

Iiyiyiu healing plants and how body cells absorb sugar *

The promise of healing plants

Peoples around the world use plants to treat diabetes. Few of these plants have ever been tested using western scientific methods, but the ones that have often show effects. In fact, some of the western medicines that are now routinely used for diabetes—like Metformin and Acarbose—originally came from plants. Use of healing plants might be even more widespread if more of them had been tested. Until the Anti-diabetic Plant Project began, none of the Iiyiyiu healing plants had been tested for anti-diabetic effects. The project is a first step towards showing how the traditional remedies work so they can be integrated into diabetes care in Iiyiyiu Aschii.

The Anti-diabetic Plant Project has many parts. The scientists are looking at different ways that the healing plants might affect how our bodies store and use sugar. For instance, they are testing if the plants affect

- how much sugar the liver produces
- how well the pancreas produces insulin to help store sugar
- how well muscles and fat absorb the sugar from the blood into their cells.

Besides this, the scientists are also looking at whether the plants might protect against some of the health problems that are caused by diabetes, such as heart disease or eye problems.

Charles Leduc's study looked at just one piece of this overall picture, namely whether the plants change how well muscle and fat cells absorb the sugar from the blood. He began with lab tests to identify which plants seemed to have the most effect on muscle and fat cells. Then he went on to check whether those plants helped to control blood sugar levels in living creatures (in this case, mice), using two different methods.

* This is a plain-language summary of an MSc thesis written by Charles Leduc, entitled *Identification and pharmacological evaluation of Cree medicinal plants with potential use for the treatment of Type 2 diabetes*. The thesis was submitted to the Department of Pharmacology at the Université de Montréal in July 2005. This summary was prepared for the Cree Health Board by Ellen Bobet in December 2007.

Finding out which plants to test

At the start of the project, the scientists talked with 34 Elders in Mistissini about the plants they used to treat diabetes. (For more details, see the report in this series titled “A new way to look at the plants that Iiyiyiuch traditionally used for diabetes.”) Charles chose eight of the plants recommended by the Elders to test in the lab:

- Labrador tea
- Tamarack
- Balsam fir
- Jack pine
- Black spruce
- Speckled alder
- Pitcher plant
- Showy mountain ash

The lab tests

Most of the problems caused by diabetes are the result of having too much sugar in the blood. Our bodies turn food into sugar, so this is one way that sugar gets into the blood. Sugar can also be produced by our liver, which acts as the body’s main store of sugar. The sugar gets out of our blood by getting absorbed into the cells of our body. Usually, this happens with the help of insulin (although other things like exercise also help our cells to store sugar).

When people have diabetes their muscle and fat cells resist insulin, so the sugar does not get stored as easily. The point of the lab tests was to see if the healing plants help muscle and fat cells to absorb more sugar from the blood. This could happen if the plants do the same thing that insulin does, that is, help the muscle or fat cells to store sugar. It could also happen if the plants help insulin to work better. Charles tested for both of these possibilities.

How the lab tests were done

Charles began by seeing how much sugar the cells would absorb without insulin and how much they would absorb with insulin. To do this he covered the muscle and fat cells in a mixture of sugar and water and waited a few minutes. Then he poured off the sugar and water, broke open the cells, and measured how much sugar went into the cells. He then repeated the same test but adding insulin to the sugar and water. As expected, more sugar went into the cells when insulin was added.

The next step was to repeat the same procedure, but adding plant extract (tea made from the plant) instead of insulin to the sugar and water mixture. This showed if the cells absorbed more sugar when the plant extract was added. That is, it showed if the plants had some of the same effects as insulin.

The final step was to do the same thing again, but this time adding both plant extract and insulin. The purpose was to see if the cells absorbed more sugar that way than they did with insulin alone. If they did, it would mean that the plants helped the insulin to work better.

Results of the lab tests

The results showed that all eight plants had some effect on how muscle and fat cells store sugar. Six of the plants seemed to help cells to store sugar in the same way that insulin does. The other two seemed to make insulin work better.

Charles used these results to pick out the three most promising plants for tests in live animals. Since all the plants had effects, how did he decide which ones were “most promising”? First, he reasoned that diabetes is an ongoing disease, so it makes sense to choose the plants that have the most long-lasting effects. He also considered whether the plant had more effect on muscle cells or on fat cells. Both effects are good, but when fat cells store sugar, people gain weight and this can be a problem. So Charles chose the long-lasting plants that work mainly on muscle cells. This meant that he ended up using Pitcher plant, Showy mountain ash, and Labrador tea for his tests on live animals.

Tests on live animals

Not everything that works in the lab works in real life. In lab tests, plant extracts can be added directly to the cells that the scientist wants to look at. But in real life, digestion and all kinds of other processes may change the way a plant acts. This is why it is worth doing tests on live animals.

The tests in this study used mice that had been specially treated so as to produce some of the same effects as diabetes. The tests were meant to see if the plants did one or both of two things, either in the short term or after 18 hours:

1. Reduce the amount of sugar in the blood (when the mice had not been fed for a while)
2. Reduce the sudden rise in blood sugar levels that comes after a meal

Sometimes, a plant or medicine that doesn't work in one set of tests works in another; so Charles did two different kinds of tests.

First set of tests on mice

The first set of tests used mice that had been treated with a drug that kills off the cells that produce insulin. This meant that the mice had something like Type 1 diabetes—the kind where the body doesn't produce any insulin at all. Charles divided the mice into four different groups so he could compare the results for different types of medicines. The first group he treated with Pitcher plant, the second with Showy mountain ash, and the third was given a common diabetes medicine (Metformin). A fourth group of mice wasn't given any treatment. This was so he could compare the results of the various treatments to what happens when you don't use any medicines at all. Then Charles ran some of the usual tests that we do for diabetes (like an Oral Glucose Tolerance Test) on these different groups of mice to see if the plants helped control their blood sugar levels.

The results were disappointing. Neither of the two plants helped lower blood sugars in mice that had not been fed for a while. Pitcher plant seemed to help a bit with reducing the sudden rise in blood sugars after a meal, but it didn't help at other times.

Does this mean the healing plants don't help with diabetes? Not necessarily. First, Charles' study looked at only one part of the picture. The plants might still have good effects in other ways, like reducing the health problems that go along with diabetes. Second, the plants might still show effects in other types of tests. This is why he did the second set of tests.

Second set of tests on mice

The second set of tests was a bit different. Scientists have found that if you feed mice a very high-fat diet, they will eventually get fat and develop either pre-diabetes or the kind of diabetes that most people get (Type 2). So Charles fed a group of mice a high-fat diet until they became pre-diabetic. Then he divided the mice into groups and treated each group with a different plant, just as he had in the first set of tests. This time, he tested all three plants: Pitcher plant, Mountain ash, and Labrador tea.

The plants showed no effects in this second set of tests either. This is discouraging, but again it doesn't mean the plants don't help, it just means the effects couldn't be found using these particular methods. Charles thought perhaps he should have fed his mice a high-fat diet for longer, until they became completely diabetic rather than just pre-diabetic. Some effects might have been missed because the mice were not really very sick. Or perhaps the plants would work on other animals or humans but don't work very well on mice.

Conclusion

Charles' study told us several things. First, it showed us how much scientists can learn from Elders about healing plants for diabetes. It also told us which plants were recommended most often by Elders, so that the lab tests could begin on those plants. Charles' work showed that these plants do have a strong effect when they are placed directly on cells, but don't seem to have an effect when given to mice. Perhaps by using a different method, like feeding the mice the plants over a longer period of time, or using different animals like rats, we will see effects like we saw with the cells. This is the kind of research that is being done now by the other people in the Anti-diabetic Plant Group. We hope to see some encouraging results soon.