

A review on benefits of sweet potato for the management of diabetes mellitus

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Abstract

Sweet potatoes are considered a super food for diabetics. They have been shown to stabilize blood-sugar levels by lowering insulin resistance. They contain a high amount of fiber, which also helps to reduce levels of "bad" LDL cholesterol in the body. Sweet potatoes are a good food choice for diabetics as they are high in fiber and have a low glycemic index. Foods with a low glycemic index have less of an immediate impact on blood glucose levels, and therefore can help diabetics control their blood sugar. The method used to cook sweet potatoes will affect their glycemic index; certain cooking methods spike the glycemic index of sweet potatoes and render them less desirable for diabetics.

Keywords: Sweet potato and glucose level.

Introduction

The sweet potato (*Ipomoea batatas*) is a dicotyledonous plant that belongs to the bindweed or morning glory family, Convolvulaceae. Its large, starchy, sweet-tasting, tuberous roots are a root vegetable. The young leaves and shoots are sometimes eaten as greens. The sweet potato is only distantly related to the potato (*Solanum tuberosum*) and does not belong to the nightshade family, Solanaceae, but both families belong to the same taxonomic order, the Solanales.

Sweet potatoes are vegetables that look like large ordinary potatoes but taste sweet. They have pinkish-brown skins and yellow flesh. Orange-fleshed sweet potatoes may be one of nature's unsurpassed sources of beta-carotene. Several recent studies have shown the superior ability of sweet potatoes to raise our blood levels of vitamin A. This benefit may be particularly true for children. In several studies from Africa, sweet potatoes were found to contain between 100-1,600 micrograms (RAE) of vitamin A in every 3.5 ounces enough, on average, to meet 35% of all vitamin A needs, and in many cases enough to meet over 90% of vitamin A needs (from this single food alone).

Sweet potatoes are not always orange-fleshed on the inside but can also be a spectacular purple color. Sometimes it's impossible to tell from the skin of sweet potato just how rich in purple tones its inside will be. That's because scientists have now identified the exact genes in sweet potatoes (IbMYB1 and IbMYB2) that get activated to produce the purple anthocyanin pigments responsible for the rich purple tones of the flesh. The purple-fleshed sweet potato anthocyanins primarily peonidins and cyanidins have important antioxidant properties and anti-inflammatory properties. Particularly when passing through our digestive

tract, they may be able to lower the potential health risk posed by heavy metals and oxygen radicals. For more details on purple-fleshed and orange-fleshed sweet potatoes, please see our Description section below.

Health Benefits

They provide some surprising health benefits. Many people think about sweet potatoes as being nothing more than plain old potatoes that can tweak our taste buds with some extra flavor. One difficulty in describing the health benefits of sweet potatoes knows where to begin. There are a surprising number of nutrient categories responsible for the health benefits of this underappreciated tuber. Among these categories are antioxidants, anti-inflammatory nutrients, and blood sugar-regulating nutrients. Each category brings with it valuable health benefits.

Antioxidant Nutrients in Sweet Potatoes

Sweet potatoes contain a wealth of orange-hued carotenoid pigments. In countries throughout Africa, in India and in the Caribbean, sweet potatoes have been shown to be a highly effective way of providing school age children with sizable amounts of their daily vitamin A. In some studies, sweet potatoes have been shown to be a better source of bioavailable beta-carotene than green leafy vegetables. Because sweet potatoes are available in many countries on a virtual year-round basis, their ability to provide us with a key antioxidant like beta-carotene makes them a standout antioxidant food.

Yet beta-carotene only begins to tell the story of sweet potato antioxidants. Particularly in purple-fleshed sweet potato, antioxidant anthocyanin pigments are abundant. Cyanidins and peonidins are concentrated in the starchy core of part of purple-fleshed sweet potatoes, and these antioxidant nutrients may be even more concentrated in the flesh than in the skin. That's sweet potatoes have genes that are specialized for the production of anthocyanin pigments in the fleshy part of the tuber. Ordinary, sweet potatoes have been shown in research studies to increased the activity of two key antioxidant enzymes copper/zinc superoxide dismutase (Cu/Zn-SOD) and catalase (CAT).

Recent research has shown that particularly when passing through our digestive tract, sweet potato cyanidins and peonidins and other color-related phytonutrients may be able to lower the potential health risk posed by heavy metals and oxygen radicals. That risk reduction might be important not only for individuals at risk of digestive tract problems but for all persons wanting to reduce the potential risk posed by the presence of heavy metal residues (like small amounts of mercury or cadmium or arsenic) in their diet.

Storage proteins in sweet potato also have important antioxidant properties. These storage proteins called sporamins get produced by sweet potato plants whenever the plants are subjected to physical damage. Their ability to help the plants heal from this damage is significantly related to their role as antioxidants. Especially when sweet potato is being digested inside of our gastrointestinal tract, we may get some of these same antioxidant benefits.

Anti-Inflammatory Nutrients in Sweet Potatoes

Anthocyanin and other color-related pigments in sweet potato are equally valuable for their anti-inflammatory health benefits. In the case of inflammation, scientists understand even more about the amazing properties of this tuber. In animal studies, activation of nuclear factor-kappa B (NF- κ B); activation of inducible nitric oxide synthase (iNOS), and cyclooxygenase-2 (COX-2); and formation of malondialdehyde (MDA) have all be shown to get reduced following consumption of either sweet potato or its color-containing extracts. Since each of these events can play a key role in the development of unwanted inflammation, their reduction by sweet potato phytonutrients marks a clear role for this food in inflammation-related health problems. In animal studies, reduced inflammation following sweet potato consumption has been shown in brain tissue and nerve tissue throughout the body.

Fibrinogen is one of the key glycoproteins in the body that is required for successful blood clotting. With the help of a coagulation factor called thrombin, fibrinogen gets converted into fibrin during the blood clotting process. Balanced amounts of fibrinogen, thrombin and fibrin are a key part of the body's health and its ability to close off wounds and stop loss of blood. However, excess amounts of these clotting-related molecules may sometimes pose a health risk. For example, excess presence of fibrinogen and fibrin can trigger unwanted secretion of pro-inflammatory molecules (including cytokines and chemokines). In animal studies, too much fibrin in the central nervous system has been associated with breakdown of the myelin sheath that surrounds the nerves and allows them to conduct electrical signals properly. If fibrin excess can trigger unwanted inflammation in nerve tissue and increase breakdown of the myelin wrapping the nerve cells (a process that is usually referred to as demyelination), health problems like multiple sclerosis (in which there is breakdown of the myelin nerve sheath) may be lessened through reduction of excess fibrinogen and/or fibrin. In preliminary animal studies, intake of sweet potato color extracts has been shown to reduce inflammation, and simultaneous reduction of fibrinogen levels.

Potential Improvement of Blood Sugar Regulation

Many people think about starchy root vegetables as a food group that could not possibly be helpful for controlling their blood sugar. That's because many people realize that food starches can be converted by our digestive tract into simple sugars. If foods are especially concentrated in starch, there can often be a risk of too much simple sugar release in our digestive tract and too much pressure upon our bloodstream to uptake more sugar. (The result in this situation would be an overly quick elevation of our blood sugar level.) What's fascinating about sweet potatoes is their ability to potentially improve blood sugar regulation even in persons with type 2 diabetes in spite of their glycemic index (GI) rating of medium. (Sweet potatoes are one of four WH Foods vegetables that have a GI ranking of medium. The other three vegetables are beets, corn, and leeks.) The 6.6 grams of dietary fiber in a medium sweet potato are definitely a plus in terms of blood sugar regulation, since they help steady the pace of digestion. But recent research has also shown that extracts from sweet potatoes can significantly increase blood levels of adiponectin in persons with type 2 diabetes. Adiponectin is a protein hormone produced by our fat cells, and it serves as an important modifier of insulin metabolism. Persons with poorly-regulated insulin metabolism and insulin insensitivity tend to have lower levels of adiponectin, and persons with healthier insulin metabolism tend to have higher levels. While more research on much larger groups of individuals to further evaluate and confirm these blood sugar regulating benefits, this area of health research is an especially exciting one for anyone who loves sweet potatoes but is nevertheless concerned about healthy blood sugar regulation.

Other Potential Health Benefits of Sweet Potatoes

One of the more intriguing nutrient groups provided by sweet potatoes yet one of the least studied from a health standpoint are the resin glycosides. These nutrients are sugar-related and starch-related molecules that are unusual in their arrangement of carbohydrate-related components, and also in their inclusion of some non-carbohydrate molecules. In sweet potatoes, researchers have long been aware of one group of resin glycosides called batatins (including batatin I and batatin II). But only recently have researchers discovered a related group of glycosides in sweet potato called batatosides (including batatodide III, batatoside IV, and batatoside V). In lab studies, most of these sweet potato glycosides have been shown to have antibacterial and antifungal properties. To what extent these carbohydrate-related molecules in sweet potatoes can provide us with health benefits in these same antibacterial and antifungal areas is not yet clear. But we expect to see increasing interest in sweet potato's batatins and batatosides and their potential to support our health.

1. They are high in vitamin B6.

Vitamin B6 helps reduce the chemical homocysteine in our bodies. Homocysteine has been linked with degenerative diseases, including heart attacks.

2. They are a good source of vitamin C.

While most people know that vitamin C is important to help ward off cold and flu viruses, few people are aware that this crucial vitamin plays an important role in bone and tooth formation, digestion, and blood cell formation. It helps accelerate wound healing, produces collagen which helps maintain skin's youthful elasticity, and is essential to helping us cope with stress. It even appears to help protect our body against toxins that may be linked to cancer.

3. They are a good source of vitamin D, which helps build healthy bones.

Vitamin D is critical for immune system and overall health at this time of year. Both a vitamin and a hormone, vitamin D is primarily made in our bodies as a result of getting adequate sunlight. You may have heard about seasonal affective disorder (or SAD, as it is also called), which is linked to inadequate sunlight and therefore a vitamin D deficiency.

Vitamin D plays an important role in our energy levels, moods, and helps to build healthy bones, heart, nerves, skin, and teeth, and it supports the thyroid gland.

4. Sweet potatoes contain iron and support a healthy immune system.

Most people are aware that we need the mineral iron to have adequate energy, but iron plays other important roles in our body, including red and white blood cell production, resistance to stress, proper immune functioning, and the metabolizing of protein, among other things.

5. Sweet potatoes are a good source of magnesium, which is the relaxation and anti-stress mineral.

Magnesium is necessary for healthy artery, blood, bone, heart, muscle, and nerve function, yet experts estimate that approximately 80 percent of the population in North America may be deficient in this important mineral.

6. They are a source of potassium.

Potassium is one of the important electrolytes that help regulate heartbeat and nerve signals. Like the other electrolytes, potassium performs many essential functions, some of which include relaxing muscle contractions, reducing swelling, and protecting and controlling the activity of the kidneys.

7. Sweet potatoes do not cause blood sugar spikes.

Sweet potatoes are naturally sweet-tasting but their natural sugars are slowly released into the bloodstream, helping to ensure a balanced and regular source of energy, without the blood sugar spikes linked to fatigue and weight gain.

Nutritional facts.

Table: 1 Nutrition Facts Sweet potato /100 grams

Nutrient		Amount	
Calories		86	
Total Fat		0%	
Saturated fat 0 g		0%	
Polyunsaturated fat 0 g			
Monounsaturated fat 0 g			
Cholesterol 0 mg		0%	
Sodium 55 mg		2%	
Potassium 337 mg		9%	
Total Carbohydrate 20 g		6%	
Dietary fiber 3 g		12%	
Sugar 4.2 g			
Protein 1.6 g		3%	
Vitamin A	283%	Vitamin C	4%
Calcium	3%	Iron	3%
Vitamin D	0%	Vitamin B-6	10%
Vitamin B-12	0%	Magnesium	6%

Diabetes mellitus

Diabetes is a disease in which your blood glucose, or blood sugar, levels are too high. Glucose comes from the foods you eat. Insulin is a hormone that helps the glucose get into your cells to give them energy. With type 1 diabetes, your body does not make insulin. With type 2 diabetes, the more common type, your body does not make or use insulin well. Without enough insulin, the glucose stays in your blood. You can also have prediabetes. This means that your blood sugar is higher than normal but not high enough to be called diabetes. Having prediabetes puts you at a higher risk of getting type 2 diabetes.

Over time, having too much glucose in your blood can cause serious problems. It can damage your eyes, kidneys, and nerves. Diabetes can also cause heart disease, stroke and even the need to remove a limb. Pregnant women can also get diabetes, called gestational diabetes.

Symptoms of type 1 and type 2 diabetes include

- Increased urine output,
- Excessive thirst,
- Weight loss,
- Hunger,
- Fatigue,
- Skin problems
- Slow healing wounds,
- Yeast infections, and
- Tingling or numbness in the feet or toes.

Some of the risk factors for getting diabetes include being overweight or obese, leading a sedentary lifestyle, a family history of diabetes, hypertension (high blood pressure), and low levels of the "good" cholesterol (HDL) and elevated levels of triglycerides in the blood.

If you think you may have prediabetes or diabetes contact a health-care professional.

Classification

- Diabetes can be classified into the following general categories:
- Type 1 diabetes (due to β -cell destruction, usually leading to absolute insulin deficiency)
- Type 2 diabetes (due to a progressive insulin secretory defect on the background of insulin resistance)
- Gestational diabetes mellitus (GDM) (diabetes diagnosed in the second or third trimester of pregnancy that is not clearly overt diabetes)
- Specific types of diabetes due to other causes, e.g., monogenic diabetes syndromes (such as neonatal diabetes and maturity-onset diabetes of the young [MODY]), diseases of the exocrine pancreas (such as cystic fibrosis), and drug- or chemical-induced diabetes (such as in the treatment of HIV/AIDS or after organ transplantation)

Causes of diabetes

Type 1 diabetes causes

Type 1 diabetes is caused by the immune system destroying the cells in the pancreas that make insulin. This causes diabetes by leaving the body without enough insulin to function normally.

This is called an autoimmune reaction, or autoimmune cause, because the body is attacking itself.

There is no specific diabetes causes, but the following triggers may be involved:

- Viral or bacterial infection
- Chemical toxins within food
- Unidentified component causing autoimmune reaction

Underlying genetic disposition may also be a type 1 diabetes cause.

Type 2 diabetes causes

Type 2 diabetes causes are usually multi factorial - more than one diabetes cause is involved. Often, the most overwhelming factor is a family history of type 2 diabetes.

This is the most likely type 2 diabetes cause.

There are a variety of risk factors for type 2 diabetes, any or all of which increase the chances of developing the condition.

These include:

- Obesity
- Living a sedentary lifestyle
- Increasing age
- Bad diet

➤ **Sweet potatoes a diabetic super food**

Sweet potatoes are considered a super food for diabetics, says the American Diabetes Association (AMA). They have been shown to stabilize blood-sugar levels by lowering insulin resistance. They contain a high amount of fibre, which also helps to reduce levels of "bad" LDL cholesterol in the body. Sweet potatoes are a good food choice for diabetics as they are high in fiber and have a low glycemic index. Foods with a low glycemic index have less of an immediate impact on blood glucose levels, and therefore can help diabetics control their blood sugar. The method used to cook sweet potatoes will affect their glycemic index; certain cooking methods spike the glycemic index of sweet potatoes and render them less desirable for diabetics.

➤ **Carbs in Sweet Potatoes**

Any discussion of food and diabetes management should begin with the American Diabetes Association's recommendation, which is to count the grams of carbohydrates you eat in a day. The number of carbs you need is calculated based on your body weight and activity levels, but as a rule the ADA suggests aiming for a range of 45 to 60 grams of carbohydrates per meal, although some people may require fewer for optimal blood sugar control. By that reckoning, sweet potatoes pose a challenge: One large baked sweet potato provides over 37 grams of carbs, which represents most of your allowance for that meal. By that measure, incorporating a sweet potato can sharply limit what else goes onto your plate.

➤ **Sweet Potatoes and Glycemic Index**

Aside from straightforward carb-counting, some diabetics use a tool called the glycemic index, or GI, to gauge a food's impact on their blood glucose. GI testing uses the effect of pure glucose as its benchmark, and then measures how the test food's impact on your blood glucose compares to that standard. A GI of 55 or lower is considered low, 55 to 69 is considered moderate, and 70 or above is high. Sweet potatoes are usually cited at an average GI of 70, which qualifies as high, but only just barely. More importantly tests results have varied widely, reporting GIs as low as 44 or as high as 94. The ADA endorses counting carbs as the more reliable tool, then using GI, if you wish, as a tool to further fine-tune your carb consumption. The glycemic index measures how carbohydrates affect blood sugar. The system was developed by University of Toronto professor Dr. David J. Jenkins in an effort to determine which food best serves the needs of diabetics. The index tracks the rate at which carbohydrates are absorbed into the blood after digestion. The lower the glycemic index of a food, the better it is for diabetics, since it can help them avoid high blood sugar levels and possible diabetes complications. Sweet potatoes have a glycemic index of 44 foods considered low on the glycemic index are 55 and less so they are good for diabetics.

➤ **Fiber**

Sweet potatoes are also good for diabetics because they contain a good deal of fiber, particularly when the skins are left on. The amount of fiber in a food slows down the rate of digestion of the starches. This action in turn lowers the glycemic index of the sweet potato and helps keep blood sugar levels within a manageable range.

➤ **Sweet potato for type 2 diabetes mellitus**

Sweet potato (*Ipomoea batatas*) is a plant found in the tropical and subtropical belts and is one of the most nutritious tropical and subtropical vegetables. As well as being popular in cooking in countries in Asia-Pacific, Africa and North America, sweet potato is also used in traditional medicine for the treatment of diabetes mellitus. We decided to investigate whether there is enough evidence from medical trials to show whether sweet potato works as a treatment for diabetes. This review of randomized controlled trials found only three studies (with a total of 140 participants) that evaluated the effects of sweet potato for type 2 diabetes mellitus compared with a fake medicine (placebo). All these trials were of very low quality. Two

studies with 122 participants showed improved long-term metabolic control of blood sugar levels as measured by glycosylated hemoglobin A1c (HbA1c) which was moderately lowered by 0.3% in participants who were given 4 g sweet potato tablets a day for three to five months. The duration of treatment ranged from six weeks to five months. No study investigated diabetic complications, death from any cause, health-related quality of life, well-being, functional outcomes or costs. Adverse effects were mostly mild, and included abdominal distension and pain. There are many varieties of sweet potatoes and sweet potato preparations. More trials are needed to assess the quality of the various sweet potato preparations as well as to evaluate further the use of different varieties of sweet potato in the diet of diabetic people.

➤ **Anti-diabetic effect of sweet potato**

There are studies that have suggested that sweet potato has the potential of lowering the blood glucose level. In some animal and human studies, different forms of sweet potato have been reported to help in maintaining blood sugar levels and lowering insulin resistance. 'C aiapo' is a dietary supplement and a crude extract of white skinned sweet potato which has been sold and consumed for a long time in Japan as a remedy for diabetes. 'White star' a sweet potato cultivar indigenous to Pakistan and 'Beauregard' which is indigenous to the United States lowers glucose blood level in diabetic patients. The leaf extract of sweet potato reduces significantly the level of blood glucose and hepatic enzymes activities in Alloxan-induced diabetic rats. This agrees with the result of a recent study by Pal et al who reported that the aqueous extract of the leaves of sweet potato shows significant improvement in the blood glucose profile of diabetic rats. The blood glucose lowering effect of white skinned sweet potato in type 2 diabetic patients has been linked to an increase in blood levels of adiponectin; an adipocyte hormone that serves as an important modifier of insulin metabolism. Patients with poorly-regulated insulin metabolism and insulin insensitivity tend to have lower levels of adiponectin, and individuals with healthier insulin metabolism tend to have higher levels. Generally, the anti-diabetic property of sweet potato has been attributed to its phytochemical content, isolated flavones from the leaves of sweet potato.

Conclusion

It was concluded that the sweet potato is very helpful for the prevention of diabetes mellitus because it is a good source of fibre, anti-oxidant. It has anti diabetic activity and anti inflammatory activity. It is rich in vitamin C, B6 vitamin that helps to reduce diabetes mellitus.

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