Editorial

How to Deal with Insulin Resistance

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Introduction: Insulin resistance is a physiological condition in which cells in the body become less responsive to the effects of insulin, a hormone produced by the pancreas. Insulin plays a crucial role in regulating blood sugar (glucose) levels by facilitating the uptake of glucose from the bloodstream into cells, where it can be used for energy or stored for future use. In a healthy individual, when blood sugar levels rise after eating, the pancreas releases insulin to signal cells to absorb glucose from the bloodstream. This helps lower blood sugar levels back to a normal range.

All tissues with insulin receptors can become insulin resistant, but the tissues that primarily drive insulin resistance are the liver, skeletal muscle, and adipose tissue. Insulin resistance impairs glucose disposal, resulting in a compensatory increase in beta-cell insulin production and hyperinsulinemia. Recent studies have debated whether hyperinsulinemia precedes insulin resistance, as hyperinsulinemia itself is a driver of insulin resistance. This concept may be clinically valuable, suggesting that hyperinsulinemia associated with excess caloric intake may drive the metabolic dysfunction associated with insulin resistance. The metabolic consequences of insulin resistance include hyperglycemia, hypertension, dyslipidemia, hyperuricemia, elevated inflammatory markers, endothelial dysfunction, and a prothrombotic state. Progression of insulin resistance can lead to metabolic syndrome, nonalcoholic fatty liver disease, and type 2 diabetes.[1-5]

Insulin resistance is primarily an acquired condition related to excess body fat, though genetic causes are also identified. The clinical definition of insulin resistance remains elusive, as there is no generally accepted test for insulin resistance. Clinically, insulin resistance is recognized via the metabolic consequences associated with insulin resistance as described in metabolic syndrome and insulin resistance syndrome.[6-7]

Etiology: Insulin resistance may be acquired, hereditary, or mixed. Majority of people with insulin resistance fall have an acquired etiology.[8]

Acquired Etiology[9]: Fat deposition and overflow from subcutaneous fat stores, Aging process, Physical inactivity, Nutritional imbalance, Medications, High-sodium diets, Glucose toxicity and Lipotoxicity from excess circulating free fatty acids.

Genetic Etiology: Myotonic dystrophy, Ataxia-telangiectasia, Alstom syndrome, Rabson-Mendenhall syndrome, Werner syndrome, Lipodystrophy and Polycystic ovarian syndrome.

Epidemiology: Epidemiologic assessment of insulin resistance is typically measured in relation to the prevalence of metabolic syndrome or insulin resistance syndrome.

There has been a rapid rise in pediatric obesity and type 2 diabetes, no consensus has been reached on the pediatric population's diagnostic criteria for insulin resistance. From a demographic standpoint, insulin resistance affects all races and ethnicities.

Pathophysiology: Three primary sites of insulin resistance are the skeletal muscle, liver, and adipose tissue.

Skeletal Muscle Tissue: After intake of a caloric load and conversion to glucose, muscle is the primary site for glucose disposal, accounting for up to 70% of tissue glucose uptake.

Hepatic Tissue: The liver is responsible for processing energy substrates. It packages, recirculates, and creates fatty acids and processes, stores, and creates glucose. If the liver becomes insulin-resistant, these processes are severely affected, resulting in significant metabolic consequences.

Adipose Tissue: The researchers determined that lipolysis is sensitive to insulin. The failure of insulin to suppress lipolysis in insulin-resistant adipose tissue, especially visceral adipose tissue, increases circulating free fatty acids FFAs. Higher levels of circulating FFAs directly affect both liver and muscle metabolism,[10]

Associated Diseases: Non-alcoholic fatty liver disease (NAFLD), Metabolic syndrome, Prediabetes or type 2 diabetes, Polycystic ovarian syndrome (PCOS), Obesity, Microvascular disease (retinopathy, neuropathy, or nephropathy) and Macrovascular disease (stroke, PAD, and CAD).

Associated Symptoms: Hypertension, Hyperlipidemia, Gender and ethnicity-specific increased waist circumference, The stigmata of PCOS (menstrual irregularities, hirsutism, acne, and alopecia), Acanthosis nigricans (see Image. Acanthosis Nigricans), The stigmata of one of several genetic syndromes that include insulin resistance syndromes and Type A or type B insulin resistance syndrome.

Treatment / Management

Lifestyle Intervention: Lifestyle intervention represents the cornerstone of treatment for insulin resistance. Dietary intervention should include a combination of calorie restriction and high glycemic index carbohydrate reduction. Physical activity improves both calorie expenditure and insulin sensitivity in muscle tissue.[11]

These interventions include, Dietary therapy with sodium reduction, fat reduction, calorie restriction, and attention to the glycemic index of foods, Education, support, and personalized programs, A 7% weight loss

reduced the onset of T2D by 58% and DPP included a metformin arm which reduced the onset of T2D by 31%

In dietary therapy, the following foods may help to Improve Insulin Resistance:

Leafy Greens: Vegetables like spinach, kale, Swiss chard, and collard greens are rich in fiber, vitamins, and minerals. They have a low glycemic index and can help stabilize blood sugar levels.

Berries: Berries such as blueberries, strawberries, and raspberries are loaded with antioxidants, fiber, and vitamins. They have a relatively low sugar content compared to other fruits and can help prevent rapid spikes in blood sugar.

Whole Grains: Choose whole grains like quinoa, brown rice, whole wheat, and oats over refined grains. Whole grains contain more fiber, which slows down the digestion and absorption of carbohydrates, leading to better blood sugar control.

Lean Proteins: Incorporate lean sources of protein like chicken, turkey, fish, tofu, and legumes into your diet. Protein can help regulate blood sugar levels and promote satiety, reducing the likelihood of overeating.

Healthy Fats: Include sources of healthy fats like avocados, nuts, seeds, and olive oil. These fats can improve insulin sensitivity and help maintain stable blood sugar levels.

Pharmacological Interventions: Metformin is a common first-line therapy for medication treatment of T2D and is approved for use in PCOS. The DPP & DPPOS study showed that the combination of metformin and lifestyle interventions was medically useful and cost-effective.

Surgery: Surgical intervention in the form of gastric sleeves, banding, and bypass is available for qualified individuals with obesity.

Prognosis: The prognosis of insulin resistance depends on the subset of the disease, the severity of the disease, underlying pancreatic beta-cell function.

Complications: The microvascular disease manifests as retinopathy, nephropathy, and peripheral neuropathy. In the central nervous system, dementia, stroke, mood disturbance, and gait instability may occur. Cardiac microvascular disease can manifest as angina, coronary artery spasm, and cardiomyopathy. Renal microvascular disease is a significant cause of chronic kidney disease, renal failure, and dialysis. Ophthalmological small vessel disease is a leading cause of retinopathy and visual impairment. Macrovascular disease, secondary to insulin resistance, causes PAD, CAD, and CVA.

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