Review Article

Causes, risks factors and medical consequences of obesity

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Abstract

Obesity has become a major cause of morbidity and mortality rates, posing an epidemic-level threat to world health. This review article explores the complex issues surrounding obesity with the goal of thoroughly illuminating its root causes, risk factors, and serious medical consequences. Through a multifaceted lens that includes genetic predisposition, environmental effects, and lifestyle factors, the etiology of obesity is investigated. This article also carefully covers the wide variety of dangers associated with obesity. These include complex psychological effects like depression, anxiety, and a lower quality of life in addition to physical health effects including type 2 diabetes, cardiovascular disease, and musculoskeletal issues. Additionally, a critical analysis of the financial costs associated with obesity is provided, emphasizing how it affects social productivity and healthcare systems. The effects of obesity on the body's many organ systems are examined, with a focus on how it encourages chronic inflammation, metabolic dysregulation, and hormonal abnormalities. The review elaborates on adipose tissue as an active endocrine organ, explaining how it secretes cytokines and adipokines

that cause systemic disturbances. The essay also explores the link between fat and cancer, neurological conditions, and problems with reproductive health.

Key words

Obesity, Aetiology, Risk factors, Medical consequences, Treatment.

Introduction

The medical community has been aware of the mortality and morbidity linked to being overweight or obese for more than 2000 years [1]. The epidemic of obesity is recognized as an energetic imbalance brought on by a rise in the consumption of high-calorie foods. Other variables include the lack of physical activity, socioeconomic and environmental changes, especially the rise in purchasing power and education levels, as well as the influence of others on food consumption [2-5]. Diabetes, osteoarthritis, dyslipidemias, and musculoskeletal problems, including endometrial, breast, and colon cancer, are all linked to obesity [6].

Additionally, clinically apparent cardiac risk factors associated with obesity include hypertension, insulin resistance, glucose intolerance, and a high body mass index (BMI) [7, 8]. Since 1980, there has been an increase in morbidity and death rates [9, 10], which has led to a social issue that is receiving institutional and governmental attention [11]. In 2013, there were almost 42 million obese children under the age of five. In 2014, there were more than 1.9 billion overweight individuals, of whom more than 600 million were obese [9].

Obesity's complex etiology involves a dynamic interaction of genetic predisposition, environmental factors, and complex metabolic pathways, transcending a simple explanation [12]. An increasing corpus of research is elucidating the complex genetic and epigenetic factors that influence a person's tendency for obesity, and hereditary susceptibility has long been recognized as a contributing factor. Genetics alone, however, cannot fully explain the rising obesity rates seen around the world. The obesity epidemic is fueled by a synergistic interaction between environmental factors and genetic predispositions. Environmental factors include sedentary lifestyles made worse by technological improvements and obesogenic food settings.

Obesity imposes a variety of dangers beyond just physical health, regardless of its etiology. Obesity is associated with a number of known health problems, including an increased risk of some malignancies, type 2 diabetes, cardiovascular disease, and musculoskeletal ailments [13, 14]. Additionally, the psychological effects of obesity on mental health, such as sadness, anxiety, and reduced quality of life, are clearly evident. The strain that obesity exerts on healthcare institutions and the overall economy is another way that it has a socioeconomic impact.

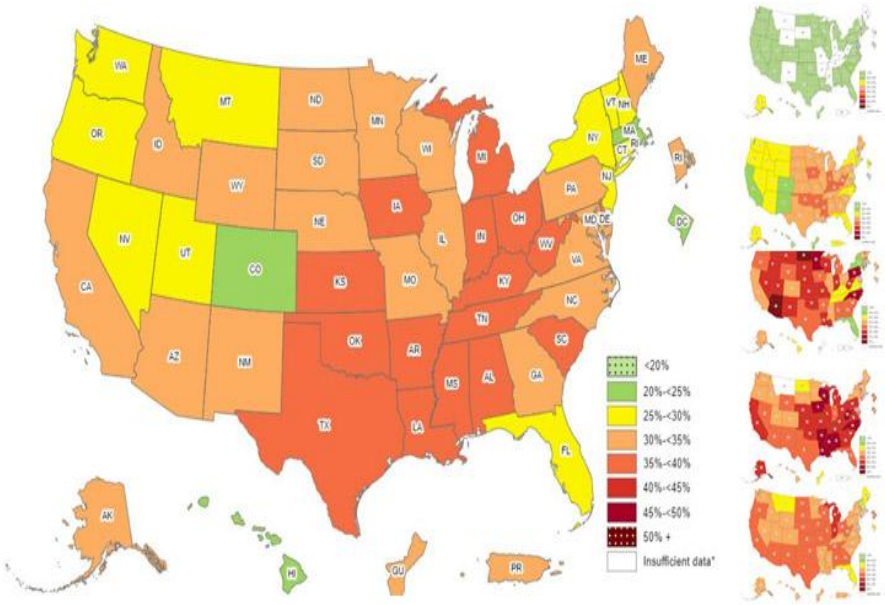
Examining obesity's medical effects uncovers a series of physiological changes that have an impact on many organ systems. Once thought of as little more than an energy storage facility, adipose tissue is now understood to be an active endocrine organ secreting a variety of bioactive chemicals known as adipokines. These adipokines have a significant impact on the initiation and development of obesity-related co-morbidities through controlling inflammation, metabolism, and hormonal balance. We aim to contribute to a greater knowledge of this global health issue and inspire novel ways to its prevention and control by deeply examining the various factors that lead to obesity and by thoroughly examining its profound repercussions on health and well-being.

Prevalence of obesity

Globally, obesity is on the rise, not just in industrialized nations but also in underdeveloped ones. As interventions are needed at all levels, the expense of healthcare for nations is rising tremendously. In 2014, the World Health Organization (WHO) reported that 13% and 39% of individuals, respectively, were overweight or obese. Based on variables like geographic location, social level, cultural influences, and lifestyle choices, obesity incidence can vary greatly. Due to its link to a number of health issues, including as cardiovascular illnesses, type 2 diabetes, some malignancies, musculoskeletal ailments, and more, high obesity prevalence rates are cause for concern. The following figure (**Figure - 1**) illustrates the prevalence of obesity [15]. Using information from the Behavioral Risk Factor Surveillance System, the CDC's 2021 Adult Obesity Prevalence Maps provide self-reported adult obesity prevalence based on race, ethnicity, and geography.

Figure - 1: Prevalence of obesity.

The maps show that different groups have differing obesity rates, especially when looking at the combined 2019–2021 statistics. No state out of 37 with non-Hispanic Asian adults had an obesity prevalence of 35% or greater, compared to 10 states out of 48 with non-Hispanic White adults who had this incidence. Out of 48 states and Guam, Hispanic individuals saw rates of 35% or greater, while non-Hispanic American Indian or Alaska Native adults did so in 31 states out of 47. Out of 47 states, 36 (including the District of Columbia) had rates of 35% or greater among non-Hispanic Black individuals.



Causes of obesity

A sustained positive shift in the energy balance equation brought on by an increase in energy intake, a decrease in energy expenditure, or both is what is known as obesity [16]. It is linked to a number of physiopathological diseases that have serious repercussions for both health and the economy [17, 18]. According to Rosenbaum et al. (1997) and Grundy (1998), a complex interaction of factors, including cultural, socioeconomic, genetic, and physiological impacts, may be to blame for the increased prevalence of obesity in recent years [19, 20]. Environmental factors account for about 30% of obesity-related changes, while genetic factors account for 40–70% of these variations [21, 22]. The rising incidence of obesity in genetically stable groups serves as a stark reminder of the importance of environmental factors [23, 24]. With increased access to calorie-dense meals and

sedentary lifestyles, modernization and economic changes in both developed and developing countries have changed dietary and physical activity habits [25-27]. Poor dietary practices, inactivity, and obesity are all related, according to a number of cross-sectional researches [28-30]. According to prospective studies, encouraging greater physical activity among communities may be able to slow the rise in obesity rates [31, 32]. The following table (**Table - 1**) demonstrates the causes of obesity according to the research studies.

Table - 1: Causes of obesity.

Causes	Contributing factors	References
Diet	high consumption of processed foods, sugary drinks, and energy-dense foods	[33]
Physical inactivity	lack of regular exercise Sedentary lifestyle	[34]
Genetics	genetic predispositions, metabolic and fat-storing gene variations	[35]
Physiological factors	Depression, Stress, Emotional eating	[36]
Socioeconomic factors	Low levels of education, insufficient access to healthy foods, and income inequality	[37]
Environmental factors	High-calorie food availability, food marketing, and built environment	[35, 38]

Medical consequences of obesity

Obesity, which is characterized by an excessive build-up of adipose tissue, has a wide range of serious medical consequences and is a serious public health problem. The worst of these impacts are on cardiovascular health, as shown by an increased propensity for hypertension, atherosclerosis, coronary artery disease, and cerebrovascular accidents. Additionally, obesity causes insulin resistance and poor glucose metabolism, which significantly increase the risk of type 2 diabetes mellitus. The effects on the respiratory system are equally significant since obesity frequently causes obesity hypoventilation syndrome and sleep apnea, which decrease pulmonary function and oxygenation. Osteoarthritis can develop and worsen as a result of musculoskeletal effects, intensifying pain and physical incapacity. With an increased prevalence of several cancers, such as breast, colorectal, and kidney cancers, the complex interaction between obesity and oncogenesis has equal importance. The psychological effects of obesity are seen in a rise in the prevalence of mood disorders, such as anxiety and depression, which frequently result from social stigma and a distorted perspective of one's own body. Additionally, being overweight can harm reproductive health, reducing fertility and heightening birthing problems. Non-alcoholic fatty liver disease and its progressive variation, non-alcoholic steatohepatitis, are hepatic repercussions that cause hepatic dysfunction.

Cardiovascular diseases

Cardiovascular disease (CVD), a group of illnesses that includes conditions including hypertension, atherosclerosis, myocardial infarction, and stroke, stands to benefit significantly from the presence of obesity. Adipose tissue's active participation in secreting pro-inflammatory cytokines, adipokines, and hormones, which together promote a state of ongoing low-grade inflammation and insulin resistance, highlights the complex interplay between obesity and CVD. The onset and development of atherosclerotic lesions within artery walls are facilitated and accelerated by this inflammatory environment, which also potentiates endothelial dysfunction. Additionally, the load on the circulatory system caused by increased body fat leads to left ventricular

hypertrophy, diastolic dysfunction, and ultimately heart failure. The atherogenic process is further aided by obesity-induced dyslipidemia, which is characterized by increased triglycerides and decreased high-density lipoprotein cholesterol. An increased risk of unfavorable cardiovascular events and a worsened prognosis are the results of the complex interaction of these processes. Strong epidemiological research backs up the link between obesity and CVD. The risk of myocardial infarction increases gradually with greater body mass index (BMI), according to a landmark study by Yusuf, et al. (2005), highlighting the dose-response link between obesity and CVD [39]. The Framingham Heart Study also clarified the significance of obesity as a separate risk factor for heart failure [40]. These conclusions were confirmed by the INTERHEART study, which established abdominal obesity as a critical risk factor for acute myocardial infarction in a range of populations [39]. The detrimental effects of obesity on CVD outcomes have been supported by longitudinal studies, with the Nurses' Health Study finding a markedly increased risk of coronary heart disease in obese people [41].

Type 2 diabetes

Before a person was diagnosed with diabetes, they had long-term signs of insulin resistance and hyperinsulinemia [42]. Insulin resistance and obesity—more especially, abdominal adiposity—have been linked [43, 44]. Different adipokines, cytokines, and free fatty acids that are secreted by adipose tissue cause persistent low-grade inflammation and interfere with insulin signalling pathways, which eventually hinders the uptake of glucose by peripheral tissues. Leptin, a hormone generated from adipose tissue that regulates appetite and energy homeostasis, may also contribute to the emergence of insulin resistance. Furthermore, ectopic fat deposition in organs like the liver and pancreas is strongly correlated with obesity, which further increases insulin resistance and impairs insulin production. This complex relationship is supported by epidemiological research, since the Nurses' Health Study showed a significant positive correlation between incident T2DM and obesity [45]. According to the Diabetes Prevention Programme, changing one's lifestyle and losing weight are efficient ways to lower the incidence of T2DM in high-risk people [46]. The dose-response link between obesity and type 2 diabetes has been further shown by longitudinal research, such as the Atherosclerosis Risk in Communities Study [47].

Osteoarthritis

As excessive adiposity is a key factor in the etiology and development of this degenerative joint illness, the complex and diverse relationship between obesity and osteoarthritis (OA) raises serious health concerns. Excessive weight puts a mechanical strain on weight-bearing joints, especially the knees and hips, which increases joint stress and speeds up cartilage deterioration. The inflammatory milieu inside the joint microenvironment is further exacerbated by obesity-induced chronic low-grade inflammation, which is coordinated by adipokines and cytokines released by adipose tissue, and contributes to the pathogenesis of OA. Notably, the hormone leptin, which is produced from adipose tissue, has been linked to the development of OA because it encourages cartilage breakdown and inflammation. The obesity-OA connection is supported by epidemiological research, with studies like the Framingham Osteoarthritis Study showing a significant correlation between obesity and knee OA [48]. Obesity has continuously been identified as a major risk factor for incident knee OA in longitudinal studies, as illustrated by the Osteoarthritis Initiative. Additionally, according to the Diet, Exercise, and Glucosamine experiment [49], weight loss therapies have been demonstrated to reduce OA symptoms and decrease the course of the illness.

Cancer

Significant research emphasis has been focused on the complex and compelling link between obesity and cancer, underlining the crucial role

of excess adiposity in oncogenesis and disease progression. Pro-inflammatory cytokines, adipokines, and altered immunological responses promote a milieu favorable to cancer in chronic low-grade inflammation, which is a hallmark of obesity. Adipose tissue also functions as an active endocrine organ, secreting hormones like leptin and adiponectin that can affect cell division, apoptosis, and angiogenesis, all of which can affect cancer risk. Epidemiological studies have shown that obesity increases the chance of developing a number of cancers, including postmenopausal breast cancer, colorectal cancer, endometrial cancer, and renal cell carcinoma [50, 51]. Longitudinal studies have emphasized the dose-response link between obesity and cancer incidence, notably breast and colorectal cancer [52], as demonstrated by the Women's Health Initiative. The mTOR pathway, insulin resistance, and adipokine signalling have all been linked to the obesity-cancer connection mechanistically, supporting the molecular basis of this intricate interaction.

Hypertension

The complex relationship between obesity and hypertension highlights a serious health issue since excess body fat is a major factor in the development and aggravation of high blood pressure. Mechanistically, adipose tissue's chronic inflammatory state and obesity-induced insulin resistance cause endothelial dysfunction and decreased nitric oxide availability, which encourages vasoconstriction and increases systemic vascular resistance. Leptin and adiponectin are adipose-derived hormones that alter sympathetic nervous system activity and renal function to further affect blood pressure management. Large-scale studies, such as the Framingham Heart Study and the National Health and Nutrition Examination Survey (NHANES), consistently show the increased risk of hypertension in obese people [53, 54], demonstrating the strong epidemiological association between obesity and hypertension. Furthermore, long-term studies have proven that obesity is a distinct risk factor for the emergence of hypertension over time [54]. It has been demonstrated that treating obesity with lifestyle changes and weight reduction programmes significantly lowers blood pressure and lowers the risk of hypertension [55].

Conclusion

The review of "Causes, Risks, and Medical Consequences of Obesity" offers a thorough summary of the complex web of causes causing obesity and the wide-ranging effects it has on health and wellbeing. The etiological landscape of obesity is supported by a complex interplay between genetic predisposition, environmental factors, and lifestyle decisions. Additionally, the dangers of obesity affect not only one's physical health but also one's psychological well-being and socioeconomic status. This study highlights the need for a holistic strategy to address this urgent public health issue by highlighting the various medical effects of obesity, from metabolic abnormalities to increased cancer susceptibility. Adipose tissue is now recognized as a dynamic endocrine organ, which highlights the need for a paradigm change in how we think about how obesity affects systemic homeostasis. The thorough synthesis offered here emphasizes the need for a concerted effort across medical specialties, public health programmes, and legislative approaches to reduce obesity. We may picture a future where the escalating obesity epidemic is slowed down and people are given the tools they need to adopt and maintain healthy lifestyles by placing a high priority on prevention, education, and individualized treatment plans. Finally, the knowledge gained from this review adds to the larger discussion on obesity by promoting a deeper understanding of its complexity and encouraging novel methods to its management and prevention.

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