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LET'S TAKE BACK YOUR HEALTH—*Starting Now.*

EBOOK

Gut Health

by CHRIS KRESSER

Gut Health

All disease begins in the gut.
– Hippocrates

Hippocrates said this more than 2,000 years ago, but we're only now coming to understand just how right he was. Research over the past two decades has revealed that gut health is critical to overall health, and that an unhealthy gut contributes to a wide range of diseases including diabetes, obesity, rheumatoid arthritis, autism spectrum disorder, depression and chronic fatigue syndrome.

In fact, many researchers (including myself) believe that supporting intestinal health and restoring the integrity of the gut barrier will be one of the most important goals of medicine in the 21st century.

There are two closely related variables that determine our gut health: the intestinal microbiota, or "gut flora", and the gut barrier. Let's discuss each of them in turn.

THE GUT FLORA: A HEALTHY GARDEN NEEDS HEALTHY SOIL

Our gut is home to approximately 100,000,000,000,000 (100 trillion) microorganisms. That's such a big number our human brains can't really comprehend it. One trillion dollar bills laid end-to-end would stretch from the earth to the sun – and back – with a lot of miles to spare. Do that 100 times and you start to get at least a vague idea of how much 100 trillion is.

The human gut contains 10 times more bacteria than all the human cells in the entire body, with over 400 known diverse bacterial species. In fact, you could say that we're more bacterial than we are human. Think about that one for a minute.

We've only recently begun to understand the extent of the gut flora's role in human health and disease. Among other things, the gut flora promotes normal gastrointestinal

function, provides protection from infection, regulates metabolism and comprises more than 75% of our immune system. Dysregulated gut flora has been linked to diseases ranging from autism and depression to autoimmune conditions like Hashimoto's, inflammatory bowel disease and type 1 diabetes.

Unfortunately, several features of the modern lifestyle directly contribute to unhealthy gut flora:

- Antibiotics and other medications like birth control and NSAIDs
- Diets high in refined carbohydrates, sugar and processed foods
- Diets low in fermentable fibers
- Dietary toxins like wheat and industrial seed oils that cause leaky gut
- Chronic stress
- Chronic infections

Antibiotics are particularly harmful to the gut flora. Recent studies have shown that antibiotic use causes a profound and rapid loss of diversity and a shift in the composition of the gut flora. This diversity **is not recovere**d after antibiotic use without intervention.

We also know that infants that aren't breast-fed and are born to mothers with bad gut flora are more likely to develop unhealthy gut bacteria, and that these early differences in gut flora may predict overweight, diabetes, eczema/psoriasis, depression and other health problems in the future.

THE GUT BARRIER: THE GATEKEEPER THAT DECIDE WHAT GETS IN AND WHAT STAYS OUT

Have you ever considered the fact that the contents of the gut are technically **outside the body?** The gut is a hollow tube that passes from the mouth to the anus. Anything that goes in the mouth and isn't digested will pass right out the other end. This is, in fact, one of the most important functions of the gut: to prevent foreign substances from entering the body.

When the intestinal barrier becomes permeable (i.e. "leaky gut syndrome"), large protein molecules escape into the bloodstream. Since these proteins don't belong outside of the

gut, the body mounts an immune response and attacks them. Studies show that these attacks play a role in the development of autoimmune diseases like Hashimoto's and type 1 diabetes, among others.

In fact, experts in mucosal biology like Alessio Fasano now believe leaky gut is a precondition to developing autoimmunity:

> *There is growing evidence that increased intestinal permeability plays a pathogenic role in various autoimmune diseases including [celiac disease] and [type 1 diabetes]. Therefore, we hypothesize that besides genetic and environmental factors, loss of intestinal barrier function is necessary to develop autoimmunity.*

The phrase "leaky gut" used to be confined to the outer fringes of medicine, employed by alternative practitioners with letters like D.C., L.Ac and N.D. after their names. Conventional researchers and doctors originally scoffed at the idea that a leaky gut contributes to autoimmune problems, but now they're eating their words. It has been repeatedly shown in several well-designed studies that the integrity of the intestinal barrier is a major factor in autoimmune disease.

This new theory holds that the intestinal barrier in large part determines whether we tolerate or react to toxic substances we ingest from the environment. The breach of the intestinal barrier (which is only possible with a "leaky gut") by food toxins like gluten and chemicals like arsenic or BPA causes an immune response which affects not only the gut itself, but also other organs and tissues. These include the skeletal system, the pancreas, the kidney, the liver and the brain.

This is a crucial point to understand: **you don't have to have gut symptoms to have a leaky gut.** Leaky gut can manifest as skin problems like eczema or psoriasis, heart failure, autoimmune conditions affecting the thyroid (Hashimoto's) or joints (rheumatoid arthritis), mental illness, autism spectrum disorder, depression and more.

Researchers have identified a protein called zonulin that increases intestinal permeability in humans and other animals. This led to a search of the medical literature for illnesses characterized by increased intestinal permeability (leaky gut). Imagine their surprise when the researchers found that many, if not most, autoimmune diseases – including celiac disease, type 1 diabetes, multiple sclerosis, rheumatoid arthritis and

inflammatory bowel disease – are characterized by abnormally high levels of zonulin and a leaky gut. In fact, researchers have found that they can induce type 1 diabetes almost immediately in animals by exposing them to zonulin. They develop a leaky gut, and begin producing antibodies to islet cells – which are responsible for making insulin.

One of the main reasons we don't want to eat wheat and other gluten-containing grains is that they contain a protein called gliadin, which has been shown to increase zonulin production and thus directly contribute to leaky gut.

But what else can cause leaky gut? In short, the same things I listed above that destroy our gut flora: poor diet, medications (antibiotics, NSAIDs, steroids, antacids, etc.), infections, stress, hormone imbalances, and neurological conditions (brain trauma, stroke and neurodegeneration).

LEAKY GUT = FATIGUED, INFLAMED AND DEPRESSED

Here's the takeaway. Leaky gut and bad gut flora are common because of the modern lifestyle. If you have a leaky gut, you probably have bad gut flora, and vice versa. And when your gut flora and gut barrier are impaired, you will be inflamed. Period.

This systemic inflammatory response then leads to the development of autoimmunity. And while leaky gut and bad gut flora may manifest as digestive trouble, in many people it does not. Instead it shows up as problems as diverse as heart failure, depression, brain fog, eczema/psoriasis and other skin conditions, metabolic problems like obesity and diabetes and allergies, asthma and other autoimmune diseases.

To adequately address these conditions, you must **rebuild healthy gut flora and restore the integrity of your intestinal barrier.** This is especially true if you have any kind of autoimmune disease, whether you experience digestive issues or not.

HOW TO MAINTAIN AND RESTORE A HEALTHY GUT

The most obvious first step in maintaining a healthy gut is to avoid all of the things I listed above that destroy gut flora and damage the intestinal barrier. But of course that's not always possible, especially in the case of chronic stress and infections. Nor did we have any control over whether we were breast-fed or whether our mothers had healthy guts when they gave birth to us.

If you've been exposed to some of these factors, there are still steps you can take to restore your gut flora:

- Remove all food toxins from your diet
- Maximize your digestive capacity using supplemental acid and enzymes
- Eat plenty of fermentable fibers (starches like sweet potato, yam, yucca, etc.)
- Eat fermented foods like kefir, yogurt, sauerkraut, kimchi, etc., and/or take a high-quality, multi-species probiotic
- Treat any intestinal pathogens (such as parasites) that may be present
- Take steps to manage your stress

We'll talk in detail about each of these important steps in this eBook. Read on to learn more!

It's All About The Gut

Digestive distress is the most common problem I see in people switching to a Paleo diet. This can range from mild gas and bloating, to changes in stool frequency and consistency (i.e. constipation, diarrhea or alternating between the two), to severe heartburn or abdominal pain. There are three primary reasons people experience these symptoms when they transition to a Paleo diet:

1. Low stomach acid.
2. Decreased enzyme production.
3. Intestinal inflammation.

I'll cover each of these in more detail below. Before I do that, it's worth pointing out that in the vast majority of cases, people who have digestive issues on Paleo also had them before. They may have consciously or unconsciously compensated for them by limiting animal proteins (if they have low stomach acid), eating more simple carbohydrates (decreased enzyme production) or limiting intake of fibrous vegetables and fruits (intestinal inflammation). This doesn't mean the diet they were on before was necessarily more gut-friendly; the symptoms were being managed, but the underlying problems weren't addressed.

LOW STOMACH ACID

Stomach acid is a prerequisite to healthy digestion. The breakdown and absorption of nutrients occurs at an optimum rate only within a narrow range of acidity in the stomach. If there isn't enough acid, the normal chemical reactions required to absorb nutrients is impaired.

Stomach acid plays a key role in the digestion of protein, carbohydrates and fat. When food is eaten, the secretion of stomach acid (HCL) triggers the production of pepsin. Pepsin is the enzyme required to digest protein. If HCL levels are depressed, so are pepsin levels. As a result, proteins don't get broken down into their component amino acids and peptides. These undigested proteins putrefy in the gut, and may cause gas, bloating, heartburn and other digestive issues.

At the same time, proteins that escape digestion by pepsin may end up in the bloodstream. Since this is not supposed to happen, the body reacts to these proteins as if they were foreign invaders, causing allergic and autoimmune responses.

Low stomach acid also impairs carbohydrate digestion. Stomach acid (HCL) supports the breakdown and absorption of carbohydrates by stimulating the release of pancreatic enzymes into the small intestine. If the pH of the stomach is too high (due to insufficient stomach acid), the pancreatic enzymes will not be secreted and the carbohydrates will not be broken down properly. As Dr. Norm Robillard explained in his book Heartburn Cured, undigested carbohydrates provoke an overgrowth of bacteria in the small intestine (a.k.a. "SIBO") which in turn leads to increased gas production and acid reflux. (I've written an entire eBook on low stomach acid and GERD <LINK>, so check that out if you haven't already.)

There are numerous causes of low stomach acid. The most common are:

- **H. pylori infection.** This is extremely common; studies suggest that 1 in 2 people are infected globally. (1) H. pylori suppresses stomach acid production as a survival strategy.
- **Stress.** Chronic stress has been shown to decrease stomach acid production.

- **Acid suppressing drugs.** Long-term use of Prilosec, one of the most potent acid suppressing drugs, reduces the secretion of hydrochloric acid (HCL) in the stomach to near zero. (2)
- **Low animal protein (i.e. vegetarian/vegan) diet.** I haven't seen studies on this, but my clinical and personal experience suggest that eating a diet low in animal protein decreases stomach acid secretion over time.
- **Age.** Numerous studies have shown that stomach acid secretion declines with age. In one study researchers found that over 30 percent of men and women past the age of 60 suffer from atrophic gastritis, a condition marked by little to no acid secretion. (3) Another study found that 40% of women over the age of 80 produce no stomach acid at all. (4)

Imagine this scenario: you've been on a vegetarian diet for a few years and under a lot of stress at work. You switch (literally overnight) to a Paleo diet where you are now eating meat at least once and often twice a day. Is it any surprise that your digestive system may not respond well to this? The combination of a vegetarian diet, chronic stress and possibly an H. pylori infection would significantly reduce your stomach acid, and thus ability to digest animal protein.

DECREASED ENZYME PRODUCTION

Digestive enzymes break down larger molecules in the food we eat into smaller molecules that can be absorbed across gut lumen into our bloodstream. They're found primarily in the mouth (saliva), stomach and small intestine, and are categorized according to the food substrate they break down:

- **Proteases** and **peptidases** break down proteins into peptides and amino acids.
- **Lipases** break fats into fatty acids and a glycerol molecule.
- **Carbohydrases** break carbohydrates into simple sugars (i.e. glucose/fructose).
- **Nucleases** break nucleic acids into nucleotides.

If your enzyme production is insufficient, you can't break down or absorb protein, fat or carbohydrates properly. It's not hard to imagine that this could lead to digestive issues, is it?

The primary causes of poor enzyme production are:

- **Low stomach acid.** The pH (acidity) of the chyme (partially digested food in the stomach) must be in a particular range in order to stimulate enzyme production when it enters the small intestine. If the pH is too high due to low stomach acid, enzyme production will be inhibited.
- **Stress.** Once again, chronic stress rears its ugly head.
- **Micronutrient deficiency**. Enzymes don't work alone; they require other nutrients (vitamins and minerals) which act as "co-enzymes". If your diet is low in certain micronutrients (i.e. B12, iron & zinc for vegetarians/vegans, or magnesium, selenium, vitamin C for those on a standard American diet), or you're not absorbing them properly due to low stomach acid, your enzyme production will be impaired.
- **Western diet.** Highly processed, refined and cooked foods contain no enzymes at all. Raw fruits and vegetables are rich in enzymes.
- **Age.** Some evidence suggests that enzyme production also declines with age.

Decreased enzyme production almost always occurs together with low stomach acid, which creates a digestive double-whammy.

INFLAMMATION

Inflammation is part of the body's response to harmful stimuli such as pathogens, irritants or damaged cells. It is a crucial aspect of our body's protective system, and we wouldn't live very long without it. It is only when inflammation becomes chronic that it becomes a problem. Chronic inflammation in the gut can lead to constipation or diarrhea, gas, bloating and abdominal pain, as well as extra-intestinal symptoms like skin rashes, muscle and joint pain and even depression.

One of the little known manifestations of gut inflammation that may be one reason people struggle when adopting a Paleo diet is a sensitivity to insoluble fiber found in certain fruits, vegetables and nuts and seeds. There are two primary types of dietary fiber: soluble, and insoluble. While soluble fiber can be soothing for the gut, consuming large amounts of insoluble fiber when your gut is inflamed is a little bit like rubbing a wire brush against an open wound. Ouch.

Like low stomach acid and decreased enzyme production, gut inflammation has numerous causes. The most common include:

- **Gut infections.** Parasites, pathogenic and opportunistic bacteria, and fungi can all cause a low-grade, chronic inflammatory condition.
- **Autoimmune disease.** Inflammatory bowel disease, including ulcerative colitis and Crohn's disease, are conditions where the immune system mounts an inappropriate attack against intestinal tissue.
- **Western diet.** Gluten, sugar, refined flour and other highly processed and refined foods can inflame the gut.
- **Environmental toxins.** Pesticides and other chemicals like BPA have been shown to disturb inflammatory cytokine production.
- **Intestinal dysbiosis.** An imbalance of good and bad bacteria, including SIBO (small intestine bacterial overgrowth), can create an inflammatory state.

Note that only two of these causes are exclusively related to diet: environmental toxins and western foods. The others are potentially modifiable by diet, but diet is not the primary cause. If you continue to experience digestive issues after a 30-day trial of the Paleo diet, chances are you have some gut inflammation and one or more of these causes is present. There are some dietary tweaks that can help, but ultimately the most important thing is to address the underlying cause, and that will probably require additional support (i.e. supplements or medications) above and beyond dietary changes.

First steps in fixing your gut

A discussion of how to fix the gut could fill an entire book. (Indeed, I plan to write that book after I've published The Paleo Cure.) While I obviously can't go into that kind of detail here, I can give you some "first steps" that have proven to work well in my practice.

RESTORE STOMACH ACID PRODUCTION

The first step in restoring stomach acid production is addressing any factors that are inhibiting it. This means getting tested for H. pylori if you suspect it, taking steps to manage chronic stress and avoiding acid-suppressing drugs.

The next step is to take hydrochloric acid (HCL). I describe the rationale and protocol for this in detail in my eBook on Heartburn and GERD <LINK>, but the short version is this: taking HCL can often help kick start the body's own acid production. Most patients I've treated only need to take HCL for somewhere between 3-6 months, and are then able to

gradually titrate off it. A minority of patients, such as elderly people with atrophic gastritis or people that have been on PPIs for many years, may need to remain on HCL indefinitely. That is a much better option than the alternative, which is to suffer from digestive problems as well as the potentially serious consequences of low stomach acid (such as decreased nutrient absorption, bacterial overgrowth, increased susceptibility to infection and even a higher risk of gastric cancer).

Be aware that HCL should always be taken with pepsin — or, better yet, acid-stable protease — because it is likely that if the stomach is not producing enough HCL, it is also not producing enough protein digesting enzymes.

Another way to stimulate acid production in the stomach is by taking bitter herbs. "Bitters" have been used in traditional cultures for thousands of years to stimulate and improve digestion. More recently, studies have confirmed the ability of bitters to increase the flow of digestive juices, including HCL, bile, pepsin, gastrin and pancreatic enzymes. (5) The following is a list of bitter herbs commonly used in Western and Chinese herbology:

- Dandelion
- Fennel
- Gentian root
- Ginger
- Beet root
- Goldenseal root
- Milk thistle
- Peppermint
- Wormwood
- Yellow dock

Bitters are normally taken in very small doses – just enough to evoke a strong taste of bitterness. Kerry Bone, a respected Western herbalist, suggests 5 to 10 drops of a 1:5 tincture of the above herbs taken in 20 mL of water.

REPLACE DIGESTIVE ENZYMES

As I mentioned above, the single most important step in increasing digestive enzyme production is by restoring stomach acid production. This will give the chyme entering the small intestine the proper pH level (acidity), which is what stimulates the pancreas to produce enzymes. Managing chronic stress and ensuring adequate micronutrient (co-enzyme) intake are also important. Raw, fermented foods like sauerkraut, kimchi, kefir or beet kvass are rich in enzymes and should be consumed regularly if tolerated.

Supplemental nutrients can be helpful for immediate relief. These include:

- **Ox bile.** While not technically an enzyme, ox bile is one of the most effective supplements for improving fat absorption.
- **Acid stable protease.** Improves protein digestion; acid-stable protease is able to survive the low pH of gastric juices to further aid in protein assimilation.
- **Pancreatin.** A mixture of enzymes produced by the pancreas, including lipase (fat digesting), protease (protein digesting) and amylase (carbohydrate digesting).
- **Bromelain.** An enzyme found in pineapple that helps with protein digestion, and may have systemic anti-inflammatory effects.
- **Ginger.** A time-tested digestive remedy.

As with HCL, in most cases you will only need to take these nutrients temporarily, until you are able to address the underlying issues. But they can be incredibly helpful in the meantime.

REDUCE INFLAMMATION

This one is a little harder to give a quick overview of, because there are so many potential causes, and some of those causes require a fairly complex approach. What I can do is give you a few general tips that are helpful in most circumstances, regardless of the cause.

The first step would be trying some tweaks to your existing Paleo or "real food" diet. (You are on a Paleo or "real food" diet, aren't you? If not, that is the first step.) There are three tweaks I've found to be helpful, and they're listed in the order I suggest you try them:

1. **Take it easy on the veggies.** Some vegetables (and fruits) are quite high in insoluble fiber, which as I mentioned above, can be very irritating to an inflamed gut. One of the easiest ways to address this is to simply reduce the quantity and

variety of vegetables you eat. I know this will sound like heresy to some of you, but keep in mind that while vegetables are nutrient-dense foods, a little goes a long way, and there are other more nutrient-dense foods like organ meat and meat. We'll talk more about this in a few pages.

2. **Try a low-FODMAP diet.** FODMAPs are specific types of carbohydrate that are poorly digested by certain people, particularly those with dysbiosis and SIBO. We'll discuss this technique next.
3. **GAPS diet.** The GAPS diet is a comprehensive, anti-inflammatory, gut-healing diet. It's especially helpful with SIBO, dysbiosis, and inflammatory bowel disease (IBD). Check out this article for a primer.

PUTTING IT ALL TOGETHER

There's no question that healing digestive issues can be a confusing and time-consuming process. In my experience it usually takes a good 3-6 months to unravel a chronic digestive issue — and sometimes longer. This may not be the news you were looking for, but setting realistic expectations will help you to stick with a therapeutic approach long enough for it to work.

The changes I suggested in this eBook should give you a good head start. I'd also recommend checking out a new line of supplements that Robb Wolf and I created specifically to address the challenges we've seen people experience as they adopt a Paleo diet — including digestive problems. One of my biggest frustrations as a clinician has been finding supplements that contain exactly the ingredients I want and don't contain the ingredients I don't want. For example, in the case of a digestive supplement, I wanted something that had HCL, acid-stable protease, carbohydrate and fat digesting enzymes, cholagogues to stimulate bile production, and bitters to stimulate acid secretion — with the right doses and forms of each — but that product didn't exist. So I decided to create it myself.

You can learn more about these supplements here.

FODMAPs: Could common foods be harming your digestive health?

Functional gut disorders such as IBS are affecting one in five Americans, causing abdominal pain, inconsistent or excessive bowel movements, and even psychological

symptoms such as anxiety or depression. (6) If you have experienced IBS, you know that these symptoms can be constant, painful, and can have a serious impact on quality of life.

There is a strategy that has recently become more popular; it is a dietary approach that I have seen work well for many of my patients, and that evidence is growing in support of. Known as the Low FODMAP Diet, this method has been demonstrated to reduce functional gut disorder symptoms in approximately 75% of patients. (7) Understanding how FODMAPs affect the gut and knowing how to eliminate them from your diet may be the key to getting your IBS symptoms under control.

WHAT ARE FODMAPS?

The acronym FODMAP stands for Fermentable Oligosaccharides, Disaccharides, Monosaccharides And Polyols. These short-chain carbohydrates are incompletely absorbed in the gastrointestinal tract and can be easily fermented by gut bacteria. (8) These sugars also exert an osmotic effect, increasing fluid movement into the large bowel. (9) The fermentation and osmosis caused by these undigested sugars are a cause of major IBS symptoms such as gas, pain, and diarrhea.

There are many common foods that are high in FODMAPs that can potentially contribute to IBS symptoms, even if they are considered healthy by most standards. Lactose from dairy products, fructose from certain fruit, coconut products, and sweeteners, fructans from fibrous vegetables, and polyols from fruit and sugar alcohols are all rich in FODMAPs and can be difficult to digest for people with functional gut disorders. These foods can cause serious and painful symptoms in those with IBS and Crohn's disease.

WHO MAY HAVE FODMAP INTOLERANCE?

While most IBS patients are FODMAP intolerant, consuming FODMAPs does not actually *cause* IBS; it simply exacerbates symptoms. (10) Therefore, while many people may be able to consume a large quantity of FODMAPs with no problem, some people will experience an abnormal or exaggerated response to the presence of these poorly absorbed saccharides. And while all FODMAPs can potentially factor in the development of IBS symptoms, the relative contribution of different types of FODMAPs varies across

ethnic and dietary groups depending on the amount of each in the diet. (11) Additionally, individuals differ in their amount of malabsorption of FODMAPs such as fructose, lactose, and fructans, and therefore are more or less sensitive to certain FODMAPs in particular.

So what causes FODMAP intolerance? There are a few possible explanations that have been explored in clinical study. In some cases, small intestinal bacterial overgrowth, also known as SIBO, contributes to the development of IBS symptoms and FODMAP intolerance. (12) The presence of pathogenic bacteria in the small intestine causes excessive fermentation of these carbohydrates, increasing gas production and allowing for the proliferation of uncontrolled gut bacteria. In other cases, certain individuals may lack adequate enzymes to break down and absorb the fermentable sugars before they reach the colon, contributing to the osmolarity changes and bacterial fermentation that occurs in the large intestine.

Of course, emotional and physical stress are also known to be contributing factors to the development of IBS, and could induce FODMAP intolerance for reasons not yet fully understood. (13) In these cases, disturbance of gut microbiota is a likely causative factor; for example, stress alters the gut flora significantly and could be the reason why stress, FODMAP intolerance, and IBS are so closely linked.

HOW CAN YOU TREAT FODMAP INTOLERANCE?

First, addressing intestinal bacterial overgrowth or imbalance is key; even if you don't have IBS, gut dysbiosis can lead to poor digestive function as well as contributing to FODMAP intolerance. There are a few gut-healing protocols available today, such as the GAPS Diet or the Specific Carbohydrate Diet; my personal approach is similar to an autoimmune Paleo diet. I often recommend probiotics to my patients to help balance out their gut flora, and occasionally recommend antimicrobial treatments depending on the severity of the individual gut infection. Managing gut flora is a highly individual process, so it's important to pay attention to your own symptoms when coming up with a treatment plan.

In addition to addressing gut bacteria, following a low FODMAP diet seems to be the most effective dietary intervention to help reduce chronic IBS symptoms. (14) Many clinical trials have shown a high level of success from IBS patients who reduce or

eliminate FODMAP containing foods from their diet. (15, 16, 17) In addition, avoiding gluten may help reduce IBS symptoms further, according to some research. (18)

While a "Paleo" or "Primal" diet may eliminate many of these culprits, there are a few Paleo-friendly staples that can worsen FODMAP intolerance symptoms. I've written about coconut milk causing digestive distress in some individuals, and coconut milk is an unfortunately high source of FODMAPs. Many fruits such as apples, peaches, mangoes, and watermelon are FODMAP rich, and dried fruits are especially problematic for those with intolerances. Even certain vegetables that are normally quite healthy can be problematic for those suffering from IBS; asparagus, brussels sprouts, broccoli, garlic, and onions are just a few of the vegetables that could be exacerbating symptoms.

To determine which specific foods that may be causing your IBS symptoms, I recommend reviewing this basic but informative chart featuring different types of FODMAPs and the foods they are found in. You may be consuming a FODMAP-rich food without knowing it, and reducing or eliminating consumption of these foods may help alleviate IBS symptoms. This chart also provides a list of low FODMAP foods that can be enjoyed in place of these problematic foods.

For much more information about FODMAP intolerance, as well as an extensive list of FODMAP foods and an in-depth gut healing protocol, check out my book, The Paleo Cure. In this book, I explain how to best adapt the standard Paleo diet into one that can help relieve IBS symptoms without needing to restrict your diet indefinitely. It's a protocol I use with my patients, and many have found success without drugs or surgical intervention. It's certainly worth a try for anyone suffering from chronic digestive disorders.

Got digestive problems? Take it easy on the veggies.

We've just discussed how FODMAPs are poorly digested in certain people and can lead to gas, bloating, pain and changes in stool frequency and consistency. Studies have shown that conditions like Irritable Bowel Syndrome (IBS) are associated with FODMAP intolerance, and that a low-FODMAP diet offers relief in a substantial percentage of people with IBS.

Now I've got another tip for those of you with digestive issues, including IBS, constipation, diarrhea and acid reflux: eat fewer vegetables.

Yep, that's right. *Fewer* vegetables.

Vegetables (as well as some fruits) are often high in insoluble fiber. While soluble fiber can be soothing for the gut, consuming large amounts of insoluble fiber when your gut is inflamed is a little bit like rubbing a wire brush against an open wound. Ouch.

Vegetables that are high in insoluble fiber include:

- Greens (spinach, lettuce, kale, mesclun, collards, arugula, watercress, etc.)
- Whole peas, snow peas, snap peas, pea pods
- Green beans
- Kernel corn
- Bell peppers
- Eggplant
- Celery
- Onions, shallots, leeks, scallions, garlic
- Cabbage, bok choy, Brussels sprouts
- Broccoli
- Cauliflower

The vegetables that are high in soluble fiber, but lower in insoluble fiber (and thus tend to be safer for those with gut issues) include:

- Carrots
- Winter squash
- Summer squash (especially peeled)
- Starchy tubers (yams, sweet potatoes, potatoes)
- Turnips
- Rutabagas
- Parsnips
- Beets
- Plantains

- Taro
- Yuca

Another helpful tip is to reduce the *variety* of vegetables you eat at any given meal. Instead of stir-fries with 6 different veggies, have a single steamed or roasted vegetable as a side dish. This works better for most people with gut issues.

BUT WON'T I BECOME DEFICIENT IN NUTRIENTS IF I DON'T EAT TONS OF VEGGIES?

First of all, I'm not suggesting that you don't eat these foods at all if you have digestive problems. I'm simply suggesting that you limit them. There are also steps you can take to make these foods more digestible and less likely to cause problems. They include:

1. Never eat insoluble fiber foods on an empty stomach. Always eat them with other foods that contain soluble fiber.
2. Remove the stems and peels (i.e. from broccoli, cauliflower and winter greens) from veggies (and fruits) high in insoluble fiber.
3. Dice, mash, chop, grate or blend high-insoluble fiber foods to make them easier to break down.
4. Insoluble fiber foods are best eaten well-cooked: steamed thoroughly, boiled in soup, braised, etc; avoid consuming them in stir-fries and if you do eat them raw, prepare them as described in #3 above.

Second, although fruits & veggies are high in certain nutrients, animal products like meat, organ meat, fish, eggs and dairy are as high and sometimes higher in those nutrients. For example, the chart below compares the micronutrient profile of beef liver and beef with blueberries and kale, two plant-foods often referred to as being particularly nutrient-dense:

(100g)	Blueberries	Kale	Beef	Beef Liver
Calcium	6.0 mg	72 mg	11 mg	11 mg
Phosphorus	12 mg	28 mg	140 mg	476 mg
Potassium	77 mg	228 mg	370 mg	380 mg
Iron	0.3 mg	0.9 mg	3.3 mg	8.8 mg
Zinc	0.2 mg	0.2 mg	4.4 mg	4.0 mg
Vitamin A	None	None	40 IU	53,400 IU
Vitamin D	None	None	Trace	19 IU
Vitamin E	0.6 mg	0.9 mg	1.7 mg	.63 mg
Vitamin C	9.7 mg	41 mg	None	27 mg
Niacin	0.4 mg	0.5 mg	4.0 mg	17 mg
Vitamin B6	0.1 mg	0.1 mg	.07 mg	.73 mg
Vitamin B12	None	None	1.8 mcg	111 mg
Folate	6 mcg	13 mcg	4.0 mcg	145 mcg

It's also worth pointing out that most traditional cultures only ate a few vegetables and fruits that were available seasonally. They couldn't walk into Whole Foods and buy every vegetable on the planet at every time of year.

I have nothing against vegetables. In fact, I like them quite a bit and I do think they're beneficial. But the advice to eat 6-8 servings a day is not based on solid scientific evidence, and may cause unnecessary distress in people with gut problems.

FERMENTED VEGETABLES: A BETTER ALTERNATIVE?

Fermented vegetables like sauerkraut, kimchi, sauerruben and cortido are excellent alternatives for people with gut issues. First, the fermentation process "pre-digests" the vegetables and makes them easier to absorb. Second, fermented veggies contain probiotic microorganisms that help heal the gut.

Although sauerkraut and kimchi contain cabbage, which is high in insoluble fiber (and a FODMAP to boot), I've found that many patients with gut problems can tolerate it quite well. FODMAPs are sugars and sugar alcohols, and fermentation breaks down sugars. This is probably why fermented FODMAPs are better tolerated than non-fermented FODMAPs.

If you're new to fermented vegetables, you have two options:

1. Make them yourself. Check out the fermentation guidebooks at the Personal Paleo Launchpad <link> for more information on how to make fermented veggies. It's really quite easy, and cheap.
2. You can buy them at a health food store. Make sure that it says "raw" on the jar, and they're in the refrigerated section. The sauerkraut you can buy in the condiments section has been pasteurized and won't have the same beneficial effect.

Myths and Truths About Fiber

For decades, fiber has been touted as an essential component of a healthy diet. The supposed benefits of a high-fiber diet have been drilled into us through recommendations by our doctors, government, and the food industry alike, yet many of these health claims have not been proven by research.

In fact, many studies have demonstrated that excess intake of fiber may actually be harmful, particularly for gut health.

The majority of the research supporting the benefits of dietary fiber come from epidemiological studies that link the consumption of fiber-rich fruits and vegetables with a lowered risk of certain diseases such as obesity, heart disease and cancer, particularly colon cancer. (19) Yet when tested in the lab, controlled intervention trials that simply add fiber supplements to an otherwise consistent diet have not shown these protective effects. (20, 21, 22)

The Institute of Medicine recommends a daily fiber intake of 38 grams for men and 25 grams for women, which may come from dietary fibers, both soluble or insoluble, or the addition of "functional fibers" to the diet. The IOM defines functional fibers as non-

digestible carbohydrates that have been isolated or extracted from a natural plant or animal source, or they may be manufactured or synthesized. Examples of functional fibers are psyllium husks, chitin from crustacean shells, fructooligosaccharides, polydextrose, and resistant dextrins. (23)

These functional fibers are often added to processed foods as a way to bulk up the fiber content for consumers looking to meet the IOM intake guidelines. A recent report by NPR commented that despite the lack of significant evidence linking fiber intake to health outcomes such as reduced heart disease or cancer, many consumers are buying foods that are fortified with synthetic fiber additives under the guise of health promotion. (24) Three grams of added fiber is enough to allow these food products to claim to be a good source of fiber, and the food industry has used these fiber guidelines as a way to increase their sales of grain-based products in particular. (25)

Tan and Seow-Choen, in their 2007 editorial on fiber and colorectal disease, call insoluble fiber "the ultimate junk food", as "it is neither digestible nor absorbable and therefore devoid of nutrition." (26) Excess insoluble fiber can bind to minerals such as zinc, magnesium, calcium, and iron, preventing the absorption of these vital nutrients. (27) Large excesses of certain soluble fibers like pectin and guar may also inhibit pancreatic enzyme activity and protein digestion in the gut, leading to an anti-nutritive effect. (28)

The addition of insoluble and soluble fibers to processed foods may actually cause these foods to be even less nutritious than if they were not enriched with any fiber at all.

A high-fiber diet has also been described as a preventative strategy for the development of diverticulosis, a disease that is markedly more common in Western countries. However, when researchers tested the theory that a high-fiber diet prevented diverticulosis, they not only found that a high intake of fiber did not reduce the prevalence of diverticulosis, but that a high-fiber diet and greater number of bowel movements were independently associated with a higher prevalence of diverticula. (29) Interestingly, this study found no association between the presence of diverticulosis and red meat intake, fat intake, or physical activity, which are other factors commonly attributed to diverticulosis.

The researchers hypothesized that one possible effect of a high-fiber diet in the development of diverticulosis could be the quantitative and qualitative changes in gut bacteria due to the excessive fiber intake. Both insoluble and soluble fibers are shown to alter gut bacteria in as little as two weeks. It is possible that the high levels of excess fiber and overgrowth of intestinal bacteria may have contributed to the development of diverticular pouches in the colon.

This hypothesis brings up another side to the fiber debate: the effect of dietary fiber on beneficial gut bacteria, as well as the bacterial fermentation of undigested soluble fiber into short-chain fatty acids such as butyrate. When we eat the soluble fibers found in whole plant foods, the bacteria in our gut ferment these fibers into short-chain fatty acids like butyrate, propionate, and acetate, and greater amounts of fiber consumed will lead to greater short-chain fatty acid production. (30) In this case, naturally occurring soluble fibers are very important for feeding the friendly bacteria that live in our guts.

One of the risks of long term very low-carbohydrate (VLC) diets, in my view, is the potentially harmful effect they can have on beneficial gut flora. VLC diets starve both bad and good gut bacteria, which means these diets can have therapeutic effects on gut infections in the short term, but may actually contribute to insufficiency of beneficial strains of gut bacteria over the long term. Providing adequate levels of carbohydrate and soluble fiber to feed friendly bacteria is important for optimizing digestive health and maintaining the integrity of the gut lining through the production of short-chain fatty acids.

Stephan Guyenet has written an excellent blog post describing the benefits of butyrate and other short-chain fatty acids on the maintenance of healthy gut integrity. (31) Butyrate has anti-inflammatory effects, increases insulin sensitivity, and may delay the development of neurodegenerative diseases. It may also be helpful in the treatment of diseases of the colon such as Crohn's, IBS or ulcerative colitis. (32)

Stephan believes that butyrate may play a significant role in healthy metabolic function, stress resistance, and the immune response. He also asserts that the epidemiologically observed benefits of a diet high in naturally occurring fiber are likely due to the higher butyrate production from these diets. **In this case, a higher fiber diet could be protective and beneficial for health, particularly if the fiber is soluble.**

So what does this mean for our own consumption of fiber?

Ideally, dietary fiber should be coming from whole food plant sources. Many foods in the Paleo diet are great sources of both soluble and insoluble fiber, such as yams and sweet potatoes, green leafy vegetables, carrots and other root vegetables, fruits with an edible peel (like apples and pears), berries, seeds, and nuts. Interestingly, butyrate itself is also found in high-fat dairy products such as butter and cheese, and can also be provided by the bacteria found in fermented foods. (33)

Although I recommend that most people get fiber from whole foods, there are some people that may benefit from soluble fiber supplementation – including those that aren't able to eat fruit or starch due to blood sugar issues or weight regulation, and those with severely compromised gut flora or gut dysbiosis. In these cases I've found soluble fiber and/or prebiotic supplements to be helpful.

For healthy people, including a variety of fibrous whole plant foods, fermented foods, and high-fat dairy as tolerated should eliminate the need to supplement with extra fiber, especially those insoluble fibers that are from sources high in anti-nutrients. A Paleo diet with some level of attention paid to the quality and quantity of vegetables, fruits, and starchy tubers can provide adequate levels of soluble fiber to feed the friendly bacteria in the gut that convert these fibers into beneficial short-chain fats like butyrate.

Soluble fibers naturally found in fruits, vegetables, starches, nuts, and seeds provide a food source for the beneficial bacteria in the gut. These bacteria ferment the fiber and produce short-chain fatty acids such as butyrate, which has anti-inflammatory properties, promotes the development of healthy cells in the colon, and may protect against colon cancer. Starches like potatoes, sweet potatoes, plantains, taro root, and yuca are particularly good sources of soluble fibers.

Another option for fermentable fiber is resistant starch. Resistant starch is an insoluble fiber with unique properties. Starch exists as large chains of glucose molecules in plants. Since humans produce amylase, an enzyme that breaks down starch, most forms of starch are easily absorbed in the digestive tract. However, resistant starch is unique among starches in that it cannot be broken down in the small intestine and digested by humans.

But unlike other types of insoluble fiber, resistant starch can be fermented by gut microbiota in the large intestine to produce helpful short-chain fatty acids like butyrate. Resistant starch has several other benefits, including increasing the uptake of minerals like calcium, boosting levels of Bifidobacteria (a beneficial genus of bacteria in the large intestine), reducing harmful pathogens, improving gut motility, and reducing blood-sugar and insulin levels.

The suggested amount of resistant starch to achieve these benefits is between twenty to forty grams a day. Unfortunately, it's not easy to come by in whole foods, because cooking tends to destroy it, and foods that contain it in large amounts can't be eaten raw. With this in mind, here are a few ways to add resistant starch to your diet:

- Mix four tablespoons of raw, unmodified potato starch (Bob's Red Mill is a good brand) with water or some other room-temperature food or beverage. Four tablespoons of potato starch provides about thirty-two grams of resistant starch.
- Make plantain chips by cutting a large, green (unripe) plantain into thin slices and placing the slices in a food dehydrator. Eat these as a snack. A single, large, unripe plantain contains about forty grams of resistant starch.
- Eat a green (unripe) banana, which contains about fifteen grams of resistant starch, depending on ripeness.

Other Recommended Supplements (if needed):

- Prebiotic: Klaire Labs Biotagen
- Soluble fiber: Organic Acacia Fiber

Caution: it's crucial to start with a very low dose of prebiotic or soluble fiber and build up slowly over time. This will minimize any potential adverse reaction that can occur with significant changes (even positive changes) to the gut microbiome. For Biotagen, start with 1/4 of 1/8 of a tsp (1/32 tsp.) and increase by 1/32 of a tsp every 4-5 days. For Organic Acacia Fiber or Unmodified Potato Starch, start with 1/4 of a tsp. once per day and build slowly from there.

Kefir: the not-quite-Paleo superfood

One of the key components of a strict Paleo diet is the complete elimination of dairy products. Unfortunately, this may lead to many dairy-tolerant individuals missing out on some of the most nutritious and beneficial foods on the planet. One dairy product that not only offers a wide range of vitamins and minerals, but also provides a variety of probiotic organisms and powerful healing qualities, is kefir (pronounced /kəˈfɪər/ kə-FEER).

The word “kefir” is derived from the Turkish word “keif”, which literally translates to the “good feeling” one has after drinking it. (34) Traditional cultures have attributed healing powers to kefir for centuries, but it has only recently become the subject of scientific research to determine its true therapeutic value.

WHAT IS KEFIR?

Kefir is a fermented milk product that originated centuries ago in the Caucasus mountains, and is now enjoyed by many different cultures worldwide, particularly in Europe and Asia. It can be made from the milk of any ruminant animal, such as a cow, goat, or sheep. It is slightly sour and carbonated due to the fermentation activity of the symbiotic colony of bacteria and yeast that make up the “grains” used to culture the milk (not actual grains, but a grain-like matrix of proteins, lipids, and sugars that feed the microbes). **The various types of beneficial microbiota contained in kefir make it one of the most potent probiotic foods available.**

Besides containing highly beneficial bacteria and yeasts, kefir is a rich source of many different vitamins, minerals and essential amino acids that promote healing and repair, as well as general health maintenance. (35) Kefir contains high levels of thiamin, B12, calcium, folates and Vitamin K2. It is a good source of biotin, a B vitamin that HELPS the body assimilate other B vitamins. The complete proteins in kefir are already partially digested, and are therefore more easily utilized by the body. Like many other dairy products, kefir is a great source of minerals like calcium and magnesium, as well as phosphorus, which helps the body utilize carbohydrates, fats and proteins for cell growth, maintenance and energy. (36)

KEFIR HAS POSITIVE EFFECTS ON GUT AND BONE HEALTH

It is a powerful probiotic, consisting of both bacterial and yeast species of beneficial flora, and may help protect against gastrointestinal diseases. It has also been demonstrated to

improve lactose digestion in adults with lactose intolerance. (37) In addition to providing the gut with healthy symbiotic microflora, many studies have also demonstrated the anti-fungal and antibacterial properties of kefir. (38) Certain bacteria strains from the kefir culture have been shown to help in treating colitis by regulating the inflammatory response of the intestinal cells. (39)

As we know, vitamin K2 is one of the most important nutrients that is greatly lacking in the American diet. (40) Vitamin K2 is a product of bacterial fermentation, so kefir is a likely a good source of this nutrient, especially if made with milk from pastured animals. (41) Vitamin K2 plays a key role in calcium metabolism, where it is used to deposit calcium in appropriate locations, such as in the bones and teeth, and prevent it from depositing in locations where it does not belong, such as the soft tissues and the arteries. (42) Since kefir is high in calcium and phosphorus and also contains vitamin K2, drinking kefir is likely beneficial to bone health, providing the essential minerals needed for bone growth as well as the vitamin K2 needed to effectively deposit those minerals in the bone

KEFIR MODULATES THE IMMUNE SYSTEM

Certain compounds in kefir may play a role in regulating immune function, allergic response, and inflammation. One study found that kefiran, a sugar byproduct of the kefir culture, may reduce allergic inflammation by suppressing mast cell degranulation and cytokine production. (43) Another study found that certain bacteria in the kefir culture inhibited IgE production, helping to moderate the body's allergic response. (44)

Research has also demonstrated that kefir may have an anti-tumor effect. In one study, kefir consumption inhibited tumor growth and induced the apoptotic form of tumor cell lysis, suggesting that kefir may play a role in cancer prevention. (45) When applied topically, kefir and its polysaccharide compounds have even been shown to be effective antimicrobial and anti-inflammatory agents for improved wound healing. (46)

As kefir clearly has a wide variety of health benefits, you may be interested in including this fermented dairy beverage in your diet. Cow, goat, or sheep dairy are all good choices, and all types of kefir are generally very low in lactose. Raw milk kefir would be the ideal choice for anyone looking for maximum nutritional quality, but may be challenging for most consumers to find.

Kefir is becoming more mainstream for health-conscious Americans, so you may be able to find full-fat, plain kefir at your local grocery store. Look for a brand with minimal additives and extra ingredients. Good commercial products include Redwood Hill Farm's Traditional Goat Kefir and Lifeway's Organic Whole Milk Plain Kefir.

MAKING YOUR OWN KEFIR AT HOME

Finding high quality kefir at your local store may not be an option for you. In this case, you can make your own kefir at home. Making kefir is surprisingly simple, and Cheeseslave has a great instructive blog post on how to make kefir at home. You can buy kefir grains online at sites such as Culture for Health, and provided you take care of the culture, it should last indefinitely. Making kefir from raw dairy products is ideal, but if you don't have access to raw dairy, you can use organic full-fat dairy, preferably from a grass-fed animal. For those who cannot tolerate any form of dairy, kefir can be made from coconut milk, coconut water, and even just sweetened water, which will provide many of the benefits found in dairy kefir.

Kefir is a great source of vitamins, minerals, probiotics, and a variety of other unique compounds that can greatly contribute to your overall health and wellbeing. I highly recommend including this nutritious superfood in your diet, even if it doesn't fall under strict "Paleo" guidelines!

How stress wreaks havoc on your gut – and what to do about it

Beyond poor diet, many other lifestyle factors can greatly increase your level of stress, such as overtraining, not sleeping enough, or not including enough pleasure in your daily life. Many of the conference speakers (including myself) focused on how stress causes cortisol dysregulation and subsequent weight gain, sleep disturbances, and even a reduction in life span.

Stress also plays a major role in the health of one of our most important organ systems: the gut.

The word stress is a broad term, and can refer to any real or perceived threat to the homeostasis of an organism, eliciting adaptive responses to help maintain internal

stability and ensure survival. (47) Stress can be acute or chronic, and it tends to be those chronic stressors from our lifestyle or environment that are far more damaging to our health.

The gut is especially vulnerable to the presence of chronic (and even acute) stress, demonstrating stress-induced changes in gastric secretion, gut motility, mucosal permeability and barrier function, visceral sensitivity and mucosal blood flow. (48) There has also been evidence to suggest that gut microbiota may respond directly to stress-related host signals. (49)

I've spoken extensively before about the brain-gut axis and its role in health. As I've mentioned before, the intestinal mucosa is infiltrated by the myenteric plexus, which is a network of nerve fibers and neuron cell bodies that are influenced by signaling from the brain. In this sense, the gut is an integral part of the nervous system, so the brain can easily effect gut function. We anecdotally recognize our brain-gut connection as a "gut feeling", which can range from butterflies in the stomach to full-on anxiety-induced nausea. (50)

The biochemical changes that occur in times of stress have significant and immediate impact on gut function.

A family of peptides called corticotrophin releasing factors (CRF) are responsible for coordinating the body's response to stress, and CRFs have a potent effects on the gut through modulation of inflammation, increase of gut permeability, contribution to visceral hypersensitivity, increased perception to pain, and modulation of the gut motility. (51) This hormone affects the hypothalamic-pituitary axis (HPA) to eventually stimulate the secretion of cortisol from the adrenal glands.

Not only does stress affect the physiological function of the gut, but it has also been shown to actually cause changes in the composition of the microbiota, possibly due to the changes in neurotransmitter and inflammatory cytokine levels. (52) Research in mice has found that exposure to stress led to an overgrowth of certain types of bacteria while simultaneously reducing microbial diversity in the large intestine of the stressed mice. (53, 54) Furthermore, this disruption of the microbiota increased susceptibility to enteric pathogens.

Chronic exposure to stress may lead to the development of a variety of gastrointestinal diseases such as gastroesophageal reflux disease (GERD), peptic ulcer disease, IBD, IBS, and even food allergies. (55) Experimental studies have shown that psychological stress slows normal small intestinal transit time, encourages overgrowth of bacteria, and even compromises the intestinal barrier. (56) Chronic stress may therefore play an important role in the development of small intestinal bacterial overgrowth (SIBO) and leaky gut syndrome.

THE GUT-BRAIN-SKIN AXIS PLAYS AN IMPORTANT ROLE IN OUR OVERALL HEALTH. Another fascinating line of research that dates back to the 1930s is the relationship between skin, gut, and mental health. I've recorded a podcast in which I discuss the role that gut health plays in the development of acne, and research suggests that chronic stress may also play an integral part in the gut-skin axis. (57) Stress-induced alterations to microbial flora could increase the likelihood of intestinal permeability, which in turn sets the stage for systemic and local skin inflammation. (58) When gut integrity is compromised, an increase in circulating endotoxins derived from gut microbes can manifest as skin eruptions such as rosacea and acne.

On the flip side, having a healthy gut flora can modulate the hypersensitivity and leaky gut permeability that comes from chronic exposure to stress. Consuming probiotic foods and/or supplements might influence both mood and acne, by reducing systemic inflammatory cytokines and oxidative stress, increasing peripheral tryptophan levels, normalizing brain levels of stress hormones, modulating tissue lipid levels, and possibly even regulating glycemic control. (59, 60, 61, 62, 63)

Recently, research has demonstrated significant improvements in depression, anger, anxiety, as well as lower levels of cortisol among otherwise healthy adults taking a daily probiotic supplement as compared to a placebo. (64) This data suggests that not only can chronic stress change the diversity of microflora in the gut, but that the quality and health of friendly gut bacteria may also conversely have an effect on mental health and wellbeing.

As we continue to learn more about the intricacies of the interplay between stress and gut health, what steps can we take in our daily lives to help minimize the health damage that arises from chronic stress?

One interesting method of treatment that researchers used in the 1930s to treat acne and mood disorders was the combination of "an acidophilus milk preparation and cod liver oil", which we now know provided patients high levels of probiotics, omega-3 fatty acids, and fat soluble vitamins A and D. (65) Healing the gut, reducing inflammation, and providing a diverse array of friendly bacteria can make a big difference in your gut's susceptibility to the negative effects of stress. Taking cod liver oil and probiotics on a regular basis may make a significant difference in your overall resilience to stress.

That said, it goes without saying that a major component of a healthy lifestyle should include stress reduction techniques.

Focusing on reducing stress is a key component of weight loss, longevity, and mental health. Stress may even cause hypothyroid symptoms such as weight gain, blood sugar swings, fatigue, decreased immunity, and sleep disturbance. I highly recommend that anyone struggling with these types of symptoms evaluate the level of stress in their life, and incorporate different strategies for minimizing stress on a regular basis.

There are many ways to mitigate the impacts of stress, including meditation, yoga, taiji ("Tai Chi"), deep breathing and spending time in nature – to name a few. However, here are two options that I've found to be particularly helpful for healing the gut-brain axis:

- The **Body Scan** (Mindfulness-Based Stress Reduction, MBSR): MBSR was developed by clinical psychologist and long-time Buddhist practitioner Jon-Kabat Zinn to cultivate greater awareness of the ways the unconscious thoughts, feelings, and behaviors can undermine emotional, physical, and spiritual health. It has been studied extensively at the Stress Reduction Clinic at the University of Massachusetts Medical Center for over 30 years, and is clinically proven to relieve chronic pain and illness. You can download a free audio recording of the Body Scan here, and I recommend doing it once a day if possible. If you prefer more in-depth training, MBSR is offered as an 8-week intensive in hospitals and medical centers around the world. It is also offered as an online course, and can be done via home study with books and audio recordings.
- Rest Assured is marketed as a program for healing insomnia naturally – and it's very effective for that purpose. However, the way this is accomplished is by maintaining a greater state of relaxation and ease throughout the day, which will

improve not only sleep but other physiological processes like gut function. As I've shown in this eBook, operating in a state of constant hyper-arousal (which many of us do) is a sure-fire path to digestive problems. The Rest Assured program contains simple exercises that coordinate breath and movement. Many of the exercises can be performed in as little as 3-4 minute throughout the day, while some take 20-30 minutes and can be done when you have a little more time – or while you're laying in bed before sleep. I've found these to be incredibly helpful myself, and my patients have as well.

The high price of antibiotic use: can our guts ever fully recover?

Maintaining proper balance of healthy gut flora is a crucial yet widely misunderstood component of human health. While the development of antibiotics has lengthened our lifespans, our excessive and inappropriate use of these drugs may be causing serious long-term consequences we are only now becoming fully aware of.

These consequences not only affect our individual health, but may even be causing permanent changes to the microflora of all people from generation to generation.

Martin Blaser's recent (2011) article published in Nature highlights the potentially dangerous long-term consequences that arise from the rampant overuse of antibiotics. (66) He argues that changes in our microbiota may even be promoting the transmission of deadly organisms, as one of the important roles of an intact microflora is to resist colonization by pathogenic organisms.

Blaser also points out that not only does the individual use of antibiotics cause permanent changes in the gut flora, but that infants born to women given antibiotics during pregnancy, or the 30% of children delivered via cesarean section, may be starting life with a significantly altered and insufficient level of friendly gut flora. (67) This is a serious concern because lack of diversity in friendly gut bacteria has been shown to contribute to a large number of diseases and complications.

Unfortunately, even a *single* course of antibiotics can permanently alter the gut flora.

One study found that after a single treatment of intravenous antibiotics, fecal bacteria tests demonstrated a significant change in the variety of bacterial strains, and the development of the pathogen *Clostridium difficile*. (68) *C. difficile* colonization in the gut can lead to serious complications such as severe diarrhea and colitis. (69)

Another study demonstrated that a short course of the antibiotic ciprofloxacin reduced the diversity of the intestinal microbiota, with significant effects on roughly one-third of the bacterial species. (70) This study also found that while much of the diversity eventually recovered, there were still several species that failed to recover after six months, suggesting that even a short course of antibiotics may cause permanent changes to the community of friendly flora in the gut.

Antibiotics are known to cause diarrhea, which may be due to infection by antibiotic resistant pathogens such as *salmonella*, *C. perfringens* type A, *Staphylococcus aureus*, and possibly *Candida albicans*, as well the various metabolic consequences of reduced concentrations of fecal flora. (71) These results suggests that disturbance of the normal intestinal flora following antibiotic use may be responsible for the overgrowth of dangerous pathogens.

Research also indicates that infants' gut flora is significantly affected by cesarean delivery, which requires the administration of antibiotics to the mother. One study demonstrated significant changes in the primary intestinal flora of infants born through cesarean delivery, lasting at least six months. (72) Primary colonization of the newborn's sterile intestinal tract normally happens during vaginal birth, and **it is unknown whether an infant born with inadequate or unbalanced colonization will ever develop normal intestinal flora without intervention.**

While breastfeeding can help restore some of the natural balance to the microflora, only about 44.3% of American women breastfeed (with only 14.8% breastfeeding exclusively) for the full six months that is recommended. (73, 74) Furthermore, breastfeeding alone may not compensate for the changes in flora associated with cesarean sections, suggesting that many infants may be at an even greater disadvantage when it comes to the proper development of a healthy, functional digestive tract. (75)

Research from diverse fields demonstrates the negative effects of gut dysbiosis and inadequate friendly flora on a variety of health outcomes.

For example, resident bacteria of the normal flora are involved in intestinal mucosal inflammation and patients with inflammatory bowel disease (IBD) have higher amounts of bacteria attached to their intestinal mucosa than do healthy people. (76) Patients with Crohn's disease and ulcerative colitis are found to have reduced concentrations of fecal *Lactobacillus* and *Bifdobacteria*, which protect against pathogenic bacteria, increase mineral absorption and induce the production of growth factor in the gut. (77)

An unbalanced microbiota in the gut is also a contributing factor in autoimmunity. (78) Infection with certain microbial pathogens can trigger autoimmune reactions in joints and other organs. (79) The destruction of healthy gut flora can make the mucosal lining more susceptible to leakage, which some researchers believe is a precondition for developing autoimmunity. (80, 81) It is well-established that the balance of gut bacteria plays a key role in the formation of a proper immune response. (82, 83) A lack of healthy gut bacteria is associated with allergies, IBD, and general autoimmune reactions when this immune modulation goes awry.

New research has linked changes in gut bacteria with obesity. One study found that the gut bacteria of obese subjects different significantly in species type than lean subjects, and that low calorie diets, restricting either fat or carbohydrates, changed the gut flora and increased the abundance of the bacterial strains found more predominantly in the lean subjects. (84) Another study found that transplanting fecal bacteria from lean or obese mice into mice with sterile guts could affect whether these mice gained body fat, even when food intake was controlled. (85) Those mice implanted with fecal bacteria from obese mice gained a significantly larger percentage of body fat than those transplanted with bacteria from lean mice. The authors hypothesized that certain types of gut flora are associated with obesity due to the increased extraction of energy from the diet. I've written about this in more detail here.

These studies demonstrate the wide range of potential consequences caused by the improper development or destruction of the intestinal flora.

Though antibiotics may be necessary in certain situations, it's important to weigh the benefits of using them with the potential risks that may come from the permanent alteration of the gut flora. If antibiotics must be used (and there are certainly situations where this is the case), special care should be taken to not only restore their gut flora using probiotic foods and supplements, but to eat a diet that supports healthy gut microbiota with plenty of fermentable fibers from starch and the removal of food toxins.

To protect infants' gut health, especially those infants born through cesarean section, it is crucial to exclusively breastfeed for at least six months, with breastfeeding continuing on-demand throughout the complementary feeding period (up to 2 years of age). I also recommend using a high-quality infant probiotic to help populate your baby's gut with beneficial flora, as I explain in this article from my natural childbirth series.

Infancy is a critical time where the development of a healthy gut microbiota is essential for the long term health of your child. You can read more about protecting the gut health of your child in The Healthy Baby Code.

In medicine and health, as in all other areas of life, each choice we make comes with consequences. The purpose of this post is not to suggest that antibiotics are "bad" and we should never take them. As I said earlier, antibiotics save lives and have significantly lengthened our lifespans. But that benefit has come with a price, and it's one that we're only just beginning to understand the full implications of. My goal here is simply to raise awareness of this price – the harmful and potentially lasting effects of antibiotics – so that you can make a more informed choice.

WHAT ARE SOME ALTERNATIVES TO ANTIBIOTICS?

Mark Sisson wrote a good post listing some alternatives to antibiotics a few months back. In my practice I use a combination of botanical antimicrobials, biofilm disruptors (bacteria often live in extracellular matrices called biofilm, which protect them from our innate immune defenses and any external antimicrobials we might take), and probiotics – as well as micronutrients to support immune function, like vitamin C, iodine and selenium.

While these botanicals do have an impact on the gut flora, it is less pronounced than the effect of broad-spectrum antibiotics. Still, I recommend taking any strong antimicrobials under the supervision of a qualified health care provider.

Conclusion

Gut health may be one of the most under-appreciated components of overall wellness in our current medical model. It's amazing how many different conditions can be affected by problems such as gut dysbiosis or leaky gut. I hope this eBook has helped in teaching you more about gut health and how to holistically improve your gut function.

To review, here are my top tips for improving your overall gut health:

- Remove all food toxins from your diet
- Maximize your digestive capacity using supplemental acid and enzymes
- Eat plenty of fermentable fibers (starches like sweet potato, yam, yucca, etc.)
- Eat fermented foods like kefir, yogurt, sauerkraut, kimchi, etc., and/or take a high-quality, multi-species probiotic
- Treat any intestinal pathogens (such as parasites) that may be present
- Take steps to manage your stress

You can also learn much more about these strategies in my new book, The Paleo Cure. I've written an entire chapter on restoring your gut flora and gut barrier function, and have included dozens of tips from every angle on how to eat and live to improve your gut health. The new Personal Paleo Launchpad has even more guides on do-it-yourself fermentation, and the Paleo Recipe Generator can provide low FODMAP recipes for any meal of the day. There are plenty of tips, guides, and recommendations to help you on your journey to optimal gut health; just check the website for more information.

For even more up-to-date information on gut health, read the the articles in the additional reading section over at ChrisKresser.com.