

Understanding how hyperinsulinemia is associated with hypertension, obesity, dyslipidemia and insulin resistance

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Description

Hyperinsulinemia is a condition in which the level of insulin circulating in the blood is too high compared to the level of glucose. Often confused with diabetes and hyperglycemia, hyperinsulinemia can result from a variety of metabolic diseases and conditions, as well as non-nutritive sugars in the diet. Common in stage type 2 diabetics, it is simply a symptom of the disease, not the cause of the disease. Type 1 diabetes only occurs when pancreatic beta-cell function is impaired. Hyperinsulinemia is seen in a variety of diseases, including type 2 diabetes mellitus, neonates, and drug-induced hyperinsulinemia. It can also occur in congenital hyperinsulinism (including islet blastosis). Hyperinsulinemia is associated with hypertension, obesity, dyslipidemia, insulin resistance, and impaired glucose tolerance. These diseases are collectively called metabolic syndrome. In type 2 diabetes, the receptors that bind the hormone become less sensitive to insulin concentrations, making the body's cells more resistant to the effects of insulin, leading to hyperinsulinemia and disrupted insulin release. When the response to insulin decreases, pancreatic beta cells secrete more insulin in response to persistently high blood glucose levels, causing hyperinsulinemia. In insulin-resistant tissues, a threshold concentration of insulin is reached, causing cells to take up glucose and lower blood glucose levels. Studies have shown that high insulin levels resulting from insulin resistance can exacerbate insulin resistance.

Neonatal hyperinsulinemia can be caused by a variety of environmental and genetic factors. Hyperglycemic maternal blood can create a hyperglycemic environment for the fetus if the infant's mother is diabetic and does not properly control blood sugar levels. Beta cells can undergo hyperplasia. Rapid division of beta cells increases insulin release to compensate for high blood sugar levels. After birth, the new born loses access to hyperglycemic maternal blood, and the

blood sugar level of the new born falls rapidly. Insulin levels are still elevated, which can lead to hypoglycemia. To treat this condition, new borns are given high doses of glucose as needed to maintain normal blood sugar levels. The hyperinsulinemia state subsides after 1-2 days. Because hyperinsulinemia and obesity are closely related, it is difficult to determine whether hyperinsulinemia causes obesity, obesity causes hyperinsulinemia, or both. Obesity is characterized by excess adipose tissue. Insulin increases the synthesis of fatty acids from glucose, promotes glucose entry into adipocytes, and inhibits lipolysis in adipocytes. Adipose tissue, on the other hand, is known to secrete various metabolites, hormones, and cytokines that contribute to hyperinsulinemia.

In particular, cytokines secreted by adipose tissue directly influence the insulin signaling cascade and thus influence insulin secretion. Adiponectin is a cytokine that is inversely proportional to body fat percentage. In other words, people with less body fat have higher levels of adiponectin, and people with more body fat have lower levels of adiponectin. In 2011, it was reported that hyperinsulinemia was strongly associated with low levels of adiponectin in obese individuals, but it remains to be seen whether low levels of adiponectin play a causative role in hyperinsulinemia.

Hyperinsulinemia is often confused with diabetes and hypoglycemia. These are separate, though related, terms. Adipocytes produce triglycerides in the presence of insulin, which is associated with liver disease rather than pancreatic disease. Metformin can do this, but treatment is usually achieved through diet and exercise. A healthy diet low in simple sugars and processed carbohydrates and high in fiber and vegetable protein is often recommended. These include replacing white bread with whole grain bread, reducing intake of starchy foods like potatoes, and increasing intake of legumes and green vegetables, especially soybeans.

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Conflict of interest

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