Seeds of Protection

Ancestral menus may hold a message for diabetes-prone descendants

By RON COWEN

Summer comes early to the Sonoran desert. Parched earth crunches underfoot and the arroyos run dry. Except for the occasional cluster of thorny agave plants and the towering saguaro cacti that pierce the hillsides, the ocher landscape seems lifeless.

But when the July rains finally begin to beat down, the desert reawakens to release its hidden bounty. Edible sprouts of bloodroot amaranth shed their seedcoats, coloring the earth with a carpet of green; the fruits of the prickly pear cactus blush purple with ripeness. And the Pima and Papago tribes prepare for another desert harvest.

For centuries, these and other Native Americans adapted their lives — and, some researchers say, their bodies — to the feast-and-famine cycle of their desert homeland. By gorging on prickly pears, tepary beans, wolfberries, mesquite pods, mustard seeds, cholla blossoms and other wild or cultivated foods during the growing season, they managed to consume enough fuel to sustain them through times of drought. Indeed, written accounts from the turn of the century indicate the Sonoran tribes enjoyed remarkably good health.

Around 1940, however, diabetes struck the Pima Indians of southern Arizona and never left. Since 1970, the incidence of Type II (non-insulin-dependent) diabetes has jumped about 40 percent among Pimas 35 and older. This adult-onset disease today afflicts about half of all Pimas over age 35 — the highest known incidence in the world. And among several other Native American tribes, the rate lags only slightly behind.

Though the Pimas still gather some plants and wild game from the desert, they have largely shifted to a modern Caucasian diet. Studies of the tribe during the past two decades point to a genetic predisposition for Type II diabetes, possibly aggravated by the Pimas' newly acquired taste for sugary or fatty foods such as hamburgers, instant pudding and processed white bread. A year-round regimen of saturated fats and "junk foods" apparently contributes to the tribe's rampant obesity — another known risk factor for diabetes (SN: 11/14/87, p.309).

Dick George

Pima woman grinds mesquite pods into flour.

While scientists continue to focus on genetics in studying the desert diabetics, Arizona ethnobotanist Gary Paul Nabhan is scrutinizing ancestral diets for a practical solution to the Piman plight. Working on behalf of the Tucson-based Native Seeds/SEARCH, an organization dedicated to preserving plants linked to tribal cultures, he has begun to examine how the desert cuisine may have protected these and other Native Americans from diabetes in the past. A return to that diet, he suggests, might help combat the problem in the future.

Nabhan and his colleagues selected six starchy foods traditionally eaten by the Pimas: mesquite pods, acorns, white and yellow tepary beans, lima beans and a strain of corn long cultivated by the tribe. They sent samples to nutritionist Janette C. Brand at the University of Sydney in Australia, who then prepared traditional Pima dishes incorporating these foods and served them to eight healthy, non-diabetic Caucasians. Brand and her coworkers found that the experimental meals slowed carbohydrate digestion and significantly lowered insulin production and blood sugar levels after mealtime, compared with meals incorporating conventional starches such as potatoes and bread.

People predisposed to or suffering from Type II diabetes need to avoid sharp rises in blood glucose and insulin, the researchers note in the May JOURNAL OF CLINICAL NUTRITION. The new findings show that mesquite pods and acorns rank among the top 10 percent of all foods ever analyzed for their effectiveness in controlling blood sugar, Nabhan says.

Other researchers have proposed a possible mechanism for the protective effect. Some desert plants may contain higher-than-average proportions of a starch called amylose, which takes far longer to break down into simple sugars than does amylopectin, the predominant form of food starch found in high levels in potatoes and white bread. Thus, foods with higher amylose content may cause smaller increases in blood sugar levels. Evidence of this emerged several years ago in a dietary study led by Kay Behall at the USDA's Human Nutrition Research Center in Beltsville, Md. (SN: 8/2/86, p.76).

Amylose may not be the sole contributor to the benefits of desert foods. Many of these plants, including those used in the Australia study, feature an abundance of soluble fibers known as gums and mucilages. Brand, Nabhan and others believe such fibers are viscous enough to

form a physical barrier between other carboyhdrates eaten at the same meal and the digestive enzymes that break those carbohydrates down. As a result, they suggest, the carbohydrates are digested and converted into sugars more slowly, translating into lower glucose levels in the bloodstream.

In addition to slowing the breakdown of other carbyohydrates, soluble fibers may lower blood glucose levels through the products of their own digestion. In the colon, the fibers ferment into short-chain fatty acids, note James W. Anderson and his colleagues at the Veterans' Administration Medical Center in Lexington, Ky. His group's research, reviewed in the May 1987 JOURNAL OF THE AMERICAN DIETETIC ASSOCIATION, suggests that one of these fatty acids, called prioponic acid, increases the liver's ability to metabolize glucose, reducing blood sugar levels.

Nabhan hypothesizes that the abundance of gums and mucilages in desert plants evolved to serve a life-sustaining botanical function: slowing the loss of water from seeds, seedlings and succulent tissues threatened by a harsh and unpredictable climate.

While noting that scientists lack a full understanding of why the human body responds as it does to these plants, Nabhan says the implication of the recent studies is clear: "For Native American and other recently Westernized indigenous people, a return to a diet similar to their traditional one is no nostalgic notion; it may, in fact, be a nutritional and survival imperative."

Research conducted at the Phoenix (Ariz.) Indian Hospital appears to support that assertion. Boyd A. Swinburn and his colleagues assembled a group of 22 healthy nondiabetics under age 38 and compared their insulin and glucose responses to a modern, high-fat diet and to a diet typical of the turn-of-the-century Pimas. Half the study participants were Caucasians, the other half Pimas. Though the two regimens contained comparable numbers of calories, the modern diet—nicknamed the "Circle-K diet" for its similarity to foods found in convenience stores — caused problems for Caucasians and Pimas alike. Both subgroups showed reduced insulin sensitivity (the ability of insulin to break down glucose to fuel cells) and greater increases in blood glucose while eating the modern diet than while eating the traditional one.

Swinburn, who had expected the modern diet to affect tribal people more dramatically than Caucasians, says he was surprised to find that the two responded similarly. He suggests that the seemingly universal risk of a high-fat diet, combined with the Pimas' genetic predisposition for diabetes, spells a double whammy for the tribe and perhaps for other diabetes-prone groups.

Swinburn, Brand and other investigators have uncovered similar tales of diet and diabetes among nonwhite, indigenous populations in several other regions of the world. Swinburn told SCIENCE NEWS he and others have found that the rate of Type II diabetes among adults native to the South Pacific rises with their access to Western diets. Inhabitants of the more isolated islands have an incidence of 10 percent, while those of the more Westernized regions such as Micronesia and New Zealand have a diabetes rate of 35 percent. Caucasians, in contrast, typically have an incidence of 2 to 3 percent, he notes.

Brand has found that the rate of Type II diabetes among adult natives of South Pacific islands and among several groups of urbanized Australian aborigines — including those living in tropical coastal regions as well as those in arid western Australia — runs as high as 35 percent.

In the January 1987 AMERICAN JOURNAL OF CLINICAL NUTRITION, Brand and her colleagues described a study of healthy Caucasian volunteers, showing that several traditional plant foods of the Pacific islands and the Australian bush were absorbed more slowly and induced lower blood glucose levels and smaller insulin increases than a diet of selected Western-type foods. "Our findings are consistent with the hypothesis that traditional starchy staple foods may once have protected indigenous populations from developing diabetes," she says.

Brand notes that several of the traditional foods in her study — including pigweed, blue grass lily, arrowroot, Polynesian wet taro and a paste of desert oak — bear no outward resemblance to the traditional Pima foods. But both cuisines are high in soluble fiber, and some tests indicate that many foods derived from Australia's bush country may also contain plenty of amylose, the slowly digested starch, she says.

The high rate of Type II diabetes among such populations may trace to an ironic interplay between genetic and environmental factors, Brand and others suggest. They hypothesize that the naturally high insulin levels result from a "thrifty gene" that once served these people well, enabling them to survive periods of famine by efficiently extracting energy from food and gaining weight during times of abundance. But with the shift to a year-round diet of rapidly digested Western fare, the thrifty metabolism may have backfired, promoting the diabetic risk factors of obesity and sharp jumps in insulin levels. In such a setting, the apparent protective effects of ancestral foods may be critical to good health, she says.

Noting that traditional foods tend to be difficult to process or unavailable in urban areas, Brand acknowledges that many diabetic or diabetes-prone people would have a hard time incorporating them into the daily diet. And for a generation unaccustomed to the cuisine of its ancestors, some traditional foods may taste downright unpleasant, she adds. To lower the risk of developing diabetes, Brand advocates significantly modifying current diets to include more soluble fiber and less fat.

At last month's meeting of the American Society for Clinical Nutrition, held in Washington, D.C., researchers suggested two possible ways for diabetes-prone people to supplement or modify their diets. David J. A. Jenkins of the University of Toronto in Ontario reported that a cereal containing the grain-like seeds of an herb known as psyllium or plantago — long cultivated by the Pimas — may reduce risk factors among the diabetes-prone and help diabetics manage the disease. Thirty minutes after eating the psyllium cereal, the six diabetics and 10 healthy volunteers in Jenkins' study showed only half the blood sugar rise detected after they had eaten a wheat bran cereal, he says.

"Our research shows that a psyllium-containing cereal may be a palatable and easy way for diabetics to reduce their postmeal rise in blood sugar," concludes Jenkins, whose study was funded by Kellogg's in Battle Creek, Mich.

At the USDA's Human Nutrition Research Center, Behall has begun a nine-month study comparing muffins, breads and other foods made with cornstarch high in either amylose or amylopectin. The results might suggest a new way for people to control blood sugar levels, she told SCIENCE NEWS.

"The old way" may still offer the most effective seeds of protection for the diabetes-prone tribes of the Sonoran, Nabhan maintains. There, the prickly pear cacti still bear fruit and the tepary bean still thrives, and the traditional farming and food-gathering methods have not yet died out.

Indeed, Nabhan says, the benefits of these age-old staples might extend beyond tribal boundaries.

"The Native American agricultural legacy is more than a few hardy, tasty cultigen waiting to be 'cleaned up' genetically for consumers and then commercialized as novelty foods," he writes in *Enduring Seeds* (1989, Northpoint Press). "Our goal must be something beyond blue corn chips, tepary bean dips, amaranth candy, sunflower seed snacks and ornamental chiles. These nutritious crops deserve to be revived as mainstays of human diets, and not treated as passing curiosities.

"[They] are rich in taste and nutrition, yes, but they are also well adapted to the peculiarities of our land." □