

# The Relationship Between Lipid Profile and Hypertension

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## ABSTRACT

**Introduction:** Hyperlipidemia (HL) and High Hypertension (HT) are considered as risk factors for cardiovascular disease. Objective of the study was to study the relationship of lipid profile and hypertension.

**Material and Method:** The study was conducted among 240 subjects attending the outpatient of consultant physicians for routine health checkup in the city of Hyderabad, Telangana. 120 males and 120 females in the age group of 20-60 years without any major medical problem and those who were not on any medication were selected. They were assessed for their plasma lipid profile, anthropometrics (BMI) and blood pressure using standard methods and techniques.

**Results:** The results were found to be statistically significant for abnormal levels of lipids with changes in blood pressure.

**Conclusion:** The study correlated well with abnormal lipid profile levels and the incidence of higher blood pressure. Preventive measures and early diagnosis of hypertension and hyperlipidemia decrease the risk of cardiovascular disease. Hypertensive patients need measuring of blood pressure and lipid profile at regular intervals, as, elevated blood pressure may predict certain disturbances in lipoprotein metabolism.

**Keywords:** Hyperlipidemia (HL), Hypertension (HT), Coronary Artery Disease (CAD), Cardiovascular Disease (CVD), Triglycerides (TG), Total Cholesterol (TC), High Density Lipoprotein (HDL)

## INTRODUCTION

Hypertension (HT) is the most common chronic medical problem prompting frequent visits to the health care providers once it is diagnosed. It is not very often accompanied by any symptoms initially and its identification is usually through screening or when seeking health care for an unrelated problem. Hypertension is diagnosed on the basis of persistently high blood pressure.

World Hypertension League (WHL), an umbrella organization recognized that more than 50% of the Hypertensive population worldwide is unaware of their condition. To address this problem, WHL initiated global awareness campaign through mass media and public rallies and dedicated May 17<sup>th</sup> as World Hypertension Day.<sup>1</sup>

Hypertension is ranked as the third most important risk factor for attributable burden of disease in South Asia (2010).<sup>1</sup> World Health Organisation (WHO) has identified hypertension as the leading cause of cardiovascular mortality. Sustained hypertension over a period of time is a major risk factor of hypertensive heart disease, coronary artery disease, stroke, aortic aneurysm, peripheral artery disease and chronic kidney disease.<sup>2</sup> Hypertension is directly responsible for 57% of all stroke deaths and 24% of all Coronary Artery dis-

ease (CAD) deaths in India<sup>3</sup> and it is recognized globally as a major risk factor for Diabetes and renal disease. Published literature reports regional variations in mortality and prevalence of CAD and stroke in India. According to statistics South India has increased CAD mortality and Eastern India has high stroke rate.<sup>4</sup> Similar variations are also seen among urban and rural areas with CAD prevalence being higher in urban parts of India.<sup>4,5</sup> According WHO 2008 estimates the prevalence of hypertension in India was 32.5% (32.2% in males and 31.7% in females). Recent studies from India have shown the prevalence of hypertension to be 25% in urban and 10% in rural people in India.<sup>6</sup> Blood pressure rises with aging and risk of becoming hypertensive in later life is considerable.

As such hypertension exerts a substantial public health burden on cardio vascular health status and health care system in India. About 80% of hypertensives have co-morbidities such as obesity, glucose intolerance, and abnormalities in lipid metabolism (hyperlipidemia).

Hyperlipidemia involves abnormally elevated levels of any or all lipids in the blood like TG-triglycerides and TC-total cholesterol. Hypertension and Hyperlipidemia are silent markers and dangerous risk factors for cardiovascular disease (CVD) and account for more than 80% of deaths and morbidity in developing countries.<sup>7</sup> The objective was to study the association between blood lipid levels and hypertension.

## MATERIAL AND METHODS

The study was conducted among 240 subjects attending the outpatient department of consultant physicians for a routine health checkup in the city of Hyderabad, Telangana. 120 were males and 120 females. The subjects selected were in the age group of 20-60 years without any major medical problem and those who were not on antihypertension medication or lipid lowering drugs.

### Measurements

After obtaining oral and written consent, height and weight were measured with the subject in light cloths without shoes

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and BMI (kg/m<sup>2</sup>) was calculated.

Blood Pressure (BP) was measured by the physician using standard BP measurement protocol after the subject has rested for 10 mins. Two measurements were taken by mercury sphygmomanometer with 5 mins interval. The mean for systolic blood pressure (SBP) and diastolic blood pressure (DBP) was recorded. Hypertension was defined as SBP $\geq$ 140 mm Hg and DBP  $\geq$  90 mm Hg without antihypertension medication according to the 7<sup>th</sup> report of Joint National Committee on Prevention, Detection, Evaluation and Treatment of high blood pressure (JNC-7).

### Biochemical Analysis

A volume of 5ml of venous blood was collected in the morning after a 12 hr over night fast and serum was separated and centrifuged and analysed for serum lipid profile. Lipid profile parameters like total cholesterol (TC), triglycerides (TG) and high density lipoprotein (HDL) were estimated by enzymatic colorimetric method.

According to the National Cholesterol Education Programme expert panel on Detection, Evaluation and Treatment of high cholesterol in adults, the values are as follows:

TC (mg/dl) = < 200 - Desirable  
200-239 - Borderline high  
> 240 - Very high

TG (mg/dl) = < 150 - Desirable  
150-199 - Borderline high  
>200 - High

HDL (mg/dl) = <40 - Low  
 $\geq$  40 - Desirable

### RESULTS

By statistical package for social science (SPSS) software the results were presented as Mean, Standard Deviation (SD) and were compared using Student's t-test and a P-value  $\leq$  0.05 was considered statistically significant.

The chi-square statistic is 63.8023. The p-value is <0.00001. The result is significant at  $p < .05$  (Table-1). As age advances the risk of HT was found to be higher. Maximum number of cases of HT were in the age group of 40-60years.

The chi-square statistic is 43.4699. The p-value is < 0.00001. The result is significant at  $p < .05$  (Table-2). As the levels of serum TG increased, the incidence of HT also increased, with maximum number of HT cases being at TG >200.

The chi-square statistic is 22.5272. The p-value is .000013. The result is significant at  $p < .05$  (Table-3). High levels TC showed increased incidence of HT. more number of HT cases being at TC >240.

The chi-square statistic is 14.6581. The p-value is .000129. This result is significant at  $p < .05$  (Table -4a).

The chi-square statistic is 26.8646. This result is significant at  $p < .05$ .

In Table 4a and 4b with HDL levels >40, 34.6% (males) and 24.3% (females) had incidence of HT compared to HDL <40. The number of females with high levels of HDL was 103 as compared to 81males, giving an advantage to females against CAD.

The study included 240 subjects, 120 male and 120 female. Maximum number of HT cases was found in the Age group of 40-60 years, BMI >30, Male to female ratio 1.25:1. The number of HT cases was more with advanced age and high BMI. Males were found to have the incidence of HT more compared to females.

In Table 2 and 3 as the level of TG and TC increased the incidence of HT was found to be more. The mean  $\pm$ SD of TG 167.24  $\pm$  70.11, TC 194.11  $\pm$  37.05. In Table 4a and 4b, the serum HDL was significantly lower in HT cases, mean  $\pm$  SD being 40.75  $\pm$  6.95 in males and 44  $\pm$  5.75 in females. The mean SBP was 144.8 and DBP was 98.2. the results were found to be statistically significant at P value <0.05.

### DISCUSSION

It is widely accepted that Cardio Vascular Disease (CVD) is

Age (Yrs)	Normal		Blood pressure		Total
	Normal	%	Hypertension	%	
20-30	50	84.7	9	15.3	59
31-40	28	45.2	34	54.8	62
41-50	15	23.4	49	76.6	64
51-60	11	20	44	80	55
				Total	240

Table -1: Variable of blood pressure in relation to age

TG	Normal		Blood pressure		Total
	Normal	%	Hypertension	%	
<150	108	60	72	40	180
150-199	5	20.8	19	79.2	24
$\geq$ 200	2	5.6	34	94.4	36
				Total	240

Table-2-Variable of BP in relation to Triglycerides

TC	Normal		Blood pressure		Total
	Normal	%	Hypertension	%	
<200	104	56.2	81	43.8	185
200-239	9	22.0	32	78.0	41
$\geq$ 240	2	14.3	12	85.7	14
				Total	240

Table-3: Variable blood pressure in relation to total cholesterol

HDL	Normal		Blood pressure		Total
	Normal	%	Hypertension	%	
<40	11	28.2	28	71.8	39
>40	53	65.4	28	34.6	81
				Total	120

Table-4a: Variable Blood Pressure in relation to HDL (Male)

HDL	Normal		Blood pressure		Total
	Normal	%	Hypertension	%	
<40	2	11.8	15	88.2	17
>40	78	75.7	25	24.3	103
				Total	120

Table-4b: Variable Blood Pressure in relation to HDL (Female)

associated with hypertension and increased levels of TC and TG. Individually decreased HDL is also risk factor for CVD. Epidemiological studies have established a strong association between hypertension and Coronary Artery Disease (CAD). Hypertension results are from a complex interaction of genes<sup>8,9</sup> and environmental factors. Several environmental factors influencing blood pressure – diet, increased salt intake, lack of exercise, obesity, stress, depression, Vitamin D deficiency<sup>10</sup> play a role in individual cases. As such HT can be considered as a preventable risk factor for premature deaths worldwide.

Hyperlipidemia also has a genetic and environmental etiology<sup>11</sup>, dietary factors playing a major role. According to Framingham study, vast amount evidence has confirmed the critical role played by hyperlipidemia in the pathogenesis of atherosclerosis. Hyperlipidemia results in increased risk of premature atherosclerosis with, structural narrowing of small arteries and arterioles, leading to endothelial dysfunction, and vascular inflammation contributing to increased peripheral resistance and hypertension.<sup>12,13</sup> Autopsy studies conducted in human coronary arteries and aorta from various parts of the world conclude that atherosclerosis is more extensive in hypertensive patients<sup>14</sup> and that atheromas appear in high pressure segments of circulation.<sup>15</sup> So in the workup of hypertensive patients, investigation of lipid profile plays an important role in CAD.<sup>16</sup>

This study was done to show the relationship between serum lipid profile and hypertension among urban population in the age group of 20-60 years. The prevalence of hypertension was found to be high in the age group of 40-60 years and high in males compared to females. Hypertension was found to be high with BMI  $\geq 30$ . This shows that subjects with high BMI and advanced in age predispose to HT and CVD.

The number of hypertension cases was found to be more with TG levels  $\geq 150$  mg/dl, 88.3% as compared to 45.6% with  $<150$  mg/dl. High percentage of hypertension cases was seen with TC  $\geq 200$  mg/dl, 74.5% as against 49.2% in  $\leq 200$  mg/dl, indicating that high levels of TG and TC are risk factors for development of hypertension. The male subjects with  $\geq 40$  mg/dl HDL had only 34.6% prevalence of HT as against 71.8% with  $\leq 40$  mg/dl HDL, and 88.3% of hypertension with  $\leq 40$  mg/dl and 24.2% with  $\geq 40$  mg/dl in females. Out of 120 females 103 had HDL  $\geq 40$  mg/dl as against 81 males. So female subjects were found to have higher levels of HDL compared to males and accordingly the number of HT cases in females is less than males giving protection to females against CAD.

Low physical activity and consumption of diet with more of carbohydrates and saturated fatty acids such as fast-food have been associated with hyperlipidemia.<sup>17</sup> According to Dancy<sup>18</sup> habitually active men and women are less likely to have hyper triglycerides and less HDL concentration.

The positive correlation between lipid profile and BMI, and HT were in collaboration with previous studies and reaffirmed the role of lipids in the pathophysiology of overweight and obesity as well as increased accumulation of lipids with age.<sup>18-20</sup>

## CONCLUSION

This study showed that advanced age and increased BMI were more likely to develop HT and HT is seen to be more prevalent in males compare to females. The subjects with HT were more likely to have hyperlipidemia including high TC and high TG with reduced HDL cholesterol levels.

Preventive measures and early diagnosis of HT and Hyperlipidemia decreases the risk of CVD in general population. Hypertensive patients need measuring of BP and lipid profile at regular intervals to prevent CVD and stroke, as elevated BP may predict certain disturbance in lipoprotein metabolism.

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