

How lowbush cranberry works to lower blood sugar levels*

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Purpose

Our lab tests so far have shown us that many of the Cree plants help muscle cells to absorb more sugar. This study looks at *how* one of these plants—lowbush cranberry—does this. It also tries to identify which ingredients in the plant produce this effect.

Background

Most of the problems caused by diabetes are the result of having too much sugar in the blood. The sugar comes from the food we eat. Normally it goes into cells in response to insulin. But in diabetes, the cells don't listen to insulin anymore and the sugar stays in the blood and causes damage.

Some plants seem to do the same thing as insulin does—they help cells to store sugar. In earlier studies, we did lab tests on 17 plants that the Iiyiyiu healers had told us about. The tests showed that more than half of these plants help muscle cells to absorb sugar.

Next, we wanted to figure out *how* the plants do this. We started by looking at seven of the plants used in Mistissini.[†] We found that the plants work the same way as the diabetes drug Metformin: they disrupt the way a cell turns food into cell-energy. This sets off a process that fools the cell into thinking they are low on

* This is a plain-language version of an article by Hoda Eid, Louis Martineau, Ammar Saleem, Muhammad Asim, Diane Vallerand, Ali Benhaddou-Andaloussi, Lidia Nestor, Arvind Afshar, John Arnason, and Pierre Haddad, called "*Stimulation of AMPK and chronic enhancement of glucose uptake in muscle cells by quercetin and quercetin glycosides, active principles of the antidiabetic medicinal plant Vaccinium vitis-idaea.*" (Draft of October 31, 2008.)

[†] See the summary called "How the healing plants work to lower blood sugar levels."

fuel, so they take in more sugar from the blood. In the current study, we did the same kinds of tests on another plant: lowbush cranberry. Healers in both Mistissini and Whapmagoostui use the berries from this plant to treat urinary problems.

About how a cell produces energy

One of a cell's jobs is to make energy. Each cell has "motors" whose job is to produce energy by burning fuel. In this case, the fuel being burned is sugar from our food (glucose). Cells also have a special kind of fuel gauge to decide if more energy is needed. The gauge measures how much energy we're making, compares it to the amount we're using up, and adjusts accordingly. This gauge is very sensitive. If we suddenly need more energy — for instance, because we're exercising — it will draw in more sugar from the blood and increase the amount of energy being produced. The scientists call this particular kind of fuel gauge "AMP kinase" or "AMPK."

How do lowbush cranberries help cells absorb sugar?

How do you get a diabetic muscle cell to accept more sugar? One way is to trick the parts of a cell that handle insulin. A second way is to trick the fuel gauge into reading "empty." So the first question we asked was: which of these two ways does lowbush cranberry use? We added cranberries to muscle cells and looked for changes in the parts of a cell that insulin uses (Akt), and in the fuel gauge parts (AMPK). Only the fuel gauge showed any change. So now we know that lowbush cranberry helps cells store sugar by acting on their fuel gauge in some way. (One of the common diabetes drugs, Metformin, also works like this.) In other words, the plant changes *something* in how a cell converts sugar into the kind of energy it can use. We think a lot of the plants that people use to treat diabetes probably work this way.

Recall that the fuel gauge constantly checks how much energy a cell is converting from food. When it notices the energy supply (cell fuel) getting low, it adds more food fuel—that is, it takes more sugar out of the blood. But in this case, the plant is interfering with the conversion, so adding more fuel doesn't change the reading of the fuel gauge. The fuel gauge checks again, finds the energy level is still low, and concludes that the motor has used up all its fuel and still needs more. So it adds yet more sugar. All of this is good for diabetes, because it takes more and more sugar out of the blood. In short, when the plant interferes with how a cell produces energy, it sets off the fuel gauge. This fools the cells into taking in more sugar than normal.

Ingredients

Next we wanted to know which ingredients in cranberries are doing this. We broke the ingredients into groups and tested each group to see if it had effects. If it did, we broke it into smaller groups and tested those. In this way, we eventually found three ingredients that seem to be the ones that act on muscle cells. These three ingredients are all related. The main one is called quercetin. The other two are basically quercetin with a few extra parts—like a shirt that can be bought in basic form or with frills or fancy buttons on it. Both quercetin and its two spin-offs seemed to set off the fuel gauge in cells. Based on some other tests we did, we think it's just the basic part—the shirt itself, not the frills—that produces this effect.

Other peoples in the world use plants in the same family as lowbush cranberries to treat diabetes. For instance, people use lowbush blueberry, American cranberry, and European bilberry. We know that these plants all contain quercetin and its spin-offs. Probably this is why these other plants fight diabetes too.

Also, we know that quercetin works in live animals, because other scientists have already tried it on rats with Type 1 diabetes. But until now no one has looked at *how* it works.

How do these ingredients disrupt the cell “motors”?

Our first tests showed us that the ingredients in lowbush cranberries make cells take in more sugar from the blood by acting on the fuel gauge. But there are two ways to do this:

1. Stop the engine so no energy gets produced
2. Run the engine with the clutch on. This is even better for diabetes because it wastes some fuel (sugar).

Most of the seven plants we tested last time had both kinds of effects. But it turns out that lowbush cranberries only have the first type of effect.

What does this tell us about using lowbush cranberries as a medicine?

There are many good things about medicines that act on a cell’s fuel gauge. We know that this gauge is very sensitive. Not only does it tell muscle cells to absorb more sugar, but it also tells our livers to *make* less sugar. Both of these things are good for diabetes, because they both lower the amount of sugar in the blood.

Besides being a good way to treat diabetes, the fuel-gauge method could also help prevent it. If you repeatedly set off the fuel gauge, your body eventually decides you need more energy than it thought, and changes the settings. It stores less fat in some kinds of cells, and having less fat helps these cells accept insulin more easily. And in the long term, it makes your body “run” a bit faster all the time—like raising the idle level on a car. This means you use up more food, and that makes it harder to gain weight.

Some medicines that affect a cell’s motors produce side effects, like having too much lactic acid. But in our tests, the active ingredient in cranberries (quercetin) did not seem to do this. The plant seems to act gradually, which makes it easier for our bodies to handle. All in all, lowbush cranberry seems to have a lot of promise for treating diabetes.