



Gut  
health

## Human microbiota as an important modulator of gut health

The brain... the heart... the gut. In recent years, it has become increasingly apparent that overall health and well-being has another foundation stone: the gut. Researchers worldwide continue to find evidence that good gut health is highly influential on many aspects of human health, stretching far beyond the digestive system itself.

The gut exerts influence on health and well-being in many ways, but is, in turn, affected by numerous factors. Understanding these factors and their impact on the gut microbiota - the collection of bacteria that reside in the human gut - is critical to understanding overall gut health. Unsurprisingly, the gut (and more specifically its microbiota) is the dominant influencer of digestive health - one of the topics of most concern to consumers today. In this whitepaper, we explain and explore the microbiota, the issues caused by dysbiosis and how it can be manipulated to improve gut health.

### A global concern

Problems with the gut are nothing new, but today, approximately 40% of consumers globally suffer from functional digestive issues<sup>1</sup>. There is a prevalence of digestive diseases, disorders and difficulties that threaten the overall health of millions worldwide - and everyone from scientists and medical professionals, to brands and consumers, is talking about it.

Digestive health has also been gaining popularity for some years as consumers understand how much they themselves can influence and improve their health and well-being. As a result, many are pursuing a more holistic approach that focuses more on prevention, not only cure. When it comes to nutrition, a keyword, for example, is "clean label". As a result, consumers are eager to incorporate ingredients such as probiotics<sup>2</sup> and prebiotics<sup>3</sup> into their daily diets to boost their gut health, and the pressure is on for scientists, brands and manufacturers to continuously develop innovative health solutions.



## Inextricable link, unquestionable issue

It is unsurprising that the gut itself (and more specifically its microbiota) is the single largest influencer of digestive health and should therefore be the main target when looking to improve it. The protective role of the gut microbiota in suppressing invading pathogens, a concept known as colonisation resistance, has been extensively researched<sup>4</sup>.

Approximately 40% of people have functional gastro-intestinal disorders that impact their quality of life, including<sup>1</sup>:



**14% with Irritable Bowel Syndrome (IBS)**



**10% with functional constipation**



**3.5% with bloating or distension**

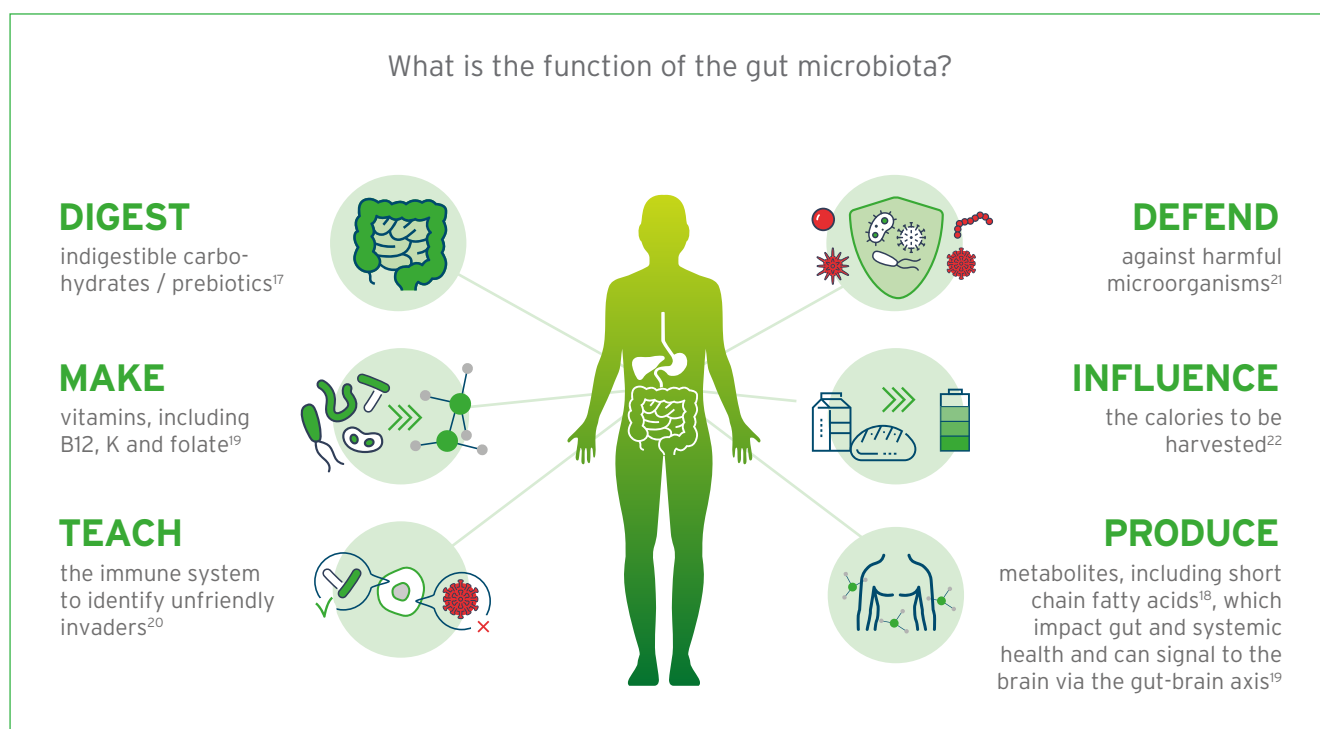
At the same time, good digestive health is a consumer priority worldwide, with more than one third of individuals suffering from digestion problems or discomfort<sup>1</sup>. These issues, ranging from stomach discomfort to diagnosed disorders such as IBS, are uncomfortable, embarrassing and unpleasant, and millions of people cope with them on a daily basis. IBS, for example, as one of the more common issues, is a lifelong problem for many consumers and is estimated to affect more than 580 million globally<sup>5</sup>. In IBS patients, abnormal contractions in the gut and a distended bowel can trigger diarrhoea, constipation, or both.

Similarly, constipation is also one of the most common gut health impairments globally - with the biggest problem reported in the western hemisphere, where there is a prevalence of 2-27%<sup>6</sup>. Meanwhile, the estimated self-defined constipation rate in Asia is 15-23% in women and approximately 11% in men<sup>7</sup>. Due to its high occurrence and difficulties in diagnosis and subsequent treatments, constipation generates high costs in health care systems every year<sup>8</sup>.

While a significant number of people look to medicine to remedy their digestive health issues, an increasing number is taking a preventative approach that encompasses healthy eating, fitness and well-being as a more sustainable, long-term solution. Central to it all is achieving and maintaining a healthy gut and its microbiota.



## All eyes on the gut microbiota



Source: Adapted from Gut Microbiota for health

The gut microbiota collectively weighs up to 2kg (more than a human brain) and contains around the same number of microorganisms as the total number of cells in the human body<sup>9</sup>. Each individual gut hosts about 100 trillion bacteria in total<sup>10</sup> and over 1,000 bacterial species<sup>9</sup>, many of which are vital in breaking down food and toxins and supporting the immune system.

Various studies have indicated the existence of a core gut microbiota, comprising prevalent gut microbiota, species, genes and essential functions, which are observed in most individuals and persist over time<sup>11</sup>. Similarly, it is widely known that the microbiota breaks down indigestible food components to make them available for the human host and facilitates nutrient absorption<sup>13</sup>. Thus, the microbiota also has a systemic metabolic impact<sup>14</sup>. But in addition to this, the gut microbiota (directly or indirectly through the production of specific metabolites) also contributes to gut physiology, gut mobility and intestinal barrier homeostasis<sup>15, 16</sup>.

### Microbiome or microbiota?

These two terms are often used interchangeably but they define different aspects. The term “microbiome” refers to the microorganisms and their activities in an entire habitat (in this case the human body). The term “microbiota” covers a community of microorganisms residing in a particular environment (in this case, the human gut)<sup>12</sup>.



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Every person's microbiota composition is different, with each gut containing various species, each represented by numerous different strains and different quantities. However, broad commonalities can be seen, depending on many factors, including diet. And, with a range of disease thought to be linked in some way to the gut and the composition and activity of the microbiota<sup>20</sup>, it has become increasingly clear that any conversation about digestive health should also consider the gut microbiota and the factors that influence it (such as nutrition).

## A balanced approach

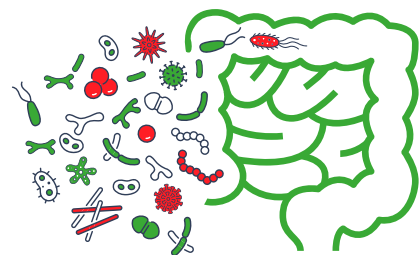


A healthy gut microbiota is complex and dynamic, with the ability to restore to equilibrium after disturbances such as pathogenic infection or antibiotic therapy<sup>11</sup>. Microbiota composition fluctuates, but balance is crucial for it to perform all of its functions properly. A healthy balance, for example, ensures that beneficial bacteria such as bifidobacteria are present, while the growth of potentially

harmful bacteria is inhibited. The gut microbiota changes as we age, and alterations in the composition and activity are associated with some diseases. The scientific community is actively working to understand better which microbes are associated with health and disease, and whether an increase in risk-related bacteria or a loss of helpful species could be causal<sup>21, 22</sup>.



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Source: Adapted from Gut Microbiota for health

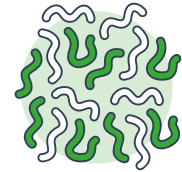
## The bifidobacteria brief

As one of the important genera of bacteria that make up the gastrointestinal tract microbiota in humans, a presence of *Bifidobacterium* has been implicated to be important for a healthy gut microbiota<sup>23</sup>. The beneficial bifidobacteria produce metabolites such as short-chain fatty acids by breaking down fibres, thereby alleviating gastrointestinal symptoms like abdominal pain or bloating<sup>24</sup>, inhibiting the growth of bad bacteria and reducing the gut pH<sup>16</sup>. The various bifidobacteria species also have influence on protecting the gut barrier<sup>16</sup>.

As a dynamic collection of bacteria and other microorganisms, there is always the possibility that the gut microbiota will be disrupted by unhealthy diet, medication or infection. This disruption can be characterised by a decline in bacterial species that benefit the body's health, an increase in harmful, disease-causing bacteria, or a restriction of the overall bacterial species richness. This type of imbalance is known as dysbiosis, and can be accelerated by exercising to exhaustion, disease and ageing<sup>25</sup>.



Bifidobacteria



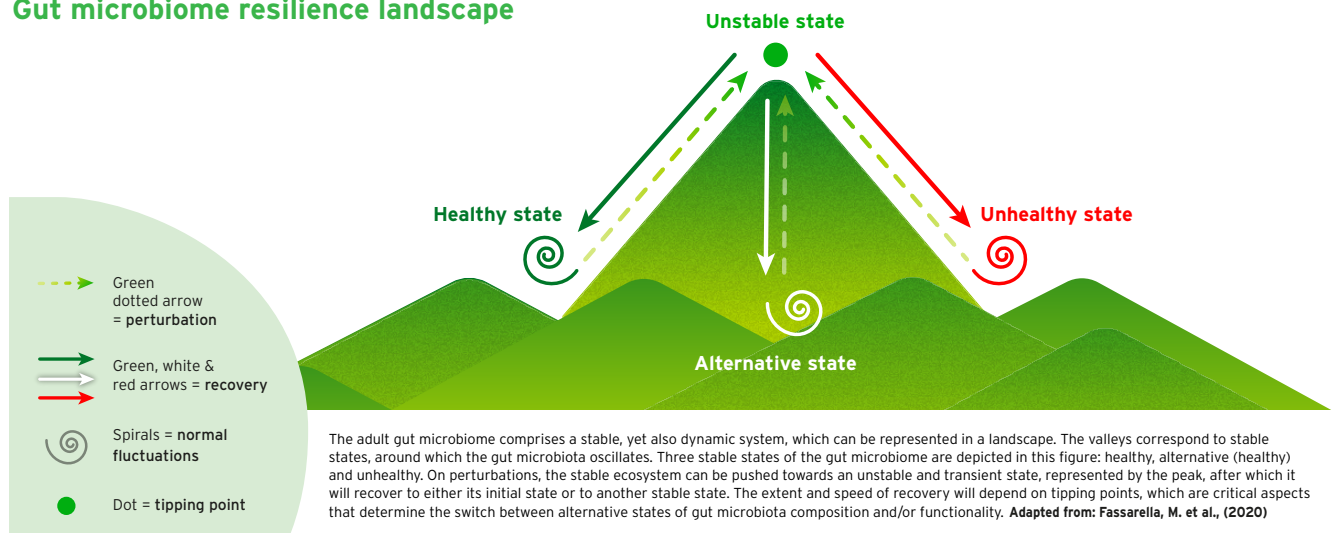
Short-chain fatty acids

## Resilience of gut microbiota

The gut microbiota's ability to self-regenerate after any perturbation (disturbance) is known as the resilience phenomenon<sup>26</sup>. Impaired ability to come back to the pre-perturbation healthy composition and activity may lead to long-lasting dysbiosis. As such, maintaining a resilient microbiota may be important for health<sup>11,27</sup>. There is growing evidence that a disrupted microbiota can contribute to the pathogenesis of gastrointestinal disorders including inflammatory bowel disease (IBD), irritable bowel

syndrome (IBS) and coeliac disease<sup>26,30</sup>. The 'tipping points' that mark the critical switch of the microbiota to an unhealthy state are only beginning to be understood, and the responses are highly individual-specific. However, it is becoming apparent that the mechanisms shaping and determining gut microbiota resilience will allow the development of modulatory strategies to increase resilience of healthy states, or rather decrease and ultimately overcome unhealthy states<sup>30</sup>.

### Gut microbiome resilience landscape

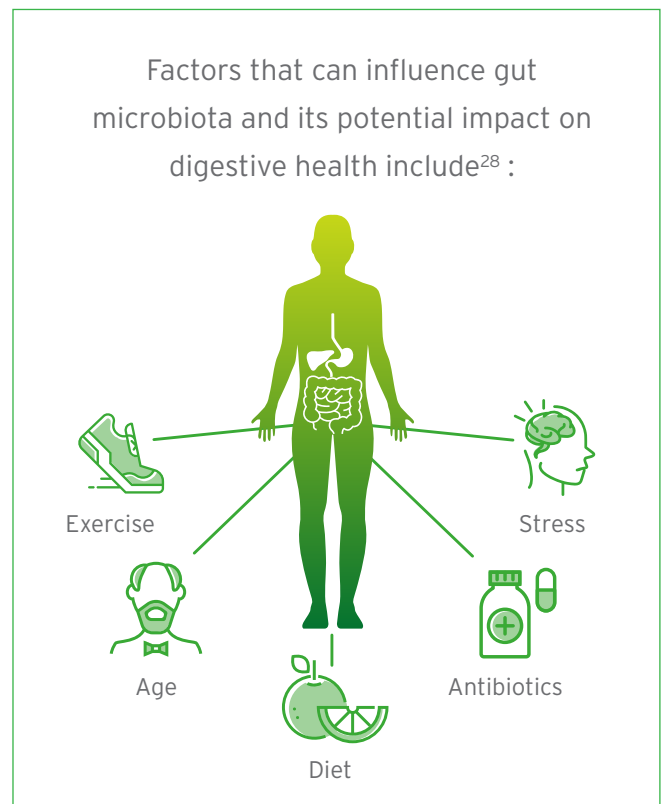




## Balancing the gut microbiota

So, if dysbiosis is a key factor in the development and prevalence of digestive health issues, how can the microbiota be 'rebalanced'? There is a huge potential to sustain, improve or restore the microbiota in at-risk or diseased individuals.

Diet has repeatedly been shown to be one of the most important factors affecting the gut microbiota. The microbiota's composition and the activity of the microbiota are important throughout the lifespan. Indeed, more than 50% of the variation of gut microbiota have been related to dietary adjustments - and major changes in diet during adulthood can modify the microbiota in a matter of days<sup>27</sup>. Specific foods and dietary patterns all influence the abundance of different types of bacteria, which in turn can affect both overall gut health and digestive health specifically<sup>28,29</sup>. In particular, prebiotics have shown themselves to be popular solutions that positively influence the gut and, in turn, digestive health<sup>31</sup>.



## The exciting future of digestive health



Balancing the microbiota via external dietary influences is a game-changer for consumer health. As they become more aware of the effects of lifestyle and diet on holistic health and well-being, scientists and new product development teams are exploring the potential of supplements and functional foods and drinks that positively influence our gut health.

At FrieslandCampina Ingredients, our world-leading experience in infant, performance and medical nutrition has allowed us to develop ingenious digestive health solutions that work with the body's natural processes to address gut health conditions and digestive problems. With decades of expertise in the science of prebiotic effects, their development and their application as ingredients, we are eager to unlock the secrets of the microbiota and provide consumers with the means to improve their gut health easily.

## Interested?

Interested in learning more about the gut microbiota, or the digestive health solutions offered by FrieslandCampina Ingredients? Get in touch with our team today via email at [info@biotis.com](mailto:info@biotis.com) to start the conversation.

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