

Correlation of Serum Calcium Level with Hypertension

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ABSTRACT

Objective: To determine the association between serum calcium level and hypertension by taking normotensive individual as control.

Materials and Methods: This cross sectional/comparative study was conducted at medicine OPD LUMHS in collaboration with diagnostic and research laboratory of LUMHS, Jamshoro. With six months after from March 2016 to August 2016. All the individuals resident of Hyderabad division and newly diagnosed as hypertensive cases and either of gender were included and in equal number normotensive individuals were taken controls. Sphygmomanometers were used to assess blood pressure in all of the study participants in sitting posture. In all patients, 3 ml of intravenous blood sample was collected under hygienic conditions for serum calcium level determination by using Hitachi Automatic Analyzer 902.

Results: Mean age of the study subjects was found to be 38.67 years and males were found in majority 70(61.94%). There was no significant variance in BMI between the non-hypertensive and hypertensive groups, which may be because obese patients were excluded. Serum calcium level was significantly decreased in hypertensive study group (7.32 ± 1.11 mg/dl) than the non-hypertensive study group (8.95 ± 1.25 mg/dl); $p=0.001$. Significant negative correlation was found between systolic & diastolic blood pressure and calcium level ($r=0.09$, $p=0.001$) and ($r=0.04$, p -value 0.13) respectively.

Conclusion: Serum calcium level was inversely associated to blood pressure in hypertensive cases. It was significantly decreased among hypertensive patients as compared to non-hypertensive individual.

Keywords: Calcium level, Hypertension, Association

INTRODUCTION

Hypertension is a major factor of cardiovascular condition¹. Inadequate consumption of vegetables, fruits, inadequate physical activity, alcohol consumption, and smoking also are the major contributors to hypertension¹. If left untreated, hypertension can result in stroke, myocardial infarction, renal failure, and congestive heart failure.² Annual death rates due to hypertension is over 7.1 million.³ In the year 2000, around 26.4 % of adults were reported to be hypertensive, and this percentage is expected to rise upto 29.2 % by the year 2025. In Southeast Asians, the incidence of hypertension is growing increasingly.⁴ Furthermore, according to a National Health Pakistan report, 8% of Pakistani population is hypertensive.⁵ Extracellular and intracellular calcium ions are both essential contributors and regulators of a variety of biological activities. There is increasing epidemiologic evidence that the lower level of calcium diets may cause the blood pressure,⁶ because it may regulate blood pressure via raising intracellular calcium in cells of the vascular smooth muscle leading to vasoconstriction, and via elevating vascular volume by renin-angiotensin-aldosterone system.⁶ Low levels of Calcium may cause modifications in the transport mechanism of plasma membrane, because level of intracellular free calcium ions determine the tension of vascular smooth muscles. Calcium ions, as a result, have a strong impact on peripheral vascular system. Peripheral resistance is among the factors that influences arterial pressure. Endothelial dysfunction is among the mechanisms that are caused by a reduction in nitric oxide synthesis and release and a rise in contracting conditions, resulting in a rise of blood pressure and peripheral vascular resistance.⁷ Since

HTN is so common, many investigators have focused their efforts on finding ways to avoid it. The role of calcium ions in preventing and regulating blood pressure is still being debated. Calcium ions have been shown to play a beneficial function in the prevention and pathology of HTN in several trials and some reported that there was no significant association.^{6,8,9} However this study has been conducted to see whether there is an association between hypertension and levels of serum calcium.

MATERIALS AND METHODS

This cross sectional/cases control study was conducted at medicine OPD, Liaquat University of Medical and Health Sciences (LUMHS) in association with diagnostic and research laboratory of LUMHS, Jamshoro, during 6 months from March 2016 to August 2016 after taking ethical approval. All the individuals of either gender with any age range, residing in Hyderabad division and freshly diagnosed as a case of Hypertension were included. All the pregnant females, lactating females, known chronic kidney disease cases and those who were on calcium supplement were excluded. Total 113 hypertensive cases were taken in group A and in equal number of healthy individuals (control) were taken in group B. Written consent was taken from all the individuals. Blood pressure measurements were taken in sitting posture with Sphygmomanometer. Two readings of blood pressure were taken after every 5 minutes and recorded as a final reading. Three ml of blood sample was intravenously collected from all study subjects under hygienic conditions to assess the serum calcium levels by using a fully automatic and computerized Roche Diagnostic/Hitachi 902 analyzer, which contains photometric measurement system, LCD

touch screen, analytical processing unit, and printer. Each participant's details were entered into a self-made study Performa. The data was analyzed using the statistical software SPSS 20.

RESULTS

The study subjects were found to have mean age of 38.67 years, with an age range of 22 to 65 years. In non-hypertensive group, most of the study participants 70(61.9%) were males, while females were 43(38.1%), while in the hypertensive group females were majority 60(53.1%), while males were 53(46.9%). In both the non-hypertensive and the hypertensive groups, most of the

patients were poor (non-privileged) 70(61.94%) and 65(57.52%) respectively. Table.1

In hypertensive study subjects, systolic & diastolic blood pressures ($145 \pm 11.32/110.33 \pm 4.41$) were elevated significantly in comparisons to the non-hypertensive group as $110 \pm 6.22/75.21 \pm 3.11$ ($p = 0.001$). Mean of serum calcium found to be significantly lower in hypertensive group (7.32 ± 1.11 mg/dl) as comparison to non-hypertensive group as 8.95 ± 1.25 mg/dl ($p = 0.001$). TABLE:2

Diastolic blood pressure correlated negatively with calcium levels; decreased level of calcium increases diastolic BP; (P - value 0.01, r -value 0.095). Fig: 1

Insignificant weak positive association was seen between calcium level and systolic BP; ($P = 0.13$ r - value 0.047). Fig: 2

Table 1: Distribution of patients according to socio economic status n=216

Variables		GROUP A	GROUP B
Age	(Mean+SD)	38.67+6.23 years	40.44+8.87 years
Gender	Male	70(61.9%)	53(46.9%)
	Female	43(38.1%)	60(53.1%)
SES	Non privileged	70(61.9%)	65(57.5%)
	Privileged	43(38.1%)	48(42.5%)

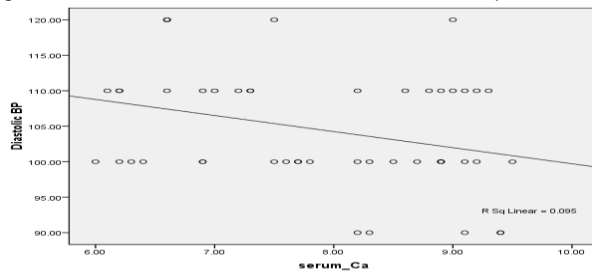
Group A=Hypertensive cases, Group B= Normotensive individuals

Table 2: Cases distribution according to Hypertension n=216

Variables		Group A	Group B	P-value
Blood pressure	Systolic (Mean+SD)	145+11.32	110+6.22	0.001
	Diastolic (Mean+SD)	110.33+4.41	75.21+3.11	0.001
Serum calcium	(Mean+SD)mg/dl	7.32+1.1	8.95+1.25	0.001

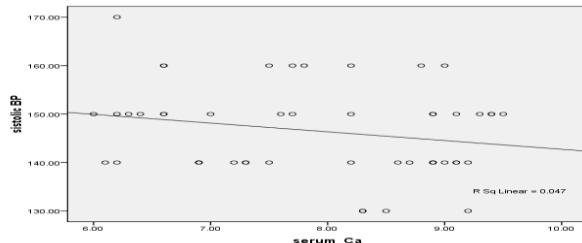
Group A=Hypertensive cases, Group B= Normotensive individuals

Fig: 1. Correlation of calcium level and diastolic blood pressure



$P = \text{value } 0.01$ r -value 0.095

Fig: 2. Correlation of calcium level and systolic blood pressure



$P = \text{value } 0.13$ r - value 0.047

DISCUSSION

Primary hypertension is a multifactorial condition of blood pressure control characterized by a rise in blood pressure above optimal level, and may be caused by a variety of factors. In this study calcium level was significantly decreased in hypertensive (7.32 ± 1.11 mg/dl) group

compared to non-hypertensive 8.95 ± 1.25 mg/dl group ($p = 0.001$) and it was inversely linked to the hypertension. Similarly Jayedi A et al¹⁰ concluded that the high intake of calcium level, independent of adiposity and other blood pressure-related minerals intake, is considerably linked to the low risk of hypertension development. On the other hand Villa-Etchegoyen C et al⁶ reported that the increases in the calcium levels can decrease the blood pressure and further they stated that the association among intake of calcium and blood pressure comprises the link in calciotropic hormones and the regulators of the blood pressure.⁶ However, Omar M et al¹¹ also found similar observations regarding serum calcium levels and blood pressure. On the other hand Nakamura H et al⁹ observed that the higher intake of the calcium was inversely linked to the hypertension. In this study hypertensive group showed a female predominance 60(53.09%), while males were 53(46.90%). Inconsistently, Pawade YR¹² found that in hypertensive group males were in majority (58), while females were 42, and male-to-female ratio was 1.38:1, and in controls group males were in majority (62) and females were 38; with 43.26 ± 7.67 years of mean age, male-to-female ratio was 1.63:1. Conflicting findings were reported by Nasri H et al¹³ of cases from urban regions, and according to gender female predominance. On the other hand it was stated that the high intake of calcium level have been showed decreased blood pressure hypertensive as well as normotensive individuals.^{9,14} Intervention of dietary calcium intake, like as food fortification or the supplementation, were seen to significantly linked with reduction in systolic blood pressure and diastolic blood

pressure among non-hypertensive and hypertensive cases.^{9,14}

CONCLUSION

The serum calcium level was found to be inversely linked to the hypertension. It was significant decreased in hypertensive group as compared to non-hypertensive individuals. Calcium level should be screened out among high risk patients, including those having developed hypertension. By the intervention of dietary calcium intake burden of hypertension can be decreased. Further large sample size studies are suggested on this subject.

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