



Obesity: A Comprehensive Review of Pathophysiology, Epidemiology, and Associated Diseases

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ABSTRACT: Obesity is a chronic disease which is defined as the excessive and undesirable deposition of body fat which has numerous complications. According to the Global Statistics released in 2022, more than 890 million adults and 340 million children and adolescents were affected by obesity. This paper aims to discuss the pathophysiology of obesity, the epidemiology of obesity and the diseases that are associated with it. This paper has endeavored to demonstrate that obesity is a complex condition that cannot be explained by a single cause. Genetic, environmental, behavioral, metabolic and molecular factors as well as adipose tissue dysfunction and low-grade inflammation result in the development of obesity. In global perspective the prevalence of obesity differs from one region to another with key differences based on demographic, socioeconomic and lifestyle factors. Obesity is socially and economically costly, both in terms of human suffering and in terms of the costs to the healthcare system; it also reduces the quality of life of those affected by it. It also gives an overview of the diseases that are associated with obesity including cardiovascular diseases, type 2 diabetes, respiratory disorders, gastrointestinal and hepatic disorders, musculoskeletal disorders, certain cancers and psychological conditions. To combat this issue, effective prevention and management measures have to be implemented. The best practice to prevent obesity includes change in life style such as diet, exercise and behavior modification; pharmacological and surgical treatment are also used in the management of obesity and weight loss as well as for better health outcome. There is therefore need to encourage individuals to adopt healthy behaviors through policy initiatives and community interventions to foster healthy environments.

1. Introduction

Overweight is a complex, protracted process that occurred due to the combined effect of genetic, physiologic, metabolic, neural, and lifestyle factors, which is accompanied by excessive adipose tissue mass and presents risk factors for chronic diseases^[1]. Obesity is a pandemic affecting about one in every ten adults and roughly 1 in 1000 children and adolescents in the age of 2022^[2]. This increase in obesity companies is a major concern in the entire population as it has been linked to many other diseases such as; cardiovascular diseases, type 2 diabetes, cancers, and respirational diseases^[3-6]. Obesity is a multifactorial condition which resulted due to the increase in the interrelation of genes,

environment exposure, behavior and metabolic factors^[7]. Other than that, it is important to note that obesity is in part a genetic disorder and research indicates that genetics contribute anywhere from 40-70% of the difference in body weight^[8]. There are accordingly now conducted genes that play important roles in controlling body weight, such as genes that control appetite amount, energy consumption, and storages of fat^[9]. Lifestyle factors, including diet and exercise are also known to play a huge role in the rise of obesity^[10]. Given the current culture of high calorie diets and decreased physical activity, or lack of it, energy intake surpasses energy expenditure and this results in emergence of obesity. Furthermore, the peri-urbanisation and default in access to processed foods



and other unhealthy diets and reduced physical activity have been made possible by man-made environment^[11]. Psychological and social factors are the other disclosed factors that add to this story of obesity^[12]. Chronic stress, depression and stress-Induced eating behavior have been linked to over eating and obesity^[13]. Other socio demographic factors have also been identified to be associated with obesity and include; people with lower income level and those with low education level^[14]. Another important set of factors include endocrine and committed cellular metabolism disturbances, including hormone levels alterations. Leptin and ghrelin that act as signals to the brain for feeling hungry and full respectively are also impaired in the obese. Obesity, characterized by insulin resistance, leads only to increased weight and a predisposition to the development of type 2 diabetes^[15].

Epidemiologically, obesity is not a constant rate for every region and population group. The trends show that high income countries have significantly higher levels of obesity; American and Britain having the highest prevalence^[16]. However, obesity is no longer exclusive to WE societies exclusively; it is rapidly increasing in LMIC societies due to changes in diet and physical activity resulting from food system transformation from traditional to modern diets^[17].

When it comes to obesity, health effects are too numerous and a cross-sectional set of effects in many systems of the body can be mentioned. One of the main medical consequences of obesity is cardiovascular diseases: hypertension, coronary artery disease and stroke. Metabolic complications associated with obesity including diabetes and metabolic syndrome are leading causes of morbid and mortal consequences. Besides, obesity is a critical determinant of all-site or overall cancers, as well as specific cancers, such as breast, colorectal, and endometrial cancers^[18]. Obesity also predisposes a person to respiratory diseases including obstructive sleep apnea and asthma through which the quality of life of a person is reduced^[19]. Other obesity related complications are gastrointestinal and hepatic diseases like NAFLD and GERD which add on as other obesity related diseases^[20].

2. Pathophysiology of Obesity

Obesity is a long-term condition in which the fat reserves actually adversely affect health. According to World Health Organization (WHO), obesity is determined by Body Mass Index (BMI)^[21]. For adults:

- **Overweight:** BMI of 25.0-29.9 kg/m²^[22].
- **Obesity:** BMI of 30.0 kg/m² or higher^[22].

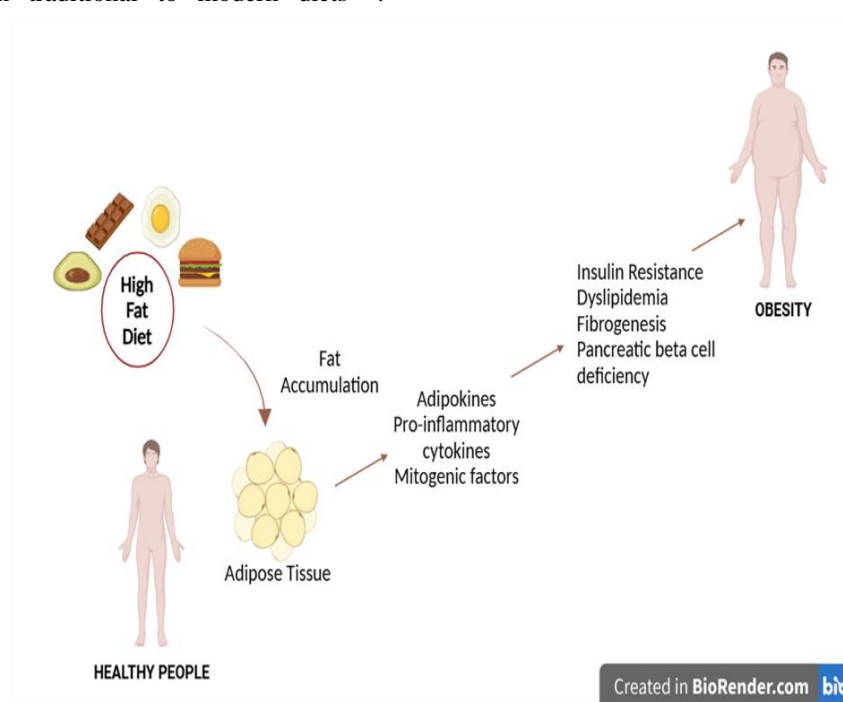


Figure 1: Pathophysiology of Obesity



2.1 Mechanisms of Obesity

1. Genetic Factors and Predisposition: Obesity is strongly influenced by genetic factors. Studies involving twins, families and adoption make it possible to calculate the heritability of BMI that varies from 40 % to 70 %². Other more rare types of obesity are caused by specific gene defects; the leptin gene and the gene of the melanocortin-4 receptor.

2. Environmental Factors: Diet, physical activity and life styles make a huge difference as far as obesity is concerned. Overconsumption of lower energy density foods and more sitting time for example during extended working hours in the production line results into positive energy balance and weight gain.

3. Metabolic and Endocrine Factors: There are hormonal factors and metabolism that link with obesity too. Mental disorders such as hypothyroidism and Cushing's syndrome are known to trigger weight gain. People who are obese especially develop insulin resistance and metabolic syndrome^[23-24].

2.2 Molecular and Cellular Mechanisms

1. Adipose Tissue Dysfunction: Adipose tissue in obese individuals is capable of releasing altered secretory products that include adipokines and inflammatory markers.

2. Inflammation and Insulin Resistance: This chronic inflammation also plays a role in development of insulin resistance common in people with obesity associated diseases^[25].

3. Epidemiology of Obesity

3.1 Prevalence and Trends

Obesity is one of the leading health issues throughout the world which has increased by more than the double since 1990. In 2022, the global population of adults with obesity was about 890 million, and children and adolescents 340 million. It was found out that the levels of obesity has major differences across the world with developed countries being the most affected. For instance, the United States, and the United Kingdom are among the first countries in the world having high obesity rates. However, obesity is also emerging very fast in low-middle income countries due to economic transitions and urbanization^[26,27,28].

3.2 Trends Over Time

Obesity has been more common in the recent past than in the previous few decades. In 1990, 25 % of the adults were overweight and this has risen to 43% in 2021. Likewise, adolescent obesity has increased four fold throughout this particular period. That is why, the obesity epidemic requires the development of viable public health interventions^[29].

3.3 Risk Factors

1. Demographic Factors: The factors which know the chances of obesity include age, gender, and ethnicity. Age related dependency of obesity rates is other characteristic feature related to obesity: it is above all higher among women than among men. Ethnicity also shows that some ethnic groups are more likely to be obese than others.

2. Socioeconomic Factors: The present study also showed that SES is an important predictor of obesity. And people of low income can rarely afford the types of foods which are beneficial to health and sufficient physical activity, and therefore there is high level of obesity.

3. Lifestyle and Behavioral Factors: The common eating behaviors that are found to that causes obesity include; increased consumption of processed foods and sugary drinks as well as lack of physical exercise. Stress and also other psychological effects like the emotional kind also contributes to the situation^[30].

3.4 Impact on Public Health

1. Economic Burden: Obesity is a huge drain on the nation's health expenses. Obesity related diseases like type 2 diabetes, cardiovascular disease, and certain cancers are very expensive to treat.

2. Healthcare Costs: Clearly, the medical costs of obesity are rather steep; patients with obesity have 30% increased medical expenses compared with normal-weight individuals. These costs are projected to further increase with the increasing statistics in obesity rates.

3. Impact on Quality of Life: A review of the effects of obesity show that obesity diminishes peoples' quality of life through risk of diseases, limited movement, and possibly depression. This implies that the total quality



of life of the people that are in the jurisdictions is significantly affected^[31].

4. Effects of Obesity on Body



Figure 2: Effects of Obesity on Body

5. Disease associated with Obesity

5.1 Cardiovascular Diseases ^[32]

Hypertension: There are copious correlations between obesity and hypertension (high blood pressure). Obesity means enhanced blood volume together with the increased arterial wall pressure causing high blood pressure. This condition is a major predisposing factor to other cardiovascular diseases^[33].

Coronary Artery Disease: Obesity involves the deposition of fatty materials in the arterial walls and leads to CAD because it thickens the interior lining of

the arteries. This can mean decreased blood supply to the heart and so increase its chances of heart attack and other related heart conditions^[34].

Stroke: Obesity poses serious and increased hazards of stroke because of hypertension, diabetes, and atherosclerosis. These conditions can cause blockage of the blood supply to the brain which results to development of a stroke^[35].

5.2 Metabolic Disorders

Type 2 Diabetes: The excessive possession of body fat is a well-known predictor of type 2 diabetes. Obesity



and particularly obesity around the waist makes the cells in the body insensitive to insulin, thus developing insulin resistance. This in effect raises blood sugar levels and cause diabetic disease^[36].

Metabolic Syndrome: Metabolic syndrome is a combination of disorders that involve high blood pressure, high amount of sugar in the blood, obesity and high levels of cholesterol. Overweight is a defining characteristic of the metabolic syndrome which doubles the risk of heart disease, stroke, and hypertension Type 2 diabetes^[37].

5.3 Respiratory Disorders

Obstructive Sleep Apnea: BMI is directly related to OSA, which is a state where the patient temporarily stops breathing during several moments of the night. The fat deposits around the neck may narrow the airways and therefore may lead to problems of breathing at night.

Asthma: Obesity increased the prevalence and severity of asthma than in non-obese patients. The exact mechanisms are unknown, but inflammation probably plays a role, as well as mechanical factors that affect lung volume^[38].

5.4: Gastrointestinal And hepatic diseases

Non-alcoholic Fatty Liver Disease (NAFLD): NAFLD stands for nonalcoholic steatohepatitis which is characterised by build up fat in the liver other than through the effects of alcohol. NAFLD is associated with obesity, and is likely to reinforce more dangerous liver pathologies, including non-alcoholic steatohepatitis (NASH), and cirrhosis of the liver.

Gastroesophageal Reflux Disease (GERD): Overweight people are prone to developing GERD – a disorder, which is marked by the constant backwash of stomach acid into the esophagus. Being overweight puts pressure on the stomach allowing acid to reflux easily against the normal process^[39].

5.5 Musculoskeletal Disorders

Osteoarthritis: Obesity also places more pressure as extra mass on weight bearing joints; hence cartilage of the knee and hip joints wears out developing into osteoarthritis.

Lower Back Pain: Lifting the weight of obesity places a mechanical demand on the spine, and postural and gait changes occur. Thus, these extra journeys can result in chronic pain and complications within the mobility of a person^[40].

5.6 Cancer

Increased Risk of Certain Cancers: This is true with increased risks for breast, colon, endometrial, kidney, and pancreatic cancers among the obesity-related diseases. These may include inflammation, hormonal imbalances as well as resistance to insulin^[41].

5.7 Psychological Impact

Depression: There is a positive relationship between obesity and depression. There is the interaction between obesity and depression that are biological, psychological and social in nature.

Anxiety: Users that are obese are at higher risk of developing anxiety disorders, this could be as a result of body image negative evaluations and social discrimination as well as the stress of coping with obesity-related diseases.

Eating Disorders: It can be associated with other eating disorders including the binge eating disorder that is characterized by a regular consumption of large portions of food in a short span of time. Unfortunately this can lead to a vicious cycle of weight gain as well as exacerbation of the associated psychological problems^[42].

6. Prevention and Management of Obesity

6.1 Lifestyle Interventions

1. Diet and Nutrition: Malnutrition, Obesity, Restricted calorie intake and unhealthy food choices can be prevented through proper diet containing a lot of fruits, vegetables, whole grains and lean meats. Limiting amount of food with plenty of calories but low nutrition like soft drinks and fast food can minimize obesity^[43].

2. Physical Activity: Physical exercise should be incorporated in a daily routine in order to keep of Check with weights. Based on WHO, adults need 150 minutes of moderate aerobic or 75 minutes of vigorous-intensity physical activity throughout the week^[44].



3. Behavioral Therapies: Lifestyle change that can be adopted include; diet modification for improved eating habits and exercise for improved activity can be adopted through CBT. Such therapies include identification of goals, self-management and achieving problem solving skills^[45].

6.2 Pharmacotherapy

Obesity is a clinical condition that can be treated by appropriate medications especially where lifestyle changes alone cannot effectively provide the needed aspiration. Commonly used medications include:

- **Orlistat:** Reduces the ability of the body to absorb fat in the small intestine.
- **Phentermine:** Suppresses appetite.
- **Liraglutide:** An incretin mimetic that achieves GI sluggishness and controls food consumption^[46].

6.3 Surgical Interventions

Bariatric Surgery: Laparoscopic adjustable gastric banding, laparoscopic sleeve gastrectomy and gastric bypass surgery also reduce body weight to a greater extent in the obese population. These surgeries can probably cause the long-term weight loss and reduction in obesity associated complications^[47].

6.4 Public Health Strategies

1. Policy Measures: Supportive environmental interventions that Governments can use include put in place polices on healthy diet and physical activity. Such as a tax on products with added sugar, provision of subsidies for foods that are good for human health and restrictions on advertising that appeals to children.

2. Community-Based Interventions: Community programs can offer services that teach, support, and offer reference on techniques and measures on how one can be healthy. Such programs can include developing culinary gardens, working out applications, and nutrition education^[48].

7. Conclusion

Obesity is a chronic, relapsing medical disorder that has become a global health issue: it affects people's health, strains the healthcare systems. The processes that result in uniform deposits of body fat are genetic,

environmental and metabolic and endocrine factors influencing the obesity. Other factors run in line with the onset of obesity are outlined to encompass molecular and cellular that encompasses adipose tissue dysfunction, chronic inflammation. Geographically, obesity incidence is not uniform, rising in LMICs, but it is also high in HICs and TLCIMs. Population data, including age, sex, education level and lifestyle, directly affect obesity risk, while the financial loss and the costs of treating obesity are also high. Furthermore, obesity reduces quality of life based on many related diseases inclusive of cardiovascular diseases, type 2 diabetes, respiratory diseases, gastrointestinal hepatic disease, musculoskeletal diseases, some forms of cancer, and psychological disorders. Prevention and management form part of the framework for tackling the obesity problem. Obviously fundamental are the lifestyle modification consisting of a healthy diet, exercise, and behavioral therapies. Pharmacologic therapy and the surgical one, including bariatric surgery, are the other substantial choices for both weight and health management. So, antecedent regulation and other public health interventions and health policies as well as community interventions are important to establish suitable conditions that contribute to the delivery of healthy behaviors.

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