

The Thyroid-Adrenal-Pancreas Connection

(No author named)

The Thyroid-Adrenal-Pancreas Axis

In addition to gastrointestinal and blood sugar disorders, adrenal gland dysfunction is the most commonly seen imbalance in today's society. Adrenal gland imbalances are also one of the major factors that cause thyroid hormone imbalance. Stress from work, relationships, electronics, poor diet choices such as consumption of refined carbohydrates and trans fats, infections, and environmental toxins all contribute to adrenal disorders.

The Adrenal Glands

The adrenal glands are about the size of a walnut and lie on top of the kidneys. The outer adrenal cortex comprises eighty percent of the gland and produces many hormones including cortisol and DHEA from cholesterol. Ninety percent of the cholesterol in the body is made by the liver and only ten percent comes from the diet. Cholesterol converts into the hormone pregnenolone in the adrenal cortex which then converts to cortisol, the stress hormone, or DHEA, the sex hormone source, immune enhancer and anabolic. Cortisol is our "fight or flight" stress hormone. Cortisol slows down digestion, suppresses immune function and raises blood sugar as a survival mechanism when we are under stress. The problem arises when this becomes chronic and over time, elevated cortisol will tear down your body. Cortisol is secreted on a circadian rhythm with highest production in the morning that slowly tapers off as the day progresses. Sleep is when our bodies repair and rejuvenate but high cortisol during sleep will prevent this from happening.

Hormones Secreted by the Adrenal Glands

DHEA

DHEA (dehydroepiandrosterone) is a precursor to estrogens, progesterone and testosterone. DHEA is extremely important for immune system function and anabolic (building up) processes in the body. DHEA levels begin to decline after age thirty-five but cortisol can remain elevated during continuing periods of stress. Low DHEA levels are also found in diseases such as multiple sclerosis, cancer, fibromyalgia, lupus, rheumatoid arthritis, Crohn's, ulcerative colitis and of course, thyroid disorders.

Healthy adrenal glands are required for the conversion of inactive T4 into active T3.

When the adrenals have reached a state of fatigue, they are no longer producing sufficient cortisol or DHEA. This leaves individuals more susceptible to chronic diseases from an inability to compensate for the stresses they encounter on a daily basis. **It is very important to treat the adrenal glands before commencing treatment of the thyroid. Increasing thyroid hormone production while the adrenals are in fatigue can overwhelm the adrenals and lead to further exhaustion. I have found that once the adrenal glands are healthy and the other related system/factors associated with thyroid imbalance are optimized, there is no need to treat the thyroid directly.**

The inner medulla produces adrenalin and noradrenalin also known as norepinephrine and epinephrine. The cortex is under the control of hormones produced in the brain and the medulla is under the control of the nervous system.

Healthy adrenal glands are vital for women who are peri- and post-menopausal. The adrenal glands are responsible for producing the majority of sex hormones in a menopausal woman once the ovaries stop functioning. If the adrenal glands are fatigued and not ready for menopause, there will be an exaggeration of menopausal symptoms such as hot flashes, weight gain, sleep problems, bone loss, mood swings, depression, anxiety, loss of sex drive and vaginal dryness. Healthy adrenals ensure an easy transition into menopause and beyond. A vast majority of the women I see in practice approach menopause with adrenal fatigue leading to severe menopausal symptoms and hormone dysfunction.

Aldosterone

Aldosterone is produced by the cortex and causes sodium absorption and potassium excretion. Low salt diets and high water intake put a major stress on the adrenal glands to retain as much salt as possible as the blood becomes more diluted from the extra water intake. One of the easiest ways to maintain healthy adrenals is to consume a half- teaspoon of unrefined Celtic sea salt every morning with a few glasses of water. It's important to consume half of your bodyweight in ounces of water every day but it must be balanced with salt to remove stress from the adrenal glands.

Cortisol

Cortisol is also produced by the cortex which increases blood sugar when it is low or if the body is under stress. Cortisol will cause glucose production in the liver or it will strip muscle tissue of protein to make glucose. Excess cortisol over long periods of time can increase the risk of diabetes due to prolonged blood sugar elevations.

Adrenaline

Adrenaline produced by the adrenal medulla will also raise blood sugar if there is stress on the body. Adrenaline will also increase fat circulation so that it can be burned as energy. This is not a good scenario for someone who is sitting at a desk and under major stress. Large amounts of fat and sugar floating in the bloodstream should be utilized to run from a saber-toothed tiger which is our built-in survival mechanism. If there is no activity, the excess sugar will be converted into fat and stored mainly around the mid-section, hips and thighs.

The adrenal cortex communicates with the pituitary gland and hypothalamus in the brain. The hypothalamus reads the amount of circulating hormones and tells the pituitary to make hormones that directly tell the cortex to make hormones. This is called the HPA axis or hypothalamic-pituitary-adrenal axis.

All hormones are secreted on a circadian rhythm over a 24-hour period. Cortisol is especially representative of this rhythm as cortisol production is the highest in the early morning and then slowly tapers off as the day progresses. Cortisol levels are lowest at night so that the body can repair itself to the best of its ability. You lose two-thirds of your stored sugar while sleeping and cortisol production ensures balanced blood sugar during the night. If the adrenals are fatigued, you may have trouble staying asleep as the body will make adrenaline to raise blood sugar due to inadequate cortisol production which is enough to wake you up. If your adrenals are in overdrive with too much cortisol production, then you probably have trouble falling asleep. If you are a slow starter in the morning, your

adrenals are probably fatigued and can't make adequate cortisol to raise blood sugar and get you going in the morning.

The adrenals will go through phases of adaptation to stress beginning with elevated cortisol due to the initial stress. In the second stage, the adrenals will begin to use sex hormone precursors to make cortisol and DHEA will drop. The final stage is adrenal exhaustion/fatigue when the adrenals can no longer produce cortisol and DHEA. If you have adrenal gland dysfunction you may have the following symptoms:

- Can't fall asleep
- Can't stay asleep
- Fatigue
- Salt or sugar cravings
- Allergies
- Slow to start in the morning
- Headaches
- Weakened immune system
- Ulcers
- Need to eat to relieve fatigue
- Irritable before meals
- Shaky or lightheaded if meals are missed
- Blurred vision
- Crave caffeine or cigarettes
- Feeling full or bloated
- Dizziness
- Asthma
- Varicose veins
- Hemorrhoids

Remember that the hormone aldosterone made in the adrenal cortex regulates blood volume through sodium retention and potassium excretion. If you have the following symptoms you have low aldosterone levels indicating adrenal gland dysfunction:

- Craving salt
- Fluid retention in the arms and legs
- Pupils do not stay constricted when exposed to light
- Rough or sandpaper tongue
- Excessive urination - up to 15-20 times/day
- Excessive sweating even without activity

Your natural physician will order a salivary hormone profile to measure cortisol production at four different times throughout the day. This allows your physician to observe adrenal gland dysfunction during all parts of the day and will dictate the type of treatment you will receive. Symptoms cannot adequately diagnose if the adrenals are in fatigue or if they are hyperfunctioning. This is why testing is so vital to properly assess adrenal gland function. In addition, it gives a baseline to compare to follow-up testing so treatment can be adjusted accordingly.

Blood sugar is intricately related to adrenal gland function and vice versa. Chronically elevated cortisol levels from adrenal stress will cause insulin receptor insensitivity. This basically means that when insulin binds to cell receptors to allow glucose (blood sugar) entry into the cell, the receptors may not respond which leaves sugar floating in the blood stream. Remember that excess sugar will be converted into fat and stored mainly around the abdomen, hips and thighs. This also puts extra stress on the pancreas to make more insulin to deal with the excess blood sugar which increases the risk of diabetes. As discussed earlier, cortisol is very important for blood sugar stability.

Hypoglycemia is a condition in which there is inadequate cortisol to raise blood sugar into the normal range. We usually see adrenal fatigue and hypoglycemia together. Hypoglycemics develop symptoms of low blood sugar and need to eat something to normalize blood sugar levels. They may feel shaky, irritable, light-headed, fatigued or may crave sugar because their adrenal glands cannot raise blood sugar into the normal range. Once hypoglycemics rejuvenate their adrenal glands, the symptoms will subside. It's important for hypoglycemics to eat frequently throughout the day and not skip meals. Each meal should be a combination of protein, carbohydrates and fats as a low-carb meal or too many carbs will further throw off blood sugar levels.

You may ask which comes first - adrenal dysfunction or blood sugar dysfunction? It doesn't matter because when one starts to become imbalanced so goes the other. This is also important to understand in treatment because both aspects should be addressed at the same time for optimal results.

So how does all this relate to optimal thyroid function? In the chapter on thyroid hormone physiology, we discussed the enzyme that converts inactive T4 (thyroxine) into active T3 (triiodothyronine). Remember that 93 percent of the hormone produced by the thyroid is inactive T4 until it is activated mainly in the liver by an enzyme. Cortisol directly inhibits this enzyme (5'-deiodinase) which converts inactive T4 into active T3. This in part can lead to low T3 levels. In addition, elevated cortisol will cause thyroid hormone receptor insensitivity meaning that even if T3 levels are adequate, they may not be able to bind normally to receptor sites. Cortisol will also increase the production of reverse T3 which is inactive. Cortisol can also lower the levels of protein that binds to thyroid hormone so it can circulate in a stable structure. Iodine, as you know from a previous chapter, is extremely vital to thyroid health but high levels of cortisol will increase the excretion of iodide from the kidney. And finally, elevated cortisol will inhibit TSH (thyroid-stimulating hormone) production by disrupting hypothalamic-pituitary feedback leading to suboptimal TSH production in the range of 1.0-1.5. Has your physician adequately assessed your adrenals before treatment? It is very irresponsible for any physician to treat thyroid hormone dysfunction without thoroughly assessing adrenal gland physiology and of course, blood sugar.

Regarding cortisol's effect on thyroid hormones, Werner and Ingbar's *The Thyroid: A Fundamental and Clinical Text*, (8th edition), states: "Serum TSH, TBG (thyroid-binding protein), T4 and T3 concentrations are slightly decreased, albeit usually within the respective ranges of normal; serum free T4 values are normal."¹¹

As discussed in our chapter on the liver, impaired detoxification can lead to abnormal thyroid function. Again, the adrenals come into play because elevated cortisol inhibits proper liver detoxification. It is sometimes necessary to support liver detoxification pathways while treating the adrenal glands and thyroid to optimize results and metabolize toxins, excess hormones and thyroid-disrupting chemicals. Signs of impaired liver detoxification include nausea, constipation, bloating, lack of response to treatment, acne, acne during menstrual cycle, medication sensitivity, and pale skin upon pressure.

There is also a powerful Adrenal-Gut connection as well. Elevated cortisol levels slowly eat away at the immune system that lines the gastrointestinal (GI) tract. Cortisol also increases inflammation in the GI tract and prevents the cells that line the GI tract from regenerating which increases the risk of ulcers. This leads to increased infections from parasites, yeast, mold, fungi, viruses, and bacteria which further stresses the adrenal glands creating a vicious cycle. Leaky gut is another consequence of chronically elevated cortisol levels which is a condition in which gaps open in the intestinal barrier allowing undigested proteins and toxins to enter the bloodstream uninhibited. This puts a major stress on the body's immune system and can lead to immune dysfunction, adrenal stress, chronic fatigue and thyroid hormone imbalance.

Adrenals that are functioning at a low level tend to exhibit various symptoms and patterns. Adrenal-fatigued people usually have to run on caffeine and sugar throughout the day to keep going. They are dragging out of bed and say, "I need my coffee before I can do anything." This is a sad state because it indicates an extremely unhealthy individual who requires a legal drug just to function. These individuals crave sweets and crash many times throughout the day, especially in the afternoon, and need a "pick me up" such as another cup of coffee or something sweet. This further drives blood sugar and hormone imbalances leading to weight gain, insomnia, fatigue and an underactive thyroid gland. In addition, these people can usually fall asleep without problems but will wake up during the night. This happens because there is inadequate cortisol production to stabilize blood sugar so the adrenals release adrenaline instead which raises blood sugar but is also too stimulatory resulting in waking up and insomnia.

People with adrenal hyperfunctioning usually cannot fall asleep because there is too much cortisol production which has an excitatory effect on the nervous system. There are many possible causes of elevated cortisol that lead to too much cortisol production and eventually adrenal fatigue. The following cause adrenal stress:

Anemia - red blood cells cannot deliver oxygen to body tissues

Blood sugar imbalances

Low cholesterol - statin medications such as Lipitor, Crestor, Zocor, etc.

Infections

Gums

Urinary tract

Gastrointestinal

Mold, yeast or fungus

Lyme Disease/Tick-Borne Infections

Chronic virus

Dehydration - especially in athletes or those who fly frequently (it is important to drink half of bodyweight in ounces of water every day)

Poor dietary habits (skipping meals, high intake of simple carbohydrates, etc.)

Eating foods you are sensitive/allergic to

Leaky gut

Liver detoxification issues

Essential fatty acid deficiencies

Not enough sleep

Over exercise

Emotional stressors (usually severe)

Heavy metals

Autoimmune adrenals

Chronic use of SSRIs (selective serotonin reuptake inhibitors, Prozac, etc.)

Chronic pain

Environmental toxin exposures - damages mitochondria

Surgical menopause

Chronic tissue injury or inflammation (autoimmune condition)

It takes a great deal of time and effort to do the proper detective work to find out why someone is ill. The supplements covered here are meant to complement diet and lifestyle changes. In order for a treatment plan to be successful, it is very important that the following guidelines are adhered to without deviation.

Adrenal stimulants will disrupt your treatment plan and consist of the following:

Inadequate sleep

Eating sugar/simple carbohydrates

Caffeine and decaffeinated beverages

Nicotine

Alcohol

Food allergies

Trans fats (hydrogenated or partially-hydrogenated oils)

Artificial sweeteners
Excess exercise

As long as blood sugar levels are out of balance, it will be extremely difficult to restore proper adrenal function. Practice the following guidelines to ensure stable blood sugar levels:

Always eat breakfast that includes more protein than carbohydrates

Eat every two to three hours

Snack on protein and fat such as nuts, eggs and seeds

Do not drink juice - this includes ALL juices which are nothing more than plant sugar

Consume protein at every meal

Blood sugar imbalances and a condition known as insulin resistance are major factors in optimizing thyroid and adrenal health. Insulin resistance basically means that insulin receptors are no longer able to respond to insulin. Insulin binds to receptors and allows blood sugar to enter cells. With insulin resistance, insulin's effects are negated leaving excess blood sugar. The following symptoms can indicate insulin resistance:

Fatigue
Sugar cravings
Abdominal obesity
High blood pressure
Inability to lose weight
Always feeling hungry
Fatigue after meals
Aches and pains all over
High cholesterol, glucose, and triglycerides
Low HDL ("good" cholesterol)

Remember that impaired liver detoxification can significantly affect optimal thyroid hormone function. Elevated insulin levels will reduce glutathione levels inhibiting the liver's ability to detoxify. This will affect the conversion of inactive T4 into active T3, increase thyroid-disrupting chemicals and may lead to excess estrogen levels which inhibit thyroid hormone function.

Thyroid hormones' main function is to regulate metabolism through the burning of sugar, fat and protein. Insulin resistance prevents adequate sugar transport into the cell decreasing the available fuel for energy production. This puts an increased strain on the thyroid to make more hormone and can eventually lead to hypothyroidism.

We have already discussed the importance of adrenal gland function and its relationship to optimal thyroid health. The following supplements will help to correct adrenal gland dysfunction. It's very important to have the adrenal hormones cortisol and DHEA tested to ensure precise treatment. Adaptogens are compounds that help to normalize the hypothalamic-pituitary-adrenal axis. They will

help adrenals that are in a state of fatigue, high stress or a combination of both. The feedback loop of the HPA axis is key in balancing adrenal hormones, and adaptogens are vital in healing this process.

Supplements That Help Correct Adrenal Gland Dysfunction

Magnolia & Philodendron

Magnolia is a tree native to the rain forests of China. Its bark has been used for a variety of medicinal purposes including the regulation of stress and anxiety. Philodendron grows in northeastern China and Japan. Together, these extracts restore cortisol and DHEA production in the adrenal gland. They bind to stress hormone receptors promoting relaxation and feelings of well-being.

Perilla oil & MCTs

These oils have natural stress-reducing effects. Perilla oil is rich in omega-3 fatty acids which stimulate repair and are anti-inflammatory. MCTs (medium chain triglycerides found in coconut oil) reduce cell acids and help to produce energy in the cell's mitochondria. MCTs are easy to assimilate and metabolize which is extremely important for those with delicate stomachs and impaired absorption.

Ashwagandha

Ashwagandha is an adaptogen that is similar to Panax ginseng. It has the ability to normalize adrenal stress syndromes. Stress responses can have many adverse affects on health and this herb will reduce these effects.

Eleutherococcus

Eleutherococcus senticosus is an adaptogen that supports the HPA axis under times of stress as well as enhance athletic performance. Eleutherococcus will enhance physical work capacity as well as brain function when under stress.

Panax Ginseng

Panax ginseng is also known as Korean ginseng and is an adaptogen. Panax ginseng optimizes the functioning of the HPA axis. It has been shown to enhance physical performance, stamina and energy production. Panax ginseng will shift metabolism into a fat-burning state as opposed to a sugar-burning state due to an increase in oxygen availability for muscles.

Rhodiola

Rhodiola is popular in traditional Eastern European and Asian medical systems. Rhodiola is an adaptogen that has been shown to enhance immune function and brain function. It also has antidepressant properties, protects the heart and protects against cancer. Rhodiola will prevent adrenaline roller coasters due to high stress.

Holy Basil

Holy basil is an adaptogen that reduces cortisol production from stress, supports blood sugar, has antihistamine properties, optimizes the functioning of the HPA axis, improves the integrity of the gastrointestinal mucosal barrier, improves immune function, and enhances athletic performance.

Pantethine (a dimeric form of panthothenic acid, or Vitamin B5)

Pantethine is required for adrenal hormone production. However, it will not over-stimulate cortisol production under times of stress but has the opposite effect.

Licorice (*Glycyrrhiza glabra*)

Licorice contains compounds that increase the half-life of cortisol which removes stress on the adrenal glands to produce more cortisol. It also has been shown to boost the immune system, reduce inflammation and also reduce/minimize allergic responses. Licorice is antibacterial and antiviral. **Due to estrogen's negative effect on thyroid function, licorice is of great benefit because it helps normalize estrogen metabolism.**

Pregnenolone

Pregnenolone is the "mother of all hormones" and is made from cholesterol in the adrenal gland. Pregnenolone converts into cortisol, DHEA, testosterone, estrogen and progesterone. Pregnenolone is a powerful antioxidant and has been shown to boost mood, improve memory and optimize brain function.

DHEA

DHEA is made by the adrenal glands and will convert into estrogen and testosterone. In men, it will mainly convert into estrogen and in women, DHEA will mainly convert into testosterone. DHEA has its own effects including resensitizing insulin receptors, boosting the immune system, preventing bone loss, enhancing memory, and lowering cholesterol. When under stress, the body will make cortisol at the expense of DHEA.

Phosphatidylserine

Phosphatidylserine's greatest benefit is its ability to lower cortisol levels by optimizing the brain's relationship with the adrenal glands. After only ten days of high doses of PS, research has shown that excessive cortisol levels can be decreased in healthy men. PS has also been shown to enhance brain function and memory, decrease anxiety and depression, improve mood, and enhance metabolism. It is also an antioxidant. It is very difficult for the body to make PS as it requires many nutrients for production. Supplementation is vital for optimizing adrenal function so cortisol cannot have its negative effects on the body and the thyroid.

Supplements that Balance Blood Sugar

Blood sugar imbalances will greatly influence the ability of your thyroid to function optimally. The following supplements are vital in balancing blood sugar.

Huckleberry/Bilberry (*Vaccinium myrtillus*)

The extract from the leaves of this plant has been shown to lower blood sugar levels and has been used traditionally to treat diabetes.

Galega Officinalis (French lilac)

This plant has been utilized since the Middle Ages in the treatment of diabetes. French lilac lowers blood sugar by decreasing insulin resistance. Prescription medications for blood sugar control such as Metformin are derived from the active ingredients in French lilac.

Gymnema sylvestre

Gymnema sylvestre has been shown to regenerate the beta cells in the pancreas that produce insulin. This herb will enhance the effects of insulin, reduce fasting blood sugar, decrease the need for insulin and help with insulin resistance. It will not cause a state of hypoglycemia, however.

Chromium

Chromium stabilizes blood sugar and insulin levels after meals. It will also ensure optimal delivery of blood sugar into your cells. Deficiencies in this nutrient can lead to insulin resistance, high cholesterol and abnormalities in sugar's ability to bind to red blood cells.

Zinc

Zinc's role in blood sugar management includes optimizing insulin metabolism, protecting insulin-producing beta cells of the pancreas and improving insulin sensitivity which ensures optimal uptake of sugar into your cells.

Vanadium

Vanadium is very important for insulin resistance by improving transport of sugar into your cells due to its insulin-like effects on cell receptors.

Alpha lipoic acid (ALA)

ALA is another important nutrient for insulin resistance and is also a strong antioxidant. ALA increases energy production by your cells, optimizes sugar metabolism and lowers lactic acid levels.

Vitamin E

Vitamin E should not be taken in its alpha tocopherol form. Mixed tocopherols including gamma and delta tocopherol are the preferred form of delivery. Vitamin E improves insulin sensitivity, lowers blood fats, is a powerful antioxidant and lowers the so-called "bad" LDL cholesterol.

Biotin

Biotin is important in supporting the liver's utilization of sugar. This nutrient will enhance insulin's effects as well as lower blood sugar levels after meals.

Magnesium

Entire books have been written on the king of minerals. Magnesium is involved in approximately 350 reactions in the body and deficiencies in our society are rampant. Magnesium deficiency will lead to insulin resistance and abnormal sugar metabolism. Magnesium appears to enhance insulin secretion by the pancreas.

L-carnitine

L-carnitine is a di-peptide compound that shuttles fatty acids in the cell to be burned as energy. Carnitine has similar effects on blood sugar by supporting sugar transport into cells.