

Association of Obesity with Cardiovascular Diseases

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ABSTRACT

Obesity is distinct as pro-inflammatory/ pro-oxidative state related with malfunctioning of adipose tissue. Impairment of the function of endocrine and paracrine systems results to disruption of homeostasis of endothelium and vascular system. This pathology along with atherosclerosis shows coronary heart disease and cerebrovascular problems. Obesity may be related to aging, diet, childhood and adulthood. It is also related with old age, sex steroids and may also be linked with metabolic impairments. Along with types of obesity, obesity paradox is also discussed. This narrative review covered an extensive literature search on PubMed, Google Scholar and Medline for papers on the impact and association of obesity with cardiovascular diseases since December 2022.

Keywords: Obesity, Cardiovascular Disease, Obesity Paradox.

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INTRODUCTION

Obesity is described as excess of fat particularly of abdomen and visceral parts. It increases medical issues. Obesity is distinct as pro-inflammatory/pro-oxidative state, related with malfunctioning of adipose tissue. Impairment of function of endocrine and paracrine systems results in disruption of homeostasis of endothelium and vascular system¹. This pathology along with atherosclerosis gives rise to coronary heart disease and cerebrovascular problems which may support the link of obesity with risk for CVD (Figure 1).

Increase in the rate of industrialization, economic growth, urbanization, sedentary life style, mechanical transport, usage of high calorie diet and processed diets over the last 35 to 40 years has

increased the incidence of obesity in populace² manifold. A disparity is observed between the incidence of obesity in males and females worldwide³. Surveys have found that 40% of humanity with age >17 year is plump and 12% is fat. Incidence of obesity increases gradually in children. It is found that in comparison to over-weight adolescents the youth are at higher risk of rising vascular malfunction and atherosclerosis⁴.

Abdominal obesity can be measured by abdominal circumference and ratio of waist/hip⁵. Abdominal obesity evaluated at circumference of abdomen >102.0 cm in males and >88 cm in females with WHR >0.9 in males and >0.85 in females, is may be related to increase hazards of CVD⁶.

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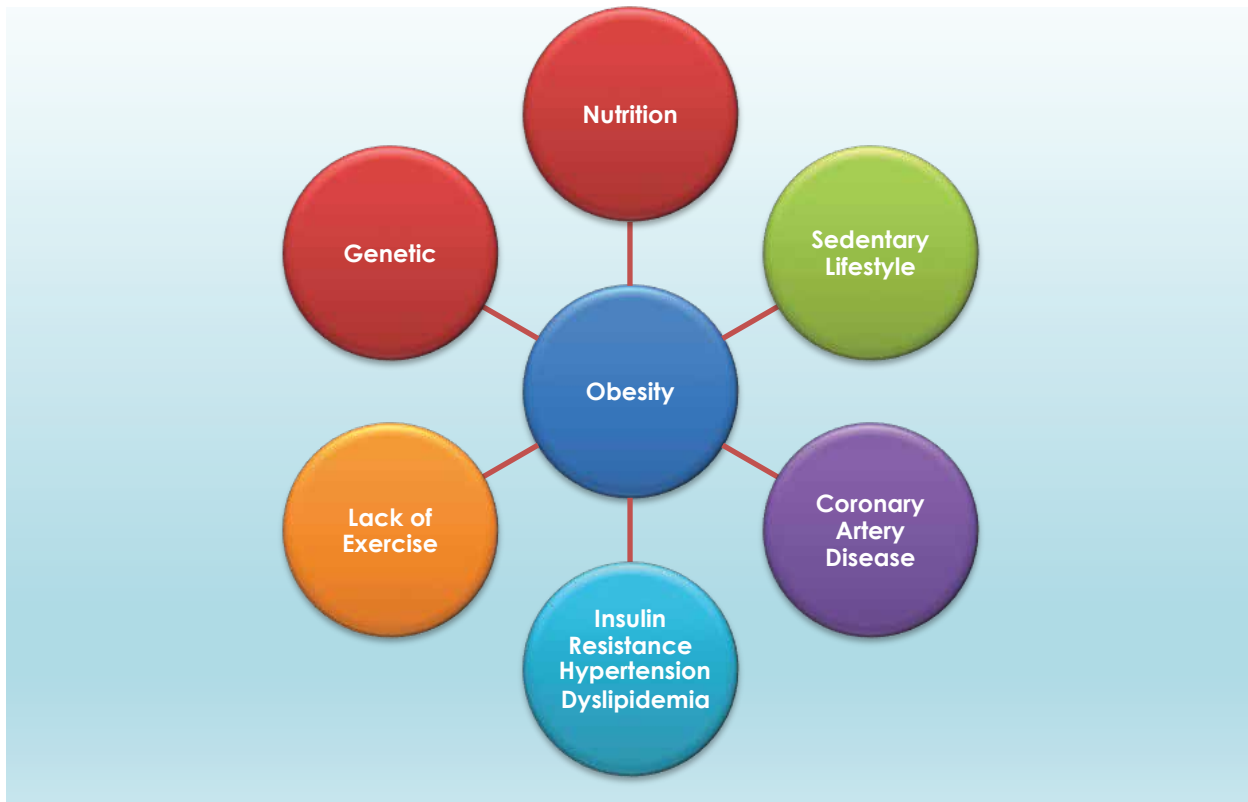


Figure 1: Risk factors for obesity.

Obesity is a complex disease and in combination with socioeconomic, environmental and genetic factors may be related to high risk of morbidity and mortality². The known dimension of obesity is ≥ 30.0 Kg/m² body mass index (BMI). This correlates with percentage of body fat in all ages. According to a study typical BMI is 18 to 24.90 kg/m², range of overweight is 25 to 29.9 kg/m² and obese is said to be ≥ 30 kg/m². Factors, such as age, sex, ethnicity, and muscular mass may show a link between BMI and body fat⁷. BMI cannot discriminate between fat content, muscular content and fat distribution. Despite limitations, BMI, is generally taken as a predictor of obesity^{6,8}. The precise dimension of distribution of fat is thickness of skin fold and ratio of waist to hip (WHR)⁷.

Categories of Obesity and Jeopardy of Cardiovascular Problems

Obesity is a major risk factor for cardiovascular problems such as heart disease and stroke. The higher the BMI, the greater the risk of developing these conditions. Individuals who are overweight or obese have a higher risk of developing high blood pressure, high cholesterol, and type 2 diabetes. These conditions can damage the arteries, leading to atherosclerosis, which is the buildup of fatty deposits in the arteries⁹. Over time, this can cause the arteries to narrow, making it harder for blood to

flow through them. In addition, obesity can also increase the risk of developing atrial fibrillation, a condition where the heart beats irregularly and can lead to blood clots, stroke and heart failure. It can also lead to sleep apnea, the breathing disorder that can cause low oxygen levels in the blood and increase the risk of cardiovascular problems^{8,9}.

Aging and Obesity

Noteworthy changes in body are related to aging. After the age of 20-30 years, mass without fat or fat free mass is slowly reduced with frequent increase in fat mass till age of 60-70 years⁹. Redeployment FFM is related with aging. Abdominal fat increases with age compared to subcutaneous fat. Increase in body fat with aging may be due to more consumption and less expenditure of energy¹⁰. The course of aging is also associated with a reduction in all forms of energy spending like resting metabolic rate, thermal effect of foodstuff, and life style. The thermal effect of food stuff is 22% less in old age compared to adulthood. Decrease in physical activity is noted with increasing age with half of the decrease in expending of energy. Besides, obesity in ancestors also affects the metabolic pathways related with storage of fat and energy¹¹.

Aging also results in imbalance of energy, alteration in hormonal secretion such as of testosterone and

growth hormone, reduced response of thyroid hormone and decreased resistance of leptin hormone. The reduced secretion of testosterone and growth hormone in the era of aging decreases FFM and increase fat mass. Conversely, the reaction of oxidative burst persuaded by thyroid hormone is decreased with aging. Decreased resistance to leptin causes decreased control of appetite¹².

Diet Persuades Obesity

Poor quality of food usually consists of large quantity of fat. Sedentary life style, sleeping apnea causes large secretion of hormone leptin with craving for food and increased feeling of hunger¹³. Factors related with diet that persuade obesity are quantity of energy, hyperphagia, stress and societal factor. Poor quality food containing trans fatty acids, highly processed starches, and added sugar increases the threat of obesity¹⁴.

It is thought that large amounts of calories may trigger the immune cell microglia. These immune cells may reduce the metabolic process of glutamate and glucose and trigger the metabolism of lipid¹⁵. Increase in weight due to diet containing large amounts of fat may be an indicator of cardiovascular ailments in both gender of mice. It is found that fat diet may affect the heart structure and its junction as well as mitochondrial size¹⁶.

Obesity in Children

Obesity in children may be a cause of early mortality and incapability in adulthood. The occurrence of obesity in children that prolongs to adolescence is estimated to be 18.0%. In addition, obese children have a problem in breathing, threat of fractures, hypertension and resistance to insulin. These are early indicators of cardiovascular problems, fatty liver and also psychological issues¹⁷.

Children of all socioeconomic classes like fast and junk food. Main factors for eating of fast food are working mothers, online fast-food shops, etc. These foods may cause obesity, dyslipidemia, cardiovascular diseases¹⁸. Children of developing countries are very susceptible to insufficient nutrition in their infancy and young age. The diet of these children consists mainly of high salt, sugar and fat with insufficient vitamin and minerals as this diet is cheap¹⁹. However, there are conflicting reports about obesity in children of developing countries²⁰. It is unclear that the obesity of childhood is an independent issue of developing cardiovascular disease in adulthood or obesity in childhood continues in the state of adulthood and may increase the problem of CVD in adulthood²¹.

Obesity in Adulthood

New diet regimen that contains fewer micro nutrients coupled with an inactive life style increases propensity to obesity in all age groups. Obesity in

adulthood begins from childhood stage and increases the risk of NCD or non-communicable diseases like cardiovascular and diabetes²². In addition, regular usage of fast food, less quantity of fruits and vegetables and a sedentary life style may help to increase body weight of an individual living alone. These factors may be a good predictor of cardiovascular problems²³.

Nature of profession, environment, processing of food stuff and increased urbanization, unawareness and easy means of transport also play a role in increasing body weight². It is thought that adiposity illustrates ongoing effect on the development of atherosclerosis as compared to the effect of adiposity diabetes and insulin resistance. Increased BMI in primary state is very important in increasing disease as compared to subsequent weight gain²⁴. However, the link between obesity and issues of health, in adults, are contentious

Geriatrics Age and Obesity

Obesity at geriatrics age is, physiologically, a multifaceted issue. The hazards of obesity in geriatric people are associated with various confounders like survival effect, opposing mortalities, increase in body weight and smoking²⁵. The fat mass of abdomen gradually increases in geriatric obese people and may be related with chances of morbidity and mortality²⁶. Dyslipidemia, is very common in old age. High values of serum triglyceride and LDL-cholesterol is a warning for MI and may be related with ischemic stroke. Besides, very slow metabolic process may also result in body weight gain²⁷.

Drugs Persuade Obesity

Increased body weight is a known outcome of some drugs and this may boost the chances of diabetes, cardiovascular problems, and other ailments. Medicines known to be related with obesity are corticosteroids, antidepressants and drugs used for heart burn, diabetes, and seizure. Other drugs known to increase weight are antibiotics used in childhood, brain stimulants and anti-bipolar and anti-psychotic medicines used in adolescence. Drug used in adulthood are cholesterol lowering drugs and drugs used for rheumatism²⁸. It is proposed that action of some medicines stimulates appetite while others impair metabolism of fat and glucose and some decrease the metabolic rate of body system. Other drugs cause tiredness, difficulty in breathing etc. Weight gain differs from one person to another. Some people put on weight of a one to two pounds only, using a drug for one year, while some people gain ten to forty pounds using drugs in some months²⁹. It is demonstrated that neurotransmitter systems, has a role in maintaining the fat that a body stores. Some antidepressants obstruct the job of neurotransmitters. This depends on the medicine dosage and it may

cause an increase in body weight up to 20 kg³⁰. Corticosteroids also play a role in increasing the body weight in many patients and increase other corticosteroid-linked health hazards³¹.

Obesity Related with Sex Steroids

Sex steroid hormones are linked with accumulation of fat and altered lipid metabolism in adipose tissues. Studies show that the receptors of estrogen, progesterone and of androgen are present in adipose tissue and show direct action by both non-genomic and genomic. This may affect the metabolic pathways and increase chances of weight gain. Besides, there is a significant function of sex related steroid hormone in the development of CVD³². Increased level of these hormones is associated with sudden cardiac arrest³³. Additionally, reduced level of serum testosterone increases the level of serum triglyceride and LDL-cholesterol³⁴.

Obesity and Metabolic Impairments

Metabolic syndrome is related with increased fat in the abdominal region, impaired glucose metabolism, insulin resistance, dyslipidemia and hypertension. This is commonly observed in old age people. Dyslipidemia is related with excess fat in abdomen in both old and young age. It is suggested that risk of cardiovascular disease is more common in old age male as compared to old female³⁵. However, some medical conditions also increase the risk of gaining weight like polycystic ovary syndrome related with imbalance of reproductive hormones in females. Cushing syndrome with a raised level of serum cortisol, hypothyroidism and decreased production of thyroid hormone, osteoarthritis lead to inactive life style. Use of contraceptive drugs and hormone replacement therapy may also be a reason of increase in body weight¹².

Obesity Paradox

Obesity paradox is a phenomenon related to the protective effect of obesity on clinical results of cardiovascular disease. It is demonstrated that obesity paradox is observed in people who are overweight with 25 to 31 kg/m² and slightly over-weight with BMI of 31-36 kg/m². It is also seen that people may have the ability to reduce all-cause mortality with various cardiovascular disease. Usually overweight and mildly obese individuals seem to have less chances of mortality in follow-up studies³⁶. Some of the studies believe in the obesity paradox and declared that excess body weight is linked with good protection from many diseases. The mechanism of obesity paradox is based on the assumption that increased level of serum lipoproteins may counter toxins of bacteria and circulatory cytokines³⁷. It is proposed that in obese patients, larger blood vessels and high muscle strength play an important role in prevention

of heart problems³⁸. However, some studies demonstrated that "obesity paradox" does exist after Percutaneous Coronary Intervention. The death rate in obese and overweight patient is significantly less than non-obese patients. However, the exact mechanism of obesity paradox needs more research.

Suggestions

To reduce the risk of cardiovascular disease, it is suggested that:

1. There is a need of taking balanced diet (consisting of carbohydrates, protein, fat, vitamins and minerals/ Mediterranean diet) and avoiding of fast food especially from childhood to old age.
2. Uses of magnesium rich foods like fish, beans, nuts and leafy vegetables may provide protection from cardiovascular problems.
3. A need of changing life style pattern in childhood state (games), exercise/walk (adulthood state) and walk in old state.
4. Avoid usage of tobacco and alcohol.

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CONFLICTS OF INTEREST

No conflicts of interest to declare.

AUTHORS' CONTRIBUTION

RK completely worked on literature search and drafting the manuscript.

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