

# Serum Uric Acid in Systemic Hypertension Patients and its association with Systolic and Diastolic Blood Pressure

Uric Acid in Systemic Hypertension

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## ABSTRACT

**Objective:** Evaluating the Serum Uric acid (SUA) in Systemic Hypertension Patients and its association with Systolic (SBP) and Diastolic Blood Pressure (DBP).

**Study Design:** Cross sectional study

**Place and Duration of Study:** Department of Medicine, Isra University Hospital from April 2017 – February 2018.

**Materials and Methods:** A sample of 100 diagnosed cases of essential systemic hypertension and 100 controls were selected according to the inclusion and exclusion criteria. Venepuncture was done to collect 2 ml venous blood. The blood samples were centrifuged. Sera were used for the uric acid estimation. Volunteers were asked to give consent in written. A pre- structure performa was used for data collection. Data was analyzed on statistical software (SPSS v 22.0, IBM, Incorporation, USA) at confidence interval of 95% ( $P \leq 0.05$ ).

**Results:** Mean  $\pm$  SD age was found  $50.32 \pm 4.13$  and  $50.25 \pm 4.20$  years in control and cases respectively ( $p=0.95$ ). Male population was predominant in present study. Serum uric acid in control and cases was found as  $4.42 \pm 1.10$  and  $5.28 \pm 1.04$  respectively ( $P=0.0001$ ). Pearson's correlation shows positive association of Serum Uric acid with systolic BP ( $r= 0.575^{**}$ ,  $p=0.0001$ ), Diastolic BP ( $r= 0.561^{**}$ ,  $p=0.0001$ ) and Body weight ( $r= 0.132$ ,  $p=0.063$ ).

**Conclusion:** The present study reports raised serum uric acid levels in systemic hypertension. Serum Uric acid shows a definite positive correlation with systolic and diastolic blood pressure.

**Key Words:** Uric acid, Systemic Hypertension, Systolic BP, Diastolic BP

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## INTRODUCTION

Systemic hypertension is a major health problem of modern society. It is a risk factor for heart failure, myocardial infarction, brain stroke, renal hypertensive disease, and peripheral arterial disease.<sup>1</sup> World prevalence of systemic hypertension is estimated as 1 billion people are suffering from it. Approximately death toll of 7.1 million has been attributed to the systemic hypertension.

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World Health Organization (WHO) reported that suboptimal rise in systolic blood pressure (BP) of  $>115$  mm Hg accounts for 49% of ischemic cardiac disease and 62% of cerebrovascular disease. There is little variation by gender. 30% of subjects remain undiagnosed and 40% are drug non-compliant. Approximately 60% hypertensive subjects have no proper control of systemic hypertension.<sup>1, 2</sup> Raised serum uric acid, termed hyperuricemia, are common in systemic hypertension, but also in the pre-hypertension patients. Association of serum uric acid and risk of systemic hypertension has been consistent and continuous in previous studies. An elevated serum uric acid level is common among prehypertension patients with microalbuminuria.<sup>1,2</sup> Previous studies<sup>3,4</sup> reported the elevated serum uric acid is a positive risk factor the development of systemic hypertension. Approximately 25–50% of Systemic hypertension subjects show hyperuricemia.<sup>4</sup> Hyperuricemia puts the subjects at increased risk for cardiovascular mortality, particularly in female subjects.<sup>3,4</sup> Despite reports on the issue of hyperuricemia in systemic hypertension, many authorities do not honor serum uric acid to be a true cardiovascular risk factor.<sup>1-4</sup> Hyperuricemia has been established as risk factor for systemic hypertension, dyslipidemia, obesity, and kidney hypertensive disease and insulin resistance. Several studies had reported

elevated serum uric acid as an independent risk factor for cardiovascular disease. And the risk is reduced after serum uric acid levels are reduced. The underlying mechanisms of how uric acid increases the risk of cardiovascular disease remain ambiguous and needs further research.<sup>3,4</sup> Emerging data shows prevalence of elevated serum uric acid is found not only in the developed countries but also among the populations of low and middle-income countries.<sup>5</sup> Many factors have been implicated in causing the hyperuricemia, and life style factors are most important among them. Obesity, sedentary life, overeating, increased meat intake, drugs and alcohol intake have been independent predictors of hyperuricemia.<sup>6</sup> Previous studies<sup>4-9</sup> from China, Japan, India, Pakistan and Iraq have reported positive association of serum uric acid, systemic hypertension and obesity. The present study was conducted to estimate serum uric acid in systemic hypertension and its correlation with systolic and diastolic blood pressure among the Pakistani adults.

## MATERIALS AND METHODS

The present study was hospital based cross sectional analytical study was conducted at the Department of Medicine, Isra University Hospital from April 2017 – February 2018. A sample of 100 diagnosed cases of essential systemic hypertension and 100 age and gender matched control (normal healthy adults) were selected. Inclusion and exclusion criteria were strictly obeyed for study protocol. Sample size was calculated by Rao-software. Patients of in- patient and out- patient departments were included. Inclusion criteria were; diagnosed cases of Essential systemic hypertension (JNC- VII criteria), age 40- 60 years, and both gender. Exclusion criteria were; age <40 or >60, secondary hypertension, diabetes mellitus, Ischemic Heart Disease (IHD), daily meat intakes, alcoholics, thiazide drug intake, chronic kidney disease, and pregnancy. Ethical approval was taken from the institute. Volunteers were informed about the aims of study. Cases and control were informed that they can withdraw the study protocol without telling the reason and this will not affect their future drug therapy. Volunteers were interviewed for getting confidence and adherence for the study. Clinical history was taken to fulfill the exclusion and inclusion criteria. Cases and controls were examined by a medical officer, followed by consultant. Blood pressure was measured as per criteria of JNC-VII by a mercury sphygmomanometer. Ante cubital fossa was sterilized by alcohol swab. A disposable syringe was used for blood sample collection. A tourniquet was applied above the cubital fossa to make the vein prominent. Venepuncture collected 2 ml venous blood was centrifuged for 15 minutes (x3000 rpm) to get sera separated. Sera were taken into sterilized Eppendorf tubes and stored at -20°C. Sera were used for the uric acid estimation.

Volunteers were asked to give consent in written. A printed consent form was used for this purpose. Confidentiality of data of cases and control was strictly maintained. A pre- structure performa was used for data collection. Data was analyzed on statistical software (SPSS v 22.0, IBM, Incorporation, USA). Student's t test and Chi ( $\chi^2$ ) square test were used for the analysis of continuous and categorical variables respectively. Correlation of serum uric acid with systolic and diastolic blood pressure was analyze by Pearson's correlation Bivariate method. Significant results were taken at confidence interval of 95% ( $P \leq 0.05$ ).

## RESULTS

Mean  $\pm$  SD age was found 50.32 $\pm$ 4.13 and 50.25 $\pm$ 4.20 years in control and cases respectively ( $p=0.95$ ) (table I). Male population was predominant in present study. Table II shows 79% and 75% were male in control and cases respectively ( $\chi^2=0.175$ ,  $P=0.67$ ). Body weight, Body mass index (BMI), Systolic and Diastolic BP, serum uric acid and creatinine are shown in table I. Serum uric acid in control and cases was found as 4.42 $\pm$ 1.10 and 5.28 $\pm$ 1.04 respectively ( $P=0.0001$ ). Normal (<25 kg/m<sup>2</sup>), overweight (<25 - 29.9 kg/m<sup>2</sup>) and Obesity ( $\geq 30$  kg/m<sup>2</sup>) in control and cases are shown in table 3.

**Table No.I: Characteristics of study subjects**

Parameter	Controls (n=100)	Cases (n=100)	P-value
Age (years)	50.32 $\pm$ 4.13	50.25 $\pm$ 4.20	0.95
Body weight (kg)	69.20 $\pm$ 16.61	73.35 $\pm$ 16.65	0.087
BMI (kg/m <sup>2</sup> )	27.53 $\pm$ 3.30	28.48 $\pm$ 3.61	0.053
Systolic BP (mmHg)	121.55 $\pm$ 7.70	148.10 $\pm$ 18.89	0.0001
Diastolic BP (mmHg)	68.90 $\pm$ 6.33	87.55 $\pm$ 13.78	0.0001
Uric acid (mg/dl)	4.42 $\pm$ 1.10	5.28 $\pm$ 1.04	0.0001
Creatinine (mg/dl)	0.92 $\pm$ 0.17	0.90 $\pm$ 0.18	0.332

**Table No.2: Gender distribution of study subjects**

Gender	Controls (n=100)	Cases (n=100)	$\chi^2$ -value	P-value
Male	79%	75%	0.175	0.67
Female	21%	25%		

Pearson's correlation shows positive association of Serum Uric acid with systolic BP ( $r= 0.575^{**}$ ,  $p=0.0001$ ), Diastolic BP ( $r=0.561^{**}$ ,  $p=0.0001$ ) and

Body weight ( $r= 0.132, p=0.063$ ) (Table 4). Positive correlation of serum uric acid with Systolic BP ( $y = 9.747x + 87.498, R^2 = 0.3304$ ) and Diastolic BP ( $y = 6.897x + 44.736, R^2 = 0.3147$ ) is shown in scatter plots 1 and 2.

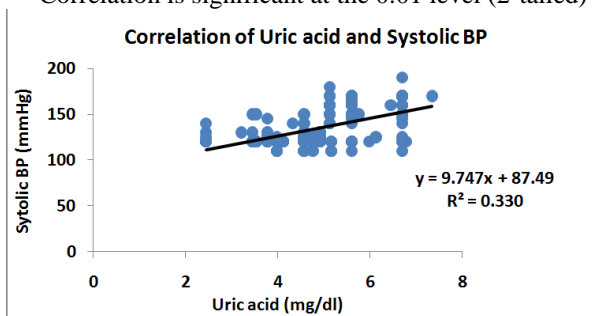
**Table No.3: Body mass index (kg/m<sup>2</sup>) in study population**

BMI	Controls (n=100)	Cases (n=100)	P-value
Normal (<25 kg/m <sup>2</sup> )	42%	32%	0.21
Overweight (<25 - 29.9 kg/m <sup>2</sup> )	41%	44%	
Obesity (≥ 30 kg/m <sup>2</sup> )	17%	24%	

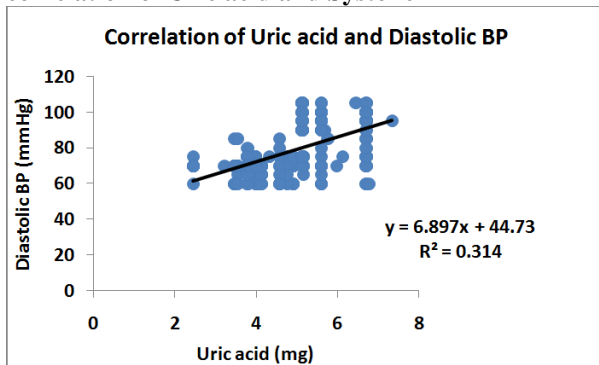
**Table No.4: Correlation co-efficient of Serum Uric Acid**

Variable	r-value	P-value
Systolic BP	0.575**	0.0001
Diastolic BP	0.561**	0.0001
Body weight	0.132	0.063

\*\* Correlation is significant at the 0.01 level (2-tailed)



**Graph No.1: Scatter plot showing positive linear correlation of Uric acid and Systolic BP**



**Graph No.2: Scatter plot showing positive linear correlation of Uric acid and Diastolic BP**

**DISCUSSION**

The present is the first study reporting on the serum uric acid level in Systemic hypertension and its association with Systolic and Diastolic blood pressure from a tertiary care hospital of Sindh. The present study was hospital based cross sectional analytical study. The study included 100 control and 100 systemic

hypertension cases. Control and cases were age, gender, body weight and BMI matched. The mean ± SD age was found 50.32±4.13 and 50.25±4.20 years in control and cases respectively ( $p=0.95$ ) (table I). The findings are supported by previous studies.<sup>10-12</sup> The findings are also in agreement with other previous studies of Divyen et al,<sup>13</sup> Habib et al,<sup>14</sup> Lee et al.<sup>15</sup> Divyen et al<sup>13</sup> reported common age of 40-60 years. While Lee et al<sup>15</sup> reported majority of cases belonged to age of 40-50 years. However, Habib et al<sup>14</sup> has reported minimum age of 20 years that contradicts with the present study. Male population was predominant in present study. Table II shows 79% and 75% were male in control and cases respectively ( $X^2=0.175, P=0.67$ ). Male dominance has been reported by Divyen et al<sup>13</sup> and Lee et al.<sup>15</sup> In the present study, the serum uric acid in control and cases was found as 4.42±1.10 and 5.28±1.04 respectively ( $P=0.0001$ ). The findings are in agreement with previous studies.<sup>13-15</sup> Divyen et al<sup>13</sup> reported the serum uric acid in cases and control were 6.18±1.79 mg/dl and 5.60±1.83 mg/dl respectively ( $p<0.05$ ). Habib et al<sup>14</sup> reported serum uric acid was higher in systemic hypertension patients compared to control in Pakistani adult population. Habib et al<sup>14</sup> reported mean uric acid of 316.87µmol/L and 273.24µmol/L in cases and control respectively. The findings are consistent with present study. Shrivastav et al<sup>16</sup> conducted a hospital based case control study and reported serum uric acid was high in systemic hypertension. This previous study reported serum uric acid 4.91 ± 0.88 mg/dl, 5.89 ± 0.97 and 6.56 ± 0.64 mg/dl in control, pre-hypertensive and hypertensive subjects. Neki et al<sup>17</sup> reported serum uric acid in hypertensive and control was quite different. Serum uric acid in systemic hypertension patients was 5.8 mg/dl compared to 4.4mg/dl in control ( $P<0.05$ ). The findings are consistent with the present study. In Divyen study<sup>13</sup>, the serum uric acid in Stage I and II systemic hypertension was 4.99±1.29 and 6.64±1.75 mg/dl respectively ( $p<0.05$ ). Vakil et al<sup>18</sup> analyzed the relationship of Systemic hypertension severity, obesity and uric acid and reported uric acid levels were elevated in systemic hypertension and more so in systemic hypertension with obesity ( $p<0.05$ ). Neki et al<sup>17</sup> reported serum uric acid was raised in patients of systemic hypertension. Mean uric acid in stage 1 and 2 hypertension was noted as 5.37 mg/dl and 6.39mg/dl. In the present study, serum uric acid was analyzed in systemic hypertension and especial reference to its correlation with systolic and diastolic BP. We report serum uric acid was high in systemic hypertension patients and it showed positive correlation with systolic and diastolic BP. Pearson`s correlation shows positive association of Serum Uric acid with systolic BP ( $r= 0.575^{**}, p=0.0001$ ), Diastolic BP ( $r= 0.561^{**}, p=0.0001$ ) and Body weight ( $r= 0.132, p=0.063$ ) (Table IV). These findings are supported by Lee et al<sup>15</sup> and Vakil et al.<sup>18</sup> Lee et al<sup>15</sup> analyzed the association between

hyperuricemia and systemic hypertension and reported positive association with OR (odds ratio) of 1.25 in <40 years male and 2.6 in <40 years female. Similarly, the Wakil A et al<sup>18</sup> reported definitive positive correlation of serum uric acid and systemic hypertension. They reported the Serum uric acid was found directly proportional to the severity and duration of systemic hypertension. The evidence based findings of present study in light of above literature, it is concluded that the serum uric acid has close relationship with the systemic hypertension.

## CONCLUSION

The present study observed raised serum uric acid levels among systemic hypertension that shows a definite positive correlation with systolic and diastolic blood pressure. Based on the evidence based findings of present study the raised uric acid is a risk factor for developing systemic hypertension. Proper measures to reduce the serum uric acid levels may help prevent and retard the systemic hypertension related complications.

### Author's Contribution:

Concept & Design of Study: Iram Jehan Balouch  
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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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