Comparative Study on Lipid Profile of Hypertensive Patients and Non-hypertensive Individuals in Bikaner, Rajasthan, India

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Abstract
Cardiovascular diseases are the highest cause of death in the industrialized world, and many of these deaths may be work related. Hypertension is the most common of the cardiovascular diseases which is the leading cause of morbidity and mortality in the industrial world. Stress, tension, smoking, liquors, insufficient rest, metabolic disorders, excessive consumption of tea or coffee, emotional disturbance etc. are also associated with high blood pressure. Several previous studies showed the relation between hyperlipidemia and hypertension. An excessive daily intake of saturated fats, cholesterol, and other sources of calories and subsequent disturbance of lipid profile leading to hypertriglyceridemia and hypercholesterolemia are associated with obesity and, consequently, hypertension. The present study was designed to compare the serum triglyceride, cholesterol, High Density Lipo-protein (HDL) and Low Density Lipo-protein (LDL levels in hypertensive and non-hypertensive individuals. While the relation between hyperlipidemia and hypertension is clearly shown, there are only a few studies which have compared the lipid profiles of hypertensive and non-hypertensive cases. The aim and objectives of the present case-control study were to find out the relationship between serum lipids levels of the hypertensive patients with controls in Bikaner, Rajasthan, India. This study was conducted in the Department of Physiology, Sardar Patel Medical College, Bikaner and Department of General Medicine, Kothari Medical and Research Institute, Bikaner. Patients were selected randomly from the city, and the selected subjects were divided into two groups each comprising of 50 patients. Group I: untreated hypertension and served as study group; Group II: normotensive persons having normal Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (BP) and served as a control group. Patients included in both the groups were assessed for lipid profile. Overall, it could be concluded that the serum lipid profile of recently diagnosed untreated hypertensive patient was deranged specially in a middle age group (the study group) as compared to healthy subjects. Based on the results obtained from the present study, it could be further envisaged that serum cholesterol; triglyceride levels are positively correlated with hypertensive patients whereas HDL-cholesterol has no significant changes with hypertension.

1 Introduction
Hypertension and dyslipidemia seem to be the two major risk factors contributing to the increasing cardio-vascular disease worldwide including India. As its prevalence is increasing globally, this is of major concern. The reasons seem to be very many and some associated with unhealthy diet and different life-style. Stress is also a major contributing factor to cardiovascular disease (CVD) but little is known about the mechanisms that underlie this connection.
Unfortunately, it has been suggested that hypertension is the most common of the cardio-vascular diseases which is the leading cause of morbidity and mortality in the industrial world as well as becoming an increasing common disease in the developing countries\(^6\). It has been estimated that many people worldwide and approximately 60 million in the United States suffer from hypertension. Hypertension, the leading cause of mortality in the world, is also a simply-treatable risk factor of stroke, myocardial infarction, cardiac failure, peripheral vascular disease, aortic dissection, atrial fibrillation, and end-stage renal disease\(^5\). Undoubtedly, environmental tobacco smoke, extreme heat and extreme cold are certain other risk factors which account for cardiovascular disease and while the reasons are not yet clear, numerous studies have shown a correlation between exposure to stress at work and heart disease\(^6\).

Hypertension in turn results in cardiovascular disease and approximately 7.6 million deaths (13-15% of the total) and 92 million disability adjusted life years (DALY) worldwide have been attributed to hypertension in 2001. Hypertension has been suggested to double the risk of cardiovascular disease, including coronary heart disease, congestive heart failure, ischemic and haemorrhagic stroke, renal failure and peripheral arterial disease\(^6\). The factors affecting blood pressure or risk factors for essential hypertension are heredity, age sedentary life style, obesity and gender. Stress, tension, smoking, liquors, insufficient rest, metabolic disorders, excessive consumption of tea or coffee, emotional disturbance etc. are also associated with high blood pressure. Several previous studies showed the relation between hyperlipidemia and hypertension\(^6,7\).

An excessive daily intake of saturated fats, cholesterol, and other sources of calories and subsequent disturbance of lipid profile leading to hypertriglyceridemia and hypercholesterolemia are associated with obesity and, consequently, hypertension\(^6,8,9\).

Impaired insulin function\(^10\), increased peripheral resistance, cardiac output, sympathetic tone and salt congestion\(^8\) are some of the responsible mechanisms, which lead to hypertension. In a study in 2000, Brown confirmed the association between several factors, including Basal Metabolic Index (BMI), serum cholesterol, HDL and hypertension\(^11\).

The present study was designed to compare the serum triglyceride, cholesterol, HDL, and LDL levels in hypertensive and non-hypertensive individuals. While the relation between hyperlipidemia and hypertension is clearly shown, there are only a few studies which have compared the lipid profiles of hypertensive and non-hypertensive cases.

Hypertension in adults is arbitrarily defined as systolic pressure to or greater than 160 mm Hg and/or diastolic pressure equal to or greater than 95 mm Hg\(^2\). The blood lipids and lipoproteins have been reported to be correlated with hypertension. The changes in serum lipid profile level on hypertensive patients should be actively investigated. Bikaner is a city lying in Rajasthan, where people are very fond of consuming sweets and fried food delicacies. This kind of habit definitely foresees them to be cases of hypertension and therefore, the present work has been carried out to compare the lipid profile in recently diagnosed untreated hypertensive patients and in healthy subjects. The findings of this study may help to understand the effect of renin-angiotensin system in the regulation of blood pressure. The aim and objectives of the present case-control study were to find out the relationship between serum lipids levels of the hypertensive patients with controls in the study area.

### 2 Materials and Method

This study has been conducted in the Department of Physiology, Sardar Patel Medical College, Bikaner and Department of General Medicine, Kothari Medical and Research Institute, Bikaner, India. Patients were selected randomly from Bikaner city.

#### 2.1 Type of study - Randomized case-control study

**Selection of patients**

One hundred patients with and without hypertension were randomly selected for this study. Both the groups were middle age group (36-55 years).

#### 2.2 Exclusion criteria

Patient suffering from diabetes mellitus, liver disease, arthritis, pulmonary tuberculosis, malabsorption, asthma, seizure disorder, pregnant and breast feeding women and any other disease and non-co-operative patients were excluded from the study.

#### 2.3 Methodology

The selected subjects were divided into two groups each comprising of 50 patients.

**Group I**

These patients have recently diagnosed untreated hypertension and served as study group.

**Group II**

These subjects were normotensive persons having normal SBP and DBP and served as control group.

#### 2.4 Procedure

Patients included in both the groups were assessed for lipid profile.

**2.4.1 Serum lipid profile**

- Estimation of serum triglyceride was done colorimetrically using enzymatic kits (GPO-POD method\(^12\)).

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- Estimation of total cholesterol was done colorimetrically using enzymatic kit (CHOD-POD method\textsuperscript{13}).
- Estimation of HDL cholesterol was done colorimetrically using enzymatic kit (precipitating reagent\textsuperscript{14}).
- Estimation of VLDL cholesterol and LDL cholesterol was calculated by using Friedwald (1972) formula\textsuperscript{15}.

\[
\text{VLDL cholesterol (mg/dL)} = \frac{\text{Triglyceride}}{5}
\]

\[
\text{LDL cholesterol (mg/dL)} = \text{Total cholesterol} - (\text{HDL cholesterol} + \text{VLDL cholesterol}).
\]

2.5 Analysis of observations

Standard statistical methods were applied for analysis of the observation. The mean values of various parameters were calculated separately in various groups of the subjects. The quantitative data was expressed as Mean ± SD, and the student’s paired ‘t’ test was used to compare the differences between the respective means by using SPSS version 10 software. All p values were 2 tailed, p value of <0.05 was considered significant.

3 Results

Lipid Profile documented in different groups are presented in table 1.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group I (Study)</th>
<th>Group II (Control)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (mg/dL)</td>
<td>SD</td>
<td>Mean (mg/dL)</td>
<td>SD</td>
</tr>
<tr>
<td>TC</td>
<td>186.3</td>
<td>44.24</td>
<td>148.8</td>
<td>39.97</td>
</tr>
<tr>
<td>Triglyceride</td>
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<td>80.60</td>
<td>108.7</td>
<td>35.42</td>
</tr>
<tr>
<td>HDL</td>
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<td>13.41</td>
<td>46.02</td>
<td>8.05</td>
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<tr>
<td>LDL</td>
<td>114.1</td>
<td>40.15</td>
<td>104.9</td>
<td>27.03</td>
</tr>
<tr>
<td>VLDL</td>
<td>27.70</td>
<td>16.22</td>
<td>21.75</td>
<td>7.084</td>
</tr>
<tr>
<td>TC/ HDL</td>
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<td>2.267</td>
<td>3.384</td>
<td>1.083</td>
</tr>
<tr>
<td>LDL / HDL</td>
<td>2.883</td>
<td>1.882</td>
<td>2.347</td>
<td>0.7199</td>
</tr>
</tbody>
</table>

Table 1: Data of lipid profile in study and control groups

- The mean value of total cholesterol in study group and control group was 186.3±44.24 mg/dL and 148.8±39.97 mg/dL, respectively. The difference was statistically significant (p<0.0001).
- The mean value of triglycerides in study group and control group was 141.3±80.60 mg/dL and 108.7±35.42 mg/dL, respectively. The difference was statistically significant (p=0.0103).
- The mean value of HDL cholesterol in study group and control group was 46.01±13.41 mg/dL and 46.02±8.05 mg/dL, respectively. The difference was statistically non-significant (p=0.994).
- The mean value of LDL cholesterol in study group and control group was 114.1±40.15 mg/dL and 104.9±27.03 mg/dL, respectively. The difference was statistically non-significant (p=0.1784).
- The mean value of VLDL cholesterol in study group and control group was 27.70±16.22 mg/dL and 21.75±7.084 mg/dL, respectively. The difference was statistically significant (p<0.0001).
- The mean value of TC/HDL cholesterol ratio in study group and control group was 4.589±2.267 mg/dL and 3.384±1.083 mg/dL, respectively. The difference was statistically significant (p=0.0010).
- The mean value of LDL/HDL cholesterol ratio in study group and control group was 2.883±1.882 mg/dL and 2.347±0.7199 mg/dL, respectively. The difference was statistically non-significant (p=0.063).

4 Discussions

This study shows that difference in lipid profile of study and control group, the values of TC, TG, VLDL and TC/HDL were statistically significant suggesting their association with hypertension and HDL, LDL and LDL/HDL were non-significant, may be because lipo-proteins as such may not be directly associated with hypertension. Earlier maximum incidence of hypertension was noticed in the age group 40-49 years\textsuperscript{16}. Male to female ratio was 2.3:1. The hypertensive subject was significantly (p<0.005) heavier than the normotensive subjects (28.58 ± 4.25 kg/m\textsuperscript{2} vs. 26.79±3.71 kg/m\textsuperscript{2}) with significantly higher lipid profile. The triglyceride level was significantly higher in the males as compared to female hypertensive patients. Hypertensive subjects had significantly higher BMI as well as lipid profile in the age group of 30-39 years and concluded that the serum lipid profiles of hypertensive patients were deranged.
specially in the middle aged group. It has also been suggested that positive correlation between total cholesterol, triglycerides (0.399, pp<0.05) among the hypertensive patients, also, HDL-cholesterol positively correlated with LDL-cholesterol (r=0.218, p<0.05) but in the normotensive patients, LDL-cholesterol negatively correlated with triglyceride (r=-0.409, p<0.05) and positively correlated with total cholesterol (r=0.876, p<0.05) as documented by Idemudia (2014). These earlier reports corroborate the present findings. Sabri et al., 2004 and Yin et al., 2006 showed that total cholesterol level was higher in hypertensive patients than non-hypertensive subjects. In 2008, Li revealed higher triglyceride levels in hypertensive patients in China. However, this research showed no statistically significant difference in serum LDL and HDL cholesterol level between hypertensive and non-hypertensive individuals. This was in contrast to the results of Assmann and Schulte (1988).

5 Conclusions

Overall, it could be concluded that the serum lipid profile of recently, diagnosed untreated hypertensive patients was deranged specially in the middle age group (the study group) as compared to healthy subjects. Based on the results obtained from the present study, it could be further envisaged that serum cholesterol; triglyceride levels are positively correlated with hypertensive patients whereas HDL-cholesterol has no significant changes with hypertension. The higher level of serum TC, TG and LDL-cholesterol in the study population may be due to genetic factors and increased consumption of dietary animal fat, lack of physical exercise, metabolic disorders like diabetes mellitus and hypothyroidism, severe stress, increased age, sex as well as alcohol and tobacco consumption may also be the contributory factors for this phenomenon.

6 Conflicts of Interests

We have not declared any conflict of interest.

7 Author's contributions

AS carried out the complete work supervised by BKB. All authors read and approved the final manuscript.

8 References


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