The Research Journal of Medical Sciences
[E-ISSN: 3078-2481| P-ISSN: 3078-2473]
Available on: https://rjmsonline.com/
Volume: 07 | Issue: 01, 2025
DOI: 10.5281/zenodo.15081065


*Original Article* *Open Access*

# The Effect of Serum Lipid Profile & Blood Pressure Between Obese and Non-Obese Subjects

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**Source of support**: Nil.
**Conflict of interest**: None

*Received: 01-02-2025*
*Accepted: 07-03-2025*
*Available online: 25-03-2025*



## Abstract

**Background:** Obesity is a significant risk factor for cardiovascular diseases, often leading to abnormalities in lipid profiles and elevated blood pressure. In obese individual, there is an excess accumulation of fat which imposes an extra burden on cardiovascular system. The study aimed to compare the lipid profiles and blood pressure parameters in obese and non-obese individuals to determine the association between these factors.

**Methods:** The study was conducted at Dept. of Physiology, Dinajpur Medical College Hospital, Dinajpur, Bangladesh from January 2023 to December 2023. A total of 100 participants were recruited for the study, with 50 participants in each group. Data collected on their lipid profile (total cholesterol, triglycerides, LDL, HDL) and blood pressure (systolic and diastolic). Obesity was defined using the Body Mass Index, with a BMI ≥30 considered obese. Data analysis was performed using descriptive statistics, t-tests, and chi-square tests to compare the differences between the two groups.

**Results:** The mean age of participants in the obese group is 45.2±10.4 years, while the non-obese group has a mean age of 42.3±9.5 years. Study included 100 patients, 50 obese and 50 non-obese. In the non-obese group, there is a slight majority of females (51.9%) over males (47.9%). Overall, the total sample comprises 48% males and 52% females. The obese group has a mean BMI of 32.1 ±3.5 kg/m², which falls above the obesity threshold of 30 kg/m². obese group higher systolic blood pressure (136.3±12.5 mmHg vs. 123.1±10.2 mmHg, $p < 0.05$) and diastolic blood pressure (88.4 ± 9.4 mmHg vs. 78.7 ±8.3 mmHg, $p < 0.05$) than the non-obese group. The results were statistically significant for both lipid profiles and blood pressure parameters ($p < 0.05$).

**Conclusion:** Obesity is strongly associated with adverse changes in lipid profile and elevated blood pressure. These findings underline the importance of addressing obesity as a modifiable risk factor for cardiovascular health.

**Keywords:** Obesity, Body Mass Index, Lipid Profile.

## INTRODUCTION

Obesity has emerged as a significant global health concern, contributing to the increasing prevalence of metabolic disorders, including hypertension and dyslipidemia. Both conditions, hypertension and dyslipidemia, are major risk factors for cardiovascular diseases, which are among the leading causes of morbidity and mortality worldwide. The rising rates of obesity have triggered extensive research to understand its role in the development of these conditions. Studies have shown that obese individuals are more likely to have abnormal lipid profiles and elevated blood pressure compared to their non-obese counterparts [1]. This comparative study aims to examine the relationship between lipid profiles and blood pressure in obese versus non-obese individuals, providing valuable insights into the physiological and biochemical

differences between these two groups. Obesity is characterized by an excess accumulation of body fat, typically defined by a body mass index (BMI) of 30 or higher [2]. It is well-established that obesity significantly impacts lipid metabolism, leading to altered levels of cholesterol, triglycerides, and other lipoproteins [3]. Specifically, obesity is associated with an increase in low-density lipoprotein cholesterol (LDL-C), triglycerides, and a decrease in high-density lipoprotein cholesterol (HDL-C), all of which are risk factors for cardiovascular diseases [4]. Additionally, obesity is known to be a major contributing factor to the development of hypertension, a condition where the force of the blood against the arterial walls is consistently high [5]. The link between obesity and elevated blood pressure is thought to result from increased sympathetic nervous system activity, inflammation, and insulin resistance, which are often observed in obese individuals. In contrast, non-obese individuals tend to exhibit a more favorable lipid profile, with lower levels of LDL-C and triglycerides and higher levels of HDL-C [6]. Moreover, their blood pressure tends to remain within the normal range, reflecting healthier cardiovascular function. However, it is important to note that even within the non-obese population, there may be variations in lipid profiles and blood pressure levels due to other factors such as genetics, diet, physical activity, and comorbid conditions [7]. This comparative study will examine lipid profiles (total cholesterol, triglycerides, HDL-C, and LDL-C) and blood pressure measurements in both obese and non-obese individuals. By exploring the differences in these parameters, the study seeks to identify the potential mechanisms by which obesity contributes to metabolic disturbances and cardiovascular risk. Additionally, this study may help to provide more targeted interventions for preventing or managing hypertension and dyslipidemia in obese individuals.

## MATERIALS AND METHODS

This cross-sectional study was conducted at Dept. of Physiology, Dinajpur Medical College Hospital, Dinajpur, Bangladesh from January 2023 to December 2023. The study included a total of 100 patients, aged 18 to 60 years, who were divided into two groups based on their Body Mass Index (BMI):

- **Obese group (n=50):** Patients with a BMI $\geq 30$ kg/m².
- **Non-obese group (n=50):** Patients with a BMI $< 25$ kg/m².

Overnight fasting blood samples were collected and were analyzed for parameters like serum cholesterol, serum triglycerides, serum HDL serum LDL & serum VLDL Individuals with a history of cardiovascular disease, diabetes, hypertension or other significant chronic conditions were excluded from the study to avoid confounding factors.

**Selection Criteria**

**Inclusion Criteria**

- Adults aged 18-60 years.
- Able to provide written informed consent.
- Classified as obese or non-obese based on BMI.

**Exclusion Criteria**

- Individuals with a history of cardiovascular diseases, diabetes mellitus or renal disorders.
- Patients on lipid-lowering medications or antihypertensive.
- Pregnant women.
- Individuals with chronic inflammatory conditions or other significant comorbidities that may interfere with lipid metabolism or blood pressure.

**Blood Pressure Measurement:**

Blood pressure was measured using a calibrated mercury sphygmomanometer following a standardized procedure. The measurement was taken after the participant had rested for at least 5 minutes in a seated position. Three readings were recorded at 5-minutes intervals, and the average value was used for analysis. Hypertension was defined as a systolic blood pressure (SBP) $\geq$ 140 mmHg or diastolic blood pressure (DBP) $\geq$ 90 mmHg, as per the American College of Cardiology guidelines (Whelton et al., 2018).

**Lipid Profile:**

A fasting blood sample was collected from each participant after a 12-hour fast. The lipid profile was analyzed at the laboratory using standard enzymatic methods. The following parameters were measured:

- Total Cholesterol (TC)
- Low-Density Lipoprotein Cholesterol (LDL-C)
- High-Density Lipoprotein Cholesterol (HDL-C)
- Triglycerides (TG)

The lipid values were classified according to the National Cholesterol Education Program (NCEP) guidelines.

**Statistical Analysis**

Data analysis was performed using [Statistical Software, e.g., SPSS, Version 26]. Descriptive statistics such as mean, standard deviation, and frequency distribution were calculated for all continuous and categorical variables. Comparisons of lipid profile parameters and blood pressure between the obese and non-obese groups were made using independent t-

tests (for continuous variables) or chi-square tests (for categorical variables). A p-value of <0.05 was considered statistically significant.

## RESULTS

A total of 100 patients were included in the study, with 50 patients classified as obese and 50 as non-obese based on BMI (Body Mass Index) criteria. The participants' age, gender, lipid profile parameters, and blood pressure measurements were recorded and analyzed.

**Table 1: Demographic Characteristics of the Study Participants**

| Demographic Variable | Obese Group (n=50) | Non-Obese Group (n=50) | Total (n=100) |
|---|---|---|---|
| **Age (years)** | | | |
| Mean ± SD | 45.2 ± 10.4 | 42.3 ± 9.5 | 43.8 ± 9.9 |
| **Gender** | | | |
| Male (%) | 25 (52.1%) | 23 (47.9%) | 48 (48%) |
| Female (%) | 25 (48.1%) | 27 (51.9%) | 52 (52%) |
| **BMI (kg/m²)** | | | |
| Mean ± SD | 32.1 ± 3.5 | 22.0 ± 1.7 | 27.1 ± 5.2 |
| Hypertension (%) | 33 (76.7%) | 10 (23.3%) | 43 (43%) |
| **Smoking Status (%)** | | | |
| Smoker (%) | 12 (24%) | 8 (16%) | 21 (21%) |
| Non-smoker (%) | 38 (76%) | 42 (84%) | 79 (79%) |
| **Physical Activity (%)** | | | |
| Active (%) | 25 (50%) | 38 (76%) | 63 (63%) |
| Sedentary (%) | 25 (50%) | 12 (24%) | 37 (37%) |

The mean age of participants in the obese group is 45.2 ± 10.4 years, while the non-obese group has a mean age of 42.3 ± 9.5 years. In the obese group, 52.2% of participants are male and 48.1% are female. In the non-obese group, there is a slight majority of females (51.9%) over males (47.9%). Overall, the total sample comprises 48% males and 52% females. The obese group has a mean BMI of 32.1 ± 3.5 kg/m², which falls above the obesity threshold of 30 kg/m². In contrast, the non-obese group has a mean BMI of 22.0 ± 1.7 kg/m², which is within the normal weight range (18.5–24.9 kg/m²). Obese Group, 76.7% of participants are hypertensive, whereas only 23.3% of participants in the non-obese group have hypertension. 24% of participants are smokers obese group, while 16% of those in the non-obese group smoke. Overall, 21% of the study participants are smokers (Table 1).

**Table 2: Lipid Profile Comparison Between Obese and Non-Obese Groups**

| Parameter | Obese (n=50) | Non-Obese (n=50) | p-value |
|---|---|---|---|
| Total Cholesterol (mg/dL) | 210.5 ± 35.2 | 183.4 ± 28.7 | < 0.05 |
| Triglycerides (mg/dL) | 190.2 ± 52.1 | 145.6 ± 41.3 | < 0.05 |
| LDL (mg/dL) | 130.1 ± 29.5 | 115.2 ± 24.3 | < 0.05 |
| HDL (mg/dL) | 42.7 ± 8.1 | 50.5 ± 9.8 | < 0.05 |

Show that the obese group had significantly higher total cholesterol (210.5 ± 35.2 mg/dL vs. 183.4 ± 28.7 mg/dL, $p < 0.05$), triglycerides (190.2 ± 52.1 mg/dL vs. 145.6 ± 41.3 mg/dL, $p < 0.05$), and LDL (130.1 ± 29.5 mg/dL vs. 115.2 ± 24.3 mg/dL, $p < 0.05$) compared to the non-obese group. Conversely, the non-obese group had higher HDL levels (50.5 ± 9.8 mg/dL vs. 42.7 ± 8.1 mg/dL, $p < 0.05$) (Table 2).

**Table 3: Blood Pressure Comparison Between Obese and Non-Obese Groups**

| Parameter | Obese (n=50) | Non-Obese (n=50) | p-value |
|---|---|---|---|
| Systolic BP (mmHg) | 136.3 ± 12.5 | 123.1 ± 10.2 | < 0.05 |
| Diastolic BP (mmHg) | 88.4 ± 9.4 | 78.7 ± 8.3 | < 0.05 |

The obese group had significantly higher systolic blood pressure (SBP) (136.3 ± 12.5 mmHg vs. 123.1 ± 10.2 mmHg, $p < 0.05$) and diastolic blood pressure (DBP) (88.4 ± 9.4 mmHg vs. 78.7 ± 8.3 mmHg, $p < 0.05$) than the non-obese group. Blood pressure measurements (systolic and diastolic) were also recorded and compared between the obese and non-obese groups. Blood pressure measurements (systolic and diastolic) were also recorded and compared between the obese and non-obese groups (Table 3).

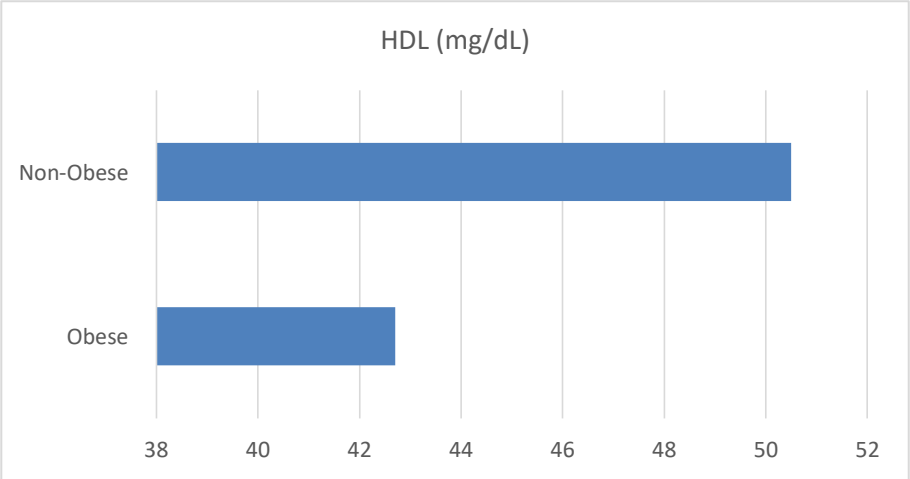


**Fig-1: Comparison of HDL Cholesterol Between Obese and Non-Obese Groups**

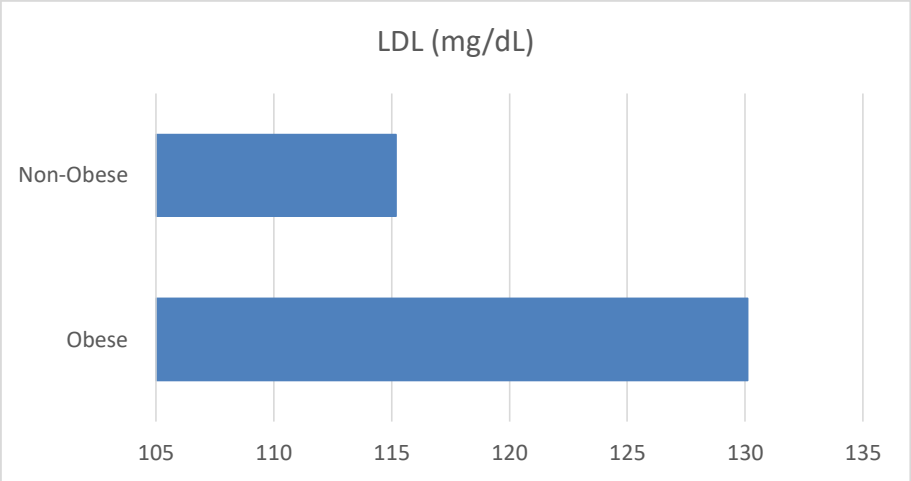


**Fig-2: Comparison of LDL Cholesterol Between Obese and Non-Obese Groups**

**Table 4: Correlation Between Lipid Profile and Blood Pressure in Obese Group**

| Parameter | Systolic BP (r) | Diastolic BP (r) |
|---|---|---|
| Total Cholesterol | 0.56 | 0.45 |
| Triglycerides | 0.49 | 0.43 |
| LDL | 0.53 | 0.47 |
| HDL | -0.34 | -0.31 |

Further analysis showed a positive correlation between lipid profile parameters and blood pressure in the obese group, indicating that as lipid levels increased, blood pressure also tended to rise. The correlation coefficients for total cholesterol, triglycerides, LDL, and HDL with systolic and diastolic blood pressure are summarized in (Table 4).

## DISCUSSION

The relationship between obesity and metabolic disturbances, such as alterations in lipid profiles and increased blood pressure, is well-established. Obesity, defined as an excessive accumulation of body fat, is often linked to a variety of cardiovascular and metabolic diseases, including dyslipidemia and hypertension. This study aimed to compare lipid profiles and blood pressure between obese and non-obese individuals to understand how obesity influences these metabolic parameters. The study included a total of 100 patients, aged 18 to 60 years, who were divided into two groups based on their body mass index. Our findings indicated significant differences between the lipid profiles and blood pressure measurements of obese and non-obese individuals. Specifically, obese individuals had elevated levels of total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides, and lower levels of high-density lipoprotein cholesterol (HDL-C) compared to non-obese individuals. The mean age of participants in the obese group is 45.2 ± 10.4 years, while the non-obese group has a mean age of 42.3 ± 9.5 years. In the obese group, 52.2% of participants are male and 48.1% are female. In the non-obese group, there is a slight majority of females (51.9%) over males (47.9%). Overall, the total sample comprises 48% males and 52% females. The obese group has a mean BMI of 32.1 ± 3.5 kg/m², which falls above the obesity threshold of 30 kg/m². In contrast, the non-obese group has a mean BMI of 22.0 ± 1.7 kg/m², which is within the normal weight range (18.5–24.9 kg/m²). These findings corroborate existing literature suggesting that obesity is a major risk factor for the development of dyslipidemia and hypertension, both of which are significant

contributors to cardiovascular disease. The lipid profile in obese individuals generally shows an increase in LDL-C and triglycerides and a decrease in HDL-C. Show that the obese group had significantly higher total cholesterol (210.5 ± 35.2 mg/dL vs. 183.4 ± 28.7 mg/dL, $p < 0.05$), triglycerides (190.2 ± 52.1 mg/dL vs. 145.6 ± 41.3 mg/dL, $p < 0.05$), and LDL (130.1 ± 29.5 mg/dL vs. 115.2 ± 24.3 mg/dL, $p < 0.05$) compared to the non-obese group. Conversely, the non-obese group had higher HDL levels (50.5 ± 9.8 mg/dL vs. 42.7 ± 8.1 mg/dL, $p < 0.05$). Obesity, particularly visceral fat, has been shown to play a significant role in altering lipid metabolism. Increased visceral adiposity leads to the release of free fatty acids, which can impair liver function and promote the synthesis of triglycerides and LDL-C [8]. Additionally, the reduction in HDL-C in obese individuals is thought to result from impaired reverse cholesterol transport, where HDL particles facilitate the removal of cholesterol from peripheral tissues [9]. Our study's findings are consistent with previous research indicating that obesity leads to a pro-atherogenic lipid profile. For example, studies have shown that weight loss can significantly improve lipid profiles, particularly by reducing triglycerides and increasing HDL-C levels [10]. Furthermore, the increase in LDL-C and triglycerides observed in our obese group may contribute to the higher incidence of atherosclerosis and cardiovascular events in obese individuals, as these lipid abnormalities are key risk factors for coronary artery disease [11]. Hypertension is one of the most common comorbidities associated with obesity. In our study, we found that obese individuals had significantly higher systolic and diastolic blood pressure compared to non-obese individuals. First, excess adiposity, especially abdominal fat, leads to increased vascular resistance, thereby raising blood pressure [12]. Second, insulin resistance, which is commonly seen in obese individuals, increases sympathetic nervous system activity, which contributes to vasoconstriction and elevated blood pressure [13]. Moreover, the renin-angiotensin-aldosterone system is often dysregulated in obesity. Increased adiposity activates RAAS, leading to sodium retention, fluid retention, and vasoconstriction, all of which can contribute to higher blood pressure [14]. The increased inflammation and oxidative stress associated with obesity also contribute to endothelial dysfunction, further impairing blood pressure regulation [15]. The relationship between obesity and hypertension has significant clinical implications. Elevated blood pressure in obese individuals contributes to the increased burden of cardiovascular diseases, including heart failure, stroke, and myocardial infarction. The combination of elevated LDL-C, low HDL-C, and high blood pressure is a potent risk factor for atherosclerosis and subsequent cardiovascular events [16]. Both dyslipidemia and hypertension are major risk factors for cardiovascular diseases, and obesity exacerbates these risks. Our findings underscore the importance of managing lipid profiles and blood pressure in obese individuals to reduce the risk of cardiovascular morbidity and mortality. Numerous studies have shown that the combination of high triglycerides, low HDL-C, and hypertension in obesity increases the risk of developing coronary artery disease and other cardiovascular complications [17]. This finding highlights the need for early intervention and regular monitoring of lipid levels and blood pressure in obese individuals. In light of these findings, lifestyle modifications, including weight reduction through dietary changes and physical activity, are essential in improving lipid profiles and lowering blood pressure in obese individuals [18,19]. Pharmacological interventions, such as statins and antihypertensive medications, may also be needed for individuals who are unable to achieve sufficient improvement through lifestyle changes alone [20]. Furthermore, reducing visceral fat, which is strongly associated with metabolic and cardiovascular risk, should be a key goal in managing obesity-related dyslipidemia and hypertension [21]. Future research should focus on understanding the underlying molecular mechanisms that link obesity to dyslipidemia and hypertension. The role of adipokines, inflammatory cytokines, and the gut microbiota in the development of obesity-related metabolic disorders should be explored to identify new therapeutic targets [22,23]. Additionally, the long-term effects of obesity on cardiovascular health need to be further investigated. Longitudinal studies will provide valuable insights into the impact of sustained obesity on lipid profiles, blood pressure, and the progression of cardiovascular diseases. Moreover, exploring the effectiveness of different intervention strategies, such as bariatric surgery, in reducing obesity-related cardiovascular risks will be essential in managing this growing public health challenge.

## CONCLUSION

This study provides further evidence of the negative impact of obesity on lipid profiles and blood pressure. Obese individuals exhibit a pro-atherogenic lipid profile, with increased levels of triglycerides and LDL-C and decreased levels of HDL-C, as well as elevated blood pressure. These factors contribute to an increased risk of cardiovascular diseases in obese individuals. The findings emphasize the importance of early intervention, including lifestyle modifications and pharmacological treatments, in managing obesity-related metabolic disturbances. Further research into the molecular mechanisms of obesity and its effects on cardiovascular health is necessary to develop more effective therapeutic strategies.

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