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PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.2530867>Available online at: <http://www.iajps.com>**Research Article****A COMPREHENSIVE STUDY ON THE ROLE OF  
PARATHYROID HORMONE AND VITAMIN-D IN  
HYPERTENSION AND BLOOD PRESSURE****<sup>1</sup>Dr. Maryam Ahmad, <sup>2</sup>Dr. Ayesha Shahjahan, <sup>3</sup>Dr. Jannat Gulzar**<sup>1</sup>WMO at DHQ hospital Mandi Bahauddin<sup>2</sup> Polyclinic Hospital<sup>3</sup> Services Institute of Medical Sciences (SIMS), Lahore.**Abstract:**

**Introduction:** Hypertension is one of the important risk factors for cardiovascular disease, which is the major cause of morbidity and mortality worldwide. Vitamin D is known to regulate calcium and phosphate metabolism. **Aims and objectives:** The basic aim of the study is to find the role of Parathyroid hormone and Vitamin-D in Hypertension and blood pressure. **Material and methods:** This study was conducted at DHQ hospital Mandi Bahauddin with the collaboration of SIMS, Lahore during 2018. This study was conducted on 100 patients which was suffering from hypertension and visit the hospital regularly. The participants with hypertension were divided based on the stage of hypertension according to the definition of Joint of National Committee for hypertension. **Results:** Calcium, Vitamin D and PTH levels significantly decreased in all hypertensive patients with a cure rate of 99.1%. The mean systolic and diastolic BP decreased in the total population of hypertensive patients and hypertensive patients on antihypertensive therapy. Patients with PHPT experienced a significant decrease in both systolic BP ( $P < .001$ ) and diastolic BP. High BP was present in 34% of the whole sample, and another 16% were taking medication for hypertension. **Conclusion:** It is concluded that serum vitamin D and PTH levels are not independently associated with blood pressure or risk of hypertension.

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**INTRODUCTION:**

Hypertension is one of the important risk factors for cardiovascular disease, which is the major cause of morbidity and mortality worldwide. Vitamin D is known to regulate calcium and phosphate metabolism. However, accumulating evidence suggests that vitamin D level is inversely related to blood pressure and risk of hypertension in observational studies in the Western populations. Numerous studies in humans and experimental models have shown that alterations in calcium homeostasis are associated with an increased risk of cardiovascular complication. In particular, changes in systemic calcium metabolism are thought to play an important role in the regulation of blood pressure [1]. One hypothesis for this link implicates parathyroid hormone (PTH). Serum calcium level is tightly regulated by PTH in a classic negative-feedback system. A small decrease in serum calcium stimulates an abrupt increase in PTH secretion, which leads to calcium mobilization from bone, increased renal tubular calcium reabsorption and increased renal hydroxylation of 25-hydroxyvitamin D to the biologically more active 1,25-dihydroxyvitamin D [2].

Thyroid gland along with the parathyroid glands and heart share a close relationship arising in embryology. In ontogeny, the thyroid and heart migrate together. There is a strong physiological relationship between the two organs, which is affirmed by predictable changes in cardiovascular functions across the entire range of thyroid disease states [3]. Many symptoms and signs recognized in patients with overt hyperthyroidism and hypothyroidism are due to increased or reduced action of thyroid hormone on the heart and the vascular system, respectively [4].

Increases in parathyroid hormone (PTH) have been associated with changes in the vascular tone and renin angiotensin system. Hyper functioning parathyroid glandular disorders have been for long associated with an increased risk of hypertension, though a causal relationship is still not established [5]. Most of the molecular and cellular mechanisms responsible for the cardiovascular effects of the thyroid hormone have been clarified. Thyroid hormone exerts both genomic and non-genomic effects on cardiac myocytes. Studies have confirmed  $T_3$  as the active form of thyroid hormone that accounts for the vast majority of thyroid effects including stimulation of tissue thermogenesis, alterations in the expression of various cellular proteins and action on the heart and vascular smooth muscle cells. The process of the genomic effect of

thyroid hormone begins with the entry of  $T_3$  into the cardio myocyte through specific transport proteins located within the cell membrane [6].

**Aims and objectives**

The basic aim of the study is to find the role of Parathyroid hormone and Vitamin-D in Hypertension and blood pressure.

**MATERIAL AND METHODS:**

This study was conducted at DHQ hospital Mandi Bahauddin with the collaboration of SIMS, Lahore during 2018. This study was conducted on 100 patients which was suffering from hypertension and visit the hospital regularly. The participants with hypertension were divided based on the stage of hypertension according to the definition of Joint of National Committee for hypertension.

**Biochemical analysis**

Venous blood samples were drawn after overnight fasting for the measurement of serum glucose, creatinine and total cholesterol. Serum was also stored at  $-30^{\circ}\text{C}$  for measurement of 25(OH)D and PTH. Serum calcium, phosphorous, and albumin were measured. BP was obtained using an automatic BP monitor (Omron model HEM-712C, Omron Health Care, Inc., USA). Three measures were taken at rest in a sitting position, with intervals of 5 min between the measurements. The average from the last two measurements was taken for analysis. The participants were stratified into categories: 1) normal BP (NBP): those with systolic/diastolic BP.

**Statistical Analyses**

Comparisons between the two groups were done using the t test or the chi-square, where appropriate. Data analysis was carried out using the SPSS software (Statistical Package for the Social Sciences, version 15.0, SPSS Inc, Chicago, Ill, USA).

**RESULTS:**

Calcium, Vitamin D and PTH levels significantly decreased in all hypertensive patients with a cure rate of 99.1%. The mean systolic and diastolic BP decreased in the total population of hypertensive patients and hypertensive patients on antihypertensive therapy. Patients with PHPT experienced a significant decrease in both systolic BP ( $P < .001$ ) and diastolic BP. High BP was present in 34% of the whole sample, and another 16% were taking medication for hypertension. Overweight and obesity (WHO, 1997) was present in 75% of the individuals. Only 23% of whole sample reported practice regular physical exercise and the use of

sunscreen was present in 22% of individuals.

**Table 01:** Analysis of relationship of hyperthyroidism and hypertension

	25(OH)D (ng/ml)				P
	<16.8	16.8–22.5	22.6–28.3	>28.3	
	(n=295)	(n=310)	(n=301)	(n=300)	
25(OH)D, ng/ml	12.8±2.8	19.7±1.6	25.3±1.6	34.0±4.8	–
PTH, pmol/l	3.12	2.89	2.54	2.52	0.0001
	(2.04–4.42)	(1.91–3.99)	(1.80–3.61)	(1.65–3.66)	
Study outcome					
Systolic BP, mmHg	124.4±18.6	124.7±19.4	124.6±17.9	123.4±17.5	0.84
Diastolic BP, mmHg	77.7±11.6	78.4±11.1	78.8±11.5	77.7±11.0	0.60
Pulse pressure, mmHg	46.6±11.5	46.3±12.3	45.8±10.4	45.7±10.5	0.69
Possible confounders					
Male, %	50.2	58.1	65.5	67.7	<0.0001
Age, years	49.5±13.4	47.0±11.9	45.9±11.9	45.6±12.3	0.0004
BMI, kg/m <sup>2</sup>	23.0±3.2	23.4±3.4	23.3±3.2	23.1±3.2	0.42
Total cholesterol, mmol/l	5.6±1.2	5.4±1.1	5.4±1.0	5.3±1.0	0.02
Serum glucose, mmol/l	5.4±2.0	5.4±1.8	5.2±1.7	5.2±1.5	0.23
GFR, ml/min.1.73 m <sup>2</sup>	97.6±19.3	95.3±18.4	97.2±21.0	94.2±18.2	0.10
Current alcohol intake, %	16.3	21.6	31.2	25.3	0.0002
Current smoking, %	31.2	34.8	40.5	41.0	0.04
Hypertension, %	23.4	22.3	22.6	22.3	0.99

### DISCUSSION:

The main findings of our cross-sectional study are that serum 25(OH)D and PTH levels are not independently associated with blood pressure level or risk of hypertension. Subclinical hyperthyroidism is characterized by subnormal thyrotropin (TSH) serum levels in the presence of circulating thyroid hormones in the normal range for the general population. It may be due to an intrinsic pathology of the thyroid gland

(endogenous subclinical hyperthyroidism) or a consequent suppressive or replacement l-thyroxine therapy (exogenous subclinical hyperthyroidism). Exogenous subclinical hyperthyroidism is the condition more frequently seen in clinical practice [7].

A number of studies have investigated the effects of subclinical hyperthyroidism on the heart, showing that this condition may be associated with various abnormalities of cardiac structure and function. The

cardiovascular disorders associated with subclinical hyperthyroidism may be a direct effect of thyroid hormone disturbance or may reflect an increased arterial pressure level in these patients [8]. There are no consistent studies proving that arterial BP rises in such patients. Recent meta-analyses of five large studies evaluating the incidence of hypertension in these patients did not reveal increased BP levels in individuals with suppressed serum TSH levels and free thyroid hormones within the reference range [9]. The finding that serum PTH level was not associated with blood pressure level or risk of hypertension is in contrast to previous studies. Several studies have consistently demonstrated that higher levels of circulating PTH were associated with higher blood pressure or prevalence of hypertension [10].

### CONCLUSION:

It is concluded that serum vitamin D and PTH levels are not independently associated with blood pressure or risk of hypertension. Hypertension associated with common endocrine conditions which are not classically considered to be etiologies involved in the work up of a patient with suspected secondary hypertension.

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