In a healthy person, the pancreas produces insulin, and insulin helps the body move glucose from the blood into cells, where glucose provides energy. Insulin resistance occurs when the body cannot use its own insulin efficiently. To compensate, the pancreas releases more insulin to try to keep blood glucose levels normal – leading to a condition called hyperinsulinemia where there is too much insulin in the blood. Insulin resistance is associated with a number of dangerous health conditions, including diabetes, hypertension, dyslipidemia and cardiovascular disease.

Insulin Resistance as a Precursor to Diabetes

Many people with insulin resistance have high levels of blood glucose and high levels of insulin circulating in their blood at the same time. People with blood glucose levels that are higher than normal but not yet in diabetic range have "pre-diabetes," sometimes called impaired fasting glucose or impaired glucose tolerance. If you have pre-diabetes, you have a higher risk of developing type 2 diabetes.

More than 60 million Americans have insulin resistance, and one in four people with insulin resistance will develop type 2 diabetes. Left untreated, insulin resistance eventually causes the insulin-producing cells in the pancreas to become defective and ultimately decrease in total number. Then, blood sugar levels begin to rise, causing full-blown diabetes to develop. An estimated 194 million people worldwide have diabetes.

Insulin Resistance and the Metabolic Syndrome

Insulin resistance is also one of the factors that is associated with the metabolic syndrome. The metabolic syndrome, which is sometimes called "syndrome x" or "insulin resistance syndrome," is "a cluster of the most dangerous heart attack risk factors: diabetes or prediabetes, abdominal obesity, changes in cholesterol and high blood pressure," according to the most recent definition from the International Diabetes Federation. The metabolic syndrome is defined as having any three more of the following conditions:

- abdominal obesity (waist circumference of more than 40 inches for men and more than 35 inches for women);
- high levels of triglycerides (150 mg/dL or higher);
- low levels of HDL cholesterol (below 40 mg/dL for men and below 50 mg/dL for women);
- high blood pressure (130/85 mm Hg or higher);
- high fasting blood glucose (110 mg/dL or higher)

-more-

How Insulin Resistance Is Linked to Diabetes and Cardiovascular Disease

Although having insulin resistance does not guarantee a person will develop diabetes, it does significantly increase the risk for heart attack, stroke and other diseases. Insulin resistance has clearly emerged as an important cause of glucose intolerance, an underlying defect of type 2 diabetes, which affects more than 18 million Americans. Almost 60 million people in the United States have insulin resistance, and one in four people with insulin resistance develops type 2 diabetes when their body becomes unable to maintain normal insulin and glucose levels. Specific cardiovascular conditions associated with diabetes include:

- **Diabetic Dyslipidemia:** Diabetic dyslipidemia is associated with insulin resistance. This type of dyslipidemia is characterized by high levels of triglycerides (hypertriglyceridemia), high levels of small low-density lipoprotein (LDL) particles and low levels of high-density lipoprotein (HDL). HDL particles contain mostly protein (versus LDL particles – which contain mostly cholesterol), and help prevent plaque buildup in the arteries by carrying cholesterol from the blood stream to the liver for disposal.

- **Atherosclerosis:** Evidence suggests that insulin resistance itself, independent of other risk factors, could be a major determinant of atherosclerosis, a condition whereby deposits of fatty substances, cholesterol, cellular waste products, calcium and other substances build up in the inner lining of an artery. This buildup is called plaque. This is why high levels of HDL (which helps clear cholesterol from the arteries) may help protect against atherosclerosis.

- **Hypertension:** Hypertension, or high blood pressure, has long been recognized as a major risk factor for cardiovascular disease. Studies report an association between hypertension and insulin resistance. When a person has hypertension and diabetes, a common combination, his/her risk for cardiovascular disease doubles. In fact, according to the NHANES III survey, nearly 80 percent of people with diabetes have hypertension.

- **Coronary Heart Disease:** Insulin resistance also is associated with an increased risk for coronary artery disease, another type of cardiovascular disease in which atherosclerosis affects the arteries that provide blood directly to the heart muscle.

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