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Study the Association of Serum Lipid Profile with Hypertension in Kingdom of Saudi Arabia- A Case Control Study

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ABSTRACT

Introduction: The highest rates of morbidity and mortality in Saudi Arabia are caused by heart disease, which is significantly increased by hypertension and dyslipidemia. The aim of this research was to compare the lipid profiles of hypertension patients in Saudi Arabia to those of normotensive control people to see if there was any relation. **Methods:** This Case Control study was performed at "Wahat Alshifa polyclinic Madinah Munawarah" Saudi Arabia, with 235 participants 201 hypertension patients and 34 normotensive controls. Socio-demographic information, measurements of anthropometric factors, blood pressure levels, and lipid profile information, including total cholesterol, triglycerides, low density lipoproteins (LDL), and high-density lipoproteins (HDL), were all gathered. **Results:** In this study lipid profile association between hypertensive and controls was as followed, high Total cholesterol (TC) (65.2% vs. 35.3%; P: 0.001), high triglyceride (TG) (77.6% vs. 61.8%; P: 0.047), low HDL (95.5% vs. 70.6%; P: 0.0001) and high LDL (72.6% vs. 50%; P: 0.008). While in our study hypertensive patients had 3.43and 2.14 times higher TC and TG, 2.65 times higher LDL, and 8.88 times lower HDL than normotensives. **Conclusion:** In conclusion, this study finding showed the highly significant association between hypertension and lipid disorders. In order to prevent heart attacks, strokes, as well as other multiple medical conditions, hypertensive individuals in Saudi Arabia need to get their blood pressure & lipid profile measured on a regular basis.

INTRODUCTION

Hypertension and lipid disorders are attributable for over eighty percent fatalities and morbidities in countries with low or middle incomes, two important risk factors for coronary artery disease[1]. According to projections, hypertension will become more common everywhere, particularly in emerging nations[2]. In the past few decades, Southeast Asia, particularly the Kingdom of Saudi Arabia, has experienced a rise in cardiovascular disease rates due to rapid urbanization, a rise in life expectancy, poor diets, and changes in lifestyles[3]. It is well acknowledged that CVD is linked to hypertension as well as higher blood levels of total cholesterol, triglycerides, and low-density lipoprotein (LDL). Contrarily, a low amount of HDL (high-density lipoprotein) increases the risk of dying from a CVD[4]. Research on epidemiology has proven that coronary artery disease and hypertension are strongly related. Adult incidence of hypertension was predicted to range between 14 to 42% in the non-communicable disease risk factors survey done with the Kingdom of Saudi Arabia included. According to the Saudi Arabia Nutrition, Health, and Demographic Survey, 34 percent of adults in the country have hypertension[5]. However, the estimates based on a number of research and most certainly do not take other symptomatic cardiovascular diseases and hypertension into consideration[6].

Lipid disorders are a primary contributor to cardiovascular diseases. Serum lipid profile values vary significantly between various population groups globally. According to studies by Kathak et al.[7] and Pizon et al.[8], higher LDL, TG, TC, and lower HDL levels are linked to significant CVD risk factors. Dyslipidemia, which includes

a changed ratio of high TC levels and a single assessment of the LDL or TG, is typically linked to higher blood pressure (BP) levels. Total LDL cholesterol levels and the risk of CVD are closely related. Lipid abnormality patterns and their respective bearing on cardiovascular risk are not well understood. Regardless of LDL levels, low HDL has come to be recognized as a risk factor on its own for adverse CVD outcomes. We lack thorough information on the true frequency of low HDL-cholesterol between patients getting treatment for lipid disorders despite infrequent studies suggesting that the disorder is common[9]. These findings strongly imply that low cholesterol levels are a clinically important issue. Consuming red meat and saturated fats is known to increase the risk of cardiovascular disease, particularly hypertension, in Saudi Arabia[10,11].However, information on the association between cholesterol levels and hypertension in Saudi Arabian patients is scarce in the literature. Cardiovascular disease has the highest morbidity and death rates, and two significant risk factors are hypertension and abnormal lipid levels. By contrasting the blood lipid levels of hypertensive patients with those of normotensive control participants in Saudi Arabia, the study's objective was to determine if high blood pressure and lipid profiles are associated. Rarely documented in Saudi population, associations of lipid disorders with hypertension have produced inconsistent findings. The purpose of this survey was to gather additional evidence.

METHODOLOGY

A Case Control study conducted at "Wahat Alshifa polyclinic Madinah Munawarah, KSA" during June to September 2023 with 235 people, 201 newly diagnosed hypertension patients (cases), and 34 persons with normal blood pressure (normotensives/Controls) was carried out in Saudi Arabia. Most of the participants were among the ages of 30 and 60. The attending doctor picked participants one at a time from the outpatient center. Patients with significant medical issues such as heart, kidney, or liver difficulties were excluded. Additionally, people on antihypertensive and lipid-lowering medications were not included. Physical interviews, demographic, clinical assessments, and laboratory tests for serum lipid profiles were used by qualified research assistants to gather data after receiving informed consent. The ethical approval was received.

Individuals' heights, weights and body mass index (BMI) were recorded. A physician took the patient's blood pressure following the accepted BP measurement technique after the individual had taken a break for ten minutes.

The Statistical Package for Social Sciences software, version 22 (SPSS Inc., Chicago, IL, USA), was used to analyze the data. The research participants' demographic information was presented using descriptive and inferential statistics.

RESULTS

A total of 235 subjects including 201 hypertensive(Cases) and 34 normotensive (Controls) included in this study. Mean age of overall study subjects was 48.8+/-8.4 years. Mean BMI was 29.4+/-4.8 kg/m^2. There was no significant difference in age and BMI between the both study groups. Mean Total Cholesterol (TC) was 213.4+/-40.9 and 197.4+/-25.8 mg/dL, Triglyceride (TG) was 278.9+/-151.2 and 215.1+/-88.4 mg/dL, HDL was 38.9+/-12.9 and 46.2+/-16 mg/dL and LDL 125.73+/-43.1 and 108.76+/-35.1 mg/dL of hypertensive and control group respectively. All the lipid profiles had significant difference ($P<0.05$). Lipid values of TC, TG and LDL are found increase in hypertensive patients as compared to normotensive subjects while HDL had decreased in hypertensive patients compared to controls.

The age distribution of the study participants is shown in the table (See Table 1). 62.1% of patients are between the ages of 41 and 55. A sizeable portion, 22.1%, are between the ages of 56 and 75, and 15.7 % are between the ages of 25 and 40. It's interesting that few of the study participants were between the ages of 25 and 40. This distribution gives essential information on the patient population's age distribution, which may have an impact on healthcare strategy and intervention tactics. The patient population, which makes up 93.6% of the sample overall, is primarily male, according to the gender distribution. In comparison, women account for only 6.4% of the population, a much lesser percentage. This gender disparity is significant and may pose issues with respect to the underlying health condition under study, access to medical services, or gender-specific healthcare demands. It might be necessary to look at gender differences in health disparities further. According to the distribution of patients determined by BMI/ obesity, 38% were found as obese. It is essential to understand how patients' body weight is distributed because it might be linked to a variety of health issues and influence treatment choices. The distribution of patients' educational levels reveals that majority of them have at least a secondary education. Education levels can affect a patient's knowledge of medical instructions, health literacy, and overall healthcare results. This distribution highlights the educational diversity of the patient group. Patients' socioeconomic circumstances are divided into groups based on their income levels. The majority, 64.7 %, are classified as having "Low" incomes (under 3,000 SAR), while just 35.3 % are classified as having "Middle" incomes (between 3,000 and 10,000).

Hba1c is raised above 6.5 in majority of the patients which is abnormal and mostly patients are diabetic here due to sedentary life style and high calorie diet. A diagnosis of diabetes mellitus has been made in 58.3 percent of patients, whereas the remaining 41.7 percent of patients do not have the disease.

The "Groups" category sheds light on how the study's participants were distributed. 15.3 percent of people had total cholesterol levels between 251 and 300 mg/dL, a modest but significant amount that indicates an increased cardiovascular risk.

Total Cholesterol levels in 39.1% of participants lie within the 200 mg/dL range, that is a typical and generally healthy range. However, 60.9 percent have higher TC levels, which 200 or more mg/dL, which may indicate elevated TC, which is linked to a higher risk of cardiovascular disease. Another essential element of lipid profiles is triglycerides. Triglyceride levels in 24.7% of

people lie within the 150 mg/dL that is a typical and generally healthy range. However, 75.3 percent have higher triglyceride levels, which TG level150 or more mg/dL, which may indicate hypertriglyceridemia, which is linked to a higher risk of cardiovascular disease.

High-density lipoprotein, or HDL, can be referred to as the "good cholesterol," because it plays a protective function in cardiovascular health only 8.1 percent of the sample falls in the >60 mg/dL range, which is regarded as normal. The undesirable range <60 mg/dL for HDL, which is generally advantageous for cardiovascular health, is only reached by 91.9% of patients.

LDL cholesterol, also known as low-density lipoprotein, is crucial for determining cardiovascular risk. The distribution of people's LDL values varies widely. Notably, 69.4 percent are considerably high in the >100 mg/dL range for LDL cholesterol. Who are more likely to have elevated levels of LDL and greater risk for heart disease.

In this study lipid profile association between hypertensive and controls was as followed, high Total cholesterol (TC) (65.2% vs. 35.3%; P: 0.001), high triglyceride (TG) (77.6% vs. 61.8%; P: 0.047), low HDL (95.5% vs. 70.6%; P: 0.0001) and high LDL (72.6% vs. 50%; P: 0.008). While in our study hypertensive patients had 3.43 and 2.14 times higher TC and TG, 2.65 times higher LDL, and 8.88 times lower HDL than normotensives (Table 2)

Table 1

Patients Demographic, Clinical characteristics and lipid profile

Study variables		Cases	Controls	Overall	P-value
Age		48.9+/-8.6	48+/-7.1	48.8+/-8.4	0.565†
BMI		29.7+/-4.9	28.2+/-3.6	29.4+/-4.8	0.097†
Total Cholesterol (mg/dL)		213.4+/-40.9	197.4+/-25.8	211.08+/-39.5	0.028*†
Triglyceride (mg/dL)		278.9+/-151.2	215.1+/-88.4	269.67+/-145.5	0.018*†
HDL (mg/dL)		38.9+/-12.9	46.2+/-16	39.9+/-13.6	0.003*†
LDL (mg/dL)		125.73+/-43.1	108.76+/-35.1	123.28+/-42.4	0.031*†
Age groups	25-40 years	33(16.4%)	4(11.8%)	37(15.7%)	0.544§
	41-55 years	122(60.7%)	24(70.6%)	146(62.1%)	
	56-75 years	46(22.9%)	6(17.6%)	52(22.1%)	
Gender	Female	12(6%)	3(8.8%)	15(6.4%)	0.529§
	Male	189(94%)	31(91.2%)	220(93.6%)	
Obesity	No	118(59%)	27(79.4%	145(62%)	0.023*§
	Yes	82(41%)	7(20.6%)	89(38%)	
Education:	Illiterate	1(0.5%)	1(2.9%)	2(0.9%)	0.657§
	Primary	17(8.5%)	3(8.8%)	20(8.5%)	
	Secondary	106(52.7%)	17(50%)	123(52.3%)	
	Intermediate	75(37.3%)	13(38.2%)	88(37.4%)	
	Higher	2(1%)	0(0%)	2(0.9%)	
Occupation	Employed	193(96%)	32(94.1%)	225(95.7%)	0.997§
	Unemployed	8(4%)	2(5.9%)	10(4.3%)	
Socio Economic Status	Low	130(64.7%)	22(64.7%)	152(64.7%)	0.611§
	Middle	71(35.3%)	12(35.3%)	83(35.3%)	
Diabetes Mellitus	No	89(44.3%)	9(26.5%)	98(41.7%)	0.051§
	Yes	112(55.7%)	25(73.5%)	137(58.3%)	
Total Cholesterol (mg/dL)	<200	70(34.8%)	22(64.7%)	92(39.1%)	0.001*§
	200 or more	131(65.2%)	12(35.3%)	143(60.9%)	
Triglyceride (mg/dL)	<150	45(22.4%)	13(38.2%)	58(24.7%)	0.047*§
	150 or more	156(77.6%)	21(61.8%)	177(75.3%)	
HDL (mg/dL)	<60	192(95.5%)	24(70.6%)	216(91.9%)	0.0001*§
	60 or more	9(4.5%)	10(29.4%)	19(8.1%)	
LDL (mg/dL)	<100	55(27.4%)	17(50%)	72(30.6%)	0.008*§
	100 or more	146(72.6%)	17(50%)	163(69.4%)	

Ind. t-test (†) & Chi-square test (§) applied; at 5% significance level; *: Significant values

Table 2

Association between Hypertension and Lipid profile

Lipid profile	OR	95% C.I for OR		Sig.
		Lower	Upper	
Total Cholesterol (≥200)	3.43	1.60	7.34	0.001*
Triglyceride (≥150)	2.14	0.99	4.62	0.051*
HDL (<60)	8.88	3.28	24.05	0.000*
LDL (≥100)	2.65	1.26	5.56	0.0108

Regression analysis at 5% significance level. OR: Odds Ratios; *: Significant values

DISCUSSION

The main cause of disability and death globally is cardiovascular disease (CVD), and dyslipidemia is a primary contributor to CVDs. Serum lipid profile values vary significantly between various demographic groups globally. Significant risk factors for CVD are recognized to be related with elevated blood levels of TC, TG, LDL, and reduced HDL. Globally, hypertension is acknowledged as a significant contributor to the risk of CVD, stroke, diabetes, and renal disorders. Around 80% of those with hypertension also have concomitant conditions such obesity, glucose intolerance, and abnormalities in lipid metabolism. [1, 5, 12, 13].

In this study lipid profile of hypertensive and controls was as followed, high Total cholesterol (TC) (65.2% vs. 35.3%; P: 0.001), high triglyceride (TG) (77.6% vs. 61.8%; P: 0.047), low HDL (95.5% vs. 70.6%; P: 0.0001) and high LDL (72.6% vs. 50%; P:0.008).All the lipids showed strong association with hypertension. Similar to our study finding this study results found that about 61% of participants with dyslipidemia. Furthermore, in this study the prevalence of elevated TG, TC, LDL and low HDL were (35.5% vs. 22.3%; P: 0.021), (33.7% vs. 9.7%; P: 0.001),

(35.5% vs. 15.3%; P: 0.001) and (74.4% vs. 85.2%; P: 0.010), in hypertensive and normotensive patients respectively. Dyslipidemia were higher in hypertensive participants than in the healthy participants[7].

The Saudi adult population was the subject of the current study. The results can be explained by noting that the incidence of hypertension was strongly correlated with lipid diseases such as high total cholesterol, triglycerides, LDL, and low HDL. Similar to our study results, a study on Chinese male patients revealed increased TC, HDL, and LDL had a substantial connection with hypertension. Additionally, HDL was favourably related with hypertension. Additional contributing variables like age, body mass index, FPG, and TC were discovered to be strongly connected to the incident of hypertension[14].

Genetic and environmental factors affect the prevalence of hypertension, and in addition to its negative hemodynamic consequences, metabolic syndrome and other cardiovascular risk factors frequently cluster in hypertensive individuals. One of the main public health issues in the world today is the metabolic syndrome, which encompasses visceral obesity, dyslipidemia, hyperglycemia, and hypertension[15]. Atherosclerosis of the arteries, endothelial cell destruction, inflammation, and oxidative stress are other pathophysiological processes that are shared by dyslipidemia and hypertension[16].

The association of lipid disorders with hypertension has been the subject of several prior investigations, and it has been shown that lipid disorders play a significant role in the development of hypertension. However, the relationship between lipid disorders and hypertension is still inconsistent between populations and patterns[14, 17]. In the 4thand 5thquintiles of triglycerides, the risk of having hypertension was 47% and 73% higher, respectively. The study's findings showed that, regardless of adiposity, there are links between factors associated to triglycerides and incident hypertension. This connection was greater than those seen for other regularly used lipid measures or lipid ratios[17].

In a comparative research with 159 hypertension patients and 75 healthy controls was carried out. In statistically significant contrast between hypertensive and normotensive patients, TC, TG, and LDL serum levels were more substantial while HDL levels were lower. Age and BMI significantly correlated with hypertension patients but not with normotensive patients. Based on the regression analysis, hypertension individuals had significantly higher levels of TC and TG, 1.2 times greater LDL, and 1.1 times lower levels of HDL than normotensives (P<0.05). while in our study hypertensive patients had 3.43and 2.14 times higher TC and TG, 2.65 times higher LDL, and 8.88 times lower HDL than normotensives. In order to prevent cardiovascular disease, stroke, and other comorbidities, hypertensive individuals need to have their blood pressure and lipid profile measured on a regular basis. those with hypertension are more likely than those with normotension to have dyslipidemia, including high levels of TC, LDL, TG, and low levels of HDL cholesterol. Similar to our work, the findings of this investigation indicated that high blood pressure may indicate specific disruptions in lipoprotein metabolism. Future methods for avoiding both hypertension and dyslipidemia by appropriate lifestyle modifications, medical care, or a mix of the two will be aided by this relationship. To avoid CVD and stroke, hypertensive patients must have frequent blood pressure and lipid profile checks throughout their primary care[1].Additionally, because of the evidence from earlier research that unhealthy diets rich in fat and calories might cause CVD due to the impact of dyslipidemia, it is necessary to determine the association between the incidence of CVD and the quality of diet as well[12].

There are a few limitations in our research. The sample size was obtained at a single centre. Furthermore, the control group was consecutively chosen and not age- and sex-matched, and our sample size was limited. Furthermore, we were unable to evaluate the effects of lipid profile change with those of dietary, physical activity, drug, or other factors.The following are our study's strengths. The first is a case-control study, which might indicate an association between dyslipidemia and hypertension. Second, variations in lipid profiles were examined; logistic regression analyses provided more clarification on the relationship between lipid patterns and, hypertension. These results add to our existing understanding of the prevalence of hypertension and dyslipidemia in Saudi population. The results of the current study among Saudi adult population demonstrate a strong association between lipid profile and hypertension. Reduced incidence of related cardiovascular disease can be achieved by early prevention of hypertension and lipid abnormalities. For a better understanding of the apparent connection, more studies that take into consideration hypertension, diabetes, and lifestyle are required. The Saudi population has a very high prevalence of modifiable cardiovascular risk factors. All cardiovascular risk factors require scheduled community-based screening. The incidence of coronary artery disease may eventually decline, and general quality of life may be enhanced, by improving primary care services to put a greater emphasis on risk factor control.

CONCLUSION

In conclusion, this study finding showed the highly significant association between hypertension and lipid disorders. The findings emphasize how urgent it is to combat hypertension, which is a significant public health issue in the Kingdom of Saudi Arabia. This thorough examination offers a thorough grasp of the study's demographic information and the cardiac condition of the patient group. The results provide useful information for planning targeted interventions, eliminating health disparities, and modifying healthcare services to fit the varied requirements of the community. They also highlight possible areas of concern. These results also provide a basis for future research and activities in healthcare planning to advance heart health in the Kingdom of Saudi Arabia. Furthermore, In order to prevent heart attacks, strokes, as well as other multiple medical conditions, hypertensive individuals in Saudi Arabia need to get their blood pressure & lipid profile measured on a regular basis.

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