DETERMINATION OF SERUM ELECTROLYTES (SODIUM)

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Advanced Clinical Biochemistry I

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Objectives

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

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

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

✓ The interpretation of laboratory results and their correlation with clinical

- conditions in real-life situations.

Introduction

- ✓ Sodium is involved in most major metabolic functions in the body, and it is amongst the most important physiological ions and the most often assayed electrolytes.
- ✓ Sodium is supplied primarily through the diet, absorbed in the GIT, and excreted via the kidneys.
- ✓ Na^+ is the major extracellular cation and functions to maintain fluid distribution and osmotic pressure.
- ✓ Some causes of decreased levels of sodium include prolonged vomiting or diarrhea, diminished reabsorption in the kidney, and excessive fluid retention.
- ✓ Common causes of increased sodium include excessive fluid loss, high salt intake, and increased kidney reabsorption.

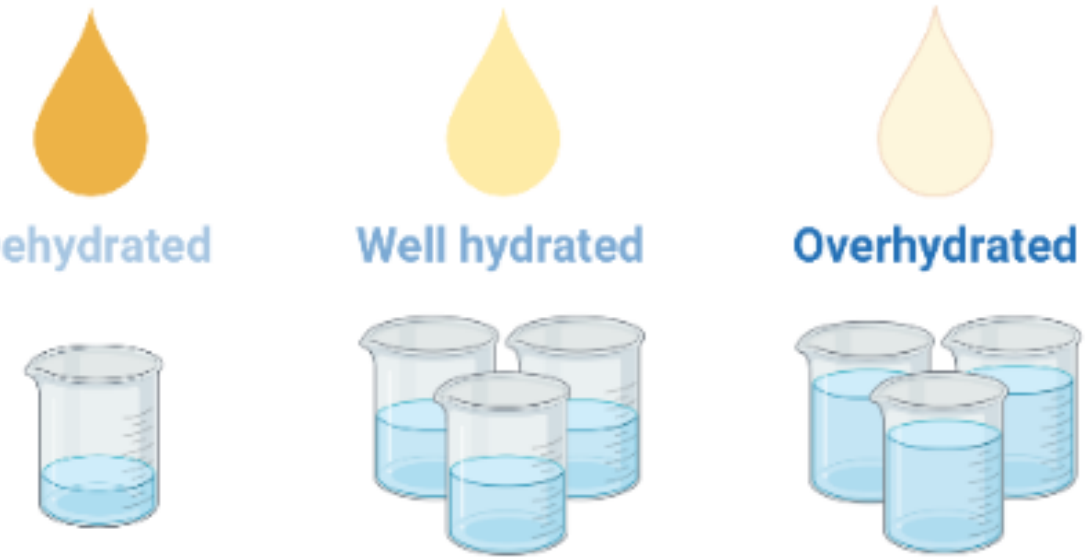
Clinical Significance

- ✓Na^+ measurements are used in the diagnosis and treatment of various forms of disease conditions.

- ✓Aldosteronism, diabetes insipidus, adrenal hypertension, dehydration, inappropriate ADH secretion, or diseases involving electrolyte imbalance.

- ✓The urine Na^+ and K^+ are used as nutritional indicators in healthy persons. Urine sodium data is an important biomarker of dietary sodium intake.

Urine color can tell you whether or not you have adequate water intake



Electrolytes imbalance and overhydration symptoms

- Confusion
- Headache
- Seizures

- Pulmunary congestion
- Tachypnea

- Vomiting
- Nausea

- Tachycardia
- Hypertension

Principle of the experiment

✓Sodium precipitates with Magnesium acetate and Uranyl-acetate.

✓The Uranyl ions remaining in the solution are forming a yellow-brown color complex together with thioglycolic acid, which will absorb at 530 nm.

✓The difference between the reagent blank. The analysis is proportional to the sodium concentration.

- $Na^{+} + 3UO_2(OAc)_2 + AcO^{-} + MgOAc_2 + 9H_2O \longrightarrow MgNa(UO_2)OAc_9 + 9H_2O$
- Free Uranyl ion + K4Fe(CN)6 ⟶ Brown colour complex

❑ Reagents

✓Precipitating Reagent (R1)

✓Acid Reagent (R2)

✓Colour Reagent (R2)

❑ Standard

Na+/K+ Standard (150/5 mmol)

Procedure

✓The experiment is to be carried out in two steps as follows:

Table 1: **Pipette into clean dry tubes as sample and standard.**

Reagents	Sample (µL)	Standard (µL)
R1 (SL1)	1000	1000
Serum Sample	20	
Standard Solution		20
Total volume	1020	1020

- Mix well and incubate at R.T for 5 mins. Measure the absorbance of the blank, standard and sample within 15 mins.

	Sample (µL)	Standard (µL)	Blank (µL)
Reagent 2	1000	1000	1000
Supernatant from step 1	20	20	
Reagent 1			20
Reagent 3	100	100	100
Total Volume	1120	1120	1120

- Mix the tube gently and keep for 5 minutes at room temperature.
- Shake vigorously for 3 sec and centrifuge at 2500 to 3000 RPM to obtain a clear supernatant.

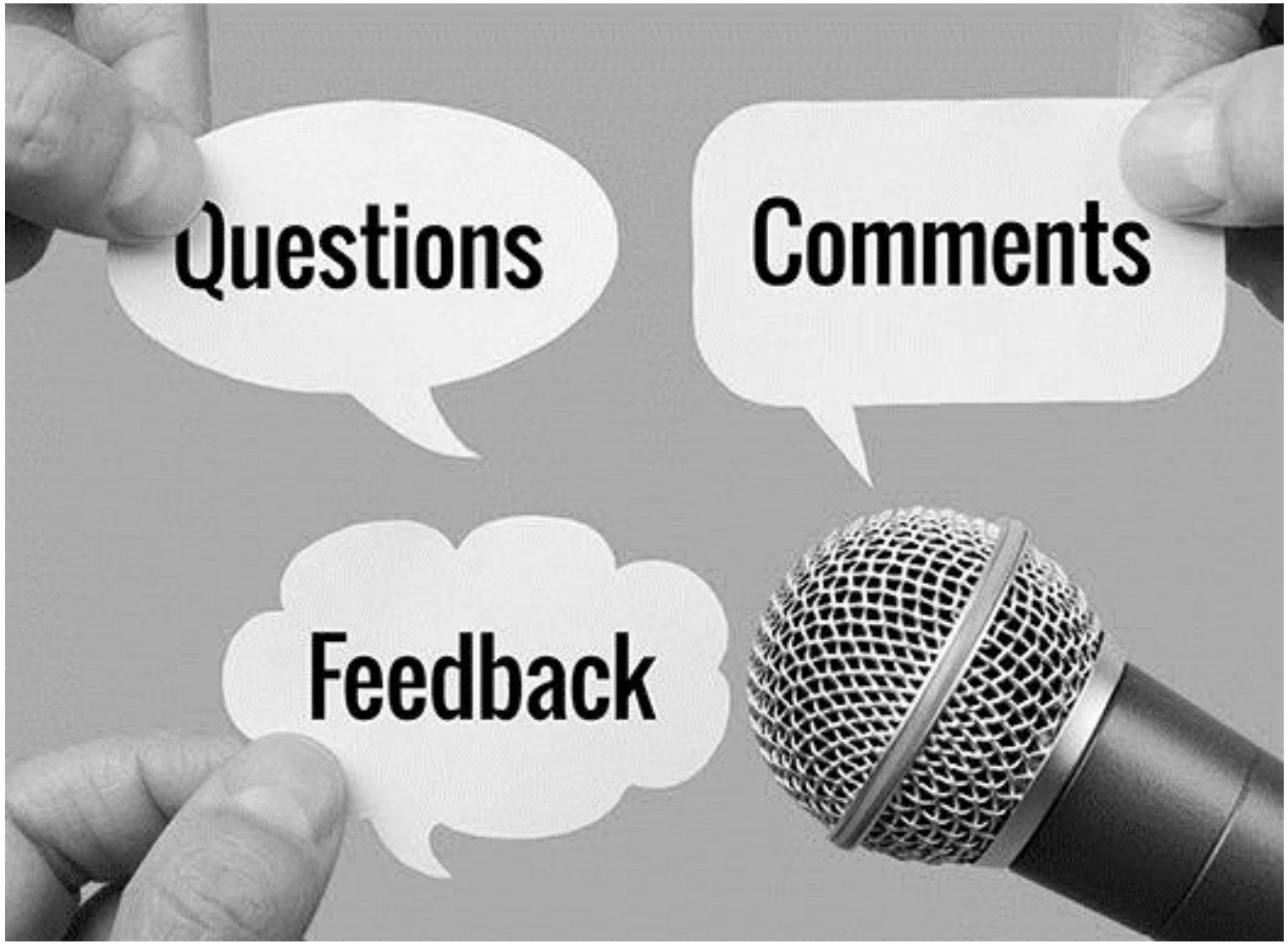
$$Na^{+}\ \text{Concentration (mmol/l)} = 150 \times \frac{\delta A_{(s)}}{\delta A_{(std)}} = \frac{\delta A_{(RBL)} - \delta A_{(s)}}{\delta A_{(RBL)} - \delta A_{(std)}}$$

Where: $\delta A_{(s)} = \delta A_{(RBL)} - \delta A_{(s)}$

$\delta A_{(std)} = \delta A_{(RBL)} - \delta A_{(std)}$

Serum electrolytes	Normal values	Abnormal values (mmol/L)
Sodium	135-145 mmol/L	**Mild to moderately low:** 125-135 mmol/L **Severely low:** less than 125 mmol/L
		Mild to moderately high: 145-160 mmol/L **Severely high:** higher than 160 mmol/L

RANGES FOR SODIUM CONC.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