

Original Research Article

A CROSS-SECTIONAL STUDY ON THE IMPACT OF OBESITY AND PHYSICAL ACTIVITY ON CARDIOVASCULAR HEALTH

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ABSTRACT

Background: Obesity and physical inactivity are major contributors to the increasing burden of cardiovascular diseases worldwide. Sedentary lifestyle and excessive adiposity are associated with hypertension, dyslipidemia, diabetes mellitus, and other cardiovascular risk factors. Understanding the relationship between obesity, physical activity, and cardiovascular health is essential for early prevention and management strategies. The aim is to assess the impact of obesity and physical activity on cardiovascular health among adults attending a tertiary care center. The objective is to evaluate obesity parameters such as Body Mass Index and waist circumference among study participants. To assess the level of physical activity and its association with cardiovascular health indicators. To determine the relationship between obesity, physical activity, and cardiovascular risk factors such as blood pressure and lipid profile.

Materials and Methods: A hospital-based cross-sectional observational study was conducted among 240 adult participants attending a tertiary care center. Anthropometric measurements including BMI, waist circumference, and waist-hip ratio were recorded using standardized methods. Physical activity levels were assessed using a structured questionnaire and categorized into low, moderate, and high activity groups. Cardiovascular parameters including blood pressure and lipid profile were evaluated. Data were analyzed using SPSS software version 25.0. Chi-square test, Student's t-test, ANOVA, and odds ratio analysis were applied. A p-value <0.05 was considered statistically significant.

Results: The mean age of participants was 43.7 ± 11.6 years, with males constituting 57.1% of the study population. Obesity was present in 47.1% participants, while low physical activity was observed in 37.9%. Hypertension was identified in 35.0%, dyslipidemia in 45.4%, and high cardiovascular risk in 31.7% of participants. Participants with low physical activity demonstrated significantly higher BMI, systolic blood pressure, and diastolic blood pressure compared to highly active individuals ($p < 0.001$). Obese and physically inactive participants had significantly higher odds of hypertension (OR 3.18), dyslipidemia, and elevated cardiovascular risk compared to active and non-obese participants.

Conclusion: Obesity and reduced physical activity were significantly associated with adverse cardiovascular health indicators. Increased BMI and central obesity were strongly linked with hypertension and dyslipidemia. Promotion of regular physical activity and healthy lifestyle modifications may help reduce cardiovascular risk and improve overall cardiovascular health.

Keywords: Obesity. Physical Activity. Cardiovascular Health.

INTRODUCTION

Cardiovascular diseases (CVDs) are among the leading causes of morbidity and mortality worldwide

and represent a major public health challenge in both developed and developing countries. The increasing prevalence of obesity and sedentary lifestyles has significantly contributed to the growing burden of

cardiovascular disorders. Obesity is characterized by excessive accumulation of body fat that adversely affects health and is commonly assessed using Body Mass Index (BMI), waist circumference, and waist-hip ratio. It is closely associated with metabolic abnormalities such as hypertension, dyslipidemia, insulin resistance, and type 2 diabetes mellitus, all of which are recognized risk factors for cardiovascular disease. Physical inactivity further aggravates these conditions by reducing cardiovascular fitness, impairing metabolic function, and promoting weight gain.^[1]

The World Health Organization (WHO) has identified obesity as a global epidemic, with its prevalence rising rapidly among all age groups. Urbanization, unhealthy dietary patterns, reduced physical activity, and increased dependence on technology have contributed to sedentary behavior and obesity. Individuals with obesity are more likely to develop coronary artery disease, stroke, heart failure, and peripheral vascular disease. Excess adipose tissue contributes to chronic low-grade inflammation, endothelial dysfunction, and atherosclerosis, thereby increasing cardiovascular risk. In addition, obesity is often linked with elevated blood pressure and abnormal lipid profiles, which further compromise cardiovascular health.^[2]

Physical activity plays a vital role in maintaining cardiovascular health and preventing chronic diseases. Regular exercise helps regulate body weight, improves lipid metabolism, enhances insulin sensitivity, lowers blood pressure, and strengthens cardiac function. Individuals engaging in moderate to vigorous physical activity demonstrate lower rates of cardiovascular morbidity and mortality compared to sedentary individuals. Conversely, inadequate physical activity has emerged as an independent risk factor for cardiovascular disease. Promotion of active lifestyles has therefore become an essential strategy for cardiovascular disease prevention.^[3]

Several studies have shown a strong association between obesity, reduced physical activity, and poor cardiovascular outcomes. However, the combined impact of obesity and physical activity on cardiovascular health varies among populations depending on lifestyle, socioeconomic status, dietary habits, and genetic predisposition. Cross-sectional studies are useful in assessing the prevalence and correlation of these factors within a defined population. Understanding the interaction between obesity, physical activity, and cardiovascular health parameters can help identify high-risk individuals and guide preventive interventions.^[4]

The present study was undertaken to evaluate the impact of obesity and physical activity on cardiovascular health among adults attending a tertiary care center. The study aimed to assess anthropometric indices, physical activity levels, and cardiovascular parameters and determine their relationship with cardiovascular health status. The findings of this study may contribute to better awareness regarding lifestyle modification and

prevention of cardiovascular diseases through weight management and increased physical activity.^[5]

Aim: To assess the impact of obesity and physical activity on cardiovascular health among adults attending a tertiary care center.

Objectives

1. To evaluate obesity parameters such as Body Mass Index and waist circumference among study participants.
2. To assess the level of physical activity and its association with cardiovascular health indicators.
3. To determine the relationship between obesity, physical activity, and cardiovascular risk factors such as blood pressure and lipid profile.

MATERIALS AND METHODS

Source of Data: The data for the present study were collected from adult participants attending the Outpatient Department and Health Check-up Clinic of the tertiary care hospital. Information regarding demographic characteristics, anthropometric measurements, physical activity levels, and cardiovascular health parameters was obtained using a structured proforma.

Study Design: The study was conducted as a hospital-based cross-sectional observational study.

Study Location: The study was carried out at the Department of General Medicine in collaboration with the Department of Cardiology and Biochemistry at a tertiary care teaching hospital.

Study Duration: The study was conducted over a period of 18 months from January 2025 to June 2026.

Sample Size: The study included a total sample size of 240 participants fulfilling the inclusion criteria.

Inclusion Criteria

1. Adults aged 18 years and above.
2. Participants willing to provide informed written consent.
3. Individuals attending outpatient or preventive health check-up services.
4. Participants capable of undergoing anthropometric and cardiovascular assessment.

Exclusion Criteria

1. Individuals with known congenital heart disease.
2. Pregnant women.
3. Patients with severe systemic illness or malignancy.
4. Individuals with physical disabilities limiting physical activity assessment.
5. Participants unwilling to participate in the study.

Procedure and Methodology: After obtaining approval from the Institutional Ethics Committee, participants fulfilling the eligibility criteria were enrolled in the study after obtaining informed written consent. A detailed history regarding demographic profile, dietary habits, smoking, alcohol consumption, medical history, and physical activity pattern was recorded using a predesigned questionnaire.

Anthropometric measurements including height, weight, waist circumference, and hip circumference were measured using standardized techniques. Body Mass Index (BMI) was calculated using the formula: weight in kilograms divided by height in meters squared (kg/m²). Participants were categorized according to WHO BMI classification.

Physical activity was assessed using a standardized physical activity questionnaire based on duration and intensity of daily activities. Participants were classified into sedentary, moderately active, and highly active groups.

Cardiovascular assessment included measurement of blood pressure using a calibrated sphygmomanometer after adequate rest. Pulse rate and other relevant cardiovascular findings were recorded. Laboratory investigations including fasting blood sugar and lipid profile were performed under aseptic precautions following overnight fasting.

The association between obesity indices, physical activity levels, and cardiovascular parameters was analyzed to determine their impact on cardiovascular health.

Sample Processing: Venous blood samples were collected under aseptic precautions after overnight fasting. Samples were processed in the central biochemistry laboratory of the institution. Serum was separated by centrifugation and analyzed for fasting blood glucose, total cholesterol, triglycerides, HDL cholesterol, LDL cholesterol, and VLDL cholesterol using automated analyzers and standard laboratory protocols.

Statistical Methods: The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 25.0. Quantitative variables were expressed as mean and standard deviation, while qualitative variables were expressed as frequencies and percentages. Association between categorical variables was analyzed using Chi-square test. Comparison of means between groups was performed using Student's t-test or ANOVA wherever applicable. Pearson correlation

analysis was used to assess the relationship between obesity parameters, physical activity, and cardiovascular health indicators. A p-value of less than 0.05 was considered statistically significant.

Data Collection: Data collection was carried out using a structured case record form. Information regarding age, gender, occupation, socioeconomic status, dietary habits, smoking, alcohol intake, medical history, anthropometric measurements, physical activity levels, blood pressure, and laboratory findings was systematically recorded for all participants. All measurements and investigations were performed using standardized procedures to maintain uniformity and accuracy of data collection.

RESULTS

[Table 1] demonstrates the overall impact of obesity and physical activity on cardiovascular health among the 240 study participants. The mean age of the participants was 43.7 ± 11.6 years with a statistically significant distribution (t = 4.21, p <0.001), and the 95% confidence interval ranged from 42.2 to 45.1 years. Male participants constituted a higher proportion of the study population, accounting for 137 (57.1%) individuals, while females comprised 103 (42.9%). The gender distribution showed statistical significance ($\chi^2 = 4.82$, p = 0.028).

A considerable proportion of the participants were obese, with 113 (47.1%) having a BMI ≥25 kg/m², which was statistically significant ($\chi^2 = 9.64$, p = 0.002). Low physical activity was observed among 91 (37.9%) participants and demonstrated a significant association with cardiovascular health status ($\chi^2 = 11.27$, p = 0.001). Hypertension was present in 84 (35.0%) participants and showed strong statistical significance ($\chi^2 = 13.46$, p <0.001). Dyslipidemia was identified in 109 (45.4%) individuals and was also statistically significant ($\chi^2 = 10.18$, p = 0.001). Furthermore, high cardiovascular risk was observed in 76 (31.7%) participants, with a highly significant association ($\chi^2 = 15.72$, p <0.001).

Table 1: Overall Impact of Obesity and Physical Activity on Cardiovascular Health among Adults, n=240

Parameter	Category / Value	n (%) or Mean ± SD	Test of Significance	95% CI	p-value
Age		43.7 ± 11.6 years	t = 4.21	42.2–45.1	<0.001
Male		137 (57.1%)	$\chi^2 = 4.82$	50.8–63.2%	0.028
Female		103 (42.9%)		36.8–49.2%	
Obese participants	BMI ≥25 kg/m ²	113 (47.1%)	$\chi^2 = 9.64$	40.8–53.4%	0.002
Low physical activity		91 (37.9%)	$\chi^2 = 11.27$	31.9–44.2%	0.001
Hypertension	BP ≥140/90 mmHg	84 (35.0%)	$\chi^2 = 13.46$	29.1–41.2%	<0.001
Dyslipidemia	Present	109 (45.4%)	$\chi^2 = 10.18$	39.1–51.8%	0.001
High cardiovascular risk	Present	76 (31.7%)	$\chi^2 = 15.72$	26.0–37.9%	<0.001

Table 2: Obesity Parameters among Study Participants, n=240

Obesity Parameter	Category / Value	n (%) or Mean ± SD	Test of Significance	95% CI	p-value
BMI		26.8 ± 4.3 kg/m ²	t = 6.18	26.3–27.4	<0.001
Normal BMI	18.5–22.9 kg/m ²	67 (27.9%)	$\chi^2 = 18.54$	22.4–33.9%	<0.001
Overweight	23.0–24.9 kg/m ²	60 (25.0%)		19.8–30.8%	
Obese I	25.0–29.9 kg/m ²	78 (32.5%)		26.7–38.8%	
Obese II	≥30 kg/m ²	35 (14.6%)		10.4–19.7%	
Waist circumference		91.6 ± 10.8 cm	t = 5.74	90.2–93.0	<0.001
High waist circumference	Present	118 (49.2%)	$\chi^2 = 8.31$	42.8–55.5%	0.004
Waist-hip ratio		0.91 ± 0.08	t = 4.96	0.90–0.92	<0.001
Central obesity	Present	121 (50.4%)	$\chi^2 = 9.12$	44.1–56.8%	0.003

[Table 2] presents the obesity-related parameters among the study participants. The mean Body Mass Index (BMI) of the participants was $26.8 \pm 4.3 \text{ kg/m}^2$, which was statistically significant ($t = 6.18, p < 0.001$), with a 95% confidence interval of $26.3\text{--}27.4 \text{ kg/m}^2$. Based on BMI classification, 67 (27.9%) participants had normal BMI, 60 (25.0%) were overweight, 78 (32.5%) belonged to Obese Class I category, and 35 (14.6%) were categorized as Obese Class II. The distribution of BMI categories was statistically significant ($\chi^2 = 18.54, p < 0.001$).

The mean waist circumference of the participants was $91.6 \pm 10.8 \text{ cm}$ and demonstrated statistical significance ($t = 5.74, p < 0.001$). High waist circumference was observed in 118 (49.2%) participants, indicating a substantial burden of abdominal obesity, with significant association ($\chi^2 = 8.31, p = 0.004$). The mean waist-hip ratio was 0.91 ± 0.08 and was statistically significant ($t = 4.96, p < 0.001$). Central obesity was identified in 121 (50.4%) participants, which also showed significant association ($\chi^2 = 9.12, p = 0.003$).

Table 3: Physical Activity Level and Association with Cardiovascular Health Indicators, n=240

Physical Activity Level	n (%)	Mean SBP \pm SD	Mean DBP \pm SD	Mean BMI \pm SD	Test of Significance	95% CI	p-value
Low activity	91 (37.9%)	139.8 \pm 14.7	88.6 \pm 8.9	29.1 \pm 4.6	F = 16.84	SBP: 136.7–142.8	<0.001
Moderate activity	97 (40.4%)	130.4 \pm 12.6	82.9 \pm 7.8	26.3 \pm 3.8		SBP: 127.9–132.9	
High activity	52 (21.7%)	123.6 \pm 10.9	78.4 \pm 6.9	23.9 \pm 3.2		SBP: 120.5–126.6	
Total	240 (100%)	131.8 \pm 14.6	83.7 \pm 8.8	26.8 \pm 4.3			

[Table 3] shows the distribution of physical activity levels and their association with cardiovascular health indicators among the study participants. Low physical activity was observed in 91 (37.9%) participants, moderate activity in 97 (40.4%), and high physical activity in 52 (21.7%) participants. Participants with low physical activity demonstrated the highest mean systolic blood pressure ($139.8 \pm 14.7 \text{ mmHg}$), diastolic blood pressure ($88.6 \pm 8.9 \text{ mmHg}$), and BMI ($29.1 \pm 4.6 \text{ kg/m}^2$). In comparison, participants with moderate activity had lower mean SBP ($130.4 \pm 12.6 \text{ mmHg}$), DBP ($82.9 \pm 7.8 \text{ mmHg}$),

and BMI ($26.3 \pm 3.8 \text{ kg/m}^2$). Those with high physical activity exhibited the lowest cardiovascular risk indicators, with mean SBP of $123.6 \pm 10.9 \text{ mmHg}$, DBP of $78.4 \pm 6.9 \text{ mmHg}$, and BMI of $23.9 \pm 3.2 \text{ kg/m}^2$.

The association between physical activity levels and cardiovascular indicators was statistically significant ($F = 16.84, p < 0.001$). The total study population had an overall mean SBP of $131.8 \pm 14.6 \text{ mmHg}$, mean DBP of $83.7 \pm 8.8 \text{ mmHg}$, and mean BMI of $26.8 \pm 4.3 \text{ kg/m}^2$.

Table 4: Relationship between Obesity, Physical Activity and Cardiovascular Risk Factors, n=240

Risk Factor	Obese / Low Activity Group n=132	Non-obese / Active Group n=108	Test of Significance	95% CI / OR	p-value
Hypertension	61 (46.2%)	23 (21.3%)	$\chi^2 = 16.28$	OR: 3.18; 95% CI: 1.78–5.69	<0.001
High total cholesterol	64 (48.5%)	29 (26.9%)	$\chi^2 = 11.72$	OR: 2.56; 95% CI: 1.49–4.41	0.001
High triglycerides	69 (52.3%)	31 (28.7%)	$\chi^2 = 13.63$	OR: 2.72; 95% CI: 1.59–4.66	<0.001
Low HDL cholesterol	58 (43.9%)	24 (22.2%)	$\chi^2 = 12.25$	OR: 2.74; 95% CI: 1.55–4.86	<0.001
Raised LDL cholesterol	67 (50.8%)	33 (30.6%)	$\chi^2 = 9.94$	OR: 2.35; 95% CI: 1.39–3.96	0.002
High cardiovascular risk	55 (41.7%)	21 (19.4%)	$\chi^2 = 13.82$	OR: 2.96; 95% CI: 1.64–5.34	<0.001

[Table 4] depicts the relationship between obesity, physical activity, and cardiovascular risk factors among the study participants. The obese and low physical activity group (n=132) demonstrated significantly higher prevalence of cardiovascular risk factors compared to the non-obese and physically active group (n=108).

Hypertension was observed in 61 (46.2%) participants in the obese/low activity group compared to 23 (21.3%) participants in the non-obese/active group. This association was highly significant ($\chi^2 = 16.28, p < 0.001$), with an odds ratio (OR) of 3.18,

indicating that obese and physically inactive individuals had more than three times higher risk of hypertension.

Similarly, high total cholesterol was present in 64 (48.5%) participants in the obese/low activity group compared to 29 (26.9%) in the active group, with significant association ($\chi^2 = 11.72, p = 0.001$; OR = 2.56). High triglyceride levels were observed in 69 (52.3%) participants in the obese group and 31 (28.7%) participants in the non-obese group, showing strong statistical significance ($\chi^2 = 13.63, p < 0.001$; OR = 2.72).

Low HDL cholesterol was reported in 58 (43.9%) obese and inactive participants compared to 24 (22.2%) active participants, with significant association ($\chi^2 = 12.25$, $p < 0.001$; OR = 2.74). Raised LDL cholesterol was also more common among obese and inactive participants [67 (50.8%)] than among active participants [33 (30.6%)], demonstrating significant association ($\chi^2 = 9.94$, $p = 0.002$; OR = 2.35).

Furthermore, high cardiovascular risk was observed in 55 (41.7%) participants in the obese and low activity group compared to 21 (19.4%) participants in the active group. This relationship was highly significant ($\chi^2 = 13.82$, $p < 0.001$; OR = 2.96).

DISCUSSION

In the present study, the mean age of participants was 43.7 ± 11.6 years, and males constituted 57.1% of the study population. Obesity was observed in 47.1%, low physical activity in 37.9%, hypertension in 35.0%, dyslipidemia in 45.4%, and high cardiovascular risk in 31.7% of participants. These findings indicate a significant clustering of lifestyle-related cardiovascular risk factors. Elagizi et al. (2020),^[1] similarly reported that obesity directly contributes to cardiovascular risk factors such as hypertension, dyslipidemia, diabetes, and reduced cardiovascular fitness. Powell-Wiley et al. (2021),^[11] also emphasized that obesity is strongly associated with cardiovascular morbidity through mechanisms involving inflammation, endothelial dysfunction, and metabolic abnormalities. Cercato et al. (2019),^[12] further highlighted that obesity substantially increases the risk of cardiovascular disease through associated metabolic derangements and hypertension.

In the present study, the mean BMI was 26.8 ± 4.3 kg/m², while 32.5% participants belonged to Obese Class I and 14.6% to Obese Class II. High waist circumference was present in 49.2%, and central obesity was observed in 50.4% of participants. These findings suggest that both generalized and abdominal obesity were common in the study population. Welsh et al. (2024),^[4] reported that abdominal obesity and increased waist circumference are independently associated with adverse cardiovascular outcomes even among individuals with similar BMI values. Csige et al. (2018),^[5] similarly observed that obesity causes significant alterations in cardiac structure and function, increasing the burden of hypertension and atherosclerosis. Ortega et al (2016),^[9] also emphasized that central obesity is more strongly associated with cardiovascular disease than generalized obesity due to increased visceral adiposity and metabolic dysfunction.

Physical activity analysis showed that participants with low activity had higher mean SBP, DBP, and BMI compared to those with moderate and high activity. Mean SBP decreased from 139.8 ± 14.7 mmHg in the low-activity group to 123.6 ± 10.9

mmHg in the high-activity group. This indicates a significant protective role of physical activity against obesity and raised blood pressure. Lind et al. (2017),^[2] reported that higher physical activity levels improve cardiovascular status among obese individuals and reduce blood pressure and metabolic risk. Koolhaas et al (2017),^[3] demonstrated that physically active overweight and obese individuals had significantly lower cardiovascular risk compared to inactive individuals with similar BMI. Waleh et al (2016),^[6] also reported that physical activity improves body composition, reduces adiposity, and enhances cardiovascular function among obese individuals. Lavie et al (2018),^[8] further stated that metabolically healthy obese individuals with good physical fitness have lower cardiovascular morbidity than sedentary obese individuals.

The present study further showed that the obese/low physical activity group had significantly higher hypertension, high total cholesterol, high triglycerides, low HDL, raised LDL, and high cardiovascular risk compared with the non-obese/active group. The odds of hypertension were 3.18 times higher, and the odds of high cardiovascular risk were 2.96 times higher among obese and inactive participants. Perone et al (2024),^[7] also found that obesity combined with sedentary behavior significantly increases cardiovascular risk and worsens lipid abnormalities. Lavie et al (2019),^[10] similarly concluded that regular physical activity and exercise substantially reduce obesity-related morbidity and mortality by improving lipid profile, blood pressure, and cardiovascular fitness. Katta et al (2021),^[13] further reported that obesity is strongly associated with coronary artery disease due to increased atherosclerotic burden, dyslipidemia, and chronic inflammatory changes.

CONCLUSION

The present study demonstrated a significant association between obesity, low physical activity, and adverse cardiovascular health outcomes among adults attending a tertiary care center. Nearly half of the participants were either overweight or obese, and a substantial proportion exhibited central obesity as indicated by increased waist circumference and waist-hip ratio. Participants with lower physical activity levels had significantly higher body mass index, systolic blood pressure, and diastolic blood pressure compared to physically active individuals. Hypertension, dyslipidemia, and overall cardiovascular risk were found to be significantly higher among obese and physically inactive participants.

The findings of the study emphasize that obesity and sedentary lifestyle are major modifiable risk factors contributing to cardiovascular morbidity. Increased BMI and abdominal obesity were strongly associated with elevated blood pressure and abnormal lipid profiles, including raised total cholesterol,

triglycerides, LDL cholesterol, and reduced HDL cholesterol. Individuals with obesity and low physical activity had nearly three times higher odds of developing cardiovascular risk factors compared to active and non-obese individuals.

The study highlights the importance of routine assessment of obesity indices such as BMI and waist circumference along with evaluation of physical activity levels for early identification of individuals at risk of cardiovascular disease. Promotion of regular physical activity, healthy dietary practices, and lifestyle modification strategies may significantly reduce the burden of cardiovascular diseases in the community. Early preventive interventions focusing on weight management and active lifestyle adoption are essential for improving cardiovascular health and reducing future cardiovascular complications.

Limitations of the study

1. The study was conducted at a single tertiary care center, limiting generalizability of the findings to the wider population.
2. The cross-sectional study design did not allow establishment of a causal relationship between obesity, physical activity, and cardiovascular outcomes.
3. Physical activity assessment was based on self-reported questionnaires, which may be subject to recall bias.
4. Dietary habits and nutritional intake were not evaluated in detail.
5. The study did not assess long-term cardiovascular outcomes or follow-up of participants.
6. Genetic predisposition and family history of cardiovascular disease were not extensively analyzed.
7. Stress levels, sleep quality, and psychosocial factors affecting cardiovascular health were not included.
8. Participants with subclinical cardiovascular disease may not have been identified.
9. Biochemical markers such as inflammatory markers and insulin resistance indices were not evaluated.

10. Variations in occupational activity and socioeconomic status may have influenced physical activity levels and cardiovascular risk.

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