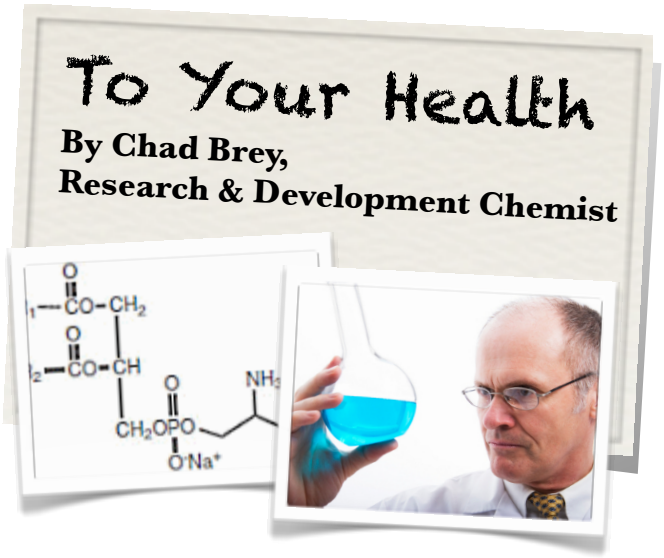
Glucose Support



There is an issue facing millions of people across the country and has been so for many years now*....Blood Sugar. Food goes in, food gets turned into sugar, sugar goes into bloodstream, bloodstream shuttles it into tissues, tissues use it for energy. Simple right? Well, maybe not so much. Blood sugar disorders ranging from diabetes to hypoglycemia have plagued the population and do not seem to be getting any better. If the problem is diet, lack of exercise, genetics, etc., then what is the solution? Perhaps what can be found in nature's medicine cabinet can be a small part of that solution.*

Lagerstroemia speciosa extract
Native to tropical regions of south Asia, the banaba leaf has a history of various medicinal uses. One such use is the treatment of diabetes. In fact, two of the extract's constituents, corosolic acid and ellagitannins, have been shown to lower blood sugar by enhancing cellular uptake of glucose, impairing the duodenal hydrolysis of sucrose and other starches, decreasing gluconeogenesis, and even regulating lipid metabolism[1]. Another study suggested the use of banaba extract for the treatment of hyperglycemia and obesity in type II diabetic sufferers[2] after observing similar mechanisms. Needless to say, banaba leaf extract seems to do its job in controlling blood sugar by multiple routes.

Bitter melon
Momordica charantia, also related to honeydew and cantaloupe, contains terpenoids that also enhance the insulin's receptor to insulin in a manner similar to that of chromium[3]. Bitter melon also contains other interesting phytochemicals, namely charantin and vicine, that have shown to *significantly* reduce blood glucose levels among type II diabetic patients[4] as well as increasing cellular uptake of glucose and improved glucose tolerance in others[5]. Just another example of a sugar-managing tropical fruit.

Gymnema sylvestre
Gymnema sylvestre is another tropical forest herb that has been used for treating elevated blood sugar for centuries. The gymnemic acids found in the herbal extract have interesting effects on the way the tongue perceives sugar. Extracts from the herb actually reduce the taste of sugar when placed in the mouth[6], in which the gymnemic acids seem to do this by blocking sugar receptors on the tongue[7]. However, Gymnema isn't just for ridding our sugar cravings, the sapponins in the extract have also displayed anti-diabetic properties – namely enhancing regeneration of β-cells in the pancreas[8] increasing insulin secretion.

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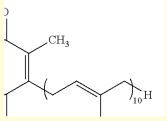

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Milk Thistle
The extract of Silybum marianum contains an assortment of fatty acids as well as a group of flavonolignans called silymarin. The fatty acids found in milk thistle have their place and duties for a number of different health benefits in humans, but what makes milk thistle extract unique is the silymarin it contains. The phytochemicals found in silymarin have been shown in studies, among other things, to aid in the treatment of type II diabetes[9]. In particular, silymarin seems to not only decrease levels of serum glucose but also has beneficial effects on serum lipids and oxidative stress levels[10]. Although the precise mechanisms are unclear as to how it performs its actions, milk thistle extract would definitely be advantageous to add to one's glucose control regime.

Vanadium
Vanadyl sulfate is one of the most stable forms of vanadium and is what is most widely used in the laboratory and in our bodies. Vanadium is most widely known for its usefulness in lowering blood sugar, in fact research indicates that it has shown to be very effective in improving glucose tolerance and insulin sensitivity in type II diabetic patients[11]. The way vanadium does its magic to lower serum glucose is similar to chromium with a slight twist. The vanadium ions actually act upon the glucose transport vessel itself to promote its migration, thus initiating glucose uptake from the bloodstream[12]. So in this sense, vanadyl sulfate and chromium could act as the dynamic duo for enhancing insulin sensitivity.

Alpha lipoic
Also called thioctic acid, α-lipoic acid (ALA) plays a variety of biological roles in nature. One aspect to be noted however is the possible forms that ALA comes in when synthesized. It can exist as either the *R* form or *S* form, the *R* enantiomer being more biologically favorable[13,14]. Although it does wonders as an antioxidant, one role that it plays in humans that is of particular interest is blood glucose. Through its antioxidant action ALA has proven itself to be very advantageous for lowering blood glucose levels in diabetic patients[15]. One of the routes in which it does this is by mimicking the actions of insulin – initiating the translocation of GLUT1 and GLUT4 glucose transport proteins for cellular uptake of glucose[16]. This is how cells "ingest" glucose when it comes knocking on the front door of the target cell's surface.

Citrus bioflavanoids
The class of anthoxanthins found in citrus fruits, often called Vitamin P, have been known to have an extremely wide variety of health benefits. With well documented in vitro and in vivo studies performed all across the globe, these interesting little fruit molecules have shown what they can do in human health ranging anywhere from antioxidant properties to cancer reduction. Of interest in the realm of normalizing blood sugar levels, it is exciting to know that the bioflavonoids found in citrus fruits have been shown to hold some promise in the management of diabetes mellitus[17]. One way that these bioflavonoids seem to do this is by postprandial glycemic control, in particular the inhibition of certain digestive enzymes within the intestinal track, namely α-amylase and α-glucosidase[18] (carbohydrate and sugar-hydrolyzing enzymes). So in this sense, you can have your cake and eat it too... just not digest it.

Jerusalem artichoke extract
This exotically named extract is a species of sunflower that contains a high amount of an oligosaccharide called fructan. These sugars, especially the ones found in Jerusalem artichoke, have the ability to aid in sugar metabolism. Studies show that it can enhance glucose tolerance in different ways, namely by reversing insulin resistance and enhancing β-cell function[19]. The main cell line in the pancreas that is responsible for production and secretion of insulin are the beta cells. This is why "enhancing beta cell function" would be of utmost importance for blood glucose management. The same study demonstrated an increase in beta cell morphometry and volume, showing the *how* of enhancing beta cell function. So this extract seems to have a dual role in its mechanism of glucose control in humans.

Vitamin E
The family of tocopherols play many beneficial roles in the human body. Besides the fact that it is one of the most widely known antioxidants, vitamin E plays a role in reducing arterial plaques, inflammation, and even influencing blood sugar homeostasis. Studies even suggest that there seems to be a correlation between blood glucose levels and reduced forms of glutathione. In fact, pharmacological doses of vitamin E actually enhance red blood cell levels of reduced glutathione[1],which in turn has shown a significant increase in blood glucose disposal. Interestingly, hypertension as well as type II diabetes and aging, is associated with the production of free radicals (in which vitamin E is

the scavenger and quencher of), a rise in plasma fasting radicals, hyperinsulinemia, and insulin resistance[20-24]. This tends to explain why the antioxidant effects of vitamin E plays such a direct role in maintaining healthy blood sugar levels.

Magnesium
Typically when one thinks of magnesium in nutrition, blood sugar is usually not the first thing that pops into one's mind. We know that magnesium helps with electrolyte balance, muscle relaxation, etc. However, isn't it interesting to know that ionic magnesium plays a direct role in blood sugar regulation? Although the exact mechanisms are still not clearly understood, it is now known that magnesium acts as a partner with glutathione to increase insulin sensitivity and blood glucose regulation[25]. What else is interesting is that there is evidence that shows the direct correlation to magnesium deficiency and both the secretion of insulin into the bloodstream and peripheral tissues' sensitivity to insulin[26]. So it looks like magnesium plays a pivotal role in blood sugar regulation, both by itself and as part of a team.

Zinc
Zinc is another mineral that seems to be well known for preventing colds and protecting skin, but maybe not so much in the department of blood sugar. It was not until recently that zinc had displayed its relationship with glucose metabolism. Research points out the role of zinc in blood sugar metabolism by showing evidence of having insulin-like behavior on certain cells, including both lipogenesis and glucose transport[27]. Zinc is just one of the many minerals that play a direct role in regulating blood sugar levels.

Manganese
Elemental Mn is a very biologically important trace mineral that, for the most part, performs its many jobs by playing the role of cofactor in various enzymes throughout the body. It is widely known through many studies that there are lower levels of serum and tissue Mn in diabetic patients than non diabetic patients, and the reason has to do with sugar transport. It seems clear now that Mn plays an active role in glucose transport and metabolism, especially within adipocytes[28]. Other studies suggest Mn's role in the actual secretion of insulin leading to carbohydrate metabolism[29]. So it seems that this trace element has a large job to do – get sugar to where it needs to go.

Chromium
One of the most widely known supplements since the late 80's that has grown in popularity for blood sugar control is trivalent chromium. Usually in the form of picolinate or polynicotinate, chromium has hogged the spotlight in the area of glucose tolerance for many years. Chromium (when chelated to the aforementioned organic acids) plays one of the most direct roles in glucose transport in all of natural supplements. It does this through insulin binding. Insulin must bind to the target cell's surface insulin receptors to initiate a signal to the inside of that cell, telling the cell to recruit sugar vessels. Chromium acts by enhancing the binding of the insulin molecule to its specific receptor[30] as well as forming complexes with other proteins to dramatically increase the sensitivity of insulin receptors to insulin[31].
We can think of chromium as the "insulin super sensitizer".

All in all, there are a variety of different herbal extracts, vitamins, and minerals that seem to improve sugar homeostasis in humans. So, whether taken by themselves or along with others, unlocking key ingredients that manage blood sugar seems to definitely be a "sweet" deal.

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