

Irritable Bowel Syndrome: The 5Rs - A Naturopathic Approach to Managing IBS

One in 5 people in the UK suffer with Irritable Bowel Syndrome (IBS).¹ Symptoms include chronic gastrointestinal (GI) patterns of diarrhoea and/or constipation resulting in feelings of incomplete bowel evacuation, bloating, flatulence, abdominal pain and cramps, mucus in the stools, as well as anxiety, fatigue and loss of quality of life. Recently defined diagnostic criteria guidelines suggest a patient must have recurrent abdominal pain or discomfort at least 3 days per month and in the last 3 months associated with two or more of the following features for an IBS diagnosis: improvement with defecation, onset associated with a change in frequency of stool, or onset associated with a change in consistency of stool.² Other conditions also need to be ruled out, such as Inflammatory Bowel Disorders like Ulcerative Colitis or Crohn's Disease. If IBS symptoms are accompanied by unexplained sudden weight loss, difficulty swallowing or blood in the stools then further medical investigations must be sought. For many people it is difficult to get an IBS diagnosis, and even once diagnosed there are no clear sustainable conventional treatments. As IBS encompasses many different physical and psychological symptoms, a holistic naturopathic nutritional approach can provide many benefits to supporting long-term gut health and wellbeing.

What is IBS?

IBS does not arise from a sole cause, hence the term "syndrome". Conventional treatment for IBS, based on symptoms and exclusion of other GI diseases, ranges from antidepressants, drugs to stop gut spasms and anti-diarrhoea medication.³ Whilst this may help reduce symptoms, the underlying causes of this common and disruptive condition are not addressed. Suppression of IBS symptoms does not necessarily support better long-term quality of life and can lead to potentially developing other conditions.⁴

IBS does not usually resolve without intervention and the gut is likely to remain predisposed to lifelong sensitivities once an initial IBS flare up occurs. In fact some of the contributory factors, such as increased intestinal permeability (i.e. Leaky Gut Syndrome) and dysbiosis, may increase the risk of developing more complicated, deep-seated Inflammatory Bowel Diseases like Ulcerative Colitis and Crohn's Disease.^{5,6} Other studies have drawn links between IBS, intestinal permeability and dysbiosis as risk factors for developing atopic conditions in the lungs and skin, like asthma and eczema, psoriasis, as well as autoimmune disorders of the thyroid (e.g. hypothyroidism) and joints (e.g. arthritis).^{7,8} One could draw parallels between developing IBS and the naturopathic understanding of many chronic illnesses, in which their origination may be linked to

changes in gut health, then reflecting in the skin or other organs including the lungs.

There is increasing acceptance that several contributory factors cause IBS symptoms including:

1. Gut bacteria imbalances (dysbiosis)
2. Increased gut barrier disruption (intestinal permeability or Leaky Gut Syndrome)
3. Inappropriate inflammation
4. Gut immune system imbalances
5. Poor digestion (malabsorption and nutrient deficiencies)
6. Gut-brain axis disruption (e.g. chronic or unmanageable stress)

Infection by parasites and yeasts like Candida may also be a contributory factor to IBS. If IBS symptoms have a clearly defined start point, for example after foreign travel, then parasitic infection should be investigated further. Helicobacter pylori are bacteria that reside in the stomach and can cause stomach ulcers in some people. Peptic ulcer symptoms can sometimes be confused with IBS; an H. pylori breath test can identify this specific bacterium. Specific naturopathic approaches to managing Candida⁹ and H. pylori¹⁰ can be found on the Nutrigold Nutritional Updates Service (www.updates.nutrigold.co.uk).

With so many different contributory causes and potential starting points for an IBS naturopathic

nutrition programme, a systematic approach is required. A proven superior and easy to follow naturopathic paradigm for IBS management is based around the 5Rs:

REMOVE offending food or gastrointestinal infections/ bacteria imbalances

REPLACE necessary digestive support

REPOPULATE levels of beneficial gut bacteria

REPAIR the gut barrier

REBALANCE by addressing lifestyle, psychological issues and stress

By carefully considering the case history and presenting IBS symptoms, the 5R programme implements food, nutritional supplements and lifestyle management as therapeutic tools to address the underlying causes and contributory factors providing a holistic and comprehensive approach to IBS management. The 5R programme also encourages the development of fundamental lifestyle changes to manage IBS and prevent the potential onset of other conditions.

The 5R IBS management system

There are many different diets and nutritional supplements that purport to “cure” IBS. This bewildering array of approaches is often overwhelming. The 5R programme cuts through the confusion and offers a clear, simple step-by-step guide to managing IBS and long-term gut health. Consulting with a qualified naturopathic nutritional therapist can help to pinpoint the most suitable entry points into an IBS naturopathic nutrition programme and provide ongoing support when altering the diet. For information about finding a qualified nutritional therapist please contact the Federation of Nutritional Therapy Practitioners (www.fntp.org.uk). Practitioners can make use of IBS information from the Rome Foundation, (Rome III Criteria questionnaires)¹¹ to help take a detailed case history and identify areas of IBS that require support.

1. Remove

Stage 1 involves addressing the **REMOVAL** of:

- **Food** that is causing digestive disturbances, damaging the gut barrier and inappropriately activating the immune system (i.e. identifying food allergies, sensitivities or intolerances).
- **Pathogenic** (harmful) and **pathobiontic** (previously beneficial but now pathogenic) **gut microbiota**, including bacteria, yeasts and parasites. Gut bacteria can be pathogenic or pathobiontic due to large numbers and/or residing in the wrong part of the GI tract (e.g. Small Intestinal Bowel Overgrowth, SIBO).
- **Environmental toxins**

The gut barrier, immune system and IBS

The gut is essentially a tube lined with protective epithelial cells that prevent the GI contents coming into direct contact with the blood. The GI epithelial cell layer is an extensive barrier that would cover more than 320m² if spread out! This barrier allows the healthy gut to control what is absorbed into the body and what is excreted out, as well as protecting the gut from damage by ingested toxins (e.g. drugs, food) or pathogenic bacteria by secreting a mucus gel rich in phospholipids. The intestinal epithelial cells also form tight junctions, which are part of the gut barrier regulation. Increased intestinal permeability is where the gut barrier and tight junctions are breached, an undesirable feature of IBS, causing many problems that we will go on and discuss.

The gut contains approximately 60% of the immune system in Gut Associated Lymphoid Tissue (GALT) providing both primary and secondary defense through secretion of different types of antibodies both within the gut (secretory immunoglobulin A - sIgA) and systemically (immunoglobulin E and G - IgE and IgG). sIgA is a primary defence protein secreted in the gut. Low levels of this antibody are associated with intestinal permeability and chronic stress. IgE and IgG are released in a secondary response to invaders, such as partially digested food proteins breaching the gut barrier and can cause IBS-related gut symptoms like cramping and abdominal pain, as well as wider reaching systemic symptoms such as joint pain and fatigue.

Certain species of beneficial gut bacteria are vital for maintaining a healthy gut barrier, as well as supporting digestive processes, interacting with and balancing the GALT. On the flipside, pathogenic and pathobiontic bacteria have been shown to damage the gut barrier tight junctions and epithelial cells and increase pro-inflammatory immune system markers resulting in chronic IBS symptoms.¹² Other factors such as stress and high levels of histamine can damage the gut barrier and trigger allergy-like mediated IBS responses such as cramping, bloating

and diarrhoea without raising IgG and IgE antibody levels. Histamine a signalling messenger made throughout the body including the gut as well as being present in substantial levels in certain foods and is an area of IBS management we will revisit in the 5R programme.

The involvement of so many factors contributing to IBS symptoms highlights the importance of a holistic approach to IBS in the 5R programme including supporting gut barrier function and repair, beneficial gut bacteria levels and immune system balancing through a variety of dietary and lifestyle approaches, as well as supplements.

IBS and food

Many tonnes of food pass through the gut in our lifetime so it shouldn't be a surprise that we need to carefully consider what we eat on a regular basis to maintain a healthy gut! Naturopaths believe that gut health holds the key to optimal vitality and wellbeing so supporting the function and structure of this organ is vital in IBS, as well as in almost all other health conditions.

There is plenty of evidence to suggest that various dietary constituents exacerbate IBS symptoms and may even contribute to the pathogenesis of IBS.¹³ This means the diet is one of the main therapeutic tools that can be successfully manipulated to provide great relief and support for IBS symptoms. Many different IBS dietary approaches have gained popularity in recent years. However, IBS symptoms and causes vary from person to person so there can be no single magic IBS diet or “one size fits all” approach. The naturopathic approach to IBS diet aims to support beneficial gut bacteria species and levels, balancing immune system activity and repair of the gut mucosal barrier¹⁴, as well as addressing the psychological aspects of IBS.



Food allergies and intolerances in IBS

Many people with IBS find they experience adverse reactions to a range of different foods. Research shows that for some people food allergies and intolerances are implicated in IBS, especially the diarrhoea predominant type. One study identified raised levels of IgG antibodies to common foods such as wheat, indicating a delayed hypersensitivity reaction (the response frequently seen in food intolerances) in the blood of people with IBS. IgE antibodies were also detected in some IBS sufferers indicating an immediate immune system reaction, the response found in allergic reactions.¹⁵ However, some reviews suggested there is no consistent evidence linking antibody-mediated food allergies and intolerances to all cases of IBS.^{16,17} These studies further underline the multifactorial nature to this condition and that for some people gut barrier repair and toxic load (e.g. histamine) may be a greater factor in their IBS symptoms.

As not all cases of IBS have a measurable antibody-mediated immune reaction to certain food proteins, relying on food allergy testing may not be the most useful route to manage IBS. Food allergy, intolerance and sensitivity tests are also limited in what foods they assess and the accuracy. For example, a person may receive a negative gluten blood test but in real life they still experience GI symptoms when eating gluten. This is often due to the sensitivity of the test, which may be limited to measuring just a couple of types of gluten peptides. This means someone may react to a gluten fraction that is not included in the test panel hence the negative test result! Also, if someone takes a food intolerance/allergy test and has not eaten a particular food for a while then the body may not be producing sufficient detectable antibodies. Other tests use raw food test substrates and the person may only react to food that has been cooked – raw egg is not a staple in the UK diet! Food allergy tests can also lead to self-diagnosis and/or removal of foods whilst not addressing the other essential stages of the 5R programme like gut barrier REPAIR. However, food is still key to managing IBS symptoms so what dietary approaches can people use to manage IBS during the REMOVAL stage of the 5R programme?

Gluten and IBS

Growing evidence suggests that gluten; a collection of proteins found in wheat, rye and barley, can damage the delicate gut lining.¹⁸ These specific protein fractions, including different types of gliadin, are found in high levels in wheat products like bread. The body does not naturally produce a digestive enzyme to break down gluten resulting in levels that can damage the gut lining and tight junctions and trigger antibody-mediated responses. This means gluten can contribute to many digestive problems like IBS, as well as other inflammatory conditions including autoimmune and inflammatory diseases like arthritis and cardiovascular disease.¹⁹

Gluten proteins have been shown to trigger a breakdown of the internal support scaffold of the gut epithelial cells leading to a change in cell structure. Once the actin filaments in the intestinal epithelial cell cytoskeleton are damaged by gluten, the tight junctions between the intestinal cells are disrupted increasing intestinal permeability.²⁰ The direct impact of different gluten proteins on the tight junction zonulin proteins allows the contents of the gastrointestinal tract to directly leak into the blood stream (i.e. intestinal permeability or Leaky Gut Syndrome).²¹ Gluten fractions can also directly increase the gut immune system causing inflammation, damage to the gut lining and increased levels of reactive antibodies.⁶

There is a spectrum of gluten sensitivity within the population. Some people can tolerate a little dietary gluten, but should assess their diets to achieve a better balance by replacing gluten products like bread and pasta with naturally gluten free grains, such as brown rice, quinoa and gluten free oats. Gluten free grains are also less acid forming than wheat, supporting a healthier pH balance in the body.^{22,23} However, people with IBS should REMOVE gluten-containing foods from the initial dietary programme due to the damage and inflammation that can be caused within the intestinal tract, contributing to symptoms such as IBS pain and bloating.

Plant based digestive enzyme supplements containing gluten digesting enzymes are a useful addition to an IBS programme to tackle any residual forms of dietary gluten (see REPLACE stage). For some people, a small amount of gluten may be gradually reintroduced back into the diet after a few months to alleviate dietary restrictions - see FODMAP Diet Guidelines for how to reintroduce foods after an elimination period. However, gluten sensitivities are increasing in the population (known as noncoeliac gluten sensitivity²⁴) contributing to long-term immune system issues, gut barrier sensitivities and other chronic conditions long after IBS symptoms may have subsided. For these reasons it is generally considered best by naturopaths for long-term bowel healthy and vitality to continue with a gluten free diet.



Dairy and IBS

Processed dairy products, like cheese and pasteurised milk, form a large part of many western diets. However, some people do not have the digestive capability to fully assimilate some of the main constituents of milk including the lactose milk sugar (i.e. lactose intolerance) and casein milk proteins. In susceptible people this can contribute to IBS symptoms of abdominal pain, bloating and diarrhoea.^{24A}

The gut, like other epithelial surfaces within the body including the lung and nasal linings, requires a protective layer of mucus, secreted as mucin by goblet cells.²⁵ The mucin layer protects the gut cells and also provides a platform for the beneficial gut bacteria to grow, which in turn regulates goblet cell mucus secretion. Naturopaths recognise that dairy products may increase mucus production in the gut (and other epithelial surfaces) potentially disrupting GI barrier function and contributing to dysbiosis,²⁶ as well as immune system dysfunction. Therefore it's highly recommended to **REMOVE** dairy from an IBS management programme. Reintroduction of some dairy products such as butter or live yoghurt during later states of the 5R programme can be achieved along the same lines as gluten. However studies, along with long held naturopathic wisdom, suggest that minimising processed dairy foods supports long-term health, as some dairy foods have been linked to increased risk of chronic disease including certain cancers.²⁷ It is also vital to **REPOPULATE** beneficial gut bacteria in IBS management programmes to regulate mucin secretion and barrier function. See the **REPOPULATE** stage for more information.

FODMAPS, diet and IBS

There are other food sensitivities that can contribute to IBS symptoms without triggering an immune mediated response, as seen with gluten or dairy. Fermentable Oligosaccharides, Disaccharides, Monosaccharides and Polyols (FODMAPs: Table 1) are a family of poorly absorbed short chain carbohydrates (also considered a type of fibre), which are highly fermentable in the presence of gut bacteria.

In a healthy colon, fermentation of different types of soluble fibres, including from FODMAP sources, produce short chain fatty acids (SCFAs), as well as gases (methane, hydrogen and carbon dioxide). SCFAs are absorbed into the blood stream and used for energy, as well as nourishing the cells of the colon and acting as a prebiotic source promoting healthy gut bacteria growth and immune balance.²⁸ As such, FODMAPs are important to bowel health.

However, in IBS where dysbiosis throughout the small (SIBO) and large intestines is prevalent, FODMAPs can lead to greatly increased fermentation.^{29,30} Intestinal permeability can also mean that FODMAPs are absorbed through the gut wall creating an osmotic effect resulting in increase infiltration of water into the bowels.³¹ All these effects cause excess gas production and increased fluid load that expands the small bowel wall leading to increased GI muscle contractions resulting in diarrhoea, bloating and cramping.³² However, for some people with IBS the excess gas may slow movement of the bowel contributing to constipation.

Studies have shown that restricting dietary FODMAPs can offer up to 86% relief of overall gastrointestinal IBS symptoms, specifically bloating, excess flatulence, abdominal pain and altered bowel habits.^{33,34,35} It's also a dietary approach that 76% people on one study were able to adhere to and 72% were satisfied with reduction of their symptoms.³⁶



FODMAP	Fructose	Polyols - Sorbitol & Mannitol	Lactose	Fructans & Galactans
High FODMAP Food Sources	<p>Vegetables - asparagus, artichokes, sugar snap peas</p> <p>Fruit - apples, pears, watermelon, mango, cherries, figs, tinned fruit in juice, fruit juice, fruit cereal bars, dried fruits</p> <p>Sweeteners - honey, high-fructose corn syrup</p>	<p>Mannitol - mushrooms, cauliflower</p> <p>Fruit - peaches, watermelon</p> <p>Sorbitol - Sweeteners - maltitol, xylitol, and isomalt</p> <p>Fruit - apples, apricots, blackberries, nectarines, peaches, plums, pears</p> <p>Also includes sugar, alcohols and many processed foods</p>	<p>Dairy - milk (cow, goat, sheep), yogurt, soft cheeses (ricotta, cottage)</p>	<p>Grains - wheat, rye, bread, pasta, gnocchi, couscous, muesli, wheat bran</p> <p>Vegetables - garlic, onions, artichokes, inulin, leeks</p> <p>Fruit - nectarine, peaches, persimmon, watermelon</p> <p>Beans, pulses & legumes including lentils, chickpeas, inulin, FOS</p> <p>Nuts & seeds - cashews, pistachios</p>
Lower FODMAP Food Sources	<p>Fruit - citrus, berries, bananas, grapes, honeydew, cantaloupe, kiwifruit, papaya, raspberry, pineapple, blueberry</p>	<p>Sweeteners - maple syrup, sugar, glucose, other artificial sweeteners not ending in "ol"</p> <p>Fruit - avocado (moderate - ¼ daily)</p> <p>Vegetables - celery (moderate - ½ stalk daily), sweet potato (moderate - ½ cup daily)</p>	<p>Dairy - lactose-free dairy products, rice milk, soy milk, hard cheeses, coconut milk, butter</p>	<p>Starches - rice, corn, potato, oats, gluten free multigrain breads, quinoa</p> <p>Vegetables - winter squash, lettuce, spinach, cucumbers, bell peppers, tomato, aubergine, rocket, cabbage (moderate - ¼-½ cup daily), Brussels sprouts (moderate - ¼-½ cup daily), broccoli (moderate - ¼-½ cup daily)</p>

FODMAP diet guidelines

REMOVE high FODMAP foods for 6-8 weeks, alongside implementing other relevant stages of the 5R programme, and monitor IBS symptoms. After 6-8 weeks, FODMAP foods can be gradually reintroduced based on symptom response, relieving the dietary restriction. Long-term restriction of dietary gluten and dairy and enjoying gluten free grains like brown rice and quinoa and processed dairy-free alternatives like unsweetened coconut yoghurt and almond milk instead is still advised. The following stages of reintroducing FODMAPs into the diet can be used for other foods like gluten, if applicable.

Reintroduction of FODMAP foods:

1. Test 1 FODMAP group at a time.
2. Work out an appropriate portion size, as too much or too little may affect the results.
3. Continue to restrict all other FODMAPs until tolerance or intolerance is confirmed.
4. Don't make other dietary changes.
5. Challenge with one FODMAP group per week and monitor symptoms:
 - First FODMAP group to test is polyols - try eating ½ avocado or 2 fresh apricots.
 - Increase to foods containing mannitol including ½ cup cauliflower and ½ cup mushrooms.
 - If all is going well try introducing lactose or fructose (e.g. ½ mango, 4tbsp live yoghurt or 1tsp honey).
 - Final group is galacto oligosaccharides such as ½ cup lentils, kidney beans or chickpeas.
6. Eat the challenge food at least twice during the test week unless you get a reaction in first attempt, in which case stop.
7. If you don't get symptoms then increase range of FODMAP foods.
8. If you do get symptoms either reduce the amount of test, try another FODMAP food group or continue to restrict FODMAPs and progress with the 5R IBS programme for continued gut healing and bacteria support.



Fibre and IBS

Fibre is essential for a healthy gut, as well as for regulating blood sugar, fat and cholesterol levels to support cardiovascular health.³⁷ However, the fermentation gases produced when eating certain types of fibre (e.g. high FODMAP foods) can contribute to and worsen IBS symptoms. Clinical studies show that increasing wheat bran (a type of insoluble fibre) intake can worsen IBS symptoms, including diarrhoea and bloating, whilst soluble fibre like psyllium husk was beneficial.³

Restricting FODMAPs, and other high fibre foods like beans and pulses, for a few weeks has been shown to improve stool consistency for patients with both diarrhoea and constipation predominant IBS. The mechanism by which constipation improves on the low FODMAP diet may be related to reduced methane production.³⁸ The improvement of symptoms by removing high fibre foods alongside following the other elements of the 5R programme to support gut repair and improve digestive function allows for phased reintroduction of higher fibre foods as the programme progresses (see FODMAP Diet Guidelines).

Psyllium is a type of fibre that has several benefits in IBS. Traditionally, a small amount of psyllium fibre can be used to bulk the stools and ease constipation – a feature for some people with IBS. New research has shed light on several active psyllium components, including natural sterols, mucilage, arabinoxylans and fatty acids, which in combination have specific anti-spasmodic activity helping to relieve diarrhoea.³⁹ This makes psyllium husk a unique type of fibre for regulating gut function in both constipation and diarrhoea predominant IBS.⁴⁰ Psyllium fibre has also been shown to act as a prebiotic, increasing the number of beneficial bifidobacteria in the colon.⁴¹ When starting an IBS management programme it is best to start with small amounts of psyllium husk powder in combination with other beneficial gut supporting botanicals like turmeric, garlic, papaya and peppermint. It's important to note that high intake of psyllium fibre (e.g. several grammes daily) without considering other areas of the 5R programme may exacerbate dehydration and constipation if used too soon within an IBS management programme. This is because large amounts of psyllium fibre absorb fluids in the colon bulking out the stools. This will exacerbate dehydration and further harden stools as the body responds by conserving fluids. If constipation is a predominant IBS symptom then focusing on rehydration through juicing and water intake alongside inclusion of some fatty acids like high potency phosphatidyl choline lecithin powder and krill oil containing bioavailable omega 3 essential fatty acids is an important naturopathic first step. See Importance of Hydration and Supporting the Liver sections for more information.⁴²

Histamine and IBS

We have discussed that not all foods raise a measurable immune (immunoglobulin) mediated reaction potentially resulting in a negative food allergy/ intolerance test but with IBS symptoms still predominant. For IBS symptoms that do not resolve with other dietary approaches like removing gluten, dairy and low FODMAPs foods, it may be useful to consider the levels of dietary histamine.

Histamine acts as an important signalling messenger throughout the body including the brain and gut. Our body synthesises and stores histamine in mast cells, especially in the gastrointestinal tract. High levels of histamine are also present in certain foods (Table 2). A healthy gut and immune system regulates histamine levels via the enzyme diamine oxidase (DAO), found in high levels in the gut mucosa. However, intestinal permeability and dysbiosis can reduce DAO activity and, coupled to high levels of histamine in the diet, may cause and/or exacerbate IBS symptoms including bloating, cramping and diarrhoea. For people who are still experiencing IBS symptoms after some dietary changes, reducing the dietary histamine load for a few weeks during the 5R programme and supplementing with DAO enzyme may be beneficial (Table 2).

Fermented foods, which have long been associated with naturopathic diets for increasing levels of beneficial bacteria, are also rich in biogenic amines that reduce the activity of DAO.⁴³ This means that in the early stages of an IBS programme, using high scientifically proven probiotic supplements, alongside dietary approaches to support the levels of beneficial gut bacteria (see REINOCULATE stage) may manage IBS symptoms better and prevent IBS flare ups. Fermented foods can be introduced later in the IBS programme and enjoyed long term when gut structure and function is more efficient.

Table 2. Histamine in the diet

High Histamine Foods or Foods That Release Histamine
Alcohol - champagne, wine, beer, cider and other fermented drinks and spirits
Pickled or canned foods - e.g. sauerkraut
Matured cheeses - e.g. parmesan, mature cheddar
Mushrooms and Quorn
Smoked meat products - salami, ham, sausages, bacon
Fish - tinned and smoked fish and shellfish
Beans and pulses - chickpeas, soy beans, peanuts
Dried fruit, seeds and nuts
Chocolates and other cocoa based products
Vinegar including salad dressings, pickles, mayonnaise, ketchup, mustard
Ready meals
Yeast extract, yeast
Additives - benzoate, sulphites, nitrites, glutamate, food dyes
FruitHR - bananas, strawberries, tomatoes, pineapple, mango, raspberry, grapefruit, avocado, tangerines
VegetablesHR - spinach, pumpkin, aubergines
Green and black tea (block DAO enzyme)
Low Histamine Foods
Fresh meat (cooled, frozen or fresh) including chicken
Freshly caught fish
Egg yolk
Fresh fruits - with the exception of strawberries, and other fruits listed on the HR column, most fresh fruits are considered to have a low histamine level
Fresh vegetables - with the exception of tomatoes, pumpkin and aubergine most fresh vegetables are considered to have a low histamine level
Grains - short grain brown rice, rice noodles, yeast free rye bread, rice crisp bread, oats, puffed rice crackers, millet flour, pasta (spelt and corn based)
Dairy alternatives - coconut milk, rice milk, oat milk
Cooking oils - especially organic virgin coconut oil
Organic flaxseed oil
Leafy herbs
Herbal teas - including peppermint, ginger or fennel

The importance of hydration

To do its job properly, the whole digestive tract needs to be well hydrated. We need fluids to make stomach acid and other digestive secretions like digestive enzymes, to keep the whole gastrointestinal tract moist and to form healthy stools. The colon and stomach are responsible for absorbing water from our digestive tract - if there's not enough water available to meet our hydration requirements, then our colon may be insufficiently hydrated, resulting in constipation and other problems. This means one of the most immediate impacts we can have on our digestive system is to make sure our diet is as hydrating as possible. The obvious hydrating habit is to regularly sip filtered water and hydrating drinks, like caffeine free herbal teas, throughout the day. **Peppermint, ginger and fennel**, which can be taken as warm soothing teas or added into cooking, are known to have calming, anti-spasmodic properties alleviating bloating and cramping in IBS.⁴³ Healthy intestinal motility has a cleansing effect and helps prevent bacteria from the colon colonising the small bowel, helping to reduce the risk of SIBO.

Food also contains fluid so enjoying hydrating and easy to digest foods such as soups and thoroughly soaked short grain brown rice can be very beneficial. Brown rice, in particular, has been shown to improve total bile acid excretion and decrease faecal bacterial enzyme activity, such as betaglucuronidase, mucinase and nitroreductase⁴⁴, associated with pathogenic gut microbiota. Good quality oils in the diet, such as essential fatty acids found in oily fish, organic flaxseed oil and coconut oils, as well as butter (for those not on a dairy free diet), can help to increase hydration by keeping cell membranes flexible. Underpinning all of this is the level of stress that we are registering: the less stress, the greater the dynamic flow of fluids and nutrients. The **REBALANCE** section of the 5R programme addresses lifestyle changes for IBS.

Juicing and IBS

Daily fresh juices are excellent way to increase many beneficial nutrients and support hydration. Vegetables in particular are rich in a variety of nutrients that support optimal immune system function.⁴⁵ There are added benefits to juicing; the process extracts plant fibre so making nutrients more accessible for absorption whilst **REMOVING** the potential for exacerbating IBS related symptoms. Emphasis should be placed on low FODMAP vegetable juices at the beginning of the 5R programme. Green juices, including kale, lettuce and

cucumber alongside organic spirulina powder, are an excellent tonic.⁴⁶ When reintroducing FODMAP foods consider beetroot juice, which is rich in betaine to support gastric acid, and carrots, which are rich in beta carotene, the precursor to Vitamin A, an essential nutrient for healthy gut immune system function.⁴⁷ Daily juicing is a healthy habit that can form part of the IBS 5R programme and beyond. Long-term healthy lifestyle changes are the key to managing IBS and maintaining wellbeing in general. Please see the **REPLACE** stage in this newsletter for more information about nutritional supplements to support gastric acid and vitamin and mineral levels, especially when eating a more limited FODMAPs diet.

Removing GI infections

REMOVING foods is not the only aspect of a successful IBS management programme. IBS sufferers often have underlying gastrointestinal infections or imbalances in levels of yeasts, bacteria and sometimes parasites. If IBS symptoms develop quickly, such as after foreign travel, a parasite infection should be investigated. GI infections, especially overgrowth of yeasts and bacterial dysbiosis affect GI barrier integrity, resulting in increased intestinal permeability, as well as inappropriately interacting with the GI immune system.^{47A}

A stool test can be used to determine levels of different yeasts and bacteria. However, our guts contain many thousands of different species of bacteria and yeasts. Functional tests are only able to detect a fraction of the gut microbiota and only show a "snap shot" of the microbiota and digestive markers tested for at the time of the stool test. Pathogens can also colonise anywhere in the GI mucosa and cell wall components of bacteria, yeasts and parasites may be absorbed. This can cause systemic symptoms that are difficult to pinpoint directly to one specific pathogen. It's for this reason that many IBS programmes can successfully start with a naturopathic approach to **REMOVING** pathogenic and pathobiontic microbiota and **REPOPULATING** with beneficial bacteria without requiring a stool test.

Abnormal growth of gut bacteria (dysbiosis) encompasses the overgrowth of certain pathogenic or pathobiontic species, as well as the location of the overgrowth. SIBO can be a common factor in IBS, with abnormal growth in the small intestine of bacteria normally only found in the colon. SIBO symptoms include nausea, abdominal cramping, bloating, excess flatulence and diarrhoea. Tests for SIBO include a breath test after consuming a fixed dose of carbohydrate (e.g. glucose or

lactulose) to measure the amount of hydrogen and methane based on the premise that bacteria are the sole producers of intestinal hydrogen, some of which is exhaled.⁴⁸ False positives can occur if the patient smokes, sleeps or eats shortly before the test.⁴⁹ Detailed case histories can also help identify SIBO. Gastric acid is important in reducing SIBO and will be discussed in the **REPLACE** section of the 5R programme.

Gut supporting botanicals can be used to help **REMOVE** overgrowths of yeast and undesirable bacteria. Whole leaf aloe vera juice has widely reported benefits in reducing GI infections, as well as supporting the growth of beneficial gut bacteria and healthy digestion.⁵⁰ Allicin, and its metabolites like ajoene, found in garlic have antimicrobial activity.⁵¹ Ginger has a potent effect on some parasitic infections,⁵² as well as useful antimicrobial activity.^{53,54} Cinnamon is another spice that has been shown to inhibit growth of bacteria including *E. coli* and yeasts including *Candida*.⁵⁵ These spices and herbs can be incorporated into the daily diet, as well as in combination with psyllium fibre in gut supporting botanical food supplements. Organic virgin coconut oil is rich in caprylic acid so can be included in a naturopathic IBS support diet to support reduction of *Candida* yeast.⁵⁶



2. Replace

The second 'R' stage of the IBS programme is to **REPLACE** the enzymes and other digestive factors that are lacking or in limited supply and affecting digestive processes, GI microbiota and barrier integrity in IBS.

Stress, nutrient deficiencies especially zinc, medications (e.g. antacids, antihistamines and proton pump inhibitors)⁵⁷ and age can all contribute to reduced levels of gastric acid production.⁵⁸ Low levels of gastric acid can result in symptoms such as indigestion, diarrhoea, and undigested food in the stools, which factor in many cases of IBS.

Gastric (hydrochloric) acid in the stomach is vital for optimal digestion of dietary protein. Partially digested proteins can trigger antibody-mediated reactions (IgE and IgG) especially with increased intestinal permeability. Undigested protein in the colon also results in putrefactive fermentation contributing to bowel damage and further dysbiosis.

Gastric acid is an effective antimicrobial agent killing and suppressing bacteria growth like *H. pylori* (responsible for peptic ulcers) and others linked to SIBO. Supplementing with betaine hydrochloride, alongside the digestive enzyme pepsin, at mealtimes will help naturally support gastric acid levels optimising digestion and managing dysbiosis.⁵⁹ For more information in this area please view the Nutrigold CPD accredited webinar "Understanding the Highs and Lows of Stomach Acid".⁶⁰

Stomach acid is also essential to detoxification as reduced levels inhibit the liver from releasing bile, compromising bile flow, which in turn may adversely affect the entire liver and lymphatic system from releasing stored toxins (see Supporting the Liver section).

Stress, IBS and nutrient deficiencies can also lead to reduced production of pancreatic digestive enzymes, disrupting digestion and nutrient absorption still further. Food allergies have long been associated with inadequate protease function allowing leakage of partially digested proteins across the damaged gut barrier and triggering immunemediated responses. Malabsorption, especially of fats due to low lipase activity, is also a key problem in digestive disorders such as IBS. Taking a broad-spectrum plant digestive enzyme with each meal best supports digestive enzyme function. Plant digestive enzyme formulations should contain enzymes for digesting protein (proteases), fats (lipase) and carbohydrates (e.g. amylase), as well as specialist enzymes like lactase for digesting the milk sugar lactose and gluten proteases to breakdown gluten proteins.⁶¹ Papaya extract contains the plant digestive enzyme papain, known to support optimal digestion especially in IBS.

In addition to digestive supplement support deficiency of other nutrients should also be considered, as malabsorption can be a feature of poor digestion in GI disorders like IBS. Zinc, in the bioavailable organic citrate form, can be supplied in addition to zinc rich foods, to support gastric acid production. Extra Vitamin B12 may also be required if gastric acid levels have been historically low. These nutrients can be supplied in multivitamin and mineral formulations alongside the diet. Fat digestion may be compromised in IBS so alongside supplying the fat digesting enzyme lipase, a source of essential fatty acids, such as bioavailable krill oil, will help to boost levels of essential omega 3 fats. Krill oil is also rich in phospholipids, an important component of healthy cell membranes and the protective and nourishing mucin that lines the GI tract.

Supporting the liver - the hub of the digestive system

As well as REPLACING digestive secretions, the liver also needs special support in IBS. Low gastric acid and nutrient deficiencies especially lack of fatty acids from poor fat digestion, impacts on hepatocyte function, detoxification processes and bile production.

Bile is stored in the gallbladder and released into the gut to aid fat digestion, maintain pH suitable for beneficial gut bacteria growth and digestion, as well as regulating gut motility and stool consistency.⁶² Impaired bile levels and quality therefore contributes to IBS symptoms of dysbiosis, poor digestion and diarrhoea and/or constipation. Research shows that pathogenic bacteria further impair bile acid modulation disrupting glucose and cholesterol balance.⁶³ IBS symptoms of dysbiosis, poor digestion, gut barrier damage and inflammation can therefore be a vicious circle from combined liver/gallbladder/bile and gut dysfunction.

Keeping the diet simple, alkalising and hydrated as described in the **REMOVE** section of the 5R programme helps to support optimal liver function. Phosphatidyl choline, an important fatty acid for hepatocyte function, found in as high potency lecithin powder can be included in meals like soups and porridge as well as fresh juices and smoothies to support liver and bile function.⁶⁴ Several spices including turmeric, ginger, garlic, fennel and mint, as well as dandelion tea can stimulate bile flow.^{65,66} For more information about liver support please view the Nutrigold CPD accredited webinar "Liver and Gallbladder Health".⁶⁷



3. Repopulate

REPOPULATION refers to the reintroduction of beneficial bacteria into the right parts of the intestine to reestablish gut microbiota balance. Beneficial gut bacteria are required for a variety of health promoting functions including producing SCFAs, regulating immune system function, maintaining gut barrier structure and integrity, preventing overgrowth of pathogenic microflora, digestion and absorption of nutrients, synthesis of certain vitamins including Vitamin K and detoxification processes.

Recent research shows that a varied, whole food diet rich in vegetables influences the beneficial gut bacteria levels, which in turn regulates healthy immune system function.^{68,69} That means we can decide which gut bacteria to feed by choosing what we eat!

We can also quickly and effectively influence levels of beneficial gut bacteria by taking scientifically proven probiotic supplements. A review of IBS studies suggests that mixed strain probiotic supplements can help reduce symptoms of diarrhoea, abdominal pain and bloating⁷⁰, as well as improve digestion.⁷¹ Species of probiotic bacteria that specifically improve IBS symptoms include Lactobacillus

rhamnosus, Lactobacillus acidophilus and Bifidobacterium bifidum.⁷² Scientifically proven probiotic supplements provide beneficial bacteria that can adhere and implant within the gut⁷³ supporting the growth of natural levels of beneficial bacteria, as well as suppressing the growth of pathogenic organisms and modulating the immune system.⁷⁴ Probiotic supplements do not contain amines like histamine found in fermented foods, which may contribute IBS symptoms if used too early some IBS management programmes. Prebiotics, such as inulin, help boost the growth of beneficial gut bacteria. They are found in high levels in certain foods, such as onions, but often these foods are high in FODMAPs so are not recommended at the

beginning of the 5R IBS programme. However, supplementary prebiotics, supplied in levels lower than found naturally in foods, have been shown to help increase beneficial gut bacteria levels reducing IBS symptoms.^{75,76,77,78} Inulin can be taken in low doses alongside other gut supporting botanicals as part of the 5R programme.

REPOPULATION also supports regeneration and health of the intestinal tract through production of SCFAs and rebalancing immune system function. This makes probiotics containing specific Lactobacilli and Bifido strains an integral part of IBS management both at the start of a programme and continued long-term.

4. Repair

Increased intestinal permeability (or Leaky Gut Syndrome) is a part of many IBS conditions. The REPAIR phase is therefore vital to heal the gut barrier that may have been damaged by pathogenic gut microbiota, dysbiosis, inflammation and immune system dysregulation. Of course, part of the healing process comes from REMOVING the insults, toxins or GI infections that continually reinjure or irritate the mucosa: certain foods (e.g. gluten), medications (e.g. aspirin) and dysbiosis are all key culprits. This means the stages we have described so far in this programme, including dietary measures and use of botanical and herbal support such as whole leaf aloe vera juice, are all contributing the gut barrier repair. However, there are other specific steps and nutrients that can be taken to help directly regenerate and REPAIR the gut barrier.

L-glutamine is a non-essential amino acid under normal conditions as it is produced in adequate amounts by the body. It is also found in foods such as chicken, beef and dairy products. However, if protein digestion is impaired and the gut barrier is damaged and/or the body is under stress then L-glutamine becomes a conditionally essential amino acid.^{79,80} That means the body cannot synthesise the necessary levels of L-glutamine needed for maintaining health so an extra boost in the form of supplements may be required.

L-glutamine has specific actions in the gut mucosa including supporting the integrity of tight junctions.⁸¹ It is the preferred fuel for the rapidly proliferating epithelial cells of the GI mucosa barrier.⁸² Gut mucosal cells regenerate every 3-5 days so a lot of L-glutamine fuel is required to maintain a healthy and integral gut barrier. L-glutamine is also part of the pathway that turns on genes in gut mucosal cells to signal for growth and generation so plays a direct role in gut barrier integrity.⁸³ L-glutamine promotes production of glutathione, an important antioxidant in GI cells, which provides additional protection from oxidative stress and support for gastric mucosal healing.⁸⁴ L-glutamine has also been shown to have an immune supporting function by increasing gastrointestinal sIgA synthesis.⁸⁵ Remember that this important antibody provides a first line of defence in GI mucosal cell membranes and is decreased in times of stress, inflammation and infection, as often seen in IBS.

Phosphatidyl Choline (PC) fatty acids form an integral part of cell membranes, including those found in the GI mucosa.⁸⁶ Reduced levels of PC occur in damaged GI mucosa barrier.⁸⁷ Supplementing with high potency PC lecithin powder has been shown to protect the gastric layer and accelerate healing in the GI mucosa,⁸⁸ as well as supporting liver health.⁸⁹

Aloe vera has many remarkable gastrointestinal supporting properties due to the many different polysaccharide fractions that are only found in the whole leaf juice. Studies show that aloe vera whole leaf juice has anti-inflammatory properties, helping to support gut barrier repair.⁹⁰ Specific mannin polysaccharide fractions stimulate collagen synthesis and fibroblast activity – important parts and processes of healthy gastrointestinal cell structure and function.⁹¹ Coupled with antimicrobial actions, promotion of beneficial gut bacteria growth, supporting optimal digestion of proteins and increased absorption of nutrients like Vitamin C and E, aloe vera whole juice is an all round product to use across the 5R programme to manage IBS.⁹²

Anti-inflammatory spices turmeric and ginger can play an important role in supporting gut barrier repair. Curcumin, the yellow pigment in turmeric, has well known anti-inflammatory properties including the ability to reduce the levels of pro-inflammatory prostaglandin markers.⁹⁶

5. Rebalance

The power of the 5R IBS management programme lies beyond the practical steps that can be taken to manage IBS symptoms in the REMOVE, REPLACE, REPOPULATE and REPAIR stages. Unsurprisingly, many people with IBS experience stress and anxiety because of the chronically unpleasant and sometimes life-impacting symptoms. Psychological factors are now known to play a huge role in the pathogenesis of IBS.⁹⁷ The gut and brain are intimately linked via the gut-brain axis; we are probably all familiar with the sensation of “butterflies” in the stomach when we’re about to take an exam and may even experience “the runs” when experiencing a situation that is stressful or makes us feel nervous. These are great examples of how the brain, our feelings and gut function are interlinked.

Physical and emotional stress, including relationship problems, work pressure and unresolved issues, trigger the autonomic nervous system. This automatically reduces digestive function including reduced production and output of gastric acid and digestive enzymes, as well as altering gastrointestinal motility, affecting beneficial gut bacteria levels and reducing immune function – all factors contributing to IBS. There is also emerging evidence showing the ability of gut microbiota to communicate with the brain influencing behaviour responses to stress and anxiety⁹⁸ demonstrating once again the link between all of the 5R stages to successfully managing IBS.

The 5R programme

The 5R programme is a comprehensive approach to IBS management. The overarching aim is to provide diet, supplement and lifestyle approaches to support long-term gut health, vitality and wellbeing. The practical step-by-step guide helps you to set healthy habits in motion and gives you the freedom to enjoy life to the fullest. For more information and IBS support consult a Naturopathic Nutritional Therapist (www.fntp.org.uk).

Rebalancing lifestyle habits that make a difference to IBS symptoms include:

- Chew food slowly and thoroughly – it’s not just what you eat but how you eat that makes a difference to digestion and gut health.
- Relax and eat each meal sitting down away from distractions such as TV.
- Do not eat on the run.
- Smell your food! Digestion starts in the head when the smell and sight of food helps release digestive enzymes and gastric acid.
- Practice mindfulness when eating and in other areas of your daily life. For example, concentrate solely on what you’re eating; concentrate on the smell and appearance of the food and then chew the food slowly enjoying the taste. Do this for at least one meal a day.
- Enjoy relaxing every day with gentle activities like walking or socialising with people you enjoy being with.
- Take up calming hobbies like yoga or t’ai chi.
- Start a regular meditation practice.



Daily menus for IBS support

It may seem overwhelming when faced with all the different dietary approaches to IBS, which is why consulting with a Naturopathic Nutritional Therapist (www.fntp.org.uk) can help to successfully navigate the process. It's best to focus on what you can enjoy eating rather than what you need to remove – there are plenty of tasty options and as you notice the positive changes by following the 5R programme you will find that your dietary horizons can soon begin to expand once again! Keeping meals simple can make a big difference. Complicated recipes with lots of ingredients and flavours can give the body too much

to deal with. Some people may also find eating animal proteins and carbohydrates separately helps ease IBS symptoms in the early stages of the dietary programme.

Remember it's not just what you eat but how you eat that can affect gut function and health so please take time to read through the other 5R IBS programme stages including the REBALANCE phase addressing lifestyle and stress management techniques.

Meals	Suggestions
Breakfast	<ul style="list-style-type: none"> • Quinoa, millet or gluten free oats porridge with almond milk and fresh berries • Omelette with spinach and tomatoes • Poached eggs with spinach • Coconut yoghurt with shelled hemp seeds, ground chia seeds and berries
Lunch/Dinner	<ul style="list-style-type: none"> • Sweet potato frittata with low FODMAP vegetables • Baked chicken or salmon with low FODMAP vegetables and sweet potato wedges • Quinoa salad with fish or chicken/turkey • Homemade turkey mince burgers with brown rice • Homemade soup using low FODMAP vegetables • Low FODMAP sources of vegetarian protein include tahini (sesame seed) paste, eggs and tofu
Snacks	<ul style="list-style-type: none"> • Carrot sticks or plain brown rice cakes and 1tbsp almond butter • Coconut yoghurt
Drinks	<ul style="list-style-type: none"> • 1.5-2L water • Herbal teas including ginger and chamomile to support digestion. Peppermint and fennel have antispasmodic effects helping to reduce gut motility • Unsweetened coconut water • Linseed tea for constipation • Avoid caffeine, alcohol, fruit juices, fizzy soft drinks, fruit juices and flavoured waters

Summary of IBS 5R programme

5R STAGE	TARGET	DIETARY & SUPPLEMENT RECOMMENDATIONS	RATIONALE
REMOVE	Food intolerances, allergies and sensitivities	<ul style="list-style-type: none"> Remove gluten and dairy, high FODMAPs or histamine foods Psyllium fibre 	<ul style="list-style-type: none"> Reducing intake of dietary allergens, short chain fermentable carbohydrates (FODMAPs) and high histamine foods helps reduce IBS symptoms, especially bloating, pain, cramping and diarrhoea Removing gluten specifically supports gut barrier integrity Removing dairy optimises digestion and bowel conditions for beneficial gut bacteria growth Low dose psyllium fibre optimises stool formation and reduces gut spasms, easing both diarrhoea and constipation
	Bacterial dysbiosis, yeasts (including Candida), parasites	<ul style="list-style-type: none"> Aloe vera whole leaf juice Gut supporting botanicals including garlic, ginger and cinnamon Organic virgin coconut oil 	<ul style="list-style-type: none"> Aloe vera whole leaf juice contains polysaccharides with specific anti-bacterial, anti-fungal and anti-parasitic actions Ginger and garlic have anti-bacterial, anti-fungal and anti-parasitic properties Cinnamon has anti-bacterial and anti-fungal properties Coconut oil contains potent anti-fungal compounds including caprylic acid
REPLACE	Digestive enzyme support	<ul style="list-style-type: none"> Broad spectrum plant digestive enzymes Gut supporting botanicals including papain (from papaya) 	<ul style="list-style-type: none"> Plant enzymes break down carbohydrates, fats and proteins, as well as gluten, lactose and raffinose plant sugars that can damage the gut barrier and cause bloating and excessive flatulence Papaya regulates gastric motility and reduces IBS pain
	Stomach acid support	<ul style="list-style-type: none"> Betaine & pepsin Aloe vera whole leaf juice 	<ul style="list-style-type: none"> Betaine supports stomach acid levels to facilitate protein digestion and improve dysbiosis Pepsin supports protein digestion in the stomach Aloe vera regulates stomach acid, facilitates digestion, improves dysbiosis and reduces inflammation
	Liver support	<ul style="list-style-type: none"> High potency phosphatidyl choline lecithin powder Gut supporting botanicals including garlic, ginger, fennel, peppermint and turmeric 	<ul style="list-style-type: none"> Phosphatidyl choline supports hepatocyte function and bile production Garlic, ginger, fennel, mint and turmeric stimulate bile production and flow enhancing digestion, reducing dysbiosis and supporting a healthy gut barrier
	Correct nutrient deficiencies	<ul style="list-style-type: none"> Krill oil Vitamins & organic minerals 	<ul style="list-style-type: none"> Krill oil is a highly bioavailable form of omega 3 essential fatty acids and phospholipids for gut barrier integrity, reducing inflammation and immune system support Vitamins (including A, D, E, K and B vitamins) & minerals (including organic magnesium citrate and zinc citrate) may be required to correct nutrient deficiencies from IBS symptoms of poor digestion and malabsorption
REINOCULATE	Support gut bacteria for gut barrier repair, digestion, immune system balance and liver function	<ul style="list-style-type: none"> Mixed strain probiotics Aloe vera whole leaf juice Prebiotics - inulin 	<ul style="list-style-type: none"> Lactobacilli and Bifidobacteria species support beneficial gut bacteria balance, optimal digestion and increase SCFA levels to support a healthy gut barrier Aloe vera whole leaf juice supports growth of beneficial gut bacteria through optimising GI pH and digestion Inulin boosts growth of beneficial gut bacterial
REPAIR	Intestinal permeability	<ul style="list-style-type: none"> Aloe vera whole leaf juice L-Glutamine Gut supporting botanicals including turmeric and ginger High potency phosphatidyl choline lecithin powder 	<ul style="list-style-type: none"> Aloe vera whole leaf juice reduces inflammation and stimulates epithelial cell collagen production to support a healthy gut barrier L-glutamine supports gut cell growth and repair, gut immune system function and a healthy intestinal barrier Phospholipids including phosphatidyl choline support mucosal healing Turmeric and ginger reduce inflammation in the GI tract
REBALANCE	Stress & anxiety	<ul style="list-style-type: none"> Stress management & lifestyle programme - exercise, meditation, yoga, massage etc. 	<ul style="list-style-type: none"> Holistically managing stress supports healthy digestive processes, beneficial gut bacteria balance, immune system function and gut barrier structure
	Poor eating habits	<ul style="list-style-type: none"> Mindfulness training 	<ul style="list-style-type: none"> Lack of chewing, rushing meals and other mindless eating habits negatively impact on digestion

This education article was co-written by Dr Elisabeth Philipps PhD and the nutrihub team.

1. <http://www.nhs.uk/conditions/irritable-bowel-syndrome/Pages/Introduction.aspx2>
2. Rome III Diagnostic Criteria for IBS. <http://www.romecriteria.org/criteria/>
3. <http://www.nice.org.uk/guidance/cg61/chapter/1/recommendations#diagnosis-of-ibs>
4. Porter, C. et al (2012) Risk of inflammatory bowel disease following a diagnosis of irritable bowel syndrome. *BMC Gastroenterology* 2012, 12:55
5. Dr E Philipps (2013) Inflammatory Bowel Disorders. Nutrigold CPD accredited webinar. www.updates.nutrigold.co.uk/educational_webinars
6. Porter, C. et al (2012) Risk of inflammatory bowel disease following a diagnosis of irritable bowel syndrome. *BMC Gastroenterology* 2012, 12:55
7. Turne, J. (2009) Intestinal mucosal barrier function in health and disease. *Nat Rev Immunol* 9:799-809
8. Tobin, et al (2008) Atopic irritable bowel syndrome: a novel subgroup of IBS with allergic manifestations. *Ann Allergy Asthma & Immunol* 100:49-53
9. Controlling Candida. Nutrigold CPD accredited webinar. www.updates.nutrigold.co.uk/educational_webinars
10. Dr E Philipps (2014) Understanding the Highs and Lows of Stomach Acid. Nutrigold CPD accredited webinar. www.updates.nutrigold.co.uk/educational_webinars
11. <http://www.romecriteria.org/questionnaires/>
12. Zucchelli, M. et al (2011) Association of TNFSF15 polymorphism with irritable bowel syndrome. *Gut* 60:1671-1677
13. Eswaran, S. et al (2011) Food: the forgotten factor in the irritable bowel syndrome. *Gastroenterol Clin North Am.* 40:141-162
14. Gibson, P. (2013) Functional bowel symptoms and diet. *Intern Med J* 43(10):1067-74
15. Sameer Zar, M.R.C.P. et al (2005) Food-specific serum IgG4 and IgE titers to common food antigens in irritable bowel syndrome. *Am J Gastroenterol* 100:1550-1557
16. Boettcher, E. & Crowe SE. (2013) Dietary proteins and functional gastrointestinal disorders. *Am J Gastroenterol.* 108(5):728-36
17. El-Salhy, M. et al (2012) The role of diet in the pathogenesis and management of irritable bowel syndrome (Review). *Int J Mol Med* 29(5):723-31
18. Hollon, J. et al (2015) Effect of gliadin on permeability of intestinal biopsy explants from celiac disease patients and patients with non-celiac gluten sensitivity. *Nutrient* 7:1565-1576
19. de Punder, K, Pruimboom, L. (2013) The dietary intake of wheat and other cereal grains and their role in inflammation. *Nutrients* 5:771-787
20. Drago, S. et al (2006) Gliadin, zonulin and gut permeability: Effects on celiac and nonceliac intestinal mucosa and intestinal cell lines. *Scand J Gastroenterol* 41: 408-419
21. Volta, U. (2012) Serological tests in gluten sensitivity (Non-celiac gluten intolerance). *J Clin Gastroenterol* 46(8):680-5
22. Nutrigold newsletters – Supergreens: The Importance of Daily Alkalisng. www.updates.nutrigold.co.uk/nutritional_newsletters
23. Nutrigold newsletters – Preventing Osteoporosis www.updates.nutrigold.co.uk/nutritional_newsletters
24. Aziz, et al (2014) A UK study assessing the population prevalence of self-reported gluten sensitivity and referral characteristics to secondary care. *Eur J Gastroenterol Hepatol* 26(1):33-9 Lomer, M. et al (2008) Lactose intolerance in clinical practice. *Aliment Pharmacol Ther* 15:93-103
25. Chan, Y.K. et al (2012) Clinical consequences of diet-induced dysbiosis. *Ann Nutr Metab* 63:28-40
26. Podolsky, D. et al (1983) Composition of human colonic mucin. Selective alteration in inflammatory bowel disease. *J Clin Invest* 72(1): 142-153
27. Aune, et al (2014) Dairy products, calcium, and prostate cancer risk: a systematic review and meta-analysis of cohort studies. *Am J Clin Nutr* 101:87-117
28. Halmos, E. et al (2014) Diets that differ in their FODMAP content alter the colonic luminal microenvironment. *Gut* 64(1):93-100
29. Magge, S., Lembo A. (2012) Low-FODMAP diet for treatment of Irritable Bowel Syndrome. *Gastroenterol Hepatol* 8(11):739-45
30. Shepherd S. et al (2014) The role of FODMAPs in irritable bowel syndrome. *Curr Opin Clin Nutr Metab Care* 17(6):605-9
31. Staudacher, H. (2012) Fermentable carbohydrate restriction reduces luminal bifidobacteria and gastrointestinal symptoms in patients with irritable bowel syndrome. *J. Nutr.* 142:1510-1518
32. Staudacher, H. (2011) Comparison of symptom response following advice for a diet low in fermentable carbohydrates (FODMAPs) versus standard dietary advice in patients with irritable bowel syndrome. *J Hum Nutr Diet* 24(5):487-9
33. Barrett, J. (2013) Extending our knowledge of fermentable, short-chain carbohydrates for managing gastrointestinal symptoms. *Nutr Clin Pract* 28(3):300-6
34. Halmos, E. et al (2014) A diet low in FODMAPs reduces symptoms of irritable bowel syndrome. *Gastroenterology* 146(1):67-75
35. Staudacher, H. et al (2014) Mechanisms and efficacy of dietary FODMAP restriction in IBS. *Nat Rev Gastroenterol Hepatol* 11(4):256-66
36. de Roesst, R. et al (2013) The low FODMAP diet improves gastrointestinal symptoms in patients with irritable bowel syndrome: a prospective study. *Int J Clin Pract* 67(9):895-903.
37. Nutrigold newsletter - Cardiovascular Health. www.updates.nutrigold.co.uk/nutritional_newsletter Bijkerk et al (2009) Soluble or insoluble fibre in IBS in primary care? Randomised Placebo Control Trial. *BMJ* 339
38. Barrett, J. (2013) Extending our knowledge of fermentable, short-chain carbohydrates for managing gastrointestinal symptoms. *Nutr Clin Pract* 28(3):300-6
39. Mehmood, M. et al (2011) Pharmacological basis for the medicinal use of *Psyllium Husk* (ispaghula) in constipation and diarrhoea. *Dig Dis Sci* 56:1460-1471
40. Longstreth, G. et al (1981) *Psyllium* therapy in the Irritable Bowel Syndrome: A doubleblind trial. *Ann Intern Med* 95(1):53-56
41. Elli, M. et al (2008) Evaluation of prebiotic potential of refined *psyllium* (*Plantago ovata*) fiber in healthy women. *J Clin Gastroenterol.* 42 Suppl 3 Pt 2:S174-6
42. Nutrigold Newsletter - How to Prepare Your Body for Supplementation. www.updates.nutrigold.co.uk/nutritional_newsletters
43. Nutrigold Newsletters. Calming and Cleansing the Colon. www.updates.nutrigold.co.uk/nutritional_newsletters Maintz & Novak (2007) Histamine and histamine intolerance. *Am J Clin Nutr* 85: 1185-1196
44. Gestel, G. et al (1994) Comparative evaluation of the effects of two different forms of dietary fibre (rice bran vs. wheat bran) on colonic mucosa and faecal microflora. *Ann Nutr Metab* 38:249-56
45. Myles, et al (2014) Fast Food Fever: Reviewing the impacts of the western diet on immunity. *Nutr J* 13:61
46. Nutrigold Newsletter - Super Spirulina. www.updates.nutrigold.co.uk/nutritional_newsletters
47. Mowat, et al (2014) Regional specialisation within the intestinal immune system, *Nat Rev Immunol* 14:667-685
48. Leone et al (2013) Diet, microbes and host genetics: The perfect storm in inflammatory bowel diseases. *J Gastroenterol* 48:315-321
49. Levitt, M.D. (1968) Production and excretion of hydrogen gas in man. *New Engl. J. Med* 281:122
50. Solomons, N.W. (1984) Evaluation of carbohydrate absorption: The hydrogen breath test in clinical practice. *Clin Nutr J* 3:71-78
51. Nutrigold newsletters – Aloe Vera. www.updates.nutrigold.co.uk/nutritional_newsletters
52. Feldberg, R. et al (1988) In vitro mechanism of inhibition of bacterial cell growth by alicin. *Antimicrob Agents Chemo* 32(12):1763-68
53. Goto, C. et al (1990) Lethal efficacy of extract from *Zingiber officinale* (traditional Chinese medicine) or [6]-shogaol and [6]-gingerol in *Anisakis* larvae in vitro. *Parasitol Res* 76:653-6
54. Mascolo, N. et al (1989) Ethnopharmacological investigation of ginger (*Zingiber officinale*). *J Ethnopharmacol* 27:129-40
55. Adewunni, C. et al (1990) Molluscicidal and antischistosomal activities of *Zingiber officinale*. *Planta Med* 36:374-76
56. Ooi, L. et al (2006) Antimicrobial activities of cinnamon oil and cinnamaldehyde from the Chinese medicinal herb *Cinnamomum cassia* Blume. *Am J Chin Med.* 34(3):511-22
57. Nutrigold CPD accredited webinar – Controlling Candida. www.updates.nutrigold.co.uk/educational_webinars
58. Lombardo, L. et al (2010) Increased incidence of small intestinal bacterial overgrowth during proton pump inhibitor therapy. *Clin Gastroenterol Hepatol* 8:504-508
59. Dr E Philipps (2014) Understanding the Highs and Lows of Stomach Acid. Nutrigold CPD accredited webinar. www.updates.nutrigold.co.uk/educational_webinars
60. Lee, S. et al (2008) Phytochemicals: mighty but ignored weapons against *Helicobacter pylori* infection. *J Dig Dis* 9:129-39
61. Dr E Philipps (2014) Understanding the Highs and Lows of Stomach Acid. Nutrigold CPD accredited webinar. www.updates.nutrigold.co.uk/educational_webinars
62. Dr E Philipps (2012) Digestive Enzymes: The Key to Optimum Health. Nutrigold newsletters www.updates.nutrigold.co.uk/nutritional_newsletters
63. Dr E Philipps (2013) Liver & Gallbladder Health. Nutrigold CPD accredited webinar. www.updates.nutrigold.co.uk/educational_webinars
64. Chiang, L. et al (2015) Bile acids as metabolic regulators. *Curr Opin Gastroenterol* 31(2):159-65
65. Dr E Philipps (2013) Lecithin & Plant Sterols. Nutrigold newsletters www.updates.nutrigold.co.uk/nutritional_newsletters
66. Platel, K et al. (2000) Stimulatory influence of select spices on bile secretion in rats *Nutr Res* 20(10):1493-150
67. Yamahara, J. et al. (1990) Gastrointestinal motility enhancing effect of ginger and its active constituents. *Chem Pharm Bull* 38(2):430-31
68. Dr E Philipps (2013) Liver & Gallbladder Health. Nutrigold CPD accredited webinar. www.updates.nutrigold.co.uk/educational_webinars
69. Maukonen, et al (2015) Human gut microbiota: Coes diet matter? *Proc Nutr Soc* 74:23-36
70. Peterson, et al (2015) Immune homeostasis, dysbiosis and therapeutic modulation of the gut microbiota. *Clin Exp Immunol* 179:363-377
71. Moayyedi, P. (2008) The efficacy of probiotics in the therapy of irritable bowel syndrome: a systematic review. *E. Gut* 17
72. Barillas, C. (1997) Effective reduction of lactose maldigestion in preschool children by direct addition of beta-galactosidases to milk at mealtime. *Pediatr* 79:766-72
73. Botschinsky, B. et al (2011) A review of the evidence available for the use and effectiveness of probiotic drinks and supplements for the treatment of irritable bowel syndrome. *Int J Probiotics & Prebiotics* 6:21-38
74. Dr E Philipps (2012) Understanding Probiotics. Nutrigold CPD accredited webinar www.updates.nutrigold.co.uk/educational_webinars
75. Ruemmele, F. (2009) Clinical evidence for immunomodulatory effects of probiotic bacteria. *J Pediatr Gastroenterol Nutr* 48(2):126-41
76. Tomomatsu, H. (1994) Health effects of oligosaccharides. *Food Tech* 61-65
77. Gibson G. (1995) Dietary modulation of the human colonic microbiota: introducing the concept of probiotics. *J Nutr* 125:1401-12
78. Roberfroid MB (2000) Chicory fructooligosaccharides and the gastrointestinal tract. *Nutrition* 16:677-79
79. Robinson, R. et al (2001) Nutritional benefits of larch arabinogalactan. *Science* 443
80. Souba, W. et al. (1990) The role of glutamine in maintaining a healthy gut and supporting the metabolic response to injury and infection. *J Surgical Res* 48(4):383-91
81. Oehler, R. et al (2002) Glutamine depletion impairs cellular stress response in human leucocytes. *Br J Nutr* 87(Suppl 1):S17-S21
82. Samak, R. et al (2012) Role of glutamine in protection of intestinal epithelial tight junctions. *J Epithel Biol Pharmacol* 5:47-54
83. Zeigler, T. et al (2000) Glutamine and the gastrointestinal tract. *Curr Opin Clin Nutr Metab Care* 3:355-62
84. Reeds, PJ, Burrin DG. (2001) Glutamine and the bowel. *J Nutr* 131(Suppl 9):2505S-08S
85. Cao, Y. et al (1998) Glutamine enhances gut glutathione production. *J Parent Enteral Nutr* 22:224-27
86. Alverdy, J. (1990) Effects of glutamine-supplemented diets on immunology of gut. *J Parent Enteral Nutr* 14(4):1095-1103
87. Dr E Philipps (2013) Lecithin & Plant Sterols. Nutrigold newsletters www.updates.nutrigold.co.uk/nutritional_newsletters
88. Wakabayashi, H. et al (1998) Effect of *Helicobacter pylori* infection on gastric mucosal phospholipid contents and their fatty acid composition. *J Gastroenterol Hepatol* 13:566-71
89. Anand, B. et al (1999) Phospholipid association reduces the gastric mucosal toxicity of aspirin in human subjects. *Am Coll Gastroenterol* 94:1818-22
90. Nutrigold newsletters – Lecithin & Plant Sterols. www.updates.nutrigold.co.uk/nutritional_newsletters
91. Nutrigold newsletters – Aloe Vera. www.updates.nutrigold.co.uk/nutritional_newsletters
92. Ghosh, S. et al (2003) Bioactive natural compounds for the treatment of gastrointestinal disorders. *Clin Sci* 104:547-556
93. Dr E Philipps (2015) Update on Aloe: A 21st Century Naturopathic Staple. Nutrigold CPD accredited webinar www.updates.nutrigold.co.uk/educational_webinars
94. Bundy, R. et al (2004) Turmeric Extract May Improve Irritable Bowel Syndrome Symptomatology in Otherwise Healthy Adults: A Pilot Study. *J Alt Compl Med* 10:1015-1018
95. Niederau, C., Gopfert, E. (1999) The effect of chelidonium and turmeric root extract on upper abdominal pain due to functional disorders of the biliary system. Results from a placebo-controlled double-blind study. *Med.* 94, 425-430
96. Prucksunand, C. et al (2001) Phase II clinical trial on effect of the long turmeric (*Curcuma longa* Linn) on healing of peptic ulcer. *Southeast Asian J. Trop. Med. Public Health* 32:208-215
97. Yamahara, J. et al (1990) Gastrointestinal motility enhancing effect of ginger and its active constituents. *Chem Pharm Bull* 38(2):430-31
98. Dinan, et al (2006) Hypothalamic-Pituitary-Gut Axis Dysregulation in Irritable Bowel Syndrome: Plasma Cytokines as a Potential Biomarker? *Gastroenterol* 130:304-311
99. Cryan, J. et al (2011) The microbiome-gut-brain axis: from bowel to behaviour. *Neurogastroenterol Motil* 23:187-912