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Research Article

Study of Serum Electrolytes by Flame Photometer and Autoanalyser

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Abstract: Electrolytes are present in the human body, and the balance of the electrolytes in our body is essential for normal functioning of our body. Common electrolytes important for quantitative estimation includes sodium and potassium. In 1930's, chemical methods were used to measure serum electrolytes. To overcome disadvantages like time consuming process, little accuracy, flame photometer was devised and after three decades, autoanalyser was introduced. Measurement of serum electrolytes by means of Sherwood Scientific model 420 flame photometer were compared with measurements made by Fully Automated Olympus AU400 autoanalyser to determine the efficiency of instrument. Determination of serum electrolytes showed slight difference in the results. Measurement of serum electrolytes by Fully Automated Olympus AU400 autoanalyser was faster and with less quantity of serum sample as compared to Sherwood Scientific Model 420 flame photometer which requires diluted serum sample, which may introduce manual error. Fully Automated Olympus AU400 autoanalyser measures serum electrolytes with ion-selective electrodes (ISE) which depends on the ionic activity, whereas flame photometer measures the stoichiometric concentration. Determination of serum electrolytes by Olympus AU400 autoanalyser was more efficient, sensitive and accurate than Sherwood Scientific Model 420 flame photometer.
Keywords: Serum electrolytes, autoanalyser, Flame photometer, ion selective electrode, stoichiometric concentration

INTRODUCTION

Electrolytes are substances that become ions in solution and acquire the capacity to conduct electricity. The balance of the electrolytes in our body is essential for normal functioning of cells & organs. Sodium is the principal extracellular cation and potassium the principal intracellular cation[1]. Sodium levels (Normal serum sodium level = 135-145mEq/L) are directly related to the osmotic pressure of plasma and regulates the total amount of water in the body. Potassium plays an important role(Normal serum potassium level = 3.5-5.0 mEq/L) in regulation of the heart beat and function of muscles. Potassium together with sodium regulate water and acid-base balance in blood and tissue [2]. In mammals ,the maintenance of osmotic pressure and water distribution in various body fluid compartments is primary function of electrolytes like sodium and potassium. They also play a role in maintenance of pH ,in oxidation reduction reactions , in heart muscle functioning and as cofactors for enzymes [3].

The objective of present study is to measurement of serum electrolytes by means of Sherwood Scientific Model 420 Flame Photometer were compared with measurements made by Fully Automated Olympus AU 400 Autoanalyser to determine the efficiency of instrument.

MATERIAL and METHODS

5 ml venous blood collected from 100 patients who came for routine check up in central laboratory, J.J.Hospital, Mumbai in plain bulbs.

Serum obtained after centrifugation of samples was analyzed for sodium and potassium on Sherwood Scientific Model 420 Flame Photometer and Fully Automated Olympus AU 400 Autoanalyser.

Exclusion criteria -Hemolyzed samples were excluded from the study.

Sherwood Scientific Model 420 Flame Photometer

Dual channel low temperature flame photometer is based on the principle of Atomic Emission Spectrometry. It has the benefit of an internal standard using lithium to eliminate interferences due to variations in dilution ratios.[4]

Standardized using standard solution (sodium = 140mEq/L potassium = 5.0mEq/L).

Fully Automated Olympus AU 400 Autoanalyser

Based on the principle of ion selective electrode which employs crown ether membrane electrodes for sodium and potassium. An electrical potential is developed according to the Nernst equation for a specific ion.[2]

Standardized using :

ISE Low serum Std (Na^+ = 130 mEq/L K^+= 3.5 mEq/L)

ISE High serum Std (Na^+ = 160 mEq/L K^+= 6.0 mEq/L)

Ethics: Institutional ethical committee approval was taken.

RESULTS and DISCUSSION

Table1. Comparision of serum electrolytes by Autoanalyser and Flame Photometer

	Autoanalyser		Flame photometer		P
S. Electrolytes	Mean ± SD	Std. error	Mean ± SD	Std. error	
Sodium	136.8±5.93	1.08	132.9±7.79	1.42	0.0003
Potassium	4.61±0.89	0.16	4.04±0.82	0.15	<0.0001

SD – standard deviation , Std.error –standard error,P – P value P value < 0.01 is considered satistically significant

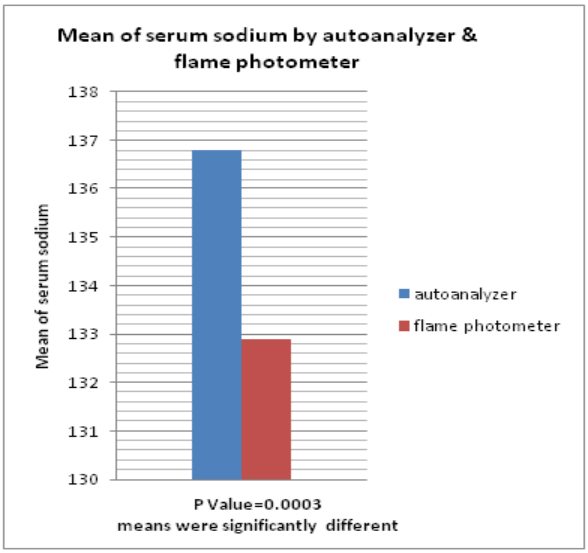

Figure-1: Comparison of mean of serum sodium by Autoanalyser and flame photometer

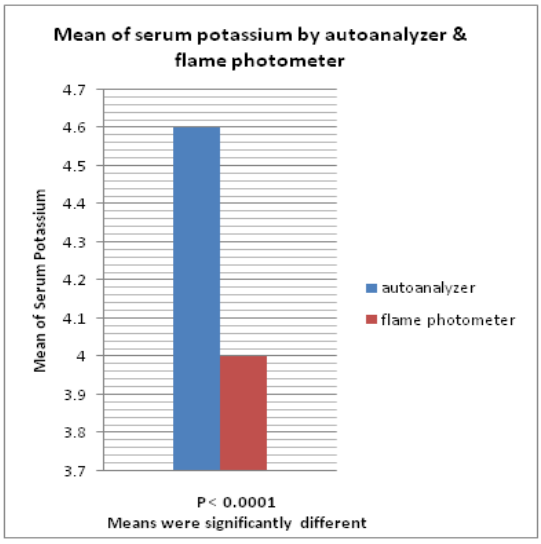

Figure-3: Comparison of mean of serum potassium by Autoanalyser and flame photometer

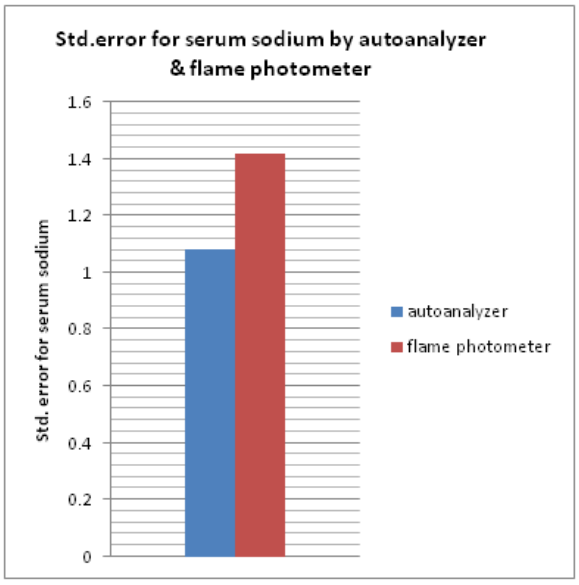

Figure-2: Standard error for serum sodium by autoanalyser And flame photometer

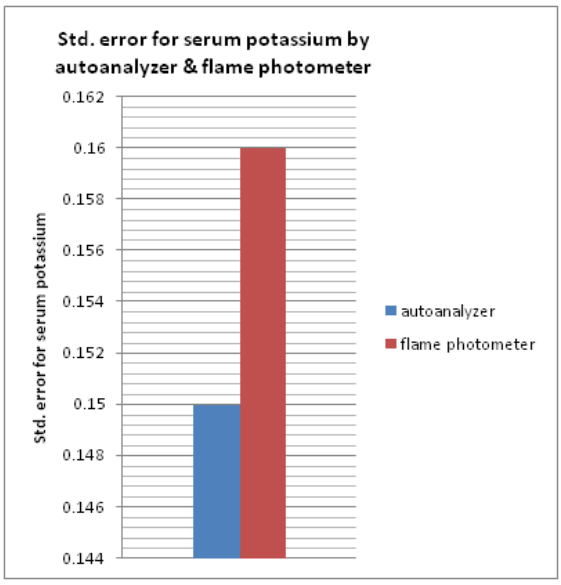

Figure-4: Standard error for serum potassium by autoanalyse And flame photometer

Determination of serum electrolytes showed slight difference in results.

Fully Automated Olympus AU 400 Autoanalyser showed slightly higher values because it measures serum electrolytes with ion selective electrodes (ISE) which depends upon ionic activity whereas Flame Photometer measures by Atomic Emission Spectrometry.The relation between two quantities depends on the ionic strength and the individual ionic activity coefficient, on the water concentration, and on the binding of these ions to proteins and other ligands.The residual liquid junction potential, interference from other ions, and the choice of calibrators also affect results with ion selective electrodes.[5]

Values for sodium electrode in autoanalyser indicates its long life but the potassium electrode changes relatively quickly that is in a period of two months.[6]Unstable conditions or a sudden change in the performance of the instrument may result in errors so large as to make determination of electrolytes worthless for metabolic studies.[7]

Measurement of serum electrolytes by Fully Automated Olympus AU 400 Autoanalyser was faster and with less quantity of serum sample as compared to Sherwood Scientific Model 420 Flame Photometer which requires diluted serum sample, which may introduce manual error.[8]

CONCLUSION

Olympus AU 400 Autoanalyser can simultaneously determine glucose, urea, protein, etc. along with electrolytes. Determination of serum electrolytes by Fully Automated Olympus AU 400 Autoanalyzer was more efficient, sensitive and accurate than Sherwood Scientific Model 420 Flame Photometer.

Hyponatremia (sodium level < 135 mEq/l) is seen in common conditions like vomiting , diarrhea, burns, pancreatitis, trauma.Hypernatremia (sodium level > 145 mEq/l) seen in renal failure, Cerebral salt wasting syndrome, Diuretic excess. Hyperkalemia (potassium >5.5 mEq/l) is a medical emergency because of its effects on heart.Cardiac arrhythmias associated with hyperkalemia include sinus bradycardia, ventricular fibrillation and finally the heart stops in asystole.[9]

The purpose of this study was to determine which method of estimating electrolyte concentration is more accurate, as electrolytes are measured routinely and their accurate measurements can be life saving and helpful in treatment.

Acknowledgment

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