# Living with Diabetes:
## *Supplements to Make the Job Easier*

 

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There are two primary types of diabetes: type 1 and type 2. Both types result in high levels of blood sugar levels, which may manifest itself through any of the following symptoms: increased thirst and an increased need to urinate; feeling edgy, tired, and sick to your stomach; and having an increased appetite (but loss of weight). In addition, other symptoms may include: repeated or hard-to-heal infections of the skin, gums, vagina, or bladder; blurred vision; tingling or loss of feeling in the hands or feet; and dry, itchy skin. If left uncontrolled, high blood sugar may result in a variety of serious complications.

**Glycosylated protein**
Many of these complications are the result of glycosylated protein (GP). GP simply means that sugar (glucose) has attached itself to protein. For example, blood sugar can attach itself to the protein in your red blood cells' hemoglobin and form glycosylated hemoglobin (HbA1c). Virtually all proteins are glycosylated to some degree. However, if this process continues to excess, eventually you end up with compounds called Advanced Glycosylation End Products (AGE). These AGE become permanent fixtures in our cells. AGE impregnated cells are very reactive and react with one another, and other proteins. In the case of blood capillaries, they can result in the walls of the capillaries thickening, eventually causing the vessels to be blocked off. This is the underlying cause of kidney complications (nephropathy) and eye complications (retinopathy). Unfortunately, the more blood sugar, the more glycosylated proteins.

**Sorbitol**
Another mechanism by which complications in diabetes result is excessive cellular sorbitol (a type of sugar-alcohol). Many cells in the body do not rely on insulin for glucose uptake. When you have hyperglycemia, you actually get high sugar levels inside these cells, which causes sorbitol to be produced in high concentrations. Intracellular sorbitol disrupts the pressure balance between the inside and outside of the cell, causing water to enter. This swelling of nerve cells is what is believed to be, at least in part, responsible for the nerve damage (neuropathy) caused by diabetes. (This does not mean that if you consume sorbitol in foods that it will have the same effect—it won't).

**Type 1 Diabetes**
Type 1, immune-mediated diabetes (formerly called insulin-dependent diabetes), is a disease that affects the way your body uses food. In type 1 diabetes your body destroys the cells in the pancreas that produce insulin, usually leading to a total failure to produce insulin. It typically starts in children or young adults who are slim, but can start at any age. Without insulin, your body cannot control blood levels of sugar. And without insulin, you would die. So people with type 1 diabetes give themselves at least one shot of insulin every day. An estimated 500,000 to 1 million Americans have this type of diabetes today. Conventional medical treatment for type 1 diabetes includes insulin injections, and diet regulation.

**Type 2 Diabetes**
Type 2 diabetes used to be called non-insulin-dependent diabetes. The most common type of diabetes, it affects about 15 million Americans. Nine out of ten cases of diabetes are type 2. It usually occurs in people over 45 and overweight, among other factors. When you have type 2 diabetes, your body does not make enough insulin—or your body still makes insulin but can't properly use it. Without enough insulin, your body cannot move blood sugar into the cells. Sugar builds up in the bloodstream. Conventional medical treatment for type 2 diabetes includes any of the following, alone or in combination: insulin injections, oral drugs, or diet alone.

Following is a discussion about dietary supplements that may help diabetics to gain greater control over

their blood sugar levels, reduce the long-term detrimental effects of high blood sugar levels, or both.

**Chromium**

Chromium levels can be below normal in patients with diabetes.[1] [2] In a randomized, placebo-controlled study[3], 180 men and women with type 2 diabetes were divided into three groups and supplemented with: 1) placebo, 2) 200 mcg chromium daily, or 3) 1,000 mcg chromium daily (from chromium picolinate for both doses).Subjects continued to take their normal medications and were instructed not to change their normal eating and living habits. The results were that that both doses of supplemental chromium had significant beneficial effects on HbA1c, glucose, insulin, and cholesterol variables, although the benefits were greater with the higher dose.

Other studies show that taking chromium picolinate orally can decrease fasting blood glucose, decrease HbA1c levels, decrease triglyceride levels, and increase insulin sensitivity in people with type 2 diabetes. [4] [5] Some evidence also suggests that chromium picolinate might decrease weight gain and fat accumulation in type 2 diabetes patients who are taking a sulfonylurea.[6] Higher chromium doses (1,000 mcg) might be more effective and work more quickly.[7] Higher doses might also reduce triglyceride and total serum cholesterol levels in some patients.[8] [9] Additional research demonstrated that chromium picolinate may have the same benefits in patients with type 1 diabetes[10] and in patients who have diabetes secondary to corticosteroid use.[11]

**Banaba**

Banaba is the common name for *Lagerstroemia speciosa*, a traditional herbal medicine used among diabetics in the Philippines.[12] Research done on Banaba extract has demonstrated that it has an "insulin-like principle" as well as an ability to reduce blood sugar. At least one component of this insulin-like principle is thought to be corosolic acid, although Banaba also contains other like candidates including ellagitannins, lagerstroemin, flosin B, reginin A. As a matter of fact, a recent study identified ellagitannins from Banaba as activators of glucose transport.[13]

One of the Banaba studies was conducted hereditary diabetic mice. The results showed blood sugar increases were suppressed, and the level of serum insulin and the amount of urinary excreted glucose were also lowered in mice fed Banaba extract. The researchers suggested Banaba extract has beneficial effects on control of blood levels of glucose in non-insulin dependent diabetes mellitus.[14]

Twelve diabetic subjects taking 48 mg of the Banaba extract were tested in a randomized, double-blind crossover study. This study confirmed that a Banaba extract promotes normal blood glucose metabolism in people with type 2 diabetes, and also showed that Banaba extract's benefits were sustained for several weeks even after discontinuation of the supplement.[15]

Another crossover, placebo-controlled clinical study with 24 subjects found similar results. Specifically, Banaba extract was effective in reducing blood glucose levels even in short-term (4 weeks) treatment, with no signs of adverse effects. Furthermore, even a one-time dose leaves a memory-effect for blood glucose control. Compared to the placebo group, a statistically significant drop in the average blood glucose level is observed with the administration of Banaba extract [16]

**Gymnema sylvestre**

Animal studies have demonstrated that the herb Gymnema sylvestre is capable of lowering blood glucose levels, improving glucose utilization, and increasing insulin levels in diabetes.[17] [18] [19] [20] The latter benefit was found to be a function of Gymnema's apparent ability to repair/regenerate beta cells, the parts of the pancreas responsible for producing insulin.[21]

Of greater significance to diabetic patients is the research conducted on humans. In one study, 22 type 2 diabetic patients received Gymnema for 18-20 months, as a supplement to the conventional oral drugs. During Gymnema supplementation, the patients showed a significant reduction in blood glucose, glycosylated hemoglobin and glycosylated blood proteins; and conventional drug dosage could be decreased. As a matter of fact, five of the 22 diabetic patients were able to discontinue their conventional drug and maintain their blood glucose homeostasis with Gymnema alone. The researchers concluded that "These data suggest that the beta cells may be regenerated/repaired in type 2 diabetic patients on [Gymnema] supplementation. This is supported by the appearance of raised insulin levels in the serum of patients after [Gymnema] supplementation."[22]

In a similar study, Gymnema was administered to 27 patients with type 1 diabetes, who were also on insulin therapy. The results were that insulin requirements came down together with blood glucose and glycosylated hemoglobin and glycosylated blood protein levels. Blood fats also returned to near normal levels with Gymnema therapy. Type 1 diabetic patients who were just on insulin therapy (no Gymnema), showed no significant reduction in serum lipids, glycosylated hemoglobin or glycosylated blood protein when followed up after 10-12 months. The researchers of this study concluded, "Gymnema therapy appears to enhance endogenous insulin, possibly by regeneration/revitalization of the residual beta cells in insulin-dependent diabetes mellitus.[23]

**Bitter Melon**
Bitter melon (Momordica charantia) is a tropical vegetable widely cultivated in Asia, Africa and South America, and has been used extensively in traditional folk medicine as a remedy for diabetes. This traditional use has also been validated by clinical research. In one study, Bitter melon was found to significantly improve the glucose tolerance of 73% of patients with adult-onset diabetes (type 2).[24] During another study, Bitter Melon significantly reduced blood glucose concentrations during a glucose tolerance test in type 2 diabetics.[25] Other research has identified the protein component of Bitter Melon that have the blood sugar lowering effects, and those researchers have stated that it is very effective for that purpose when administered to "gerbils, langurs, and humans."[26]

**Alpha Lipoic Acid**
A significant amount of research has been conducted on the natural antioxidant Alpha Lipoic Acid (ALA) in the treatment of diabetes. In one study, seventy-four patients with type-2 diabetes were given either a placebo, or ALA.. When compared to the placebo group, those receiving the ALA had significantly greater insulin-sensitivity, and improvement in insulin-stimulated glucose disposal. The researchers logically concluded, "The results suggest that oral administration of alpha-lipoic acid can improve insulin sensitivity in patients with type-2 diabetes."[27] Another benefit of ALA use in diabetics has to do with diabetic neuropathy. In one study on type 2 diabetics, ALA treatment was associated with "a favorable effect on neuropathic deficits without causing significant adverse reactions."[28] In another two-year study, ALA "appeared to have a beneficial effect on several attributes of nerve conduction" in a group of type 2 diabetic patients.[29] Additional research on diabetics has shown that ALA has been able to improve other aspects of diabetic neuropathy,[30] [31] including improvements in neuropathy symptoms.[32] [33] [34]

Another important consideration is that oxidative stress caused by free radicals can exacerbate the diabetic condition. Research provides evidence that, in type 2 diabetics, treatment with ALA significantly improves antioxidant defense[35]—even in patients with poor blood sugar control and albuminuria (i.e., too many serum proteins in the urine).[36]

Finally, one of the most important benefits offered to diabetics by ALA is the fact that it has been shown to enhance the disposal of blood sugar in patients with type 2 diabetes, which gives it great potential as a blood sugar lowering agent.[37] In a related study of lean and obese diabetic patients treated with ALA, the ALA prevented increases in metabolites that are typically associated with high blood sugar, and also increased blood sugar effectiveness.[38]

**American ginseng**
*Panax quinquefolius*, more commonly known as American ginseng, was shown to lower the rise in blood sugar following the consumption of a drink high in glucose by people with type 2 diabetes in a small pilot study.[39] The same effect was found whether the herb was taken either 40 minutes before the drink or at the same time. In a follow-up study, similar blood sugar lowering results were found; even when American ginseng was given up to two hours before or together with the drink.[30] The same researchers conducted additional research on non-diabetic subjects, and again found blood sugar lowering effects from American ginseng.[40]

**Fenugreek seeds extract**
Fenugreek (*Trigonella foenum-graecum*) has been used as a traditional herbal medicine for treating diabetes. Modern scientific research lends support to this traditional use. As the result of research conducted on diabetic rats and humans, the *International Journal of Obesity* recognized Fenugreek as having potential benefit for the control of glucose metabolism.[41] Other research in animals[42] [43] [44] [45] [46] as well as humans[47] [48] has also shown that Fenugreek is capable of lowering blood glucose levels in diabetic, as well as non-diabetic subjects.

Some of the studies assumed that it was the soluble fiber content of the Fenugreek seeds that provided the glucose modulating effect. However, other studies found that there were other natural components present which are also involved.[49] [50] In fact, one study found an enzyme in Fenugreek is implicated in synthesizing an unusual amino acid called 4-hydroxyisoleucine, which is known for its insulin stimulating effect.[51]

**Co-enzyme $Q_{10}$**
Research has shown that some diabetic patients who use diet to control their blood sugar may have a deficiency of Co-enzyme $Q_{10}$ (CoQ10), which may be further exacerbated by certain commonly used antidiabetic drugs. Such a deficiency of CoQ10 in the pancreas could impair aspects of energy metabolism, and the biosynthesis of insulin.[52] Other research has also demonstrated that CoQ10 levels are lower in diabetic patients, which can cause diabetic cardiomyopathy. That same research, however, also showed that the diabetic cardiomyopathy can also be reveresed by CoQ10 supplementation.[53] And speaking of a cardiac condition, research has also demonstrated that CoQ10 exhibits an effective antiarrhythmic (i.e., prevents abnormal heart beat) in patients with diabetes.[54]

A newly discovered form of diabetes is referred to as maternally inherited diabetes mellitus and deafness (MIDD). The characteristic clinical features of MIDD are progressive worsening of insulin secretion

and, as the name would suggest, neurosensory deafness and maternal inheritance. After three years of treatment with CoQ10 therapy on MIDD patients, progressive hearing loss was prevented and blood sugar metabolites improved after exercise. Furthermore, there were no side effects during therapy.[55]

**Bilberry**

One clinician/researcher had this to say about Bilberry (a European relative of the American Blueberry): "Perhaps the most significant clinical applications for bilberry extracts are in the field of ophthalmology." The health of the eye depends on a rich supply of nutrients and oxygen, and, "Relatively speaking, the amount of blood blow through the eye is the greatest in the body." Bilberry appears to support vision by improving the delivery of oxygen and blood, "as well as exert[ing] other important pharmacological effects," including acting as an antioxidant. Among other benefits, Bilberry has proven effective in treating or preventing diabetic retinopathy, and macular degeneration. Bilberry's strengthening effect on collagen may explain its benefit in helping to treat diabetic retinopathy. It also effectively regulates blood sugar levels in diabetic subjects.[56]

**Inositol**

An altered metabolism of inositol, a natural substance associated with the B complex group of vitamins, has been documented in patients with diabetes.[57] In fact, over 20 years ago, researchers found that high blood sugar levels in diabetes "may condition a widespread relative intracellular inositol deficiency, and suggest that restoration of normal intracellular inositol concentrations might prove to be of benefit in the prevention and treatment of certain of the complications associated with human diabetes mellitus."[58] As it turned out, supplementation with inositol has indeed proven beneficial for diabetics. For example, low levels of inositol have been associated with neuropathy in diabetic patients,[59] and inositol supplementation has been demonstrated to be effective in treating diabetic neuropathy.[60] Another benefit is that supplementation with inositol can help prevent the premature aging of certain cells in the diabetic which is caused by elevated concentrations of blood sugar.[61] Other research suggests that inositol may exert a protective effect on slowly developing diabetic cataracts.[62]

Finally, consider that the incidence of major congenital malformations is approximately 6-9% in pregnancies complicated by diabetes mellitus. This incidence is 3-4-fold higher than that in the general population. Congenital malformations are now ranked as the leading cause of death in the offspring of women with diabetes. This particular type of congenital malformation in the offspring of diabetic women is referred to as diabetic embryopathy. Dietary supplementation of inositol has been shown to reduce the incidence of diabetes-related malformations in offspring of diabetic pregnant animals.[63] Researchers have indicated that supplementation with inositol offers great promise, in addition to blood sugar control, as a dietary preventive measure against diabetic embryopathy.[64]

**Antioxidants**

Antioxidants block the production of AGE. Hence, any good antioxidant has potential value for use by diabetics. Thus far we've examined three antioxidants: Alpha Lipoic Acid, Co-enzyme $Q_{10}$ and Bilberry. Following is a description of a few others antioxidants which may have value for diabetics.

*Gingko biloba extract*

In addition to its antioxidant properties, Ginkgo biloba extract enhances peripheral circulation and will highly benefit vascular disease. Ginkgo promotes blood flow in both healthy and compromised blood vessels. Many medical experts actually advise aspirin therapy for diabetics to thin the blood and reduce its stickiness. Ginkgo does this naturally. The benefits of *Ginkgo biloba* extract are primarily attributed to two groups of active constituents: the ginkgo flavone glycosides and the terpene lactones. Ginkgo flavone glycosides, which typically make up approximately 24% of the extract, are primarily responsible for GBE's antioxidant activity and mildly inhibit platelet aggregation (stickiness). GBE's antioxidant action may also extend to the brain and retina of the eye.[65] Preliminary trials have suggested potential benefit for people with macular degeneration[66] and diabetic retinopathy.[67]

Turmeric

Turmeric is a bright yellow, ancient spice and a traditional remedy that has been used as a medicine, condiment and flavoring based on records dating back to 600 BCE. Its medicinal value is essentially due to its curcuminoid content. The curcuminoids inhibit 5-lipo-oxygenase (LOX) and cyclo-oxygenase (COX), resulting in a well-established anti-inflammatory action.[68] [69] [70] Turmeric and its curcuminoids also exhibit strong antioxidant activity[71], enhance cellular resistance to oxidative damage[72], and enhance the body's natural antioxidant glutathione levels; which in turn aids the liver in detoxification.[73]

Grape Seed Extract

Grape Seed Extract is a source of oligomeric proanthocyanidins (OPCs). Not only do OPCs have significant antioxidant properties, but they also help stabilize collagen and maintain elastin;[74] [75] important proteins in connective tissue that support organs, joints, blood vessels, and muscle. In double-blind research, OPCs have been shown to strengthen capillaries, [76] and improve venous blood flow;[77]

important considerations for diabetics. Furthermore, OPCs have improved visual performance in the dark and after exposure to glare.[78] [79]

Schizandra

Schizandra's value as an antioxidant is well-established.[80] [81] Also, it appears that the lignans in Schizandra activate enzymes in liver cells that produce the antioxidant glutathione.[82] In addition to its antioxidant properties, Schizandra is also regarded as an adaptogen in Russia.[83] Research indicates that Schizandra can improve work performance, build strength, reduce fatigue, and increase endurance[84] [85]; all consistent with the effects of an adaptogen, and all of value to a diabetic.

Green Tea Extract

Green, Oolong and black ('normal') tea are all made from the leaves of the same plant species. Green, unfermented tea is the world's second most popular beverage, after water. It is the polyphenols in Green Tea, specifically the catechin polyphenols, which gives it biological and medicinal qualities. Catechins, particularly one called Epigallocatechin gallate (EGCg), are what give Green Tea its antioxidant, antimicrobial, blood thinning, and cholesterol lowering activities;[86] all of which should be of interest to diabetics.

**A word of caution**

If you are diabetic and controlled on medication, make your health professional aware of any changes you intend to make in your lifestyle. Diet, exercise, and supplements may affect your blood sugar levels. Make your doctor a participant in any changes you would like to make in your health management. This will assure that you are being properly monitored and that you will keep yourself out of trouble.

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