

EVALUATION OF ELEMENTS IN THE PATHOGENESIS OF HYPERTENSION IN NIGERIANS

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ABSTRACT

Serum micro and macro elements play a significant role in the regulation of blood pressure. The aim of the study is to investigate the role of these elements in hypertension. The study involved 90 newly diagnosed hypertensive patients and 30 healthy subjects who served as controls. Determinations of elements K, Na, Fe, Mg, Mn, Cu, Pb, Co, Cr, Ca, Al, Cd, and Ar were performed using Atomic Absorption Spectrophotometer. Our results show higher values of Na, Fe, the toxic elements such as Pb, Co, Al, Ar, Cd, and Cr and lower levels of K, Mg, Mn, Cu, and Ca for hypertensive patients in comparison with normal healthy controls. Although, it seemed very unlikely that mineral deficiencies *per se* could be the cause of hypertension, their contribution is suspected.

Keywords: Micro elements, macro elements, hypertension, deficiencies, blood pressure.

INTRODUCTION

Hypertension also known as high blood pressure is one of the most common complex and public health problems which becomes more prevalent in developed and developing countries¹. It is becoming an area of increasing concern all over the world.

Hypertension is asymptomatic condition whereby the patient's blood pressure measurement is greater than 140/90mmHg¹. The causes of high blood pressure vary. It may be due to smoking of cigarettes, alcoholism and narrowing of arteries. Diet definitely plays a crucial role in the development of hypertension along with stress. An obese person is more prone to hypertension than to a normal physic person and increasing age is also a factor of hypertension².

Macro and micro elements are known to play a major role in various enzyme reactions directly related to the regulation of blood pressure and indirectly related to generation of oxidative metabolic energy and alterations in blood lipid levels³. Disturbances in these elements composition may therefore play a major role in the development and management of essential hypertension. The changes in plasma elements level on hypertensive patients should therefore be actively investigated. The findings of this study may help to understand the effects of elements in the regulation of blood pressure. Therefore our goal is to find out the involvement of plasma elements in the pathogenesis of hypertension in Nigerians.

MATERIALS AND METHODS

Our study was conducted in Ado-Ekiti, Ekiti State, Nigeria. The study population in this investigation was made up of 90 hypertensive patients who attended cardiovascular

clinic of the University of Ado-Ekiti Teaching Hospital, Ado-Ekiti, Nigeria. In addition, 30 control volunteers were also involved in this study. The control participants were normotensive subjects.

Elemental analysis was performed using atomic absorption spectrophotometer⁴. Data were subjected to statistical analysis using means, standard error of means and student's t-test.

RESULTS AND DISCUSSION

Lower plasma copper was found in hypertensive subjects compared with normotensive subjects (Table 1). This agrees with the reports of other workers^{5,6}. The abnormal deficiency of copper in hypertensives probably contributes to decreased activities of lysyl oxidase and superoxide dismutase which result in failure of collagen and elastin cross linking and impaired defense against free radicals. Copper deficiency also increases plasma levels of cholesterol.

The result of lower plasma manganese level in hypertensive subjects observed in this study may be of special pathogenetic importance. Studies have revealed manganese to possess choline-like lipotropic properties which is known to prevent atherosclerosis and therefore affect lipid metabolism in hypertensive patients⁷. The serum concentration of magnesium was significantly lowered in hypertensives as compared with normotensive group. Magnesium deficiency has been attributed to increased risk of cardiovascular damage including hypertension, coronary constriction and occlusion and sudden death⁸. The hypomagnesemia observed in hypertensive patients may be as a result of low Mg/Ca ratio which has been found to stimulate the release of catecholamines, the auto-oxidation of which yield free



radical which lowers tissue Mg levels⁸. Hypomagnesaemia also favours release or formation of factors that are vasoconstrictive and platelet aggregating.

The levels of potassium were found to be significantly lower among the hypertensive Nigerians than in normotensive controls. Potassium works with sodium to maintain the body's water balance. Newer evidence suggests that potassium may play a role in decreasing blood pressure⁹. Therefore, in hypertension, the maintaining homeostasis of potassium is critical as potassium seems to have a protective effect against hypertension since increased potassium may increase the amount of sodium excreted from the body.

High concentration of some toxic elements such as Pb, Cr, Cd and Ar in hypertensive patients is quite alarming. These toxic elements usually replace essential elements of the same charge or shape in the molecules or enzymes and they can also precipitate metals of metalloenzymes. This may account for the reduced levels of some of these essential elements in hypertension as observed in this study. This was in agreement with earlier report³. The toxicological action of several heavy metal ions can cause hypertension by affecting hormone metabolism, vasoconstriction and renal tubular function. We therefore concluded that alterations in the plasma concentrations of both macro and micro elements may probably be a contributory factor in the pathogenesis of hypertension.

Table 1: Plasma levels of elements in hypertensive and normotensive subjects.

Elements (ppm)	Normotensive Subjects (n=30)	Hypertensive Subjects (n=90)
Potassium	4.39 ± 2.22	2.23 ± 0.56
Sodium	143.66 ± 12.65	221.44 ± 32.44
Iron	20.38 ± 10.14	45.95 ± 15.38
Magnesium	4.38 ± 1.22	1.39 ± 0.54
Manganese	24.34 ± 7.84	12.48 ± 4.23
Copper	30.21 ± 10.18	13.31 ± 6.25
Lead	0.24 ± 0.05	1.14 ± 0.98
Cobalt	1.34 ± 0.49	4.88 ± 1.32
Chromium	0.09 ± 0.002	0.81 ± 0.21
Calcium	2.34 ± 0.92	0.99 ± 0.38
Aluminum	14.44 ± 5.22	25.22 ± 8.91
Cadmium	0.08 ± 0.001	0.98 ± 0.21
Arsenic	0.04 ± 0.001	0.58 ± 0.41

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