and benefits of biotics continues to grow, new developments and insights which emerge will continue to be incorporated into infant formula.

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