

Original Research Article


# Serum sodium and potassium levels in newly diagnosed essential hypertensive patients in Government Dharmapuri Medical College, Dharmapuri

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## Abstract

**Introduction:** Hypertension is one of the leading causes of death and disability among adults all over the world. It remains the major risk factor for coronary, cerebral and peripheral vascular disease. Essential hypertension comprises more than 90% of hypertension. Hypertension is an emerging health problem in India. When majority of people come to know that they have hypertension they have already advanced into a stage with target organ damage – a fatal stroke or myocardial infarction or irreversible renal failure. Unfortunately even in developed countries like United States, fifty million people are found to have hypertension. Of these, 70% are aware of their diagnosis, but only 50% are receiving treatment and only 25% are under control.

**Aim of the Study:** To study the levels of sodium and potassium in patients with primary hypertension. To correlate the sodium and potassium levels with blood pressure.

**Materials and methods:** Seventy newly diagnosed essential hypertensive patients attending the medicine OPD or admitted to the medical wards of Govt. Dharmapuri Medical College Hospital, Dharmapuri for the period of one year from June 2016 to May 2017 formed the study group. Thirty healthy people were kept as controls. This control group comprised of normotensive individuals who were attendants of patients with primary hypertension living in the same environment other than their own siblings.

**Results:** The mean systolic and diastolic blood pressure distribution for the males was  $172.63 \pm 16.71$  mm Hg and  $103.42 \pm 7.08$  mm Hg respectively. Similarly for the females the mean systolic and

diastolic blood pressure distribution was  $171.56 \pm 13.22$  mm Hg and  $103.13 \pm 4.71$  mm Hg respectively. There was no statistical significance in the systolic and diastolic blood pressure among the cases.

**Conclusion:** Serum sodium was significantly more among hypertensives and it was independent of associated risk factors and gender. Serum sodium level was also correlated positively with the level of blood pressure. Serum potassium was significantly less among hypertensive and it correlated negatively with blood pressure.

## Key words

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Hypertension, Serum sodium, Serum potassium, Coronary heart disease.

## Introduction

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An elevated arterial pressure is one of the most important public health problems and despite its widely recognized high prevalence and associated danger; it remains inadequately treated in majority of the patients [1]. It is common, readily detectable, and usually easily treatable and if left untreated can lead to serious morbidity and mortality from cardiac, cerebrovascular, vascular and renal disease. Adequate hypertension control remains elusive because of the asymptomatic nature of the disease for the first 15 – 20 years even as it progressively damages the cardiovascular system [2]. Although our understanding of the pathophysiology of hypertension has increased in 90% to 95% of cases, etiology is still mostly unknown cardiovascular diseases account for a large proportion of all deaths and disability worldwide [3]. In 1990 there were 5.2 million deaths from cardiovascular diseases in economically developed countries and 9.1 million deaths from the same causes in developing countries [4]. In 1990 in India, out of 9.4 million total deaths, cardiovascular diseases caused 2.3 million deaths (25%), 1.2 million deaths were due to coronary heart disease and 0.5 million were due to stroke [5]. It has been predicted that by 2020, there would be a 111% increase in cardiovascular deaths in India [6]. Hypertension is a major cardiovascular risk factor and important public health problem in the Indian subcontinent and among the South Asians world-wide Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths [7]. This fact is

important because hypertension is a controllable disease and a 2 mm Hg population-wide decrease in blood pressure can prevent 151,000 stroke and 153,000 coronary heart disease deaths in India. Awareness status of hypertension in India is poor [8]. In urban population of Mumbai there was a very low awareness of hypertension and only 6.1% males and 10.1% females were aware of the hypertension in early 1990's. Cigarette smoking raises blood pressure, probably through the nicotine induced release of norepinephrine from adrenergic nerve endings. In addition, smoking causes an acute and marked reduction in radial artery compliance independent of the increase in blood pressure [9]. When smokers quit, a rise in the blood pressure may occur, probably reflecting a gain in weight. Numerous studies have shown that smokers are thinner than non-smokers and that smoking reduces weight. However they will have larger waist hip ratio than non-smokers [10].

## Materials and methods

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The work was carried out in the outpatient department and medical wards of Govt. Dharmapuri Medical College Hospital, Dharmapuri. Period of the Study was One year – June 2016 to May 2017. 100 cases (70 cases and 30 controls). The present project was approved by the ethical committee.

## Inclusion criteria

- Patients with primary hypertension.
- Patients whose age was above 18 years was included.
- Both sexes were included.

### Exclusion criteria

- Patients below 18 years.
- Patients with renal failure.
- Pregnancy.
- Patients with secondary hypertension.
- Patients on non-steroidal anti-inflammatory agents, antihypertensive, diuretics, beta blockers or stimulants.
- Patients with malignant hypertension.

All the patients were subjected to detailed history taking, careful physical examination and biochemical analysis to exclude secondary hypertension. Patient's height and weight were measured. The body mass index was calculated using the formula weight / height<sup>2</sup>. Patient's hip and waist circumferences were measured. All the peripheral pulses were checked with special attention to carotid and the femoral to detect evidence for early atherosclerosis. An ocular fundus examination was done to detect hypertensive retinopathy. Patients were informed to refrain from smoking or drinking tea or coffee for at least thirty minutes before measuring blood pressure. Then blood pressure was measured using the following guidelines. Note the pressure, patient position, the arm, cuff size (e.g.,

140/90, seated, right arm, large adult cuff). Urine albumin, sugar, microscopy and pH were done for all the subjects. A twelve lead electrocardiogram and chest x ray were also taken. Overnight (12 hour) fasting blood sugar and urea was done by using Dactyl monoxide (DAM) technique. Serum creatinine was estimated using COBAS auto analyzer. Serum sodium and potassium was estimated using Flame emission photometric method.

### Results

Body mass index was independent of gender and electrolyte status, but it was significantly more in those with grade II hypertension (**Table – 1**).

#### Distribution of cases and controls with respect to cardio vascular risk factors

Analysis of other risk factors like smoking, alcoholism and family history were done among hypertensive.

Since alcoholism and smoking were noticed among men only in this part of the country, statistical analysis was not attempted for these risk factors (**Table – 2**).

**Table – 1:** BMI with respect to Hypertension.

BMI	Grade I Hypertension		Grade II Hypertension	
	No.	%	No.	%
Underweight <18.5	-	-	6	8.6
Normal 18.6 – 22.9	5	7.1	20	28.6
Overweight 23 – 24.9	4	5.7	11	15.7
Obese >25	2	2.9	22	31.4

**Table – 2:** Risk factors among cases and controls.

	Smoking		Alcohol		Both	Family history	
	Yes	No	Yes	No		Yes	No
Cases	27	43	10	60	8	10	60
Control	14	16	6	24	8	-	30

Distribution of systolic and diastolic blood pressure was as per **Table – 3**. Serum sodium in the study population varied from 132 to 158

mmol / L and in the control from 136 to 146 mmol / L. The mean and standard deviation of serum sodium among cases was 145.41 ± 5.55

mmol / L while in the control group it was  $139.9 \pm 3.21$  mmol / L respectively. **Table - 4** clearly shows that the serum sodium level was significantly more among hypertensive population studied.

Serum potassium in the study population varied from 3.1 to 5.2 mol / L and in the control from

3.8 to 4.8 mol / L. The mean and standard deviation of serum potassium among cases was  $4.03 \pm 0.49$  mmol / L while in the control group it was  $4.29 \pm 0.33$  mmol / L respectively. **Table - 5** clearly shows that the serum potassium level was significantly lower among the hypertensive population studied.

**Table – 3:** Distribution of systolic and diastolic blood pressure.

Blood Pressure	Cases	Control
	Mean + SD	Mean + SD
Systolic	$172.14 \pm 15.12$	$106.53 \pm 6.37$
Diastolic	$103.29 \pm 6.07$	$71.4 \pm 4.24$

**Table – 4:** Serum Sodium levels in cases and controls.

Serum sodium	Case		Control		P value
	Mean	SD	Mean	SD	
	145.41	5.55	139.9	3.21	0.000001

**Table – 5:** Serum potassium level in cases and controls.

Serum potassium	Case		Control		P value
	Mean	SD	Mean	SD	
	4.03	0.49	4.29	0.33	0.0026

## Discussion

Hypertension is one of the leading causes of death and disability among adults all over the world. Hypertension the most common form of cardiovascular disease is present in nearly 25% of adults and increases in prevalence with age. It remains the major risk factor for coronary, cerebral and peripheral vascular disease [11]. Essential hypertension comprises more than 90% of hypertension. Patients were studied on the basis of clinical parameters and simple biochemical investigations. Serum sodium and potassium was done for all the patients. In our part of the country, there is excessive intake of dietary salt. But in spite of that not everyone has essential hypertension [12]. The rarity of hypertension among those consuming large amount of salt may probably be related to chronic adaptation of body system towards renal clearance of sodium. However this aspect of

chronic adaptation of sodium handling by kidneys requires further molecular studies. So in addition to the hereditary predisposition and high sodium intake and lower potassium intake, the renal handling of these cations also play an important role in the pathogenesis of essential hypertension [13]. Salt intake was more in the tropical countries by and large in order to overcome sodium loss through sweating. In modern days the consumption of salt is more than earlier days in view of various food preparations or a combination of them, as man is tuned more to taste of the food. Combination of food materials requires additional salt. As a result, people consume more than actually required (2 vs. 8-10 g / day / person). Such an amount of salt consumption contributes for the development of hypertension in a genetically susceptible population [14]. In our study the mean serum sodium was estimated in the control

and study groups. Results were compared with other studies. Serum sodium was higher in the hypertensive group than the control group even though both were within the normal range. The mean and standard deviation of serum sodium among cases was  $145.41 \pm 5.55$  while in the control group it was  $139.9 \pm 3.21$  respectively. Our study was supported by Jan, et al. (2006), Srinagar, Kashmir. In his study, one hundred thirty five hypertensive patients and equal number of age and sex matched healthy controls were taken for the study [15]. Serum sodium in the hypertensive group was  $140 \pm 2.90$  while in the control group it was found to be  $138.5 \pm 1.12$ . Serum sodium was higher in the hypertensive group than the control group and considered to be a factor responsible for the causation or perpetuation of blood pressure. In another study conducted by Williams et al, they studied the relationship of body sodium, chlorine and potassium in 30 patients with essential hypertension [16]. They found that a positive correlation exists between serum sodium and blood pressure in this study group. A study was conducted among Japanese people by Komiya, et al. They studied 3222 normal Japanese subjects (610 in Kashiwa City Hospital and 2612 in Shinshu University Hospital), 741 Japanese patients with essential hypertension (256 in Kashiwa City Hospital and 485 in Shinshu University Hospital) to determine the possible roles of sodium, renal function, and plasma aldosterone concentration (PAC) on blood pressure elevation.. They found that the peak of the serum sodium distribution curve was approximately 2 mmol / L higher in the hypertensive group as compared with that in the control group [17]. The prevalence of higher serum sodium concentration ( $>$  or  $=$  147 mmol/l) was also significantly higher in the hypertensive group. In another study conducted by Bulpitt, two thousand, three hundred and twenty-eight men and 1496 women between the ages of 35 and 64 years were screened for hypertension and their plasma sodium and potassium concentrations measured. It was found that plasma sodium was positively related to that of blood pressure and an increase in serum sodium

of 1 mmol / L was associated with an increase of 1 mm of Hg in both men and women [18].

## Conclusion

Essential hypertension is the major risk factor for coronary, cerebral and renal vascular diseases. Etiology for essential hypertension is not known. Many theories were postulated. The present study attempts to focus the serum sodium and potassium level among isolated newly diagnosed essential hypertensive that were free from any other illnesses or under any medication and to correlate electrolyte status with the blood pressure [19]. Changing life styles have modified the food habits, making people to consume food rich in sodium but low in potassium. As a result genetically susceptible population when exposed to high sodium content coupled with low potassium in their diet, hypertension becomes overt. The possible mechanisms were discussed [20].

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