

# Calcium – a possible element behind hypertension

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## ABSTRACT

**Background.** Hypertension is the one of the important reasons of mortality and morbidity worldwide which affects around 6% to 32% of the general population. It has been documented that the serum calcium level has the impact on cardiovascular functions. Patients with essential hypertension display altered calcium metabolism, including elevated cytosolic calcium, reduced serum calcium levels and augmented urine excretion of calcium. Therefore, this study was undertaken in the direction for evaluate the link of calcium in newly diagnosed hypertensive patients.

**Materials and methods.** This cross-sectional study was conducted in isolated newly diagnosed essential Hypertensive subjects who came to the hypertensive OPD, who were free from any other illness or under any medication. 100 cases and 50 controls were included in this study. Body mass index, Blood pressure and serum calcium levels were evaluated in the enrolled subjects. Student's *t* test and chi-square test were used for statistical analysis.

**Results.** The mean serum calcium in newly diagnosed hypertensive group was  $8.35 \pm 1.04$  and in control group it was  $10.04 \pm 0.66$ . The mean corrected calcium in newly diagnosed hypertensive group was  $8.40 \pm 1.01$  and in control group it was  $9.87 \pm 4.76$ . These results were highly statistically significant  $p=0.000$ . Negative correlation was found between serum calcium and blood pressure among our subjects.

**Conclusion.** Patients with essential hypertension had lower corrected serum calcium levels, and there was a substantial inverse association (negative correlation) between corrected serum calcium levels and blood pressures. So, while treating patients with hypertension, more attention to be given for the serum calcium levels.

**Keywords:** essential hypertension, serum calcium, blood pressure

## INTRODUCTION

Hypertension is the growing health concern with 7.1 million deaths annually [1]. It has been recognized that the serum calcium level has the impact on cardiovascular functions [2]. The pathogenesis of essential hypertension may be significantly influenced by disturbances in calcium metabolism. Peripheral vascular resistance (PVR) is influenced by the free intracellular level of calcium, which regulates the tone of vascular smooth muscle (VSM) cells. Increased intracellular calcium lev-

els were noticed in individuals with hypertension [3]. Fu Y et.al, detected that difference was present in the extracellular calcium levels between normotensive and hypertensive individuals [4]. Previous research has demonstrated that patients with essential hypertension exhibit altered calcium metabolism, including elevated cytosolic calcium, decreased serum calcium levels, and raised urinary excretion of calcium [5,6]. It has been noted in various experiments that individuals with hypertension have elevated intracellular free calcium concentrations, which fall to normal levels following

antihypertensive medication. Therefore, the purpose of this study is to assess the relationship between serum calcium in patients with newly diagnosed hypertension.

### MATERIALS AND METHODS

This cross-sectional study was conducted in isolated newly diagnosed essential hypertensive subjects who came to the hypertensive OPD, who were free from any other illness or under any medication. 100 cases and 50 controls were included in this study. Patients with newly detected essential hypertension and above the age of 40 years age in both the gender were included in this study. Patients with known hypertension, on antihypertensive medication, subjects with existing renal disease, cardiovascular diseases and acute illness were excluded from this study. Body mass index, blood pressure and serum calcium levels were evaluated in the enrolled subjects were assessed. Serum calcium was estimated using the Arsenazo III method. The following formula was used to calculate the corrected calcium level  $Ca (mg/dl) + 0.8 (4.0 - \text{serum albumin } [g/dl])$ . Student's t test was used for statistical analysis.

### RESULTS

The systolic blood pressure on right hand and left hand in newly diagnosed individuals was  $160.80 \pm 10.91$  and  $161.07 \pm 10.71$  and in control group it was  $110.68 \pm 7.35$  and  $111.12 \pm 7.15$  respectively. The diastolic blood pressure on right hand and left hand in newly diagnosed individuals was  $90.57 \pm 9.86$  and  $90.11 \pm 8.12$

and in control group it was  $72.42 \pm 6.18$  and  $73.14 \pm 5.85$  respectively. These results were highly statistically significant  $p = 0.000$ .

The mean serum calcium in newly diagnosed hypertensive group was  $8.35 \pm 1.04$  and in control group it was  $10.04 \pm 0.66$ . The mean corrected calcium in newly diagnosed hypertensive group was  $8.40 \pm 1.01$  and in control group it was  $9.87 \pm 4.76$ . These results were highly statistically significant  $p=0.000$ . Negative correlation was found between serum calcium and blood 2 pressures among our subjects.

### DISCUSSION

Essential hypertension is a well-known, modifiable risk factor for peripheral artery disease, 3 atrial fibrillation, myocardial infarction, stroke, and heart failure [7]. There was no statistical significant relationship of BMI between groups.

In this study, it was found that the mean serum calcium in newly diagnosed hypertensive group was  $8.35 \pm 1.04$  and in control group it was  $10.04 \pm 0.66$ . These result was highly statistically significant  $p=0.000$ . Similar results have been reported by K. Sudhakar et al., who found that both males and females in the hypertension group had considerably lower mean total serum calcium levels when it was compared to normotensive controls [5].

In the present study, the mean corrected calcium in newly diagnosed hypertensive group was  $8.40 \pm 1.01$  and in control group it was  $9.87 \pm 4.76$ . These result was highly statistically significant  $p=0.000$ . This shows that

**TABLE 1.** Comparison of blood pressure on both arm between newly diagnosed hypertensive and control group by using student t test

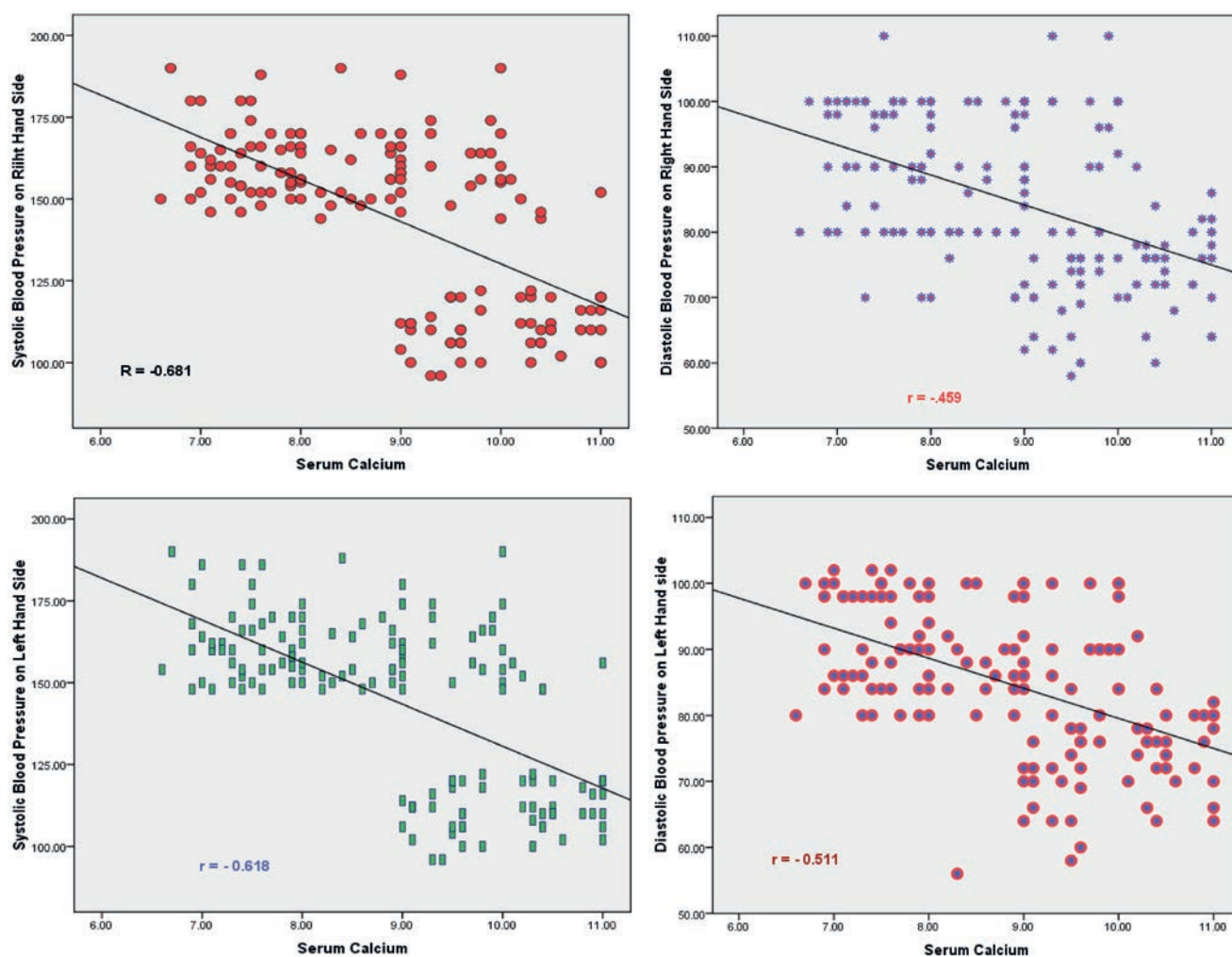
Parameter	Newly diagnosed hypertensive group Mean $\pm$ SD N=100	Control group Mean $\pm$ SD N= 50	t value	p value
SBP on Right Hand side	$160.80 \pm 10.91$	$110.68 \pm 7.35$	29.307	0.000***
SBP on Left Hand side	$161.07 \pm 10.71$	$111.12 \pm 7.15$	29.82	0.000***
DBP on Right Hand side	$90.57 \pm 9.86$	$72.42 \pm 6.18$	11.89	0.000***
DBP on Left Hand side	$90.11 \pm 8.12$	$73.14 \pm 5.85$	13.16	0.000***

\* $p < 0.05$ - \*\* $p < 0.001$ - statistically significant, ns- not significant

**TABLE 2.** Comparison of calcium, corrected calcium, blood sugar and serum albumin between newly diagnosed hypertensive and control group by using student t test

Parameter	Newly diagnosed hypertensive group Mean $\pm$ SD N=100	Control group Mean $\pm$ SD N= 50	t value	p value
Serum Calcium	$8.35 \pm 1.04$	$10.04 \pm 0.66$	- 10.467	0.000***
Corrected Serum Calcium	$8.40 \pm 1.01$	$9.87 \pm 4.76$	- 9.119	0.000***
Blood Sugar Level	$112.54 \pm 22.84$	$99.34 \pm 14.19$	3.742	0.000***
Serum Albumin	$3.93 \pm .433$	$4.21 \pm .389$	-3.780	0.000***

\* $p < 0.05$ - \*\* $p < 0.001$ - statistically significant



**FIGURE 1.** Correlation of blood pressure on left hand side and serum calcium level between newly diagnosed hypertensive and control group

the serum calcium level was lower in essential hypertensive individuals than controls. According to a Vidhya S et al. study from 2019, 65% of patients with hypertension had lower adjusted blood calcium levels. Correlations between adjusted serum calcium levels and systolic blood pressure were strongly negative [8]. Previous studies revealed a definite inverse correlation between calcium levels and systolic as well as diastolic blood pressure levels [9,10]. The present study also revealed a strong inverse relationship between calcium levels with both the systolic and diastolic blood pressure.

The mean serum albumin in the newly diagnosed group was  $3.93 \pm .433$  and in control group was  $4.21 \pm .389$ . Thus the serum albumin in newly diagnosed group was lower than control group and it was statistically significant ( $p = 0.000$ ). A study done by Oda E et.al on a Japanese population participating in a health screening programme, a reduction in serum albumin was found to be a significant predictor of hypertension [11]. This is in accordance with the present study.

Present study revealed higher intracellular calcium levels and lower serum albumin levels in hypertensive people which could be the noteworthy forecasters of essential hypertension.

## CONCLUSION

In patients with recently diagnosed essential hypertension, the total and adjusted blood calcium levels were much lower than in normotensive controls. Total and adjusted serum calcium levels have shown an inverse connection with diastolic blood pressure in newly discovered essential hypertensive individuals. So, in conclusion while treating hypertensive patients, more attention to be given for the serum calcium levels. Since essential hypertension is characterised by a reduction in serum ionised calcium, it can be managed with calcium supplements.

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