



## ESTIMATION OF SERUM SODIUM AND POTASSIUM LEVELS IN NEWLY DIAGNOSED HYPERTENSION PATIENTS AT MMIMSR MEDICAL COLLEGE, AMBALA

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**ABSTRACT** **Background:** Hypertension exerts a substantial public health burden on cardiovascular health status and healthcare systems in India. Essential hypertension, a rise in blood pressure of undetermined cause, includes 90% of all hypertensive cases and is a highly important public health challenge that remains, however, a major modifiable cause of morbidity and mortality. The pathophysiological link between sodium intake and increase in BP values has been widely debated. Actual potassium requirements would vary with an individual's genetics, blood pressure status, and sodium intake. Understanding pathophysiological link of sodium, potassium with blood pressure may help to improve health outcomes. **Aims & Objectives:** Estimation of Serum Sodium and Potassium Levels in Newly Diagnosed Hypertension Patients at MMIMSR Medical College, Ambala. **Materials & Methods:** A hospital based cross-sectional study with a total of 100 patients with age 18 years and above with Newly Diagnosed Hypertension. A detailed history of the patient was taken regarding the symptoms to rule out secondary cause of hypertension. Patients Were informed to refrain from smoking or drinking tea or coffee for at least 30 min before measuring BP. Normal BP was defined as a mean systolic BP of <120 mmHg and mean diastolic BP of <80 mmHg. Elevated was defined as a mean systolic BP of 120–129 mmHg and mean diastolic BP of <80 mmHg. Stage 1 was defined as mean systolic 130-139 mmhg & mean diastolic 80-89 mmhg while Stage 2 was defined as mean systolic >140 mmhg & mean diastolic >90 mmhg. Serum potassium and sodium levels was measured in the institute laboratory. Normal Level of Sodium was defined as 135-145 mEq/L while Normal Potassium is defined as 3.5 - 5.5 mEq/L. Data collected was analyzed by appropriate statistical methods. The analysis included profiling of patients on different demographic, clinical and laboratory parameters. Descriptive analysis of quantitative parameters was expressed as means and standard deviation. **Conclusion:** Our results provide support for a more aggressive target for reduced sodium intake and increasing potassium intake in combination with other dietary modifications for the prevention and treatment of elevated blood-pressure levels.

**KEYWORDS :** Hypertension, Potassium, Sodium

### INTRODUCTION

Hypertension is ranked as the third most important risk factor for attributable burden of disease in south Asia (2010). Hypertension exerts a substantial public health burden on cardiovascular health status and healthcare systems in India. In an analysis of worldwide data for the global burden of HTN, 20.6% of Indian men and 20.9% of Indian women were suffering from HTN in 2005. The rates for HTN in percentage are projected to go up to 22.9 and 23.6 for Indian men and women, respectively by 2025.

Essential hypertension is defined as high blood pressure without any clearly defined etiology.

Available evidence suggests a direct relationship between sodium intake and blood pressure values. Excessive sodium consumption (defined by the World Health Organization as >5 g sodium per day) has been shown to produce a significant increase in BP and has been linked with onset of hypertension and its cardiovascular complications. Conversely, reduction in sodium intake not only decreases BP levels and hypertension incidence, but is also associated with a reduction in cardiovascular morbidity and mortality.

The pathophysiological link between sodium intake and increase in BP values has been widely debated. Increased salt consumption may provoke water retention, thus leading to a hypertension. The mechanism of pressure natriuresis has been proposed as a physiologic phenomenon where an increase in BP in the renal arteries causes increased salt and water excretion.

Potassium is an essential nutrient. It is the most abundant cation in intracellular fluid, where it plays a key role in maintaining cell function, particularly in excitable cells such as muscles and nerves. Potassium concentration is higher in fruits and vegetables than in cereals and meat. Salting foods and discarding the liquid induces sodium (Na<sup>+</sup>) for potassium (K<sup>+</sup>) exchange and reduces the potassium content of foods. Western dietary practices with higher consumption of cereal, low nutrient density processed foods and lower consumption of fruits and vegetables has led to a diet lower in potassium and higher in

sodium in recent decades.

Actual potassium requirements would vary with an individual's genetics, blood pressure (BP) status, and sodium intake. Blood pressure is currently the primary criterion for determining potassium requirements, with blacks being more vulnerable to hypertension and more responsive to potassium supplementation than whites, hypertensive individuals more responsive to increasing potassium intakes than normotensive individuals, and potassium having a greater benefit for those consuming a high salt diet.

### MATERIALS AND METHODS

Type of Study: A hospital based cross-sectional study

Place of Study: The Outpatient as well as the Inpatient department of the Department of General Medicine, Maharishi Markandeshwar Institute of Medical Science and Research, Mullana (MMIMSR), Haryana, India.

Period of Study: 2 years (2022-2024).

Sample Size: Total of 100 patients with age 18 years and above with Newly Diagnosed Hypertension.

### Inclusion Criteria

1. Patients with newly diagnosed HTN.
2. Age group > 18 years. Both Males and Females.
3. BP ≥ 130/80 mmHg were included in the study.

### Exclusion Criteria

1. Age < 18 years
2. Secondary Hypertension
3. Patients with drug-induced sodium and potassium imbalance
4. Pregnancy
5. Females on oral contraceptive pills
6. Renal Disease
7. Patients on anti hypertensives

### METHODOLOGY

A detailed history of the patient was taken regarding the symptoms to rule out secondary cause of hypertension. Patients Were informed to refrain from smoking or drinking tea or coffee for at least 30 min before

measuring BP. Normal BP was defined as a mean systolic BP of <120 mmHg and mean diastolic BP of < 80 mmHg. Elevated was defined as a mean systolic BP of 120–129 mmHg and mean diastolic BP of <80 mmHg. Stage 1 was defined as mean systolic 130-139 mmhg & mean diastolic 80-89 mmhg while Stage 2 was defined as mean systolic >140 mmhg & mean diastolic >90 mmhg. Serum potassium and sodium levels was measured in the institute laboratory. Normal Level of Sodium was defined as 135-145 mEq/L while Normal Potassium is defined as 3.5 - 5.5 mEq/L. Data collected was analyzed by appropriate statistical methods. The analysis included profiling of patients on different demographic, clinical and laboratory parameters. Descriptive analysis of quantitative parameters was expressed as means and standard deviation.

**RESULTS**

The present study was conducted for estimating Serum Sodium and Potassium Levels in Newly Diagnosed Hypertension Patients at MMIMSR Medical College, Ambala. A total of 100 patients were enrolled. Following results were obtained:

- Mean age of the patients was 28.07 years. 56 percent of the patients were males while the remaining were females.
- 24 percent of the patients each were housewives and students while 18 percent of the patients were office workers. 16 percent of the patients were shopkeepers while 6 percent of the patients were farmers.
- Positive family history of hypertension was seen in 29 percent of the patients. Alcohol and smoking habit history was seen in 26 percent and 23 percent of the patients. 20 percent of the patients had habit of both alcohol consumption and smoking.
- Giddiness, headache, palpitations, dyspnea, chest pain and easy fatigability was seen in 85 percent, 12 percent, 8 percent, 4 percent, 2 percent and 2 percent of the patients respectively.
- Out of 100 patients, 55 percent of the patients had Stage 1 hypertension while the remaining 45 percent of the patients had stage 2 hypertension.
- Mean sodium levels were found to be 142.33 mmol/L. While comparing the sodium levels among patients with different Stage of hypertension, it was seen that patients with Stage 2 hypertension had significantly raised sodium levels in comparison to patients with Stage 1 hypertension. Mean serum potassium levels were found to be 3.697 mmol/L. While comparing the potassium levels among patients with different Stage of hypertension, it was seen that patients with Stage 2 hypertension had significantly reduced potassium levels in comparison to patients with Stage 1 hypertension.

**Table 1: Results Of Study Showing Serum Sodium Levels In Different Stages Of Hypertension**

Sodium levels range	Stage 1		Stage 2		p-value
	Number	Percentage	Number	Percentage	
Less than 135	1	1.82	0	0	0.018 (Significant)
135 to 140	10	18.18	8	17.78	
140.1 to 145	44	80	30	66.67	
More than 145	0	0	7	15.55	
Total	55	100	45	100	0.0010 (Significant)
Mean	141.56		143.27		
SD	2.09		2.96		

**Table 2: Results Of Study Showing Serum Potassium Levels In Different Stages Of Hypertension**

Potassium levels range (mmol/L)	Stage 1		Stage 2		p-value
	Number	Percentage	Number	Percentage	
≤ 3	0	0	5	11.11	0.036 (Significant)
3.1 to 3.5	16	29.09	19	42.22	
3.6 to 4.0	24	43.64	13	28.89	
4.1 to 4.5	14	25.45	8	17.78	
More than 4.5	1	1.82	0	0	
Total	55	100	45	100	0.0086 (Significant)
Mean	3.79		3.57		
SD	0.36		0.46		

**DISCUSSION**

Mean sodium levels were found to be 142.33 mmol/L. Our results were in concordance with the results obtained by previous authors who also reported similar findings in their study. In a previous study conducted by Shimizu Y et al, mean sodium levels among hypertensive patients were 142.6 mmol/L. In another previous study conducted by Prabhakaran et al, mean sodium levels were found to be 147 mmol/L.

While comparing the sodium levels among patients with different grade of hypertension, it was seen that patients with grade 2 hypertension had significantly raised sodium levels in comparison to patients with grade 1 hypertension. Our results were in concordance with the results obtained by previous authors who also reported similar findings in their study. In a similar study conducted by N Anbuvel et al, the mean serum sodium level of Stage 1 HTN patients was 136.48 mmol/L and Stage 2 HTN patients was 146.21 mmol/L. There is a statistically significant difference in serum sodium level between Stage 1 HTN and Stage 2 HTN patients. Aravind C et al, in contrast to our findings reported that mean serum sodium levels among patients with Stage I and Stage II hypertension was 142.4 mmol/L and 142.5 mmol/L respectively.

Mean serum potassium levels were found to be 3.697 mmol/L. In a previous study conducted by Shimizu Y et al, mean potassium levels among hypertensive patients were 4.3 mmol/L.

There is a statistically significant difference in serum potassium level between Stage 1 HTN and Stage 2 HTN patients. Aravind C et al, in contrast to our findings, reported that mean serum potassium levels among patients with Stage I and Stage II hypertension was 3.72 mmol/L and 3.80 mmol/L respectively. Different in duration of hypertension and other dietary factors might be responsible for this difference.

In a study done by Bulpitt et al., among 2328 men and 1496 women in the age group of 35 and 64 years screened for hypertension, their plasma sodium and potassium concentrations were measured. Those patients on antihypertensives or diuretics were excluded from the study. After adjusting for age, BMI and other variables, plasma potassium level was found to be negatively associated with systolic and diastolic blood pressure in men and women. A drop in plasma potassium of 1 mmol/l was associated with a rise in systolic blood pressure in women of 7 mmHg and diastolic blood pressure of 4 mmHg. In men, it was 4 mmHg and 2 mmHg.

Several mechanisms exist by which sodium and potassium can influence blood pressure, and evidence indicates that the interaction between these nutrients plays a dominant role in the development of primary hypertension. Specifically, diets characteristic of the modern Western diet—which is high in sodium and low in potassium—produce a biologic interaction with the kidneys, resulting in excessive sodium and insufficient potassium concentrations in the human body; these biologic changes result in vascular smooth muscle cell contraction, followed by an increase in peripheral vascular resistance and higher blood pressure, and finally hypertension. The joint effects of low sodium and high potassium intakes on blood pressure, hypertension, and related factors may be larger than the effects of either sodium or potassium alone. Up to the present date, no known systematic review has been undertaken to determine if the sodium-to-potassium ratio is more strongly associated with blood pressure and related risk factors for CVD than either sodium or potassium alone. The influence of sodium or potassium intake on the renin-angiotensin system, arterial stiffness, and endothelial dysfunction remains under study.

Based on the knowledge acquired from this study, it is recommended that forthcoming research initiatives give precedence to the utilization of standardized procedure, delve into the molecular mechanisms that underlie electrolyte imbalances and take into the account the impact of hereditary factors on individual's responses. These endeavors will not only augment our comprehension of fundamental hypertension but also provide the groundwork for pioneering and more efficacious methodologies in its avoidance and control.

**Summary**

The present study was conducted for estimating Serum Sodium and Potassium Levels in Newly Diagnosed Hypertension Patients at MMIMSR Medical College, Ambala. A total of 100 patients were enrolled. Following results were obtained:

- Mean age of the patients was 28.07 years. 56 percent of the patients were males while the remaining were females.
  - 24 percent of the patients each were housewives and students while 18 percent of the patients were office workers. 16 percent of the patients were shopkeepers while 6 percent of the patients were farmers.
  - Positive family history of hypertension was seen in 29 percent of the patients. Alcohol and smoking habit history was seen in 26 percent and 23 percent of the patients. 20 percent of the patients had habit of both alcohol consumption and smoking.
  - Giddiness, headache, palpitations, dyspnea, chest pain and easy fatigability was seen in 85 percent, 12 percent, 8 percent, 4 percent, 2 percent and 2 percent of the patients respectively.
  - Out of 100 patients, 55 percent of the patients had Stage 1 hypertension while the remaining 45 percent of the patients had stage 2 hypertension.
  - Mean serum sodium levels were between 140.1 mmol/L to 145 mmol/L in 74 percent of the patients. In 18 percent of the patients, it was found to be between 135 mmol/L to 140 mmol/L. sodium levels were less than 135 mmol/L in one patient only. However; in 7 percent of the patients, mean sodium levels were found to be more than 145 mmol/L. Mean sodium levels were found to be 142.33 mmol/L.
  - Among 55 patients with Stage 1 hypertension, 80 percent had mean sodium levels between 140.1 mmol/L and 145 mmol/L while 18.18 percent of the patients had mean sodium levels between 135 mmol/L and 140 mmol/L. Mean serum sodium levels among patients with Stage 1 hypertension was 141.56 mmol/L. Among 45 patients with Stage 2 hypertension, 66.67 percent had mean sodium levels between 140.1 mmol/L and 145 mmol/L while 17.78 percent of the patients had mean sodium levels between 135 mmol/L and 140 mmol/L. 15.55 percent of the patients with Stage 2 hypertension had mean sodium levels of more than 145 mmol/L. Mean serum sodium levels among patients with Stage 2 hypertension was 143.27 mmol/L. While comparing the sodium levels among patients with different Stage of hypertension, it was seen that patients with Stage 2 hypertension had significantly raised sodium levels in comparison to patients with Stage 1 hypertension.
  - 37 percent and 35 percent of the patients had mean potassium levels between 3.6 mmol/L to 4 mmol/L and 3.1 mmol/L to 3.5 mmol/L respectively. 22 percent of the patients had mean potassium levels between 4.1 mmol/L to 4.5 mmol/L. Mean serum potassium levels were found to be 3.697 mmol/L.
  - Among the 55 patients with Stage 1 hypertension, 43.64 percent and 29.09 percent of the patients had serum potassium levels within the range of 3.6 mmol/L to 4 mmol/L and between 3.1 mmol/L to 3.5 mmol/L respectively. Among the 45 patients with Stage 2 hypertension, 28.89 percent and 42.22 percent of the patients had serum potassium levels within the range of 3.6 mmol/L to 4 mmol/L and between 3.1 mmol/L to 3.5 mmol/L respectively. 11.11 percent of the patients with Stage 2 hypertension had potassium levels of less than or equal to 3.5 mmol/L. While comparing the potassium levels among patients with different Stage of hypertension, it was seen that patients with Stage 2 hypertension had significantly reduced potassium levels in comparison to patients with Stage 1 hypertension.
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## CONCLUSION

Our results provide support for a more aggressive target for reduced sodium intake and increasing potassium intake in combination with other dietary modifications for the prevention and treatment of elevated blood-pressure levels.

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