Childhood microbiome: a keystone of future health

This CPD module is for the use of Pharmacists and Pharmacy Professionals

Reviewed by **Dr Gemma Walton** PhD

PHARMACY ACADEMY

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CPD

Module summary

The composition of the gastrointestinal (GI) microbiome during infancy is associated with several conditions in childhood and later life. The early years of childhood offer the opportunity to influence the child's GI microbiome and, in turn, their short-term and long-term health.

Learning objectives

After studying the clinical review and completing the online assessment, you should:

- Appreciate the long-term health impact of an infant's GI microbiome
- Understand that a healthy GI microbiome maintains normal immune responses
- Be familiar with the benefits of supplementation in a range of diseases
- Feel confident recommending probiotics for infants in clinic

Reviewed by Dr Gemma Walton PhD

Next steps

- Read the clinical review content
- Complete the online assessment
- Receive CPD certificate

References provided at the end of the module.

This learning module can be used towards CPD for revalidation with the General Pharmaceutical Council (GPhC)

Date of Publication: August 2022

Pre-learning reflection

Please take a moment to answer these pre-learning questions. Once completed, click 'next step' below to start this module. These answers will be logged on your CPD certificate, which will be emailed to you on completion as evidence of your learning.

How often do you consider the microbiome as a factor contributing to the long-term health of a child?

Are you aware of the lasting impact that birth and feeding method can have on the infant microbiome?

Have you ever recommended probiotics to infants before?

How often and for which conditions do you proactively suggest that an infant receives a probiotic?

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Definitions

Term	Definition
Probiotics	Live bacteria and yeasts that when consumed in adequate amounts benefit human health; probiotics are usually added to yoghurts or used as food supplements[1]
Prebiotics	Substrates (some carbohydrates and fibre) that the host's microorganisms use selectively and that confer a health benefit[2]; examples of prebiotics include galacto-oligosaccharides (GOS) and fructo-oligosaccharides (FOS), which are both forms of soluble fibre
Microbiome	The collective genomes (genetic sequences) of micro-organisms in a particular area of, for example, the skin, gut or vagina[1]
Microbiota	The community of microorganisms in a specific area, such as parts of the gastrointestinal tract, skin and vagina[1]
Synbiotic	A mixture of probiotics and prebiotics taken in combination; not to be confused with symbiotic (mutually beneficial relationship between two species)[3,4]

The names of some Lactobacilli have recently been updated: please see www.microbiometimes.com/the-lactobacillus-taxonomy-change-has-arrived-what-do-you-need-to-know/ for further information.

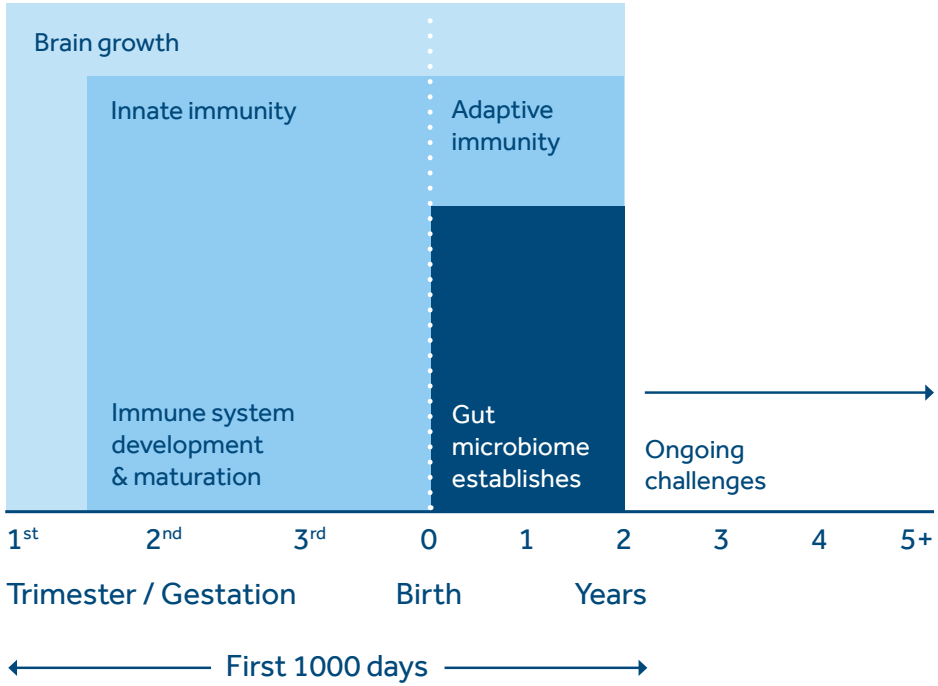
References provided at the end of the module.

Date of Publication: August 2022

The early years can establish a trajectory for life

The first 1000 days of a child's life lay many of the foundations of their health and physical, cognitive, social, emotional and behavioural development. Indeed, the early years can establish a trajectory followed for the rest of the person's life[5]

The microbiome is largely established during this window of development and provides an opportunity to influence the child's GI microbiome and, in turn, their short- and long-term health[6,7]



Adapted from Goyal[8]; image supplied by Optibac

Brain development extends beyond the first 1000 days, while the GI microbiota assembles during the first 2–3 years after birth[8]

References provided at the end of the module.

Date of Publication: August 2022

The GI microbiota composition in early life and outcomes

The composition of the GI microbiome during infancy is associated with several conditions in childhood and later life that can impact quality of life, cause stress within families and place demands on health services[9]

Infections
(eg necrotising enterocolitis and *Clostridium difficile*)[13*]

Allergic and atopic diseases
(eg food allergy, asthma)[11-13]

Infant temperament
(eg emotionality and fear reactivity)[10]

Neurodevelopmental disorders
(eg autism and ADHD)[10]

Obesity and metabolic diseases[13,14]

Autoimmune disorders
(eg type 1 diabetes, rheumatoid arthritis and MS)[13]

ADHD: attention deficit hyperactivity disorder; MS: multiple sclerosis; *Recently renamed *Clostridioides difficile*

References provided at the end of the module.

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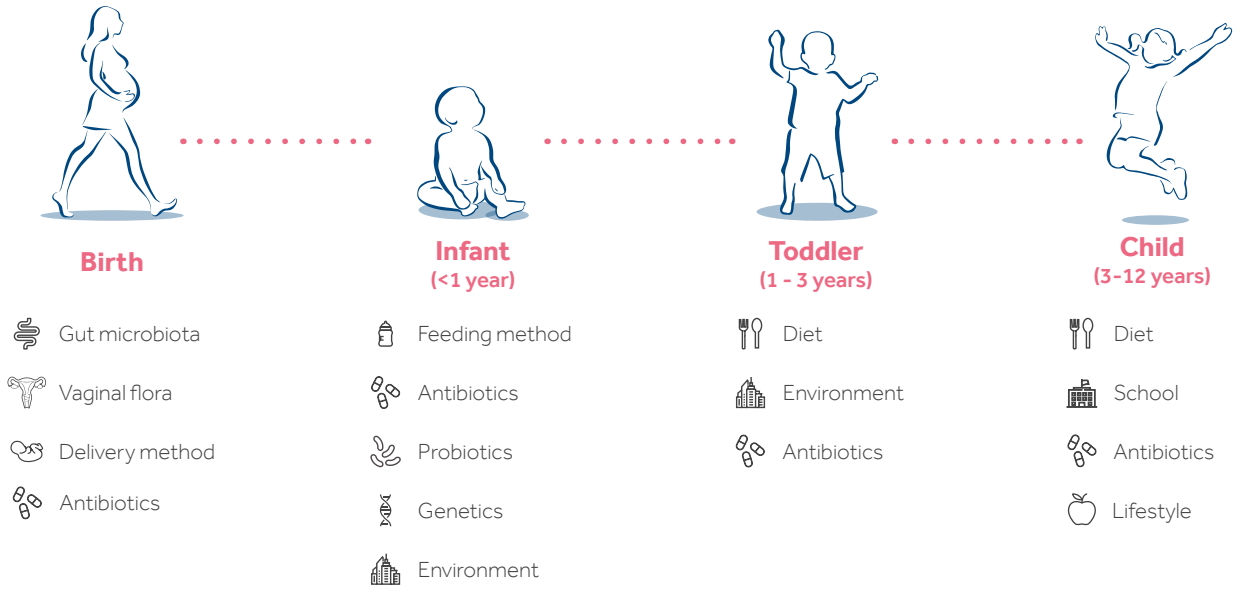
Factors that can influence microbiome development

Numerous factors shape the neonatal microbiome during early life

A woman's gut and vaginal microbiome change during pregnancy, which may be exacerbated by diet and certain medications. Research analysing how this impacts fetal health is ongoing[15]

The infant's microbiome depends on whether the child was delivered vaginally or by caesarean section (CS). Following birth, antibiotic use, diet (eg breast-feeding versus formula), genetics and environmental exposures influence the health of the microbiome[6]

After the introduction of solid food, the microbiome increasingly resembles that in adults and is usually fully established by about 3 years of age[6]



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Composition of the baby microbiome

Delivery mode is one of the most influential factors that determines the developing microbiome; studies report that differences can persist during the first 6 months and even, perhaps, a year[16]

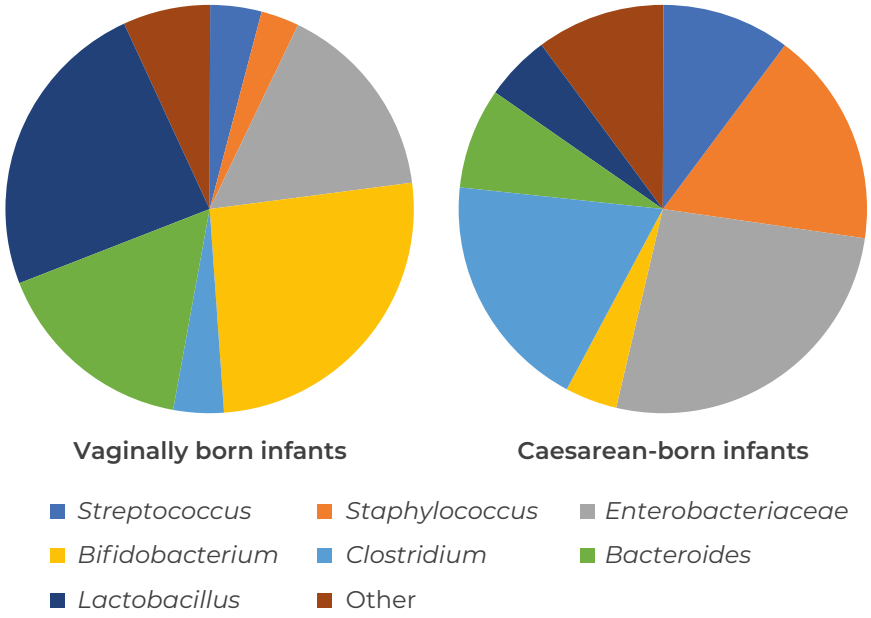
In the first few months, populations of beneficial bacteria, including *Bifidobacterium* species (yellow) and *Lactobacillus* species (navy), are significantly lower in CS born infants. *Bacteroides* species (green) play an important role in immune regulation and are lower in CS-born infants[17,18]

Higher numbers of the bacterial family *Enterobacteriaceae* (grey) are found in CS-born infants. This family includes potentially pathogenic bacteria:[19]

- *Escherichia coli*
- *Klebsiella* species
- *Salmonella* species

Enterobacteriaceae are associated with toxin production (including lipopolysaccharide from the bacterial cell wall) and weakening tight junctions in the gut epithelium leading to inflammation[20]

The microbiome of children with colic display low levels of *Bifidobacterium* and *Lactobacillus* as well as higher levels of Enterobacteria[21]



Differences in the microbiomes of infants born vaginally and by CS[22]

References provided at the end of the module.

Date of Publication: August 2022

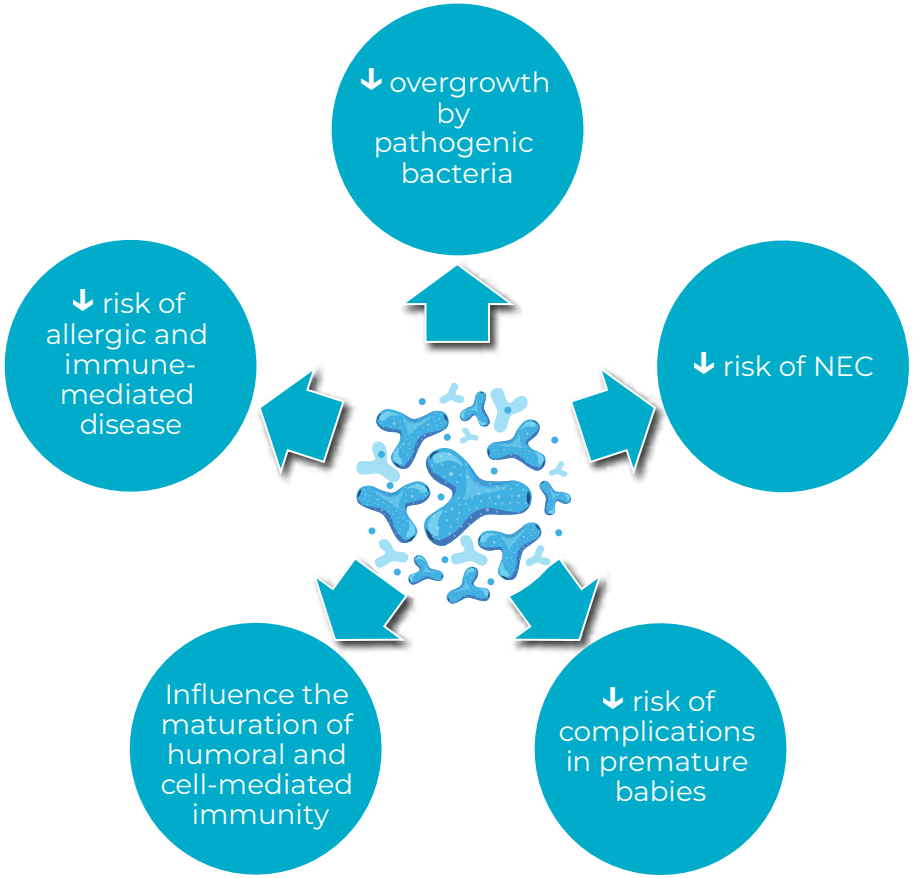
Bifidobacterium's importance during early life

Bifidobacterium, a 'keystone' of an infant's GI microbiome, regulates several immunological and physiological functions[23]

Bifidobacterium are (ideally) among the first microbes to colonise the infant gut and can metabolise unique oligosaccharides (prebiotics) found in breast milk, resulting in a healthier, *bifidobacterium*-rich microbiome in breast-fed, compared with formula-fed, infants[24,25]

Early colonisation seems most impactful; low levels of bifidobacteria, particularly in the first few months, may increase the risk of certain health conditions[4,26,27]

- Delayed colonisation of bifidobacteria can occur due to: CS, pre-term birth, antibiotics and certain medications



Beneficial microbes, such as bifidobacteria, influence human health through several mechanisms

NEC: necrotising enterocolitis

References provided at the end of the module.

Date of Publication: August 2022

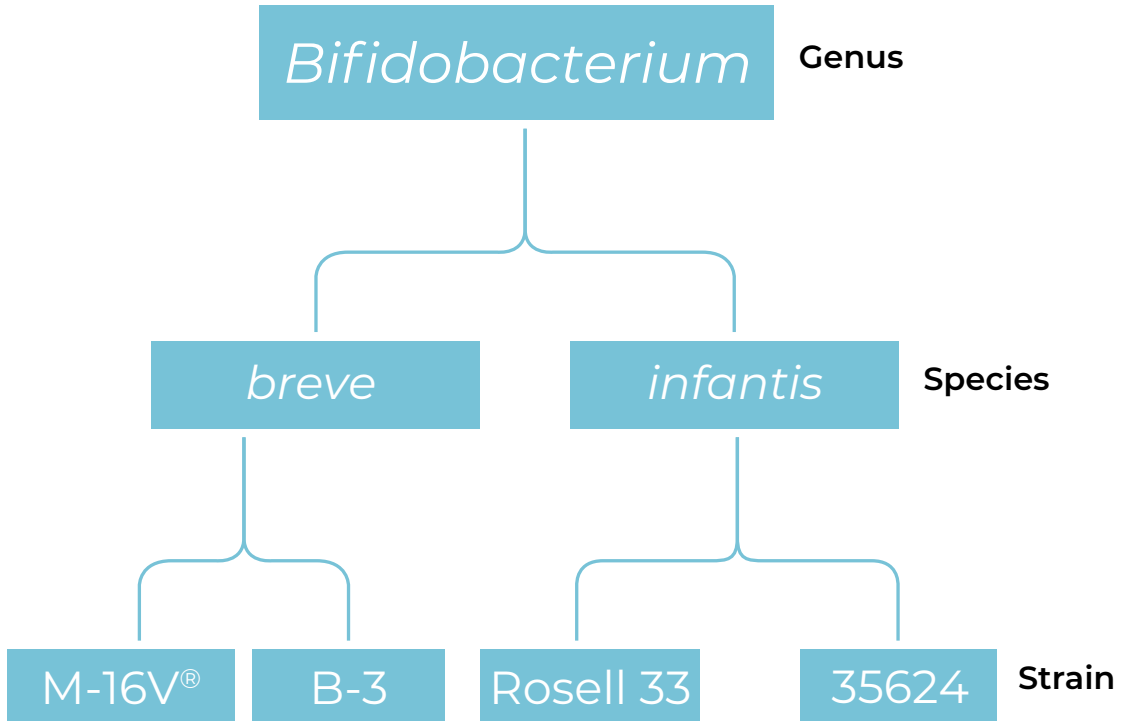
The importance of strain specificity

Probiotics, which work in a strain- and disease-specific manner, can improve microbial composition during the first 1000 days, as well as supporting the microbiome throughout life[7]

Microbes can be classified based on genetics and characteristics. Biologically important ranks include genus, species and strain

The World Health Organisation (WHO) notes that probiotics' effects are strain specific, commenting: ***"Strain identity is important to link a strain to a specific health effect"***[28]

A meta-analysis of 228 trials concluded that probiotics work in a strain- and disease-specific manner, which should be taken into consideration when recommending a probiotic[29]



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Probiotic strains should demonstrate safety and efficacy in the intended age group

Probiotic strain	Age(s) studied	Total number of clinical trials	Total number of infant/child participants	CFU/Billions count studied	Condition(s)
Lactobacillus reuteri DSM 17938 (Protectis)	From birth	20	2,600+	10^{8}+	Functional abdominal pain; Constipation; Acute Diarrhoea; Infections; Colic; Gastroesophageal reflux disease
Lactobacillus rhamnosus GG	From birth	40+	12,000+	1 x10^{9} <20 x 10^{9}	Immunity: RTI; Colic; Cow's Milk Allergy; Gastroenteritis; AAD; IBS, Abdominal pain; Eczema; ADHD
Bifidobacterum breve M-16V®	From birth	30+	4000+	1 x 10^{9}	Healthy microbiome development; NEC and preemie infections; Atopy; Asthma/wheezing; IBS ; Softer stools
Lactobacillus rhamnosus HN001	From birth	1	474	6 x 10^{9}	Eczema/allergy/rhinitis risk
LAB4b (*Lactobacillus salvarius* CUL61, *Lactobacillus paracasei* CUL08, *Bifidobacterium bifidum* CUL20, *Bifidobacterium animalis*, subsp. lactis CUL34)	From birth	1	454	1 x 10^{10}	Atopic sensitisation
Lactobacillus acidophilus Rosell 52, *Bifidobacterium infantis* Rosell 33, *Bifidobacterium bifidum* Rosell 71	0 years +	10	1,400+	3 x 10^{9}	RTI and wheezing; Immunity
Bacillus coagulans Unique IS-2	2 years +	4	436+	2 x 10^{9}	IBS; Abdominal pain; Constipation
Saccharomyces boulardii	From birth	5	1500+	5 x 10^{9}	Diarrhoea; AAD; Rotavirus; NEC

AAD: Antibiotic-associated diarrhoea; ADHD; Attention deficit hyperactivity disorder; IBS: Irritable bowel syndrome; NEC; Necrotising enterocolitis; RTI: Respiratory tract infection

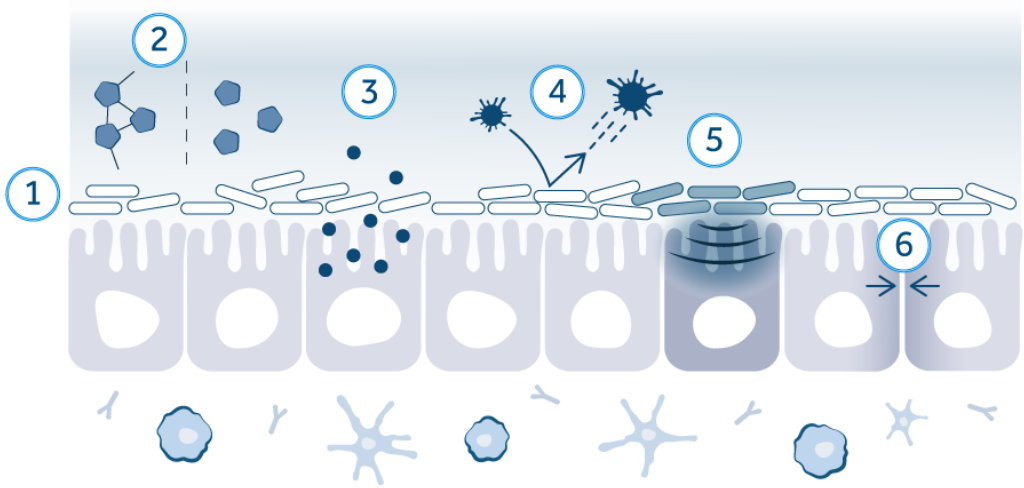
Please see the hub for a copy of this table and a full list of references

References provided at the end of the module.

Date of Publication: August 2022

Probiotics: modes of action

Probiotics may reduce the risk of certain common complaints through a combination of four actions, including modulating immunity and inflammation. Between 70% and 80% of immune cells are present in the gut. The intestinal microbiota interacts with the intestinal epithelial layer and mucosal immune system[30]



Key:

- Friendly Bacteria
- Pathogens
- Modulates inflammation
- Lactose
- Monosaccharides
- Short chain fatty acids
- Dendritic Cell
- Immunoglobulins
- Macrophage

1. Probiotics bind to the mucosal lining and fortify the barrier
2. Produce digestive enzymes like ß-galactosidase to support lactose digestion
3. Produce SCFAs to encourage a healthy epithelial lining
4. Probiotics are able to inhibit the growth of pathogens through competitive inhibition, bacteriocin production and lactic acid
5. Probiotics can modulate immune cells and inflammation (enhance anti-inflammatory action and calm proinflammatory responses)
6. Probiotics can help support gut cell integrity (tight junctions), cell turnover and enterocyte health and encourage peristalsis

SCFAs: Short-chain fatty acids

Image supplied by Optibac

References provided at the end of the module.

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The story so far...

- The early years of a child's life lay the foundations for, and help establish the trajectory of, their health and physical, cognitive, social, emotional and behavioural development[5]
- The microbiome is largely established during early years, which provides an opportunity to influence the child's short- and long-term health[6,7]
- *Bifidobacterium*, a 'keystone' of an infant's GI microbiome, regulates several immunological and physiological functions[23]
- Probiotics may reduce the risk of common complaints through a combination of four actions, including modulating immunity and inflammation[30]

Please click to continue the module

References provided at the end of the module.

Date of Publication: August 2022

A synbiotic combination may restore 'normal' GI microbiome in children born by CS

In children born by CS, a synbiotic combination of *Bifidobacterium breve* M-16V®, GOS and FOS* produces a microbiome similar to that in vaginally born children[4]

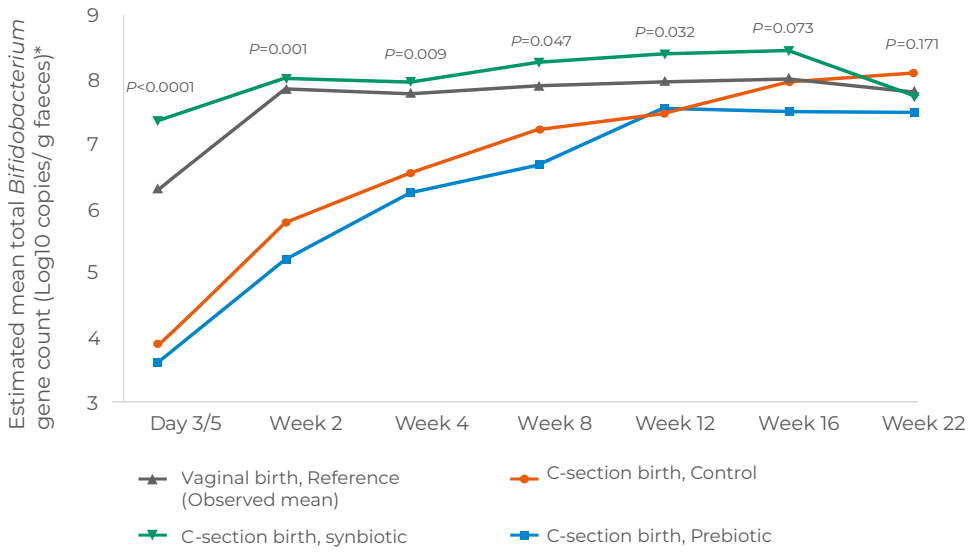
Infants received a standard formula with the synbiotic combination or with GOS and FOS from birth until week 16

Many infant formulas include GOS and FOS, however, adding *B. breve* M-16V® resulted in significantly:

- Higher bifidobacteria proportion from day 3 or 5 until week 8 compared with the control and the prebiotic alone
- Lower *Enterobacteriaceae* from day 3/5 until week 12 compared with the control and the prebiotic alone
- Lower faecal pH and higher acetate compared with prebiotic alone, which may help prevent overgrowth of pathogens

Six weeks after treatment, 38.7% of infants who received the synbiotic showed *B. breve* M-16V® in their faeces

* 90% short-chain galactooligosaccharides and 10% long-chain fructooligosaccharides (0.8 g/100 mL)



* Statistically significant difference (p<0.01)

Mean *Bifidobacterium* gene count in 153 infants delivered by CS randomised to the synbiotic (n=52), prebiotic (n=51) or a control formula (n=50); The reference group included 30 subjects born vaginally[4]

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

Upper respiratory tract infections in children

Upper respiratory tract infections are very common among children (those <2 years of age may have 5-6 episodes within a year) and are one of the most common reasons why children attend general practice over the winter months[31,32]

Respiratory tract infections are, probably, a leading reason why parents need to take time off from work. A survey found that parents lose an average of 3 hours of work a month taking children to medical appointments or to look after a sick child[33]

- 67% of parents admitted taking a day off work to look after an ill child in the last 12 months
- 34% parents had taken three or more days off to look after an ill child in the past year

References provided at the end of the module.

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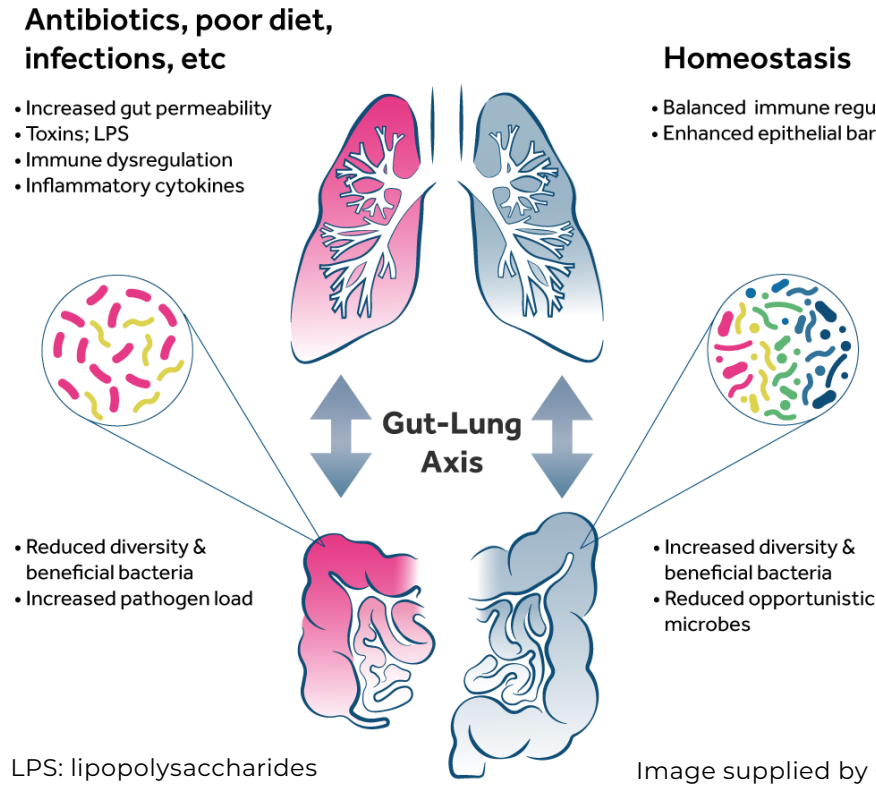
A healthy GI microbiome protects against respiratory infections

A healthy GI microbiome maintains normal immune responses, in turn protecting against respiratory infections. Compounds from gut bacteria, including lipopolysaccharides, peptidoglycans and short-chain fatty acids modulate immune responses. Changes in the GI microbiome may alter the balance of these signals and, potentially, change immune responses in the lungs. Probiotics and prebiotics may restore or bolster immune function in the GI tract and, indirectly, in the lungs[34]

The health of the gut microbiome can influence that of the lungs

Gut bacteria can modulate immune activity, which may in turn affect the lungs defence against viruses. Probiotics support healthy microbiome and homeostatis, encouraging healthy immune responses.



LPS: lipopolysaccharides

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References provided at the end of the module.

Date of Publication: August 2022

L. rhamnosus GG supplementation reduces respiratory infection risk in children

A meta-analysis* found that *Lactobacillus rhamnosus* GG reduced the incidence of acute otitis media, upper respiratory infections and antibiotic use in children compared with placebo[35]

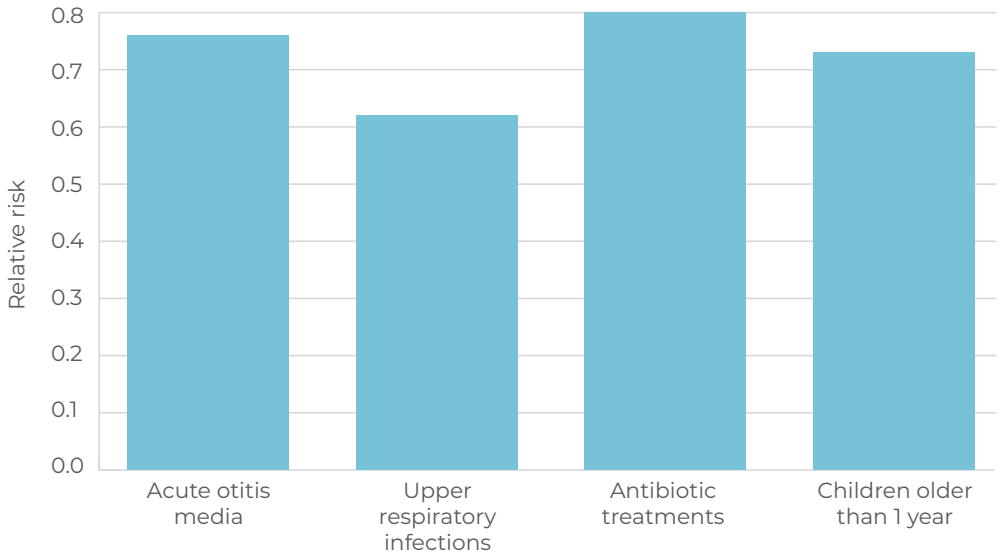
The meta-analysis included four studies involving 1805 children, aged 0 month to 18 years

A 5–10% reduction in the incidence of acute otitis media and antibiotic use could, the authors comment, “have important clinical, public health, and economic consequences”

One study in the meta analysis found that children taking *L. rhamnosus* GG had reduced absence from day care (3 days off) compared with the control group (5 days)

Adverse effects were similar in both groups. No serious adverse events were reported

* A meta-analysis is a statistical technique that combines results from multiple scientific studies.



There was no significant difference between the control and *L. rhamnosus* GG for overall respiratory tract infections, possibly due to the non-significance for lower respiratory tract infections

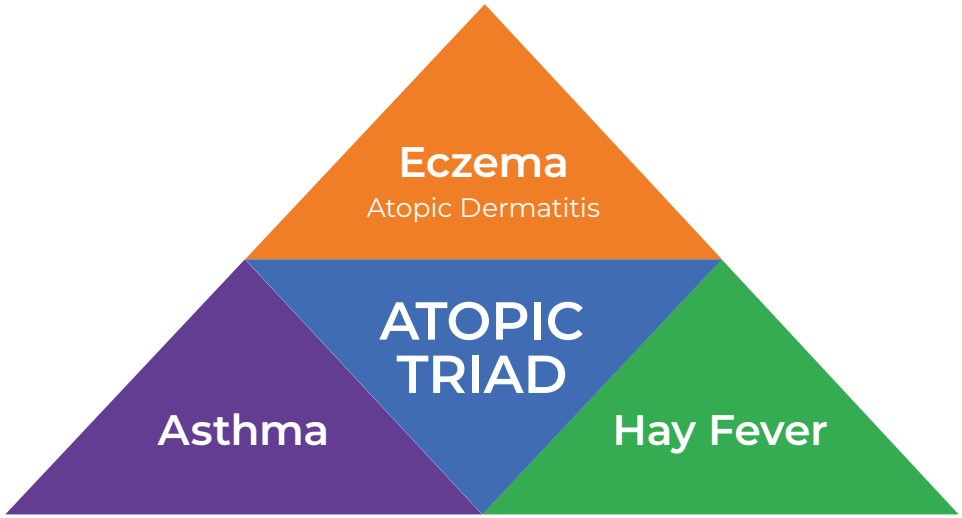
The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

Children often experience more than one atopic disease

Children often experience more than one atopic disease. A study of 27,507 children aged 12–14 years old reported that about half (47.6%) had one or more atopic disease, such as hay fever (35%), eczema (23%) and asthma (21%)[36]



References provided at the end of the module.

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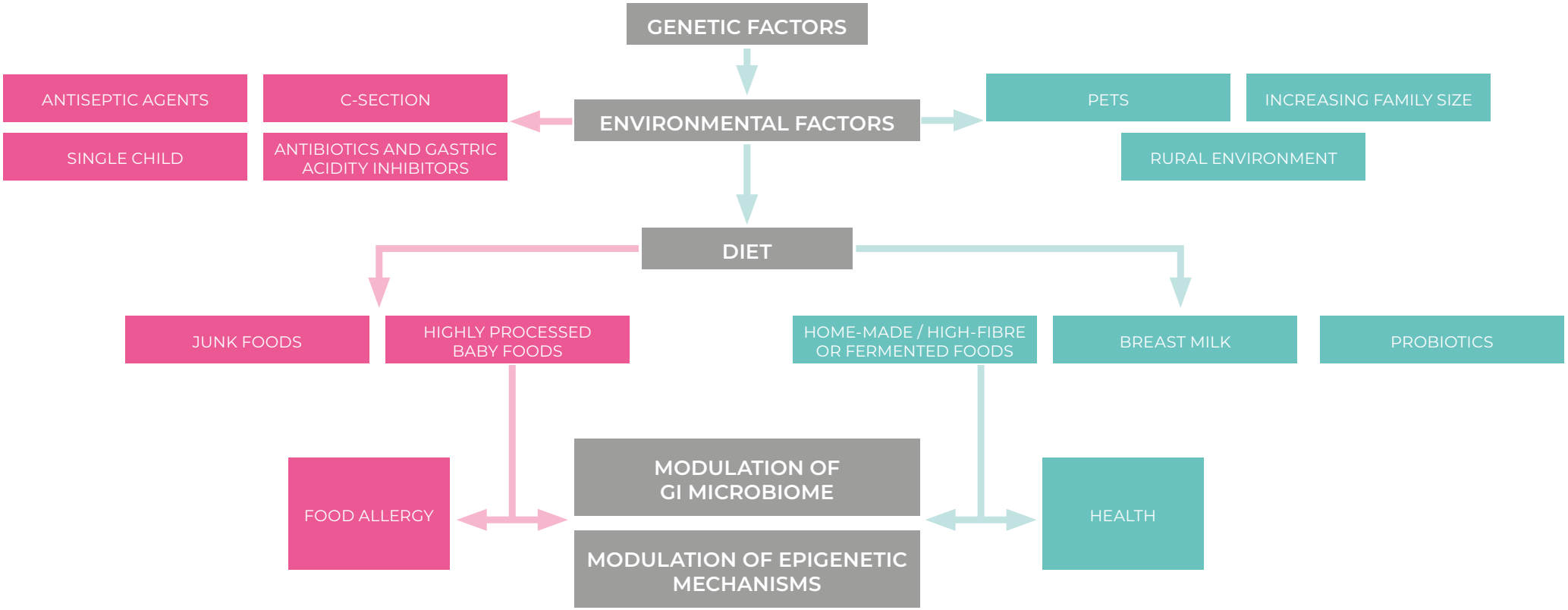
Numerous factors contribute to the risk of food allergies

More than 170 foods can trigger food allergy. Genetic, environmental and dietary factors could modulate the interaction between the GI microbiome and immune system, and, in turn, influence the likelihood of developing food allergy[11,36]



Epigenetics: changes to the control of gene activity without alterations to the DNA sequence

References provided at the end of the module.

Date of Publication: August 2022

Childhood eczema: a common problem

Up to 20% of children have eczema (atopic dermatitis). Intense pruritus is common, which leads to scratching and, in turn, exacerbates eczema and xerosis[37,38]

Eczema can be associated with psychosocial issues among children and disrupt family life[39]

Severe itch can mean children become irritable, inattentive and at risk of sleep disturbance. Parents and carers can also experience sleep disturbance[39]

The NHS spends more than £116.2 million on emollients a year, not to mention the costs of other treatments (eg steroids)[40]

References provided at the end of the module.

Date of Publication: August 2022

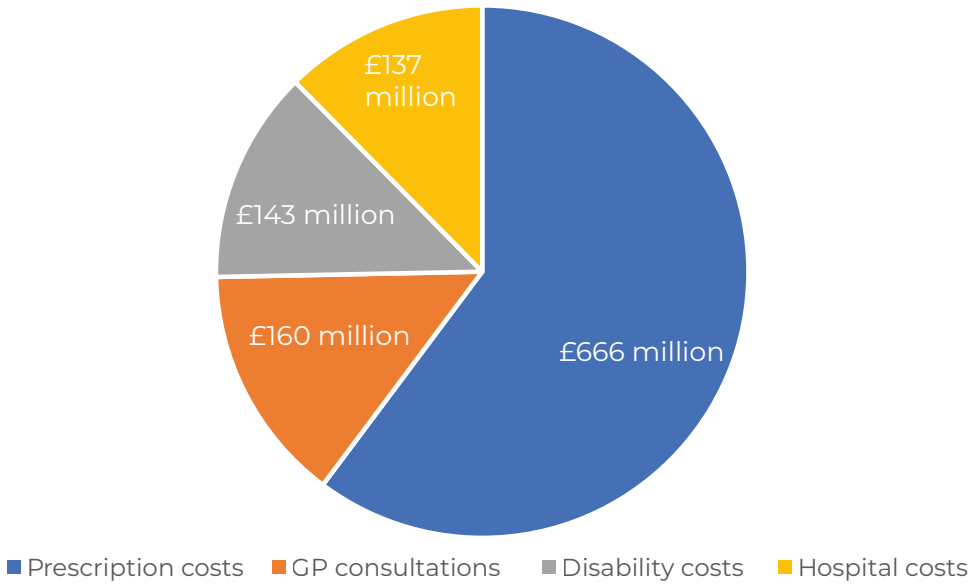
The costs and consequences of asthma

8 million people have been diagnosed with asthma in the UK – equivalent to about 12% of the population. Some children grow out of asthma[41]

About 5.4 million people are being treated for asthma, which costs more than £1.1. billion in the UK each year[41,42]

About 1200 people die from asthma each year[41]

Asthma accounts for about 60,000 hospital admissions, 200,000 bed days and 6.4 million GP and nurse consultations each year[41,42]



Examples of costs associated with asthma (£ million annually)[42]

References provided at the end of the module.

Date of Publication: August 2022

A synbiotic combination may reduce asthma risk in infants

A synbiotic combination of *B. breve* M-16V®, GOS and FOS* reduced the risk that infants with atopic dermatitis would develop asthma-like symptoms[43]

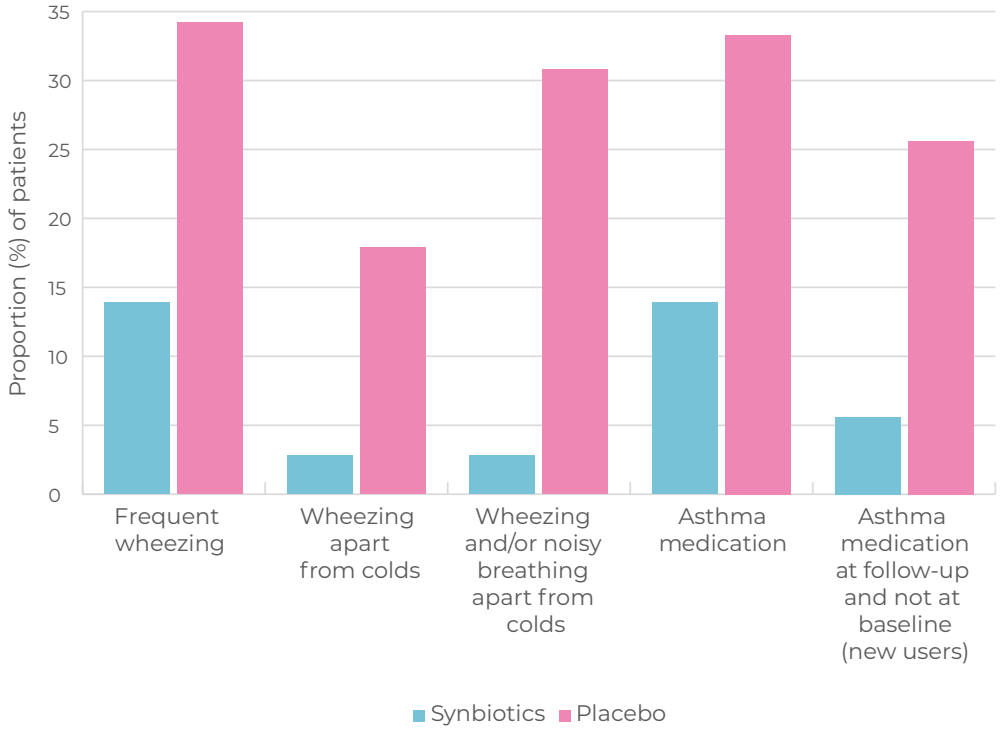
In a double-blind, placebo-controlled multicentre trial, 90 children (<7 months of age) with atopic dermatitis were randomised to receive an extensively hydrolysed formula with or without the synbiotic combination for 12 weeks

Infants that received the synbiotic mixture were significantly less likely to develop asthma-like symptoms or use asthma medication at 1-year follow-up than those who received placebo:

- Frequent wheezing: absolute risk reduction (ARR) 20.3%
- Wheezing and/or noisy breathing apart from colds: ARR 28.0%
- Started to use asthma medication after baseline: ARR 20.1%

The long-term outcomes are unknown

* 90% short-chain galactooligosaccharides and 10% long-chain fructooligosaccharides (0.8 g/100 ml)



Prevalence of asthma-like symptoms and asthma medication use at 1-year follow-up

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

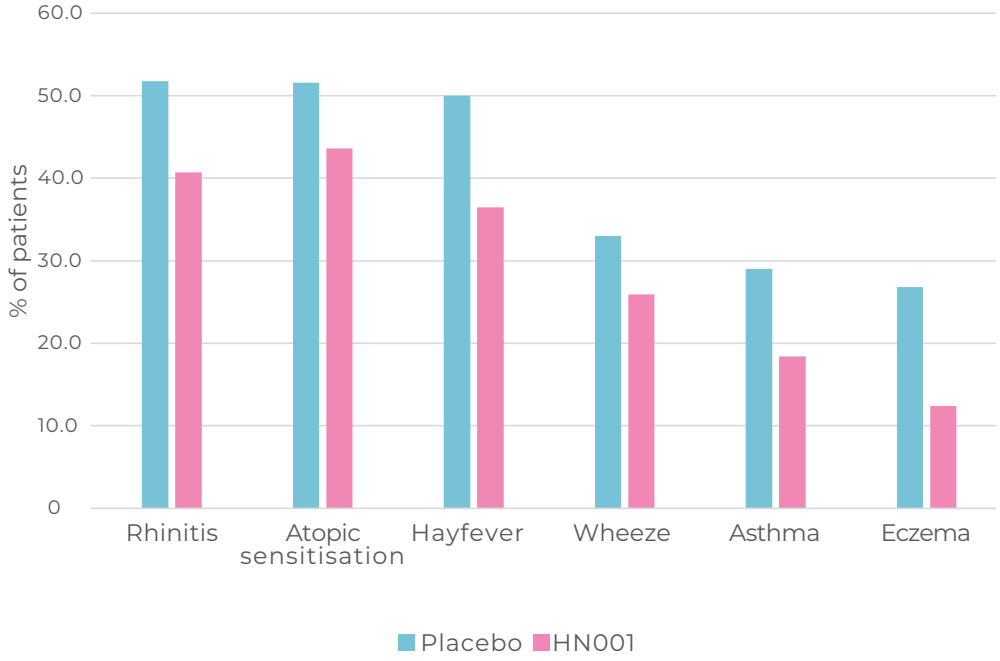
L. rhamnosus HN001 reduces the risk of eczema development

A randomised controlled trial (RCT) assessed *L. rhamnosus* HN001 taken daily from 35 weeks gestation to 6 months' postpartum in breastfeeding mothers and from birth to age 2 years in infants[25-27]

L. rhamnosus HN001 protected against eczema at 2, 4 and 6 years and atopic sensitisation at 6 years[44-46]

At age 11 years, early childhood supplementation with *L. rhamnosus* HN001 was associated with significant:[27]

- Reductions in the 12-month prevalence of AD (54%) and hay fever (27%)
- Reductions in the life-time risk of wheeze (24%), atopic sensitisation (29%) and AD (42%)[24-26]



12-month prevalence of atopic diseases in patients receiving *L. rhamnosus* HN001[44]

References provided at the end of the module.

Date of Publication: August 2022

Cow's milk protein allergy: common in young children

Cow's milk protein allergy (CMPA) affects 2% to 7.5% of children younger than 1 year of age[47]

Between 80% and 90% of children are tolerant to cows milk proteins (such as those in casein and whey) by the age of 5 years. However, CMPA can persist and seems to be becoming more severe[47,48]

GI symptoms of CMPA seem to arise from GI inflammation and dysmotility[47]

Children with CMPA have reduced quality of life and in some cases reduced nutritional status. CMPA is also associated with parental anxiety and stress[49,50]

	Immunoglobulin E (IgE) mediated	Non-immunoglobulin E (IgE) mediated
Speed	Rapid: minutes - 2 hours	Slower – hours/days
Severity	Acute, specific	Chronic, Non-specific
Common symptoms	• Angioedema of the oropharynx • Oral pruritus • Urticaria • Rhinorrhoea About 15% of allergic children show symptoms of anaphylaxis such as stridor or wheeze	• Treatment-resistant gastro-oesophageal reflux • Eczema • Colic or persistent crying, • Diarrhoea (which can be associated with mucus or blood) • Food aversion • Constipation

Characteristics of CMPA[47]

References provided at the end of the module.

Date of Publication: August 2022

L. rhamnosus GG reduces the allergic manifestations of IgE-mediated CMPA

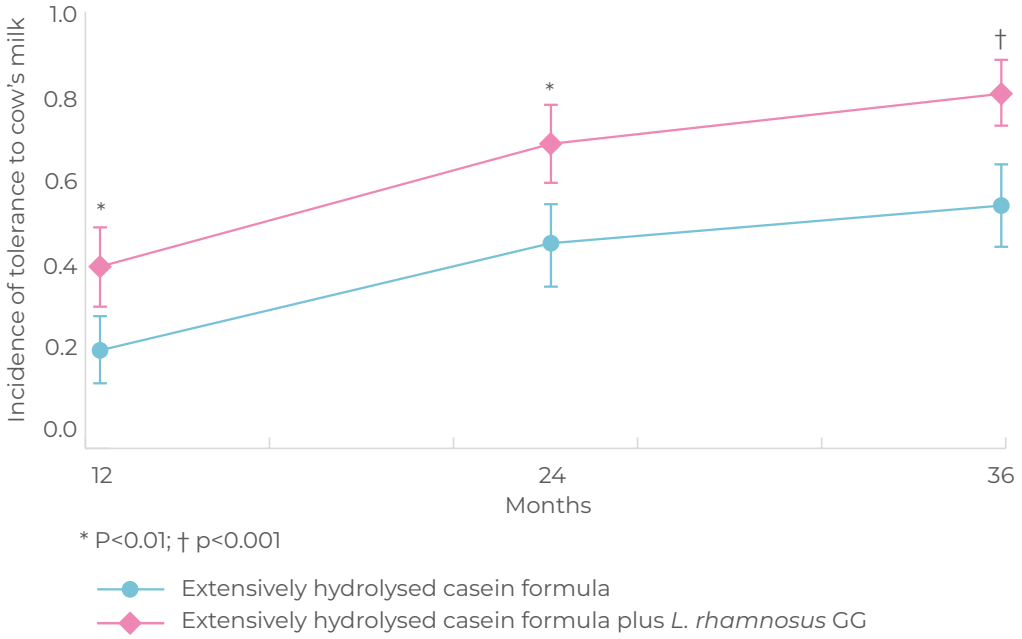
Adding *L. rhamnosus* GG to extensively hydrolysed casein formula reduces the risk of allergic manifestations and hastens the development of cow's milk tolerance in children with IgE-mediated CMPA[51]

Compared with the formula alone, the formula containing *L. rhamnosus* GG:

- Significantly reduced the risk of at least one allergic manifestation (eczema, urticaria, asthma or rhinoconjunctivitis) by 23%
- Significantly increased the likelihood of acquiring tolerance to cow's milk by 20% at 12 months, 24% at 24 months, and 27% at 36 months

No adverse events were attributed to the formulas. There was no change in their daily intake or changes in weight, length, and height between the groups

L. rhamnosus GG also reduces CMPA symptoms, including vomiting and diarrhoea[52]



Incidence of tolerance to cow's milk. Children with a median age of 5.0 months were randomised to the formula alone (n=110) or with *L. rhamnosus* GG (n=110)[51]

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

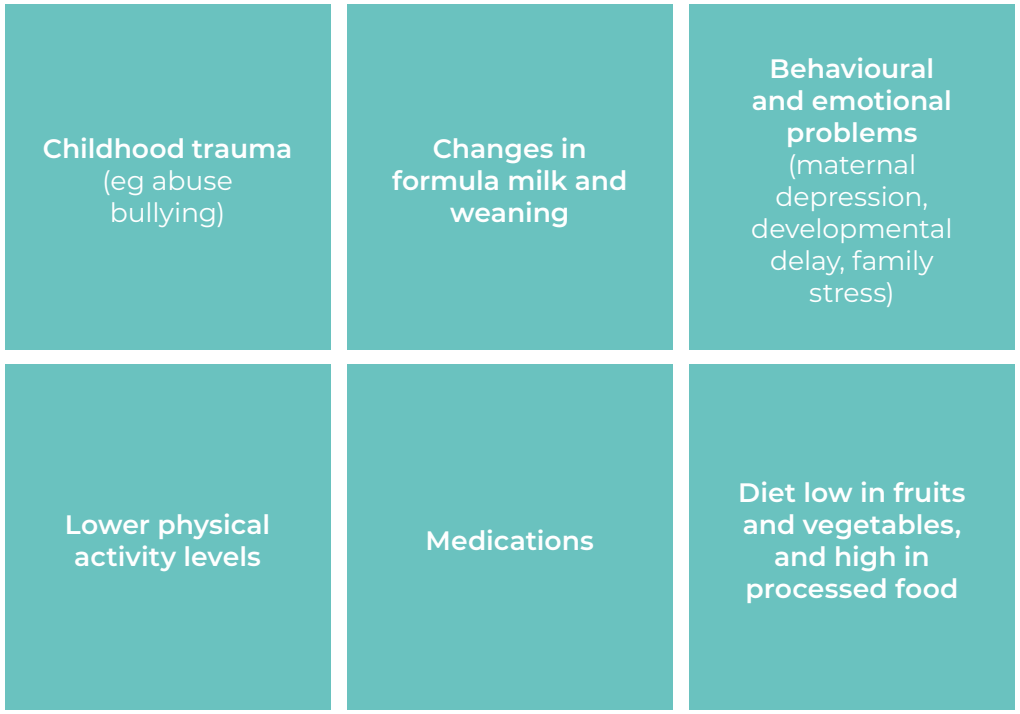
Date of Publication: August 2022

Constipation: epidemiology and risk factors

About 1 in 10 children (9.5%) develop functional constipation, although the rate varies between 0.5% and 32%. Constipation is one of the most common functional GI disorders in infants[53]

Many factors increase the likelihood that children will develop constipation (see right); the complications of childhood constipation can include:[54-57]

- Faecal impaction (hard stool packs the intestine)
- Anal fissures (small tears or cracks that cause bleeding, itching or pain)
- Rectal prolapse (the rectum sticks out of the anus)
- Encopresis (inability to control passage of stools
- Faecal incontinence, abdominal pain, enuresis and urinary tract infections
- Low self-esteem, poor quality of life and family stress



Factors that may increase the risk of constipation in children

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

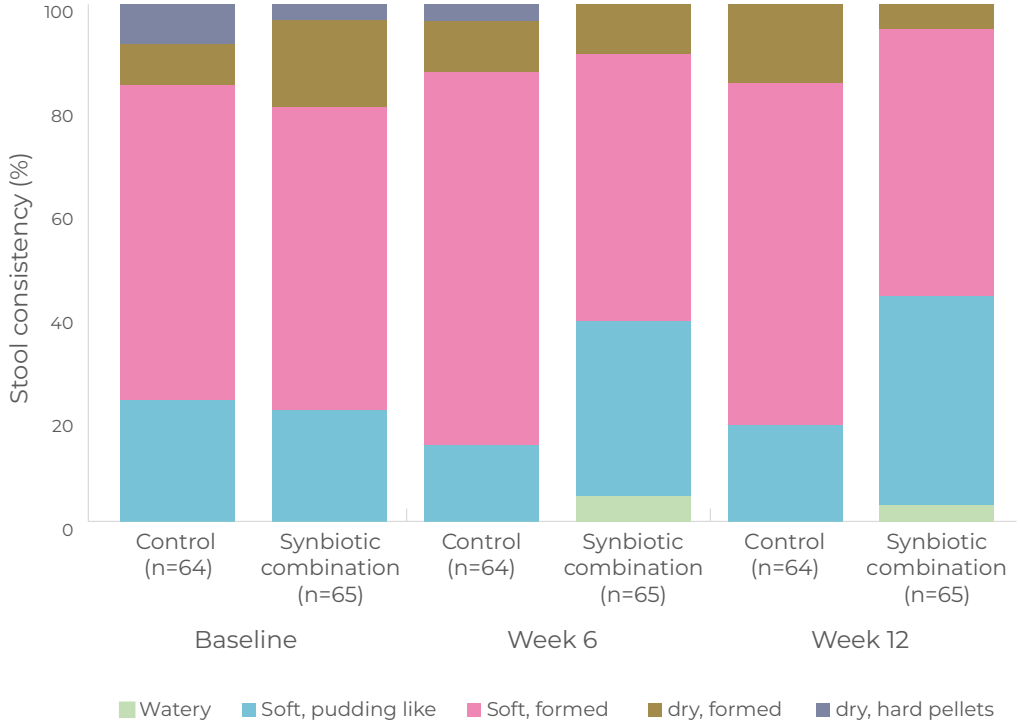
Date of Publication: August 2022

A synbiotic combination could reduce the risk of childhood constipation

A synbiotic combination of *B. breve* M-16V®, GOS and FOS in healthy toddlers increased *Bifidobacterium* levels in the GI microbiome, creating a more acidic intestinal environment and softer stools[58]

The randomised controlled trial included 129 children aged 1-3 years who received the synbiotic combination or a control for 12 weeks. The synbiotic combination:

- Increased the proportion of *Bifidobacterium* from a mean of 27.3% at baseline to 33.3% at week 12
- Decreased the pH value from a median pH of 7.05 at baseline to 6.79 at week 12
- Resulted in softer stools



Stool consistency characteristics of the all-subjects-treated group

* 90% short-chain galactooligosaccharides and 10% long-chain fructooligosaccharides (0.95 g/100 ml)

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

Summary

- The microbiome is largely established during these early years and provides an opportunity to influence the child's short- and long-term health[6,7]
- A healthy GI microbiome maintains normal immune responses, in turn protecting against respiratory infections. Probiotics and prebiotics may restore or bolster immune function in the GI tract and, indirectly, in the lungs[34]
- *L. rhamnosus* HN001 reduces the risk of eczema development[44-46]
- Adding *L. rhamnosus* GG to extensively hydrolysed casein formula reduces the risk of allergic manifestations, hastens the development of cows milk tolerance in children with IgE-mediated CMPA, and reduces the risk of upper respiratory tract infections and the associated antibiotic use[35,51]
- A synbiotic combination of *B. breve* M-16V®, GOS and FOS reduced the risk that infants with atopic dermatitis would develop asthma-like symptoms and in healthy toddlers increased *Bifidobacterium* levels in the GI microbiome, creating a more acidic intestinal environment and softer stools[58]

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

Please click to continue the module

References provided at the end of the module.

Date of Publication: August 2022

Assessment

Now that you have reviewed the learning, please complete the following multiple choice questions to test what you've learnt and receive your CPD certificate

QUESTION 1:

The composition of the GI microbiome during infancy is associated with which of the following?

- ◯ Allergic and atopic diseases
- ◯ Autoimmune disorders
- ◯ Infant temperament
- ◯ Neurodevelopmental disorders
- ◯ Necrotising enterocolitis
- ◯ All of the above

References provided at the end of the module.

Date of Publication: August 2022

Assessment

ANSWER 1:

The composition of the GI microbiome during infancy is associated with which of the following?

- ○ Allergic and atopic diseases
- ○ Autoimmune disorders
- ○ Infant temperament
- ○ Neurodevelopmental disorders
- ○ Necrotising enterocolitis
- ◉ All of the above

References provided at the end of the module.

Date of Publication: August 2022

Assessment

QUESTION 2:

Approximately what proportion of the body's immune cells are present in the gut?

- ◯ 20–30%
- ◯ 30–40%
- ◯ 50–60%
- ◯ 60–70%
- ◯ 70–80%

References provided at the end of the module.

Date of Publication: August 2022

Assessment

ANSWER 2:

Approximately what proportion of the body's immune cells are present in the gut?

- ○ 20–30%
- ○ 30–40%
- ○ 50–60%
- ○ 60–70%
- ◉ 70–80%

References provided at the end of the module.

Date of Publication: August 2022

Assessment

QUESTION 3:

Is this statement "Adding *L. rhamnosus* GG to extensively hydrolysed casein formula reduces the risk of allergic manifestations and hastens the development of cows milk tolerance in children with IgE-mediated CMPA"

- ◯ True?
- ◯ False?

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

Assessment

ANSWER 3:

Is this statement "Adding *L. rhamnosus* GG to extensively hydrolysed casein formula reduces the risk of allergic manifestations and hastens the development of cows milk tolerance in children with IgE-mediated CMPA"

- (●) True?
- ( ) False?

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

Assessment

QUESTION 4:

Which of the following are potential complications of childhood constipation:

- ◯ Anal fissures
- ◯ Encopresis
- ◯ Faecal impaction
- ◯ Rectal prolapse
- ◯ All of the above

References provided at the end of the module.

Date of Publication: August 2022

Assessment

ANSWER 4:

Which of the following are potential complications of childhood constipation:

- ○ Anal fissures
- ○ Encopresis
- ○ Faecal impaction
- ○ Rectal prolapse
- ◉ All of the above

References provided at the end of the module.

Date of Publication: August 2022

Assessment

QUESTION 5:

A synbiotic combination of *B. breve* M-16V®, GOS and FOS in healthy toddlers produced which of the following?

- ◯ Increased the proportion of *Bifidobacterium* in the GI microbiome
- ◯ Decreased the median pH value
- ◯ Resulted in softer stools
- ◯ All of the above

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

Assessment

ANSWER 5:

A synbiotic combination of *B. breve* M-16V®, GOS and FOS in healthy toddlers produced which of the following?

- ◯ Increased the proportion of *Bifidobacterium* in the GI microbiome
- ◯ Decreased the median pH value
- ◯ Resulted in softer stools
- ◉ All of the above

The Department of Health and WHO recommend that babies have nothing other than breastmilk for the first 6 months of life and then continue breastfeeding with complementary foods for up to two years and beyond

References provided at the end of the module.

Date of Publication: August 2022

Post-learning reflection

Please take a moment to answer these post-learning questions. These answers will be logged alongside your pre-learning responses on your CPD certificate which will be emailed to you on completion as evidence of your learning.

In this module we covered the numerous benefits of giving probiotics during infancy. List 3 that were most important for you in your practice:

How confident do you now feel to advise parents and carers about giving probiotics to infants?

What else do you feel you need to know about the infant microbiome and its influence on long-term health?

How will you continue to improve your knowledge?

Date of Publication: August 2022

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Advertorial

Introducing the babies and children's range from Optibac Probiotics – the brand parents trust the most*

Optibac
Trusted friendly bacteria

Expertly formulated for little tummies, Baby Drops and Babies & Children contain some of the world's most researched probiotic strains for children's health – scientifically proven to support development from birth[1,2,3] – and offer a choice of fuss-free liquid drops or flavourless sachets.

Baby Drops

Provides 1 billion probiotics per dose and comes with an easy-to-use, measured dropper.

Contains *Bifidobacterium breve* M-16V®, a strain clinically studied in thousands of infants and used in over 140 ICUs around the world.

Scientifically proven to:

- ✓ Build the baby's microbiome, significantly increasing Bifidobacteria[4,5]
- ✓ Restore a 'normal' GI microbiome in children born by caesarean section, to resemble that of a vaginally born infant[5]
- ✓ Inhibit harmful bacteria associated with colic[5]
- ✓ Improve symptom severity of asthma, eczema and allergy[6]
- ✓ Improve stool consistency, reducing the risk of constipation[7]

Babies & Children

Provides 3 billion probiotics per sachet, including: *Lactobacillus rhamnosus* GG, the most scientifically studied strain in the world, *Bifidobacterium breve* M-16V® and *Lactobacillus rhamnosus* HN001.

Scientifically proven to:

- ✓ Support a healthy microbiome from birth[4,5]
- ✓ Reduce incidence & duration of URTI's[8] and gastroenteritis[9]
- ✓ Reduce risk of developing asthma-like symptoms[10]
- ✓ Improve symptoms, incidence & severity of eczema[11,12,13]
- ✓ Reduce incidence of symptoms of CMPA and help develop oral tolerance[14]
- ✓ Support digestive health – IBS,[15] stool consistency[7]

Plus Vitamin D3 for added immune support and prebiotic FOS, which increase natural gut bacteria.

Both award-winning supplements are dairy-free and gluten-free, with no added sugars or artificial colours. Suitable for breast-fed and formula-fed infants.

Available from your local pharmacy.

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*An independent UK survey of 1,000 people, August 2020

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Your feedback

To finish this module and receive your results and certificate, please complete the following feedback...

Please rate the overall quality of this CPD module:

◯ Excellent ◯ Good ◯ Fair ◯ Poor

Before completing this module, how likely where you to recommend probiotics for infants and children?

◯ Very likely ◯ Likely ◯ Neither likely or unlikely ◯ Very unlikely

After completing this module, how likely are you to recommend probiotics to infants and children in your practice?

◯ Very likely ◯ Likely ◯ Neither likely or unlikely ◯ Very unlikely

Before completing this module, how likely were you to recommend Optibac Probiotics?

◯ Very likely ◯ Likely ◯ Neither likely or unlikely ◯ Very unlikely

After completing this module, how likely are you to recommend Optibac Probiotics?

◯ Very likely ◯ Likely ◯ Neither likely or unlikely ◯ Very unlikely

In practice, which indication(s) would you most likely recommend the Optibac Probiotics Children's range for?

◯ A healthy microbiome from birth ◯ Children's immunity (URTIs) ◯ Atopy
◯ Cows milk allergy ◯ Constipation ◯ Other:

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