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How the healing plants work to lower blood sugar levels*

Purpose

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.

Some plants seem to help cells absorb sugar without insulin, so they can replace insulin. The first study in the Anti-diabetic Plant Project tested eight healing plants, and found that seven of them help muscle cells to accept more sugar.† The purpose of the current study was to figure out exactly *how* the plants do this.

Healing plants and diabetes

Many peoples around the world use healing plants to lower blood sugar levels. Scientific studies have shown that many of these plants really work. This gives us lots of alternatives to the diabetes drugs that are currently on the market.

One plant that has been used for centuries to treat diabetes is French lilac. In fact, the diabetes drug Metformin is based on ingredients that come from French lilac. But even though Metformin has been used since the 1950s, it was only in 2001

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* This is a plain-language version of an article by Louis Martineau, Danielle Adeyiwola-Spoor, Diane Vallerand, Arvind Ashfar, John Arnason, and Pierre Haddad called "Enhancement of muscle cell glucose uptake by medicinal plant species of the Canadian boreal forest is mediated by a common, Metformin-like mechanism." (Draft of September 11, 2008).

† For details, see the report by Spoor and others called "A first look at how eight Iiyiyiu medicinal plants affect diabetes."

that scientists figured out exactly how it helps cells to absorb sugar. They now think that Metformin disrupts the way cells convert food into energy. This fools the cells into absorbing more sugar from the blood—and that makes for lower blood sugar. One goal of the current study was to see if the Iiyiyiu plants do the same thing.

The study focused on the following plants:

- Balsam fir (inner bark)
- Speckled alder (inner bark)
- Tamarack (inner bark)
- Black spruce (cones)
- Jack pine (cones)
- Labrador tea (leaves)
- Pitcher plant (whole plant except roots)
- Showy mountain ash (inner bark).

About how a cell produces energy

One of a cell's jobs is to make energy. Each cell has "motors" (called mitochondria) whose job is to produce energy by burning fuel. In this case, the fuel being burned is sugar (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."

How do the Iiyiyiu plants help muscles to accept more 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 use the fuel gauge. Metformin works on the fuel gauge. It does this by blocking energy conversion (the way a cell turns food fuel into cell fuel) so that the fuel gauge reads empty.

The scientists did lab tests to figure out which of these two kinds of effects the Iiyiyiu plants produce. The results showed that Iiyiyiu plants work the second way: they block energy conversion and the fuel gauge reads empty.

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 other words, by interfering with the fuel gauge, the plant fools the cells into taking in more sugar than normal.

It is useful to know that the plants work this way. It also tells us something about what other kinds of plants might fight diabetes. We know that some plants have learned to fight off fungus, germs, and insects by blocking the way the predator's cells produce energy (because if you block energy production completely, the cell dies). Now that we know that blocking energy production is good for diabetes, this will help us find other anti-diabetic plants. For example, we can look for the plants that we already know are good at fighting infections.

A closer look at exactly how the plants disrupt cell "motors"

In their next set of tests, the scientists looked in more detail at exactly how the plants act on the cell "motors." There are two possible effects:

- The first way is as if the motor does not run at all.
- The second way is like running the motor with the clutch on.

It turns out that six of the plants have both kinds of effects. This probably means they have several anti-diabetic ingredients. One plant—Labrador tea—only has the first kind of effect.

Both effects help with diabetes, but the second one is especially useful. If you run a car motor with the clutch on, you waste a lot of fuel. In humans, this means you're wasting sugar. Since people with diabetes have too much sugar, wasting it is actually a good thing in this case. And just as running a motor for nothing produces heat, human cells also produce heat in this situation. In fact, a few of the elders have mentioned that some of the plants make you feel hot. This could mean that those plants are creating this second type of effect.

Checking for risky side-effects

What happens when a plant interferes with the "motors" in a cell? When a cell can't produce enough energy the usual way, it turns to a backup method. The backup method is less efficient, and it makes a waste product called lactic acid. Too much lactic acid can be dangerous. So the scientists looked at how much lactic acid muscle cells produce when you treat them with the plants. Most of the plants raise lactic acid levels, but they usually only do so for a short time. (Metformin also does this.) Only two of the plants—tamarack and balsam fir—cause lots of lactic acid. So these two should be used carefully.

Do the plants affect all kinds of cells the same way?

The scientists also did some of the same tests using liver cells instead of muscle cells. Interestingly, the results were somewhat different. This suggests that the plants might only set off the “fuel gauge” in certain parts of the body and not others. This would be a very good effect for a medicine to have. If you trigger the gauge in the pancreas, you can actually reduce how much insulin gets made. If you trigger it in the brain, you can make people feel hungry. So a medicine that only triggers the gauges in muscle cells would be ideal.

Summary

To sum up, the scientists have found out how some of the plants help cells absorb sugar from the blood even without insulin. The plants start by interfering with how a cell converts energy from food into energy it can use. As a result, the cell has less energy. This causes the fuel gauge to come on. And it makes sugar come into the cell to fill the fuel tank.

This action of the plants on the cells has another benefit. If the energy production is blocked but the cell still uses oxygen, it’s like running a car motor with the clutch on. This is wasteful and it burns sugar. So more calories are being spent than usual and this can help decrease people’s fat reserves.

Now that we know how the plants work inside the cells, it will also be easier to identify the active ingredients in the plants. Until now, we had to use a long set of tests to gradually narrow in on each active ingredient. But to affect the way a cell burns energy, an ingredient has to have some specific characteristics. Now that we know that we’re looking just for ingredients with those characteristics, it will make the search easier. The more we know about the active ingredients, the more we can be sure that the plants are safe and effective. This will pave the way for us to make medicines that combine the strengths of western science and traditional knowledge.

[Sidebar to go beside the Summary]

Why look at how the plants work in our bodies?

- It makes it easier to identify the active ingredients in the plants. The ingredients in plants vary a bit with where the plant is growing, and from year to year. In future, if the healing plants are to be used in clinics in Iiyiyiu Aschii, we will need to quickly test each batch of plants to be sure they contain the usual good ingredients and don't contain harmful ones. And we will need to know how much of these ingredients we are giving people. Knowing how the plants work will help us to identify the active ingredients more easily.
- It helps point us at other plants that might help with diabetes. For instance,
    - ► Now that we know that some good ingredients create heat, we can ask the healers about other plants that make you feel hot. And we can start looking at processes in cells that involve heat.
    - ► This study showed us that the diabetes-fighting mechanism that plants use is the same one they use to defend themselves against germs and insects. Knowing this, we can now include plants that are good at fighting off germs and insects in our search.