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Visceral Fat Increases Cardiometabolic Risk Factors Among Type 2 Diabetes Patients

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Abstract

The aim of this study is to discuss the increase in risk for obesity-related disorders. It is believed that such complications arise due to store of visceral fat. The visceral fat is considered as an independent predictor of all-cause of mortality among type 2 diabetes (T2D) patients. Higher visceral fat is associated with an adverse lipid and glucose profile. Accumulation of visceral fat is located inside the abdominal cavity and surrounds internal organs, such as in the liver, stomach, kidneys, pancreas, intestines, and heart. Store of visceral adipose tissue (VAT) is characterized as pro-inflammatory, metabolically active, and susceptible to lipolysis. This study tries to present briefly the harmful activities of visceral fat in human body.

Keywords: abdominal obesity, cardiovascular disease, visceral fat, diet and physical activity

1. Introduction

Visceral fat is known as belly fat or organ fat, and is considered as hidden fat that is located inside the peritoneal cavity. It is the white fat that is stored in the abdomen and around all of major organs, such as in the liver, stomach, kidneys, pancreas, intestines, and heart (Yusuf et al., 2004). It is composed of several adipose depots, such as mesenteric, epididymal white adipose tissue (EWAT), and perirenal depots (Nagai et al., 2010). The accumulation of visceral adipose tissue has been shown to be a predictor for the onset of metabolic disorders and diseases including impaired glucose tolerance (Xu et al., 2012). Child obesity is a global epidemic that increases a risk factor for cardiovascular diseases, arterial hypertension, diabetes, hyperlipidemia, and fatty liver disease among children (Abrams & Levitt Katz, 2011).

Accumulation of visceral fat makes a person an apple shaped that can be produced toxic chemicals and hormones. It is more common in men than in women. If an individual consumes too many calories and have too little physical activity, s/he can possess visceral fat around various vital organs (Mohajan & Mohajan, 2023e). Also, age, sex, physical activity, menopausal status, and genetics play a role in developing visceral fat. The liver can turn the visceral fat into cholesterol and passes through the bloodstream. Sometimes it stores along the walls of the arteries and narrows them and causes to atherosclerosis (Schlecht et al., 2016).

High visceral fat levels can increase the risk for type 2 diabetes (T2D), liver disease, heart disease, dementia, gall bladder disease, stroke, fertility problems, hypertension, insulin resistance, lower back pain, gout, artery disease, asthma, osteoarthritis, and some cancers (Ye et al., 2022; Mohajan & Mohajan, 2023c, d, o, p, q). Visceral fat in the abdominal cavity can be measured by many methods, such as bioelectrical impedance analysis (BIA), ultrasound, dual-energy X-ray absorptiometry (DXA), computed tomography (CT) scan, and magnetic resonance imaging (MRI) (Browning et al., 2010; Mohajan & Mohajan, 2023t, u). It can be reduced through the losing

weight, diet, and at least 30 minutes daily exercise through the reduction of sugary drinks, and getting enough sleep. Also saturated fat can be taken less than 7%, and limit the consumption of harmful Trans fats (Wedell-Neergaard et al., 2019; Mohajan & Mohajan, 2023k, m, j, s).

2. Literature Review

The literature is an introductory portion of research area that presents the works of previous researchers in the same field within the existing knowledge (Polit & Hungler, 2013). It is a scholarly inquiry and investigation that aims for the discovery of new facts and findings (Adams et al., 2007). Ian J Neeland and his coworkers have found that visceral and ectopic fat are key drivers of adverse cardiometabolic outcomes in obesity. In the study they have realized that in adults with overweight or obesity at high cardiovascular disease risk, once-daily liraglutide 3·0 mg plus lifestyle intervention significantly lowered visceral adipose tissue over 40 weeks of treatment. They have advised that visceral fat reduction may be one mechanism to explain the benefits seen on cardiovascular outcomes in previous trials with liraglutide among T2D patients (Neeland et al., 2021).

Carmen María Piernas Sánchez and her coworkers have tried to show the excess of visceral abdominal adipose tissue is one of the major concerns in obesity and its clinical treatment through the application of the two-dimensional predictive equation proposed by Garaulet et al. to determine the abdominal fat distribution and to compare the results with the body composition obtained by multi-frequency bioelectrical impedance analysis to obtain an accurate, costless and safe classification of abdominal obesity (Sánchez et al., 2010). André Tchernof and Jean-Pierre Després have shown that excess intra-abdominal adipose tissue accumulation, often termed visceral obesity, is part of a phenotype including dysfunctional subcutaneous adipose tissue expansion and ectopic triglyceride storage closely related to clustering cardiometabolic risk factors (Tchernof & Després, 2013).

Omar Yaxmehen Bello-Chavolla and his coworkers have shown that intra-abdominal and visceral fat (VAT) are risk factors for the development of cardio metabolic comorbidities. They have aimed to develop a novel score (METS-VF) to estimate VAT by combining the non-insulin-based METS-IR index, waist-height ratio (WHtr), age and sex (Bello-Chavolla et al., 2020). Zhengyang Xu and his coworkers have shown that the measurement of visceral fat (VF) is clinically important for the identification of individuals at high risk of visceral obesity-related health conditions. They have investigated agreement between BIA and CT for the assessment of VF in adults. Devajit Mohajan and Haradhan Kumar Mohajan have studied diabetes mellitus, eating disorders, and various anthropometric indices. They have also studied on insulin and various oral medications for the treatment of T2D. They have stressed that overweight and obesity are the roots of many non-communicable diseases (Mohajan & Mohajan, 2023a-z).

3. Research Methodology of the Study

The aim of a research is the systematic investigations that requires collection, interpretation and refinement of data, and ultimately prepares an acceptable work (Pandey & Pandey, 2015). Methodology is a guideline of any research, which is considered as an organized procedure that follows scientific methods efficiently (Kothari, 2008). Research methodology provides the principles to the researchers for organizing, planning, designing and conducting a good research (Legesse, 2014). We have studied books and handbooks of famous authors, national and international journals, e-journals, and theses that are related to our research area. We have also collected valuable information from websites and internets to develop this article (Mohajan, 2017, 2018, 2020).

4. Objective of the Study

The main objective of this study is to discuss the aspects of visceral fat. Some other minor objectives of this study are as follows:

- to highlight the abdominal obesity,
- to consult negative effects of obesity briefly, and
- to show the various measurements of visceral fat.

5. Obesity and Its Side-Effects

Central obesity and long-term glucocorticoid exposure are both characterized by visceral fat enlargement and increased risk for metabolic diseases (Mohajan & Mohajan, 2023a). Obesity is defined by an excess of body fat that is a major public health problem. It is caused by excessive adipose tissue, and the pathogenesis is due to a positive energy balance. It is a major health issue and a risk factor for the development of numerous chronic diseases, such as diabetes mellitus, hypertension, stroke, and several types of cancer (Tchernof & Després, 2013; Mohajan & Mohajan, 2023i). The excess visceral fat in the abdominal and some other vital organs of the body is central to the pathogenesis of type 2 diabetes (T2D), impaired glucose tolerance, hypertension, insulin resistance, coronary heart disease, dyslipidemia, hyperinsulinemia, atherosclerosis, and metabolic syndrome. Moreover, it is a multifactorial disease that affects adults with substantial cardiovascular disease (CVD) with morbidity and mortality. Therefore, estimating the visceral fat accumulation is important before the development of CVD and for

the proper treatment of obese patients (Powell-Wiley et al., 2021; Mohajan & Mohajan, 2023a, b, r). Excess visceral fat may cause the enhancement of lipid synthesis and gluconeogenesis as well as insulin resistance, resulting in hyperlipidemia, glucose intolerance, hypertension, and atherosclerosis (Matsuzawa et al., 1994). Anti-obesity drugs, such as orlistat and sibutramine (SIB) have modest clinical efficacy, but safety and tolerability concerns may limit their use (Sumithran & Proietto, 2014).

6. Abdominal Obesity

Abdominal obesity is known as central obesity and truncal obesity. A cause of abdominal obesity is due to the consumption of more useable calories from carbohydrate and fat than expends (Marino, 2022). Abdominal obesity is a condition in which excessive abdominal fat has built up around the stomach and abdomen, and create various health problems. It is strongly related to type 2 diabetes (T2D), hyperlipidemia, cardiovascular disease, atherosclerosis, Alzheimer disease, and other metabolic and vascular diseases and also increases the risk of fatty liver and coronary artery disease (Razay et al., 2006).

7. Measurement of Visceral Fat

The measurement of visceral fat (VF) is important for the identification of individuals at high risk of obese individuals. Visceral fat (VF) is a strong and independent predictor of all-cause mortality. It can be measured in per area, manually or using a bioelectrical impedance analysis (BIA) diagnostic machine or by means of imaging methods, such as using a computed tomography (CT) scan at the umbilical level, ultrasonography, and magnetic resonance imaging (MRI) (Browning et al., 2010; Mohajan & Mohajan, 2023l, t, u). These are precise and reliable imaging techniques for measuring regional adipose tissue distribution (Xu et al., 2021). Among these CT is the most utilized method, but it involves exposure to ionizing radiation and has high cost. Ultrasonography is a reliable and convenient method to quantify the visceral fat (Dâmaso, A. R, 2008). BIA is a widely available and frequently used body composition assessment method, but there have been few validation studies for the measurement of VF (Bello-Chavolla et al., 2020). The VF measurement using BIA can be expressed as;

$$VF = a_0 + a_1 V_0 W \tag{1}$$

Where a and a are constants, V is the voltage measured at the flank and W is the waist circumference. The voltage occurring at the flank to the flow between the umbilicus and the back becomes larger as the visceral fat can be different even with subjects with the same W because the resistance of intra-abdominal fat is greater than the resistance of fat free mass. Waist circumference (W) can be measured very accurately.

8. Conclusions

In this study we have tried to identify various effects of obesity to determine some risk factors related to obesity. Obesity-related metabolic diseases, such as type 2 diabetes and cardiovascular disease are increasing at an alarming rate worldwide. It is estimated that abdominally obesity is due to increase level of visceral fat. The increased amount of visceral fat is strongly correlated with the increased risk factors associated with CVD. Diet and physical exercise are two major practices that can control visceral fat. Maintaining a healthy lifestyle an individual can maintain normal weight and healthy life.

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