



Biochemical Role of Insulin Resistance in Diabetes and their Characterization

Sava Tanase *

Department of Ophthalmology and Internal Medicine, Xiamen University Malaysia, Sepang, Malaysia

DESCRIPTION

The biochemistry of diabetes is a complex topic that involves the disruption of carbohydrate metabolism and the regulation of insulin. Insulin is a hormone that helps cells take up glucose from the blood and use it for energy. Diabetes is characterized by high blood glucose levels (hyperglycemia) due to either a deficiency of insulin production (type 1 diabetes) or a resistance of the tissues to the action of insulin (type 2 diabetes). Hyperglycemia can lead to various complications such as cardiovascular disease, kidney damage, nerve damage, eye damage, and infections.

The biochemical role of insulin in diabetes is to regulate the level of glucose in the blood and in the cells. Insulin is a hormone that is produced by the beta cells of the pancreas and secreted into the bloodstream when blood glucose levels rise. Insulin binds to specific receptors on the surface of fat, muscle, and liver cells and activates a signal transduction pathway that stimulates the uptake of glucose from the blood into the cells. Insulin also inhibits the production of glucose by the liver and promotes the storage of glucose as glycogen or fat. Biochemical complications of diabetes are non-enzymatic glycation of proteins where glucose molecules bind to proteins and alter their structure and function. This can affect various tissues and organs such as blood vessels, nerves, kidneys, eyes, and skin. Increased production of sorbitol is a sugar alcohol that is formed when glucose is reduced by an enzyme called aldose reductase. Sorbitol can accumulate in cells and cause osmotic stress, oxidative stress, and depletion of antioxidants. This can damage nerves, eyes, kidneys, and blood vessels. Decreased levels of myo-inositol is a sugar alcohol that is involved in cell signaling and membrane function. Diabetes can reduce the uptake of myo-inositol by cells and impair its metabolism.

The term “pathies” of diabetes refers to the various complications that can arise from chronic hyperglycemia and damage different organs and systems in the body. There are many possible complications of diabetes, but three of the most common ones are:

- Neuropathy is a condition where the nerves are damaged by high blood glucose levels, oxidative stress, inflammation, and other factors. Neuropathy can affect different types of nerves, such as sensory, motor, or autonomic nerves. Neuropathy can cause symptoms such as numbness, tingling, pain, weakness, or loss of function in various parts of the body.
- Nephropathy is a condition where the kidneys are damaged by high blood glucose levels, high blood pressure, inflammation, and other factors. Nephropathy can affect the filtering units of the kidneys (glomeruli) and the blood vessels that supply them. Nephropathy can cause symptoms such as proteinuria (protein in the urine), edema (swelling), hypertension (high blood pressure), or renal failure (loss of kidney function).
- Retinopathy is a condition where the eyes are damaged by high blood glucose levels, high blood pressure, oxidative stress, inflammation, and other factors. Retinopathy can affect the blood vessels of the retina (the light-sensitive layer of the eye) and cause them to leak, bleed, or become blocked. Retinopathy can cause symptoms such as blurred vision, floaters (spots or lines in the vision), or blindness.

These are three of the most common pathies of diabetes. There are other complications that can also affect other organs and systems, such as cardiovascular disease, peripheral vascular disease, gastroparesis, skin infections, foot ulcers, and more.

CONCLUSION

This can affect nerve conduction, insulin secretion, and kidney function. Increased oxidative stress is a condition where there is an imbalance between the production of Reactive Oxygen Species (ROS) and the ability of cells to neutralize them. ROS can damage DNA, proteins, lipids, and other molecules. Diabetes can increase oxidative stress by various mechanisms such as hyperglycemia, glycation, sorbitol pathway, inflammation, and mitochondrial dysfunction. Oxidative stress can contribute to various complications such as cardiovascular disease, neuropathy, nephropathy, and retinopathy. In diabetes, either the production or the action of insulin is impaired, leading to high blood glucose levels (hyperglycemia) and low

Correspondence to: Sava Tanase, Department of Ophthalmology and Internal Medicine, Xiamen University Malaysia, Sepang, Malaysia, E-mail: tanase@pang.com

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cellular glucose levels (hypoglycemia). In type 1 diabetes, the beta cells are destroyed by an autoimmune reaction and cannot produce enough insulin. In type 2 diabetes, the cells become resistant to the effects of insulin and do not respond properly to

its signals. Both types of diabetes can cause serious complications such as cardiovascular disease, kidney damage, nerve damage, eye damage, and infections.