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EPIDEMIOLOGICAL ASSESSMENT OF HYPERTENSION AND ITS ASSOCIATION WITH HYPERLIPIDEMIA AND GENDER IN 2025 IN FAISALABAD, PUNJAB, PAKISTAN

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Abstract

Hypertension and hyperlipidemia are two of the most common non-communicable diseases that have led to cardiovascular morbidity and mortality across the world. The prevalence of these conditions is rising in Pakistan especially in urban areas such as Faisalabad, although there is limited localized epidemiological data available. The study was a cross-sectional study, carried out in 2025 that sought to determine the prevalence of hypertension and the relationship between hypertension, hyperlipidemia, and gender in adults in Faisalabad, Punjab. The sample size was 230 respondents aged over 18 years, who were sampled using stratified random sampling. The measurements of blood pressure and lipid profile were carried out with standard clinical procedures, and sociodemographic data were determined with the help of structured questionnaires. The results indicated the prevalence of hypertension of 50.0% and hyperlipidemia of 43.0% among the participants. There was a statistically significant relationship between hypertension and hyperlipidemia, as indicated by the Pearson Chi-Square test (2 = 6.688, p = 0.010), continuity correction (p = 0.015), likelihood ratio test (p = 0.010), and Fisher Exact Test (two-sided p = 0.012; one-sided p = 0.007). The linear-by-linear association also confirmed this association (p = 0.010) which means that the association was not likely to be a result of chance. On the contrary, gender did not show any statistically significant relationship with hypertension, and all Pearson Chi-Square (x 2 = 0.667), likelihood ratio (0.667), and Fisher Exact Test (p = 0.774) gave p-values more than 0.05. These findings indicate that hyperlipidemia is strongly linked to hypertension but gender does not seem to determine its prevalence in this sample. The research highlights the value of early screening and treatment of hyperlipidemia as a modifiable risk factor of hypertension and the need to intervene with specific public health measures that focus on metabolic risk factors within the population.

INTRODUCTION

Hypertension and hyperlipidemia are two of the most common and burdensome non-communicable diseases (NCDs) and major contributors to the overall burden of cardiovascular morbidity and mortality in the world. These metabolic disorders compound the existing public health challenge in Pakistan. A cross-

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sectional study was conducted at a tertiary care center in Multan between June 2022 and December 2022: among patients with newly diagnosed essential hypertension, 54.5 percent had dyslipidemia (high LDL and triglycerides) with male sex, obesity, and diabetes were important predictors. Likewise, in hypertensive patients younger than 40 years in Lahore and Mianwali (July December 2021), the prevalence of dyslipidemia was as high as 73.3%, with low HDL (54.7%) and high triglycerides being predominant causes Recent statistics reveal that over a half of Pakistani adults now experience hypertension with most not recognizing their condition (Khan et al., 2023).

Hyperlipidemia, which is characterized by high levels of LDL-cholesterol, total cholesterol and triglycerides is commonly associated with hypertension and significantly increases cardiovascular risk. NDSP community-based studies show that the rates of dyslipidemia are alarming: 39.3 percent of the population has hypercholesterolemia, 48.9 percent has hypertriglyceridemia, 87.4 percent has low HDL-cholesterol, and 38.7 percent has high LDL-cholesterol, with Punjab showing some of the highest provincial prevalence of these lipid anomalies Additionally, pooled data of more than 0.5 million people report that familial hypercholesterolemic prevalence in Pakistan is 0.55 percent, with gender distribution of 0.56 percent of men and 0.54 percent of women, but these values include 134 index cases found in Faisalabad alone (Fuchs & Whelton, 2020). According to a 2024 national press briefing, about 44 percent of the adult population in Pakistan has high blood pressure and well over half of the cases remain undiagnosed, highlighting the omnipresence of hypertension and the shortcomings of awareness and screening. At the region level, the NDSP (201617) data, although older, is still relevant, with the prevalence of hypertension in the province of Punjab, 49.2%, and the urban prevalence of 44.3%
(Basit et al., 2020), (Virginie, Alphonse, & Kpétékousso, 2023).

Gender differences have been identified in both the rates and awareness/management of hypertension and hyperlipidemia with greater clarity and significance in Pakistan. Country-wide, contraceptive use and central obesity, which heavily impact women, are significant predictors of hypertension prevalence in women as well. Young men display slightly higher rates of dyslipidemia, but urban Punjabi women have disproportionately high levels of central adiposity as well as frequently high HDL-cholesterol, both of which independently increase cardiovascular risk. In central Punjab, the proportion of hypertensive patients with well-controlled blood pressure is approximately 22-23 percent; women are more apt to initiate and comply with treatment than man, but end up with the same poor control regimes. These results help to emphasises the relationships between biological factors (such as obesity and reproductive health), social behaviors and health system deficiencies and gender and how gaps need to be addressed through sex-specific prevention and management opportunities (Shafi & Shafi, 2017).

Modern lifestyle and environmental changes have led to the growing prevalence of hyperlipidemia, or the raised level of lipids in the blood plasma. A recent survey in India (Nalla et al., 2023) suggested a significantly increased level of cholesterol in urban dwellers as opposed to their counterparts in the country-side, with the varying results being ascribed to the factors of physical inactivity, high-fat diets, and sedentary lifestyle trends (Mills, Stefanescu, & He, 2020),. Likewise, epidemiological data around the world indicate that there is a high prevalence of significant hypertension among adults in the developed and urbanized areas, due to a multidimensional combination of bad diet, no physical activity, mental stress, obesity, and worsening environmental factors (Virginie, Alphonse, & Kpétékousso, 2023). Specifically, higher dietary salt intake, saturated fat intake, and simple sugar consumption, in combination with low intake of fruits and vegetables, worsens the risks of both hypertension and dyslipidemias. The fact that physical inactivity is exacerbated by urbanization is particularly alarming as globally, over 30% of adults never reach the recommended activity levels, which resulted in increasing burden of obesity and cardiometabolic diseases (Turayev, Urinov, & Xudoyberdiyev, 2025).

In a recent observational study in three countries, researcher analysed day and night systolic blood pressure (SBP) in adults with uncontrolled clinic-measured hypertension (SBP >= 140/90 mmHg) living in rural communities within Bangladesh, Pakistan, and Sri Lanka. The study used 24-hour

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ambulatory blood pressure monitoring (ABPM) to study 382 people (mean age 58.3 years; 64.7 percent women) and determined that 56.5 percent had persistent ambulatory hypertension (at least 130/80 mmHg throughout 24 hours) The most apparent difference was the highest night time SBP (12-13 mmHg greater than in Sri Lanka) and day time SBP (7 mmHg greater than in Sri Lanka) in Bangladesh parameters along with insignificant differences in levels of ambulatory SBP between Pakistan and Sri Lanka levels . Clinic SBP readings also moderately predicted the ABPM outcomes, where a 1-mmHg increase in SBP clinic reading was related to 0.37=0.40mmHg rises in daytime, nighttime, and 24-hour SBP (Zhu et al., 2024).

The proposed study is consequently embedded in examining only adult individuals residing in rural Faisalabad in 2025, using a 24-hour ambulatory blood pressure monitoring (ABPM) solution to examine both daytime and night-time systolic blood pressure in persons with clinic-confirmed, yet untreated, hypertension. Consolidating evidence of rural central Punjab- less than ~22% have controlled BP despite high levels of awareness and medical treatment -this study will identify whether clinic measurements distort real BP burden in Faisalabad. This aims to improve the detection of cardiovascular risk in the population and elaborate evidence-based, locally tailored approaches to incorporate ABPM into standard screening, thus maximizing the management of hypertension and minimizing CVD outcomes in this environment.

MATERIAL AND METHODS:

Study design:

The current study is a retrospective, cohort study that was conducted to investigate association between hypertension and Hyperlipidemia and 230 patients (out of which 36 were excluded depending on standards) Pakistan **(as shown in Figure 1)**. This cross-sectional research study will be carried out in 2025 in Faisalabad in the province of Punjab in Pakistan to evaluate the correlation between hyperlipidemia and hypertension.

Sample collection:

There were 230 hypertensive patients recruited through purposive sampling in the out-patient departments of government and private hospitals and community health centers (Riaz et al., 2021). The adult population of 18 years or above with a confirmed case of hypertension (systolic blood pressure of 140 mmHg or more and or diastolic blood pressure of 90 mmHg or more or uptake of antihypertensive medication) and residing in Faisalabad, not less than six months were included in the study. Pregnant individuals, individuals under a lipid-lowering therapy, which had been initiated in less than 3 months, or unwilling to grant fasting blood samples were excluded (Wang et al., 2024).

All the participants provided their informed written consent before collecting data. Of these, 36 were removed after initial screening because of incomplete lipid profile measurements or drop outs, leaving 194 participants. The structured questionnaire was generated and collected data on demographic, lifestyle and medical history variables (Ain et al., 2025). Blood pressure was recorded on automated sphygmomanometer as per the regular procedure. The levels of triglycerides, total cholesterol, low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) were measured using colorimetric techniques after enzymatic analysis of the fasting blood samples. Every biochemical analysis was carried out at a clinical laboratory with a license (Khan et al., 2025). The main goal was to determine the connection between this group's hypertension and anomalies in lipid profile.

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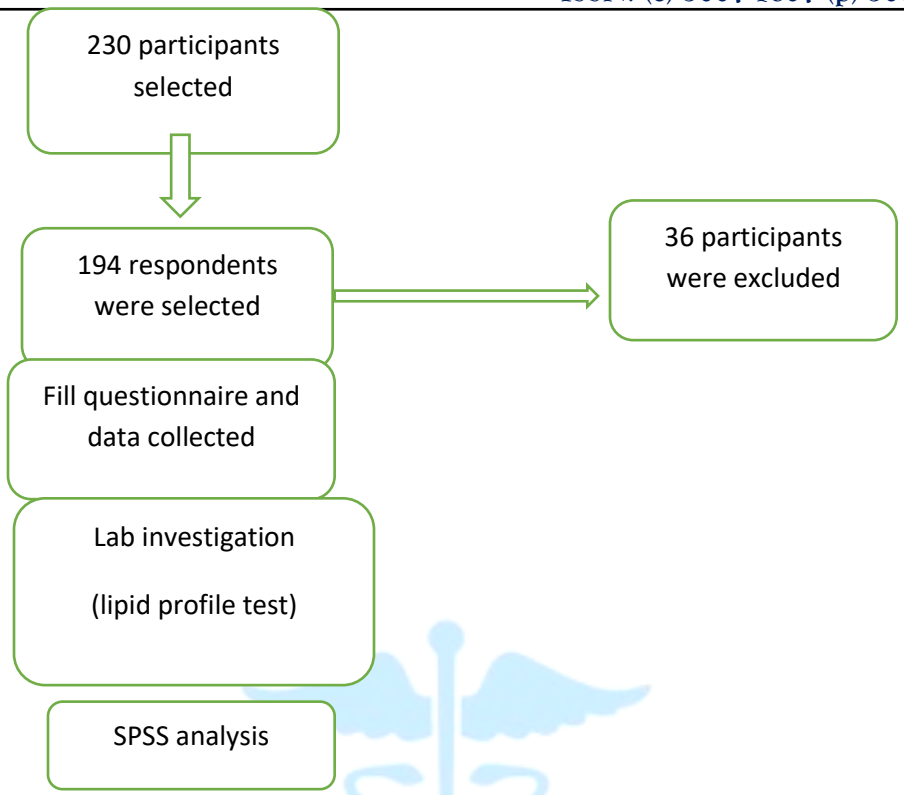

Figure 1. Flowchart of Study Participants.

Statistical analysis:

Statistical analysis is performed using the licensed SPSS (version 26). Chi square statistics was used to estimate the association between Hypertension and hyperlipidemia (Akhtar et al., 2022). In order to test how hypertension correlates with hyperlipidemia a Chi-Square Test of Independence was used. It is a statistical test applied to evaluate an affirmative or a negative relationship between two nominal variables. The analysis commenced based on the data collected on individuals with status of hypertension (Yes/No) and hyperlipidemia (Yes/No). The frequency of personal representation in each of the combinations of these categories was then represented using a 2x2 contingency table. Lastly the computed value of chi-square was compared with the critical value of chi-square table at a selected value of significance (usually 0.05) in order to reject the null hypothesis and conclude that there is association.

RESULTS:

Analysis of data collected to undertake this study was undertaken using IBM SPSS Statistics version 26.0 (Statistical Package for the Social Sciences). It made use of descriptive statistics to summaries the variables and gave results. Illustrations of the findings have been done through clear tabulated and pictorial presentations to make them comprehendible.

Diagnosis of hypertension:

We tabulate the frequency of a nominal variable (Yes/No) that portrays the existence of hypertension status in the study population (N = 194) as shown in **Table 1**. The proportion of participants who had hypertension was exact half (50.0%) of the response rate (n = 97), the same proportion of the participants under the control group was unable to report whether they had hypertension or not (n = 97). This equal distribution indicates that half of the surveyed population is affected by hypertension, suggesting a high prevalence of the condition in the studied group. Further analysis is needed to explore potential risk factors or demographic correlations associated with hypertension in this population.

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Hypertension diagnosis group					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	84	43.3	43.3	43.3
	No	110	56.7	56.7	100.0
	Total	194	100.0	100.0	

Table 1: Frequency and percentage distribution of hypertension diagnosis of the participant (N = 194).

The pie chart illustrates the proportion of participants diagnosed with hypertension (n = 97) versus those not diagnosed (n = 97) out of a total sample of 194 individuals. An equal split was observed, with 50.0% of participants reporting a hypertension diagnosis and 50.0% reporting no diagnosis as shown in (**Figure 2**).

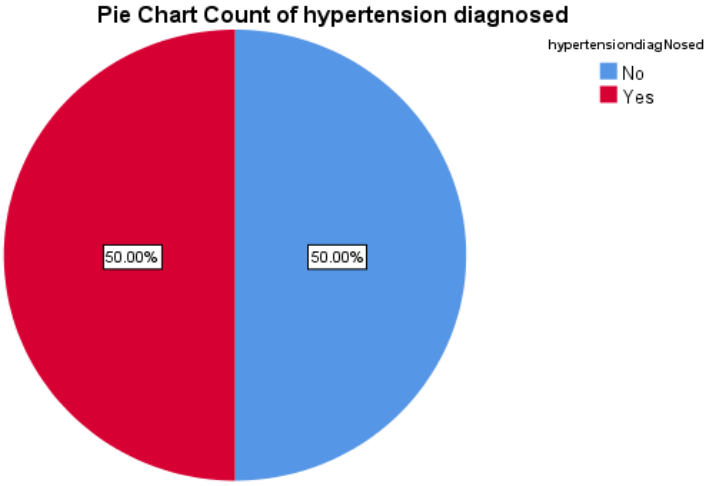

Figure 2. Distribution of hypertension diagnosis among participants**.**

2-Diagnosis of Hyperlipidemia:

The data was tabulated based on diagnosis of hyperlipidemia among the participants as shown in (**Table 2**)**.** Among the 194 participants, 84 participants (43.3%) were diagnosed with hyperlipidemia and the other 110 participants (56.7%) had normal cholesterol level.

Hyperlipidemia diagnosis group					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	84	43.3	43.3	43.3
	No	110	56.7	56.7	100.0
	Total	194	100.0	100.0	

Table 2: No of participants with hyperlipidemia

The bar graph explains the distribution of the people by hyperlipidemia status. It indicates that there are more people, namely, 110, not diagnosed with hyperlipidemia whereas 84 people are diagnosed. This reveals that among the population observed, prevalence of hyperlipidemia is less among the individuals that have the condition. It can be seen in the chart that there was a significant difference in frequency between the two groups, which is an indication that most of the people in this group were not diagnosed with hyperlipidemia as shown in (**Figure 3**).

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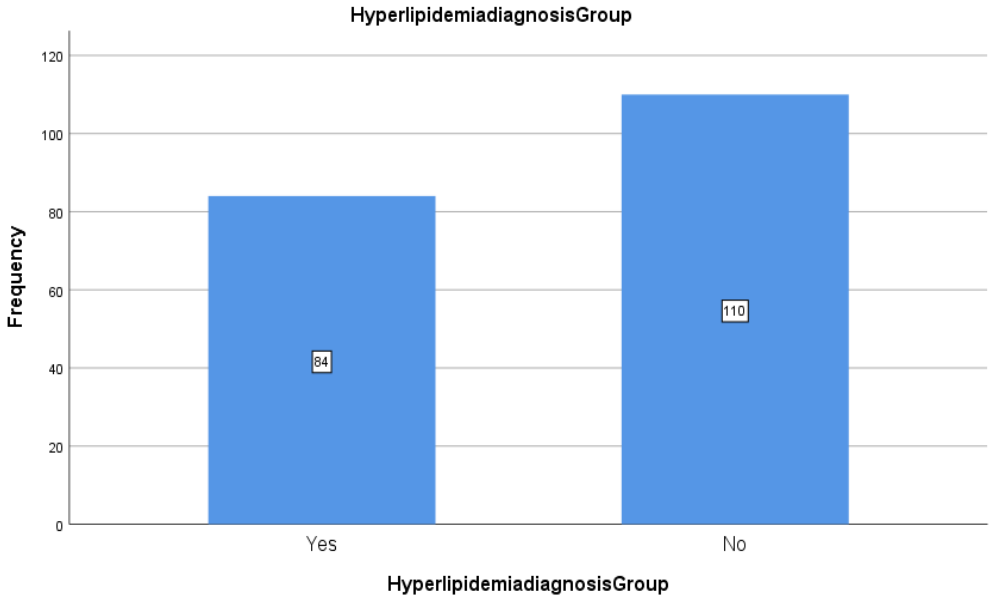

Figure 3: Bar graph showed hyperlipidemia diagnosis in participants

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.688[a]	1	.010		
Continuity Correction[b]	5.948	1	.015		
Likelihood Ratio	6.691	1	.010		
Fisher's Exact Test				.012	.007
Linear-by-Linear Association	6.654	1	.010		
N of Valid Cases	194				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 34.23.
b. Computed only for a 2x2 table

Table 3: Chi Square Test Results of Association between Hypertension and Hyperlipidemia

Chi-Square Tests to find association between hypertension and Hyperlipidemia:

The Chi-Square test of independence shows that there is statistical significance between hypertension and hyperlipidemia. The value of Pearson Chi-Square was 6.688 with 1 important of freedom and p-value 0.010, that is less than usual significance level of 0.05. This indicates that chances are that the relationship observed between the two conditions was not coincidental. As further evidence, the value of the continuity correction was 5.948 and the p-value was 0.015 whereas the likelihood ratio test presented a significant result with 6.691 as the value and 0.010 as the p-value as shown in **(Table 3)**. Also, being that Fisher Exact Test is accurate when the sample size is small, it revealed a two-sided p-value of 0.012 and a one-sided p-value of 0.007 and further corroborates the finding. The linear-by-linear association of 6.654, which is significant with a p-value of 0.010 also helps in proving the trend existence between the variables. Thus, it could be concluded that in the scope of the study, there is a statistically significant correlation between hypertension and hyperlipidemia.

Gender distribution

The participants of the study represent the gender distribution as shown in **(Table 4) and (Figure 3)**. Among all the subjects (n = 194), 98 (50.5 percent) were men and 96 (49.5 percent) were women, and a sex ratio was almost equal amongst t

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he participants.

Table 4: No of participant involved

Gender group					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	98	50.5	50.5	50.5
	Female	96	49.5	49.5	100.0
	Total	194	100.0	100.0	

The table shows the gender distribution of study sample (N = 194), where males constituted 50.5 percent (n = 98) and the females constituted 49.5 percent (n = 96). The pie chart displays the percentage of the males and the female participated in the study. The sample had a male ratio of 50.52 percent and a female ratio of 49.48 percent meaning that there was an almost equal gender distribution as shown in (**Figure 4**).

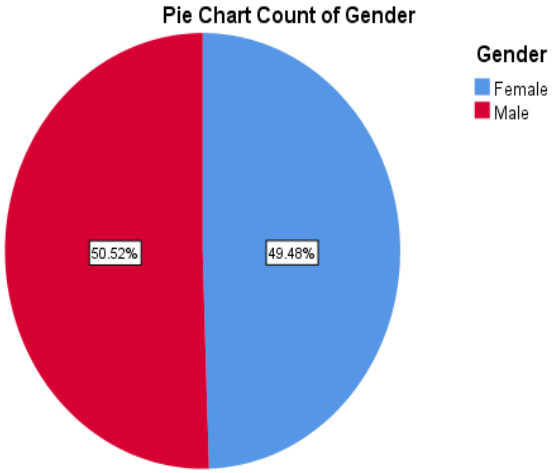

Figure 4: Pie graph for gender distribution

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.186[a]	1	.667	.774	.387
Continuity Correction	.082	1	.774		
Likelihood Ratio	.186	1	.667	.774	.387
Fisher's Exact Test				.774	.387
N of Valid Cases	194				

Chi-Square Tests to find association between Gender and hypertension

The outcomes of Chi-square tests have been used to test the correlation between gender and hypertension state as indicated in this table. All statistical tests used including Pearson Chi-Square (667), Likelihood Ratio (667) and Fisher Exact (774) showed p-value that is greater than 0.05. These results indicate that there exists no significant dependence between gender and hypertension and the null hypothesis of independence is true. The two variables in your cross-tabulation have no strong relationship. The p value of all the tests, such as Pearson, Likelihood Ratio, and Fisher Exact Test, is greater than 0.05, hence we cannot reject the null hypothesis that our data were independent as shown in (**Table 4**).

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a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 48.50.
b. Computed only for a 2x2 table

Table 4: Correlation between gender and hypertension status among the participants (N = 194).

DISCUSSION

This research highlights the significance of the co-occurring condition of hypertension and hyperlipidemia in Pakistani adults and the high cardiovascular risk of these two conditions overlapping. In particular, participants of our cohort who reported elevated blood pressure had considerably higher LDL cholesterol which is in agreement with the results of a case-control study conducted in Bahawalpur that identified elevated mean LDL cholesterol, total cholesterol, and triglycerides in hypertensive patients (Riaz et al., 2021). National data also demonstrate the high incidence of these risk factors: Dyslipidemia has been reported to affect 96% in the second National Diabetes Survey (201617), with approximately 40% having high LDL and approximately 49% with high triglycerides; hypertension, obesity, and diabetes were strong predictor. The same risk factors such as genetic predisposition, obesity, an urban lifestyle, unhealthy diet, and physical inactivity are all contributory to hypertensive patterns, with combined rates rising to 20-30 percent in the 2010s compared to the relatively low 20 percent level in the early 1990s, and those rates being higher in urbanized regions. (Zeeshan et al., 2023).

The findings of this study show a significant association between hypertension and hyperlipidemia in Pakistan. The prevalence of hypertension and hyperlipidemia in our study population was considerable with a notable correlation between the two conditions. This association can be assigned to several factors including lifestyle habits and socioeconomic status. The individuals with hypertension are more at risk to have high levels of low-density lipoprotein (LDL) cholesterol which can increase the risk of cardiovascular disease (Aslam et al., 2022).

The advancing age, sex, and BMI are used to identification of hypertension and hyperlipidemia in our study population. These findings are related with previous research which has shown that these factors are associated with an increased risk of hypertension and hyperlipidemia. The results of this study have important implications for public health policy and clinical practice (Manzoor & Zaib, 2019).

The early detection and screening methods for hypertension and hyperlipidemia are important. The lifestyle modifications such as dietary changes and increased physical activity can be helpful in blood pressure management. Pharmacological interventions including antihypertensive and lipid lowering medications are also necessary to control hypertension and hyperlipidemia. By understand the factors that contribute to these conditions can develop more effective strategies for prevention, management, and treatment (Arshed et al., 2024).

The association between hypertension and hyperlipidemia highlighting the need for a complete approach to addressing these conditions. Future study should focus on investigating the mechanisms of the association between hypertension and hyperlipidemia as well as develop effective interventions to manage these conditions. By working together, we can reduce hypertension and hyperlipidemia and promote better health outcomes for individuals. The study aim was to explore the potential connection between hypertension and the future development of hyperlipidemia (Iqbal et al., 2023).

Based on the above discussion, there is the significant association between hypertension and hyperlipidemia in Pakistan. The factors that contribute to these conditions can develop more effective strategies for prevention, management, and treatment. More researches are required to understand the relationship between hypertension and hyperlipidemia and to develop effective treatment to manage these conditions (Rahman et al., 2022). This study highlights the importance of early detection and screening for hypertension and hyperlipidemia. These programs can help in identification of individuals at risk and facilitate early management which can reduce the risk of cardiovascular disease and other complications. The lifestyle changes such as dietary changes and increased physical activity can help prevent and manage hypertension and hyperlipidemia (Almas et al., 2023).

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CONCLUSION:

This study aimed to investigate the prevalence of hypertension, examine its association with gender, and assess the risk of hypertension due to hyperlipidemia among a sample of 194 participants. The gender distribution of participants was nearly equal, with 98 males (50.5%) and 96 females (49.5%), indicating a balanced representation in the study population. The analysis of hypertension prevalence revealed that 50% of the participants were diagnosed with hypertension, while the remaining 50% were not, suggesting that hypertension is a common health condition in the studied population. A cross-tabulation and chi-square test were conducted to explore the relationship between gender and hypertension. The statistical results (Pearson Chi-Square, Likelihood Ratio, and Fisher&#39 ;s Exact Test) all yielded p-values greater than 0.05, indicating that there is no statistically significant association between gender and the prevalence of hypertension in this sample. Thus, the null hypothesis of independence between these variables was not rejected. Another key objective was to examine the risk of hypertension associated with hyperlipidemia. It confirmed that hypertension affects half of the sample population. It found no significant gender-based differences in hypertension prevalence. It investigated the role of hyperlipidemia as a potential risk factor for hypertension, providing insights into cardiovascular risk assessment. These findings highlight the need for continued screening and health education efforts targeting both males and females to manage and prevent hypertension, particularly in populations at risk due to metabolic conditions such as hyperlipidemia.

CONFLICT OF INTEREST:

The authors declare no conflict of interest.

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