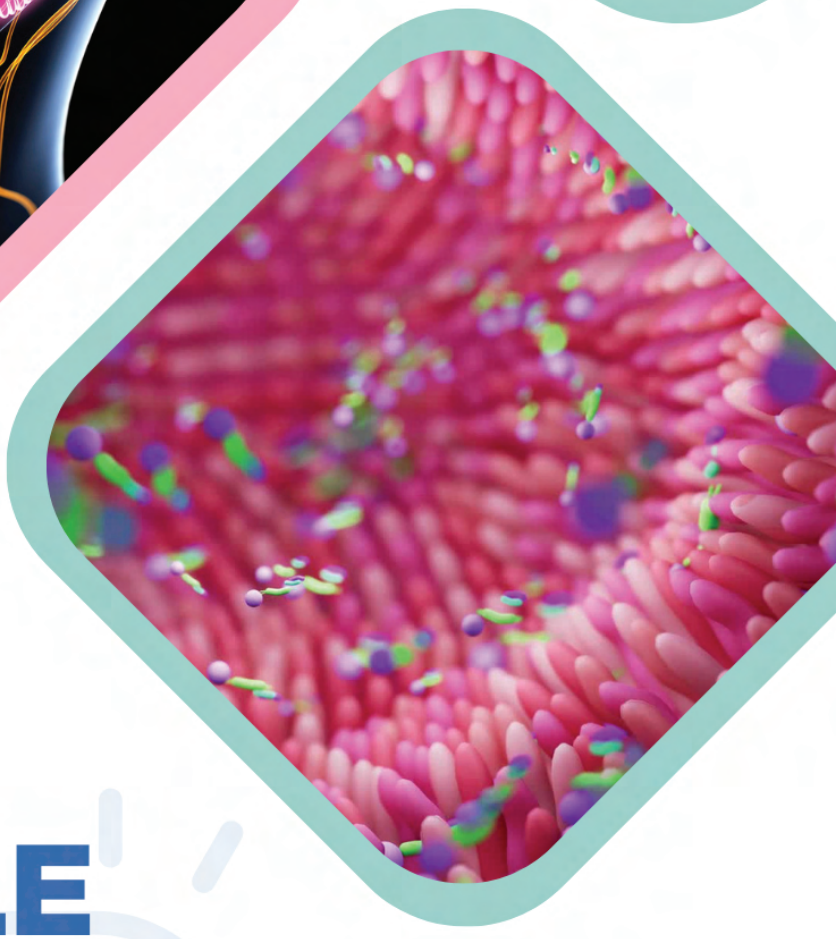


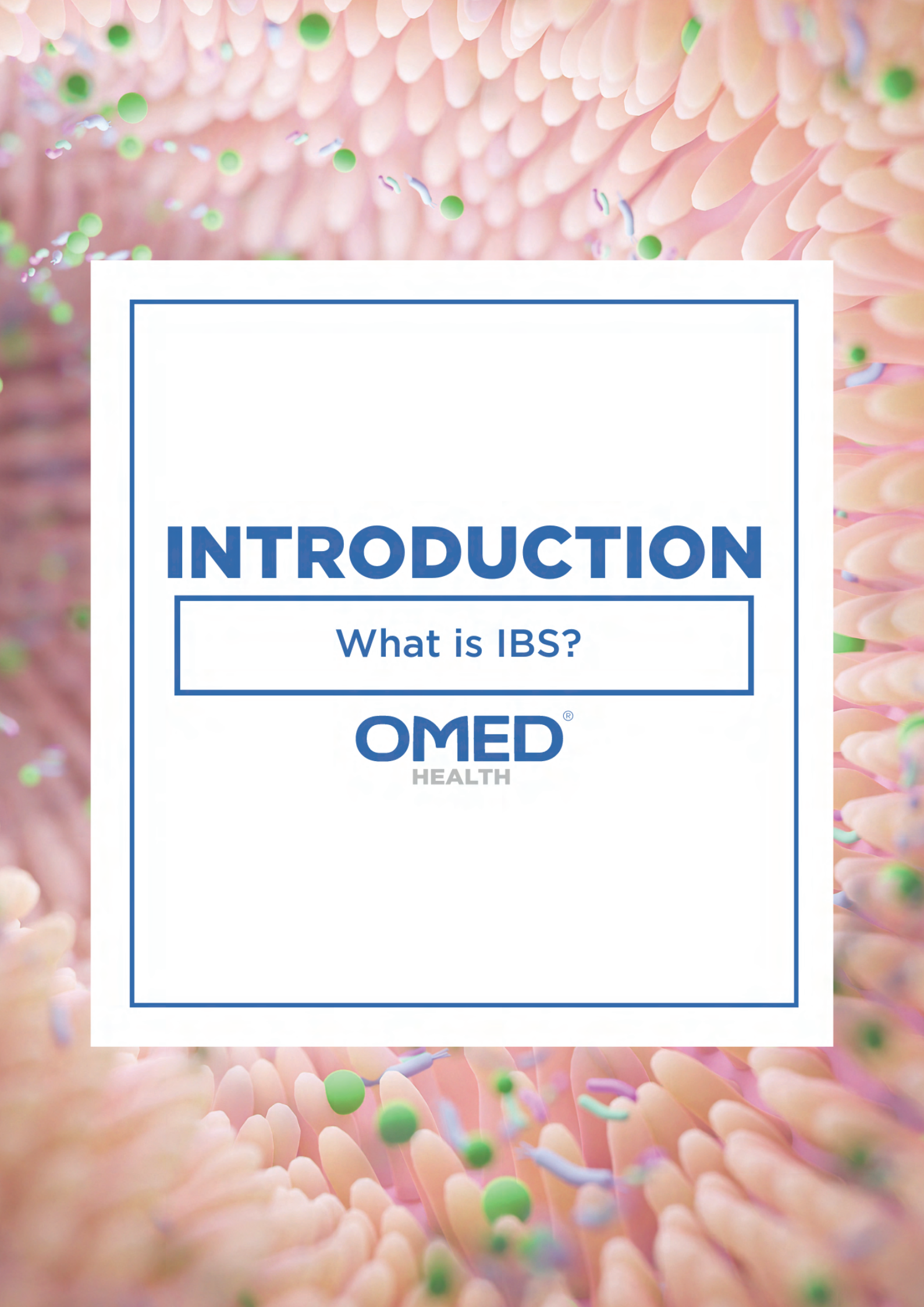
IRRITABLE BOWEL SYNDROME

Discover what IBS is, how it can be diagnosed, and the most effective ways to manage it

OMED® HEALTH

TABLE OF CONTENTS

OMED® HEALTH



INTRODUCTION

What is IBS?

OMED®
HEALTH

Introduction

What is IBS?

Did you know that 9-23% of the global population suffers from irritable bowel syndrome (IBS) (1)? IBS is a functional gut disorder – a group of disorders that cannot currently be diagnosed using standard medical tests. For example, a blood test will generally show normal results in IBS patients (2). Functional gut disorders cause gastrointestinal symptoms such as abdominal pain, diarrhea, constipation, and bloating.

Other functional gut disorders:

- Gastroesophageal reflux disease
- Functional dyspepsia (indigestion)
- Fecal incontinence
- Functional nausea and vomiting
- Functional constipation
- Functional diarrhea

Recent research has implicated the involvement of alterations in the pathways connecting the gut and the brain within the gut-brain axis. Functional gut disorders are the most frequently diagnosed conditions in gastroenterology (3), and the most common functional gut disorder is IBS.

IBS is defined as the presence of abdominal pain or discomfort accompanied by altered bowel habits for six months. These symptoms can range from mild to debilitating. IBS is often associated with other comorbidities (more than one disease occurring in one person at the same time) such as pain syndromes and migraines. It is also associated with psychiatric conditions such as depression (4) and patients with high levels of anxiety are more likely to suffer from IBS symptoms (5). Unfortunately, most individuals with IBS experience recurring and worsening symptoms over time (6).

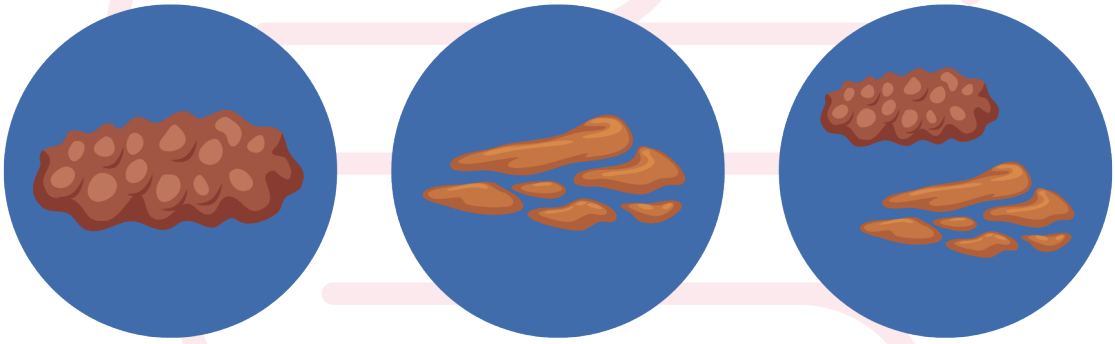
Several factors can increase a person's risk of developing IBS, such as sex, age, and socioeconomic status. For example, women are more likely to have IBS than men (5), with two in three cases occurring in women (7). However, the differences in help-seeking behavior seen in males could influence this number (8). IBS symptoms can also be triggered by eating certain foods. In one study, more than half of patients reported that their symptoms were linked to specific foods, such as spicy or fried food, dairy products, and coffee (9).

Types of IBS

IBS is diagnosed using the ROME criteria (see page 21) based on the symptoms experienced, and a distinction can be made between the different subtypes of the condition. The three most common subtypes are irritable bowel syndrome predominantly with diarrhea (IBS-D), irritable bowel syndrome predominantly with constipation (IBS-C), and irritable bowel syndrome mixed (IBS-M).

For patients whose stool consistency does not match the criteria for these types, an unclassified IBS diagnosis (IBS-U) may be given. Other subtypes of IBS include post-infectious IBS (PI-IBS) which can develop after an episode of infectious gastroenteritis, food poisoning, or post-diverticulitis, though more research is necessary to confirm whether diverticulitis flare-ups can cause IBS (10). Diverticular disease and diverticulitis are gastrointestinal conditions that affect the large intestine, causing abdominal pain and other symptoms. they are caused by small bulges in the walls of the large intestine called diverticula (11).

Main types of IBS



IBS-Constipation

More than a quarter of your stools are hard or lumpy and less than a quarter are loose or watery

IBS-Diarrhea

More than a quarter of your stools are loose or watery and less than a quarter are hard or lumpy

IBS-Mixed

More than a quarter of your stools are hard or lumpy and more than a quarter are loose or watery

IBS causes gastrointestinal symptoms that are non-specific and therefore could be associated with other gastrointestinal conditions. Because of this, the diagnosis of IBS is difficult. Even though IBS is not life-threatening, the symptoms can significantly affect the quality of life of patients and impose a profound burden on physicians and healthcare systems. Once IBS has been identified, there are treatments and management strategies available. Because the causes and symptoms of IBS can vary from person to person, what works for some might not work for others. Everyone is different!

IBS can share a significant overlap with various underlying conditions, some of which are treatable, meaning that many IBS patients may be misdiagnosed or have treatable causes for their symptoms. Gastrointestinal conditions such as small intestinal bacterial overgrowth (SIBO), food intolerances (lactose intolerance), and celiac disease all present symptoms that are also seen in IBS such as abdominal pain, bloating, and altered bowel movements. Treating these underlying conditions through treatments, such as antibiotics for SIBO and dietary changes for food intolerances, can lead to substantial symptom relief. The overlap of IBS with other conditions highlights the importance of a thorough diagnostic process for IBS, as

many patients may experience better outcomes through more precise diagnoses and treatments tailored to their specific conditions.

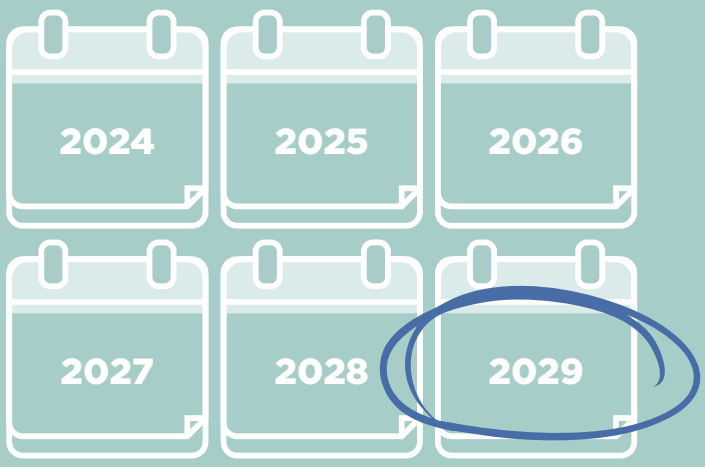
In this eBook, we will first cover what factors can play a role in the development of IBS symptoms, followed by an in-depth look at the symptoms themselves. We will then discuss how IBS can be diagnosed and managed to achieve better gut health.

IBS

IBS costs the UK economy **£800,000 a year** through lost productivity

IBS is twice as common in women as in men

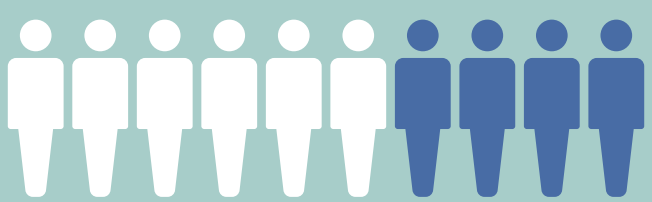
It can take on average **6.5 years** to get a diagnosis through the NHS



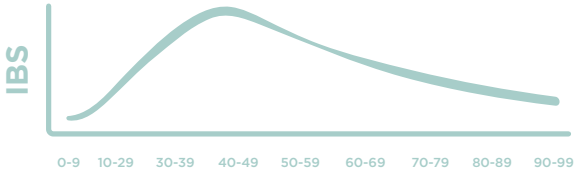
As many as **1 in 8 people** have symptoms of IBS at any one time

Approximately **20 to 40%** of all visits to gastroenterologists are due to IBS symptoms.

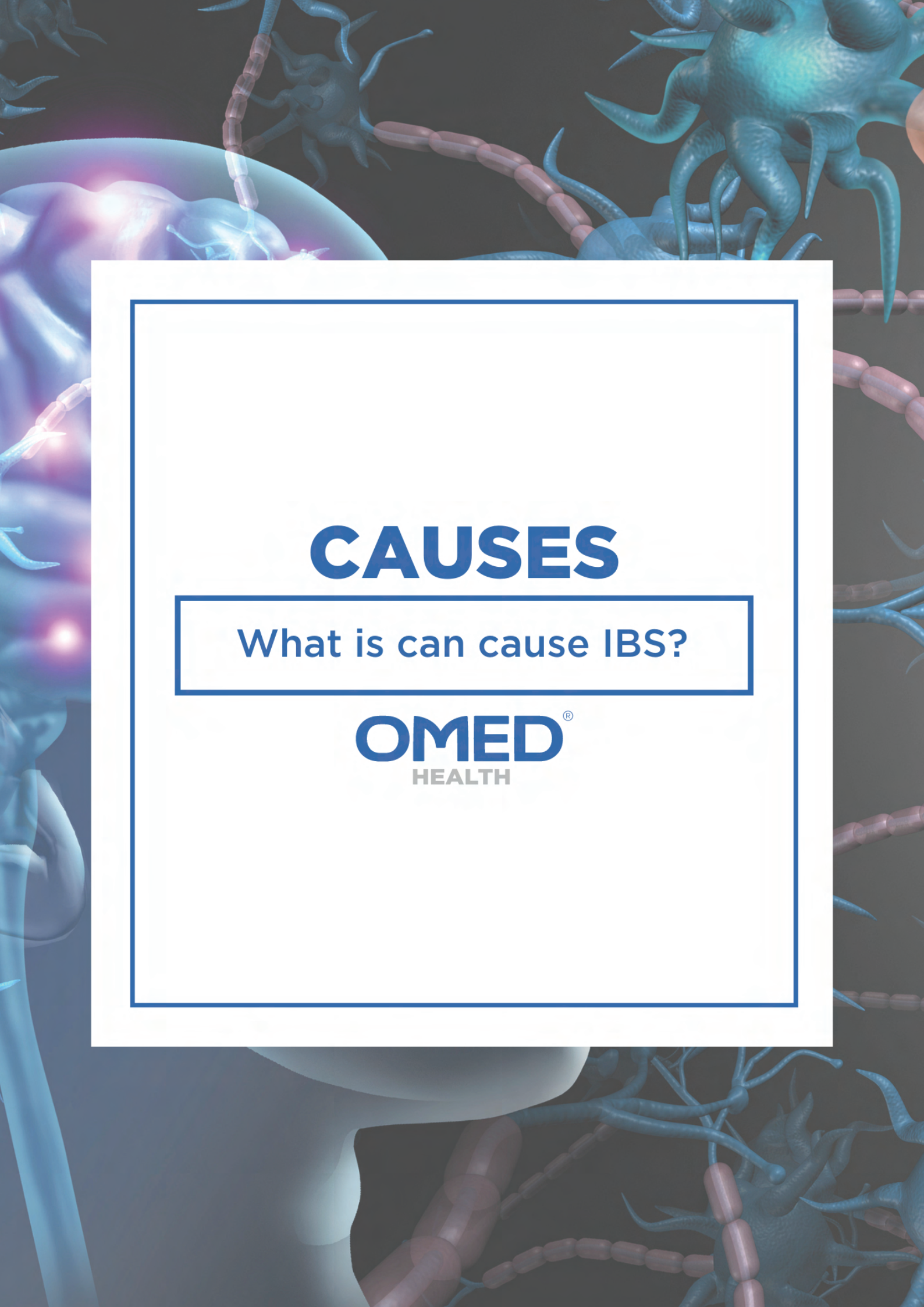
6 in 10 sufferers have never sought professional help



People younger than age 50 are more likely to develop IBS



These stats are all estimates



CAUSES

What is can cause IBS?

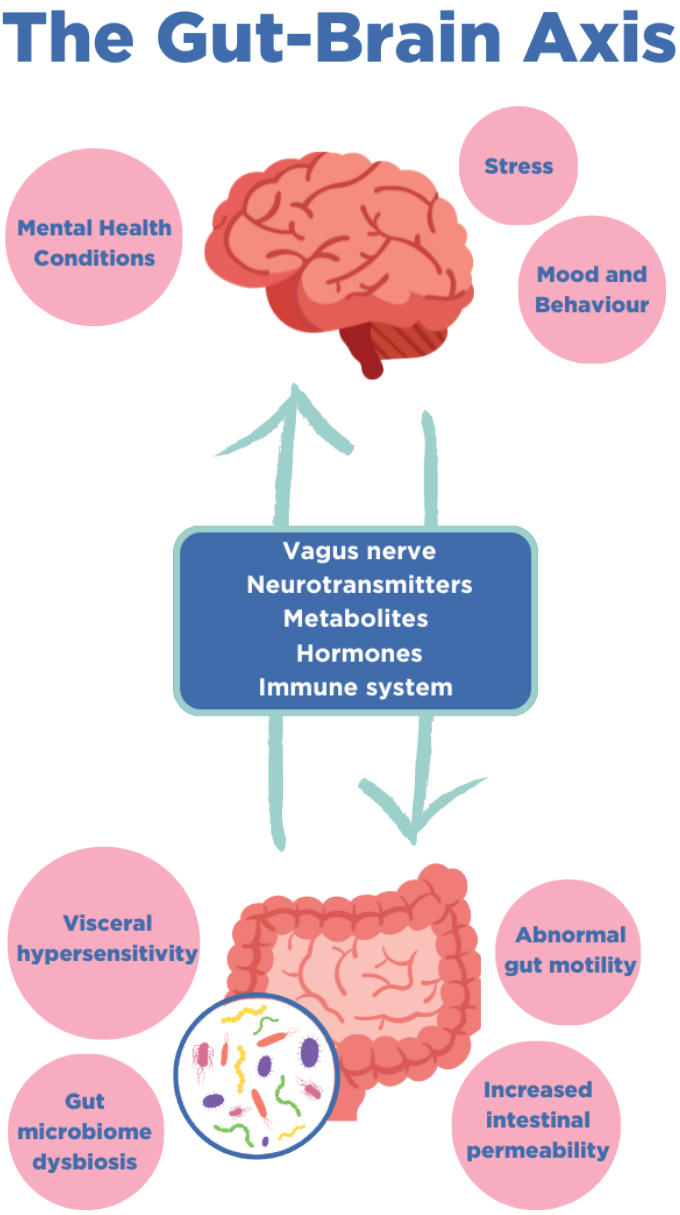
OMED®
HEALTH

Causes

To successfully manage or treat any health condition, it's important to understand the underlying causes behind it. In the case of IBS, the exact causes of the condition can vary between each patient, but it is thought to be a result of a combination of factors that will be explained in this chapter. Factors include abnormal muscle movement in the gut, gut microbiome imbalances, improper functioning of the nervous system, and stress. Let's take a closer look at how each of these factors can cause IBS.

The Brain, Stress, and IBS

The gut-brain axis describes the communication that occurs between the central nervous system (CNS) of the brain and spinal cord, and the enteric nervous system of the gastrointestinal tract, allowing the two to communicate with each other. The factors that facilitate this connection include hormones, the immune system, and metabolic signals, including those regulated and/or produced by the gut microbiota. The communication between the gut and the brain is bi-directional, meaning that whilst our emotions and mental state can affect our gut, our gut can impact our mind.



Stress is an important factor that can influence our gut. When we experience stress, our body activates what is known as the fight-or-flight response. This response originally evolved to help us escape physical danger by slowing down or stopping digestion, allowing the body to divert its energy to face or escape the threat. In modern life, the threats to our physical safety that we commonly faced thousands of years ago are, thankfully, much rarer.

However, the fight-or-flight response remains. This means that we often experience the same bodily reaction in situations where our physical safety is not at risk, for example before an important presentation. Whilst feeling nervous for a one-off presentation is not inherently negative, experiencing stress and anxiety daily can lead to chronic problems that may disrupt digestion and lead to unpleasant gut symptoms such as abdominal pain (12). Stress can play an important role in the development of IBS. A specific peptide (corticotropin releasing factor (CRF),

produced in the brain, has been shown to be a major mediator of the stress response. The frequent activation of the stress response leads to CRF production and CRF-receptor overactivation, which contributes to anxiety and depression (13). A study has shown that administration of CRF increases abdominal pain and motility in IBS patients more than in non-IBS patients (14). Overactivation of the gut-brain axis can result in spasming of the muscles surrounding the intestinal tract leading to painful cramp-like sensations, inflammation, an overactive immune response, and changes to the intestinal barrier in the gut, all of which contribute to IBS (15). For this reason, long-term and early-life stress are particularly likely to be causal factors of IBS.

Some mental health conditions have also been heavily linked to IBS, with IBS patients more commonly experiencing depression and anxiety than the general population (16). However, the bi-directional communication between the gut and the brain means that the interactions between mental health conditions and the gut are complex. For example, having painful and sometimes embarrassing chronic gut symptoms can lead to anxiety around experiencing said symptoms, which can in turn negatively further impact your gut health. This can mean that it is difficult to be certain whether a mental health condition is a causal factor of IBS, or if IBS contributes to worse mental health outcomes.

Gut Motility

Gut motility refers to the movements of the muscles in our intestinal walls that transport food and waste through the digestive system. The contraction and relaxation of these muscles control the speed at which food passes through the intestines. In those with IBS, the normal function and movement of these muscles can be disrupted, therefore altering the process of digestion and causing the abdominal pain and discomfort experienced (17). Abnormalities in gut motility vary across the different subtypes of IBS. For example, in IBS-C, there is decreased gut motility due to less frequent movements of the intestinal walls, whereas in IBS-D there is increased motility as the intestinal walls contract more frequently (18). Learn more about the symptoms of these IBS subtypes in the next chapter.

The Nervous System

Nerves are the main pathways of communication between the gut and the brain. The biggest nerve connecting these organs is the vagus nerve. This nerve helps the gut to respond to changing conditions, for example, by increasing gut motility in the presence of food. Signals are sent through this nerve in both directions, and it plays an important role in anti-inflammatory pathways (19).

When the nerves in the gut are overly sensitive, they can cause increased sensations of abdominal pain and discomfort. This condition is known as visceral hypersensitivity and is seen in between 30-40% of IBS patients across all IBS subtypes (20,21). Movement of the gut walls or disruption to the gut mucosal barrier can trigger gastrointestinal nerves, which then overcommunicate signals of pain to the brain (20). Visceral hypersensitivity can also impact gut motility. If the nerves in the gut are more sensitive, they may cause the muscles to contract too

rapidly or strongly in response to weak signals. On the other hand, if the nerves are dulled, there may be an inadequate frequency or strength of muscle contraction in the gut, reducing gut motility. Low activity of the vagus nerve, which could be caused by stress or physical damage, has also been shown to cause inflammation that can contribute to IBS (22).

Neurotransmitters are chemical compounds essential to send signals through the nervous system including the brain. Serotonin, most known for regulating mood and boosting happiness, is a neurotransmitter key to maintaining normal gastrointestinal function. The gut produces 95% of serotonin (23), which acts in the peripheral nervous system instead of the brain, as it cannot pass through the blood-brain barrier. However, serotonin produced in the gut can still impact the brain as it can affect the nerves that connect the brain and the gut.

The dysregulation of serotonin disrupts the balanced gut environment, causing visceral hypersensitivity, inflammation, and gut motility issues that contribute to IBS (24). Some IBS patients have been shown to have lower levels of serotonin, meaning muscles in the gut are less stimulated and contract less, resulting in the hard or lumpy stools commonly seen in IBS-C. In contrast, increased serotonin levels are associated with patients suffering from IBS-D. The difference in serotonin levels between IBS patients is thought to be a result of different copies of the genes that code for the machinery for serotonin production, which result in either increased or decreased levels of the neurotransmitter.

The Impact of the Microbiome

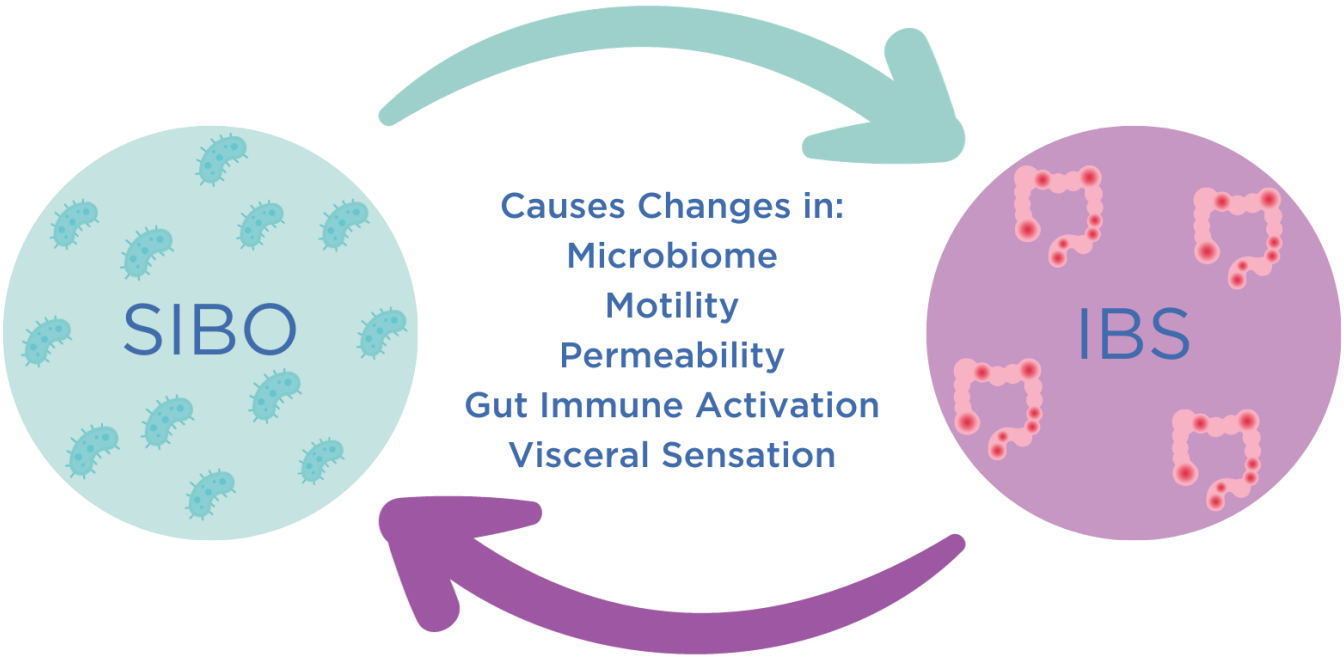
There are roughly 100 trillion microbes in the gut, representing as many as 5000 species of bacteria, fungi, archaea, and viruses (25). These gut microbes help to keep the digestive system functioning smoothly by helping to digest foods, synthesize nutrients, and protect the gut from invading microorganisms. The microbes that live in our gut are collectively known as the gut microbiome. Some of the microbes in the gut microbiome are classed as 'bad' or 'harmful', however, when balanced in a healthy gut with 'good' microbes, they do not usually cause us harm.

A balanced microbiome is where there is a healthy diversity of microorganisms, where no single bacteria, virus, or fungus dominates. An imbalance in the microorganisms making up the gut microbiome, also known as dysbiosis, is thought to contribute to IBS. Dysbiosis can cause an unnecessary activation of the immune system and disrupt the gut barrier, both of which contribute to inflammation and IBS. SIBO is an example of a condition characterized by dysbiosis of the gut microbiome, yet it is still unclear whether this condition is a cause or product of IBS.

Molecules released in the stress response, called catecholamines, have been shown to elevate certain bacteria levels by up to 10,000-fold (26). These species, which include *Escherichia Coli,* can overcrowd the beneficial species in the gut, leading to gut microbiome dysbiosis (27).

The Connection Between IBS and SIBO

Growing evidence suggests a significant link between IBS and SIBO. SIBO is a gastrointestinal condition caused by excessive bacteria in the small intestine (particularly those that usually live in the large intestine), with the common symptoms being abdominal pain, bloating, and diarrhea. Given that these symptoms overlap with those of IBS, it has been theorized that there is a link between the two conditions. Studies have now confirmed that patients with IBS tend to have higher bacterial counts in the upper small intestine compared to healthy individuals (28), which is the main cause of SIBO. Additionally, IBS patients are more likely to exhibit abnormal results in hydrogen or methane breath tests which are used to diagnose SIBO.



Several studies have examined the prevalence of SIBO in patients with IBS compared to healthy controls using hydrogen breath tests. Up to 78% of IBS patients have been found to also have SIBO, and although this frequency is varied across studies, SIBO was found to be more common among IBS patients than

healthy patients overall (28). This highlights that there is a significant relationship between the two diseases. However, it remains uncertain whether SIBO acts as a cause or a consequence of IBS, or perhaps both. SIBO may induce IBS symptoms in some individuals, while in others, IBS may predispose patients to the development of SIBO. Therefore, we see a reciprocal relationship where one condition worsens the other, creating a vicious cycle that causes chronic gut health problems. For more information on SIBO, visit our website to download our **free eBook** on the disease.

Genetics and Inheritance

Some people seem to be genetically predisposed to having IBS, for example, relatives of an individual with IBS are two or three times more likely to also have the condition (29). Studies have identified a wide range of genes that may contribute to IBS, some of which are also associated with mood and anxiety disorders or the nervous system (30). There is also an epigenetic aspect to IBS, which means that the environment and experiences can influence whether genes related to IBS are turned on or off.

Post-infection IBS

Sometimes IBS occurs after someone has suffered from a serious infection or illness and is subtyped as PI-IBS. This is most commonly caused by bacterial, viral, or parasitic infections in the gut, and IBS could develop as a direct result of changes to the gut microbiome, mucosal, immune, or neuronal function during infection (31). The complex inflammatory and immune responses triggered by the body to respond to the infection are thought to be involved in changing these gut properties, which can contribute to the development of IBS.

Gut Gases

Those with IBS are known to produce more intestinal gas in response to a carbohydrate challenge, which has been associated with dysbiosis of the intestinal microbiome (32,33). A carbohydrate challenge test measures the levels of hydrogen and methane in breath samples to detect lactose maldigestion or fructose malabsorption. Hydrogen gas is produced in the gut by bacteria through the fermentation of undigested carbohydrates. Specific sulfate-reducing bacteria in the gut can feed on this hydrogen, producing hydrogen sulfide (a foul-smelling gas) as a result. Hydrogen sulfide is also able to interfere with the ability of gut cells to use energy molecules, such as short-chain fatty acids, that beneficial bacteria produce. A combination of these mechanisms likely contributes to some of the unpleasant symptoms experienced in IBS.

Methane is another gas synthesized through the fermentation of carbohydrates by the gut microbiome, but this instead occurs through specific methane-producing microbes known as archaea. Elevated methane levels are also associated with IBS, mainly with the IBS-C subtype (34). Methane can act as a neurotransmitter to delay the movement of food through the digestive system by reducing gut motility. This contributes to the constipation that is characteristic of IBS-C. High methane

levels also directly contribute to some symptoms of IBS, such as bloating and excess gas. Head over to page 15 to learn more about the symptoms of IBS.

Due to their production by the gut microbiome, hydrogen, and methane gases are clinically validated indicators (also known as biomarkers) of gut dysbiosis. Once produced within the gut, hydrogen and methane can dissolve into the blood, where they can be transported around the body. When these gases reach the lungs, they are exchanged into the air before being exhaled in the breath. Their detection in exhaled breath can reveal valuable and real-time information on the status of gut health and the gut microbiome. By correlating the levels of these gases with other gut symptoms you experience, you can gain a much better understanding of your gut health.

Whilst there is no single cause of IBS, many factors contributing to the disease have been identified and research in this area is still contributing to our collective understanding of IBS. These factors can result in a range of different symptoms, as discussed in the next section of this book.

SYMPTOMS

How can IBS make us feel?

OMED®
HEALTH

Symptoms

1. Bloating
2. Abdominal pain and cramping
3. Excess Gas
4. Nausea and vomiting
5. Diarrhea
6. Constipation
7. Urgent Stools
8. Fatigue
9. Brain Fog

Symptoms

As we have explained in the previous chapter, the causes of IBS symptoms are not always clear, yet many of them occur due to altered connections between the gut and the brain. In this chapter, we will break down each symptom to help you understand them better. Please note that many symptoms can be experienced at different times or in combination with each other.

Bloating

Bloating is a feeling of increased pressure in the gut and is often associated with the physical build-up of gas (35). This can result in uncomfortable pressure in the abdomen, making previously comfortable clothing unbearably tight. Bloating occurs when the intestines are filled with gas, which can be due to the fermentation of certain foods by the gut microbiome. However, bloating in IBS patients can also be due to altered gut motility or visceral hypersensitivity, even in the absence of significant gas accumulation.

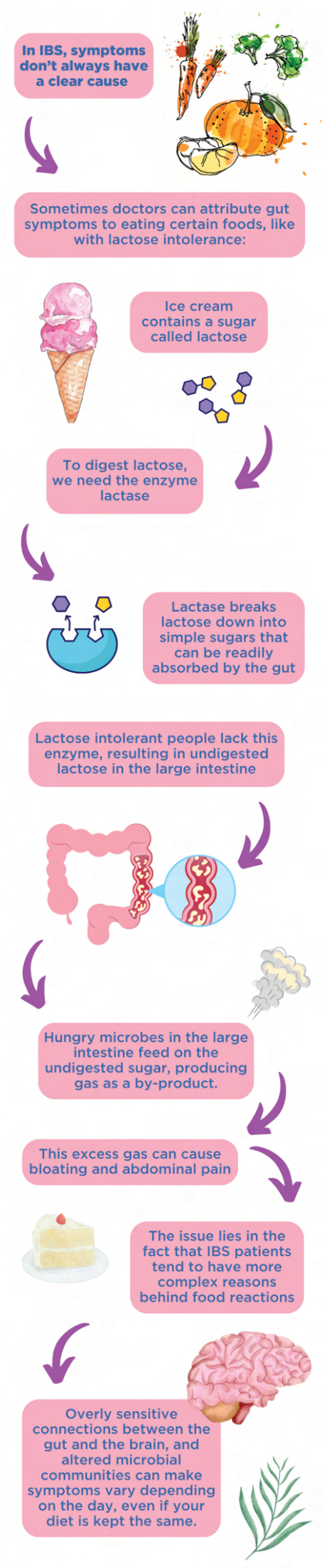
Abdominal Pain and Cramping

Abdominal cramps are feelings of sudden pain or tightness in the gut. These are abdominal spasms or quick contractions that are not within your conscious control. In general, IBS is associated with abnormal contractions of these muscles which can affect gut motility, which impacts how long it takes for food to move through the digestive tract. Sometimes, even small changes in muscle contractions cause pain in IBS patients due to visceral hypersensitivity. Simply put, overly sensitive nerves going from the gut to the brain can make even normal digestion feel uncomfortable (36). The role of the abdominal muscles in digestion could explain why exercise can improve gut symptoms. Read more on the role exercise can play in IBS management on page 32.

Excess Gas

Why do we sometimes get gassy after eating? Microorganisms in our guts produce gases as by-products when they help us break down certain food components that we cannot digest on our own (like dietary fiber) (37). These microorganisms are mostly bacteria, fungi (yeast), and bacteria-like microbes known as archaea that live inside our gastrointestinal tract. Everyone has a unique gut microbiome, and unfortunately, IBS patients often have a lower diversity of gut bacteria than people with healthy guts (38), and are therefore also more likely to have an imbalance of gut microbiota which can lead to excess gas production. Some studies even show that introducing a healthy mix of microbes via fecal transplant can help relieve symptoms (39).

In people with food intolerances, excess gas is caused by the inability of their body to digest a certain food. As shown in the infographic to the right, people with lactose intolerance cannot adequately digest lactose because they do not produce enough of the enzyme lactase. This means that lactose molecules pass through the



small intestine unabsorbed until hungry microbes waiting in the large intestine break it down themselves, producing excess gas (3). If you have a food intolerance without IBS, removing the problem food should ease abdominal pain, bloating, and gas. However, IBS patients can experience these symptoms without any clear cause. Although the exact mechanisms are unclear, hypersensitive nerve cells in the gut can alter secretory processes (i.e. how much fluid is secreted into the gut) which can cause further symptoms and alter the balance of the microbiome, also resulting in excess gas (40).

Nausea and Vomiting

Nausea can range from a mild feeling that one might vomit to a complete inability to eat and keep food down. In general, nausea is linked to depression and anxiety, which are also more likely in IBS patients (41). This association between nausea and mental health is thought to be due to the gut-brain axis, as high levels of stress can trigger the 'flight or fight' response as explained in the previous chapter. Physical changes include an increase in heart rate and a diversion of oxygenated blood flow away from the digestive system to vital organs such as the brain and the heart (42). These stress-induced physiological changes could trigger nausea in IBS patients, as they can cause an increase in signals sent from the brain to the gut, which can trigger hypersensitive nerves in the gut. This can cause IBS patients to perceive a mild digestive issue as a more serious threat, which triggers the nausea response (43).

Other causes of nausea and vomiting could be influenced by eating food that has gone bad, eating too much or too fast, poor sleep quality, pregnancy, or suffering from gastro-esophageal reflux disease (GERD) (44). IBS patients are more likely to experience problems with sleep which could impact the prevalence of morning nausea (45). Furthermore, the co-occurrence of IBS and GERD has been well cited in the literature, with a recent study finding that 35.8% of GERD patients also had IBS (46).

Diarrhea

Diarrhea is characterized by loose stools and may be accompanied by pain and gas. The causes of diarrhea in IBS are not all that clear, yet clinical studies suggest that most cases of IBS-D are brought about by one of the following three causes (47). Firstly, diarrhea may be caused by increased gut motility. This means that food moves through the gastrointestinal tract too quickly – the opposite of what happens with IBS-C. Yet IBS is not limited to either one or the other, rather, you can think of IBS as being characterized as having altered gut motility (48). A second cause of diarrhea is having an excess of bile acid in the colon (the longest part of the large intestine). Bile acid acts like dish soap to help us break down and absorb fats and fat-soluble vitamins (49). However, sometimes our bodies produce too much bile, or it is not absorbed properly, causing watery stools and even incontinence (inability to control bowel movements). Lastly, diarrhea can sometimes be attributed to dysbiosis of the gut microbiome, which you can read more about on page 9.

Constipation

Constipation occurs when passing a stool feels difficult due to hard or lumpy stools, or simply the feeling of not being able to 'go'. Many factors impact the development of constipation. As with all IBS subtypes, factors contributing to IBS-C include diet, genetics, slow gut motility, medications, and lifestyle (50). It is thought that in those with IBS-C, the gut motility is impacted so that material moves through the gastrointestinal tract more slowly than normal (48). Low fiber intake, not drinking enough water, and being sedentary – not moving your body and getting enough regular exercise, can all contribute to constipation. When comparing healthy cohorts with IBS-C patients, scientists have found differences in which strains of microbes were present in the gut, but perhaps more importantly, the number of bacterial strains present differed (10). Since microbes feed on the food we eat, it follows that a poor diet could contribute to constipation and alter the gut microbiome. Read more about how changes in your diet can be used to manage IBS on page 27.

IBS-friendly Recipes

Discover low-FODMAP recipes to help you manage your IBS at omedhealth.com/recipes

Key Tip: food labels with micronutrient intake included can make shopping for IBS-friendly foods easier and ensure you are consuming the right levels of nutrients in your diet

Nutrition Facts

Serving Size oz.
Serving Per Container

Amount Per Serving:

Calories	Calories From Fat
	% Daily value*
Total Fat	%
Saturated Fat	%
Trans Fat	
Cholesterol	%
Sodium	%
Total Carbohydrate	%
Dietary Fiber	%
Sugars	
Protein	

*Percent Daily values are based on a 2000 calorie diet. Your daily values may be higher or lewer depending on you calorie needs.

Urgent Stools

Both diarrhea and constipation are linked with stools that feel urgent, difficult to pass, or incomplete. Urgency in stool passing is common in patients specifically with IBS-D, often because the rectum in these patients is more sensitive to pressure changes as well as uncontrollable spasms of the gut as it moves food, meaning there is not much control over when you need to go the toilet (51). Experiencing changes in stool type and frequency is a common symptom of IBS. Having a lack of routine in your bowel habits can cause stress, potentially exacerbating effects through the role the stress response plays.

Fatigue

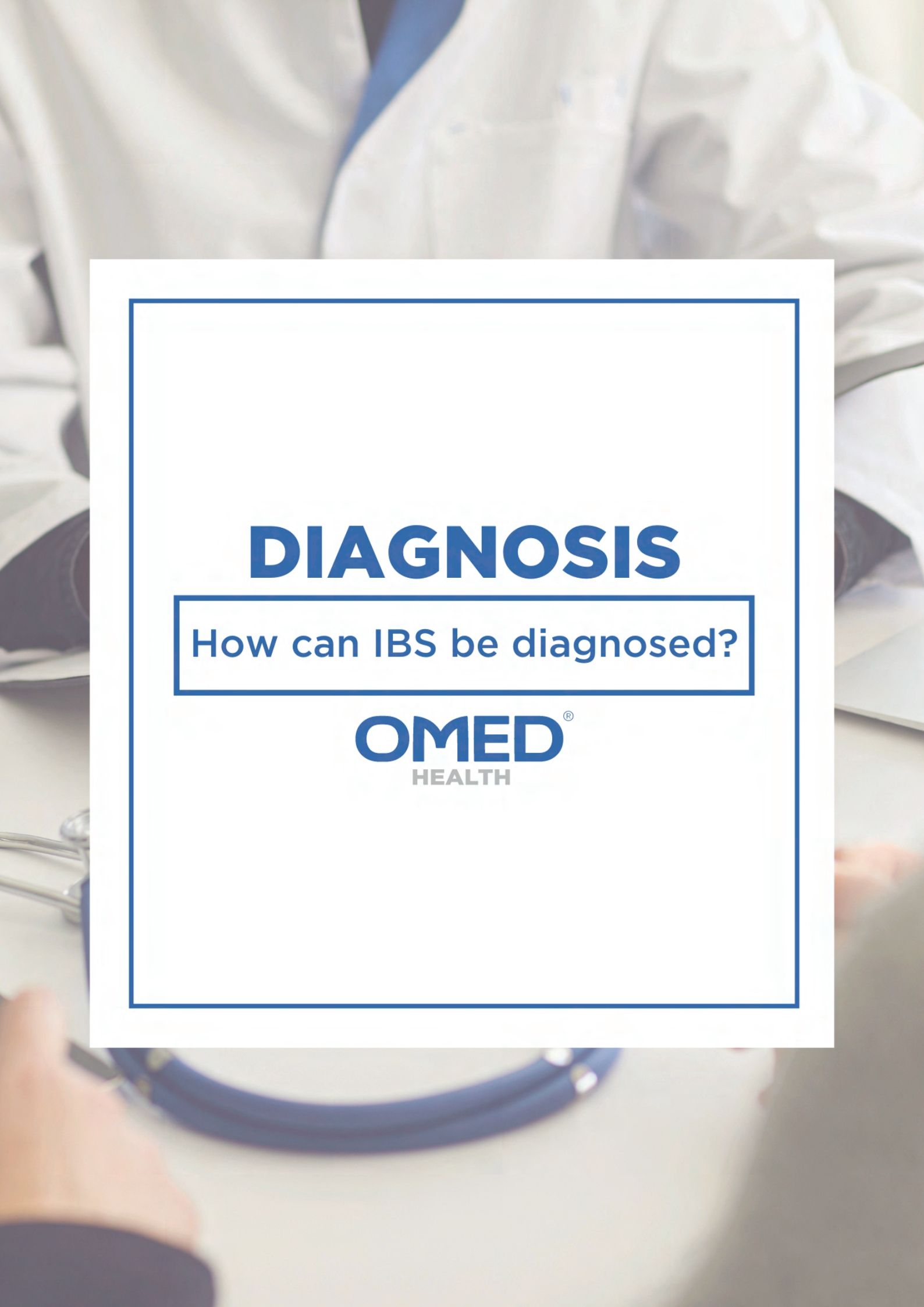
When tiredness and fatigue are persistent and feeling energized becomes rarer, we can lack the motivation to eat healthily and keep our body moving, both of which are important for good gut health. Feeling this way can have several root causes. One key reason behind feeling fatigued is a lack of vitamins and minerals due to poor absorption. A review of the literature suggests that IBS patients have lower levels of vitamin B2, vitamin D, calcium, and iron than healthy controls (52). Many of the gut symptoms discussed so far are linked to poor digestion, meaning that you may not be absorbing nutrients from the food that you eat. This can lead to a lack of basic nutrients that we need. Restrictive diets aimed at controlling symptoms may also contribute to undereating, resulting in low energy levels. Learn more about nutrition for IBS in the treatment section of this eBook.

Another key reason behind physical tiredness is linked to the emotional stress and anxiety of dealing with IBS which can worsen sleep quality. Poor sleep, particularly sleep disturbances like waking up during the night, has been linked to worsened gut symptoms (53). However, some studies have had inconclusive results (54). Nevertheless, this suggests a possible connection between perceived sleep quality and the feeling of fatigue in those with IBS.

Brain Fog

Brain fog is characterized by feelings of confusion, poor concentration, impaired short-term memory, and reduced cognitive ability (55). Although definitions often lack clarity, dysbiosis of the gut microbiome, certain gastrointestinal infections, and conditions such as inflammatory bowel disease (IBD) are known to be linked to the symptoms of brain fog (56–58). Brain fog is sometimes accompanied by headaches. Studies have found correlations between IBS and migraines, which can cause brain fog (59). Furthermore, headaches could be linked to hypersensitivities to outside factors like pain (60). Overall, it is helpful to think about the body as one interconnected entity made up of several organs that work together to make you be you. Chances are that if you are suffering in one area, then other areas of your body may be impacted as well.

The next section of our eBook will discuss how IBS can be diagnosed. A diagnosis of IBS can ensure patients receive the correct treatment and management strategies for the specific symptoms they are suffering from.



DIAGNOSIS

How can IBS be diagnosed?

OMED®
HEALTH

Diagnosis

Diagnosing IBS can be a complex and lengthy process, with some patients waiting for up to six or seven years before receiving a diagnosis (61). Because there is no specific test to definitively diagnose IBS, the diagnostic process primarily relies on the exclusions of other conditions as well as a clinical evaluation of the patient. In this section of our eBook, we will highlight the steps involved in diagnosing IBS, and how to navigate the tough journey effectively.

Going to the Doctor

The first thing to do if you suspect you have IBS is to make an appointment with your doctor or healthcare professional. There will be a detailed discussion of your symptoms, such as when they started, how long you have been experiencing them, any triggers you have, details on your bowel movements, and lifestyle factors such as diet and exercise. It is important in this stage of the process to be open and detailed when discussing your symptoms as this will help obtain a gut health diagnosis easier. They may ask about your medical history and if any family members have gut health issues, as these can sometimes run in the family (62), as well as any previous diagnoses or current medications.

After going through symptoms verbally, your doctor may also do a physical examination to check for any lumps or obstructions in the abdomen, particularly in any areas of localized pain. If you are suffering from IBS your abdominal pain will typically be across the entire abdomen rather than one specific area. Overly active guts can be present in IBS, and these guts make more noise. Doctors can listen to these sounds by using a stethoscope on the abdomen.

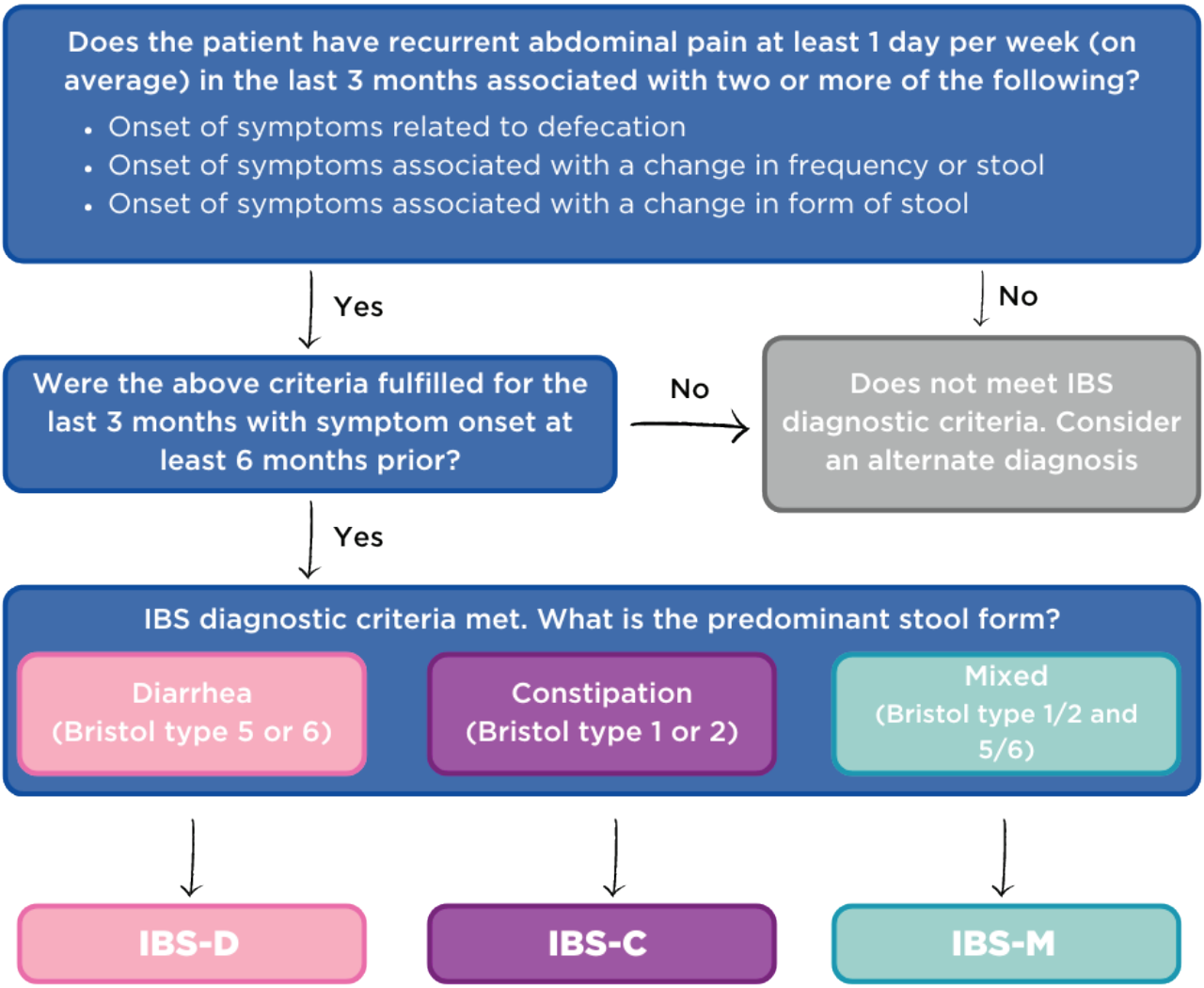
Most doctors will start the process of an IBS diagnosis by ruling out other conditions. This is because similar symptoms can present with various conditions, some of which are life-threatening. IBS itself does not endanger your life but can significantly affect your quality of life. Getting diagnosed can help you in your journey to recovery and management.

The Rome Criteria

The Rome IV criteria is used to assist an IBS diagnosis. The Rome Criteria was developed by a panel of experts in the field of gastrointestinal disorders, specifically functional gut disorders. Although the criteria were initially developed for research purposes, they have undergone several rounds of revisions with the intent to make them clinically useful for the diagnosis of IBS – resulting in the Rome IV criteria (63).

Rome IV defines IBS as a functional gut disorder in which recurring abdominal pain is associated with a change in bowel habits. Unusual bowel habits such as diarrhea, constipation, or a mixture of the two are typically present, alongside symptoms such as bloating. Using these criteria, symptoms must have started at least six months before diagnosis and have been present in the last three months (63).

Irritable Bowel Syndrome: Rome IV Criteria



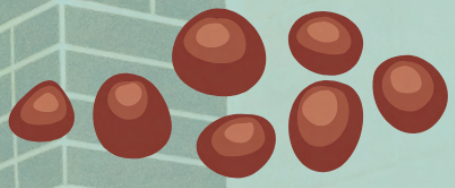
Classifying IBS into a specific subtype based on bowel habits helps to ensure treatment is tailored to the most bothersome symptoms and mechanisms causing them (see page 2 for more details on the different subtypes of IBS). Abnormal bowel habits can then be classified using the Bristol stool chart.

The Bristol Stool Chart is a method used to describe the shapes and types of stools. Your doctor may ask you which of these stool types you experience more regularly to help determine which IBS sub-type you have.

Stool types 1 and 2 are associated with constipation, and stool types 6 and 7 are associated with diarrhea (and stool type 5 to a certain degree). The two extremes of the chart could also serve as markers of gut transit time and therefore changes in intestinal function (64). Stool types 3 and 4 are considered 'normal' stools – if your stool doesn't look like type 3 or type 4, you might be experiencing constipation or a loose stool. Contact your healthcare providers if you are unsure. The Bristol Stool Chart and the Rome IV Criteria are used side-by-side to facilitate an accurate diagnosis of IBS.

The Bristol Stool Chart

Type 1

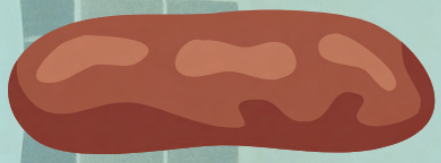


Separate hard lumps, like nuts (hard to pass)

Type 2

Sausage shaped but lumpy

Type 3

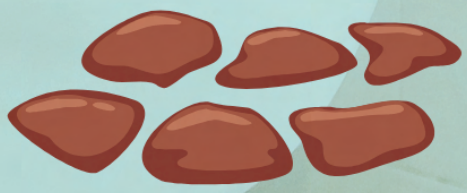


Like a sausage but with cracks on the surface

Type 4

Like a sausage or snake, smooth and soft

Type 5



Soft blobs with clear-cut edges

Type 6

Fluffy pieces with ragged edges, mushy

Type 7

Watery, no solid pieces. Entirely liquid

Other Tests

Doctors may recommend a series of tests to ensure that you are not suffering from other, potentially more serious, or more easily treatable conditions. The following tests are commonly used to rule out other conditions when patients present with IBS-like symptoms:

1. Blood tests.

Blood tests can be used to identify anemia, which involves a lack of sufficiently working red blood cells to deliver enough oxygen around the body, as well as infections which can be treated with prescription medications. Blood tests can also identify the presence of inflammation in the body by measuring levels of C-reactive protein (CRP), which can help establish the cause of symptoms (65).

2. Stool samples.

Stool samples may be requested to check for blood or mucus in the stool, signs of infection, or a stool culture to identify bacterial infections. A fecal calprotectin test can be used to help diagnose IBD (65). A fecal occult blood test (FOBT) can check for blood in the stool, which could be a sign of colon cancer (66).

3. Celiac disease test.

Celiac disease is an autoimmune disease in which the immune system reacts badly to even tiny gluten particles, causing inflammation and damage to the gut. Blood tests can be used to screen for celiac disease by measuring levels of IgA-tTG and IgA-EMA. A duodenal biopsy is the most conclusive test for the presence of Celiac disease and is undertaken if blood tests are positive for the markers of the disease (67). A strict gluten-free diet is the only way to manage Celiac disease.

4. SIBO test.

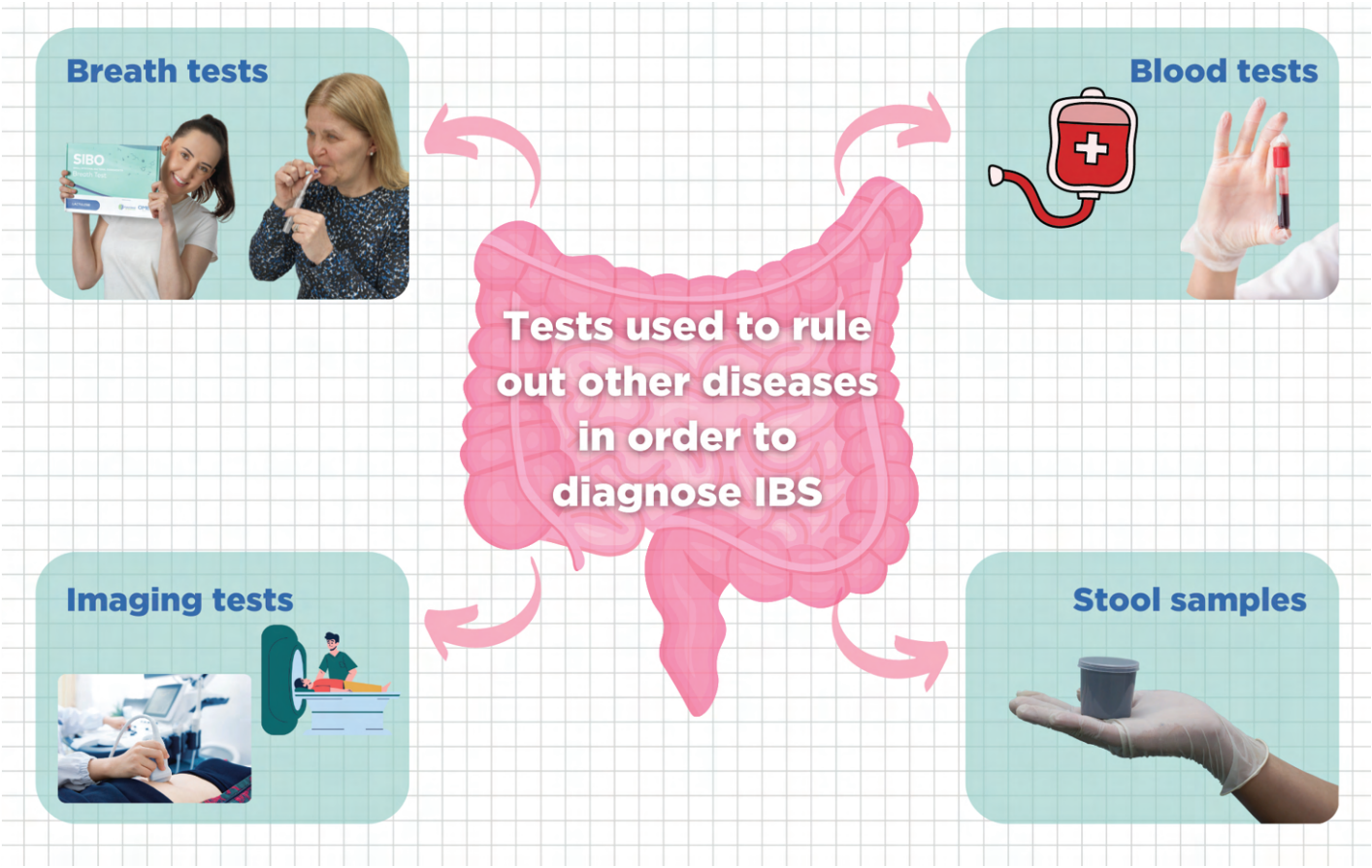
SIBO is the growth of certain microbes in the small intestine, where they aren't normally found. This can cause similar symptoms to IBS, and there is hypothesized to be a link between having IBS and SIBO (see page 10 for more information on the connection between SIBO and IBS). SIBO can be easily diagnosed using a hydrogen-methane breath test. The levels of the gases found in the breath can indicate the presence of SIBO. SIBO can be treated using antibiotics in combination with specific dietary interventions (68). You can find out more about SIBO in our **eBook.**

5. Food intolerance test.

If you are intolerant to a certain sugar such as lactose, a breath test can diagnose the issue. Avoidance of the food you are intolerant to should improve symptoms (69). You can find out more about food intolerances in our **eBook.**

6. Imaging tests.

Imaging tests provide visual insights into the gut to identify any structural abnormalities. Your doctor may recommend an ultrasound, an abdominal X-ray, or a CT scan. If your symptoms are severe and other tests are inconclusive, an endoscopic examination, such as a colonoscopy, may be performed to check for conditions such as colon cancer.



The journey to obtaining an IBS diagnosis is challenging, but understanding the process and what to expect can empower you to take the first step towards better gut health. By identifying your symptoms and working closely with your healthcare professional, you can get an accurate diagnosis and begin the path of effectively managing IBS. A precise diagnosis is important and allows you to start focusing on finding relief for your symptoms and improving your quality of life.

In the next chapter of this eBook, we will delve into the various treatment and management strategies available for IBS, including dietary changes, lifestyle modifications, and exercise. You can live a healthy and fulfilling life despite being diagnosed with IBS, and effective management of your symptoms long-term is key to achieving this.

TREATMENT AND MANAGEMENT

How can IBS be managed?

OMED®
HEALTH

Treatment and Management

IBS is a symptom-based disorder, meaning that treatment and management goals are aimed at resolving symptoms such as abdominal pain, diarrhea, and constipation, rather than curing the condition. There is no "cure" for IBS, but the correct management strategy can help to control the symptoms and allow patients to live a relatively normal life. The exact course of treatment and management for IBS will depend on the type and severity of the symptoms experienced.

Regular follow-up appointments with healthcare professionals are essential to monitor symptom improvement, assess the success of treatment and management strategies, and make necessary adjustments to achieve a well-managed condition. Discussing symptoms openly with your doctor to help them understand what is affecting you is important. Studies have shown that patients with good relationships with their healthcare providers report better control over their symptoms (70). In this section of the eBook, we will cover the different ways IBS can be managed to improve symptoms.

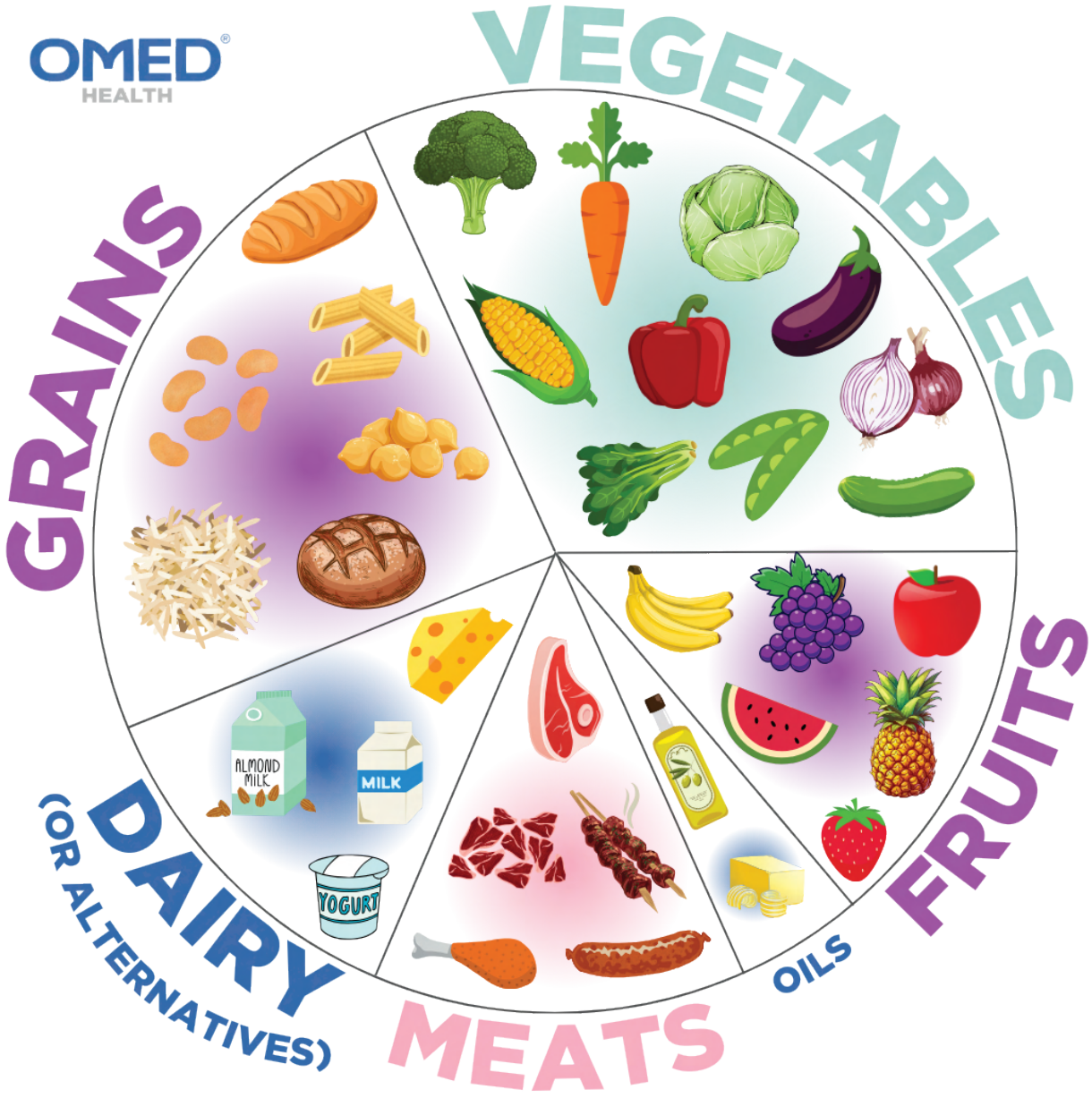
Diet

A large percentage of patients with IBS report that the intake of certain foods can lead to a worsening of symptoms (71). Therefore, one of the main treatment options for patients with IBS is via their diet. A key step for reducing IBS symptoms is to identify whether any problem foods are triggering symptoms and to reduce or remove them from the diet. Maintaining a well-balanced diet can minimize the risk of nutrient deficiency and weight loss, as well as reduce the risk of poor gut health due to an imbalance of the gut microbiome.

Here is a rough guide on how to follow a healthy, well-balanced diet:

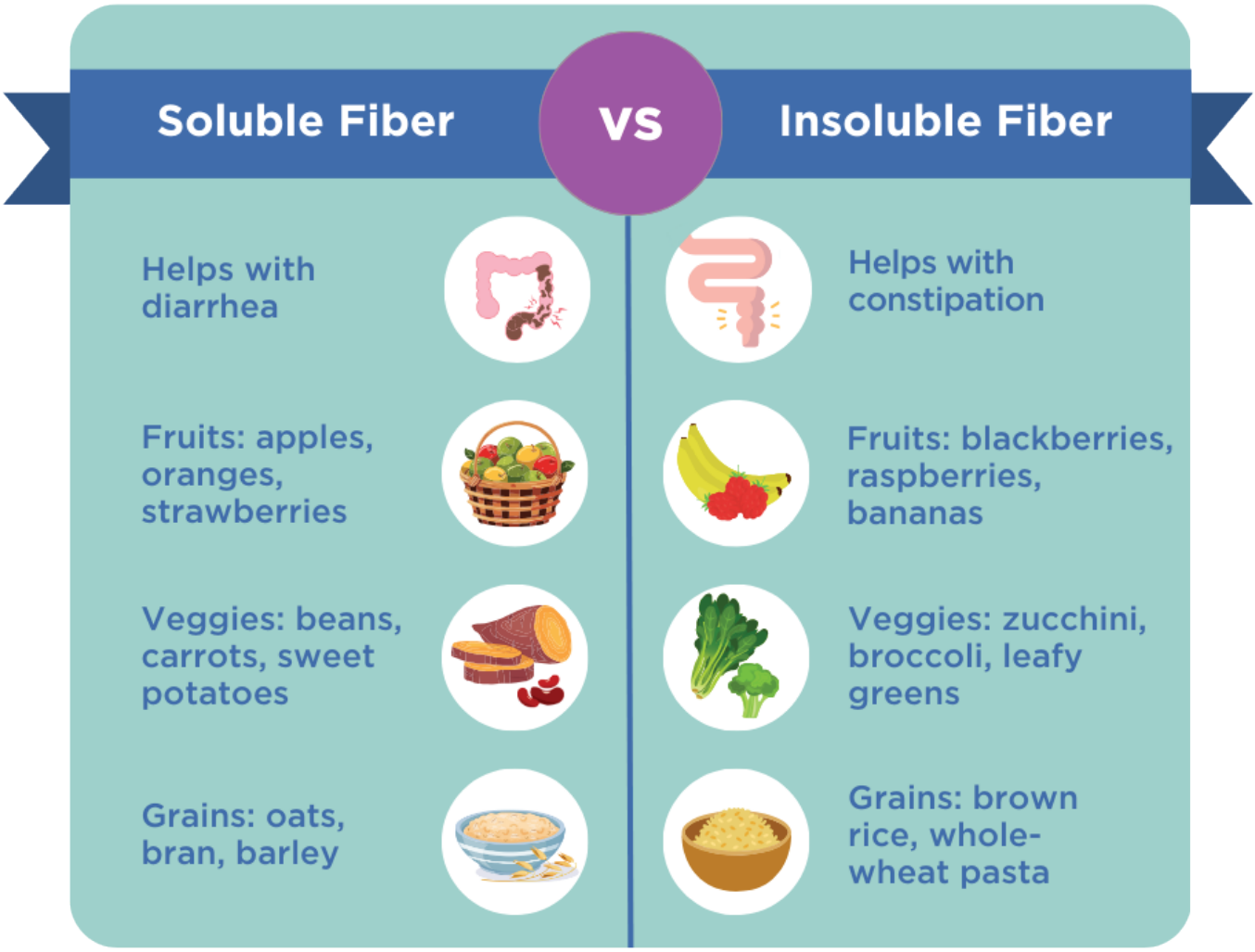
- Include at least five portions of fruit and vegetables every day.
- Eat a variety of carbohydrates such as whole grains, potatoes, and rice – about 3-4 portions per day.
- Aim for 2-3 portions of protein a day such as meat, fish, eggs, beans, and legumes.
- Aim for 2-3 portions of low-fat dairy or dairy alternatives a day.
- Include small amounts of unsaturated oils and spreads.
- Limit intake of high-fat and high-sugar foods such as pastries, fast food, and crisps.
- Limit intake of processed foods like ready meals, pizzas, and oven chips (72).

It is important to remember that this is general advice on how to eat a balanced diet. Every person is unique and therefore will require different amounts of each food group. For example, an athlete will consume more protein and carbohydrates than the average person to ensure their muscles stay strong and they have enough energy available. Discuss your diet with a healthcare professional to ensure you are consuming the right balance of food for you.



Fiber

One possible contributing factor to IBS is an insufficient intake of dietary fiber, and therefore healthcare professionals may suggest that an increased intake of dietary fiber may relieve IBS symptoms (73). However, different types of dietary fiber have different chemical structures, and therefore the health benefits are different for each type of fiber. Dietary fibers are non-digestible carbohydrates that form the key structures of foods such as whole grains, fruits, and vegetables. These fibers can be divided into two main groups – soluble and insoluble fibers. In the gut, soluble fibers can form a gel that interacts with the gut microbiome and decreases intestinal motility (74). This is often beneficial for those with IBS-D, as it can reduce diarrhea. On the other hand, insoluble fibers add bulk to the stool and can help alleviate constipation, making them potentially more suitable for IBS-C patients (75). However, responses to fiber can vary, and some individuals, regardless of their IBS subtype may require a balanced intake of both types. It's essential to gradually increase fiber intake and consult with a healthcare professional to tailor the approach to your individual needs. There is no 'one-size-fits-all' treatment.



The Low-FODMAP Diet

A relatively new approach to IBS treatment and management is the restriction of fermentable oligosaccharides, disaccharides, monosaccharides, and polyols in the diet (FODMAPs). This is known as the low-FODMAP diet and is usually a short-term plan to help reduce gut discomfort. FODMAPs are a class of small non-digestible carbohydrates that can cause gut symptoms in IBS patients. This is because they are easily fermented by the gut microbiome, which produces gas resulting in bloating and cramping (76). They can also draw water into the intestine, which may contribute to diarrhea in some individuals with IBS (77).

Therefore, reducing the amount of FODMAPs consumed in the diet can be a treatment option for IBS patients. A high intake of FODMAPs can also be linked to factors such as visceral hypersensitivity, dysbiosis, inflammation, and other conditions related to the cause and worsening of IBS (78). The low-FODMAP diet can be used to test a patient's tolerance to certain foods, enabling healthcare professionals to identify and eliminate from the diet trigger foods that cause IBS symptoms.

The low-FODMAP diet is a three-step elimination diet, step one is stop eating high-FODMAP foods. Step two is slowly reintroduce foods to identify which ones are causing trouble and ascertain tolerance levels. Step three is once identified, avoid, or limit the intake of the food to hopefully see a reduction in symptoms (79).

Research has shown that the low-FODMAP diet can reduce symptoms of IBS and SIBO in up to 86% of people (80). It is important to note that combining too many low-FODMAP servings into one meal may add up to an overall higher FODMAP meal. Also, adding smaller servings of high-FODMAP foods to a meal can still be considered a low-FODMAP meal overall. It is all about balance.

Food group	Low-FODMAP examples	High-FODMAP examples
Vegetables	 Lettuce, carrot, cucumber	 Garlic, beans, onion
Fruits	 Strawberries, pineapple, grapes	 Blackberries, watermelon, peaches
Protein	 Chicken, eggs, tofu	 Sausages, battered fish, breaded meats
Fat	 Oils, butter, peanuts	 Almonds, avocado, pistachios
Starch, cereal, and grain	 Potatoes, tortilla chips, popcorn	 Beans, gluten-based bread, muffins

Prebiotics and Probiotics

Prebiotics are types of fiber that are not digested by our enzymes in the gastrointestinal tract but are fermented by the bacteria in our gut, known as the gut microbiome. Prebiotics therefore feed the healthy bacteria in our gut, maintaining the balance of the gut microbiome and improving the absorption of vitamins and minerals (81). As mentioned previously, fiber can help reduce the symptoms of IBS, especially in IBS-C patients, meaning prebiotics could have the same effect. However, individuals on the low-FODMAP diet can consume very low amounts of prebiotics because they are often found in FODMAP-containing foods.

There is little evidence that suggests that prebiotics reduce IBS symptoms overall, however, some studies have found that prebiotics increased the amount of healthy bacteria in the gut and reduced anxiety scores in IBS patients, although other studies found that prebiotic supplementation led to worsening of IBS symptoms after four weeks (82). These studies looked at different strains of prebiotics, which could explain why the results are inconsistent. The evidence is not clear on whether prebiotics in general can improve IBS symptoms, more research is needed.

Probiotics are live microorganisms that can be supplemented via food sources and are intended to provide health benefits. These microorganisms are generally types of helpful bacteria or yeasts. Probiotics aim to support the gut microbiome by helping it remain balanced, helping with digestion, breaking down medications, supporting gut cells, and preventing an overgrowth of harmful bacteria. Studies have found that probiotics can significantly reduce symptoms in patients with IBS (82). If you are interested in giving either pre- or probiotics a try, talk to your doctor who can give you advice on what to take. Each person experiencing IBS may react differently to the same foods, meaning that a personalized approach is the best way forward.

Medication

Based on what symptoms are being experienced and the severity of the symptoms, medications may be recommended to help manage IBS. There are medications specifically for IBS, and medications that are not specifically for IBS.

Medications not specifically for IBS:

- Laxatives – if increased fiber in your diet does not help with the constipation seen in IBS-C, your healthcare provider may recommend over-the-counter laxatives. This medication should only be used for the short term as it may have negative health impacts when used long-term (83).
- Anti-diarrheal medications – over-the-counter medications, such as Imodium, can help control diarrhea (84).
- Amitriptyline – this is a tricyclic antidepressant medication and is thought to regulate the activity of the neurons that control the intestinal muscles. These medications can therefore help reduce abdominal pain in those with IBS who haven't improved with first-line treatments (85).
- General pain medications (86).

Medications specifically for IBS:

- Alosetron – this medication is designed to relax the colon and slow down the movement of waste through the bowel. Alosetron is prescribed for severe cases of IBS-D in women who have not responded to other treatments. Alosetron has not been studied in large numbers of men and is not approved or recommended for men because studies have shown it has no benefit among men with IBS (87). The exact reason for this is unknown.
- Anticholinergic medications – these medications, such as hyoscine butylbromide (commonly sold under the brand name Buscopan), can help reduce painful bowel spasms. They are commonly prescribed for patients who have IBS-D; however, they can cause constipation (88).
- Eluxadoline – this medication can reduce diarrhea by reducing muscle contractions and fluid in the intestine. Eluxadoline has side effects that include abdominal pain, nausea, and mild constipation.
- Rifaximin – this is an antibiotic that can decrease bacterial overgrowth and diarrhea (89), and it is often prescribed for the treatment of SIBO as well.
- Lubiprostone – this medication increases fluid in the small intestine to help stool pass and its approved for those who have IBS-C (90).
- Linaclotide – this medication also increases fluid in the small intestine to help stool pass through (86).

All medication should only be taken following a healthcare provider's advice.

Exercise

Physical activity can improve gastrointestinal symptoms such as excess gas, bloating, and bowel disturbances, all of which are key symptoms in IBS patients. Also, conditions that are often associated with IBS, such as depression and anxiety, can benefit from regular exercise (91). Despite this, studies have found that patients with IBS partake in less physical activity than healthy controls (92). This could be because IBS symptoms are often debilitating and physically stop patients from being able to carry out physical exercise, or that patients are unaware of the benefits that exercising moderately could have on their symptoms.

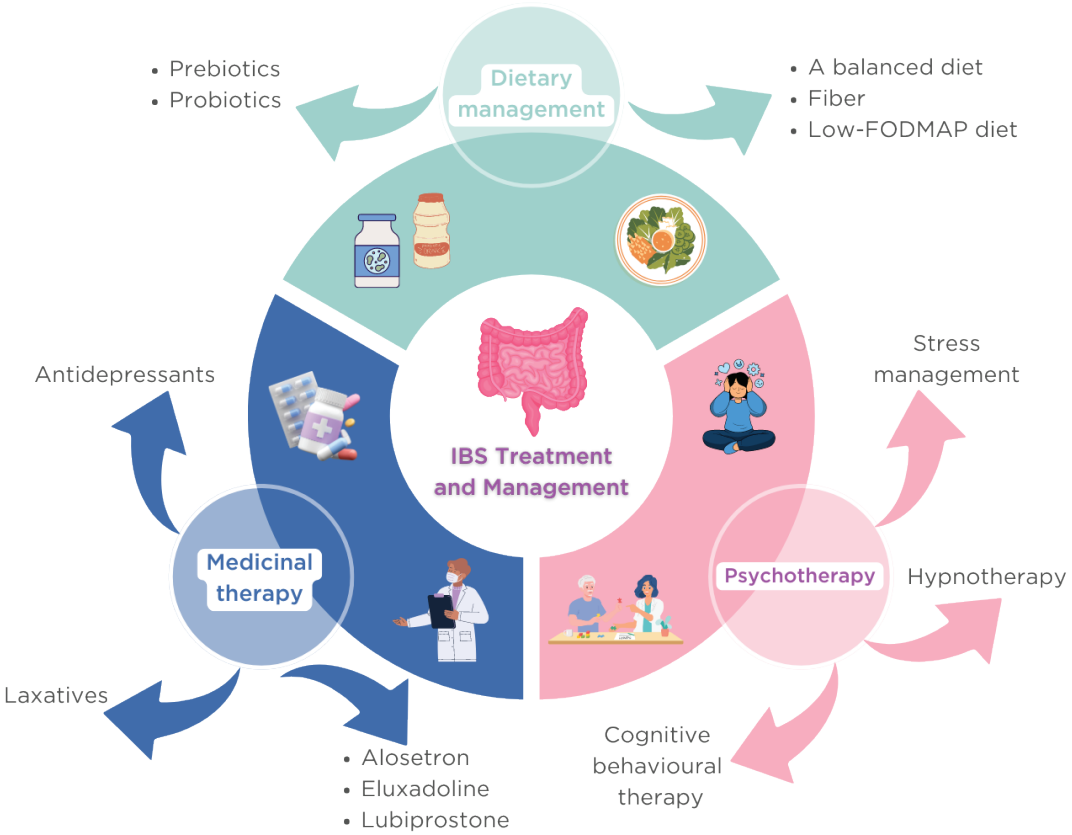
Studies have found that low to moderate exercise such as yoga could help relieve symptoms such as bloating and gas (93). Research has also suggested that physical activity promotes gut muscle contractions, improves gastrointestinal motility, and decreases colonic transit time (all of which will improve constipation seen in IBS-C) (91,94). However, intense, long-lasting forms of exercise such as endurance running, or competitive cycling may trigger IBS symptoms. For example, breath analysis of ultramarathon runners suggests an altered gut microbiome in response to exhaustive exercise (95). This altered gut microbiome can cause excess gas to be produced and could in turn result in bloating and abdominal pain. Patients with IBS can respond differently to the same treatment options and the same exercise plans. It might be necessary to experiment with different types of exercise to understand what works best for you.

Psychotherapy

As we have discussed previously, there is a strong connection between the gut and the brain known as the gut-brain axis. Stress plays a very key role in the severity of the symptoms seen in IBS patients. Stressful life events, a current stressful situation, and poor stress management in everyday life can trigger IBS symptoms. Some patients with IBS may find that when their mental health worsens, so do their IBS symptoms (96).

Many different psychological interventions can be used for patients with IBS who find that emotions and stress are triggers for their symptoms. The most studied technique is cognitive behavioral therapy (CBT), a talking therapy that is effective for IBS. CBT is a type of psychotherapy where negative thoughts about self and the world are challenged to help alter unwanted behavioral patterns – for example, stress. As we have explained, the body undergoes several physiological changes because of evolutionary adaptions linked to a physical threat, which can disrupt digestion as your body attempts to conserve energy to fight off the 'threat' (97). CBT works for IBS patients because it can help manage the stress response in the gut. It does this by using behavioral methods to teach positive coping strategies for negative thoughts. This is done to relax the digestive system and take it out of 'survival' mode (98). Hypnotherapy has also been shown to help improve IBS symptoms (99).

Living with IBS can be very challenging, with a life full of doctors' appointments, having to deal with uncomfortable gut symptoms, and feeling misunderstood by others. However, with the right treatment plan in place, IBS can be managed to minimize symptoms and experience a relatively normal quality of life. Monitoring of the symptoms experienced as well as other lifestyle factors could be the key to developing a deeper understanding of the condition and taking the correct steps toward a managed condition.



Take control of your gut health with the OMED Health Breath Analyzer and App

OMED HEALTH

@omedhealth

- Take regular breath samples, analyzing hydrogen and methane that is produced by the gut microbiome
- Monitor symptoms and other lifestyle factors such as diet, sleep, exercise, and more
- Receive expert support from healthcare professionals
- Make associations between lifestyle factors and your gut microbiome to learn how to manage gut health

JOIN THE WAITLIST

Breath sampling and lifestyle tracking could provide a window into your gut health

ABOUT US

What is OMED Health?

OMED®
HEALTH

The OMED Solution

OMED Health® is a dedicated, patient-centred brand developed by Owlstone Medical, the global leader in Breath Biopsy® technology. OMED Health utilizes Owlstone's expertise in analyzing exhaled breath and offers patients and clinicians access to breath-based diagnostic tests, point-of-care (PoC) devices, and detailed resources for various health conditions. We aim to help those with digestive issues have an improved quality of life by enabling better, and faster, understanding and management of their conditions. In digestive health, breath testing is emerging as an effective way for patients to monitor and manage symptoms. We have a dedicated Advisory Group to offer informed perspectives and advice, allowing us to deliver appropriate products and services to our customers.

A Deeper Dive Into Gut Health

For the millions of people suffering from IBS globally, digestive issues are a barrier to living a full and comfortable life. Because IBS is highly connected to the brain, the condition can cause problems extending beyond the gut, including depression, anxiety, and stress. OMED Health provides these patients with tools to enable them to take control of their gut health, leading to better overall health and well-being.

People living with IBS can be left waiting years to receive a diagnosis and often have little choice but to live their daily lives in discomfort, with many people turning to fad diets, expensive supplements, apps, and devices that have little to no scientific basis. OMED Health is establishing state-of-the-art breath analysis technology, developed with the support of gastrointestinal health experts, to provide people with a solution they can trust. OMED Health can offer a scientifically backed route to allow patients to take control of their gut health.

Diagnose Certain Gut Conditions with Breath Tests

OMED Health's gastrointestinal health tests detect small amounts (up to parts per million) of hydrogen and methane gases in breath, which can be collected at home or in the clinic. These gases can be key indicators of gut health and can signal the presence of certain conditions, such as SIBO, IMO and carbohydrate malabsorption.

We currently offer clinically validated at-home breath testing kits which provide a simple and safe way to collect hydrogen and methane in the breath to gain a better understanding of an individual's microbial output.

As we have discussed, SIBO can be a cause or effect of IBS, so taking a breath test that can accurately diagnose such conditions can help patients better manage their IBS and help treat any other conditions. You can self-refer on our website if you suspect you could have SIBO.

Longitudinal Monitoring for Optimized Gut Health

Our portable OMED Health Breath Analyzer that can monitor gut health over time by measuring hydrogen and methane levels in the breath is soon to launch. The device will be accompanied by our mobile app that allows patients to view their hydrogen and methane results, as well as track symptoms and lifestyle factors, such as diet, exercise, and sleep.

Longitudinal monitoring of IBS symptoms and lifestyle factors can allow patients to identify their IBS triggers and what factors may cause them to have a flare-up. The device can provide valuable data that can be used in conjunction with professional medical advice to create personalized healthcare plans for ongoing gut health management. By combining our breath test data with expert support, we aim to help patients make meaningful changes that can alleviate digestive discomfort but also monitor improvements to IBS symptoms and quality of life.

You Can Trust OMED Health

Our breath testing kits are already in use by multiple NHS trusts across the UK. The OMED Health website provides a platform for the sale of our clinical tests, as well as offering access to news, articles, events, and other content. For more information about OMED Health and the digestive health breath tests we offer, visit our website at **https://omedhealth/com/**. We can help you take control of your gut health.

Further Resources

https://www.nhsinform.scot/illnesses-and-conditions/stomach-liver-and-gastrointestinal-tract/irritable-bowel-syndrome-ibs/managing-irritable-bowel-syndrome-ibs/

https://www.mkuh.nhs.uk/patient-information-leaflet/a-self-help-guide-for-people-with-irritable-bowel-syndrome

https://www.nhs.uk/conditions/irritable-bowel-syndrome-ibs/

https://www.mayoclinic.org/diseases-conditions/irritable-bowel-syndrome/diagnosis-treatment/drc-20360064

https://omedhealth.com/food-intolerances-ebook/

https://omedhealth.com/sibo-ebook/

References

1. Saha L. Irritable bowel syndrome: Pathogenesis, diagnosis, treatment, and evidence-based medicine. World Journal of Gastroenterology: WJG. 2014 Jun 6;20(22):6759. doi: 10.3748/wjg.v20.i22.6759
2. Fikree A, Byrne P. Management of functional gastrointestinal disorders. Clinical Medicine. 2021 Jan 1;21(1):44–52. doi: 10.7861/clinmed.2020-0980
3. Drossman DA. Functional Gastrointestinal Disorders: History, Pathophysiology, Clinical Features, and Rome IV. Gastroenterology. 2016 May 1;150(6):1262-1279.e2. doi: 10.1053/j.gastro.2016.02.032
4. Enck P, Aziz Q, Barbara G, Farmer AD, Fukudo S, Mayer EA, et al. Irritable bowel syndrome. Nat Rev Dis Primers. 2016 Mar 24;2(1):1–24. doi: 10.1038/nrdp.2016.14
5. Zeeshan MH, Vakkalagadda NP, Sree GS, Anne K kishore, devi S, Parkash O, et al. Irritable bowel syndrome in adults: Prevalence and risk factors. Annals of Medicine and Surgery. 2022 Sep 1;81:104408. doi: 10.1016/j.amsu.2022.104408
6. Ford AC, Sperber AD, Corsetti M, Camilleri M. Irritable bowel syndrome. The Lancet. 2020 Nov 21;396(10263):1675–88. doi: 10.1016/S0140-6736(20)31548-8
7. Kim YS, Kim N. Sex-Gender Differences in Irritable Bowel Syndrome. J Neurogastroenterol Motil. 2018 Oct;24(4):544–58. doi: 10.5056/jnm18082
8. Allan S. Canadian Digestive Health Foundation. 2022 [cited 2024 Jun 10]. Why does IBS Affect more Women than Men? Available from: https://cdhf.ca/en/why-does-ibs-affect-more-women-than-men/
9. Lee HJ, Kim HJ, Kang EH, Jung KW, Myung SJ, Min YW, et al. Self-reported Food Intolerance in Korean Patients With Irritable Bowel Syndrome. Journal of Neurogastroenterology and Motility. 2019 Apr 30;25(2):222–32. doi: 10.5056/jnm18125
10. Types of IBS: Symptoms, diagnosis, and treatment [Internet]. 2024 [cited 2024 May 29]. Available from: https://www.medicalnewstoday.com/articles/types-of-ibs
11. nhs.uk [Internet]. 2017 [cited 2024 Aug 21]. Diverticular disease and diverticulitis. Available from: https://www.nhs.uk/conditions/diverticular-disease-and-diverticulitis/
12. Harvard Health [Internet]. 2010 [cited 2024 Jul 9]. Stress and The Sensitive Gut - Harvard Health Publishing. Available from: https://www.health.harvard.edu/newsletter_article/stress-and-the-sensitive-gut
13. Keck ME, Holsboer F. Hyperactivity of CRH neuronal circuits as a target for therapeutic interventions in affective disorders. Peptides. 2001 May;22(5):835–44. doi: 10.1016/s0196-9781(01)00398-9
14. Fukudo S, Nomura T, Hongo M. Impact of corticotropin-releasing hormone on gastrointestinal motility and adrenocorticotropic hormone in normal controls and patients with irritable bowel syndrome. Gut. 1998 Jun;42(6):845–9. doi: 10.1136/gut.42.6.845
15. Salvo-Romero E, Martínez C, Lobo B, Rodiño-Janeiro BK, Pigrau M, Sánchez-Chardi AD, et al. Overexpression of corticotropin-releasing factor in intestinal mucosal eosinophils is associated with clinical severity in Diarrhea-Predominant Irritable Bowel Syndrome. Sci Rep. 2020 Nov 26;10(1):20706. doi: 10.1038/s41598-020-77176-x
16. Lee C, Doo E, Choi JM, Jang S ho, Ryu HS, Lee JY, et al. The Increased Level of Depression and Anxiety in Irritable Bowel Syndrome Patients Compared with Healthy Controls: Systematic Review and Meta-analysis. J Neurogastroenterol Motil. 2017 Jul;23(3):349–62. doi: 10.5056/jnm16220
17. Lee OY. Asian Motility Studies in Irritable Bowel Syndrome. J Neurogastroenterol Motil. 2010 Apr 30;16(2):120–30. doi: 10.5056/jnm.2010.16.2.120
18. Sarna SK. Colonic Motility: From Bench Side to Bedside [Internet]. San Rafael (CA): Morgan & Claypool Life Sciences; 2010 [cited 2024 Aug 12]. (Integrated Systems Physiology: From Molecule to Function to Disease). Available from: http://www.ncbi.nlm.nih.gov/books/NBK53477/
19. Bonaz B, Bazin T, Pellissier S. The Vagus Nerve at the Interface of the Microbiota-Gut-Brain Axis. Front Neurosci. 2018;12:49. doi: 10.3389/fnins.2018.00049
20. Tian S, Zhang H, Chen S, Wu P, Chen M. Global research progress of visceral hypersensitivity and irritable bowel syndrome: bibliometrics and visualized analysis. Front Pharmacol. 2023;14:1175057. doi: 10.3389/fphar.2023.1175057
21. Dudzińska E, Grabrucker AM, Kwiatkowski P, Sitarz R, Sienkiewicz M. The Importance of Visceral Hypersensitivity in Irritable Bowel Syndrome—Plant Metabolites in IBS Treatment. Pharmaceuticals (Basel). 2023 Oct 3;16(10):1405. doi: 10.3390/ph16101405
22. Breit S, Kupferberg A, Rogler G, Hasler G. Vagus Nerve as Modulator of the Brain–Gut Axis in Psychiatric and Inflammatory Disorders. Front Psychiatry. 2018 Mar 13;9:44. doi: 10.3389/fpsyt.2018.00044
23. Appleton J. The Gut-Brain Axis: Influence of Microbiota on Mood and Mental Health. Integr Med (Encinitas). 2018 Aug;17(4):28–32.
24. Vahora IS, Tsouklidis N, Kumar R, Soni R, Khan S. How Serotonin Level Fluctuation Affects the Effectiveness of Treatment in Irritable Bowel Syndrome. Cureus. 12(8):e9871. doi: 10.7759/cureus.9871
25. Ferranti E, Dunbar SB, Dunlop AL, Corwin EJ. 20 Things you Didn't Know About the Human gut Microbiome. J Cardiovasc Nurs. 2014;29(6):479–81. doi: 10.1097/JCN.0000000000000166
26. Madison A, Kiecolt-Glaser JK. Stress, depression, diet, and the gut microbiota: human–bacteria interactions at the core of psychoneuroimmunology and nutrition. Curr Opin Behav Sci. 2019 Aug;28:105–10. doi: 10.1016/j.cobeha.2019.01.011
27. Freestone PP, Williams PH, Haigh RD, Maggs AF, Neal CP, Lyte M. Growth stimulation of intestinal commensal Escherichia coli by catecholamines: a possible contributory factor in trauma-induced sepsis. Shock. 2002 Nov;18(5):465–70. doi: 10.1097/00024382-200211000-00014
28. Ghoshal UC, Shukla R, Ghoshal U. Small Intestinal Bacterial Overgrowth and Irritable Bowel Syndrome: A Bridge between Functional Organic Dichotomy. Gut and Liver. 2017 Mar 15;11(2):196–208. doi: 10.5009/gnl16126
29. Saito YA. The Role of Genetics in IBS. Gastroenterol Clin North Am. 2011 Mar;40(1):45–67. doi: 10.1016/j.gtc.2010.12.011
30. Eijsbouts C, Zheng T, Kennedy NA, Bonfiglio F, Anderson CA, Moutsianas L, et al. Genome-wide analysis of 53,400 people with irritable bowel syndrome highlights shared genetic pathways with mood and anxiety disorders. Nat Genet. 2021 Nov;53(11):1543–52. doi: 10.1038/s41588-021-00950-8
31. Berumen A, Edwinson AL, Grover M. Post-infection Irritable Bowel Syndrome. Gastroenterol Clin North Am. 2021 Jun;50(2):445–61. doi: 10.1016/j.gtc.2021.02.007
32. King TS, Elia M, Hunter JO. Abnormal colonic fermentation in irritable bowel syndrome. Lancet. 1998 Oct 10;352(9135):1187–9. doi: 10.1016/s0140-6736(98)02146-1
33. Dear KLE, Elia M, Hunter JO. Do interventions which reduce colonic bacterial fermentation improve symptoms of irritable bowel syndrome? Dig Dis Sci. 2005 Apr;50(4):758–66. doi: 10.1007/s10620-005-2570-4
34. Bin Waqar SH, Rehan A. Methane and Constipation-predominant Irritable Bowel Syndrome: Entwining Pillars of Emerging Neurogastroenterology. Cureus. 11(5):e4764. doi: 10.7759/cureus.4764
35. Hayes PA, Fraher MH, Quigley EMM. Irritable Bowel Syndrome: The Role of Food in Pathogenesis and Management. Gastroenterol Hepatol (N Y). 2014 Mar;10(3):164–74.
36. Thiwan S. ABDOMINAL BLOATING: A MYSTERIOUS SYMPTOM.
37. Fu J, Zheng Y, Gao Y, Xu W. Dietary Fiber Intake and Gut Microbiota in Human Health. Microorganisms. 2022 Dec 18;10(12):2507. doi: 10.3390/microorganisms10122507

38. Kim GH, Lee K, Shim JO. Gut Bacterial Dysbiosis in Irritable Bowel Syndrome: a Case-Control Study and a Cross-Cohort Analysis Using Publicly Available Data Sets. Microbiology Spectrum. 2023 Jan 18;11(1):e02125-22. doi: 10.1128/spectrum.02125-22
39. Halkjær SI, Boolsen AW, Günther S, Christensen AH, Petersen AM. Can fecal microbiota transplantation cure irritable bowel syndrome? World J Gastroenterol. 2017 Jun 14;23(22):4112–20. doi: 10.3748/wjg.v23.i22.4112
40. Camilleri M. Intestinal Secretory Mechanisms in Irritable Bowel Syndrome-Diarrhea. Clin Gastroenterol Hepatol. 2015 Jun;13(6):1051–7. doi: 10.1016/j.cgh.2014.07.020
41. Cain KC, Jarrett ME, Burr RL, Rosen S, Hertig VL, Heitkemper MM. Gender Differences in Gastrointestinal, Psychological, and Somatic Symptoms in Irritable Bowel Syndrome. Dig Dis Sci. 2009 Jul;54(7):1542–9. doi: 10.1007/s10620-008-0516-3
42. Harvard Health [Internet]. 2011 [cited 2024 Jul 15]. Understanding the stress response. Available from: https://www.health.harvard.edu/staying-healthy/understanding-the-stress-response
43. Sanger GJ. Hypersensitivity and hyperreactivity in the irritable bowel syndrome: An opportunity for drug discovery. Dig Dis. 1999;17(2):90–9. doi: 10.1159/000016910
44. Scorza K, Williams A, Phillips JD, Shaw J. Evaluation of Nausea and Vomiting. afp. 2007 Jul 1;76(1):76–84.
45. Orr WC, Harer K. Sleep and Irritable Bowel Syndrome.
46. Alshammari SA, Almutairi MN, Alomar MO, Alsherif ZM, Alsubaie FH, Almezaini AI. Overlap Between Gastroesophageal Reflux Disease and Irritable Bowel Syndrome and Its Impact on Quality of Life. Cureus. 2023 Dec;15(12):e50840. doi: 10.7759/cureus.50840
47. Frissora CL, Schiller LR. Getting the BS out of Irritable Bowel Syndrome with Diarrhea (IBS-D): Let's Make a Diagnosis. Curr Gastroenterol Rep. 2024 Jan 1;26(1):20–9. doi: 10.1007/s11894-023-00909-1
48. Bhattarai Y, Muniz Pedrogo DA, Kashyap PC. Irritable bowel syndrome: a gut microbiota-related disorder? Am J Physiol Gastrointest Liver Physiol. 2017 Jan 1;312(1):G52–62. doi: 10.1152/ajpgi.00338.2016
49. Staels B, Fonseca VA. Bile Acids and Metabolic Regulation. Diabetes Care. 2009 Nov;32(Suppl 2):S237–45. doi: 10.2337/dc09-S355
50. Di Rosa C, Altomare A, Terrigno V, Carbone F, Tack J, Cicala M, et al. Constipation-Predominant Irritable Bowel Syndrome (IBS-C): Effects of Different Nutritional Patterns on Intestinal Dysbiosis and Symptoms. Nutrients. 2023 Jan;15(7):1647. doi: 10.3390/nu15071647
51. Bouin M, Plourde V, Boivin M, Riberdy M, Lupien F, Laganière M, et al. Rectal distention testing in patients with irritable bowel syndrome: sensitivity, specificity, and predictive values of pain sensory thresholds. Gastroenterology. 2002 Jun;122(7):1771–7. doi: 10.1053/gast.2002.33601
52. Bek S, Teo YN, Tan XH, Fan KHR, Siah KTH. Association between irritable bowel syndrome and micronutrients: A systematic review. J Gastroenterol Hepatol. 2022 Aug;37(8):1485–97. doi: 10.1111/jgh.15891
53. Patel A, Hasak S, Cassell B, Ciorba MA, Vivio EE, Kumar M, et al. Effects of disturbed sleep on gastrointestinal and somatic pain symptoms in irritable bowel syndrome. Aliment Pharmacol Ther. 2016 Aug;44(3):246–58. doi: 10.1111/apt.13677
54. Tu Q, Heitkemper MM, Jarrett ME, Buchanan DT. Sleep disturbances in irritable bowel syndrome: a systematic review. Neurogastroenterology & Motility. 2017;29(3):e12946. doi: 10.1111/nmo.12946
55. Lucius K. "Brain Fog": Exploring a Symptom Commonly Encountered in Clinical Practice. Alternative and Complementary Therapies 2021 Feb;27(1):23–30. doi: 10.1089/act.2020.29313.klu
56. Forbes JD, Bernstein CN, Tremlett H, Van Domselaar G, Knox NC. A Fungal World: Could the Gut Mycobiome Be Involved in Neurological Disease? Front Microbiol. 2019 Jan 9;9:3249. doi: 10.3389/fmicb.2018.03249
57. Zhang B, Wang HE, Bai YM, Tsai SJ, Su TP, Chen TJ, et al. Inflammatory bowel disease is associated with higher dementia risk: a nationwide longitudinal study. Gut. 2021 Jan;70(1):85–91. doi: 10.1136/gutjnl-2020-320789
58. Gareau MG, Wine E, Rodrigues DM, Cho JH, Whary MT, Philpott DJ, et al. Bacterial infection causes stress-induced memory dysfunction in mice. Gut. 2011 Mar;60(3):307–17. doi: 10.1136/gut.2009.202515
59. Li C, Yu S, Li H, Zhou J, Liu J, Tang W, et al. Clinical features and risk factors for irritable bowel syndrome in Migraine patients. Pak J Med Sci. 2017;33(3):720–5. doi: 10.12669/pjms.333.12379
60. Zhou Q, Fillingim RB, Riley JLI, Malarkey WB, Verne NG. Central and peripheral hypersensitivity in the irritable bowel syndrome. PAIN. 2010 Mar;148(3):454. doi: 10.1016/j.pain.2009.12.005
61. IBS Facts and Statistics - About IBS [Internet]. 2021 [cited 2024 Aug 13]. Available from: https://aboutibs.org/what-is-ibs/facts-about-ibs/
62. SAITO YA, MITRA N, MAYER EA. Genetic Approaches to Functional Gastrointestinal Disorders. Gastroenterology. 2010 Apr;138(4):10.1053/j.gastro.2010.02.037. doi: 10.1053/j.gastro.2010.02.037
63. Lacy BE, Patel NK. Rome Criteria and a Diagnostic Approach to Irritable Bowel Syndrome. J Clin Med. 2017 Oct 26;6(11):99. doi: 10.3390/jcm6110099
64. Lewis SJ, Heaton KW. Stool form scale as a useful guide to intestinal transit time. Scand J Gastroenterol. 1997 Sep;32(9):920–4. doi: 10.3109/00365529709011203
65. Noiseux I, Veilleux S, Bitton A, Kohen R, Vachon L, White Guay B, et al. Inflammatory bowel disease patient perceptions of diagnostic and monitoring tests and procedures. BMC Gastroenterol. 2019 Feb 13;19:30. doi: 10.1186/s12876-019-0946-8
66. Li JN, Yuan SY. Fecal occult blood test in colorectal cancer screening. Journal of Digestive Diseases. 2019;20(2):62–4. doi: 10.1111/1751-2980.12712
67. Charlesworth RP. Diagnosing coeliac disease: Out with the old and in with the new? World J Gastroenterol. 2020 Jan 7;26(1):1–10. doi: 10.3748/wjg.v26.i1.1
68. Rangan V, Nee J, Lembo AJ. Small Intestinal Bacterial Overgrowth Breath Testing in Gastroenterology: Clinical Utility and Pitfalls. Clin Gastroenterol Hepatol. 2022 Jul;20(7):1450–3. doi: 10.1016/j.cgh.2022.02.031
69. Tuck CJ, Biesiekierski JR, Schmid-Grendelmeier P, Pohl D. Food Intolerances. Nutrients. 2019 Jul 22;11(7):1684. doi: 10.3390/nu11071684
70. Halpert A. Irritable Bowel Syndrome: Patient-Provider Interaction and Patient Education. J Clin Med. 2018 Jan 2;7(1):3. doi: 10.3390/jcm7010003
71. Simrén M, Månsson A, Langkilde AM, Svedlund J, Abrahamsson H, Bengtsson U, et al. Food-related gastrointestinal symptoms in the irritable bowel syndrome. Digestion. 2001;63(2):108–15. doi: 10.1159/000051878
72. British Nutrition Foundation [Internet]. [cited 2024 Jul 17]. Portion sizes | British Nutritional Foundation. Available from: https://www.nutrition.org.uk/creating-a-healthy-diet/portion-sizes/
73. El-Salhy M, Ystad SO, Mazzawi T, Gundersen D. Dietary fiber in irritable bowel syndrome (Review). Int J Mol Med. 2017 Sep;40(3):607–13. doi: 10.3892/ijmm.2017.3072
74. Algera J, Colomier E, Simrén M. The Dietary Management of Patients with Irritable Bowel Syndrome: A Narrative Review of the Existing and Emerging Evidence. Nutrients. 2019 Sep 9;11(9):2162. doi: 10.3390/nu11092162
75. McRorie JW, McKeown NM. Understanding the Physics of Functional Fibers in the Gastrointestinal Tract: An Evidence-Based Approach to Resolving Enduring Misconceptions about Insoluble and Soluble Fiber. J Acad Nutr Diet. 2017 Feb;117(2):251–64. doi: 10.1016/j.jand.2016.09.021
76. Bellini M, Tonarelli S, Barracca F, Morganti R, Pancetti A, Bertani L, et al. A Low-FODMAP Diet for Irritable Bowel Syndrome: Some Answers to the Doubts from a Long-Term Follow-Up. Nutrients. 2020 Aug 7;12(8):2360. doi: 10.3390/nu12082360
77. Gibson PR, Shepherd SJ. Evidence-based dietary management of functional gastrointestinal symptoms: The FODMAP approach. J Gastroenterol Hepatol. 2010 Feb;25(2):252–8. doi: 10.1111/j.1440-1746.2009.06149.x

78. Morariu ID, Avasilcai L, Vieriu M, Lupu VV, Morariu BA, Lupu A, et al. Effects of a Low-FODMAP Diet on Irritable Bowel Syndrome in Both Children and Adults—A Narrative Review. Nutrients. 2023 May 13;15(10):2295. doi: 10.3390/nu15102295
79. Sultan N, Varney JE, Halmos EP, Biesiekierski JR, Yao CK, Muir JG, et al. How to Implement the 3-Phase FODMAP Diet Into Gastroenterological Practice. J Neurogastroenterol Motil. 2022 Jul 30;28(3):343–56. doi: 10.5056/jnm22035
80. Nanayakkara WS, Skidmore PM, O'Brien L, Wilkinson TJ, Gearry RB. Efficacy of the low FODMAP diet for treating irritable bowel syndrome: the evidence to date. Clin Exp Gastroenterol. 2016 Jun 17;9:131–42. doi: 10.2147/CEG.S86798
81. Slavin J. Fiber and Prebiotics: Mechanisms and Health Benefits. Nutrients. 2013 Apr;5(4):1417–35. doi: 10.3390/nu5041417
82. Rau S, Gregg A, Yaceczko S, Limketkai B. Prebiotics and Probiotics for Gastrointestinal Disorders. Nutrients. 2024 Jan;16(6):778. doi: 10.3390/nu16060778
83. Portalatin M, Winstead N. Medical Management of Constipation. Clin Colon Rectal Surg. 2012 Mar;25(1):12–9. doi: 10.1055/s-0032-1301754
84. Cangemi DJ, Lacy BE. Management of irritable bowel syndrome with diarrhea: a review of nonpharmacological and pharmacological interventions. Therap Adv Gastroenterol. 2019;12:1756284819878950. doi: 10.1177/1756284819878950
85. Ford AC, Wright-Hughes A, Alderson SL, Ow PL, Ridd MJ, Foy R, et al. Amitriptyline at Low-Dose and Titrated for Irritable Bowel Syndrome as Second-Line Treatment in primary care (ATLANTIS): a randomised, double-blind, placebo-controlled, phase 3 trial. Lancet. 2023 Nov 11;402(10414):1773–85. doi: 10.1016/S0140-6736(23)01523-4
86. Peyton L, Greene J. Irritable Bowel Syndrome: Current and Emerging Treatment Options. P T. 2014 Aug;39(8):567–78.
87. Camilleri M, Mayer EA, Drossman DA, Heath A, Dukes GE, McSorley D, et al. Improvement in pain and bowel function in female irritable bowel patients with alosetron, a 5-HT3 receptor antagonist. Aliment Pharmacol Ther. 1999 Sep;13(9):1149–59. doi: 10.1046/j.1365-2036.1999.00610.x
88. Wall GC, Bryant GA, Bottenberg MM, Maki ED, Miesner AR. Irritable bowel syndrome: A concise review of current treatment concepts. World J Gastroenterol. 2014 Jul 21;20(27):8796–806. doi: 10.3748/wjg.v20.i27.8796
89. Khan Z, Khan SK, Reyaz I, Anam H, Ijaz O, Attique I, et al. Effectiveness of Rifaximin on the Outcomes of Irritable Bowel Syndrome: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Cureus. 15(9):e44807. doi: 10.7759/cureus.44807
90. Soubra M, Schey R. Lubiprostone for the treatment of adult women with irritable bowel syndrome with constipation. Clin Med Insights Gastroenterol. 2012;5:23–30. doi: 10.4137/CGast.S7625
91. Riezzo G, Prospero L, D'Attoma B, Ignazzi A, Bianco A, Franco I, et al. The Impact of a Twelve-Week Moderate Aerobic Exercise Program on Gastrointestinal Symptom Profile and Psychological Well-Being of Irritable Bowel Syndrome Patients: Preliminary Data from a Southern Italy Cohort. J Clin Med. 2023 Aug 17;12(16):5359. doi: 10.3390/jcm12165359
92. Gao X, Tian S, Huang N, Sun G, Huang T. Associations of daily sedentary behavior, physical activity, and sleep with irritable bowel syndrome: A prospective analysis of 362,193 participants. J Sport Health Sci. 2024 Jan;13(1):72–80. doi: 10.1016/j.jshs.2023.02.002
93. D'Silva A, Marshall DA, Vallance JK, Nasser Y, Rajagopalan V, Szostakiwskyj JH, et al. Meditation and Yoga for Irritable Bowel Syndrome: A Randomized Clinical Trial. Am J Gastroenterol. 2023 Feb;118(2):329–37. doi: 10.14309/ajg.0000000000002052
94. Kim YS, Song BK, Oh JS, Woo SS. Aerobic exercise improves gastrointestinal motility in psychiatric inpatients. World J Gastroenterol. 2014 Aug 14;20(30):10577–84. doi: 10.3748/wjg.v20.i30.10577
95. Chou H, Arthur K, Shaw E, Schaber C, Boyle B, Allsworth M, et al. Metabolic insights at the finish line: deciphering physiological changes in ultramarathon runners through breath VOC analysis. J Breath Res. 2024 Feb 12;18(2). doi: 10.1088/1752-7163/ad23f5
96. Fadgyas-Stanculete M, Buga AM, Popa-Wagner A, Dumitrascu DL. The relationship between irritable bowel syndrome and psychiatric disorders: from molecular changes to clinical manifestations. J Mol Psychiatry. 2014 Jun 27;2(1):4. doi: 10.1186/2049-9256-2-4
97. Leigh SJ, Uhlig F, Wilmes L, Sanchez-Diaz P, Gheorghe CE, Goodson MS, et al. The impact of acute and chronic stress on gastrointestinal physiology and function: a microbiota-gut-brain axis perspective. J Physiol. 2023 Oct;601(20):4491–538. doi: 10.1113/JP281951
98. Kinsinger SW. Cognitive-behavioral therapy for patients with irritable bowel syndrome: current insights. Psychol Res Behav Manag. 2017 Jul 19;10:231–7. doi: 10.2147/PRBM.S120817
99. Slouha E, Patel B, Mohamed A, Razeq Z, Clunes LA, Kollias TF. Psychotherapy for Irritable Bowel Syndrome: A Systematic Review. Cureus. 15(12):e51003. doi: 10.7759/cureus.51003

OMED Health
183 Cambridge
Science Park
Milton Road
Cambridge
CB4 0GJ

OMED® HEALTH

@omedhealth
info@omedhealth.com