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Sedentary Lifestyle and Obesity – A Risk for Cardiovascular diseases

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Abstract
Background: *Obesity is an increasing, global public health issue. Patients with obesity are at major risk for developing a range of comorbid conditions, including cardiovascular disease (CVD), which may significantly affect their daily lives as well as increased mortality risks. Cardiovascular disease (CVD) mortality and morbidity have been shown to be elevated in individuals who are overweight, particularly with central deposition of adipose tissues. Abdominal obesity has been shown to be a risk factor for CVD worldwide.*
Materials and Methods: *A total of 300 patients attending cardiology department were subjected to prospective study for a period of 3 months in Warangal region.*
Results: *out of 300 people 67.32% people were obese and overweight, 65% people were leading a sedentary lifestyle.*
Conclusion: *In our study highest prevalence of cardiovascular diseases was observed in people who are obese and leading sedentary lifestyle.*
Keywords: *Obesity, Cardiovascular diseases, sedentary lifestyle*

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I. Introduction

The World Health Organization (WHO) defines overweight and obesity as abnormal or excessive fat accumulation that presents a health risk. A body mass index (BMI) ≥25 kg/m^2 is generally considered overweight, while obesity is considered to be a BMI ≥ 30 kg/m^2. Obesity is an increasing, global public health issue. Patients with obesity are at major risk for developing a range of comorbid conditions, including cardiovascular disease (CVD), gastrointestinal disorders, type 2 diabetes (T2D), joint and muscular disorders, respiratory problems, and psychological issues, which may significantly affect their daily lives as well as increased mortality risks[1]. Sedentary behavior (SB), defined as any posture (sitting, reclining, or lying) characterized by an energy expenditure ≤1.5 metabolic equivalents of task (MET) while waking is observed in all domains including behaviors at work or school, at home, during transport, and in leisure-time. Examples are watching television, playing board games, driving or sitting whilst traveling, sitting or lying down, whilst reading, or sitting at work (desk-based computer)[2]. Sedentary Behavior Research Network (SBRN) defined sedentary behavior as any activity involving sitting, reclining, or lying down that has a very low energy expenditure. Sedentary behavior is known to be associated with obesity, independent of leisure-time physical exercise. This association may be due to immobility or other associated factors predisposing to obesity, such as dietary behavior. In addition, sleep duration is associated with obesity, and sleep duration and sedentary behavior may be linked. It has also been suggested that obese individuals might favor spending more time sitting and be physically less active because of their body weight and genetic predisposition[3] Sedentary behavior and physical inactivity are among the leading modifiable risk factors worldwide for cardiovascular disease and all-cause mortality. The promotion of physical activity and exercise training (ET) leading to improved levels of cardiorespiratory fitness is needed in all age groups, races, and ethnicities and both sexes to prevent many chronic diseases, especially cardiovascular disease[4].

Sedentary lifestyle obesity and cardiovascular risk

There is abundant evidence that obesity increases the risk of elevated blood sugar, hypertension, and hypercholesterolemia. Similarly, there is ample evidence that weight loss mitigates those risk factors. Several recent studies, however, have explored the question of whether obesity increases the risk of CVD in the absence of other comorbid conditions. Most of the evidence supports obesity as an independent risk factor for CVD in men and women. Even in the absence of metabolic abnormalities or comorbid conditions, individuals who are obese have higher rates of cardiovascular events over their lifetimes. One study suggests that the mechanism for this increased risk may be related to the presence, in obese individuals, of elevated inflammatory markers that are associated with CVD[5].

Cardiovascular disease (CVD) mortality and morbidity have been shown to be elevated in individuals who are overweight, particularly with central deposition of adipose tissues. Abdominal obesity has been shown to be a risk factor for CVD worldwide. Obesity may be associated with hypertension, dyslipidemia, diabetes, or insulin resistance, and elevated levels of fibrinogen and C-reactive protein, all of which increase the risk of CVD events[6]. In addition to CVD, obesity has been shown to increase the risk of high blood pressure (HBP)[7]. Persistent hypertension is one of the risk factors for stroke, myocardial infarction (MI), heart failure, and arterial aneurysm, and is a leading cause of chronic kidney failure. Moderate elevation of arterial blood pressure leads to shortened life expectancy, which also increases the risk of heart diseases.

The Relationship between Obesity and Atherosclerosis

In the past three decades, many details of the pathophysiological processes of obesity and atherosclerosis have been revealed. Previously, both diseases had been regarded as lipid storage disorders with triglyceride accumulation in the fat tissue and cholesterol esters in atherosclerotic plaques. Nowadays, both obesity and atherosclerosis are considered chronic inflammatory conditions, in which the activation of both nonspecific and adaptive immune processes is assigned a significant role[8].

The pathogenesis of obesity and atherosclerosis has several common factors. In both cases, lipids, oxidized LDL particles, and free fatty acids activate the inflammatory process and trigger the disease. Inflammation is responsible for all the steps towards atherosclerosis, from early endothelial dysfunction to the atherosclerotic plaques causing complications, and is related to obesity, insulin resistance, and type 2 diabetes. The fatty tissue releases adipocytokines, which induce insulin resistance, endothelial dysfunction, hypercoagulability, and systemic inflammation, thereby facilitating the atherosclerotic process. In visceral obesity, inflammatory adipocytokines (e.g., TNF-α, IL-6, MCP-1, leptin, and resistin) rise to higher levels. Moreover, the increased level of C-reactive protein is associated with an increased risk of myocardial infarction, peripheral vascular disease, and diabetes mellitus[9]. Interestingly, a clinical study performed on obese women confirmed that bodyweight reduction achieved through lifestyle changes reduces the level of inflammatory biomarkers and insulin resistance. In the course of the process, adiponectin, an anti-inflammatory and insulin-sensitizing adipocytokine, is released. It is important to understand the relationship between the inflammatory process and atherosclerosis and the accelerating role of obesity[10].

Obesity and Coronary Artery Disease

Obesity is closely related to coronary atherosclerosis. Atherosclerosis begins several decades before manifested coronary artery disease. Atherosclerotic vascular lesions of patients with higher BMI values are more frequent and advanced compared to subjects with normal body weight. Obesity is likely to be an independent risk factor for coronary artery disease. A 10 kg rise in body weight increases the risk of coronary artery disease by 12% and at the same time, systolic blood pressure rises by 3 mmHg and diastolic by 2.3 mmHg as a consequence. Furthermore, in the case of non-ST segment elevation myocardial infarction (NSTEMI) affecting young people, excess weight can be considered the most important risk factor, ahead of smoking. The higher the BMI, the sooner NSTEMI develops. The same relationship can also be observed in the case of ST-elevation myocardial infarction (STEMI). Based on the data available, obesity is an independent risk factor of STEMI developing at a young age[11]. An increase in BMI by one unit causes a 4% rise in the risk of ischemic and a 6% rise in hemorrhagic strokes[12].

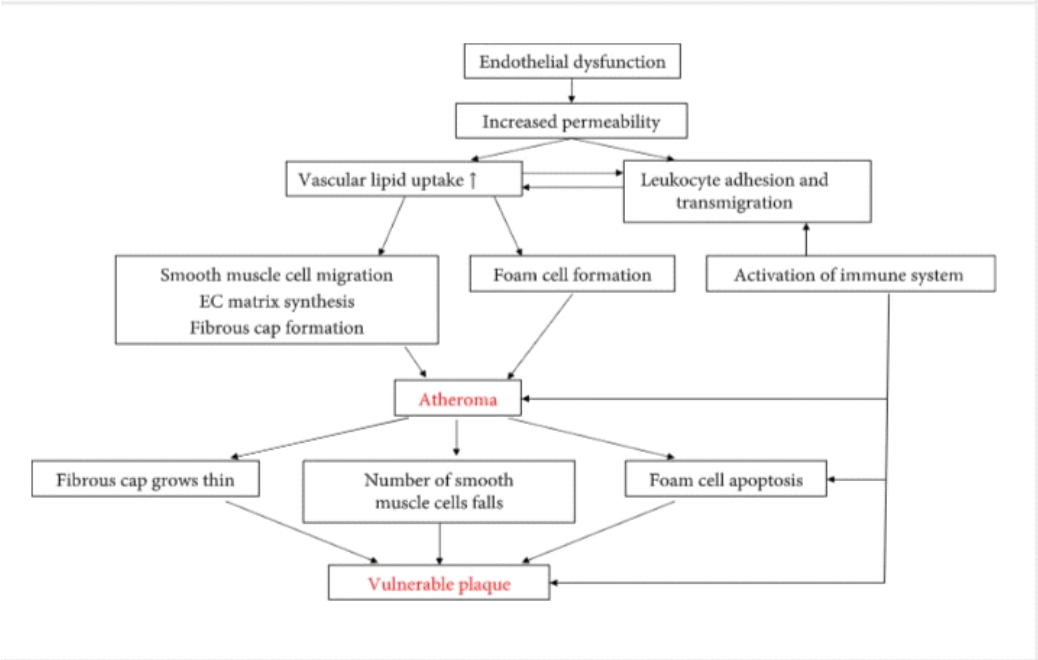

Figure 1: The pathomechanism of coronary artery disease in obesity. (Imre Csige et al., 2018)

Obesity and Sudden Cardiac death

Obesity is considered an independent risk factor in the development of ventricular tachyarrhythmias. The structural remodeling in the ventricular myocardium of obese patients results in left ventricular hypertrophy and consequential systolic and diastolic ventricular dysfunctions. Myocardial hypertrophy, fibrosis, focal myocardial disarray, and increased volume of epicardial fat are also parts of the pathological process[13].

Obesity may also be associated with prolonged and inhomogeneous ventricular repolarization, which can manifest in the prolongation of the QT interval and QT interval corrected to the heart rate (QTc) measured on the 12-lead surface electrocardiogram. These ECG parameters are known as independent markers of cardiovascular mortality, and their pathological prolongation may draw attention to an increased risk of ventricular arrhythmias. In the development of the pathologically prolonged and inhomogeneous repolarization observed in obesity and the electrical instability involved as a consequence, the main roles are assigned to obesity cardiomyopathy, the altered function of voltage-dependent potassium channels, and autonomic dysregulation[14].

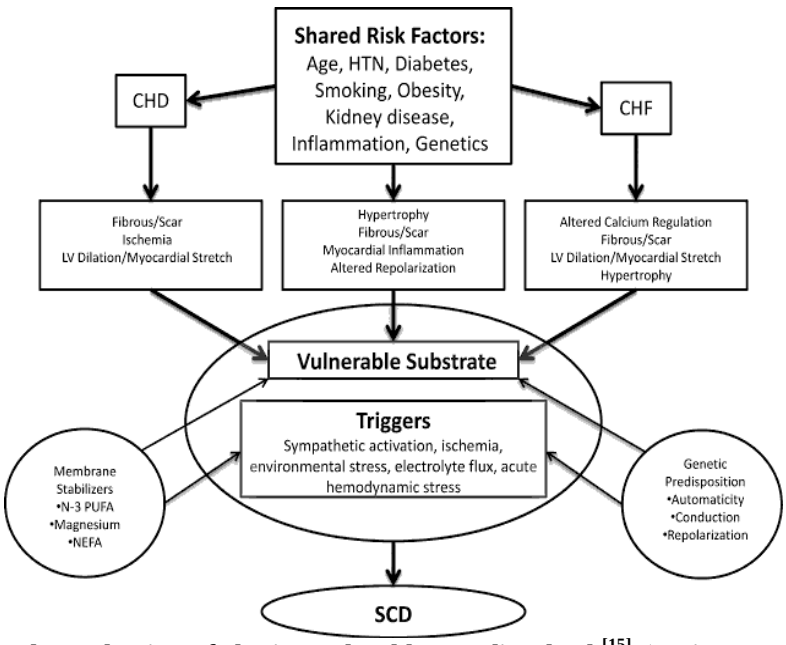

Figure 2 - Pathomechanism of obesity and sudden cardiac death[15] (Rajat Deo et al., 2012)

II. Materials and methods

Study site – Sri Sri Cardiac Centre
Study design – Prospective observational Study, Retrospective observational study.
Study Period – 3 months
Study criteria:

Inclusion Criteria

- Patients with Cardiac diseases
- Patients with Cardiac diseases and other comorbidities
- Obesity
- Sedentary lifestyle
- All age group patients

Exclusion criteria

- Patients without cardiac diseases
- Patients with congenital heart diseases

Source of data

- Review of patient's records
- Direct communication with patients and their caretakers

Procedure Methodology

A total of 300 patients attending cardiology department were subjected to prospective study for a period of 3 months in Warangal region at Sri Sri Cardiac centre, Hanamkonda after obtaining approval from Institutional Ethics Committee. Every individual patient was approached before and after consultation with the clinician. Nature and purpose of the study have been explained to every individual person and informed consent was obtained. Patients with all cardiovascular diseases were included in the study. Information was collected from case sheets, direct communication with patients and their care givers.

III. Results

Table 1 Distribution of data based on BMI

BMI Range	Category	No. of patients	Percentage
13 – 18.5	Underweight	7	2.33%
18.5 – 24.9	Normal	91	30.33%
25.0 – 29.9	Overweight	167	55.66%
30.0 – 36.0	Obese	35	11.66%
Total		300	100%

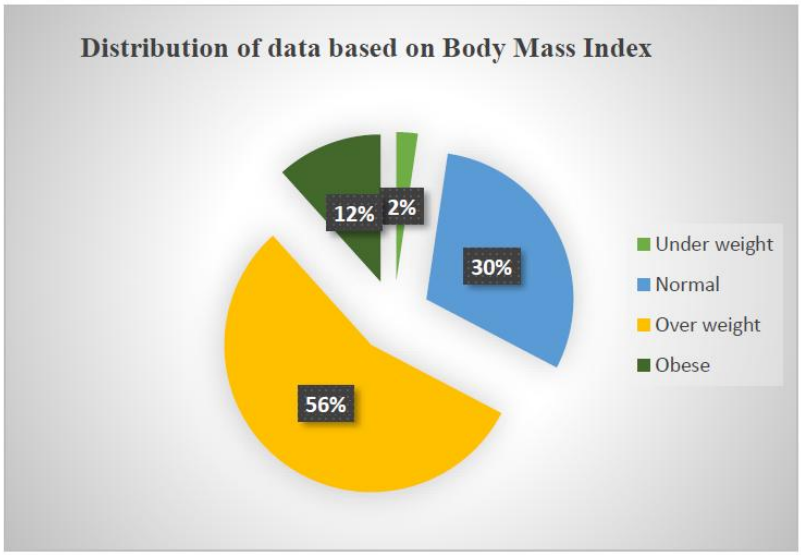

Fig 3 Distribution of data based on BMI

Table 2 Distribution of data based on Gender

Gender	No. of Patients	Percentage (%)
Male	148	49.33%
Female	152	50.66%
Total	300	100%

Table 3 Distribution of data based on Locality

Urban	Rural
193	107

Table 4 Distribution of data based on Occupation

Occupation	Percentage
Agriculture	29%
Doctor	7%
Teacher	11%
Software	8%
Retired employees	40%
Student	5%

Table 5 Distribution of data based on Physical activity

Physical activity	No. of patients	Percentage
Active	29	9.66%
Normal	76	25.33%
Inactive	195	65%
Total	300	100%

Table 6 Distribution of data based on Dietary Habits

Diet	No. of patients	Percentage
Mixed	269	86.66%
High non-veg	14	4.66%
High spicy food	17	5.66%

Table 7 Distribution of medical condition based on BMI

BMI	MI	Arrhythmias	Angina	HTN	CAD	Cardiomegaly	Valve dysfunctions
13.0 – 18.4	0	0	0	2	2	2	1
18.5 – 24.9	3	8	0	14	24	25	17
25.0 – 29.9	25	9	10	30	81	8	4
30.0 – 35.0	2	0	4	6	20	2	1

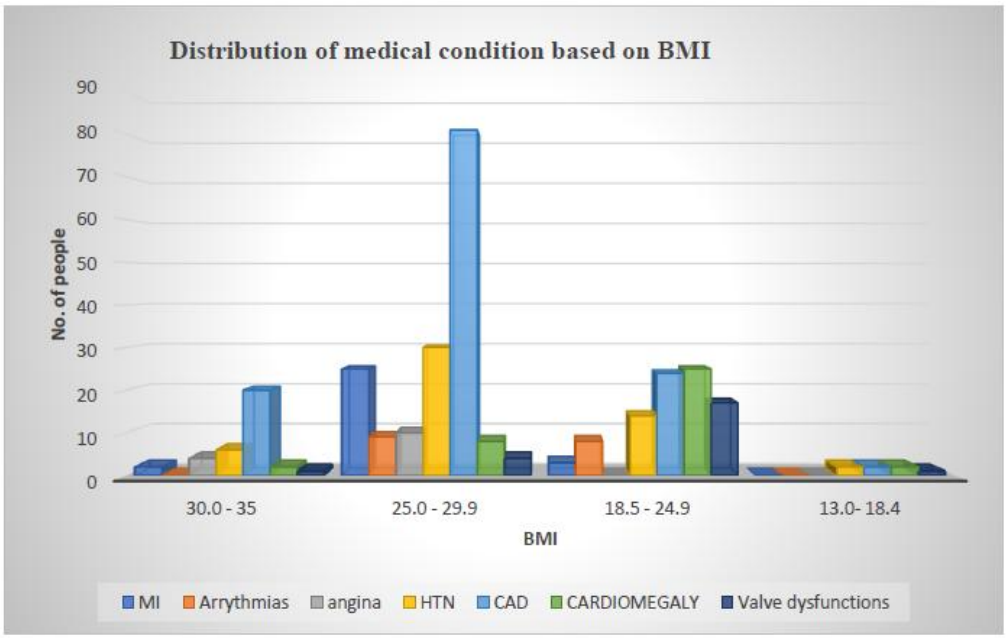

Fig 4 – Distribution of medical condition based on BMI

IV. Discussion

Age group

In our study, it is observed that out of 300 patients, the majority i.e., 28.33 % of them were in the age group between 45 to 55 years, followed by 55 to 65 years (23.33 %). Compared to a study conducted by Jousilhati *et al*., 2006 in a prospective cohort of nearly 15000 individuals aged 25–64 yrs there was an age-related increase in CVD in all individuals Findings were also compatible that the prevalence of hypertension increases with age.

Gender

In our study, it is observed that out of 300 patients 49.33% of patients were male and 50.66% of patients were female. The highest prevalence was observed in females. Compared to a study conducted by Soumya Deb et al., 2007 in which the study population comprised of an equal number of males and females – 123 each.

Locality

In our study, it is observed that out of 300 study participants 193 (64.3%) study participants were living in urban areas and 107 (35.6%) participants belong to rural areas. Compared to Asri Maharani et al., 2017 in which the prevalence of high 10-year cardiovascular risk was highest in urban areas (31.6%, CI 30.7–32.5%) and lowest in rural areas (26.2%, CI 25.2–27.2%).

Occupation

In our study, it is observed that out of 300 study participants highest prevalence of cardiovascular diseases was found in patients who were retired employees (40%). Compared to Behdin Nowrouzi-Kia et al., 2018 in which Canadian data from the CCHS do not exhibit a trend toward an association between heart disease and the number of hours worked/wk. There is an association between heart disease and physical exertion at work, but the trend is inconsistent

BMI

In our study, it is observed that out of 300 patients 7 patients had BMI between 13- 18.5 (Underweight), 91 patients had BMI between 18.5 – 24.9 (Normal), 167 patients had BMI between 25.0 – 29.9 (Overweight) and 35 patients had BMI between (30.0 – 36.0) Obese. Compared to Fransisco Buitrago et al., 2010 in which a total of 33.5% of the population were obese (body mass index ≥30 kg/m2). Patients meeting the obesity criteria were more commonly female (36.6%) and were older, had higher mean values of blood pressure and triglycerides, higher percentages of diabetes, and higher coronary risk using either the original Framingham or the Framingham function calibrated for the Spanish population.

Physical activity

In our study out of 300 patients, 9.66% of patients were physically active, 25.33% of patients were having normal physical activity, 65% of patients were physically inactive. Compared to AlJohara M. AlQuaiz et *al*., (2019) in which the multivariable logistic regression model after adjusting for education level and housing type, found that *low physical activity* (aOR & 95%CI for males 2.91 (1.45, 5.80); females 1.38 (1.06, 1.81); *prolonged sitting time* (aOR &95%CI for males 1.36 (0.98, 1.90) females 1.58 (1.20, 2.07), high *central obesity* (defined as waist circumference in males > 102 cms, and females > 88 cms) (aOR & 95%CI for males 2.38 (1.67, 3.41); females 3.35 (1.92, 5.87) were associated with high/ intermediate risk for CVD.

Diet

In our study out of 300 study population Highest prevalence of Cardiovascular diseases was observed in people who were having a mixed diet 86.66%. compared to Taslima Khatun et al., 2021 in which the Serum lipid profiles, sugar concentrations, and blood pressure levels of CAD patients revealed higher levels than clinically defined cut-off values as established risk factors for CAD. Odds ratios (CI 95%) as risk factors for consuming junk food {OR=5.49 (2.25–13.38)}, chicken {OR=4.54 (1.89–10.9) was the most, followed by beef {OR=2.68 (1.19–4.98)}, eggs {OR=2.38 (1.14–10.92)}, fish {OR=2.81 (1.31–6.04)}, and vegetables {0R=.968 (0.510–1.839)}. However, fat-free milk, ghee/butter oil, curd/yogurt, and fruits had lower ORs revealing no or fewer risks for CAD.

Distribution of medical conditions based on BMI

In our study out of 300 participants Highest prevalence of cardiovascular diseases was found in people having BMI (25.0 – 29.9) overweight, lowest prevalence was found in people having BMI (13.0 – 18.4) underweight. CAD was found to be the most prevalent disease. Compared to Wilbert S. Aronow et al., 2017 in which In 19,841 Canadians aged 18 to 74 years, the prevalence of hypertension in men and in women increased with increasing body mass index, especially in those aged 18 to 34 years. In the younger adults, men and women with a body mass index of more than 30 kg/m2 had a 5 times higher prevalence of hypertension than persons with a body mass index of less than 20 kg/m2. A cohort of 82,473 female nurses in the United States, aged 30 to 55 years were followed every 2 years since 1976. In 1992, the body mass index was positively associated with the development of hypertension. Compared with a weight change of 2 kg or less, the risk of hypertension was 15% less in women who lost 5 to 9.9 kg, 26% less in women who lost 10 kg or more, increased 74% in women who gained 5 to 9.9 kg and increased 5.21 times in women who gained 25 kg or more.

V. Conclusion

The study determines the risk of developing cardiovascular diseases associated with obesity and a sedentary lifestyle. In our study risk of developing cardiovascular diseases was found to be high in patients who are overweight and obese 67%, and leading sedentary lifestyle.

Out of 300 study population, patients were divided into various groups according to their age. The highest prevalence of cardiovascular diseases was observed in the age group between 45 – 55 years (28.33%). Females were predominantly affected with cardiovascular diseases than males.

The highest prevalence of cardiovascular diseases was found in patients who were living in urban areas, and patients who were retired.

Here is the need for a clinical pharmacist where he/she plays a major role in patient education, counselling about the diseases, need for modifying their lifestyle opting for healthy dietary habits, identifying the patients at risk of developing heart diseases, detecting it in early stage, raising the awareness among people will significantly reduce the incidence, economic burden, reduce the length of hospital stay, recurrence and severity of the disease among patients with cardiovascular diseases.

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