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Original Research Article

TO ASSES SERUM LEVELS OF MAGNESIUM, COPPER, ZINC AND IRON IN PATIENTS WITH ESSENTIAL HYPERTENSION

Dr. Ramesh Chandra Thanna[1] (Assistant Professor) & Dr. Amrita Vamne[2] (Assistant Professor)

Department of Biochemistry, Government Medical College, Ratlam, M.P.[1&2]

Corresponding Author: Dr. Amrita Vamne

Abstract:

Background & Method: The aim of the study is to asses Serum Levels of Magnesium, Copper, Zinc and Iron in Patients with Essential Hypertension. The patients were compared with 50 normal age & sex matched controls. Patients with diabetes mellitus, thyroid disorders and any other chronic diseases and those who are on vitamin or mineral supplements, steroids were excluded from the study besides the patients who did not give voluntary consent & patients less than 25 and more than 65 years.

Result: The serum levels of copper and zinc in the hypertensives show that they were statistically significantly elevated; serum magnesium and iron levels were statistically significantly decreased in hypertensives when compared to the normotensives.

Conclusion: Our study concluded that the serum levels of magnesium and iron were significantly decreased in hypertensive individuals when compared to their normal counterparts. The serum levels of copper and zinc and the systolic as well diastolic blood pressure was found on the higher side in hypertensive subjects than their normal aged matched controls. Further large scale multi-centric population studies are essential to establish the role of various trace elements in hypertensive and normotensive individuals.

Keywords: Serum, Magnesium, Copper, Zinc, Iron & Hypertension.

Study Designed: Observational Study.

1. Introduction

It is estimated that nearly one billion people are affected by hypertension worldwide, and this figure is predicted to increase to 1.5 billion by 2025[1]. Because of the complex etiology, traditional markers of the prevalence of hypertension in the general population, such as age, smoking, alcohol consumption, and obesity, cannot accurately reflect this prevalence. The previous study has linked pollution and environmental metal intake to hypertension [2]. Recent studies have shown an intriguing role for stress in the release of low testosterone which can lead to diabetes. Regarding this sentence, it is possible that due to hypertension the

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level of hormones goes up or down and may cause alteration in metal elements. Future research will take an interesting tack by trying to understand this idea[3]. Hypertension is classified into two stages. Stage I has a systolic blood pressure of 140-159 mmHg and diastolic blood pressure of 90-99 mmHg, whereas stage II has a systolic blood pressure of 160 mmHg and diastolic blood pressure of 100 mmHg [4]. Lead toxicity is a serious health concern due to pollution and miseducation. It affects almost all of the organ systems throughout the body. Copper, an essential trace metal, possesses antioxidant properties maintained by various redox enzymes. Previous studies on the link between serum copper and blood pressure (B.P.) were unclear or conflicting. Copper has been shown to block the angiotensin-converting enzyme, a key enzyme in blood pressure regulation. Following a randomized trial conducted in the United States of America (U.S.), low-to-moderate was associated with hypertension in the general public [5-6].

2. Material & Method

A hospital based observational study was conducted on total of 50 patients of age group 25-65 years over a period of 06 months with convenient sampling of hypertensive patients attending the medical out-patient of AIMS, Dewas, M.P. The patients were compared with 50 normal age & sex matched controls. Patients with diabetes mellitus, thyroid disorders and any other chronic diseases and those who are on vitamin or mineral supplements, steroids were excluded from the study besides the patients who did not give voluntary consent & patients less than 25 and more than 65 years. Detailed medical history and relevant clinical examinations were carried out in these patients.

Sample collection, Venous blood (5ml) was collected from antecubital vein using aseptic precautions into red capped plain vaccutainers for estimation of serum levels of magnesium, copper, zinc and iron.

3. Results

Table 1: Mean and Standard deviation of various parameters in normotensives

S. No.	PARAMETER	No.	Percentage	P-VALUE
1.	25-35	05	10	.568209
2.	36-45	08	16	
3.	46-55	14	28	
4.	56-65	23	46	

The chi-square statistic is 0.0016. The *p*-value is .968209. The result is *not* significant at $p < .05$.

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Table 2: Mean and Standard deviation of various parameters

S. No.	PARAMETER	MEAN + SD IN HYPERTENSIVES	MEAN + SD IN NORMOTENSIVES	P-VALUE
1.	MAGNESIUM (mg/dL)	1.46 + 0.19	1.98 + 0.15	<0.001
2.	COPPER (ug/dL)	153.78 + 33.26	105.24 + 21.62	
3.	ZINC (ug/dL)	26.80 + 8.7	23.36 + 5.09	
4.	IRON (ug/dL)	37.72 + 1.7	68.21 + 4.3	
5.	SBP (mm Hg)	163.76 + 12.04	120.20 + 8.30	
6.	DBP (mm Hg)	93.72 + 3.55	74.48 + 5.02	

The serum levels of copper and zinc in the hypertensives show that they were statistically significantly elevated; serum magnesium and iron levels were statistically significantly decreased in hypertensives when compared to the normotensives.

Table 3: Mean and Standard deviation of SDP & DBP

S. No.	PARAMETER	MEAN + SD IN HYPERTENSIVES	MEAN + SD IN NORMOTENSIVES	P-VALUE
1.	SBP (mm Hg)	163.76 + 12.04	120.20 + 8.30	<0.001
2.	DBP (mm Hg)	93.72 + 3.55	74.48 + 5.02	

There was a statistically significant increase in mean value of SBP and DBP in hypertensives than in normotensives.

4. Discussion

Nutrition plays a crucial role in cardiovascular disorders, with trace elements like zinc, magnesium, copper, and iron exhibiting known antioxidant or oxidant activity and influencing atherogenesis in coronary artery disease (CAD). In this study, we assessed the levels of iron, zinc, and magnesium in patients with CAD and apparently healthy subjects. Our findings revealed a higher level of serum zinc in CAD patients compared to healthy controls, consistent with literature suggesting that intracellular zinc release, triggered by events such as ischemia and infarction, can elevate serum zinc levels, as observed in our study [7]. However, conflicting reports indicate a decrease in serum zinc concentration after myocardial infarction. Unlike studies reporting a decline in serum zinc within 24-48 hours post-event , our results did not show a significant fall, likely due to our sample collection occurring outside the acute phase of the critical event. Low serum iron is associated with cardiovascular disease [8]. Our study results identified significant changes in serum iron levels between CAD patients and controls, with CAD patients exhibiting low serum iron levels. This aligns with findings of increased iron stores in CAD [9]. Serum iron is elevated in atherosclerotic heart disease and correlates with its severity. Human body has evolved a

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delicately balanced network to monitor iron entry, transport it to sites of need, and serve as a distinctive storage and recycling system, in the absence of an excretory system, to remove excess iron through intestinal absorption and shedding. However studies have found that stored iron concentrations, as assessed by serum ferritin, is a strong and independent risk factor for premature CAD. Excess iron, with its ability to generate reactive oxygen species, is implicated in oxidative stress and organic biomolecule oxidation. High serum ferritin levels have been linked to an increased risk of atherosclerosis in the absence of other risk factors, catalyzing oxygen free radical production and lipid peroxidation, ultimately leading to oxidized LDL formation. Magnesium is essential for ATP activation necessary for the sodium-potassium pump maintenance, and magnesium deficiency has been associated with arrhythmias in acute myocardial infarction patients [10]. Studies have shown reduced serum magnesium levels in patients with acute myocardial infarction and ischemic heart disease. In our study, magnesium values were within the normal range, possibly attributed to the timing of sample collection in the second week post-event. These findings underscore the complex interplay of trace elements in cardiovascular health and warrant further investigation.

5. Conclusion

Our study concluded that the serum levels of magnesium and iron were significantly decreased in hypertensive individuals when compared to their normal counterparts. The serum levels of copper and zinc and the systolic as well diastolic blood pressure was found on the higher side in hypertensive subjects than their normal aged matched controls. Further large scale multi-centric population studies are essential to establish the role of various trace elements in hypertensive and normotensive individuals.

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