AMERICAN JOURNAL OF PHARMTECH RESEARCH

Journal home page: http://www.ajptr.com/

Changes in Electrolyte Levels in Malaria Patients in University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers State, Nigeria

Nnadi Henrrietta Ogadimma[1]*, Uwakwe Augustine A[2], Maria Okwudili Okata[3]

1. Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt, Choba, Rivers State, Nigeria.

2. Department of Biochemistry, Faculty of Chemical Sciences, College of Natural and Applied Sciences, University of Port Harcourt, Choba, Rivers State, Nigeria.

3. Department of Science Laboratory Technology, Akanu Ibiam Federal Pilytechnique, Uwana. P.M.B, 1007, Afikpo, Ebonyi State, Nigeria.

ABSTRACT

The present study was designed to assess the blood electrolytes (Sodium, potassium, chloride, calcium and phosphate) values in healthy volunteers and some malaria patients of males and females categories and to compare between them. The study aimed to examine possible changes in electrolyte levels of healthy volunteers and malaria patients in University of Port Harcourt Teaching Hospital. The subjects were 120 healthy staff and student adults between 18-50 years of the University community and 120 patients of the University teaching hospital randomly selected. 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 data analysis. The mean values of Sodium, potassium, chloride and calcium in healthy volunteers were higher compared to those of malaria patients. Phosphorous were higher in the malaria patients compared to the healthy volunteers. The results obtained showed a significant difference at $p < 0.05$ significant level between healthy and malaria individuals for various blood electrolytes. We can thus conclude that healthy volunteers and malaria patient blood electrolytes is significantly different.

Keywords: Electrolytes, serum, malaria

*Corresponding Author Email: henrrietta.nnadi@uniport.edu.ng

Received 29 June 2015, Accepted 11 July 2015

Please cite this article as: Henrrietta NO *et al.*, Changes in Electrolyte Levels in Malaria Patients in University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers State, Nigeria. American Journal of PharmTech Research 2015.

INTRODUCTION

Malaria is life threatening parasitic disease transmitted through bite of a female anopheles mosquito[1]. Plasmodium Falciparum malaria has been reported to be one of the most parasitic disease with high morbidity and mortality rated in tropical areas of Africa[2]. The World Health Organization (WHO) estimated that 270 million new malaria infections occur worldwide along with 110 million cases of illness and 2 million deaths where 25% of childhood deaths in Africa are attributed to malaria[3]. Although it is a disease that can be treated in just 48hours, it can cause fatal complications if the diagnosis and treatment are delayed[4]. Most adults living in malaria endemic areas have partial immunity and are at risk of repeated infection[1]. Electrolytes are chemical substances that separate when dissolved in fluids, into electrically charged particles (ions) capable of conducting electric current vital for the function of nerves and muscles[5]. In addition to homeostasis, electrolytes play an important role in maintenance of ph, regulation of heart and muscle function, electron transfer reactions as well as serving as cofactors for enzymes[6]. The most serious electrolyte disturbances involves abnormalities in the level of Sodium ion, Potassium ion, Phosphorus ion, chloride and Calcium ion leading to Hyponatraemia, Hypernatraemia, Hypokalaemia, Hyperkalaemia, hyperphosphataeemia, hypophosphataeemia, acidosis, alkalosis, Hypocalcaemia and Hypercalcaemia as seen to be common in severe *falciparium* malaria infection[7], extremely found in age and in patients with high degree of fever and vomiting[8]. In human electrolytes infected with malaria parasite, cytosolic concentration of sodium ion is increased and that of potassium is decreased[9]. Thus, correction of fluid and electrolyte imbalance forms a major component of the treatment of severely infected malaria patients in modern intensive care settings[10]. Since water homeostasis is fundamental to the survival of all organisms, it is therefore necessary to estimate the levels of these electrolytes in all cases of severe malaria infection for better management of such patients.

MATERIALS AND METHOD

The subjects used were healthy volunteer males and females' staff and students genders selected within the University community and patients who came to the University of Port Harcourt teaching hospital for medical reasons. Inclusive criteria were human subject that gave consent, was confirmed to be healthy (for the control group), those who were diagnosed with malaria and have not started taking medication for their health issue. The subjects were from different ethnic groups in Nigeria who reside in Port Harcourt. The study population was a total number of 240 samples in all, 120 healthy adults (60 males and 60 females) and 120 (48 male and 72 female) sick adults

randomly selected within the age range of 18-50 years. Ethical approval was obtained from the University of Port Harcourt Teaching Hospital Research Ethical Committee of the College of Health Sciences, University of Port Harcourt. Informed consent was sought and obtained from the participants with dully signed informed consent form prior to the study. The procedure was explained to each subject and was well reassured all through the procedure. 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 malaria patients. The measurement of serum sodium, potassium and chloride was analyzed using ISE (ion selective electrode), [11, 12]. The machine was ignited and allowed to stand for 10minutes. Aspirated the serum sample into the probe (atomizer) which carried the sample to the selective membrane (liquid membrane) where the ion was measured, automatically selected by the machine. The result was displayed on the output density (OD). Took the readings and recorded the results of each selected ion. The same was repeated for all the samples. Serum calcium (ca) (randox method, in o-cresolpthalein complexone, without deproteinization) by colorimetric method, selected Calcium CPC in the Run Test Screen and carry out a water blank as instructed by manufacturer manual (Randox). Arranged 3 test tubes; first tube was reagent blank SO, second tube was for standard SI and the third tube was Sample. To the first tube added 12.5μl distilled water, to the second tube added 12.5μl standard, to the third tube added 12.5μl sample and to each of the three tubes added 500μl of reagent. Mixed and incubated for 5minutes at 25℃, 30℃ or 37℃. Inserted the cuvette into the RX Monza flow-cell holder and then pressed read as instructed on the text kit.[15] and serum phosphorus (po_4) (phosphomolybdate/uv method).[11] Four test tubes were arranged on the test tube rack; Pipette 10μl of distilled water into first tube (Reagent blank), 10μl of sample each into the second tube and third tube, 10μl of phosphorus standard (s) into fourth tube (standard), 10μl of reagent (A) into the second-tube (sample blank) and finally 10μl working reagent each into first-tube, third-tube and fourth test tubes. Thoroughly mixed and allowed tubes to stand at room temperature for 5minutes. Read absorbance (A) of the sample blanks at wavelength 340nm against the distilled water and also read the absorbance (A) of samples and standard at the same wavelength against the reagent blank. Calculation of phosphorus concentration was done following the manufacturer's manual[16]. 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 ± standard error of mean.

RESULTS AND DISCUSSION

This study is an attempt to determine blood electrolytes (sodium, potassium, chloride, calcium and phosphorous) values in some healthy volunteer individuals of University of Port Harcourt staff and students group, the values obtained were compared with the malaria patients group of University of Port Harcourt Teaching Hospital in Port Harcourt City of Rivers state, Nigeria. Both increasing and decreasing differences were observed. Differences and similarities were observed when analyzed the mean values of blood electrolyte (Na, K, Cl, Ca and PO_4) that was obtained, (Tables 1 and 2) in both female and male groups. I 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 selected disease patients groups in the female and male categories studied, the table were presented in mean ± standard error of mean of each of the electrolytes; all measurement been measured in mill mol per liter (mmol/l). For the Sodium ion ($\mathbf{Na^+}$), significant lower values were found in male malaria patients group as when compared with the healthy volunteer group. The female category shows no significant but rather fell within the normal range and when compared with the normal individual. Potassium (K^+) also shows no significant difference when compared in both female and male categories. This finding has disagreed with the finding of Kakkilaya and Matthys which stated increased sodium and decreased potassium level in malaria patients.[4, 9] Chloride ions in the other hand shows decreased significant difference in both female and male categories when compared with the healthy control in each of the group in both tables. Calcium like sodium shows decreased significant difference in the male malaria patients' group while the female category shows no significant difference. Phosphorous in both female and male categories shows a marked increase in malaria patients group when compared with the healthy volunteer groups. Cross-checking the result of phosphorous in table 3, it is observed that phosphorous shows the same marked increase in healthy groups when compared with the Caucasian group [13, 14] which indicated alteration in the composition of these blood electrolytes that serves crucial clinical importance thereby resulting to pathological condition. Hyperphosphataemia were some of the consequences of imbalance of the electrolytes under investigation. This study confirms that significant differences do exist in some of the blood electrolytes under investigation between healthy volunteer individuals and malaria patients in Port Harcourt city of Nigeria. The higher electrolytes values seen in healthy volunteer phosphorous

group compared to Caucasian group were attributed mainly due to the environmental factor, location and African nutritional factors (Nigeria) or sedimentary lifestyle.

Table 1: Values of Blood Electrolytes (ions and cations) in Female Malaria Patients and Healthy volunteer groups.

Electrolytes (ions and cations)	Female Healthy Volunteer Group Mean ± SEM	Female Malaria Patients Group Mean ± SEM
Sodium ion (mmol/l)	138.88 ± 0.15	138.42 ± 1.02
Potassium ion (mmol/l)	4.04 ± 0.02	3.91 ± 0.91
Chloride (mmol/l)	102.45 ± 0.28	99.92 ± 0.47*
Calcium ion (mmol/l)	2.24 ± 0.01	2.16 ± 0.54
Phosphorous (mmol/l)	1.53 ± 0.02	1.65 ± 0.53*

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

Table 2: Values of Blood Electrolytes (ions and cations) in Male Malaria Patients and Healthy volunteer groups

Electrolytes (ions and cations)	Male Healthy Volunteer Group Mean ± SEM	Male Malaria Patients Group Mean ± SEM
Sodium ion (mmol/l)	139.97 ± 0.19	137.75 ± 0.43*
Potassium ion (mmol/l)	4.09 ± 0.02	4.05 ± 0.06
Chloride (mmol/l)	101.70 ± 0.20	100.42 ± 0.58*
Calcium ion (mmol/l)	2.27 ± 0.01	2.15 ± 0.03*
Phosphorous (mmol/l)	1.53 ± 0.02	1.64 ± 0.07*

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[13, 14]

Electrolytes (ions and cations)	Field Result for healthy volunteers	Normal Range (Caucasian)
Sodium ion (mmol/l)	136 - 142	135 - 145
Potassium ion (mmol/l)	3.8 – 4.3	3.5 – 5.0
Chloride (mmol/l)	90 - 107	95 – 105
Calcium ion (mmol/l)	2.10 - 2.50	2.15 – 2.25
Phosphorous (mmol/l)	1.10 – 1.80	0.80 – 1.35

CONCLUSION

In conclusion, the present study reports changes in a number of basic blood electrolytes in malaria patients compared to healthy volunteers in University of Port Harcourt and its Teaching Hospital, Rivers State. However, the healthy volunteers groups had better electrolytes values as seen to be within the normal range when compared to the malaria patients groups in both categories. This

reports that the blood electrolytes (Sodium, Potassium, Calcium, Chloride and Phosphate) levels in malaria patients groups were significantly low compared to healthy volunteer group in Port Harcourt, Nigeria at $p< 0.05$. Thus, the disorders require timely recognition and often reversed with appropriate intervention and treatment of underlying predisposing factors.

REFERENCES

1. World Health Organization (WHO) Malaria Rapid Diagnostic Test Performance-Results of WHO Product Testing of Malaria RTDs Round 1(2008). 2009; WHO Geneva
2. Snow RW, Craig M, Deichmann U. and Marsh, K. Estimating Mortality, Morbidity and Disability due to malaria among Africa's non pregnant population Bull. 1999.
3. http//www.malariatest.com/malaria.
4. Kikkilaya BS. Rapid Diagnosis of Malaria Lab. Med. 2003; 34: 602 – 608.
5. Ganong FW. Review of Medical Physiology. Twenty-second Edition International Edition. 2005; 30-36,515.
6. Mayne DP. Sodium, Potassium and Water Metabolism: In Clinical Chemistry in Diagnosis and Treatment. (6thedition). 1994: Arnold Euston Publishers, London.
7. Kakkilaya BS. Malaria: In Parks Textbook of Preventive and Social Medicine. (15th edition), k Park: 1997.
8. Hendricks RG, Hassan AH, Olurinde LO, Akindkani A. Malaria in Early Childhood. Annals of Tropical Medicine. 1971; 65: 316 - 320.
9. Matthys B, Sherkanov T, Karimov SS, Khabirov Z, Mostowlansky T, Utzinger J, Wyss, K. History of malaria control in Tajikistan and rapid malaria appraisal in an agro-ecological setting. Malar. J. 2008; 7: 217-221.
10. Hotchkiss, R.S. and Karl, I. E. The Pathophysiology and Treatment of Sepsis. N. Engl. J. Med. 2003; 348: 138-150.
11. OchieJ. and Kolhatkar A. Medical Laboratory Science Theory and Practice. Mc Graw-Hill Publishing New Dehli (7th edition). 2008; 85, 176 – 187.
12. Barker, F.J., Silverton, R.E. and Pallister, C.J. Baker & Silverton's Introduction to Medical Laboratory Technology. Bounty Press Limited (7th edition). 2001: 73 – 74.
13. Crook A. M. Clinical Chemistry and Metabolic Medicine. 7th Edition; 2006: 4- 75.
14. Guyton and Hall. Textbook of Medical Physiology. 11th Edition; 2006: 365-381.
15. Randox Laboratories Limited. BT29 4QY, United Kingdom application@randox.com www.randox.com.

16. Biosystems S.A. Costa Breva 30. Barcelona (Spain) EN ISO 13485 and EN ISO 9001 Standards.