

Ferritin level and blood parameters in patients with hypertension and diabetes

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Abstract

Diabetes and hypertension are two of the most prevalent chronic diseases in the world. In this investigation, ferritin, Na, and K levels in serum as well as certain tests for liver and kidney function were estimated and compared between hypertensive, diabetic, and healthy persons.

The current study was an analytical and observational study conducted at a hospital. Total 60 patients and 30 healthy volunteers were included, three groups comprised, each group involved 30 diagnosed hypertension patients, diabetes mellitus patients and healthy volunteers (with normal values). The results showed significant differences among control and patient groups in potassium and ferritin and urea level. While, nonsignificant change in test liver enzymes, neither with normal nor with patient groups were observed.

Keywords: Diabetes, hypertension, chronic diseases.

INTRODUCTION

Essential micronutrients which vital for the body's normal functioning includes minerals and trace elements. Particularly appropriate for physiological processes are these elements. Several biochemical processes require the presence of minerals and trace elements, which also serve as cofactors for numerous enzymes and as stabilizing elements in proteins. Definite trace elements control important biological processes by attaching to the receptor at cell membrane or by altering receptor's structure to block the entry of specific molecules. Micronutrients perform a dual function: they keep cellular structures stable at ideal levels, but when levels are low, alternate pathways are opened up and illnesses may result. These crucial micronutrients reveal clear connections with diabetes mellitus and have significant physiological effects. (Dubey, P., V. 2020).

The physiological homeostasis of the organism is significantly influenced by iron. Serum ferritin is used as a sensitive indicator of the body's iron status and a well-known diagnostic biomarker for iron deficiency. Additionally, high serum ferritin concentrations have been associated to diabetes type II, metabolic disorders, dyslipidemia, and obesity. Systemic inflammation has also been linked to elevated serum ferritin as an acute phase response. Although the correlation between hypertension and serum ferritin in women was not conclusively proved and has generated debate, publications have revealed such association. (Lee, D.-H., 2018).

An critical cation, sodium (Na⁺) is vital for maintaining electrolyte balance and for many biological functions, including action potentials (signal transduction). The primary source of sodium (Na⁺) is table salt (NaCl), which comprises 40% sodium and is often used in all cuisine to enhance flavor. Another important mineral is potassium (K⁺), which is crucial for maintaining glucose homeostasis, electrolytic/fluid balance, and cellular metabolism. Banana, avocado, grains/beans, almonds, milk, and potatoes are the main sources of potassium. The maintenance of overall Na⁺ and K⁺ concentrations therefore depends on the Na⁺/K⁺ pump, in which Na⁺ flows into extracellular space and K⁺ moves inside cells. potassium's effect on HT is the reverse of that of Na⁺. Because potassium levels are higher and sodium levels are lower, the rise K⁺/Na⁺ proportion favor a hypotensive effect, reduce the risk of CVD and cerebrovascular disorders. (Chiu, H.-F., et al 2021).

Hypertension (HT) is defined medically as a chronic, continuous rise in arterial blood pressure (BP) that exceeds 140/90 Hg mm (systolic blood pressure/diastolic blood pressure), in accordance with National Institute for Health and Clinical Excellence—NICE criteria. HT is divided into main or vital (90–95%) and secondary (5–10%) components. Due to the

complexity of the process and the multifactorial etiology of HT, its pathophysiology has not been fully investigated. However, the primary pathogenic mechanisms linked to HT are thought to be endothelial dysfunction, oxidative stress, inflammation, and immunomodulation. When pancreatic beta cells are destroyed, diabetes type-II mellitus, an immune mediated disorder, as a result minimal or no insulin was produced. Examples of risk factors for the development of T1DM include family history and some speculative environmental factors, like exposure to particular viruses and foods. The body requires insulin from external source to be capable of store glucose because it is incapable of synthesise insulin on its own. Blood glucose levels are high in the absence of insulin. High blood glucose levels have the risk of damaging blood vessels and neurons, particularly in the heart, kidneys, and eyes, if left untreated. Which may result in side effects such cardiovascular disease, retinopathy, nephropathy, and diabetic neuropathy. Without the right care, greater threat of stroke or heart attack, kidney failure, and blindness may occur. Type II diabetics also are susceptible to these consequences. Diabetes mellitus Type II a chronic disorder in which the body produces insufficient insulin and cells might develop insulin resistance, making it challenging for the body to regulate blood sugar levels with its own insulin. Several variables, including the environment (food and lifestyle) and some biological connections, can contribute to it. (Yeung, S., 2018).

Method

The present observational study was conducted at (Qurna Hospital) in AL-Basrah. Ethical approval from the Basrah University's Faculty of Pharmacy's Institutional Ethical Committee as well as the Basra Health Directorate's Scientific Committee of Researches. In addition, prior consent was taken for patients and healthy subjects.

Clinically definite cases of diabetes mellitus and hypertension, people aged 20 to 60 were included in the current observational and analytical investigation conducted at a hospital. Study sample included 30 people in each group. The first group consist patients that diagnosed with hypertension, the second included diabetes mellitus patients and the third group included healthy volunteers

Blood samples (5ml) were collected from each volunteer under all antiseptic state from venipuncture by using a sterile disposable syringe. Blood was disposed of into tubes without the use of anticoagulant, blood left to for 30 minutes at room temperature to promote clot retraction. By centrifuging blood samples at 3000 rpm for 20 min (Genex, Florida, USA), serum was extracted, and serum samples were then kept in polyethylene eppendorff tubes at (-20 oC) for additional biochemical analysis, Alanine transaminase (ALT), aspartate aminotransferase (AST) which use for determining liver function by using commercial kits (JOURILABS, Ethiopia). Urea and creatinine levels were investigated to determined kidney function by using (COBAS,INTEGRA400 PLUS) and ferritin, Sodium, potassium by using (COBAS,INTEGRA400 PLUS).

Statistical analysis

With the help of the window-based analysis application GraphPad Prism 5, the findings of this inquiry were assessed (San Diego, CA, USA). The data were expressed using means and standard Error of the Mean (SEM). Intergroup comparisons were assessed using one-way analysis of variance (ANOVA) and Bonferroni's multiple comparison tests (MCT). All findings were considered statistically significant if the p-value was less than 0.05.

Results

The results showed significant increase in K concentrations at both HT and DM patients in comparison with control group. Also; the results exhibited significant increments in ferritin in both patients groups compared with control group ; while sodium levels showed no significant alteration among test groups, as in table (1). In this study the creatinine levels exhibited no significant alterations among test groups, while urea plasma levels showed significant increased compare with control group, table(2) exhibited such results. All lever function tests that measured AST, ALT, and ALP showed no significant changes among test groups as in table(3)

Table (1): showed the levels of K, Na, and Ferritin concentration

	K	Na	Ferritin
HT	4.05±0.64939 a	142.375±18.35	181.15±0206.97132 a
DM	4.10±0.53058 a	142.33±12.08	96.62±066.85509 b

NOR	3.54±0.39194 b	144.27±7.64	63.98±012.30573 b
LSD	0.513	No significant differences	117.13

Table (2): showed creatinine and urea plasma levels

	Creatinine	Urea
HT	0.9178±0.53	56.37±036.7 a
DM	0.9240±0.44	54.21±027.23 a
NOR	0.7527±0.08	18.21±03.15 b
LSD	No significant	35.99

Table (3): showed liver enzyme plasma levels

	AST	ALT	ALP
HT	40.2133±27.9	38.3667±35.08	99.4267±18.94
DM	39.6715±17	24.5608±11.32	106.8931±15.75
NOR	25.8783±7.23	26.7542±9.05	98.1783±21.59
LSD	No significant	No significant	No significant

Discussion

Higher ferritin values were identified in type-II DM patients reported by Wolide et al.¹⁸ in Ethiopia, which was published by (Dinneen and colleagues in the January 1994) issue, Diabetes Mellitus causes increased Ferritin Concentration. Our results show a significant increase compared with control group, which is agree with the research mentioned above. H₂O emigration from cells, which lowers serum sodium levels ([Na⁺]) as a result of dilution are both caused by hyperglycemia, which raises serum osmolality. Compared to the general population, diabetic individuals have a higher frequency of hyperkalemia.^(6,7) In our study the Na show insignificant change in patient with diabetes erom normal and that disagree with the studies above while agree about the k level Liver enzyme. The outcomes showed that liver enzymes, particularly ALP, ALT and AST have insignificant increases at Iraqi comunnity with T2DM. In the current study, levels of AST and ALP increased only at 17% and 16% respectively of diabetes patients, respectively, but the ALT levels were elevated in 40.4% of the diabetic group (8). As opposed to the control groups, a study by Shrestha et al., and Thanpari et al. from Nepal likewise noticed ALT levels statistically significant(p<0.05) rise in ALT levels in diabetes⁽⁹⁾, and that don't show in our study

An Indianan article at -tertiary teaching hospital- exhibited deficiency of serum creatinine was more common (15%) than urea impairment (18%) (Bamanikar et al., 2016). The frequency of creatinine impairment was 34% and urea deficiency was 32% inconclusive in the study by (Sirivole, 2017). Additionally, a study done in Nepal found that the rate of urea impairment (15%) was consistent, whereas the occurrence of creatinine was 7% inconsistent (Singh et al., 2014), which agree with our study that show significant increases in urea level but insignificant increases in creatinine level.

Numerous cross-sectional investigations have proven that ferritin and BP are definitely correlated. Hypertension prevalence was strongly correlated with serum ferritin and shift work. The fifth Korean National Health and Nutrition Examination Survey 2010-2012 showed that interaction was above multiplicative.

In our result show significant increase in comparison with control group and this agree with studies above (10, 11, 12, 13) Clinical Medicine Journal / Article In North Sulawesi, Indonesia, electrolyte levels analysis at hypertensive patients indicated a substantial direct link between serum levels of sodium with systolic blood pressure, but an inverse relationship with diastolic blood pressure. With regard to K⁺, potassium levels are inversely correlated to systolic and diastolic blood pressures (14),

which disagree with present study. In people with hypertension, increased liver enzyme levels were more common. An investigation on Bangladeshi individuals indicated that high serum ALT activities were positively linked with hypertension (15).

The key conclusion of this study was that high levels of serum ALT, AST, and ALP were directly related to an increased risk of hypertension as shown by A Cross-Sectional Study Based on Data from Rafsanjan Cohort Study(16). In our results show no significant increase in level of liver enzymes

In the United States, higher systolic and diastolic blood pressures, the presence of hypertension, and use of antihypertensive medications were all associated with higher serum creatinine levels, according to the prevalence of High Blood Pressure and Elevated Serum Creatinine Level in the United States Findings from the Third National Health and Nutrition Examination Survey (1988-1994) article(17). Our investigation, which showed no significant differences in creatinine levels and substantial differences in urea levels compared to the control group, confirmed this.

Conclusion

The diabetes mellitus and hypertension have significant effect on plasma urea level resulting from effects of these diseases on renal function and tissue, unlike urea. The creatinine level doesn't be affected by these diseases. Diabetes mellitus and hypertension don't have effect on liver enzyme. Diabetes mellitus and hypertension have significant effect on ferritin and potassium level but not affect the sodium levels, Although that there is a differences in the effect of diabetes and hypertension on ferritin and blood parameters between countries and individuals depending on environmental factors, areas and individuals variety.

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