

**ORIGINAL RESEARCH**

# Evaluating the serum uric acid levels, serum lipid profiles and blood pressure in patients with essential hypertension compared to healthy controls

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## ABSTRACT

**Aim:** This study aims to evaluate the serum uric acid levels, lipid profile, and blood pressure in patients with essential hypertension compared to healthy controls. **Material and methods:** A cross-sectional analysis was conducted involving two groups: hypertensive patients (n = 50) and age- and sex-matched healthy controls (n = 50). Blood pressure was measured using an OMRON automatic blood pressure monitor after subjects had rested in a seated position for at least 10 minutes. The sera were used for analysis of serum uric acid by Uricase-Peroxidase Method using ERBA CHEM – 5 PLUS SEMIAUTO ANALYZER, Triglycerides (TG) by Glycerol-3-Phosphate method, Total cholesterol (TC) by CHOD-PAP method, High Density lipoprotein (HDL) by DIRECT method, low density lipoprotein (LDL) by FRIEDEWALD EQUATION and very low density lipoprotein (VLDL) by FRIEDEWALD EQUATION. **Results:** Demonstrated that patients with essential hypertension exhibited significantly higher serum uric acid levels ( $p < 0.001$ ), elevated lipid profiles, including total cholesterol, low-density lipoprotein (LDL), and triglycerides ( $p < 0.001$ ), and increased systolic and diastolic blood pressure ( $p < 0.001$ ) compared to healthy controls. **Conclusion:** These findings suggest a strong association between essential hypertension and metabolic disturbances, highlighting the need for comprehensive cardiovascular risk management in hypertensive patients. Further research is warranted to explore the underlying mechanisms and potential therapeutic interventions targeting these metabolic parameters.

**Keywords:** essential hypertension, Uric acid, lipid profile, blood pressure.

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## INTRODUCTION

Essential hypertension, in simple terms, is high blood pressure without a clear cause. It's a chronic condition where the blood pressure in your arteries is consistently elevated, potentially leading to health issues if not managed properly [1].

Hypertension is a major global health issue, affecting about 1.28 billion adults aged 30-79 years worldwide,

according to the World Health Organization. The prevalence is high, with many cases going undiagnosed or untreated [2]. In India, hypertension is also a significant health concern. The prevalence varies across different studies, but it's estimated that around 30% of the adult population suffers from high blood pressure. This number might be higher in urban areas compared to rural ones. The increasing

prevalence is linked to lifestyle factors such as diet, lack of physical activity, obesity, and stress, as well as genetic predispositions [3-5].

Uric acid is a chemical compound that is the final oxidation product of purine nucleotide metabolism in humans. It is produced when the body breaks down purines, which are found in certain foods and are also produced by the body [6]. The relationship between uric acid levels and essential hypertension has been widely studied, while there is a strong association, the causal role of uric acid in hypertension remains debated [7, 8]. Some longitudinal studies suggest that high uric acid levels can predict the development of hypertension, while others view it as a marker of renal damage or a by-product of other metabolic disorders like obesity and insulin resistance [9,10].

In hypertensive patients, lipid abnormalities are often part of a cluster of metabolic disturbances that include insulin resistance, obesity, and dyslipidemia. Numerous epidemiological studies indicate that dyslipidemia is more prevalent in hypertensive individuals than in normotensive individuals. This relationship suggests a shared pathophysiological pathway, possibly involving insulin resistance [11].

The blood pressure however, is not the only determinant of cardiovascular damage and the propensity of hypertensive patients to develop target organ damage is markedly influenced by coexisting risk factors such as age, sex, smoking, obesity, diabetes, dyslipidemia and others. Among these factors lipoproteins are fundamental to the atherosclerotic process and greatly affect the impact of hypertension on development of target organ damage and therefore on cardiovascular morbidity and mortality [12].

However given that the results linking uric acid and hypertension are not entirely consistent [13-14], this study was carried out to evaluate the serum uric acid levels, serum lipid profiles and blood pressure in patients with essential hypertension compared to healthy controls in Kanpur population.

## MATERIAL AND METHODS

Upon ethical clearance, study was conducted in biochemistry department among the hypertensive patients attending the general medicine OPD of Rama Medical College, Mandhana, Kanpur (U.P). 100 subjects were included in study. Out of which 50 subjects was Hypertensive (Cases) and 50 subjects was normotensive (control).

### Inclusion criteria

Age: 30-60 years newly detected patients of essential hypertension.

### Exclusion criteria

Patients with Diabetes, renal failure, vascular diseases, liver diseases, patients on treatment with drug altering Uric acid levels such as Thiazides, Loop

diuretics, Pyrazinamide and Allopurinol, Malignant diseases, Secondary Hypertension and pregnancy induced hypertension.

A written consent was obtained from participants before the sample collection.

Blood pressure will be recorded as average of 2 readings after initial screening from the right arm placed at the heart level using an automatic blood pressure measuring device OMRON after the subjects had rested for at least 10 minutes in a sitting position. The measurements were taken 60 seconds apart and the average systolic and diastolic blood pressures were recorded and used for analyses. Hypertension was defined as a systolic blood pressure  $\geq 140$  mmHg and or diastolic pressure  $\geq 90$  mmHg, Pre-hypertension as systolic pressure 120-139 mmHg and or diastolic pressure 80-89mmHg and Normotension as systolic pressure  $<120$  mmHg and Diastolic blood pressure as  $<80$  mmHg according to the seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7)

The medical records of these patients were reviewed and details such as medical history, age, sex, B.P will be measured at time of assessment through a standard questionnaire.

5 ml of fasting venous blood was collected from antecubital vein. The sera was used for analysis of serum uric acid by Uricase-Peroxidase Method using ERBA CHEM – 5 PLUS SEMIAUTO ANALYZER, Triglycerides (TG) by Glycerol-3-Phosphate method, Total cholesterol (TC) by CHOD-PAP method, High Density lipoprotein (HDL) by DIRECT method, low density lipoprotein (LDL) by Friedewald Equation and very low density lipoprotein (VLDL) by Friedewald Equation.

$LDL-c$  (mg/dL) =  $TC$  (mg/dL) –  $HDL-c$  (mg/dL) –  $TG$  (mg/dL)/5

$VLDL-c$  (mg/dL) =  $TG$  (mg/dL)/5

### Data analysis

The results were expressed in Mean  $\pm$  standard deviation (S.D.). Data were analyzed by statistical software SPSS VERSION 25.0. Comparison of study group to control group by using

Student's t-test. The P-values considered significant were as follows:  $P < 0.05$  – As significant,  $P < 0.001$  – As highly significant.

## OBSERVATION AND RESULTS

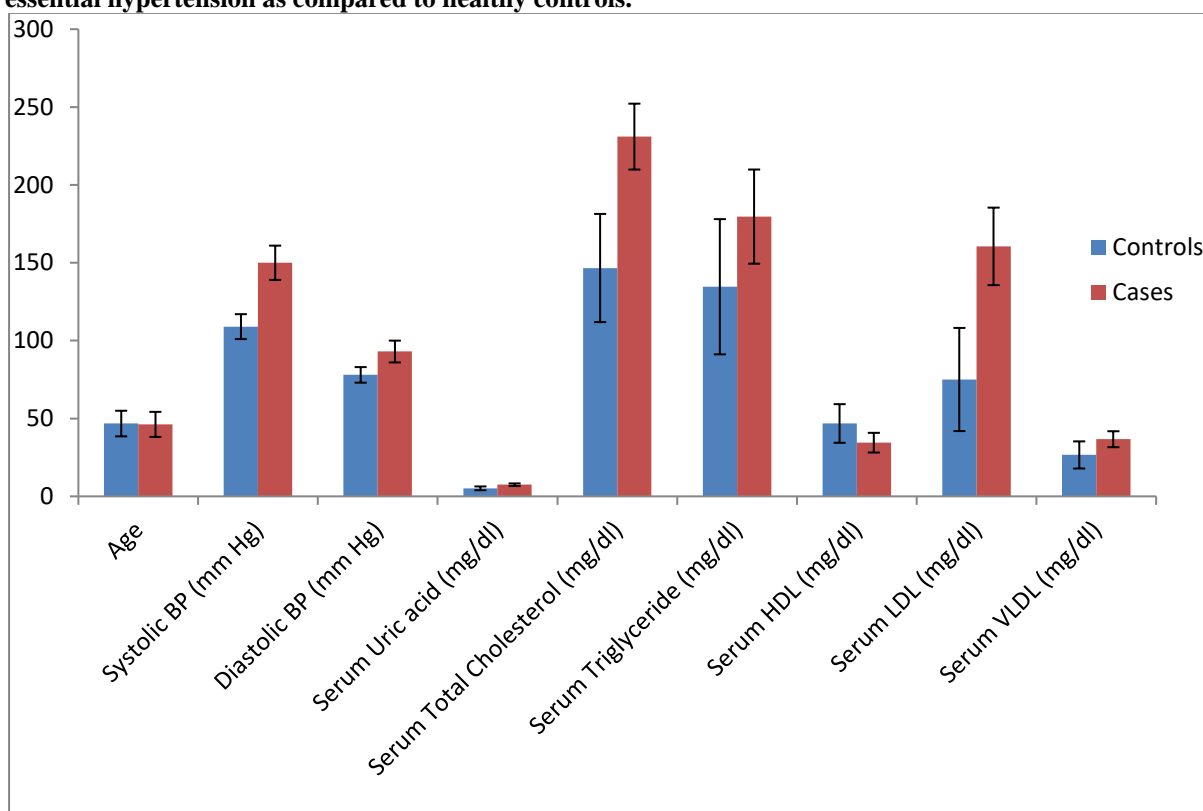
Mean and standard deviations (SD) of blood pressure, serum uric acid levels and serum lipid profiles in patients with essential hypertension as compared to healthy controls were shown in table 1. The blood pressure, serum uric acid levels and serum lipid profiles in patients with essential hypertension were significantly high ( $p < 0.001$ ) as compared to healthy controls.

**Table 1:- Showing the of blood pressure, serum uric acid levels and serum lipid profiles in patients with essential hypertension as compared to healthy controls.**

Parameters	Cases (Male=27, Female=23) Mean ±S.D.	Controls (Male=28, Female=22) Mean ±S.D.	P-value
Age	46.22 ± 8.04	46.76 ± 8.22	0.74
Systolic BP (mm Hg)	150 ± 11	109 ± 8	0.0001**
Diastolic BP (mm Hg)	93 ± 7	78 ± 5	0.0001**
Serum Uric acid (mg/dl)	7.48 ± 0.84	5.15 ± 1.22	0.0001**
Serum Total Cholesterol (mg/dl)	231.02 ± 21.15	146.64 ± 34.73	0.0001**
Serum Triglyceride (mg/dl)	179.64 ± 30.24	134.62 ± 43.42	0.0001**
Serum HDL (mg/dl)	34.46 ± 6.33	46.8 ± 12.41	0.0001**
Serum LDL (mg/dl)	160.52 ± 24.89	75.04 ± 33.12	0.0001**
Serum VLDL (mg/dl)	36.70 ± 5.13	26.6 ± 8.71	0.0001**

\*\* As highly significant

**Figure1:- Showing the of blood pressure, serum uric acid levels and serum lipid profiles in patients with essential hypertension as compared to healthy controls.**



**DISCUSSION AND CONCLUSION**

High uric acid levels are often observed in patients with essential hypertension compared to age and gender-matched healthy controls. One significant study published in the journal Hypertension by the American Heart Association, titled "Uric acid and the development of hypertension: the normative aging study," found that elevated uric acid levels were associated with an increased risk of developing hypertension. The researchers concluded that uric acid might play a role in the pathogenesis of hypertension, suggesting that hyperuricemia (high uric acid) could be a contributing factor to the development and maintenance of high blood pressure [15]. Another

important study published in Hypertension Research by the Intensive Care Unit and Department of Cardiology, Toranomon Hospital, Tokyo, Japan, titled "Hyperuricemia and Risk of Hypertension," reinforces these findings by demonstrating that hyperuricemia is an independent risk factor for hypertension. The researchers highlighted that controlling uric acid levels might be beneficial in managing blood pressure in hypertensive patients [16]. These studies provide strong evidence that high uric acid levels are more prevalent in individuals with essential hypertension compared to healthy controls, and suggest that uric acid might play a contributory role in the development of hypertension.

Elevated lipid profiles was found in patients with essential hypertension supported by a study published in Lipid in Health and Disease titled "The association of lipid ratios with hyperuricemia in a rural Chinese hypertensive population" found that hypertensive patients had significantly higher levels of total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides. The study emphasized that dyslipidemia often accompanies hypertension, suggesting a shared pathophysiological basis between lipid abnormalities and high blood pressure [17]. Another study published in the Journal of Front Public Health titled " Relationship between Lipid Profiles and Hypertension: A Cross-Sectional Study of 62,957 Chinese Adult Males. " reported similar findings, with hypertensive individuals showing elevated levels of LDL-C and triglycerides. The researchers concluded that lipid abnormalities are prevalent among those with hypertension, indicating the need for comprehensive cardiovascular risk management in these patients [18]. In The American Heart Association, an article titled " Dyslipidemia and the Risk of Developing Hypertension in a Working-Age Male Population reviewed the interrelationship between hypertension and dyslipidemia, highlighting that hypertensive patients frequently exhibit adverse lipid profiles. The review suggested that managing lipid levels in hypertensive patients could have significant benefits for reducing cardiovascular risk [19].

These studies collectively reinforce the notion that dyslipidemia is a common comorbidity in patients with essential hypertension, which necessitates integrated therapeutic strategies to manage both conditions effectively.

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#### CONFLICT OF INTEREST

There was no any conflict of interest in this research work.

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