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Sodium And Potassium Electrolytes Levels Among Hypertensive Patients In Jos Metropolis

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Abstract

Electrolytes are electrically charged particles called ions which body cells use to maintain voltage across the cell membranes and carry electrical impulses such as nerve impulses to other cells including cardiac cells and tissues. The study was carried out to find out Sodium and Potassium electrolyte levels (concentration) among hypertensive patients in Jos metropolis while reviewing relationship between hypertension and electrolytes. Photometric (spectrophotometric) method was used in the study among hypertensive patients and control subjects in Jos metropolis. There is a relationship between hypertension and electrolytes, however, the Na⁺ and K⁺ among hypertensive and non-hypertensive subjects in Jos metropolis under this study is not significant at P<0.05. Testing for electrolytes especially sodium and potassium should not be ignored in the management of hypertension in Jos metropolis.

Keywords: Electrolytes, Homeostasis, Hypertension, Atherosclerosis, Cardiovascular disorders.

Introduction

Electrolytes play important roles in maintaining homeostasis. They are critical in allowing the cells to generate energy, they maintain the stability of the cell walls, contract muscles, move water and fluids within the body and participate in the other myriad activities. The number of electrolytes relative to another is important to how every cell in the body functions. The kidney is an important organ that helps to regulate the amount of

electrolyte in the body as long as the kidney is working properly [1,2].

Hypertension is the major leading risk factor for Atherosclerosis and several diseases, especially renal and cardiovascular disorders including myocardial Infarction stroke and heart failure. Hypertension affects approximately 25% of the adult population worldwide and its prevalence is predicted to increase by 60% by 2025, when a total of 1.56 billion people may be affected

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[3].

Recent evidence as well as classic studies points to the interaction of sodium and Potassium as the dominant environmental factor in the Parthenogenesis of Primary Hypertension and its associated cardio-vascular risk. Concomitant to Sodium reduction, higher Potassium intake or supplementation has also been repeatedly shown to reduce the blood pressure of especially hypertensive patients. Therefore, the American Heart Association recently proposed a dietary Potassium intake of 3500 – 5000 mg/ day, in addition to the well-known advice to reduce the consumption of dietary Sodium (1500mg/day or at least 100mg/day decrement) for adults with normal and elevated blood pressure. In addition, World Health Organisation (WHO) recommends that sodium consumption should be less than 2000mg and Potassium intake at least 3510mg for adults per day [4].

Hypertension remains a serious public health issues and found as one among the major risk factor also including smoking, High blood glucose and High body mass index all responsible for approximately 29 million death globally, according to the World Heart Foundation, hypertension is the most important risk factor for stroke which causes about 50% of Ischaemic stroke [3].

Hypertension, which causes electrolytic imbalances leading to serious cases like stroke, irregular heart beat and heart attack, muscle contraction, fluid imbalance and even leads to death has become alarming and a threat. The need for the maintenance of electrolyte balance i.e. Sodium and Potassium also need to be taken note of among healthy and hypertensive individuals and hence, the need for this research. The aim of the study is to find out Sodium and Potassium electrolyte levels among hypertensive patients in Jos Metropolis.

Making an effort to control high blood pressure (hypertension) can reduce the risk of heart attack stroke, and other serious illness. If one is at risk for hypertension, centre for disease control (CDC 2018) recommends the following [5]:

Maintain a healthy weight, people who are over weighted should try to lose weight and people of normal weight should avoid adding weight on any found.

Eating a balanced diet and healthy foods such as plenty of fruit and vegetables especially those risk in potassium and limit the intake of excess calories, fat, sugar and also-

- Reduce salt intake as the higher the sodium intake, the higher the blood pressure.
- Limit smoking and taking too much of alcohol can lead to high blood pressure.
- Exercise regularly or moderate exercise for about 30 minutes three times a week is a good start.
- Regular monitoring of blood pressure.

Potassium and sodium have been reported to influence baro receptor sensitively and favourably [6-8]. In addition, potassium may function as direct modulator of vasodilatatory effect via its action as a vasodilator. The vasodilator effect of potassium also seems to be important in exercise, potassium is released from muscle cell leading to an increase in extracellular potassium concentration, which induce a vasodilator that increase local blood flow. Peripheral resistant and thus blood pressure may be influenced profoundly [9].

Sodium and Potassium test are early indicators of hypertension among patients as the electrolytes' tests give idea of the status of kidney which predisposes patients to hypertension and other related clinical implications [10]. Considering that clients are encouraged to do electrolytes test annually even when they are not at risk of hypertension, this study seeks to find out the concentration of sodium and potassium among hypertensive patients in Jos so as to provide knowledge on the relationship between hypertension, sodium and potassium.

Materials and Methods

Study Design: The study is an experimental type involving those that have been confirmed hypertensive and compared with non-hypertensive subjects

Ethical Approval: Ethical Approval was given by Federal School of Medical Laboratory Science, Jos Ethical Committee via the approval letter FSMLT/EC/200/19.

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Study Population and Sample Size: The study population is the confirmed cases of hypertensive patients attending various clinics in Jos Metropolis. The COVID-19 affected the population survey for adequate calculation of sample size. However, the study was carried out on 15 hypertensive patients and 15 non hypertensive subjects (30 subjects).

Inclusion/Exclusion Criteria: The patients who have been confirmed to be hypertensive before the study was included while those who have high blood pressure for the first time was excluded.

Methodologies of the Electrolytes: The principle of methodology used was spectrophotometric method in line with Teitz (2008) as described by Maruna (1958) and Trindre (1951) for Sodium and turbidometric method (Spectrophotometric) (Terri and Sesin, 1958) for

Potassium using Spectrum Diagnostics, Egypt and tested in Manifestation Laboratory, Hwolshe Jos [11-14].

Limitations of the Study: The limitation of the study could be effects of anti-hypertensive drugs on Na⁺ and K⁺ as the hypertensive patients studied have been receiving treatment from either Jos University Teaching Hospital, Plateau Specialist Hospital or Madonna Clinic. Study is also limited by sample size of 30.

Data Analysis/Statistical Methods: The SPSS version 2010 software was used to do the statistical analysis using t-test.

Results

The demographic variables such as age and gender are presented in table 1 whereas the electrolyte results and their statistical data are presented in the table 2.

Age	Number	Percentage (%)
41-50	14	47
51-60	16	53
Total	30	100
Gender	Number	Percentage(%)
Male	20	67
Female	10	33
Total	30	100

Table 1. Demographics of study participants

Treatment	BP	PR	Na ⁺	K ⁺
Test	147.46/103.80	70.80±2.24	142.74±2.26	4.29±0.29
Control	122.33/81.86	69.13±3.31	140.86±2.82	4.17±0.22
t-value	10.825	1.613	2.011	1.255
p-value	0.001	0.118	0.054	0.22

Table 2. Result and Statistics for Blood Pressure and Electrolytes under study

Footnote: Results under the same column is significant where p<0.05; values are Mean ± SD

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Hypothesis Testing

There exists significance in the BP of the Hypertensive (test) and non-hypertensive (control) subjects because of their status. However, there is no significant difference between the Na^+ (0.054) and K^+ (0.220) at $P < 0.05$. Therefore, the null hypothesis that there is no significant difference in the electrolytes (Sodium and Potassium) concentration among hypertensive and non-hypertensive patients in Jos is hereby accepted and the alternative hypothesis that there is a significant difference in the electrolytes (Sodium and Potassium) concentration among hypertensive and non-hypertensive patients in Jos is thus rejected.

Discussion

There are diverse opinions on the relationship between electrolytes especially sodium and potassium and blood pressure. The study is set out to examine concentration of Na^+ and K^+ among hypertensive and non-hypertensive subjects in Jos. The p-value result shows that Na^+ (0.054) and K^+ (0.220) was not significant at $P < 0.05$ as seen in table 2.

This study agrees that testing of Na^+ and K^+ among hypertensive and non-hypertensive subjects in Jos is very important in line with Nguyen et al. [15]. The testing helps to advice the hypertensive appropriately on whether to reduce Na^+ intake or increase K^+ consumption in line with Campbell [16] and WHO [17].

There is no significance in the relationship between Na^+ and K^+ concentration in relation to BP from this study. This is in agreement with Nnadi et al. [18] and Perez and Chang [19].

From this study, the result is limited by the fact that the sample size was low (30 samples of 15 tests and 15 controls) and not to be compared with Siani et al. [20] in size due to COVID-19 lock down and restriction to movement. The study could be verified with large sample size.

Conclusion

This study concludes that it is very important to monitor Na^+ and K^+ among hypertensive patients. There are various methods available for testing Na^+ and K^+ of which the testing facility should ensure a quality system approach no matter the method afforded for use.

The relationship Na^+ and K^+ among hypertensive and non-hypertensive subjects in Jos metropolis under this study is not significant at $P < 0.05$. Notably, Na^+ and K^+ testing is germane in hypertension management and should not be ignored no matter the method used in the testing facility.

The study recommends that electrolytes such as Na^+ and K^+ should be regularly monitored among hypertensive patients; adequate standardization of Na^+ and K^+ testing equipment with well trained personnel in facilities managing hypertension and increase in sample size. It would be good to study Na^+ and K^+ ratio among the hypertensive subjects in a subsequent study.

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