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Obesity & Diabetes: A Review

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ABSTRACT

Worldwide obesity has become an epidemic with many obesity-associated health problems, such as cardiovascular disease, hypertension and type II diabetes. Cardiovascular disease still remains as the leading cause of death in women and obesity as the leading risk factor for type 2 diabetes. Obesity and diabetes mellitus, both are important independent risk factors for the development of cardiovascular diseases. Lifestyle, food habits, genetic makeup and environment play important roles in adipose tissue function or dysfunction. Obesity, chronic inflammation and insulin resistance leads to the development of type 2 diabetes and other complications related to obesity such as hepatic steatosis, obstructive sleep apnea, polycystic ovarian syndrome, etc.

This paper aims to describe the relationship between diabetes and obesity giving an overview of obesity and type 2 diabetes and their associated complications. This paper describes the epidemiology of both obesity and diabetes and their potential implications on health consequences.

INTRODUCTION

Abnormal deposition of fat in the adipose tissue due to chronic over nutrition or reduced physical activity or hereditary reasons is called as obesity[1-3]. The etiology of obesity can be broadly attributed to the worsening lifestyle. This increase in obesity leads to multiple obesity-associated health complications mainly cardiovascular disease (CVD), type 2 diabetes mellitus (DM)[4-8], and hypertension (HTN), and most of the times these diseases occur altogether. This type of clustering disease conditions are often called as metabolic syndrome[9-13]. Still it is unclear at which the obesity associated complications begin. Whether obesity is the lone culprit or any other underlying factors such as inflammation is the primary cause is still unknown clearly. Hence, clear understanding of the role of fat deposition in appetite stimulation[14-18], inflammation, hormone secretion etc. is critical in the development of prevention strategies and treatment for the obesity associated complications.

Adipose Tissue

Most of adipose tissue is made up of fat storing cells adipocytes[19-22] which are held together by collagen fibers. Other cells of adipose tissue[23-28] include pre-adipocytes[29-31], leukocytes, stromal-vascular cells and macrophages. Adipose tissue is the storage site for body's fuel which will be mainly in the form of triglycerides[32-35]. Mammalian adipose tissue is of two types namely white adipose tissue (WAT) and brown adipose tissue. Most of the fat in obese people will be stored as WAT. While Brown adipose tissue is mainly used for body heat regulation by means of thermogenesis, heat insulation etc. Adipose tissue acts as buffer during energy imbalances and adipocytes numbers is mainly controlled by apoptosis and are generated when required from pre-adipocytes and progenitor cells.

Adipose tissue plays an important role in many homeostatic processes such as energy expenditure, immune response, thyroid function, bone health maintenance, blood clotting, and reproduction and in regulation of some hormonal pathways through the secretion of free fatty acids, adipsin, adiponection, etc. Any disturbance in normal signaling or deficiency of the signaling proteins will result in severe complications.

Effects of Increasing Adiposity

Increase in adipocytes size and number disturbs the complex interactions of Growth and reproductive hormones and the feedback allosteric mechanism are disturbed. This creates the disturbance in feedback

mechanism for energy intake and expenditure, physical activity [36-40] which delineates the body's inability of accommodating the chronic overfed state. This Chronic over-nutrition leads to proinflammatory cytokine secretion and suppression of anti-inflammatory[41-44] protein sections leading to metabolic derangements insulin resistance[45-49] and diabetes.

Insulin Resistance

In obese adults glucose[50] disposal will be reduced especially at the level of skeletal muscle and impairment of insulin action in fatty acid oxidation can be seen. This leads to insulin resistance and abnormal lipolysis. But the level of obesity for the onset these complications are not yet determined. Some studies have shown that the secretion rates of insulin are higher in obese people when compared with the normal individuals and even there is no significant difference in insulin clearance and hepatic insulin extraction between obese and non-obese individuals. Many studies have shown that obese children with normoinsulinaemia are found with insulin resistance the no esterified fatty acids[51-53] response to insulin infusion is similar in both obese and no obese children.

Several studies have shown that the loss of excess body weight[54-58] can reduces the skeletal muscle, whole body, and hepatic insulin resistance and metabolism indicating a strong relationship between glucose regulation and weight loss (Adipose tissue reduction). But the mechanism for obesity-induced insulin resistance is not known clearly yet. Some scientist found that the Retinol-binding protein-4 which is secreted by the adipose tissue potentially induces insulin resistance by reducing phosphatidylinositol-3-OH kinase signaling in the muscles; and by increasing the expression of phosphenolpyruvate carboxykinase in the liver cells.

Many scientists demonstrated that, insulin resistance improves the regional adipose-specific insulin resistance which does not improve with weight loss which may be due to the irreversible GLUT-4 translocation in adipose tissue. This mechanism provides us a molecular link between obesity and fat or glucose dysregulation. Hence it can be concluded that the earliest negative effects of obesity is insulin resistance development.

Healthy obese

Even though obesity is linked to many complications but it is not likely that every time a direct relationship exists between obesity and diabetes[59-60]. Around 20% of the obese people are healthy without diabetes and its comorbidities. Healthy obese people are insulin sensitive and will have intimal medial thicknesses, less skeletal muscle and hepatic fact as seen in normal weight individuals giving healthy obese people an advantage of low risk of diabetes and its associated comorbidities when compared to other same weight obese peoples.

Management

Repercussions of obesity can be effectively managed by Weight loss[61-67] which can be achieved through modifications in lifestyle like regular physical activity and dietary adjustments. These kind of lifestyle modifications not only minimize the treatment costs but also reduces the pill and injection burdens which will give psychological strength to the persons. Recently many studies have shown that Bariatric surgery [68-74] is very effective than lifestyle modifications and safer than the usual pharmacological treatments.

Nutritional Management

Diet management is of primary importance in preventing diabetes or managing existing diabetes and preventing or slowing diabetic complications. Calorie intake must be in accordance with the goals of weight management of the individual. Macro and micronutrients[75] intake should be precise and must be according to the metabolic status and lipid profile of the patient. However there is no evidence-based recommendation for the micronutrient supplements.

Exercise for Obese

Regular exercise effectively manages the glycemic control in diabetes. As physical activity reduces the insulin resistance Insulin, which is the e is the major cause for the hyperglycemia[76-80] in obese diabetics, Regular exercise along with yoga is highly recommended. Physical activity will improve insulin resistance through the reduction of free fatty acid-induced hepatic insulin resistance[81-85]. Moreover the weight loss achieved by regular exercise improves hepatic insulin sensitivity is better than the weight loss induced through calorie restriction[86-92]. Exercises are proved to increase skeletal muscle glucose uptake and utilization. Physical exercise also increases muscle insulin sensitivity which can be effective in blood glucose[93-99] level management by the body.

CONCLUSION

Obesity and diabetes are one the major problems faced by the modern man. The study of the link between the two conditions is very important because obesity is the major risk factor for type 2 diabetes. The prevalence of obesity and diabetes along with associated complications increases the costs to society.

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