Available online on 15.11.2025 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

Copyright © 2025 The Author(s): This is an open-access article distributed under the terms of the CC BY-NC 4.0 which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited

Open Access Full Text Article

Review Article

Obesity: A Global Health Concern

Trishna Mani Nath [1], Pallab Kalita [2]*, Gaurav Kumar Bhargav [1]

[1] Assistant Professor, School of Pharmaceutical Sciences, University of Science and Technology, Meghalaya, Meghalaya, India.

[2] Professor, School of Pharmaceutical Sciences, University of Science and Technology Meghalaya, Meghalaya, India.

Article Info:

Article History:

Received 07 Aug 2025
Reviewed 04 Oct 2025
Accepted 30 Oct 2025
Published 15 Nov 2025

Cite this article as:

Nath TM, Kalita P, Bhargav PK, Obesity: A Global Health Concern, Journal of Drug Delivery and Therapeutics. 2025; 15(11):64-71
DOI:
http://dx.doi.org/10.22270/jddt.v15i11.7446

*For Correspondence:

Pallab Kalita, Professor, School of Pharmaceutical Sciences, University of Science and Technology Meghalaya, Meghalaya, India.

Abstract

Obesity can be defined as an abnormal or excessive accumulation of body fat that poses significant health risks, either independently or in association with other medical conditions. The primary health consequences of obesity can be better understood by examining the pathophysiological mechanisms behind increased adiposity. In obese individuals, the presence of excessive intra-abdominal (visceral) fat is a key indicator of poor metabolic health. These associated health risks may vary across different populations due to genetic, environmental, and lifestyle factors.In developed countries, the conservative estimate of the economic burden of obesity ranges between **2% and 7%** of total healthcare expenditures. This reflects a substantial strain on national healthcare budgets, highlighting obesity as not only a medical concern but also a critical socioeconomic issue.

Keywords: Obesity, Health, Risk-factors, Diabetes, Stroke.

Introduction:

Obesity is as an abnormal or excessive accumulation of fat that leads to serious health problems independently or in association with other diseases. The main health consequences of obesity are anticipated by knowing the pathophysiology of increasing body fat. Obese people have excess fat on the Intra-abdominal sides which is an indication of negative health, these health risks are different in certain populations. In the developed countries the conservative estimate of economic costs of obesity is between 2% and &% of total health costs, which denotes a major expenditure of the national health care budget [1].

Complications:

Obesity has a great association with other chronic diseases like heart disease, type II diabetes, osteoarthritis, hypertension, and several cancers. Not astonishingly, obesity is linked with high risks of disability and mortality. Currently, the mortality rate associated with obesity in the United States has been declining due to better management of cardiovascular risk factors. In Canada, there is parallel improvement in the treatment of cardiovascular risk factors like high cholesterol and hypertension, In the meantime, there has been a severe increase in obesity and heart disease risk factors such as hypertension and diabetes[2]. A national population survey of Canada indicated that from 1985 to 2000 the rate of obesity and overweight increased from 5.1% to 9.3% and the annual number of deaths due to these factors increased from 2514 to 4321. Collectively, the total deaths were 57181 due to obesity and overweight in these 15 years [3]. The United States has the highest obesity prevalence which is 36.5% from 2011 to 2014, while Europe ranked second ranging from 10 to 30%[4]. On average 22% of women and 15% of men were obese, overweight is more common among women than men. In Europe, more than half of the population between the ages of 35 to 65 years, were either obese or overweight. A health survey in England and Wales has confirmed the prevalence of obesity from 6% to 17% in men and 8% to 20% in women [5].

Causes :

Obesity is not a single disorder, it's a heterogeneous group of complications with manifold reasons. The body weight is mainly determined by an interaction of psychological, genetic, and environmental factors substituted by the physiological mediators of energy

intake. The major complication due to obesity are already mentioned (heart disease, type II diabetes, osteoarthritis, hypertension, and several cancers) the less well-known complications include gallbladder disease, endocrine abnormalities, hepatic steatosis, pulmonary function impairment, gout, immunologic impairment, increase hemoglobin concentration, proteinuria, obstetric complications, cutaneous disease. The relationship between obesity and gall bladder disease has been studied many times, obesity enhances the risk of dying due to this disease. Individuals with overweight (15 to 35%) are at high risk of this digestive disease[6]. A study revealed that the weight of men without gallstones was significantly lower than the man with gallstones. The increased production and secretion of cholesterol increased the risk of gallbladder disease.

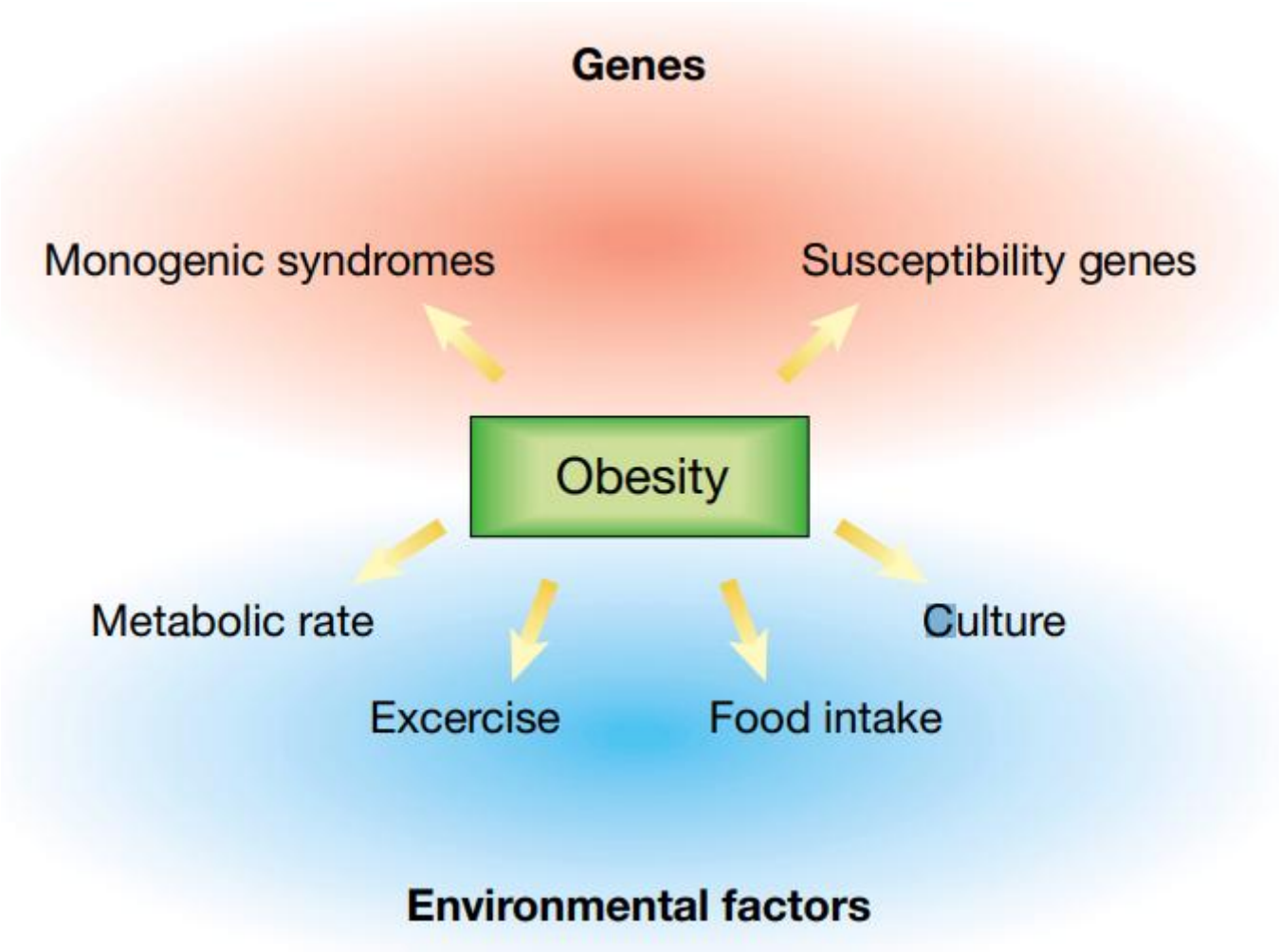

Figure 1. Factors influencing the development of obesity

In European countries, genome-wide studies identified the genetic variations in adult morbid obesity and childhood-onset morbid obesity. A chromosomal deletion that includes 30 genes was identified in a group of severely obese individuals. The deleted portion of the gene mainly contributesto hormone signaling (insulin and leptin) that regulates glucose metabolism and appetite. Dysregulation of these hormones is associated with hyperphagia and with tissue resistance to insulin that leads to type II diabetes[7]. Human has leptin deficiency due to mutation in the leptin gene, which is linked with the early onset of obesity and lead to pituitary dysfunction [8].The major cause of obesity worldwide is due to a major shift in behavior and environmental factors rather than a significant change in genetics.

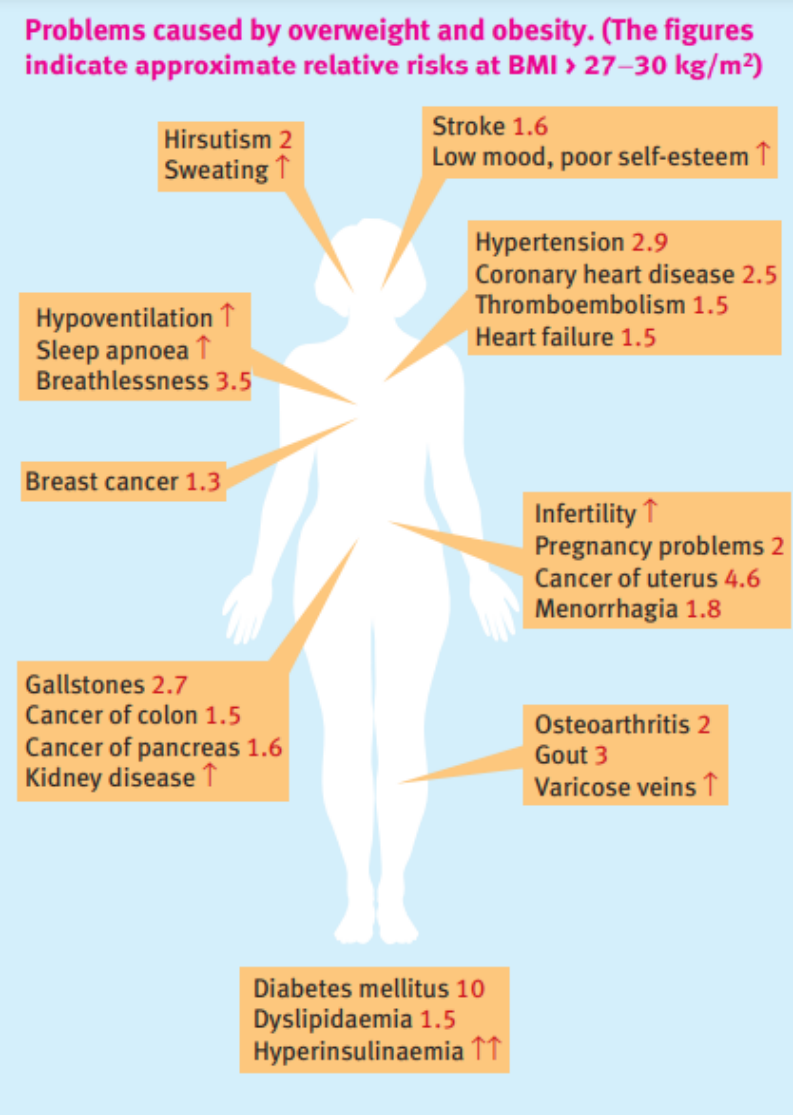

Figure 2. Obesity and other chronic disorders

The two key behaviors that are food intake and physical activity affect the energy balance that playsa significant role in the etiology of obesity. On the other hand,a high level of physical activity enhanced the innate appetite control system and makes it easy to create a balance between energy intake and energy needs. Obesity is not only attributed due to high energy intake or less physical activity, it also represents a failure in homeostatic mechanisms that precisely match the energy need and energy intake[9].There is also a link between obesity and the environment, the economic progress proposes that we have underlying susceptibility to obesity.Some communities follow the traditional lifestyle and in the 21st century when they are exposed to the western lifestyle, they readily gain weight and develop diabetes.

Treatments:

The different types of treatment strategies used to treat obesity or overweight. In starting a healthy eating plan and physical activity, strategies are used to overcome the weight. Some people follow the weight loss programsthen if these initial steps were not effective people used weight-loss medicines and devices. Mainly the five strategies are used for the development of weight-loss drugs

1. By reducing the food intake by inhibiting the effects of anorexigenic signals (signals that suppress the food intake) or by blocking the signal that stimulates the food intake.
2. By blocking the nutrient absorption mainly fat in the gut.
3. By increasing the thermogenesis process, which is coupled with fuel metabolism for the generation of ATP.
4. By regulating the protein or fat storage or metabolism, an increase in protein or fat turnover may reduce the weight.
5. By modifying the main controller regulation body weight.

In addition to weight loss medication, endoscopic procedures are used for weight loss, which include endoscopic sleeve gastroplasty (stitches are placed in the stomach to reduce the amount of liquid or food in the stomach. Another one is an intragastric balloon for weight loss, in which a small balloon is placed in the

stomach that is filled with water and reduces the amount of space in the stomach. Moreover, weight loss surgery also called bariatric surgery used for weight loss.

Barriers in treatment:

In the western world obesity is one of the most prevalent health problems, it's a progressive and chronic condition which is why with the other chronic disease these patients require lifelong treatment. The long-term effectiveness and efficacy of such treatments are especially poor. The considerable barriers that challenge the long-term obesity management strategies include low socioeconomic status[10], lack of recognition of obesity as a chronic condition,and a wide variety of comorbidities including sleep, cardiovascular, digestive, endocrine, respiratory, and musculoskeletal disorders. The medication used to treat these disorders destabilize the weight loss efforts. The lack of specific training related to obesity, patient beliefs, and attitudes along with lack of exposure and availability of obesity treatment can impose important barriers[11].

Obesity and neuroendoimmunomodulation:

The nervous, endocrine, and immune system are intricately linked and their mutual communication may contribute to treating obesity and another disease in the best way. The hormones like insulin, leptin, growth hormones and sex hormones affect our metabolism appetite, and distribution of body fat. The release of these hormones is under the control of the nervous system. Obese people have a high level of these hormones that imposed abnormal metabolism and the assembly of body fat, so obesity is associated with several endocrine diseases. The increased secretion of leptin from the adipocyte is a well-established endocrine change in obesity[12]. The nervous system mainly the sympathetic nervous system plays a key role in obesity-related hypertension. Obesity also impairs the immune response by altering the cell-mediated immune response and leucocyte counts. So, new treatment strategies were developed to treat obesity by involving these systems to provide better results and control the other health condition associated with obesity.

Hypertension:

Scientists developed different therapeutic approaches to control arterial hypertension, but still, it's the most impacting cause of mortality and morbidity worldwide. All the present strategies used for the treatment of hypertension arethe combination of the sympathetic nervous system, renin-angiotensin system, and mechanisms contributing to increasing the peripheral system. The inflammatory and immune mechanisms were playing role in hypertension, different types of experimentation on mice indicate that mice that lack lymphocytes are secure from high blood pressures in response to various stimuli [13]. Some other experiments showed that CD8 mice are protected from high blood pressure response when the chronic infusion of angiotensin II is given, but CD4 mice show the opposite response. Mice with severe combined immunodeficiency are protected from high blood pressure. In hypertensive conditions, the T cells are activated due to hypertensive stimuli and become capable to permeate the specific organs that regulate renal function and peripheral resistance, which ultimately increase the blood pressure and damage the target organ. So an effective neuroimmune strategy was developed that includes antibody-mediated neutralization and gene knock out of the interleukin 17 cytokines that limit the development of angiotensin II-dependent hypertension in mice [14].

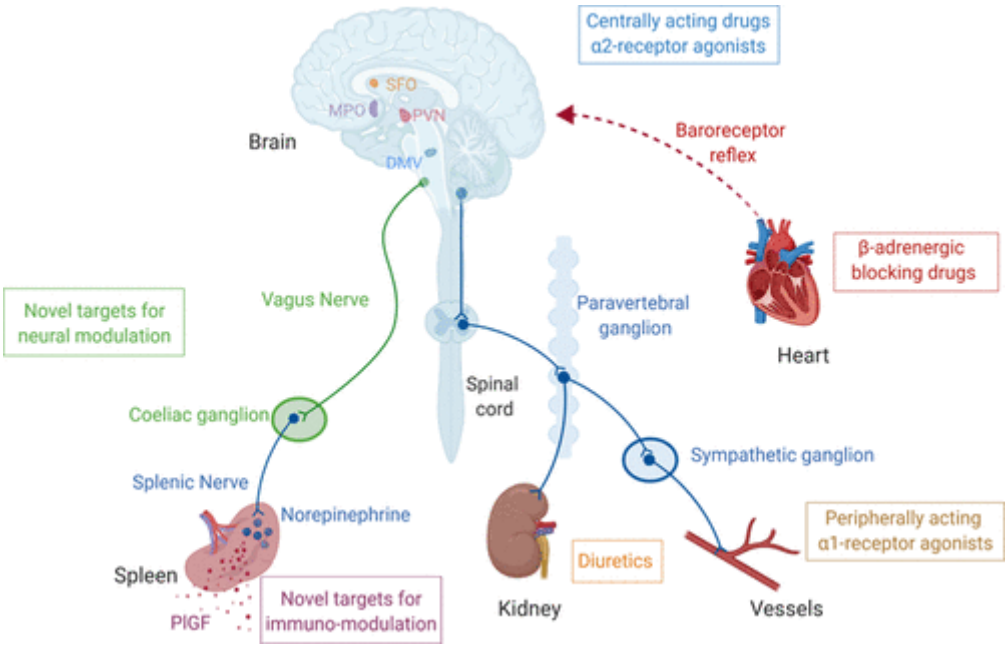

Figure 3. Neuroimmune pathway in hypertension

The above figure represents the neural connections established by the autonomic nervous system at different peripheral cardiovascular organs, adding the currently identified neuroimmune reflex linking the brain to the spleen. The ANS reflexes regulate the vascular, renal, and cardiac function that developed a new path for the therapeutic strategies for hypertension.

Diabetes:

Diabetes mellitus is a disorder in which the concentration of blood sugar is elevated than a normal level. It increased mainly when the hormone insulin is not produced properly or because of some other factors that oppose the action of insulin. Different factors disturb the normal functioning of the central and peripheral nervous system that decrease the level of insulin so the glucose level increases.Diabetes affects the endocrine system and the pancreas that produce the insulin to control the blood sugar level, the upregulation of glucagon and downregulation of insulin increase the level of glucose in the blood. So, diabetic conditions are directly linked to the endocrine and nervous system for the release of hormones. The discussion shows that neuroendoimmuno modulation provides new insight for the treatment of these diseases and targets the main points through drug delivery development for the proper regulation of these systems.

Obesity and mental disorders and NEIM factors:

There is a connection between obesity and depression/anxiety. Some studies show a negative relationship between anxiety and obesity, other shoes overweight or underweight individuals are more likely to have anxiety and depression than those with normal weight. Factors such as inflammation, hormonal dysregulation, and genetic deficiency are involved in the connection between obesity and different mental disorders. Anxiety may cause an increase or decrease in appetite that is mainly the dysregulation of hormones in the body, these physiological conditions affect the process of digestion that leading to obesity. The hypothalamus plays a central role in the regulation of appetite, the arcuate region in the hypothalamus produces two types of neurotransmitters, and the neuropeptide Y and agouti-related peptide increase the food intake while the alpha-melanocyte-stimulating hormone decreases the appetite. These neurotransmitters project to the paraventricular part of the hypothalamus, whichmodulates the energy expenditure of the body and appetite according to the signal received from the arcuate part. The paraventricular nucleus of the hypothalamus also produced corticotrophin-releasinghormones that decrease the appetite in humans. The adipose tissues produced leptin hormone, which is secreted in the bloodstream and reaches the hypothalamus. Leptin when reached inthe hypothalamus down-regulates the expression of orexigenic neurotransmitters (that increase the appetite) and increases the level of anorectic neurotransmitters (that decrease the appetite, anorexia). Obese individuals havea high level of leptin, leptin also increases the level of CRH which decreases the appetite. So, in the future leptin and neuropeptide Y are the main targets of anti-obesity medications.

Ghrelin is another peptide produces in the mucosa that stimulates food intake. It increases the appetite and increases the level of neuropeptide Y (orexigenic neurotransmitters) in the hypothalamus that induce positive energy balance. Ghrelin level is low in the obesity condition and high in the anorexia condition[15]. Stress brings changes in the hormone level that control appetite, chronic stress causes the hyperactivation of the HPA axis, which induces the CRH release which decreases the neuropeptide Y production, on the other hand, it increases the cortisol secretion that increases the appetite [16].

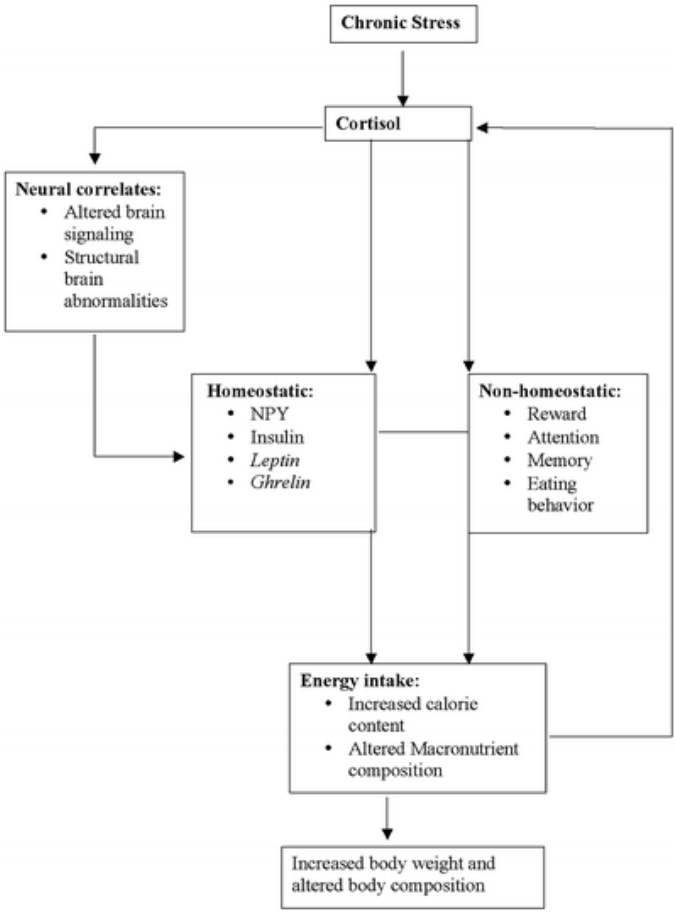

Figure 4. The possible relationship between HPA axis, obesity, and stress exposure

Diabetes and NEIM:

The high blood glucose level leads to diabetes which is a chronic disorderthat alters the metabolic process of lipid, protein, and carbohydrates. The inability of beta Langerhans cells to produce insulin or the inability of peripheral tissue to uptake insulin caused diabetes mellitus. There are two types of diabetes mellitus type 1 and 2. The damage to pancreatic cells due to environmental and infectious agent lead to type 1 diabetes. The individuals that are susceptible to genetic changes, their immune system is activated to produce an immune response against an altered form of beta cells or against molecules of beta-cells that are similar to viral proteins. The main point in the pathophysiology of type 1 diabetes is autoimmunity. The linkage between

type 1 diabetes and obesity was first studied in 1975, which suggests that there was a link between overfeeding and hormonal dysregulation[17].

Wilkin proposed the most accepted theory that demonstrates the link between type 1 diabetes and body mass called the accelerator hypothesis. The young children that gain more weight during their diagnosis period complete an early age, as the more weight accelerates the weight gain that leads to the development of type 1 diabetes. Obesity and type 2 diabetes both are associated with insulin resistance. The historical study of type 2 diabetes shows that endothelial dysfunction is accompanied by insulin resistance or obesity in prediabetes or diabetes conditions. In such situations, beta cells did not produce enough insulin to compensate for the decrease in insulin sensitivity. The non-esterified fatty acids released from adipose tissues provide the link that obese people may develop beta-cell dysfunction and insulin resistance.

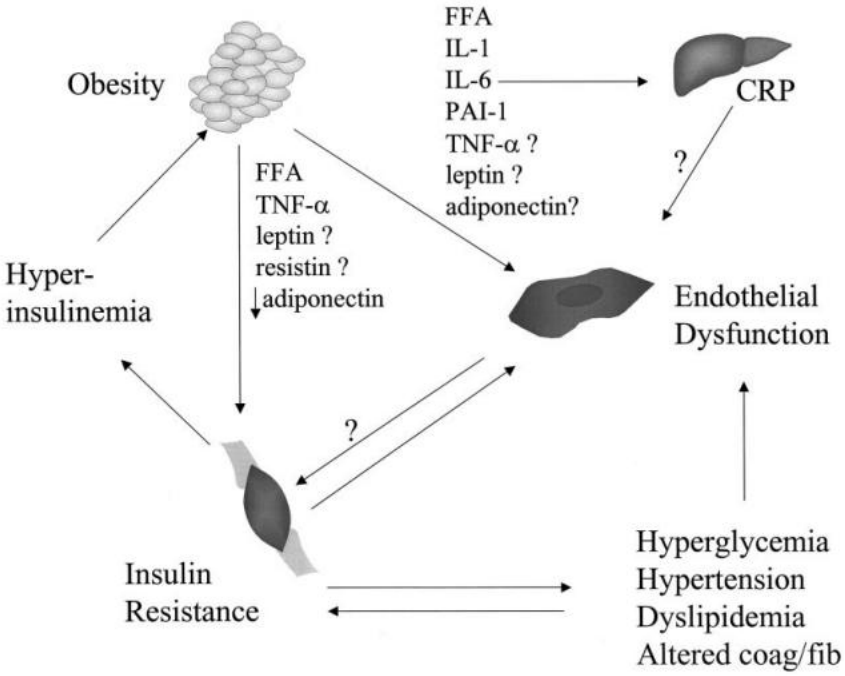

Figure 6. Mechanism that shows obesity, insulin resistance and endothelial dysfunction are closely associated.

The nervous system sense and respond to hormonal release like insulin and leptin that are released in sections for the energy storage and metabolism of different nutrients (glucose and fatty acids). These signals input the adaptive changes in hepatic glucose production, energy intake, and energy expenditure as shown in Figure 7. The reduced neuronal insulin action increases the food intake and body weight gain that develop insulin resistance [18]. The neurotransmitters, hormones, and other neuronal peptides modulate the T cell functions in diabetes. The neuroendoimmuno modulation was used to developtarget-oriented strategies to treat the disease through specific biomarkers, hormonal control, and targeting the signaling pathway.

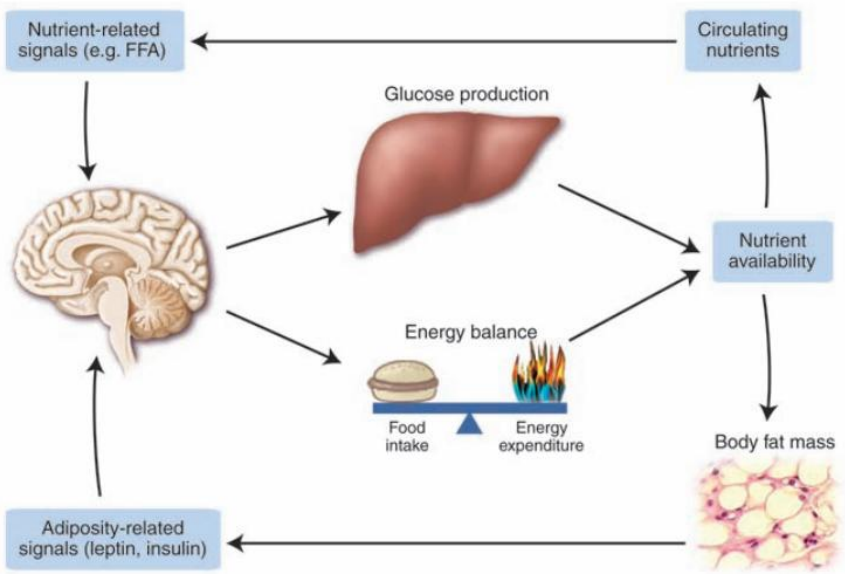

Figure 7. Control of energy homeostasis and hepatic glucose metabolism by nutrient and adiposity-related signals.

Obesity and hypertension:

Obesity significantly increases the possibility of hypertension and cardiovascular diseases that is linked to the activation of the sympathetic nervous system (SNS). The over activation of SNS directly or indirectly increased the blood pressure in obesity. The mechanism of hypertension in obesity is complex that involved the alteration of many systems. It increases the activation of insulin resistance, renin-angiotensin-aldosterone system, and SNS. Obesity increased renal sodium absorption and volume expansion. Moreover, obesity alters the structure of the kidneys which caused chronic kidney diseases and further elevation in blood pressure[19].

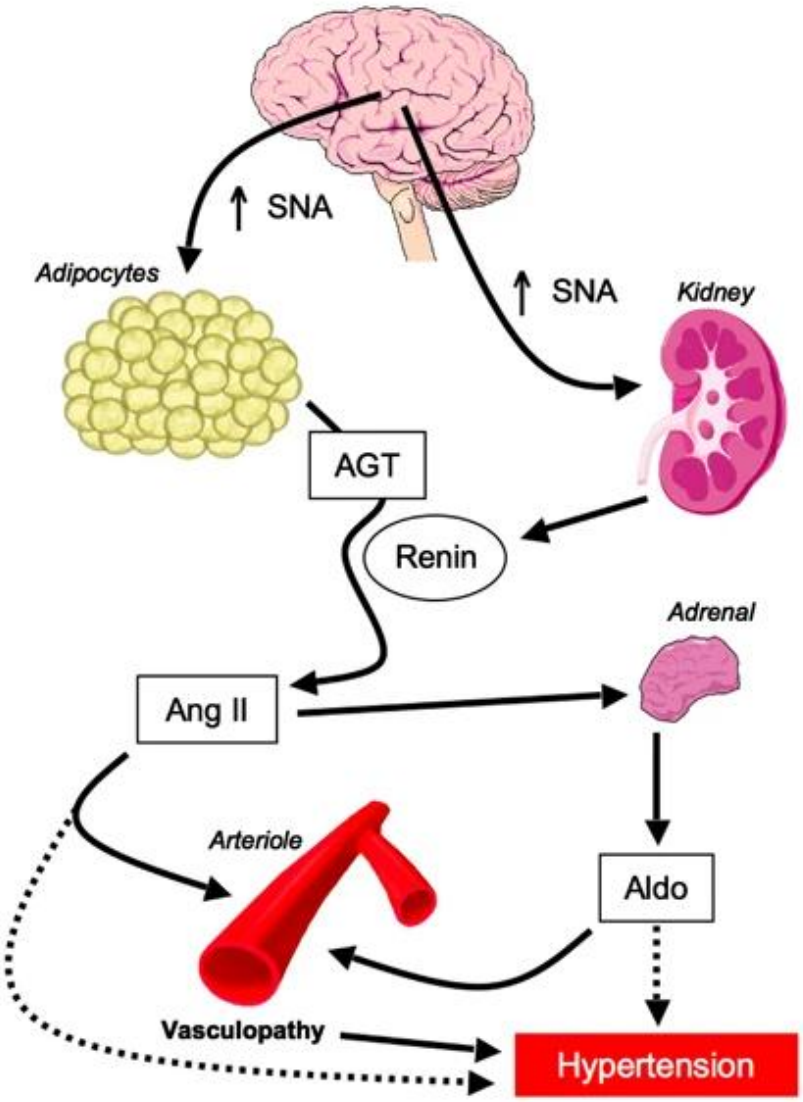

Figure 8. Possible association between sympathetic nervous system and renin angiotensin aldosterone system.

Figure 8 shows the mechanism in which, obesity boosts up the nerve activity in SNS that released the acute amount of activated renin from the kidney, and through stimulation of adipose tissue angiotensinogen generates at a chronic level. Then angiotensin II stimulates the production of aldosterone from the adrenal cortex. Both aldosterone and angiotensin II have deleterious effects on blood pressure and blood pressure that lead to cardiac stroke and other heart diseases.

Obesity has a deleterious effect on lipid profile, it increases the level of triglycerides. The mechanism of triglycerides accumulation in obesity is due to an increased level of hepatic triglyceride synthesis and consequent increase in the production of hepatic very low-density lipoprotein. This happened because of non-esterified fatty acids that are metabolized by the liver. An increased level of lipoprotein lipase activity is associated with obesity, there is also an increase in the level of cholesterol synthesis associated with obesity[20]. The high level of these substances in the blood leads to stroke due to blood vessel blockage.

Ways to prevent obesity

Strategies used by individuals to control weight problems

- Choose natural food
- Only eat when sitting down
- Walk more

- Increase low energy foods like fruits and vegetables
- Decrease dietary fat consumption
- Avoid sugary foods

Core actions proposed by World Health Organization

- Introducing different strategies to improve food and physical activity
- Reduce the use of fat, sugar and salt in manufactured products
- Creating opportunities in local surroundings for people so they become physically active
- Provide health service to advice on diet and physical diet[21]

Conclusion :

Obesity is characterized by an abnormal or excessive accumulation of body fat that significantly increases the risk of various health complications, either on its own or in combination with other diseases. Understanding the pathophysiological mechanisms: particularly the role of visceral fat accumulation, provides crucial insight into the broad range of health problems associated with obesity. The condition is closely linked to several chronic disorders, including type 2 diabetes, hypertension, cardiovascular diseases, stroke, and metabolic syndrome**.** These complications not only impair quality of life but also increase mortality risk. Furthermore, obesity-related health outcomes can vary among different populations, influenced by genetic predisposition, environmental factors, and lifestyle choices. In developed nations, obesity represents a major public health and economic burden, accounting for an estimated **2% to 7%** of total healthcare expenditures. This underscores the urgent need for effective prevention and intervention strategies at both individual and policy levels. Addressing obesity holistically is essential to reduce its medical, social, and economic impact on society.

Conflict of Interest: The authors declare no potential conflict of interest concerning the contents, authorship, and/or publication of this article.

Author Contributions: All authors have equal contributions in the preparation of the manuscript.

Source of Support: Nil

Funding: The authors declared that this study has received no financial support.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data supporting this paper are available in the cited references.

Ethical approval: Not applicable.

References

1. Seidell JC. The impact of obesity on health status: some implications for health care costs. Int J ObesRelatMetabDisord. 1995;19 Suppl 6:S13-6.
2. Lebenbaum M, Zaric GS, Thind A, Sarma S. Trends in obesity and multimorbidity in Canada. Prev Med. 2018;116:173-179. https://doi.org/10.1016/j.ypmed.2018.08.025 PMid:30194961
3. Katzmarzyk PT, Ardern CI. Overweight and obesity mortality trends in Canada, 1985-2000. Can J Public Health Rev Can SantePublique. 2004;95(1):16-20. https://doi.org/10.1007/BF03403627 PMid:14768735 PMCid:PMC6975909
4. Overweight and obesity - BMI statistics - Statistics Explained. Accessed December 22, 2021. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Overweight_and_obesity_-_BMI_statistics
5. Mindell J, Biddulph JP, Hirani V, et al. Cohort Profile: The Health Survey for England. Int J Epidemiol. 2012;41(6):1585-1593. https://doi.org/10.1093/ije/dyr199 PMid:22253315
6. Lew EA, Garfinkel L. Variations in mortality by weight among 750,000 men and women. J Chronic Dis. 1979;32(8):563-576. https://doi.org/10.1016/0021-9681(79)90119-X PMid:468958
7. Wabitsch M, Funcke JB, von Schnurbein J, et al. Severe Early-Onset Obesity Due to Bioinactive Leptin Caused by a p.N103K Mutation in the Leptin Gene. J Clin Endocrinol Metab. 2015;100(9):3227-3230. https://doi.org/10.1210/jc.2015-2263 PMid:26186301 PMCid:PMC4570156
8. Clément K, Vaisse C, Lahlou N, et al. A mutation in the human leptin receptor gene causes obesity and pituitary dysfunction. Nature. 1998;392(6674):398-401. https://doi.org/10.1038/32911 PMid:9537324
9. Tremblay MS, Willms JD. Is the Canadian childhood obesity epidemic related to physical inactivity? Int J Obes. 2003;27(9):1100-1105. https://doi.org/10.1038/sj.ijo.0802376 PMid:12917717
10. Bowerman S, Bellman M, Saltsman P, et al. Implementation of a primary care physician network obesity management program. Obes Res. 2001;9 Suppl 4:321S-325S. https://doi.org/10.1038/oby.2001.137 PMid:11707560
11. Bucher Della Torre S, Courvoisier DS, Saldarriaga A, Martin XE, Farpour-Lambert NJ. Knowledge, attitudes, representations and declared practices of nurses and physicians about obesity in a university hospital: training is essential. Clin Obes. 2018;8(2):122-130. https://doi.org/10.1111/cob.12238 PMid:29327430
12. Boden G, Chen X, Kolaczynski JW, Polansky M. Effects of prolonged hyperinsulinemia on serum leptin in normal human subjects. J Clin Invest. 1997;100(5):1107-1113. https://doi.org/10.1172/JCI119621 PMid:9276727 PMCid:PMC508285
13. Role of the T cell in the genesis of angiotensin II-induced hypertension and vascular dysfunction | Journal of Experimental Medicine | Rockefeller University Press. Accessed December 22, 2021. https://rupress.org/jem/article/204/10/2449/46665/Role-of-the-T-cell-in-the-genesis-of-angiotensin https://doi.org/10.1084/jem.20070657 PMid:17875676 PMCid:PMC2118469
14. Madhur MS, Lob HE, McCann LA, et al. Interleukin 17 Promotes Angiotensin II-Induced Hypertension and Vascular Dysfunction. Hypertension. 2010;55(2):500-507. https://doi.org/10.1161/HYPERTENSIONAHA.109.145094 PMid:20038749 PMCid:PMC2819301
15. Greenman Y, Golani N, Gilad S, Yaron M, Limor R, Stern N. Ghrelin secretion is modulated in a nutrient- and gender-specific manner. Clin Endocrinol (Oxf). 2004;60(3):382-388. https://doi.org/10.1111/j.1365-2265.2004.01993.x PMid:15009005
16. BJÖRNTORP P. Hypertension and the Metabolic Syndrome: Closely Related Central Origin? Blood Press. 2000;9(2-3):71-82. https://doi.org/10.1080/08037050050151762 PMid:10855728