DETERMINATION OF SERUM ELECTROLYTES (POTASSIUM)

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Advanced Clinical Biochemistry I

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Practical 1

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Objectives

- **The students should understand/practice:**

✓The importance and principle behind the laboratory test for electrolytes.

✓ The step-by-step procedure of potassium determination in serum

✓ The interpretation of laboratory results and their correlation with clinical

- conditions in real-life situations.

Introduction

- Potassium is one of the most important intracellular cations in the human body, playing a vital role in maintaining cellular membrane potential, neuromuscular excitability, acid–base balance, and osmotic equilibrium.

- Slight deviations can lead to severe physiological disturbances such as cardiac arrhythmias, muscle weakness, or paralysis.

- The estimation of serum potassium is a critical component of routine clinical biochemistry investigations, particularly in assessing renal function, electrolyte imbalance, and metabolic disorders.

Cont.

- Spectrophotometric estimation of biomolecules is widely used in research and diagnosis to a certain extent due to its simplicity, accuracy, and cost-effectiveness.

- The technique is advantageous due to its rapid and reproducible results, with minimal sample volume and reagent consumption.

- However, care must be taken to avoid hemolysis during sample collection and handling, as the release of intracellular potassium from red blood cells can lead to falsely elevated results.

Clinical Significance

- ✓ Potassium is the principal cation of the ICF. It is also an important constituent of the ECF due to its extracellular function, namely influencing acid-base balance and osmotic pressure, including water retention.

- ✓ Elevated level of potassium (hyperkalemia) is often associated with renal failure, dehydration, shock, or adrenal insufficiency.

- ✓ Decreased potassium levels (hypokalemia) are associated with malnutrition, negative nitrogen balance, GIT fluid losses, and hyperactivity of the adrenal cortex.

Principle of the experiment

In the spectrophotometric method, potassium ions in the serum sample react with a specific sodium tetraphenylborate to form a turbid complex. The intensity of the resulting turbidity is directly proportional to the concentration of potassium in the sample. This absorbance is then measured at a 578 nm.

- Na^- Tetraphenylborate + K^+ $\longrightarrow$ K^- Tetraphenylborate + Na^+

- The potassium concentration is determined by comparing the absorbance to that of known standards.

Reagents

❑ **Potassium Reagent**

✓ Sodium tetraphenylborate

❑ **Potassium Standard**

✓Potassium standard (5 mmol/L

Procedure

✓Table 1: **Step 1** of the procedure.

	Tubes	
Reagent	Sample (µL)	Standard (µL)
Potassium Reagent	1000	1000
Serum	25	-
Potassium standard	-	25
Total volume	1025	1025

- Shake the tubes and keep at room temperature for five minutes.
- Take absorbance at 578 nm within 10 minutes using distilled water as a blank.
- Record your result and calculate the K^+ concentration as follows:

- Potassium Concentration (mmol/L) = $\frac{\text{Absorbance of Sample}}{\text{Absorbance of standard}} \times 5$

- **Normal Range: 3.5–5.0 mmol/L.**


Questions
Comments
Feedback