

BLOOD SUGAR

THE HIDDEN FACTOR IN HEALTH

Disorders in blood sugar balance disrupt all aspects of human physiology. To understand this, we must keep in mind that our bodies primarily produce their energy from converting glucose (blood sugar) into ATP. If this system is not working properly, health cannot be achieved.

Blood sugar disorders are extraordinarily common in the U.S. today. Much (but not all) of the problem can be placed on the Standard American Diet that is high in saturated fats and sugars while being low in essential fatty acids and fiber. In the past decade, there has been an explosion in the number of cases of diabetes, which only figures to grow in the decades ahead.

INSULIN

Insulin is a protein hormone secreted by the pancreas. Its primary job is to stimulate the uptake of glucose from our blood into our cells. Cell membranes have a lipid layer thru which glucose cannot pass on its own. It has to be carried across with the assistance of insulin. Once inside the cells, glucose can be used for energy. All foods are ultimately converted into glucose. An increase of glucose in the bloodstream stimulates the release of more insulin.

Insulin promotes the production of glycogen, which is the form that glucose is stored in, for later use. Insulin also promotes the formation of lipids, triglyceride and protein.

Alterations in insulin are responsible for causing metabolic disorders such as hypoglycemia and diabetes.

HYPOGLYCEMIA

If the pancreas overreacts to a sudden surge in glucose, it will release excess insulin which will subsequently cause a drop in blood sugar. This drop is known as reactive hypoglycemia.

The key blood markers that we are looking at and the values we are monitoring for hypoglycemia are:

- Fasting Glucose < 85
- LDH < 140 (LDH levels go down when there is insufficient glucose to produce it)

The following are the key symptoms of hypoglycemia:

- Crave sweets during the day
- Irritable if meals are missed
- Depend on coffee (or other stimulants) to keep yourself going or to get started
- Get lightheaded if meals are missed
- Eating relieves fatigue
- Feel shaky, jittery between meals
- Agitated, easily upset; Nervous
- Poor memory, forgetful
- Blurred vision

After eating, a hypoglycemic usually feels much better (more clear-headed and better energy). As strange as this may sound, this is a clear sign of blood sugar imbalance. Eating should only satiate hunger, not improve energy, well-being or cognitive status.

In more advanced cases of hypoglycemia, a person actually loses the ability to feel hunger as their hypothalamic appetite centers dis-coordinate. The person only realizes they need to eat when they lose function (like getting shaky or unable to think clearly). This is definitely not normal and absolutely needs to be taken care of.

There are two main mechanisms that drive hypoglycemia. The first and most important is diet and lifestyle. If a person tends to skip meals and has a diet rich in simple sugars (meals built around things like candy bars, fruit-filled yogurt, juices, coffee drinks, soda and pastry) they will not likely be making sufficient glycogen. If eating habits are the culprit and blood markers and/or symptoms of hypoglycemia are present, diet is the place to begin treatment. These problems cannot be fixed with supplements alone.

Here are some dietary suggestions to help keep blood sugar balanced. In addition, we have provided a complete Hypoglycemia Food List:

- Eat protein at breakfast. From a blood sugar standpoint, breakfast is the most important meal of the day. Some suggestions include: eggs, turkey bacon or sausage, left-over chicken or salmon, seeds, nuts and beans. Minimize high-glycemic foods like fruit juices, muffins and donuts, processed cereals, potatoes, etc.
- Limit high glyceemic foods throughout the day. These are the foods listed in 'Red' on the food list.
- Eat some form of protein with every meal.
- Eat frequent high-quality snacks and meals. This can include any 'Green' foods that are listed. You will know you have gone too long between eating if you develop any symptoms of hypoglycemia. This situation needs to be absolutely avoided, as the surge in insulin released by the pancreas to meet the blood sugar deficit can cause a cascade of bio-chemical imbalances that can last for days.
- Emphasize 'Green' foods on the list. These are ideal foods to eat at every meal.

The second mechanism that drives hypoglycemia is seen in a person who is eating a well-balanced diet that supports good blood sugar levels, yet has abnormal blood markers and/or relevant symptomology. This person is usually making sufficient glycogen but is unable to convert it into glucose. This conversion is driven by the adrenal hormone cortisol. Insufficient cortisol levels occur when the adrenal is in a state of fatigue or exhaustion. Since diet is not the key issue with these patients, we need to look at other aspects of lifestyle (like stress factors related to work, finances, relationships, over-exercise, insufficient sleep, etc.) or some other factor that is weakening adrenal function (like chronic infections or chemical challenges).

We will discuss this phenomenon in more detail later in this paper.

INSULIN RESISTANCE

Insulin Resistance is a syndrome in which glucose cannot get into the cell very efficiently. Remember that insulin is produced by the pancreas and helps to carry glucose across the cell membrane and into the cell for conversion into energy.

The key factors leading to insulin resistance are over-eating (of diet high in sugars and saturated fats) and lack of exercise on an on-going basis. With a high caloric, high sugar diet, a person is getting all this glucose circulating in their blood stream. This is not a problem as long as they are getting sufficient exercise to burn the calories and sugars.

However, if a person does not get sufficient exercise, the high levels of circulating glucose will trigger insulin surges (as the body tries to get glucose into the cell), that can lead to a situation in which our cells become less and less responsive to insulin as the cell receptor sites stop responding. This condition, known as insulin resistance, is a pre-cursor to diabetes.

The key blood markers that we are looking at and the values we are monitoring for insulin resistance are:

- Fasting Glucose > 99
- Total Cholesterol > 199
- Triglycerides > 100

The following are the key symptoms of insulin resistance:

- Fatigue after meals (this symptom is the most important indication of insulin resistance)
- Crave sweets during the day
- Eating sweets does not relieve cravings for sugar
- Must have sweets after meals
- Waist girth is equal or larger than hip girth
- Frequent urination
- Increased thirst and appetite
- Difficulty losing weight

These people are often tired, because they can't get glucose into their cells. They feel especially tired after they eat because glucose demands are not being met at a cellular level.

The glucose, however, needs to go somewhere. Part of the circulating glucose gets immediately attacked by free radicals which eventually destroy cell membranes, neurotransmitters, hormones and brain tissue. A lot of the remaining glucose will convert into triglycerides, in the liver, and be stored as body fat. This conversion takes a great deal of energy and utilizes large amounts of ATP, also feeding the fatigue.

As the insulin resistance pattern progresses and glucose levels continue to rise, we begin to see total cholesterol and LDL cholesterol go up and HDL cholesterol go down. When we begin to see triglycerides rise above cholesterol we have moved into a condition referred to as Metabolic Syndrome. As the condition progresses further, we move into diabetes (which the American Diabetic Association describes as fasting glucose above 127).

Here are some dietary and lifestyle suggestions to help prevent the insulin surges that lead to insulin resistance. In addition, we have provided a complete Insulin Resistance Food List:

- Limit intake of starchy, carbohydrate foods like cakes, cookies, pastry, breads, noodles, chips, crackers and potatoes.

- Decrease intake of sugars, alcohol and high saturated fat foods (listed in 'Red' on the food list.
- Limit intake of all the foods listed in 'Red' on the food list.
- Emphasize 'Green' foods on the list. These are ideal foods to eat at every meal.
- Get sufficient aerobic exercise on a regular basis. This includes activities like walking, jogging, swimming, dancing, etc.

ADDITIONAL BLOOD MARKERS

As you can glean from the above discussion, a whole series of factors are at play in blood sugar imbalances. Determination of blood sugar status is not always clear cut. In addition to looking at the symptom picture and above listed blood markers, we also consider the following markers as an indication of glucose imbalance. Readings outside of the functional range for the following blood markers are indicative of non-specific glucose imbalances; that is, they can be indicative of either hypoglycemia or insulin resistance.

- Sodium < 135 or > 140
- Potassium < 4.0 or > 4.5
- Carbon Dioxide < 25
- Anion Gap > 12

The Relation of the Adrenals to Blood Sugar

Adrenal production of the hormone cortisol is crucial to the conversion of glycogen into glucose and the utilization of glucose within the cell in its conversion to energy. The constant demand of elevated glucose (from diet) can cause an over-response by the adrenals which, in time, can lead to an inability of the adrenals to produce sufficient levels of cortisol.

- This over-response is referred to as adrenal hyper-function which is most closely correlated to the repetitive insulin surges that result in insulin resistance.
- The inability of the adrenals to produce sufficient cortisol to meet the body's needs is called adrenal hypo-function. This state of adrenal fatigue or exhaustion is mostly associated with hypoglycemia.

These are not hard and fast rules though as:

1. It is possible for a person to have both hypoglycemia and insulin resistance.
2. It is possible for a person to have high glucose levels while the adrenals are burned out from long-term over stimulation.

For these reasons (and more), it is important to consider, along with blood studies and examination of the blood sugar symptom picture, a salivary panel to measure cortisol production throughout the day.

The levels of cortisol production as well as the rhythm of the production throughout the day can provide much greater clarity to the metabolic condition. It is entirely possible, for instance, that disturbances in blood sugar and cortisol production can be specific to certain times of the day. This can also be seen in many of the following symptoms.

The following are the key symptoms of adrenal hypo-function:

- Cannot stay asleep
- Crave salt
- Slow starter in the morning
- Afternoon fatigue
- Dizziness when standing up quickly
- Afternoon headaches
- Headaches with exertion or stress
- Weak nails

The following are the key symptoms of adrenal hyper-function:

- Cannot fall asleep
- Perspire easily
- Under high amounts of stress
- Wake up tired after 6 or more hours of sleep
- Excessive perspiration or perspiration with little or no activity

You will have noticed that sleep conditions are listed at the top of both categories. These symptoms are often crucial to forming an accurate diagnosis of blood sugar disorders. The main cause for the type of insomnia when a person cannot stay asleep is poor adrenal function. In this condition, the overnight levels of cortisol are insufficient to convert adequate amounts of glycogen into glucose to meet the energy demands of the brain. This causes functional hypoglycemia during the night.

The inability to fall asleep is usually caused by elevated cortisol levels at bedtime wherein the normal rhythm of cortisol production is out of balance. This type of imbalance is usually due to both dietary factors and lifestyle factors. In addition to proper diet, it is often valuable to significantly ramp down evening activity so that the nervous system has the opportunity to unwind. Specific supplementation can also be very beneficial and general recommendations for this can be found in my article on Brain Chemistry.

Only when adrenal function and its normal rhythms are re-established, and when the blood sugar issues are brought into functional balance, can proper sleep patterns be re-established.

As discussed earlier in this paper, there can often be hidden factors (apart from diet) that are causing the adrenals to function at chronic, sub-optimal levels. These factors can include chronic stress, chronic infections, food allergies, dental infections, chemical and/metal toxicity and more. The satisfactory resolution of adrenal (and blood sugar) syndromes must address any existing factors that may exist.

THE EFFECTS OF INSULIN SURGING

Insulin Surges begin a wind-up of the Neuro-Endocrine-Immune System that leads to a series of vicious cycles that are described below.

- Insulin Resistance leads to Insulin Surges as the receptor sites become less sensitive to insulin.
- Insulin surges drive the Hypothalamic-Pituitary-Adrenal Axis (HPA).
- Insulin is a stimulant to the adrenal glands and drives the production of cortisol

- Cortisol actually causes increased insulin resistance.
- Insulin resistance (as we have seen earlier) drives cortisol over-production.
- In males, insulin surges stimulate an enzyme called aromatase which over-stimulates the conversion of testosterone into estrogens. This leads to Andropause symptoms of low libido, depression, weight gain, hair loss, etc.
- In females, insulin surges stimulate an enzyme called 17,20 Lyase which converts hormones like DHEA into testosterone. These often huge surges of testosterone lead to symptoms like hair loss, mustache, fatigue and depression. Estradiol levels will also go up from insulin stimulation of the ovaries causing a suppression of FSH (which matures the eggs in menstruating women). This leads to infertility (and is, in fact, the leading cause of infertility in the US).
- Elevated testosterone in women and elevated estrogens in men lead to (further) insulin resistance.
- Chronic stress/cortisol/insulin surges stimulate a messenger protein called Interleukin-6 which impacts the antibody producing aspect of the immune system causing it to become overzealous. This leads to the development of food and chemical sensitivities.
- Chronic stress/cortisol/insulin response depresses the Secretory IgA count. This is the immunoglobulin that maintains the gut, lung and brain barrier systems. Over time, this leads to the loss of the gut mucosa (causing leaky gut) and the lung endothelium (causing reduced respiratory immuno-protection) along with the loss of the blood-brain barrier. These conditions lead to even greater food and chemical sensitivities as foreign proteins pass these barriers unimpeded. This leads to severe inflammation which further drives the stress response (further feeding all the issues listed above).
- Hormone detoxification, which takes place in the liver, becomes compromised. The liver's primary function is to break down fat soluble substances into water soluble substances so they can be eliminated. Hormones are fat soluble, so the body can't eliminate them until they become water soluble. The main hormone detoxification pathway is called glucuronidation. This is a very simple bio-chemical step that requires the compound glucuronic acid, which is made from glucose. Glucose has to get into the cell for glucuronidation to occur. With insulin resistance, this does not occur effectively, and hormone detoxification breaks down. Thus, it becomes very difficult to clear cortisol, insulin, testosterone and estrogens which are already high.

CONCLUSION

I hope this article gives you an idea of both the importance and complexity of blood sugar issues and what can occur in the body when blood sugar goes out of balance. It is a multifaceted process affecting every part of our physiology. Balancing blood sugar is absolutely essential for maintaining and/or reclaiming good health.