Assessment of Electrolyte Levels in Hypertensive Patients in University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers State, Nigeria.

Nnadi, Henrrietta Ogadimma[*1], Awi-Waadu, Grace Dornu-Bari [2], Ama-Tariah Fortune[3]
1. Department of Biomedical Technology, School of Science Laboratory Technology, University of Port Harcourt, Port Harcourt.
2. Department of Animal and Environmental Biology, Faculty of Science, University of Port Harcourt.
3. Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt.

ABSTRACT

This study was designed to assess the blood electrolytes (Sodium, potassium, chloride, calcium and phosphate) levels in some hypertensive patients and healthy volunteers and to compare between them. The study aimed to determine possible changes in electrolyte levels of hypertensive patients in University of Port Harcourt Teaching Hospital. The study population was a randomly selected total of 120 healthy staff and student adults between 18-50 years of the University community and 120 patients of the University teaching hospital. 5mls of blood sample were collected separately from ante cubital vein of each of the study subjects. The serum electrolytes determined were sodium, potassium and chloride (Ion Selective Electrode method); calcium (Randox method) and phosphorus (Phosphomolybdate method). Measurements of results were analyzed using statistical package for social science (SPSS) version 17.0. The mean values of potassium and chloride in hypertensive female patients were lower compared to those of control, while sodium and calcium showed no significant difference. The male category showed significant lower values in sodium, chloride and calcium while Phosphorous were higher in the hypertensive patients in both categories when compared to the healthy volunteers (control). The results obtained showed a significant difference at $p < 0.05$ significant level between hypertensive and healthy individuals for various blood electrolytes in both female male categories. We can then conclude that hypertensive patients and healthy individuals blood electrolytes is significantly different.

Keywords: Phosphomolybdate method, hypertensive female patients, blood electrolytes

INTRODUCTION

Electrolytes and water are absolutely two of the most critical component of normal physiological function. Electrolyte are compounds that influence many aspect of body function, balances the amount of fluid inside and outside of cells throughout the body and play a vital role in muscle contraction and heart function (Ganong, 2005)[1]. Without a correct balance of fluid and electrolytes the cell of the body lack the essential electrical conductivity necessary for cellular energy production. Electrolyte imbalance affects the body and can lead to life threatening cardiovascular conditions including hypertension, thus Kannel (1996)[2] reported high-normal and high blood pressure as continue to be major contributors to cardiovascular disease. Hypertension is described as a medical condition characterised by consistent high blood pressure. Kearney et al (2005)[3]describes hypertension as a worldwide pathogenic state that affects both the poor and rich. Some conditions such as sedimentary life style, environmental factor and sound pollution are also contributing factors to hypertension. Ima (2002)[10] noted that complication of hypertension has caused so many in Nigeria to suffer from stroke.

Aldosterone is a hormone that regulates sodium and water balance. Sodium retention and hypokalaemia are signs of hyperaldosteronism leading to heart rhythm irregularities and possibly muscle weakness (Onusko, 2003)[4]. Bernard (1961)[5], in a study on serum sodium and potassium in essential hypertension summarized that no significant difference exist between them. Weller (1959)[6] and Winer (1959)[7] in their study also reported no significant difference on electrolyte values of hypertensive patients.

In the other hand Holley et al (1951)[8] and Albert, Morita and Iseri (1958)[9] reported slight increase in sodium concentration in serum electrolyte in hypertensive patients. Electrolyte assessment in hypertensive patients together with some other laboratory investigation will help to assess the lifetime risk of cardiovascular events.

MATERIALS AND METHOD

Volunteer male and female staff and students of the University community and hypertensive patients of the University of Port Harcourt teaching hospital were the subject for the study. Inclusive criteria were confirmed healthy subjects who were free from any disease other than essential hypertension.

Exclusive criteria were patients on antihypertensive medication, patients with renal, cerebral, cardiac, adrenal disease and diabetic cases. 120 healthy adults (60 males and 60 females) and 120 (60 males and 60 female) hypertensive patients were randomly selected within the age range of 18-

50 years. Ethical approval was sought and obtained from the University of Port Harcourt Teaching Hospital Ethical Committee; with dully signed informed consent form prior to the study, consent was obtained from each participant. 5mls of blood sample were collected from ante-cubital vein with minimum stasis from each subject using disposable syringe. The collected blood was immediately transferred to lithium heparin sample bottle and labeled. These blood samples were spun in the centrifuge and the supernatant (serum) was collected into the plain sample bottle and labeled.

All test subjects were confirmed hypertensive patients. Serum sodium, potassium and chloride were analyzed by ISE (ion selective electrode). Serum calcium (ca) (randox method, in o-cresolpthalein complexone, without deproteinization) and serum phosphorus (po_4) (phosphomolybdate/uv method) were analyzed by colorimetric method, Calculation of phosphorus concentration was done following the manufacturer's manual and same was repeated for all the samples. All statistical analysis was performed using statistical package for social sciences (SPSS Version 17.0). The results were analyzed using the one way analyses of variance (ANOVA) with a statistical difference at $P < 0.05$. The results are presented as mean $\pm$ standard error of mean.

RESULTS AND DISCUSSION

Table1. Values of Blood Electrolytes (ions and cations) in Hypertensive Female Patients and Healthy volunteer groups. Henrrietta et al (2015)

Electrolytes (ions and cations)	Hypertensive Female Patients Group	Female Healthy Volunteer Group
	Mean $\pm$ SEM	Mean $\pm$ SEM
Sodium ion(mmol/l)	138.67 $\pm$ 0.38	138.88 $\pm$ 0.15
Potassium ion(mmol/l)	3.92 $\pm$ 0.63	4.40 $\pm$ 0.02
Chloride(mmol/l)	95.42 $\pm$ 0.92*	102.45$\pm$ 0.28
Calcium ion(mmol/l)	2.19 $\pm$ 0.45	2.24 $\pm$ 0.01
Phosphorous(mmol/l)	1.64 $\pm$ 0.04*	1.53 $\pm$ 0.02

All values are expressed as mean $\pm$ SEM, p< 0.05 * = statistically significant when compared to (Healthy volunteer) control

Table 2. Values of Blood Electrolytes (ions and cations) in Hypertensive Male Patients and Healthy volunteer groups. Henrrietta et al (2015)

Electrolytes (ions and cations)	Hypertensive Male Patients Group	Male Healthy Group
	Mean $\pm$ SEM	Mean $\pm$ SEM
Sodium ion (mmol/l)	137.42 $\pm$ 0.70[*]	139.97 $\pm$ 0.19
Potassium ion(mmol/l)	4.00 $\pm$ 0.05	4.09 $\pm$ 0.02
Chloride(mmol/l)	99.75 $\pm$ 0.43*	101.70 $\pm$ 0.20

Calcium ion(mmol/l)	2.18 ± 0.04*	2.27 ± 0.01
Phosphorous(mmol/l)	1.79 ± 0.06*	1.53 ± 0.02

All values are expressed as mean ± SEM, p< 0.05 * = statistically significant when compared to (Healthy volunteer) control.

Table 3. Table showing the ranges of blood electrolytes in healthy volunteers group studied and Caucasian normal range, Guyton and Hall (2006), Henrrietta et al (2015)

Electrolytes (ions and cations)	Field Result for healthy volunteers	Normal Range (Caucasian)
Sodium ion(mmol/l)	135 - 141	135 - 145
Potassium ion(mmol/l)	3.4– 4.2	3.5 – 5.0
Chloride(mmol/l)	90 - 102	95 – 105
Calcium ion(mmol/l)	2.0 - 2.5	2.15 – 2.25
Phosphorous(mmol/l)	1.4 – 2.1	0.80 – 1.35

The study of electrolyte value has long been analyzed in different part of the world; due to its role in the body function, any imbalance of any parameter will lead to abnormal increase or decrease thereby affecting the normal function expected. The study was designed to assess the blood electrolyte level in some hypertensive patients and healthy volunteer male and female categories and to compare between them. The study aimed to determine possible changes in electrolyte levels in hypertensive patients in UPTH. Both increasing and decreasing differences were observed in an attempt to determine blood electrolytes values in some healthy volunteer individuals of University of Port Harcourt staff and students group, as the values obtained were compared with the hypertensive patients group of University of Port Harcourt Teaching Hospital Port Harcourt, Rivers state. Differences and similarities were observed as we analyzed the mean values of blood electrolyte (Na, K, Cl, Ca and PO_4) as obtained in Tables 1 and 2 above. We also observed differences when compared between males and female gender categories.

Table 1and 2 shows the amount of major electrolytes (ions and cations) in the healthy volunteer group and hypertensive patients groups in the female and male categories studied. The tables were presented in mean ± standard error of mean of each of the electrolytes; all measurement been measured in mill mol per liter (mmol/l). Mean level of chloride in hypertensive female patients were significantly lower compared to the control group. Sodium, potassium and calcium showed no significant different. The female patient group of this study agrees with Bernard et al (1961)[5], Weller (1959)[6] and Winer (1959)[7] in their findings which showed no significant difference in the mean serum sodium and potassium of the hypertensive group and that of the normotensive. Male hypertensive group in this study shows significant lower values in sodium, chloride and calcium

when compared to the control group. This finding disagree with the report of Iyalomhe et al (2008)[11] in his study on electrolyte profile in Nigerian Patients with essential hypertension which showed significantly higher sodium and chloride in patients than their normotensive subjects. His serum potassium which was significantly lower also disagrees with our findings which show no significant difference. Phosphorous in hypertensive patients of both male and female groups were significantly higher than the control. African nutritional factors (Nigeria), environmental factor, and sedimentary lifestyle may be the attributing factors to higher electrolytes values seen in healthy volunteer phosphorous group compared to Caucasian group.

REFERENCES

1. Ganong, W.F. (2005) Review of Medical Physiolology. 22nd Edition. McGraw-Hill Companies, Asia; pp 515-532.

2. Kannel W.B., (1996) Blood Pressure as a Cardiovascular Risk Factor JAMA: 275: 1571-1576 Ref Medline.

3. Kearney P. M., Whelton M., Reynolds K., Munter P., and Whelton P. K., HJ (2005) Global Burden of Hypertension: Analysis of Worldwide Data. Lancet 365: 217-223

4. Onusko E. (2003) Diagnosing Secondary Hypertension. Amerian Family Physician 67(1): 67-74.

5. Bernard E. Levine, M.D., John M. Weller, M.D., and Richard D. Ramington, PH.D. (1961). Circulation LEVINE: 29 - 33.

6. Weller J. M. (1959) The acid-base balance and Sodium Distribution of the Blood in Essential Hypertension. J. Lab. and Clin. Med. 53: 553.

7. Winer B. M. (1959) Hypertension, the First Hahnemann Symposium on Hypertensive Disease. Edited by Moyer, Philadelphia, J. H., Sauders W. B. Co., p 291.

8. Holley H.L., Elliott H.C. JR and Holland C.M., JR (1951) Serum Sodium Value in Essential Hypertension. Proc. Soc. Exper. Biol and Med. 77: 561.

9. Albert DG., Movita Y., and Iseri IT (1958) Serum Magnesium and Plasma Sodium levels in essential vascular hypertension. Circulation 17: 761.

10. Olerunfemi G. (2002) The Profile of Stroke in Nigeria's Frderal Territory. Trop. Doct: 32: 209-212.

11. Iyalomhe G.B.S., Omogbai EKI., Ozolua RI., Dada FL., and Iyalomhe OOB., (2008) Electrolyte Profile in Nigerian Patients with Essential Hypertension. Afr. J. Of Biotechnology Vol. 7(10): 1404 1408.

AJPTR is

- **Peer-reviewed**
- **bimonthly**
- **Rapid publication**

Submit your manuscript at: editor@ajptr.com