

# Diabetes and Dietary Supplements

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As the incidence of diabetes increases to epidemic proportions, people with diabetes are turning more and more to alternative therapies to help manage this condition, despite the availability of numerous traditional therapies. In fact, Americans spent almost \$34 billion out of pocket on complementary and alternative products, practitioner visits, and materials in 2007, according to data from the National Health Interview Survey.<sup>1</sup> It is important for health care practitioners not only to be aware of what dietary supplements their patients are taking, but also to understand how these supplements work and their possible side effects.

## Defining CAM

First, it is helpful to be familiar with some terminology. The acronym CAM stands for “complementary and alternative medicine.” According to the National Center for Complementary and Alternative Medicine, CAM consists of medical and health care systems, practices, and products that are not generally considered part of conventional medicine. Examples of CAM therapies include acupuncture, biofeedback, chelation therapy, yoga, hypnosis, reiki or energy healing, massage, dietary therapies, meditation, tai chi, and dietary supplements.

Complementary medicine is used along with conventional medicine, whereas alternative medicine is used in place of conventional medicine. In the United States, 38% of adults

(or 4 in 10) and 12% of children (or 1 in 9) use some form of complementary medicine. People with diabetes are ~ 1.6 times more likely to use CAM therapies than people without diabetes.<sup>2</sup>

## Defining Dietary Supplements

Dietary supplements are one form of oral CAM therapy. The Dietary Supplement Health and Education Act (DSHEA) of 1994 defines a dietary supplement as a “product taken by mouth that contains a dietary ingredient intended to supplement the diet.” These dietary ingredients may consist of “vitamins, minerals, herbs, amino acids, and other botanicals and substances such as enzymes, organ tissues, glandulars, and metabolites.”

Dietary supplements can take various forms, including tablets, capsules, softgels, liquids, powders, and bars.

It is important to note that dietary supplements are not considered to be drugs. Rather, they fall under the umbrella category of “foods” and must be labeled as dietary supplements.

Patients and practitioners should be aware that because of DSHEA, supplements are not subject to the same Food and Drug Administration (FDA) regulatory standards as drugs. For example, supplement manufacturers are not required to obtain FDA approval to market their products. Manufacturers are responsible for

determining that their products are safe. This means that, unless a supplement contains a “new dietary ingredient” (an ingredient not sold in the United States before 1994), its manufacturer does not need to provide the FDA with evidence that the product is safe or effective. Also, supplement manufacturers are responsible for determining their own practice guidelines to ensure that products contain what they claim to contain and are safe. The FDA cannot remove a supplement from the market unless it is proven that the supplement is unsafe.

The FDA does require that the supplement containers provide a Supplement Facts panel (similar to the Nutrition Facts label found on packaged foods) that identifies each ingredient in the product. More information on DSHEA and the role of the FDA can be found online at <http://www.fda.gov/Food/DietarySupplements/ConsumerInformation/ucm110417.htm#what>.

In addition, the FDA recommends that supplement manufacturers use “good manufacturing practices” (GMPs). GMPs help ensure that supplements are produced in an environment that focuses on several quality assurance standards, including cleanliness and safety, strict documentation, and in-house testing. There are independent laboratories and consumer organizations that reinforce GMPs and test dietary supplements for quality

and safety, including ConsumerLab.com, the U.S. Pharmacopeia (look for the USP seal on the product), the National Sanitation Foundation, and even Good Housekeeping.

Many supplements are used in the treatment of diabetes and its complications. Although this article addresses several common supplements that health care providers are likely to encounter in their practice, it does not offer an extensive or exhaustive listing.

### Common Diabetes Dietary Supplements

#### Alpha lipoic acid

**Intended use.** Alpha lipoic acid (ALA), sometimes called lipoic acid or thioctic acid, is an antioxidant that works in a manner similar to the B complex vitamins, helping the body convert food into energy. ALA has been used with success for quite some time in Germany as a treatment for peripheral neuropathy. A series of clinical trials, called the Alpha-Lipoic Acid in Diabetic Neuropathy (ALADIN) trials, showed that both 600 and 1,200 mg/day of ALA given intravenously improved certain symptoms of peripheral neuropathy.<sup>3,4</sup>

However, there is no evidence that ALA prevents neuropathy, and longer-term trials are needed to determine whether ALA slows the progression of neuropathy or just improves symptoms. ALA may also lower blood glucose levels; therefore, patients should be advised to monitor glucose levels more frequently when taking this supplement.

**Sources.** ALA can be found in liver, spinach, broccoli, Brussels sprouts, peas, potatoes, and yeast.

**Typical dosing.** ALA is typically given in doses of 600–1,200 mg/day in tablet form.

**Potential side effects.** Side effects of ALA are relatively rare but may include hypoglycemia (if taken in

conjunction with insulin or insulin secretagogues), rash, thiamine deficiency in those at risk, and possible interaction with treatment for under- or overactive thyroid.

#### Bitter melon

**Intended use.** Bitter melon (*Momordica charantia*) is a green fruit related to cantaloupe, honeydew, casaba, and muskmelon. Found in tropical climates, bitter melon (also called bitter gourd or bitter cucumber) is used mainly in India, Asia, South America, and Africa, both in cooking and as a medicine. The fruit and seeds of the bitter melon are believed to lower glucose levels; possible modes of action include increased glucose uptake by tissues, increased muscle and liver glycogen synthesis, and enhanced glucose oxidation.<sup>5</sup>

Researchers have isolated four compounds from bitter melon that activate an enzyme called AMPK. AMPK regulates fuel metabolism and promotes glucose uptake in a manner similar to exercise.<sup>6</sup> Only a small handful of studies have examined the effect of bitter melon (in varying forms) on diabetes; glucose and A1C levels decreased, although not always significantly.

**Sources.** Bitter melon may be consumed as a vegetable, tea, or juice or may be ingested in capsule form. It has even been used as an injection.

**Typical dosing.** Because of wide variations in the form of bitter melon consumed, there is no typical dosing regimen. However, doses of between 50 and 100 ml (~ 3–6 tablespoons) have been used.

**Potential side effects.** Bitter melon eaten as a vegetable is likely to be safe. People allergic to melons may experience an allergic reaction to bitter melon; symptoms include rash, itching, and shortness of breath. The main side effect of bitter melon, however, is gastrointestinal distress. Other adverse effects include headache, he-

molytic anemia, and hypoglycemia if ingested with medications that lower blood glucose.

Pregnant women should avoid bitter melon due to the risk of possible birth defects and miscarriage. In addition to enhancing the effect of glucose-lowering medication, bitter melon may interact with lipid-lowering drugs, immune system suppressants, and chemotherapy medications.<sup>7</sup>

#### Chromium supplementation

**Intended use.** Chromium is an essential trace mineral that is needed for glucose metabolism. It works by enhancing the effect of insulin. Chromium, usually in the form of chromium picolinate, is a popular supplement among people with diabetes and those who are interested in losing weight. Its effect on glucose levels has been researched, with mixed results. Chromium is found primarily in two forms: trivalent, a biologically active form found in food, and hexavalent, which is toxic and a result of industrial pollution.

The effects of chromium supplementation in people with diabetes have been mixed. Although a meta-analysis<sup>8</sup> of the effects of chromium supplements on A1C, glucose, and insulin levels showed little effect among those with and without diabetes, other studies have shown some benefit on these same markers in subjects who were chromium deficient. Other studies have shown little, if any, benefit of chromium supplements on weight loss.<sup>9</sup>

**Sources.** Chromium is found in broccoli, grape juice, brewer's yeast, dried garlic, dried basil, beef, and red wine. However, the amount of chromium in food is challenging to deter-

mine because of varying agricultural and manufacturing processes.

**Typical dosing.** Supplementation of chromium is typically 400–800 µg/day.

**Potential side effects.** Excessively high intakes of chromium may cause renal and liver failure, thrombocytopenia, hemolysis, skin reactions, and mood disturbances. Chromium may interact with a number of medications, including anatacids, H<sub>2</sub> blockers, proton pump inhibitors, β-blockers, corticosteroids, nonsteroidal anti-inflammatory drugs, and nicotinic acid. In addition, patients who take insulin or insulin secretagogues and chromium may have an added risk of hypoglycemia.

#### Cinnamon supplementation

**Intended use.** Cinnamon has been used for medicinal purposes since ancient times. There are two types of cinnamon: Ceylon and cassia. Cassia cinnamon (the kind people use for cooking and baking) is the type used in the purported treatment of diabetes, as well as for the treatment of gastrointestinal distress. The active ingredient in cinnamon is hydroxychalcone, a substance that is thought to enhance insulin action.

In a 2003 study published in the journal *Diabetes Care*, type 2 diabetic subjects consumed 1, 3, or 6 g of cinnamon daily for 40 days. The cinnamon lowered blood glucose from 18 to 29% in all three groups; however, the participants who consumed the smallest amount of cinnamon (1 g, which is approximately one-half of a teaspoon) continued to have improved glucose levels for up to 20 days after discontinuing the cinnamon. Cholesterol and triglyceride levels also improved with cinnamon, but no changes in A1C were reported.<sup>10</sup> However, other studies have shown mixed results. Although cinnamon may lower fast-

ing glucose levels, it does not appear to lower A1C levels.

**Sources.** Cinnamon is typically consumed in ground form, sprinkled on foods or used as a spice in baking. It is also consumed as a tea and is available in capsule form and as an essential oil.

**Typical dosing.** Standard doses of cinnamon are 1 g (1/2 teaspoon) daily.

**Potential side effects.** There are few adverse effects from taking cinnamon. Allergic reactions are rare but possible, and contact dermatitis is a possibility. Also, hypoglycemia could occur in those taking insulin or using an insulin secretagogue. People with liver damage should use cinnamon with caution.

A potential cause for concern is that cassia cinnamon naturally contains a substance called coumarin. Large doses of coumarin, which is also found in celery and parsley, may lead to or worsen liver damage.<sup>11</sup> For this reason, some cinnamon supplements are made with water-extracted cinnamon, which may contain less coumarin.

#### Fenugreek supplementation

**Intended use.** Fenugreek has been used since ancient times for a variety of ailments, including digestive problems and menopausal symptoms. Native to India and North Africa, fenugreek seeds are also used as part of ayurvedic medicine. Currently, fenugreek is a popular remedy for type 2 diabetes, among other health conditions, but it is also used in cooking. Interestingly, it tastes and smells like maple syrup.

Several small studies have indicated that these seeds may help lower blood glucose, possibly by stimulating the release of insulin. Because fenugreek seeds contain fiber, it is thought that the seeds may slow gastric emptying and thus carbohydrate digestion and absorption. The

seeds may also lower cholesterol and triglycerides.<sup>5</sup>

**Sources.** In studies of patients with type 2 diabetes, fenugreek has been consumed as seeds or as a hydroalcoholic extract. Fenugreek is also available in capsule form and as a tea.

**Typical dosing.** Doses of fenugreek range from 5 to up to 100 g/day.

**Potential side effects.** Ingesting fenugreek as seeds or in capsule form may lead to gastrointestinal distress (gas, bloating, diarrhea). Pregnant women should be advised to avoid taking fenugreek because it may lead to uterine contractions. Fenugreek may interact with blood-thinning medications and can enhance the effect of insulin and insulin secretagogues; therefore, hypoglycemia is another possible side effect.

#### Gymnema supplementation

**Intended use.** Gymnema (*gymnema sylvestre*) is a woody plant originating in central and southern India but used in traditional medicine in Japan, Australia, and Vietnam. Another name for this herb is gurmar, which means “sugar destroyer,” because chewing the leaves hinders the ability to detect sweetness.

Gymnema has been used to treat a number of conditions, including stomach ailments, constipation, liver disease, and heart arrhythmias. One of its main uses has been to treat both type 1 and type 2 diabetes, and studies, although few, have shown that it has led to a decrease in both A1C and fasting glucose levels.<sup>5</sup>

Gymnema’s mechanism of action likely involves increased glucose uptake and insulin secretion from β-cells. In addition to its glycemic effect, gymnema may have a lipid-lowering effect.<sup>12</sup>

**Sources.** Gymnema is available as a water-soluble extract that is standardized to contain 24% gymnemic acid.

It can also be ingested in capsule form or as a tea.

**Typical dosing.** The typical dose of gymnema extract is 400–600 mg/day: as a capsule, 100 mg three to four times daily, and as a powder used to make tea, 0.5–1 teaspoon daily.

**Potential side effects.** Gymnema may lead to hypoglycemia if taken along with insulin or insulin secretagogues. It may also interfere with the ability to taste sweet or bitter flavors.

### Talking With Patients About Supplements

Despite insufficient data on supplement safety and effectiveness, the fact remains that people with diabetes do and will continue to use dietary supplements. One common misconception is that if a product is “natural” it must be good, or at least harmless. In addition, many people believe that if an herb or product has been used for hundreds or thousands of years, it must be okay.

Health care providers have a responsibility to ask their patients about any and all dietary supplements that they take, just as they ask about medications; provide information, if available, about the safety and effectiveness of those supplements; be familiar with common supplements used for the treatment of diabetes or know of resources from which to obtain this information; and also be familiar with possible side effects of and drug interactions with supplements. Following are some suggestions for discussing supplements with patients.

- Ask patients why they are interested in taking a supplement and for what particular condition they wish to take it. Are they worried about taking a medication, perhaps because of possible side effects or cost? Did they see an info-mercial on television or read about a particular supplement on the Internet and

conclude that the supplement can benefit them?

- Inform patients about claims that sound too good to be true. Provide a resource list of reliable sources of information.
- Some dietary supplements should be avoided altogether because they can be extremely harmful. These include chaparral, comfrey, germander, bitter orange, yohimbe, lobelia, wormwood, kava, pennyroyal oil, skullcap, and aristolochic acid.
- Other supplements may pose a risk for patients taking blood-thinning medications. These include garlic, ginger, ginkgo biloba, ginseng, and vitamin E.
- Remind patients that their health plan will likely not cover the cost of the supplement, and, therefore, they will pay the entire cost from their own pocket.
- If patients decide to take a supplement, advise them to choose a brand from a manufacturer that practices GMPs and that has been evaluated by an independent orga-

nization, such as ConsumerLab.com, NSF International or the U.S. Pharmacopeia. Such brands will typically display a seal of approval from the independent organization.

- Advise patients to take a single-product supplement that displays, on the container, how much of the product is in the supplement. Look for standardized extracts or quantities of active ingredients listed on the label. Supplements should also list an expiration date.
- In general, patients should be instructed to avoid taking supplements from other countries. These are more likely to contain contaminants because of little, if any, regulation.
- Point out any possible interactions with medications that patients may be taking.
- Be cognizant that many supplements may be dangerous for or have not been adequately tested in pregnant women or children.
- If patients are taking a supplement for glycemic control, they should monitor blood glucose levels and

**Table 1. Questions for Patients to Ask Before Starting on a Supplement<sup>13</sup>**

- Is there any evidence that this supplement can improve my diabetes control and my health?
- Is there reliable research about the supplement's benefits?
- Is it known whether this supplement is safe for me?
- Could this supplement interact with any other medicine I take or medical conditions I have?
- How much should I take and how often?
- Are there any known side effects that I should be aware of?
- Are there situations when I should stop taking it?
- How can I tell if the supplement is improving my health?

**Table 2. Online Resources for Dietary Supplement Information**

- ConsumerLab.com: [www.consumerlab.com](http://www.consumerlab.com)\*
- Natural Standard: [www.naturalstandard.com](http://www.naturalstandard.com)\*
- National Center for Complementary and Alternative Medicine (NCCAM): [www.nccam.nih.gov](http://www.nccam.nih.gov)
- Office of Dietary Supplements, National Institutes of Health: <http://ods.od.nih.gov>
- Food and Drug Administration: [www.cfsan.fda.gov/~dms/ds-savvy.html](http://www.cfsan.fda.gov/~dms/ds-savvy.html)

\* Fee required to access database



record their results more than usual, especially if they are taking insulin or an insulin secretagogue. Hypoglycemia is a definite risk.

- Be sure to monitor patients' blood pressure, weight, A1C, lipids, or other relevant parameters based on the supplements used and the reasons for which the patients are taking them.
- Discuss time frames for taking a supplement. For example, patients may decide to try a particular supplement for, say, 3 months, and if no improvement in blood glucose is noted, they will then discontinue the supplement.
- Recommend that patients take or start just one supplement at a time. In the event of benefits or side effects, it will be easier to pinpoint the specific supplement responsible.
- Reinforce that patients should stop taking supplements immediately and call their provider if they experience any deleterious side effects.
- At each visit, ask about any supplements patients may be taking, the doses they are using, and the length of time they have taken the supplements.
- Table 1 offers a list of questions patients should ask before start-

ing a supplement. Table 2 offers a list of resources from which to get more information about dietary supplements.

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