

# The prevalence of Hypertension among patients with hyperlipidemia in Imam Muhammed Ibn Saud Islamic University medical center

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## Abstract

**Background:** The prevalence of cardiovascular diseases and their complications is rising, and they are considered the leading reason of death, along with disability, in many nations (1). Among the other cardiovascular risk factors, hypertension and dyslipidemia play a crucial role in developing various disorders, but most importantly, cardiovascular diseases (2), (3).

**Aim:** To measure the prevalence of hypertension among hyperlipidemic patients at Imam Mohammad Ibn Saud Islamic University (IMSIU) medical center. Additionally, we set out to measure the prevalence of diabetes mellitus among the same sample.

**Methods:** The present study is an observational retrospective study that includes collecting data from medical records in a cardiology clinic from 16/03/2017 to 25/04/2021 at the IMSIU medical center in Riyadh, Saudi Arabia.

**Results:** There were 413 subjects in total who took part in the investigation, with males constituting 85.7% of the sample. In addition, 83.1% of the patients were over the age of 40. It was recognized that among patients with hyperlipidemia, hypertension was reported in 60.1% of them. Also, 58.7% of patients with hyperlipidemia have diabetes mellitus. Regarding prescriptions, 75.1% of the patients were on lipid-lowering medications. Besides, it was noticed that the prevalence of diabetes mellitus and hypertension rose dramatically with age.

**Conclusion:** It was revealed that most patients with hyperlipidemia also have concurrent hypertension. On top of that, most hyperlipidemic patients are diagnosed with diabetes mellitus. Overall, the main findings support previous studies' results that suggest an association between hyperlipidemia and hypertension.

**Keywords:** Hypertension; Hyperlipidemia; Diabetes Mellitus.

## Introduction

Cardiovascular disease (CVD), which includes coronary heart disease, cerebrovascular diseases, and peripheral arterial disease, is recognized as one of the main causes of mortality worldwide (4). The prevalence of cardiovascular diseases and their complications is rising, and they are the leading cause of death along with disability in many countries, which makes it a critical topic to focus on (5). A global study estimated that 17.92 million deaths occur annually due to CVDs (5). This large number of cases indicates the need for appropriate management, recognizing risk factors, and prevention of CVDs. The risk factors of cardiovascular disease (CVD) are well-known as they include lipid disorders, hypertension, tobacco smoking, obesity, diabetes, male gender, and physical inactivity. Of these factors, hypertension and dyslipidemia play a crucial role in developing various disorders, but most importantly, cardiovascular diseases (2). A significant proportion of the population is diagnosed with dyslipidemia and hypertension, which, as mentioned, are risk factors for cardiovascular diseases (5). Dyslipidemia, which includes increased levels of cholesterol, low-density lipoprotein cholesterol, triglycerides, and low levels of high-density lipoprotein cholesterol in the circulating blood, is a major risk factor for atherosclerosis that leads to various cardiovascular diseases (6). In addition, the association between hypertension and dyslipidemia is common, which may be due to a shared pathogenesis between the two conditions (7). A systematic review conducted in GCC countries showed that hypertension prevalence was 26% to 50.7% in males and 20.9% to 31.7% in females (8). Dyslipidemia has a considerable impact on the body's blood pressure, which has an important role when addressing cardiovascular diseases. Consequently, there is clear evidence that hyperlipidemia and hypertension are somewhat correlated in terms of epidemiological statistics, metabolic processes, and clinical features (9), (10). Besides, having both of these major risk factors for cardiovascular disease—hypertension and hyperlipidemia—may increase the risk of developing CVD more than either risk factor alone (11). The co-existence of hypertension and hyperlipidemia with the mechanism by which these two come into line remains not sufficiently understood. This vagueness encourages researchers to investigate more about the CVD risk factors, which is what the present study aims to do. Furthermore, hyperlipidemia and hypertension may have some overlap in underlying causes. Knowing these causes is a great help in taking appropriate therapeutic measures. As there is a scarcity of studies that are concerned with the prevalence of concomitant hypertension and hyperlipidemia, this study was performed at the Imam Mohammad Ibn Saud Islamic University medical center, precisely at the Cardiology clinic department. With regard to the objectives, the study is intended to measure the prevalence of hypertension among hyperlipidemic patients at Al-Imam Muhammed Ibn Saud Islamic University Medical Center in Riyadh, Saudi Arabia. Also, as a secondary objective, the study measured the prevalence of diabetes among patients with hyperlipidemia at the same medical center. Also, the research is planned to facilitate future epidemiological studies that intend to

measure the prevalence of concomitant hypertension and hyperlipidemia on a larger scale in Saudi Arabia through systematic review or meta-analysis, which would give a more accurate idea regarding the percentage of hyperlipidemia that is accompanied by hypertension in adult patients. The motives for conducting such research are multiple and are as follows: First, the increased need for more attention as the effect of hypertension among hyperlipidemic patients may have serious consequences. Next, due to a shortage of similar studies conducted in the capital city of Riyadh, the research hypothesized that there is a high prevalence of hypertension among hyperlipidemic patients at the Imam Mohammad Ibn Saud Islamic University medical center in Riyadh, Saudi Arabia.

## Methods

Following written consent that was obtained from Imam Mohammad Ibn Saud Islamic University's medical center and institutional review board approval, the research team conducted an observational retrospective study for adult patients diagnosed with hyperlipidemia who were aged 18 years old and above. Data was obtained from the medical records in Imam Mohammad Ibn Saud Islamic University medical center's database at a single cardiology clinic from 16/03/2017 to 25/04/2021. During the data collection process, patients who were aged under 18 years old and those who were not diagnosed with hyperlipidemia were excluded. There were a total of 413 individuals who matched the inclusion criteria. Once patients were selected, the present research collected and measured the following variables: demographic characteristics (gender and age), medical history (hyperlipidemia, hypertension, and diabetes mellitus), and drug profile (lipid-lowering drugs and anti-diabetic drugs). Also, the main purpose of the present study is to find out how common hypertension is among people who have a confirmed diagnosis of hyperlipidemia.

## Statistical analysis

For data analysis, MS Excel was utilized, and for data analysis, SPSS version 25 was implemented. Categorical variables were delineated using frequency as well as percentage. The Chi square test was used to assess the relationship between the incidence of hypertension and diabetes mellitus and demographic characteristics such as age, gender, DM incidence, and usage of lipid-lowering medicines. Lastly, the findings revealed were significant if the p value was lower than or equal to 0.05.

## Results

In the present study, data was collected on 413 hyperlipidemic patients admitted to the IMSIU medical center in Riyadh, Saudi Arabia, from 16/03/2017 to 25/04/2021. According to the findings, 85.7% of the patients were male, with a male-to-female ratio of 6:1. Regarding the age groups of the patients, it was found that 28.4% were between the ages of 51 and 60, and 26.2% were between the ages of 41 and 50. In general, 83.1% of the patients were over the age of 40, and 77.1% were between the ages of 41 and 70 (Table 1).

Moreover, it was recognized that among patients with hyperlipidemia, hypertension was reported in 60.1% of them (248 patients) (Figure 1). Additionally, it was noticed that 58.7% of those with hyperlipidemia also had diabetes mellitus. On top of that, it was found that 75.1% of the patients were on lipid-lowering medications, and 38.6% were on anti-diabetic medications (Figure 2).

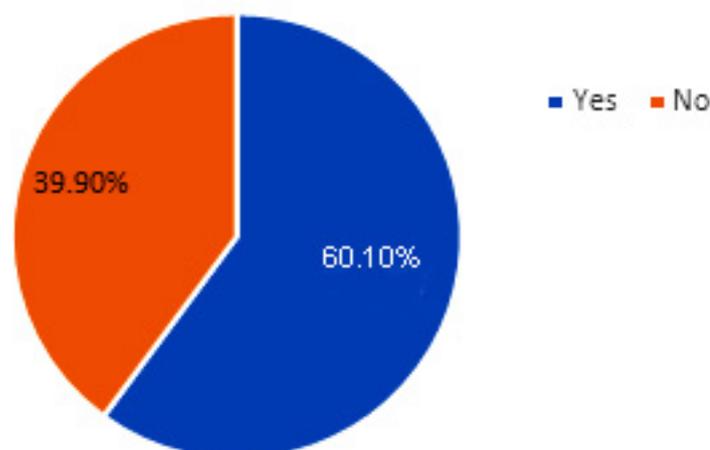
Furthermore, the researchers attempted to investigate the prevalence of hypertension and diabetes mellitus in hyperlipidemic patients. The gender of the patients had a significant impact on the prevalence of hypertension and diabetes mellitus, with the prevalence of hypertension and diabetes mellitus being higher in the female population than the male population (67.8% vs. 58.8%, and 44.1% vs. 40.90%, respectively). However, the limited number of females in the present study may reduce the accuracy

of this impact. Regarding the age group, it was revealed that the prevalence of hypertension and diabetes mellitus increased significantly with age, with the prevalence of hypertension increasing from 15% in patients aged 18–30 years old to 74.2% in patients aged 61–70 years old, 89.5% in patients aged 71–80 years old, and 100% in patients aged over 80 years old ( $P = 0.000$ ). The same was observed when the prevalence of diabetes mellitus increased from 0% in participants aged 18–30 years old to 52.6% in patients aged 71–80 years old. Furthermore, it was discovered that there is a significant relationship between diabetes and hypertension, with 67.8% of patients with diabetes mellitus having hypertension (0.007). Finally, the prevalence of hypertension and diabetes turned out to be significantly higher in patients who were on lipid-lowering drugs in the sample (Table 2).

**Table 1: The demographic factors of patients with hyperlipidemia (N=413)**

|               |        | Count | Column N % |
|---------------|--------|-------|------------|
| <b>Gender</b> | Male   | 354   | 85.7%      |
|               | Female | 59    | 14.3%      |
| <b>Age</b>    | 18-30  | 20    | 4.8%       |
|               | 31-40  | 50    | 12.1%      |
|               | 41-50  | 108   | 26.2%      |
|               | 51-60  | 117   | 28.4%      |
|               | 61-70  | 93    | 22.5%      |
|               | 71-80  | 19    | 4.6%       |
|               | 81-90  | 6     | 1.4%       |

**Figure 1: The prevalence of hypertension among hyperlipidemic patients**

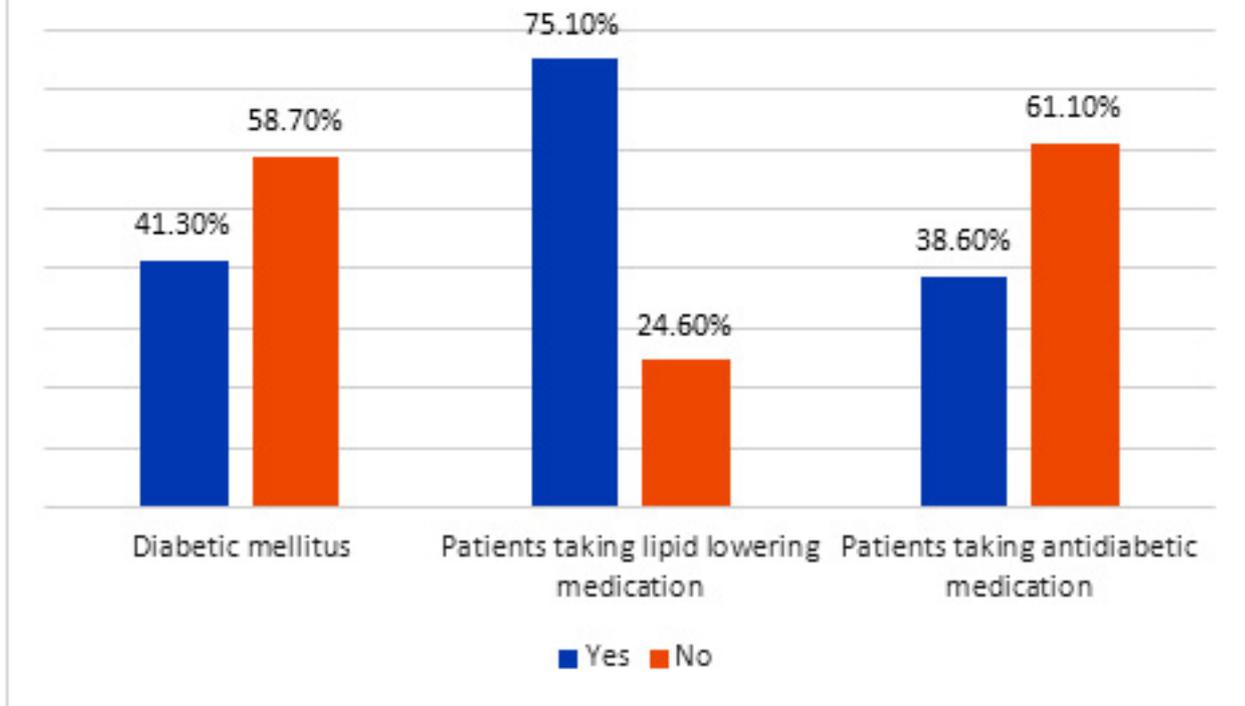


**Table 2:** The relation between prevalence of hypertension and diabetes mellitus and the demographic factors of hyperlipidemic patients

|                             |         | Hypertension |       |       |        | Diabetes mellitus |        |       |       |
|-----------------------------|---------|--------------|-------|-------|--------|-------------------|--------|-------|-------|
|                             |         | No           |       | Yes   |        | No                |        | Yes   |       |
|                             |         | Count        | N %   | Count | N %    | Count             | N %    | Count | N %   |
| Gender                      | Male    | 146          | 41.2% | 208   | 58.8%  | 209               | 59.1%  | 145   | 40.9% |
|                             | Female  | 19           | 32.2% | 40    | 67.8%  | 33                | 55.9%  | 26    | 44.1% |
|                             | P-value | 0.008*       |       |       |        | 0.012*            |        |       |       |
| Age                         | 18-30   | 17           | 85.0% | 3     | 15.0%  | 20                | 100.0% | 0     | 0.0%  |
|                             | 31-40   | 33           | 66.0% | 17    | 34.0%  | 38                | 76.0%  | 12    | 24.0% |
|                             | 41-50   | 49           | 45.4% | 59    | 54.6%  | 68                | 62.9%  | 40    | 37.1% |
|                             | 51-60   | 39           | 33.3% | 78    | 66.7%  | 58                | 49.6%  | 59    | 50.4% |
|                             | 61-70   | 24           | 25.8% | 69    | 74.2%  | 45                | 48.4%  | 48    | 51.6% |
|                             | 71-80   | 2            | 10.5% | 17    | 89.5%  | 9                 | 47.4%  | 10    | 52.6% |
|                             | 81-90   | 0            | 0.0%  | 6     | 100.0% | 4                 | 66.7%  | 2     | 33.3% |
|                             | P-value | 0.000*       |       |       |        | 0.000*            |        |       |       |
| Diabetes mellitus           | No      | 109          | 45.0% | 133   | 55.0%  |                   |        |       |       |
|                             | Yes     | 55           | 32.2% | 116   | 67.8%  |                   |        |       |       |
|                             | P-value | 0.007*       |       |       |        |                   |        |       |       |
| Taking lipid lowering drugs | No      | 52           | 51.5% | 49    | 48.5%  | 83                | 82.2%  | 18    | 17.8% |
|                             | Yes     | 111          | 35.7% | 200   | 64.3%  | 159               | 51.1%  | 152   | 48.9% |
|                             | P-value | 0.004*       |       |       |        | 0.000*            |        |       |       |

\* Significant at p value lower or equal to 0.05.

Figure 2: The prevalence of diabetes mellitus among hyperlipidemic patients, and medications prescribed for the study sample



## Discussion

The study's goal was to find out how common hypertension and diabetes mellitus are among hyperlipidemic patients at IMSIU Medical Center, with hypertension being the primary aim of the investigation. In the present study's investigation, hypertension was noticed to be prevalent in 60.1% of hyperlipidemic individuals. Alzahrani G, et al. discovered a 71.8 percent prevalence of hypertension among hyperlipidemic individuals in previous research (4). When compared to earlier studies that looked at the prevalence of hypertension in the general population, this study showed that it is much greater. Another study by Bcheraoui C et al. intended to determine the prevalence of hypertension in Saudi Arabia's general population, and the results revealed a prevalence of 15.2 percent (5), while another study by Tohme R. found a prevalence of 23.1 percent (6). Other studies have established a link between a high incidence of hypertension and the occurrence of hyperlipidemia (7), (12), (13), (14), (15). One hypothesis for why hyperlipidemia is linked to the occurrence of hypertension is the influence of hyperlipidemia on the reduction of nitric oxide (NO), a vasodilator (16), as well as the link between hyperlipidemia and increased vasoconstrictor molecule release as a result of activation of the renin-angiotensin-aldosterone pathway (17). Considering the prevalence of diabetes mellitus among hyperlipidemic patients, this study reported a prevalence of 41.3%. With respect to diabetes mellitus prevalence, it was recognized to be 59.2 percent in Alzahrani G, et al.'s study (4). In comparison with other reports, the prevalence of diabetes mellitus among the general population was

found to be (12.1%) (18)–23.7%) (19), whereas this study showed that the prevalence of diabetes mellitus among the hyperlipidemic population was much higher. The relation between hyperlipidemia and diabetes mellitus might be because of the role of lipoprotein lipases, which are responsible for lipid breakdown and are controlled by insulin concentration (20). Moreover, the findings revealed that hypertension and diabetes mellitus are significantly more prevalent in the elderly population. These results confirm the results published in previous studies [1,3,5]. Furthermore, the study shows that there is a significant relationship between the incidence of hypertension and diabetes mellitus, which is supported by previous studies (21) (22) (23). The incidence of hyperglycemia and resistance-induced hyperinsulinemia is associated with increasing peripheral artery resistance, vascular remodeling, and increased body fluid volume, which are associated with increased blood pressure, inducing hypertension (22).

## Limitations

Concerning the limitations, there were a set of limitations to the present investigation that were identified. One of these disadvantages is the reliance on data from a single institution. As a result, the findings could not be extrapolated to the populations of Riyadh or the Kingdom of Saudi Arabia. Consequently, it's highly encouraged that a larger-scale cohort investigation or multicenter research be conducted. In addition, female sex involvement constitutes only 14.3% of the whole sample.

## Conclusion

It was revealed that most patients with hyperlipidemia also have concurrent hypertension. On top of that, most hyperlipidemic patients are diagnosed with diabetes mellitus. Overall, the main findings of the present study support previous studies' results that suggest an association between hyperlipidemia and hypertension.

**Declaration of Interests:** the authors declare they have no conflict of interest.

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**Statement of Ethics:** Ethical approval for this study's conduction and data collection was reviewed and approved by the Institutional Review Board (IRB) committee of Imam Mohammad Ibn Saud Islamic University. Written informed consent was obtained from all participants.

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