

THE EFFECT OF STRESS ON GUT HEALTH

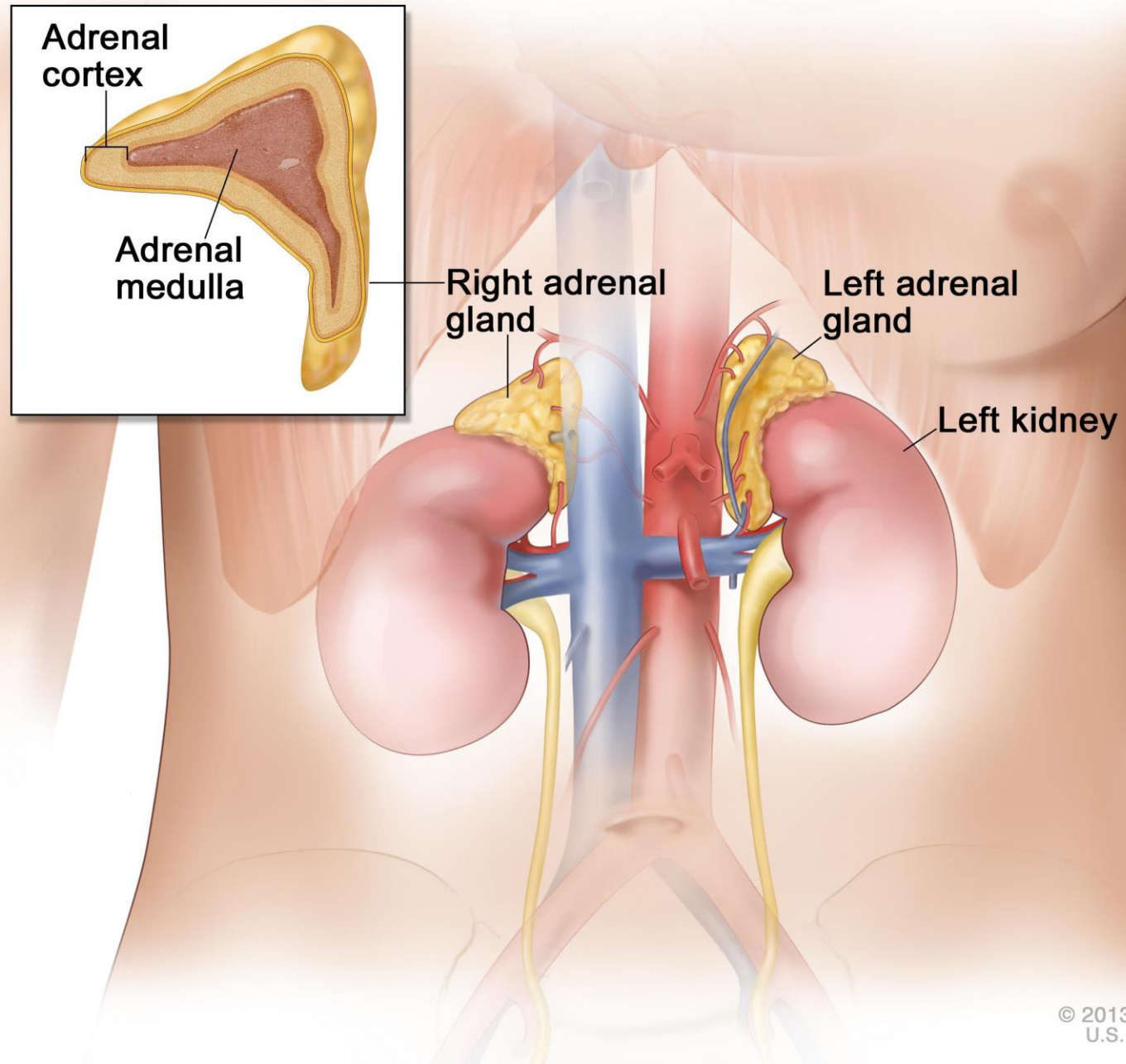


What is Stress

- It is a physical response that occurs in our body when we are “stressed”
- Physiologically, it is a series of actions in the body that are regulated by specific hormones made by the adrenal glands
- The adrenals glands sit on top of the kidneys
- They are made up of two distinct parts:
- The adrenal medulla and the adrenal cortex

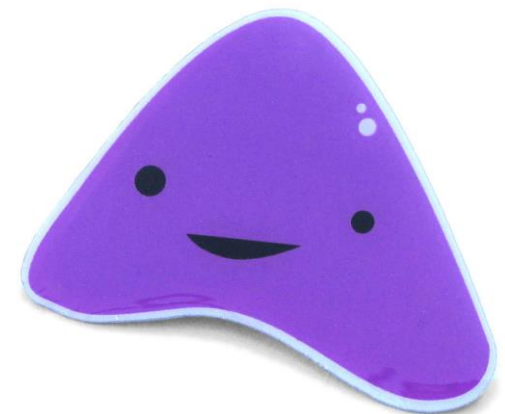


Anatomy of the Adrenal Gland



Adrenal Cortex

- Adrenal cortex – outer part- produces hormones that are essential to life such as cortisol and aldosterone
- Role of Cortisol: Essential for the maintenance of homeostasis and maintaining life, helps regulate blood sugar, immune response, anti-inflammatory response, blood pressure, heart muscles contractions, nervous system function, fat, protein and carbohydrate metabolism, keeps you awake
- Aldosterone: Plays a central role regulating blood pressure, also helps with conservation of sodium and potassium from the kidneys

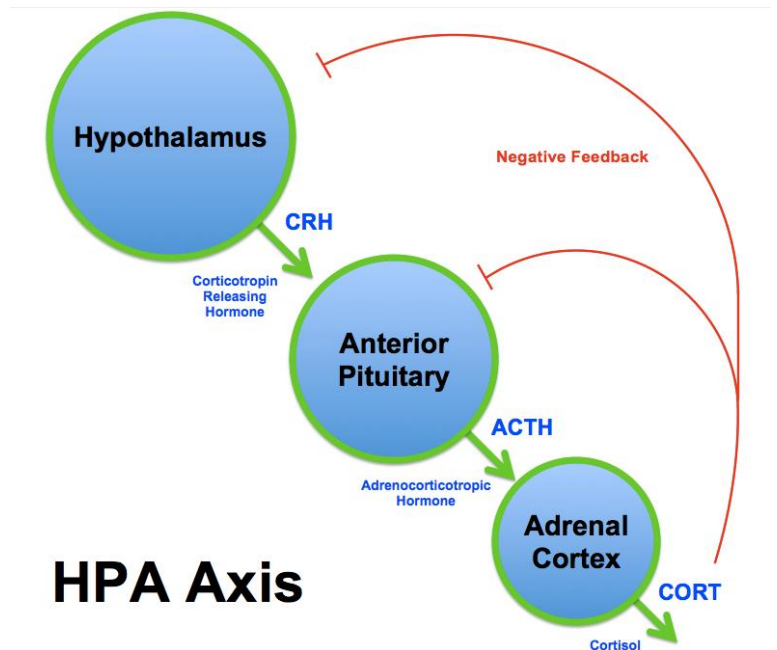


Adrenal Medula

- Inner part of the gland – produces non-essential hormones such as adrenaline and noradrenaline
- Hormones from the adrenal medula are released after the sympathetic nervous system is stimulated during times of stress
- Addison's Disease: failure to produce cortisol (autoimmune) – has been linked to gut health problems
- Cushing's Disease: Too much cortisol (often due to a tumor) – probiotics have been used to help this disease in horses

The HPA-Axis

- The hypothalamus releases CHR (corticotropin –releasing hormone) which signals the pituitary to release ACTH (adrenocorticotrophic hormone)
- The adrenals are stimulated by ACTH to produce glucocorticoids - cortisol and corticosterones (anti-inflammatory)
- Glucocorticoid steroids in turn suppress the function of the hypothalamus and the pituitary to suppress glucocorticoid production



Fight or Flight Response

- Our body's defense response to danger
- Designed for physical threats – to protect us from danger
- Adrenaline works with cortisol to increase the body's ability for immediate energy and strength. It causes blood vessels to contract. It increases heart rate and tells your brain to pump more cortisol
- The purpose is so you can fight or run from danger ie if being chased by a bear.



The Problem

- Our bodies do not know the difference between running from a bear and or being yelled at by a boss or being stuck in traffic
- As a result we are secreting excess cortisol and adrenaline too much and our bodies were not designed for this
- Flight or flight is supposed to be short term
- Chronic use of this response, causes all kinds of problems in the body including the digestive and intestinal system issues



Brain to Gut

- The autonomic nervous system communicates to the gut via the sympathetic and parasympathetic system
- The sympathetic communicates with the gut directly
- The gut communicates with the brain via the vagus nerve and the parasympathetic uses the vagus nerve to communicate with the gut
- This gives the fight or flight response an advantage in affecting the gut



Inflammation and Cortisol

- The adrenal cortex produces glucocorticoids, which suppress the immune system response
- This means that they lower inflammation
- However, lower levels of cortisol have been shown to stimulate an inflammatory response (IL6 and TNF-alpha) in response to LPS (lipopolysaccharide – found in the outer cell wall of bad bacteria)
- Adrenaline and noradrenaline have a confused relationship with inflammation although also promote inflammation in response to LPS



Inflammation and Cortisol

- Chronic sustained stress with a prolonged increased in cortisol, suppresses the immune system but also has been shown to increase inflammation in those who have chronic psychological stress (depression)
- Acute stress – stimulates the sympathetic nervous system which in turn stimulates the production of adrenaline and noradrenaline and later an increase in cortisol
- Under this scenario – inflammation goes up when stimulated by LPS
- As a side note – increased inflammation increases cortisol (maybe to lower inflammation)



Systems Connected to Adrenals

- Thyroid
- Liver
- Blood Sugar (pancreas and liver)
- Stomach
- Heart
- Nervous System
- Intestines (gut bacteria)
- Brain (neurotransmitters)
- Skeletal and Muscular
- Immune system



Issues With Excess Cortisol

- Weight gain (around the middle)
- Sleep issues
- Catch colds and flu easily
- Headaches and backaches
- Low sex drive
- Food cravings (because of blood sugar)
- Depression, mood swings
- High blood pressure (low blood pressure also has an adrenal factor)
- Accelerated tissue loss for joints (cartilage) and bones



Excess Cortisol

- Fatigue
- Poor concentration
- Weaken muscles or muscle loss
- Can interfere with the production of thyroid hormones
- Disrupts the reproductive system and may be involved in infertility and miscarriage
- Testosterone levels and progesterone go down and estrogen can go up
- Immune system is weakened by deregulated T and B cells
- Can shut down enzyme needed for maintaining telomeres



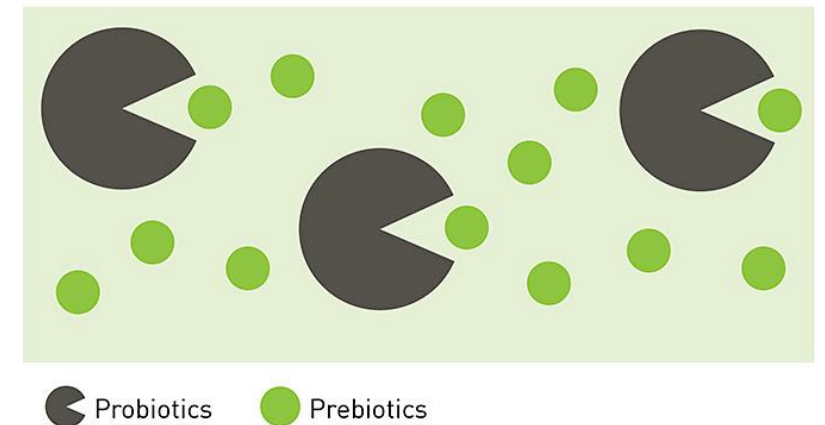
Excess Cortisol

- Can decrease stomach acid (during fight or flight)
- Nausea, heartburn, abdominal cramps, constipation or diarrhea
- Cortisol controls the recycling of bile acids. Excess cortisol cause the production of excess bile which is sent to the gall bladder, it becomes overloaded. This causes excess bile to be dumped into the small intestine and start reflux back towards the stomach (often mistaken for excess acid).
- This will cause heat or burning across the lower ribcage, as bile moves backwards through the small intestines and into the stomach
- Fiber can help prevent the recycling of bile acids and cause bile to be excreted and can prevent excess bile



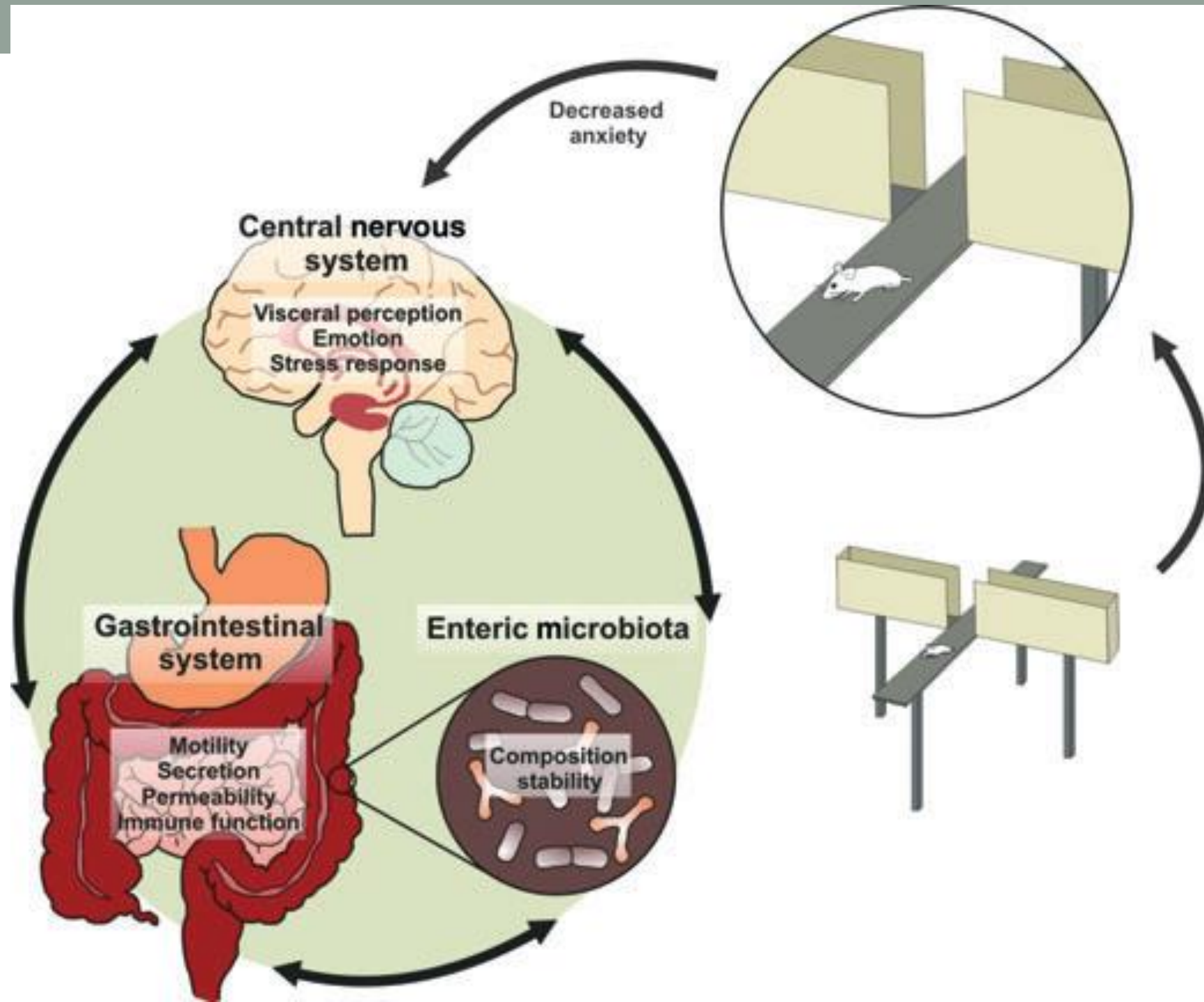
Gut Bacteria and Stress

- Good bacteria developed in early life effects how the stress system develops
- This actually starts in infancy – mice study found that gut microbes affect the development of the HPA axis and therefore the stress response
- This study also indicated that there is a time frame to reverse the lack of development of the system (this was a mouse study)
- Prebiotics and probiotics suppress excess cortisol function and lower anxiety (a symptom of excess cortisol and adrenaline)
- Modulating gut bacteria can affect the stress response – exact mechanism is not known



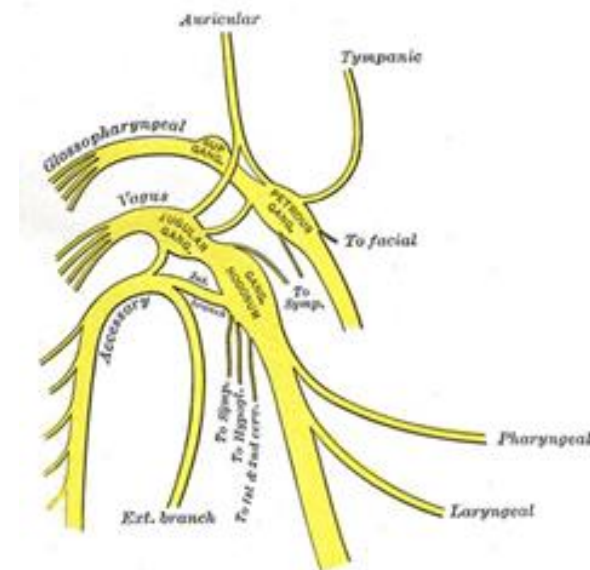
Stress

- Gut bacteria can activate the central nervous system and other neural pathways - can influence stress related behavior
- When dysbiosis is present, it causes an irregular stress response and this means a confused cortisol response
- Mouse research has shown that prolonged stress lowered good bacteria and allowed bad bacteria levels to increase
- Healthy gut flora can modulate the hypersensitivity and leaky gut permeability that comes from chronic exposure to stress.
- Since good gut bacteria can decrease leaky gut and associated inflammation, is this the relationship that links stress with increased inflammation



Brain to Gut

- Stress can influence the gut by:
- Alterating the general physiology of the GI tract
- Making changes to epithelial function
- Making changes to mucin function needed for protecting the lining
- Affect motility
- Changes the manufacture and release of neurotransmitters made in the gut
- Affects inflammation of cells
- The bloodstream is a source of stress related signals



Brain To Gut

- Acute stress is associated with increased parasympathetic output to the small and large intestine and reduced vagal nerve communication to the stomach
- Norepinephrine can stimulate the proliferation of several strains of enteric pathogens
- All of this happens because the vagus nerve send signals to the gut and the gut to the brain or direct communication via the bloodstream
- Further research is need to know which is in control - the brain or the gut



Probiotics

- One study of healthy women showed that after 4 weeks of fermented milk (fermented with *Bifidobacterium animalis* subsp *Lactis*, *Streptococcus thermophiles*, *Lactobacillus bulgaricus*, and *Lactococcus lactis* subsp *Lactis*) brain activity in emotional centres were affected - less reactive
- In another study, 39 CFS sufferers were given 24 billion CFUs of *Lactobacillus casei* or a placebo for four months
- Results showed a significant increase of both *Lactobacillus* and *bifidobacteria* and a significant decrease of anxiety levels

Probiotics

- A recent study had healthy participants take a probiotic daily or a placebo
- There were significant improvements in depression, anger, anxiety, as well as lower levels of cortisol among those taking the probiotic
- Memory and learning are also affected by poor good gut bacteria levels and probiotics have been shown to help
- Probiotics are also being investigated as possible treatment for depression as animal studies have shown a potential benefit – in particular increasing tryptophan levels by bifido bacteria

Prebiotics and Stress

- A study of healthy volunteers took a GOS prebiotic or a placebo each morning for three weeks
- They were given an series of emotional processing tasks
- On one task, those taking the prebiotic did not pay much attention to negative words and were much more responsive to positive words
- Volunteers taking the prebiotic also had lower levels of cortisol in their saliva
- FOS did not show the same results and supports previous studies that GOS is better at stimulating the growth of good bacteria
- The fact that prebiotics can lower cortisol shows that gut microbes continue to play a role in influencing the stress response
- Prebiotics (and probiotics) can play a role in the treatment of mental illness where stress plays a significant role

Adaptagens

- Holy basil help with fighting fatigue and stress; boosts the immune system; and regulates blood sugar, blood pressure and hormone levels.
- Ashwaganda regulates the immune system, eases anxiety and aids the body in lowering cortisol levels.
- Astragalus boosts immunity and balances the effects of stress by increasing anti-stress compounds that our bodies can use to repair and prevent stress-related damage to the body. It may also be able to reduce the ability of stress hormones like cortisol to bind to cell-receptors.



Adaptagens



- Licorice root can increase energy and endurance, boost the immune system, and protect the thymus from being damaged by cortisol, keeps cortisol from being taken out of action and helps prevent progesterone from being converted to cortisol
- Rhodiola a balance to stress-related mental and physical fatigue, combat anxiety, aging. Rhodiola suppresses the production of cortisol and increases levels of stress-resistant proteins. It can normalize patterns of eating and sleeping after stress and protects against oxidative stress, heat stress, radiation and exposure to toxic chemicals. It protects the heart and liver, increases use of oxygen, improves memory, and aid weight loss

Adaptagens



- Cordyceps is a fungus found in caterpillar – helps support recovery from adrenal depletion, aids immune function, improves respiratory capacity and help with physical endurance
- Schizandra stabilizes blood sugar, supports the liver, kidney and the nervous system. Helpful for depression, insomnia, anxiety and support low energy due to adrenal fatigue
- Relora aids sleep and weight loss by lowering cortisol levels and upping DHEA
- Belly fat has four more time the receptors for cortisol

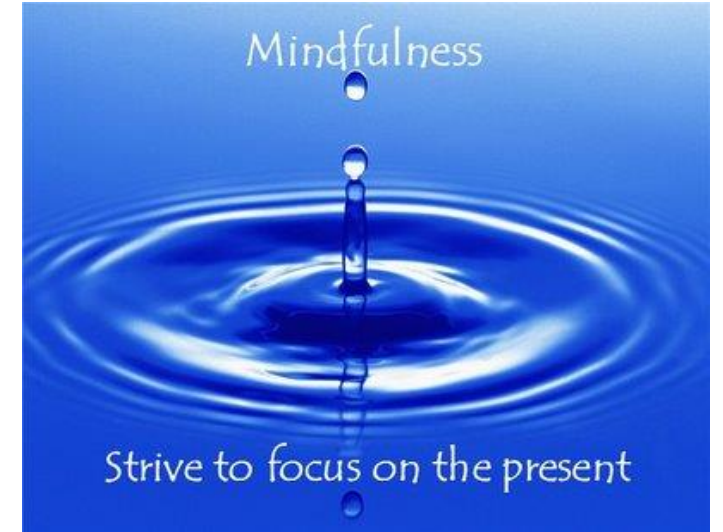
Stress management

- Increased fiber and good bacteria to help correct imbalances in the small intestine, along with the use of digestive enzymes.
- Regular low-intensity aerobic exercise can help to condition your cortisol system to be more fit.
- Stress management skills and stress management nutrition that helps you feel energized yet calmer and more in control.
- Nutrients such as guggulsterones (guggulipids), which help calm down excess bile due to food overload



Lifestyle Suggestions

- Set a regular sleep schedule and make good quality sleep a priority
- Accept you cannot always get everything done that you plan in a day - take the pressure off
- Practice deep breathing especially during times of stress
- Practice mindfulness and meditation
- Mindfulness: Mental state achieved by focusing one's awareness on the present moment, while calmly acknowledging and accepting one's feelings, thoughts, and bodily sensations, used as a therapeutic technique.



In Conclusion

- Stress is a big issue for many people
- Dysbiosis is as well
- Because of the interrelationship between the adrenals, the stress response and the gut – they cannot really be separated
- Therefore – stress issues are always going to include a gut health protocol
- And you cannot ignore stress as a factor for those with gut health
- There is still a lot to be understood but it does not change what we know to do for the gut and for stress