

by Linda Milo Ohr

Defeating Diabetes

Almost 24 million people in the United States, or 8% of the population, have diabetes, according to the American Diabetes Association (ADA), Alexandria, Va. (phone 800-342-2383, www.diabetes.org). The prevalence of diabetes has increased 13.5% from 2005 to 2007. If current trends continue, one out of every three children born today will face a future with diabetes.

Nutrition plays an important role in managing diabetes. ADA's Web site lists the top 10 foods to include in the diet—all of which have a low glycemic index (GI) and provide key nutrients that are lacking in the typical Western diet such as calcium, potassium, fiber, magnesium, and vitamins A, C, and E. They include beans, dark green leafy vegetables, citrus fruit, sweet potatoes, berries, tomatoes, salmon, whole grains, nuts, and fat-free milk and yogurt.

Packaged foods and beverages are increasingly targeting diabetics. Many of these products are formulated with low GI sweeteners, whole grains, and fiber. Here is a look at some potential nutraceutical ingredients that reportedly can help manage or prevent the risk of diabetes.

Black Tea

Chen et al. (2009) showed that polysaccharides in black tea have the potential to help manage diabetes. Many studies have focused on the hypoglycemic activities of tea polysaccharides, but little is known about their glycosidase inhibitory effects, according to the researchers. For their study, the researchers isolated three polysaccharide-rich fractions from green tea, oolong tea, and black tea and found that the polysaccharides in black tea had the most glucose-inhibiting properties. The black tea polysaccharides also showed the highest scavenging effect on free radicals, which are involved in the onset of diseases such as cancer and rheumatoid arthritis.

Blueberries

Blueberries are rich in anthocyanins. Grace et al. (2009) demonstrated that blueberry anthocyanins have the potency to alleviate symptoms of



Blueberries and many other foods can provide health benefits to people with diabetes.
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hyperglycemia in diabetic mice. They gave the mice 500 mg/kg body weight of a phenolic-rich extract or an anthocyanin-enriched fraction. Both treatments had comparable hypoglycemic activities to that of an antidiabetic drug; however, the anthocyanin-enriched fraction had a greater effect on lowering elevated blood glucose (51% lowering effect compared to 33% for the phenolic-rich extract).

Vuong et al. (2009) investigated the anti-obesity and antidiabetic potential of biotransformed blueberry juice in KKAy mice, a rodent model of leptin

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resistance. The blueberry juice was extracted from North American lowbush blueberries and biotransformed with *Serratia vaccinii* bacteria from the skin of the fruit. The researchers found that the blueberry juice protected the mice from hyperphagia, significantly reduced their weight gain, and protected against the development of glucose intolerance and diabetes mellitus.

Chromium

Chromium has been shown to improve insulin sensitivity. A commercially available chromium, *ChromeMate*® from InterHealth Nutraceuticals Inc., Benicia, Calif. (phone 800-783-4636, www.interhealthusa.com), is a bioavailable niacin-bound chromium complex that helps promote insulin

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Cinnamon may improve insulin sensitivity and improve fasting blood glucose in diabetics.
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sensitivity and improves long-term blood sugar control. Jain et al. (2007) showed that diabetic rats that took *ChromeMate* had a 12% lower level of HbA1, an indicator of glucose control and long-term blood sugar status, and thus had improved glucose control. The niacin-bound chromium also reduced triglyceride and total cholesterol levels by 52% and 26%, respectively, compared to the rats in the control group.

Nutrition 21 Inc., Purchase, N.Y. (phone 914-701-4500, www.nutrition21.com), offers *Chromax*[®] chromium picolinate (CrPic). The company currently holds patents covering the uses of chromium picolinate for reducing hyperglycemia and stabilizing blood glucose, increasing lean body mass and reducing body fat, and maintaining healthy cholesterol levels. Broadhurst et al. (2006) reviewed 15 clinical studies of CrPic supplementation on type 2 diabetes mellitus and found substantial reductions in hyperglycemia and hyperinsulinemia, which equate to a reduced risk for disease complications. Collectively, the data support the safety and therapeutic value of CrPic for the management of cholesterolemia and hyperglycemia in subjects with diabetes. Positive results from CrPic supplementation included reduced blood glucose, insulin, cholesterol, and triglyceride

levels, as well as reduced requirements for hypoglycemic medication.

Cinnamon

Cinnamon has been shown to improve insulin sensitivity. Anderson (2008) reported that cinnamon polyphenols have been shown to improve insulin sensitivity in *in vitro*, animal, and human studies. Cinnamon reduced mean fasting serum glucose (18–29%), triacylglycerol (23–30%), total cholesterol (12–26%), and low-density lipoprotein (LDL) cholesterol (7–27%) in subjects with type 2 diabetes who consumed 1–6 g of cinnamon/day for 40 days. The subjects with metabolic syndrome who consumed an aqueous extract of cinnamon had improved fasting blood glucose, systolic blood pressure, percentage body fat, and increased lean body mass compared with those in the control group.

Olive Extract

Made from the juice of olives, *HidroX*[™] from DSM Nutritional Products Inc., Parsippany, N.J. (phone 800-526-0189, www.dsmnutritionalproducts.com), possesses a high concentration of polyphenols with strong antioxidant and anti-inflammatory activities. The main polyphenol is hydroxytyrosol (HT), which is considered one of the most important polyphenolic compounds responsible for the

Mediterranean diet health benefits, including lowering the incidence of cardiovascular disease.

Hao et al. (2009) showed that HT may stimulate the function of mitochondria in cells thought to help prevent diseases like diabetes and obesity. Using mouse-derived fat cells, the researchers tested the effects of different concentrations of HT—ranging from 0.1 to 10 $\mu\text{mol/L}$ —on the expression of proteins linked to mitochondrial function. The results showed that HT effectively stimulated mitochondrial biogenesis and function. The researchers concluded that the mitochondrial targeting property may provide a possible mechanism for the efficacy of the Mediterranean diet for lowering the risk of cardiovascular disease and they also suggested that HT may be used as a therapeutic intervention for preventing type 2 diabetes and obesity.

Pistachios

Earlier this year, the University of Toronto unveiled research that showed incorporating pistachios into daily meals resulted in delayed emptying of the stomach and blunting of the blood sugar curve, which may lead to long-term blood sugar control (WPA, 2009). Fifteen men and women fasted and then consumed three similar types of test meals in random order. The meals consisted of white bread plus 2 oz of pistachios, white bread plus butter and cheese, and white bread (control). The results showed that the subjects who ate the pistachios meal had reduced peak blood sugar levels relative to those who ate the white bread plus butter and cheese meal. At 3 hr, serum ghrelin levels in the subjects who ate the pistachio and control meals were significantly lower than in those who ate the white bread meal. The researchers concluded that pistachios consumed with carbohydrate-rich meals may blunt/moderate the blood sugar response after a meal or postprandial GI and thus may be of

benefit in improving long-term glycemic control.

Pulses

Peas, beans, lentils, and chickpeas are pulses, the edible seeds of plants belonging to the legume family, which is characterized by pods containing seeds of variable size, shape, and color. Pulses have a low GI, which is particularly beneficial for people with diabetes. Sievenpiper et al. (2009) reported that pulses improved markers of longer-term glycemic control in humans. They conducted a systematic review and meta-analysis of 41 randomized controlled experimental trials investigating the effect of pulses, alone or as part of low-GI or high-fiber diets, on markers of glycemic control in people with and without diabetes. When eaten on their own or as part of a high-fiber diet, pulses lowered fasting blood glucose levels. Pulses were also found to improve glycosylated hemoglobin (HbA1c), an indicator of long-term blood sugar control. In fact, when pulses were eaten as part of a high-fiber or low-glycemic diet, the significant reduction in HbA1c seen in subjects with type 2 diabetes was comparable to that achieved by oral medications.

Resistant Starch

In March 2009, Robertson et al. (2009) presented preliminary results from a clinical study that found that the consumption of *Hi-maize*TM resistant starch from National Starch Food Innovation, Bridgewater, N.J. (phone 800-743-6343, www.foodinnovation.com), significantly increased insulin sensitivity in subjects with insulin resistance and metabolic syndrome. The 8-week randomized, crossover study showed that 10 overweight subjects with insulin resistance and metabolic syndrome who consumed 40 g of dietary fiber from *Hi-maize* resistant starch/day increased their hepatic insulin sensitivity by 54%, their peripheral (muscle) insulin sensitivity by 24%, and their glucose uptake into forearm muscle by 68%. They also had reduced fasting insulin levels, reduced postprandial insulin responses to a standardized meal, and significantly lower levels of fasting non-esterified fatty acids.

Past research has demonstrated that consumption of *Hi-maize* resistant starch increased insulin sensitivity in people with normal blood glucose levels. Robertson et al. (2005) found a 33% increase in insulin sensitivity following a meal tolerance test and a 14% improvement in insulin sensitivity as measured by the euglycemic clamp in people with normal blood glucose levels. Zhang et al. (2007) showed that the resistant starch ingredient also increased insulin sensitivity in people with type 2 diabetes.

Salba Seeds

Salba is a novel variety of an ancient oily grain, *Salvia hispanica* L. Vuksan et al. (2007) showed that long-term supplementation with salba may have cardio-protective properties in subjects with type 2 diabetes. They randomly assigned 20 subjects with type 2 diabetes to receive either 37±4 g of salba or

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Chickpeas, beans, lentils, and peas can lower fasting blood glucose levels, research shows.

Photo courtesy of Pulse Canada



wheat bran/day for 12 weeks. The subjects maintained their conventional diabetes therapies during the study. The subjects who took salba had reductions of 6 units in systolic blood pressure and a 40% reduction of C-reactive protein levels, a marker of low-grade body inflammation.

Vuksan et al. (2009) evaluated the effect of salba particle size on postprandial glycemia. They gave 13 healthy subjects either 7, 15, or 24 g of whole or finely ground salba baked into white bread that contained 50 g of available carbohydrate, or white bread (control). This occurred on eight different occasions. The subjects who took the bread made with whole or ground salba had reduced blood glucose levels by 20%, 28%, and 35% for the 7 g, 15 g, and 24 g of salba, respectively. The researchers did not observe differences in glucose responses in the subjects who consumed either whole or ground salba. They concluded that the addition of either whole or ground salba to white bread lowers postprandial glycemia equally in a dose-dependent manner.

Soy

Pipe et al. (2009) showed that soy protein reduced serum LDL cholesterol in adults with type 2 diabetes. For the double-blind, randomized, crossover, placebo-controlled intervention study design, the researchers gave adults with diet-controlled type 2 diabetes (n=29) either 80 mg of aglycone isoflavones soy protein isolate (SPI) or milk protein isolate (MPI)/day for 57 days, each separated by a 28-day washout period. The results showed that consuming SPI reduced serum LDL cholesterol but did not affect serum total cholesterol, HDL cholesterol, triacylglycerol, apolipoprotein B, or apolipoprotein A-I. They also showed that consuming soy protein can modulate some serum lipids to help minimize cardiovascular disease risk in adults with type 2 diabetes. **FT**



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