The Insulin Fat-Loss Connection
Supplementary Materials & Resources

Disclaimer: Information contained in this book is not intended to provide treatment for any disease, disability, or medical condition, or to substitute for personal, individual medical care from a qualified physician. The reader is advised to check with his or her own physician prior to following any recommendations given in this book or any of its references. Every attempt has been made to provide accurate information. However, the reader is on notice that the information in this book has been compiled and written to address general principles. It is not intended as specific advice for any individual. Thus, the personal application of any information provided herein is the sole responsibility of the user and, if implemented, would be applied at his or her own risk.

Blood sugar and insulin issue are among the most prevalent and physiologically damaging conditions today. The negative impacts of chronically elevated insulin, including transient insulin surges, cause damage to virtually every bodily system leading to everything from coronary and atherosclerotic damage, obesity and weight control issues, neurological symptoms, hormonal dysregulation, hepatic (liver) dysfunction, fatigue and mitochondrial issues, inflammation, and immune system dysfunction, to name a few.

If optimal health and weight loss are desired, it is highly recommended that individuals seek to evaluate and correct any potential issues in this area.

**SUMMARY**

The spectrum of blood sugar and insulin imbalances are as follows:

**Early Phase**

The early phase is typically cased by elevations in blood sugar and therefore an excessive insulin response. This results on a blood chemistry as low blood sugar, and can result in symptoms of shakiness, lightheadness and agitation between meals, as well as afternoon sugar cravings, and feeling energized after meals.
In the very early phases of insulin resistance insulin is being produced in sufficient amounts and the insulin receptor sites are functioning well. Therefore glucose levels will tend to be low when measured due to the relative efficiency of the entire blood sugar management system.

**Blood chemistry readings during the Early Phases may indicate:**

- Glucose readings below 85mg/dL
- LDH (lactodehydrogenase) below 140 IU/L
- Elevated insulin and/or C-Peptide

**Glucose tolerance test may indicate:**

- High-normal glucose 20-40 minutes after drinking the glucose solution, followed by excessively low glucose (i.e. 20-30 points below the first baseline reading) one to two hours after the glucose solution.

**What To Do:** Because insulin and insulin receptor are still functional during this phase, the key to correcting the hypoglycemic tendencies is to better manage blood sugar levels through proper dietary habits. Following healthy dietary strategies and a consistent exercise program is of the utmost importance during this phase. Nutritional supplementation may be helpful, but is generally unnecessary if proper diet, lifestyle and exercise prescriptions are followed.

Individuals in this phase must also consider evaluating adrenal and other relevant hormones. Reason being, there are four hormones designed to elevate blood sugar when it is too low for optimal body function – cortisol, epinephrine, glucagon and growth hormone. Anyone experiencing periods of low blood sugar must consider deficiencies in any of these hormones, the most common deficiency being cortisol, and it is therefore recommended to consider evaluating cortisol levels as well.

**Intermediate Phase**

The intermediate phase is often characterized by normal blood sugar values on a blood chemistry lab, but it is in fact this is beginning of insulin resistance due to insulin receptor malfunction. In the previous phase, insulin level were so high, it started creating damage to the insulin receptors. When the insulin receptors become damaged, the same amount of insulin will no longer bring as much glucose into cells. Therefore, while elevations in
blood sugar still drives this phase, because the body lacks the sensitivity to insulin, less glucose gets into the cells than in the prior phase and therefore may be normal on blood sugar testing. Insulin will likely remain elevated, but will not be as efficient in getting glucose into cells.

Blood chemistry values may indicate:

- Glucose between 85-100mg/dL
- Cholesterol/Triglyceride ratio less than 2:1
- HDL less than 55mg/dL
- Hemoglobin A1C above 5.6%
- Elevated insulin and/or C-Peptide

**What To Do:** Similar diet, exercise and lifestyle recommendations apply as the previous phase. However, additional nutritional supplementation will likely be helpful during the Intermediate Phase. Also, consider exploration into food sensivities, as well as other sources of stress, as they can sometimes contribute to elevated blood sugar levels.

**Late Phase**

The final phase of blood sugar and insulin dysregulation are typically characterized by elevations of glucose levels on a blood chemistry test. This phase will often have relatively significant insulin receptor dysfunction and therefore elevations in blood sugar due to the inability to get glucose into cells. More advanced stages of insulin resistance will likely show normal or even low insulin and C-peptide levels due to the pancreas’ inability to produce them adequately.

Blood chemistry values may indicate:

- Glucose above 100mg/dL
- Cholesterol/Triglyceride ratio close to 1:1
- HDL less than 55mg/dL
- Elevated LDL above the laboratory reference range
- Hemoglobin A1C above 5.6%
- Normal or low insulin and/or C-Peptide
- Elevated uric acid
What To Do: To prevent further dysfunction, individuals in this phase must employ a rigorous diet and exercise program for a minimum of six months to help correct blood sugar and insulin handling. Nutritional supplementation is recommended during this phase, as is addressing food sensitivities, areas of stress, and gut dysfunction. Each of these areas may be contributing to the underlying blood sugar dysregulation.

TESTING

Testing is necessary to fully evaluate blood sugar and insulin dyregulation. The following are tests are recommended to most accurately evaluate possible blood sugar and insulin mishandling:

1. Blood chemistry
   a. Lipid panel (cholesterol, HDL, LDL, triglycerides)
      i. The closer the cholesterol/triglyceride ratio is to a 1:1 ratio, the more likely a blood sugar issue exists; ideally it will be a 2:1 ratio. Additionally, high LDL and low HDL may also indicate a trend towards insulin resistance.
   b. Glucose
      i. Glucose is not an accurate marker by itself, but in conjunction with other markers can be valuable. When fasting glucose is above 100mg/dL, this can indicate a tendency towards insulin resistance. Along with an elevated Hemoglobin A1C and cholesterol/triglyceride ratio close to 1:1, elevated fasting glucose further indicates the likelihood of insulin resistance.
      ii. Glucose below 85mg/dL, along with an LDH below 140 IU/L, may indicate a tendency towards reactive hypoglycemia.
   c. Hemoglobin A1C
      i. Above 5.6% can indicate a general trend towards insulin resistance. The higher the value, the more likely there is blood sugar and insulin dysregulation.
   d. Insulin
      i. As mentioned in the video, this is not a valuable marker due to its short half-life. However, in conjunction with other markers, including Cpeptide, insulin levels can offer additional information.
      ii. Elevated insulin often points to early signs of insulin resistance and possibly a causative factor of reactive hypoglycemia. If insulin is low,
this may be an indication of poor pancreatic production and late stage insulin resistance.

e. C-peptide
i. C-Peptide is produced by the pancreas in a similar quantity as insulin but has a longer half-life than insulin and is therefore a more stable and reliable marker.

ii. If C-Peptide is elevated, there is an increased chance of early insulin resistance and reactive hypoglycemia. If C-Peptide is low, along with elevated glucose and/or Hemoglobin A1C, there is an increased chance of late stage insulin resistance.

2. Glucose tolerance test*

a. This is a valuable test that can further assist in the evaluation of blood sugar and insulin issues. The test is performed as follows:

i. On a day of low planned activity (i.e. the weekend) take your fasting morning glucose upon arising.*

ii. Shortly afterward, drink approximately 75g of high glycemic carbohydrates. This can be accomplished by approximately 2 cups (16oz) of grape juice, or the glucose tolerance test drink found at many local drug stores or pharmacies.

iii. **Twenty minutes** after the glucose drink, perform another glucose reading using your glucometer and record the results.

iv. **Forty minutes** after the glucose drink, perform another glucose reading using your glucometer and record the results.

v. **Sixty minutes** after the glucose drink, perform another glucose reading using your glucometer and record the results.

vi. **Ninety minutes** after the glucose drink, perform another glucose reading using your glucometer and record the results.

vii. **One hundred and twenty minutes** after the glucose drink, take your final glucose reading using your glucometer and record the results.

*It is critical that you perform absolutely no physical activities during this test and therefore merely sit to read a book or watch television for the duration of this test. You may only get up to use the restroom during the test.

Interpretation of the result is briefly discussed in the accompanying video. It can be helpful to view your results using a line graph for a visual representation of your findings. Ideal blood sugar and insulin handling will often demonstrate a small rise of
blood sugar above the initial reading (i.e. approximately 20-40 points above baseline), followed by a steady decrease back to normal by the end of the test two hours later. Excessively high glucose levels, a significant drop below the initial reading, or any reading that has not returned to normal after two hours, can indicate a dysfunction in blood sugar handling.

*Please talk with your doctor before performing this test to see if it is appropriate for you.

**EVALUATION**

Though there are diagnosable blood sugar related conditions, such as hypoglycemia or diabetes, most blood sugar and insulin issue are somewhere along a spectrum of glucose dysregulation. As previously mentioned, early stages are characterized by physiological elevations of glucose but efficient insulin production and binding, and therefore low glucose on blood chemistry tests. Later stages of blood sugar dysregulation are often characterized by elevated glucose readings on a blood chemistry test due to insulin’s inability to efficiently get glucose into cells.

The goal of this information is to help the reader learn where along that particular spectrum they fall and, to offer options as to how to correct the underlying imbalance. Ultimately there is no one ideal protocol to follow but rather directions to take based on your own physiological imbalances, and then retesting lab markers to determine if the protocol is working or not.

**HYPOGLYCEMIC TENDENCIES**

Hypoglycemia is a term used to describe a variety of symptoms due to blood sugar fluctuations, including periods of low blood sugar. Conventionally hypoglycemia typically refers to fasting blood sugar below 50mg/dL, but many people can experience symptoms of low blood sugar well above this level (i.e. 70mg/dL for some individuals). The primary concern with low blood sugar is inadequate brain function. The brain is the first organ to suffer when glucose is unavailable and even permanent damage can take place when blood glucose is too low for too long.

Reactive hypoglycemia, or functional hypoglycemia, is typically caused by one of two reasons:
1. **Excess refined carbohydrate consumption leading to excessive insulin production.**
   Symptoms will typically include excessive mood swings, erratic behavior before and after eating, and a volatile personality.

2. **Low cortisol levels leading to an inability to raise blood glucose between meals.**
   Symptoms will often include sweating, shakiness, weakness and hunger between meals. These symptoms are typically cause by epinephrine secretion to compensate for the lack of cortisol.

A third and more rare form of hypoglycemia is caused by poor intestinal digestion and absorption of nutrients. This would be evident on the glucose tolerance test by a relatively flat glucose response less than +/- 15% from the fasting glucose level.

**INSULIN RESISTANCE TENDENCIES**

Once elevated blood glucose has become chronic, insulin will progressively become less efficient at getting glucose into cells due to slowly deteriorating insulin receptor. The result will be elevated fasting serum glucose and triglyceride levels. Over time, the pancreas will likely decrease its insulin production due to gradual damage and failure of beta cells. This will further elevate fasting serum glucose and triglyceride levels due to not only poor insulin receptor function, but low levels of insulin as well.

**CORRECTING IMBALANCES**

The goal in correcting an underlying blood sugar or insulin imbalance is to:

1. **Decrease the blood sugar response from food**
   This is accomplished by 1) consuming glycemically balanced meals, 2) increasing fiber intake during meals to slow down carbohydrate absorption and, 3) eliminating foods that may be causing sensitivities, i.e. following an elimination diet. Information regarding the elimination diet can be found in the *Gut Fat-Loss Connection* Supplementary Materials.

2. **Improve glucose entry into cells**
   This is accomplished by 1) improving insulin sensitivity of the insulin receptor sites, 2) improving pancreatic insulin production, and 3) utilizing exercise to enhance the exerciseinduced GLUT-4 mechanism.
CORRECTING HYPOGLYCEMIC TENDENCIES

The symptoms associated with hypoglycemic tendencies have been described earlier in this text. Hypoglycemic tendencies are characterized on blood work by low serum fasting glucose levels. Stable glucose is necessary for organ function, specifically proper brain function. Therefore it is critical to attempt to maintain healthy, stable blood sugar levels while the underlying cause is corrected.

DIET
The first and most critical step with hypoglycemic tendencies is to eat small, protein-based, frequent meals throughout the day. This means never skipping a meal, including breakfast. Eating in this manner will help maintain stable blood sugar levels whether the hypoglycemic tendencies are 1) due to elevated insulin levels or 2) due to low cortisol.

Small, protein-based meals will help maintain stable blood sugar levels preventing the much dreaded glucose rebound effect due to elevated insulin levels after high glycemic meals.

If the cause of hypoglycemic tendencies is low cortisol, frequent meals will enable you to exogenously maintain stable blood sugar levels to compensate for the body’s inability to maintain stable glucose on its own.

SUPPLEMENTS
Nutritional supplementation can be helpful with hypoglycemic tendencies depending on the underlying cause. If the hypoglycemic tendencies are being caused by excessively elevated insulin levels, the focus should primarily be on maintaining a healthy diet, performing adequate exercise, and possibly including some of the blood sugar lowering compounds listed below. However, diet and exercise are typically enough to help correct this hypoglycemic tendencies due to insulin fluctuations.

On the other hand, if the hypoglycemic tendencies are being caused by hormone deficiencies (i.e. low cortisol), they must first be corrected before glucose balance is to be achieved. More on how to correct cortisol imbalances can be found in the Cortisol Fat-Loss Connection video and supplementary materials.
ADDITIONAL TESTING
Evaluating the underlying cause of hypoglycemic tendencies is critical. A salivary adrenal test can help determine whether or not low cortisol is a contributing factor. Evaluating C-peptide can be helpful in determining whether or not the hypoglycemic tendencies are related to elevated insulin levels. If C-peptide is high, this can indicate that the hypoglycemic tendencies are related to elevated insulin levels and your goal would be to maintain stable glucose levels using diet and exercise.

If hypoglycemic tendencies are present, the following tests should be considered:

1. Salivary adrenal hormone testing
2. C-peptide (serum)
3. Insulin (serum)
4. IGF-1 (to determine growth hormone levels and liver function)

Depending on the result of these tests, consider retesting a minimum of every three months until the imbalance is corrected. Retesting the glucose tolerance test every three months may also be helpful.

INSULIN RESISTANCE TENDENCIES
An individual with insulin resistance will typically see the following patterns: 1) elevated fasting glucose, 2) glucose that is excessively elevated during the glucose tolerance test or fails to return to baseline after 2 hours, 3) elevated triglycerides (less than 2:1 with the cholesterol/triglyceride ratio, or greater than 1:1 with the triglyceride/HDL ratio), 4) depressed HDL, 5) Hemoglobin A1C above 5.6%, and 6) possibly elevated uric acid. The more of these markers that are out of balance, or the more significant the elevations are, the more advanced the insulin resistance tendencies will be.

DIET
The goal the diet for insulin resistant tendencies is similar to that of hypoglycemic tendencies – maintain stable blood sugar levels throughout the day. The reasons for this however, are to reduce the need for insulin production, which will then allow insulin receptor sites to resume normal function. Also, glucose is toxic to the body in excess and will cause significant damage over time. Therefore managing glucose levels is key in insulin resistance tendencies.
Small, protein based, low glycemic meals is the goal, with emphasis on high fiber, and low starchy or refined carbohydrates. Many books have been written on this subject and rather than go into further details here, some books and websites are listed in the Resources section below.

EXERCISE
Research is clear that a combination of cardiovascular and resistance/strength training is invaluable in helping to correct blood sugar and insulin dysregulation. But again, this has been written about extensively by a variety of experts in the field and therefore needs no further discussion here. The goal of the material here is to not rehash what has already been covered elsewhere, or to create even more information to further confuse consumers. Rather, the goal is to make other currently existing programs work even more effectively due to your new and improved physiology.

SUPPLEMENTATION
Nutritional supplementation can be very helpful in correcting insulin resistance tendencies. The primary goal of nutritional supplementation is to improve insulin receptor function. Note that the goal is not merely to lower blood sugar. Blood sugar causes damage to the body but the reason it usually cannot get into cells is usually due to dysfunction in insulin production and/or insulin receptors. Many pharmaceutical drugs, and even some natural compounds, lower blood sugar by increasing insulin production from the pancreas. Because elevated insulin levels likely caused the resistance issue in the first place, further elevating insulin levels will likely serve to create more dysfunction. Therefore, the goal is to improve insulin receptor function and signaling, and not simply to lower blood sugar.

Many of the compounds listed below are chosen because they will not increase the risk of insulin resistance by increasing insulin levels, but rather serve to improve the body’s ability to get glucose into the cell either by improving insulin receptor function and/or intracellular mechanisms.

ADDITIONAL TESTING
When insulin resistant tendencies are found, one may want to look further into possible contributors to elevated glucose levels. For example elevations in cortisol, a hormone that potently elevates blood glucose, can create high blood glucose despite attempts at correcting it using diet and exercise.
Therefore if insulin resistant tendencies are present, the following tests should be considered:

1. Salivary adrenal hormone testing
2. Intestinal permeability
3. Insulin and C-peptide (serum)
4. Hemoglobin A1C

Depending on the result of these tests, consider retesting every one to three months until the imbalance is corrected. Retesting the glucose tolerance test every three months may also be helpful.

NUTRITIONAL SUPPORT

Most herbs and supplements have not been thoroughly tested for interactions with other herbs, supplements, drugs, or foods. The interactions listed below are based on reports in scientific publications, laboratory experiments, or traditional use. You should always read product labels. If you have a medical condition, or are taking other drugs, herbs, or supplements, you should speak with a qualified healthcare provider before starting a new therapy.

If blood sugar and insulin imbalances exist, the primary goal of nutritional supplement should be to improve insulin sensitivity of insulin receptor sites. This concept cannot be overstated. Many of the pharmaceutical medications for blood sugar dysregulation are aimed at lowering blood sugar levels. This may seem reasonable at first glance, but the mechanisms in which some medications achieve this are by increasing insulin levels. This is highly undesirable, as it was elevated insulin that caused receptor insensitivity in the first place.

The goal of correcting blood sugar and insulin dysregulation issues should be to improve insulin receptor site function and not to further elevate insulin. This point is being made because some of the nutritional compounds and herbs typically used to help lower blood sugar act in a similar fashion as some pharmaceutical medications and therefore may make the situation worse in the long run. Other herbs are simply not well enough understood to see if they increase insulin resistance or not.

Below is a list of commonly used nutritional compounds used to help manage blood sugar dysregulation. Where applicable, mention will be made as to the theorized mechanism of
action of each compound, as well as an appropriate dose. Consult with your doctor before starting any nutritional supplements.

COMPOUNDS TO CONSIDER FOR BLOOD SUGAR MANAGEMENT

Lipoic Acid (Alpha Lipoic Acid)

*600-1800mg in divided doses daily* (taking with Biotin has been shown to improve the blood sugar and insulin lowering effect than either taken alone).

Lipoic acid is a sulfur-containing compound that seems to improve insulin resistance by increasing activation of glucose transporters (GLUT-4 vesicles), which help sensitize tissues to insulin. Studies performed on Alpha Lipoic Acid have been shown to improve insulin sensitivity. ALA also has potent antioxidant activities. Lipoic acid enhances the effectiveness of other antioxidants, facilitates the production of energy in cells, and provides support for detoxification processes of the liver. Lipoic acid is both water and lipid soluble, aiding to its multiple benefits, but has a short half-life and therefore either sustained released capsules or frequent dosing is necessary.

Chromium

*200-1000mcg daily, in divided doses*

Chromium is an essential trace mineral that plays an important role in carbohydrate metabolism and glucose tolerance. Chromium deficiencies are common in the United States, which are further depleted by a diet high in sugar and refined carbohydrates. Also known as “glucose tolerance factor”, studies demonstrate strong evidence that chromium may optimize the impact of insulin on receptor sites and therefore improve glucose uptake and insulin sensitivity. Chromium may also positively impact postprandial glucose and insulin levels, glycated hemoglobin, total cholesterol and LDL cholesterol. There is evidence that chromium taken with biotin may synergistically improve glucose tolerance.
Carnitine

2,000mg daily, in divided doses

One question is whether mitochondrial dysfunction might be a factor in the development of type 2 diabetes, and whether insulin resistance is associated with a defect in muscle fatty acid oxidation. Intramyocellular lipid levels have become a marker for insulin resistance. Preliminary data suggest that supplementation with L-carnitine can improve insulin sensitivity in individuals with type 2 diabetes, as evidenced in part by its ability to decrease intramyocellular lipid levels.

Banaba Leaf (Lagerstroemia speciosa)

50-100mg, three times a day

Banaba leaves contain a number of active components, including corsolic acid, that have demonstrated the ability to activate glucose transport and uptake across cell membranes. Studies have demonstrated the ability for corsolic acid to aid in the regulation of blood sugar levels, serum insulin, and total cholesterol. The active constituents in banaba leaf have even shown to have a “memory effect” for blood glucose control that lasted for several days after just one dose.

Cinnamon

250mg of standardized extract, three times a day; or 1-6 grams of dry powder daily

Cinnamon contains a water-soluble compound called MCHP (methylhydroxychalcone polymer) that has been shown to lower blood glucose levels via activation and improved efficiency of insulin receptors. Studies have suggested that ¼ to 1 teaspoon of cinnamon daily might be helpful in type 2 diabetes.

A more active substance, called Cinnulin PF, is the only extract validated in studies by the USDA to improve insulin response up to twenty-fold and can be found in some blood sugar management nutritional formulas.

Of note, cinnamon contains coumarin and ingestion of large amounts should be first discussed with your doctor. Liver toxicity in animal models has also been reported.
and reversible hepatotoxicity has been reported in humans at daily doses of 50-7000mg.

**Berberine**

*250-500mg, three time a day*

Numerous studies demonstrate the ability of berberine to improve blood sugar and insulin management. Some of the proposed mechanisms for this benefit includes 1) mimicking insulin action, 2) activation of AMPK, 3) reducing insulin resistance by upregulating insulin receptor expression, 4) inducing glycolysis, 4) promoting glucagonlike peptide-1 release, 5) inhibiting DPP-4 and 6) inhibiting hepatic gluconeogenesis.

**Myricetin (*Myrica cerifera*)**

*100-300mg per day in divided doses*

Myricetin is a relatively new ingredient gaining recognition for its fast-acting effects. Recent research suggests it increases insulin sensitivity by enhancing the activity of 3 proteins (IRS-1, PI3-kinase and GLUT 4), which are involved in post-receptor insulin signaling. Myricetin has also been shown to lower triglyceride levels and enhance glycogen metabolism in the liver. In addition, in vitro studies have shown that myricetin mimics insulin in stimulating lipogenesis and glucose transport in rat adipocytes.

**Gymnema Leaf Extract (*Gymnema sylvestre*)**

*200-400mg daily in divided doses*

Gymnema is a water-soluble extract that may enhance the effects of insulin by reducing glucose absorption in the intestine, as well as stimulate the production of the insulin producing cells of the pancreas called beta-cells. When placed directly on the tongue, gymnema competes with sweet substances for receptor sites and can decrease the desire and taste for sweets. However, there is also evidence that gymnema may also stimulate endogenous insulin production or, increase the body’s own production of insulin, which could potentially contribute to insulin resistance.
Given the multiple blood sugar regulating mechanisms of Gymnema, the benefit of taking it may exceed the possible negative consequences of increased endogenous insulin production. However, this mechanism must be taken into account.

Some studies have suggested that while Gymnema does increase insulin production from the pancreas, it does not lead to insulin resistance. Therefore this compound may be helpful for some individuals.

**Fish Oil**: (Eicosapentaenoic Acid/Docosahexaenoic Acid, EPA/DHA)

1.8 grams of EPA, 1.2 grams of DHA per day

Daily intake of 1,500-4,000mg of EPA and 1,000-2,000mg of DHA have been shown to improve insulin sensitivity in skeletal muscle, thus reducing fasting glucose. Krill Oil is another option that may provide similar benefits.

**Opuntia streptacantha** (nopal, prickly cactus)

Recommended dose is 100 g of nopal stems grilled or 3 tablespoons of prickly pear fruit concentrate daily. (Historically nopal has been consumed by Mexican natives in the whole form. Some studies have demonstrated that juice or capsule form of nopal have no significant changes in serum glucose. This is not to suggest that it would not be helpful, just that studies have not yet demonstrated this effect.)

*Opuntia streptacantha* has a high-soluble fiber and pectin content, which may affect intestinal glucose uptake, partially accounting for its hypoglycemic actions. Animal models have reported decreases in postprandial glucose and Hemoglobin A1C with synergistic effects with insulin. Studies in pancreatectomized animals report that hypoglycemic activity is not dependent on the presence of insulin. In other words, it seems that Opuntia works to decrease carbohydrate absorption in the gastrointestinal tract, thus lowering the glycemic effect of food, and the subsequent lowering of serum insulin levels.

Side effects may include mild diarrhea, nausea, abdominal fullness and headache.
Salacia Oblong

500-1000mg per day in divided doses

The herb, according to the study authors, seems to work similarly to oral diabetes drugs known as alpha-glucosidase inhibitors, which impede the body's absorption of carbohydrates. Salacia has demonstrated the ability to lower blood glucose and insulin levels after a meal. May cause gas and/or cramping.

Green Tea (epigallocatechin gallate, EGCG)

275-1300mg daily in divided doses

Numerous studies suggest that green tea and its active constituents can enhance insulin activity and protect pancreatic cells. EGCG (epigallocatechin gallate) is a major polyphenol or catechin in green tea that has been tested in may studies and is thought to be one of the most active ingredients. Green tea promotes healthy blood sugar metabolism in humans and obese, diabetic mice without increasing insulin levels. Green tea rich in EGCG enhances insulin action instead of promoting insulin release. It has also been shown to reduce intestinal glucose absorption, downregulate glycogenolysis and upregulate glycogenesis. Furthermore, green tea and EGCG reduce fat cell creation and growth, as well as blood levels of triglycerides and cholesterol. As an added bonus, green tea protects against protein oxidation and glycation.

Bilberry

160 mg twice per day of an herbal extract containing 25% anthocyanosides

Bilberry extract has been shown to lower blood sugar while increasing insulin sensitivity.
American Ginseng (Panax quinquefolius)

200mg of herbal extract daily, containing approximately 5 to 7% ginsenosides with or following meals

Studies have shown that American ginseng may improve insulin sensitivity. However, it must have a significant quantity of ginsenosides to have a blood lowering effect. In a small preliminary trial, 3 grams of American ginseng was found to lower the rise in blood sugar following the consumption of a high-glucose drink by people with type 2 diabetes. The study found no difference in blood sugar–lowering effect if the herb was taken either 40 minutes before the drink or at the same time. A follow-up to this study found that increasing the amount of American ginseng to either 6 or 9 grams did not increase the effect on blood sugar following the high-glucose drink in people with type 2 diabetes. This study also found that American ginseng was equally effective in controlling the rise in blood sugar whether it was given together with the drink or up to two hours before.

Glucomannan

500 to 700 mg per 100 calories in the diet

Glucomannan is a water-soluble dietary fiber derived from konjac root (Amorphophallus konjac) that delays stomach emptying, leading to a more gradual absorption of dietary sugar. This effect can reduce the elevation of blood sugar levels that is typical after a meal. After-meal blood sugar levels are lower in people with diabetes given glucomannan in their food, and overall diabetic control is improved with glucomannan–enriched diets, according to preliminary and controlled clinical trials. For controlling blood sugar, 500 to 700 mg of glucomannan per 100 calories in the diet has been used successfully in controlled research.

Additional Nutrients

There are a number of additional nutrients that may prove helpful in managing blood sugar and insulin. Such nutrients such as mixed tocopherols (vitamin E), magnesium, zinc, biotin and vitamin K have been shown to improve insulin sensitivity, increase glucose tolerance and decrease insulin resistance.
Biotin: 10,000mcg daily, in divided doses. When taking large doses of any B vitamin, it is recommended to take other B vitamins with it. Biotin has been shown to improve the function of lipoic acid.

Vitamin K: 500mcg daily, in divided doses. Low vitamin K has been shown to induce an early insulin response, and late hyperinsulinemia. One study on vitamin K2 found that intake had a statistically significant inverse relationship to the risk of developing type 2 diabetes.

Zinc: 25mg daily, in divided doses. Zinc has been shown to help improve insulin sensitivity, insulin metabolism and is important in the management of blood sugar disorders. It is questionable as to the benefits of zinc in non-zinc deficient individuals, but given the prevalence of zinc deficiency today, adding zinc to a blood sugar management protocol will likely prove helpful.

Mixed Tocopherols (vitamin E): 400-800IU daily, in divided doses. Vitamin E has been shown to improve insulin sensitivity and may help improve blood lipids.

Magnesium: 400-800mg per day, in divided doses. Magnesium may help improve multiple mechanisms of insulin, including insulin receptor function, glucose transport and intracellular processes. As with many minerals (i.e. zinc, chromium), individuals with blood sugar disorders are typically deficient in one or more of them.

QUESTIONABLE COMPOUNDS

Bitter Melon (Momordica charantia, Momordica elegans)

Many nutritional blood sugar formulations contain Bitter Melon, due to its potent ability to rapidly lower glucose. However, one of the proposed mechanisms for this effect is that Bitter Melon contains insulin-like polypeptides, which are structurally similar to insulin and thus may contribute to insulin resistance. In other words, if elevated insulin levels are what contributed to insulin resistance in the first place, it stands to reason that something was structurally similar to insulin would lower glucose, but also may cause more insulin resistance. The benefits of a nutritional formula that contains Bitter Melon may outweigh the risks, but it would be wise to be cautious with this compound when trying to improve glucose levels long-term.
Vanadyl sulfate

Vanadyl sulfate a biologically active form of vanadium, a trace mineral that mimics the action of the hormone insulin. Vanadyl Sulfate may reduce hepatic gluconeogenesis and “mimic” insulin’s effect. It appears to have insulin-like impact on receptor sites and improves the transport of glucose transporter to the cell membrane to allow cells to intake serum glucose. This physiologic impact is of great importance because most defects in insulin resistance involve intercellular transduction reactions that vanadium appears to enhance.

Holy Basil (*Ocimum sanctum*)

While the mechanism for holy basil’s glucose lowering effect is still not clear, it is postulated that it does so by increasing insulin secretion. Again, this could feasibly worsen one’s progression towards insulin resistance by increasing insulin levels.

Taurine

Several studies have demonstrated improved insulin sensitivity and insulin action in animal models. One study suggests that it may be beneficial to take Taurine with NAC. Taurine is likely a safe amino acid to take, but the research on it in managing blood sugar and insulin is scant, and there are numerous other compounds with much stronger evidence.

COMPOUNDS TO AVOID

Fenugreek

Fenugreek is known to stimulate insulin production from the pancreas, which will likely further the development or progression of insulin resistance. This compound is found in many blood sugar formulas, but if excess insulin is the cause behind insulin resistance, there are very few people who would benefit from increased insulin production.
SPECIFIC FORMULAS

Some products and formulas will work better for some people than they will for others. Therefore the best method in nutritionally supporting blood sugar and insulin dysregulation is to try certain products for 30 days and retest laboratory markers to determine if a positive benefit was achieved. If so, continuing on a certain protocol will likely be beneficial in correcting blood sugar imbalances.

On the other hand, if negative symptoms exist using a specific formula or compound or, if laboratory markers do not improve, either adjusting the dose or trying a different protocol is necessary. If after 90 days laboratory markers and/or symptoms do not improve, it is likely that the particular mechanism driving the physiological imbalance has not been adequately addressed.

No protocols are listed here simply because there generalized protocols to fix physiological imbalances simply do not exist. Finding an effective protocol requires evaluating your particular physiological imbalances and then experimenting with different products, followed by retesting, to determine the most effective products and dosages for you.

Here are some specific professional formulas that may be beneficial in helping to correct blood sugar and insulin imbalances:

- Xymogen: CinnDrome-X
- Apex Energetics: Glysen, Protoglysen
- Vital Nutrients: Berberine 200mg, Green Tea Extract 80%
- Designs for Health: Metabolic Synergy, Carnitine Synergy, Carnosine Supreme, Carnitine Tartrate Powder
- Integrative Therapeutics: Glycemic Manager
- Pharmax: Multiple varieties of fish oil
RESOURCES

www.precisionnutrition.com
One of the best, most reliable and down-to-earth websites for good quality diet and exercise information. The results their clients have achieved using their programs speaks for itself. Also check out their Precision Nutrition System (http://www.precisionnutrition.com/products/system).

www.alwyncosgrove.com
Alwyn Cosgrove is highly respected in the fitness industry and has a number of effective exercise programs that will likely assist people in achieving weight loss. Many of his workouts are the type that has been shown to be beneficial in improving blood sugar and insulin levels.

www.turbulencetraining.com
Craig Ballantyne has a variety of online materials and workouts that will likely be helpful in achieving your weight loss goals.

www.amazon.com
Inexpensive glucometers and a variety of good diet books (i.e. South Beach Diet, The Perfect Health Diet, The Paleo Solution)

www.directlabs.com/fatisnotyourfault
A variety of blood, salivary and stool testing is available from this website for people living in the United States (except NJ, NY and RI).
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