Diabetes & Insulin Resistance

Diabetes causes an abnormally high level of sugar, or glucose, to build up in the blood. In type 2 diabetes glucose levels rise because the body is resistant to the effects of insulin and the amount insulin produced by the body is insufficient to overcome this resistance. Insulin is required for the entry of glucose into body cells. Once released into the bloodstream, insulin attaches to the cells, triggering a process that allows the glucose to enter them and be converted to energy. Although the pancreas does produce insulin in people with type 2 diabetes, the cells of the body "resist" the insulin's effects. As a result, the glucose circulating in the bloodstream cannot enter the cells and be used for energy.

Insulin also plays a role in the metabolism of proteins and fats and the storage of glucose in the muscles, liver, and fat tissue. People with diabetes have an increased risk of severe complications if the disease goes undiagnosed and untreated -- or if it is poorly managed. High blood glucose levels make it easier for blockages to form in the blood vessels that supply the heart, brain, and legs as well as the rest of the body. High blood glucose can also damage nerves, causing numbness and tingling -- especially in the legs and feet. Diabetes-related damage to a person's circulatory and nervous systems increases the risk of heart attacks, strokes, blindness, kidney failure, and foot and leg amputations. Early diagnosis and aggressive treatment of diabetes reduce the risks of developing these complications.

Symptoms of diabetes include

Feeling thirsty

Having to urinate more than usual

Feeling more hungry than usual

Feeling very tired

Blurred vision

Tingling or numbness in your hands or feet

Lots of skin, gum, or bladder infections

Vaginal yeast infections

Insulin Resistance

Insulin resistance is the condition in which normal amounts of insulin are inadequate to produce a normal insulin response from fat, muscle and liver cells. Insulin resistance in fat cells results in hydrolysis of stored triglycerides, which elevates free fatty acids in the blood plasma. Insulin resistance in muscle reduces glucose uptake whereas insulin resistance in liver reduces glucose storage, with both effects serving to elevate blood glucose. High plasma levels of insulin and glucose due to insulin resistance often leads to the metabolic syndrome and type 2 diabetes. In patients who use insulin, "insulin resistance" is production of antibodies against insulin that lead to lower-than-expected falls of glucose levels (glycemia) after a given dose of insulin. Insulin resistance denotes decreased sensitivity of target cells(muscle, adipose and hepatic cells) to insulin. In some patients with excess body fat, compensatory hyperinsulinemia reduces the expression of the membrane insulin receptor (down regulation) which maintains the maximal response. More importantly, defects in processes within the cell itself (also called post-receptor defects) appear to play a much larger role in the development of insulin resistance. A relationship between leptin resistance and insulin resistance has been suggested. In a person with normal metabolism, insulin is released from the beta cells of the Islets of Langerhans located in the pancreas after eating ("postprandial"), and it signals the body to allow glucose to enter insulin-sensitive tissues (e.g., muscle, adipose) and maintain normal blood glucose levels. In an "insulin resistant" person the message does not get through to those cells until much more insulin is released in an attempt to compensate. Occasionally, this can lead to a steep drop in blood sugar and a hypoglycemia reaction several hours after the meal.

In some individuals, frank hypoglycemia develops as panceatic β-cells are unable to produce adequate insulin to maintain normal blood sugar levels ("euglycemia"). The inability of the β-cells to produce more insulin in a condition of hyperinsulinemia is what characterizes the transition from insulin resistance to type 2 diabetes. Elevated blood levels of glucose regardless of cause leads to increased glycation of proteins.

Insulin resistance is often found in people with visceral adiposity (i.e., a high degree of fatty tissue underneath the abdominal muscle wall - as distinct from subcutaneous adiposity or fat between the skin and the muscle wall), hypertension, hyperglycemia and dyslipidemia involving elevated triglycerides, small dense low-density lipoprotein (sdLDL) particles, and decreased HDL cholesterol levels.

Fasting Insulin Levels

A fasting serum insulin level of greater than the upper limit of normal for the assay used (approximately 60pmol/L) is considered evidence of insulin resistance.

Glucose tolerance testing (GTT)

During a glucose tolerance test , which may be used to diagnose diabetes mellitus, a fasted patient takes a 75 gram oral dose of glucose. Blood glucose levels are then measured over the following 2 hours. Interpretation is based on WHO

guidelines, but glycemia greater than or equal to 11.1mmol/L at 2 hours or greater than or equal to 7.0mmol/L fasting is diagnostic for diabetes mellitus. GTT can be normal or mildly abnormal in simple insulin resistance. Often, there are raised glucose levels in the early measurements, reflecting the loss of a postprandial (after the meal) peak in insulin production. Extension of the testing (for several more hours) may reveal a hypoglycemic "dip", which is a result of an overshoot in insulin production after the failure of the physiologic postprandial insulin response.