September 30, 2009

Can the healing plants affect how our guts handle sugar?*

Purpose

This study looks at whether the healing plants can affect how much sugar gets passed from our gut into our bloodstream.

Many things can affect how high our blood sugars go, including:

1. How much sugar (glucose) our liver makes
2. How well our cells take sugar out of the blood and store it
3. How much insulin we make
4. How well our small intestine (gut) absorbs sugar from food and passes it into the blood.

Any plant or medicine that affects one of the things in this list has the potential to help fight diabetes. So far, the anti-diabetic plant project has looked at several of the items on this list. But until now, we have not looked at the last one. Yet if a plant or drug affects how much sugar gets passed into our blood, it might prevent the rise in blood sugars that people get after a meal. This could help fight obesity and prevent or delay diabetes and the health problems that go along with it.

About how our small intestines handle sugar

When we eat, digestion starts in the stomach and above. But our small intestines (guts) handle one of the last stages. They break some kinds of foods (carbohydrates) down into a type of sugar that the body can use. We can think of the process as being like a factory that makes sugar. First, the sugar has to be

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* This is a plain-language version of an article by Lidia Nistor Baldea, Louis Martineau, Ali Benhaddou-Andaloussi, John Arnason, Émile Lévy, and Pierre Haddad called "Inhibition of intestinal glucose absorption by antidiabetic medical plants derived from the James Bay Cree traditional pharmacopeia."

extracted from a source like sugar beets or sugar cane. From there, it must be taken to the shipping department and packaged. Finally, it gets loaded onto trucks that use the road system to take it to customers. In the same way, our guts begin by turning carbohydrate foods into simple sugar. A protein called SGLT1 then acts like a truck to move this sugar to the gut's "shipping department" (the gut wall or cells of the intestine). Finally, another protein called GLUT2 moves the sugar from the gut wall into the bloodstream, which is like putting a delivery truck on the road. Once the sugar is in our blood, it can be taken to all the different parts of the body that need it.

Notice that in the example above, there are two kinds of trucks moving sugar around. It turns out that people with diabetes have more of these "trucks" than usual. This allows their guts to move a lot of sugar into the blood. If we could interfere with one or both kinds of "trucks," less sugar would make it into the blood. This would help with both weight and diabetes. In this study, we were looking to see if the healing plants reduce the amount of sugar being moved around and the number of trucks available. We did basic tests on all 17 of the healing plants, and further tests on a few of the most promising plants.

Results

Basic tests to see if the plant reduce how much sugar our guts absorb

For the basic tests, we put intestine-like cells into a lab dish along with powder made with the different plants, and then added sugar. This showed us if the cells absorb less sugar when you add the plants. We tried this three different ways.

First, we looked at what happens when you add plant and sugar at the same time. When we did it this way, we found seven plants with strong effects: they reduced the sugar absorbed by over 75%. This suggests that these plants might really help if people took them along with their meals.

Next, we tried bathing the cells with the plant powder for six hours, taking them out, and then adding the sugar. We found five plants that worked when we did this. Four of them were the same plants as in the first set of tests. The fifth was black spruce.

Finally, we picked three plants (two that had effects, one not, to be able to compare), and looked at what happens if you bathe the cells with each plant for six hours, then leave the plant in the mixture and add sugar. We tried this on marsh Labrador tea, jack pine, and black spruce. We found that marsh Labrador tea worked better this way, but black spruce worked the same as before. Jack pine had no effect no matter which way we tested it.

Tests on live rats

Then we checked some of our lab results on live rats. We checked

- two plants that had strong effects in the first set of lab tests (marsh Labrador tea and lowbush cranberry)
- one that had medium effects in the first set of lab tests (jack pine)
- one that had no effects in the first set of lab tests (black spruce)

For these tests, we took healthy rats, made them fast overnight, then fed them plant and a lot of sugar. (This is like the Oral Glucose Tolerance Test that doctors use on humans.) Then we kept checking their blood sugar levels for the next two hours.

The rats that got marsh Labrador tea or black spruce with their sugar had much lower blood sugar levels over the next two hours. The rats that got jack pine and lowbush cranberry showed no effects. Some of these results differ from what we saw in the first round of tests. We are not sure why some of these plants worked in rats but not in lab dishes, or vice-versa. One possibility is that much less sugar was put in the lab dishes than in the rats; so perhaps some plants work when there is less sugar while others can be effective even when there is a lot.

Looking at *how* some of these plants work

The rat tests told us if a plant lowers blood sugar, but not *how* it does this. In our final set of tests, we took a closer look at marsh Labrador tea and black spruce. We wanted to know if these plants act on how many "trucks" our guts make to move sugar around. We found that marsh Labrador tea reduces the number of "trucks" inside the gut (SGLT1 transporters). Black spruce reduces the number of delivery trucks that get put on the road (GLUT2 transporters). Next, we would like to find out exactly which ingredients in the plants do this.

Conclusions

Based on all these tests, we think that black spruce and marsh Labrador tea show the most promise in terms of helping people keep their blood sugars down after a meal. Black spruce was the only plant that worked on the "delivery truck" kind of protein. Marsh Labrador tea seemed to be the plant that had the strongest effect. It was often mentioned by the elders and healers. And it worked in both lab tests and live rats.