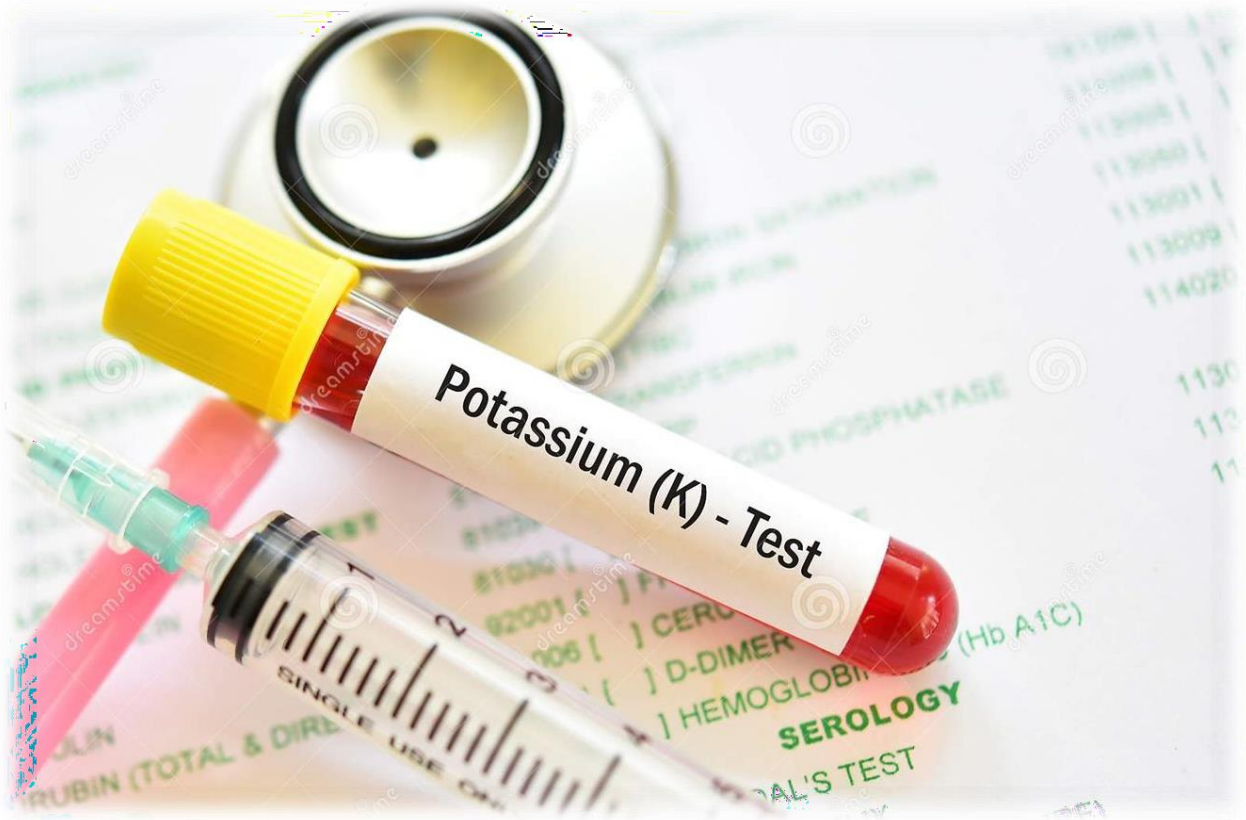
Estimation of potassium in blood serum



Potassium is the major cation (positive ion) inside animal cells, while sodium is the major cation outside animal cells. The concentration differences of these charged particles causes a difference in electric potential between the inside and outside of cells, known as the membrane potential. The balance between potassium and sodium is maintained by ion pumps in the cell membrane.

Functions of Potassium

- Potassium regulates water and salt metabolism in the cell
- Maintains osmotic pressure and acid-base balance
- normalizes heartbeat
- participate in the surrender of nerve impulses muscles
- increases removal of sodium and water from the body and activates certain enzymes.
- potassium plays an important role in protein biosynthesis and the conversion of blood sugar into glycogen

Principle

Potassium is determined via enzymatic reaction, in which phosphoenolpyruvate is converted to pyruvate by the action of a potassium-dependent pyruvate kinase. The pyruvate produced is converted to lactate in presence of NADH (nicotinamide dinucleotide), in a reaction which is catalyzed by lactate dehydrogenase. The oxidation of NADH to NAD and subsequent decrease in optic density at 380 nm is proportional to the amount of potassium in sample.

$$\text{Phosphoenolpyruvate} + \text{ADP} \xrightarrow[\text{Pyruvate kinase}]{K^+} \text{Pyruvate} + \text{ATP}$$

$$\text{Pyruvate} + \text{NADH} \xrightarrow[\text{Lactate dehydrogenase}]{} \text{Lactate} + \text{NAD}$$

Normal range

Potassium is measured in milliequivalents per liter (mEq/L) or millimoles per liter (mmol/L). Normal results are about:

- 3.5 to 5.2 mmol/L for adults
- 3.4 to 4.7 mmol/L for children ages 1 to 18 years old
- higher than 5.5 mmol/L is critically high
- over 6 mmol/L can be life-threatening

hyperkalemia

Hyperkalemia is an elevated level of potassium (K^+) in the blood.

Symptoms of hyperkalemia

- tiredness or weakness
- a feeling of numbness or tingling
- nausea or vomiting
- trouble breathing
- chest pain
- palpitations or irregular heartbeats

Causes

Kidney failure is the most common cause of high potassium. When your kidneys fail or don’t function properly, they can’t remove extra potassium from your body. This can lead to potassium buildup.

Hypokalemia

is a low level of potassium (K^+) in the blood serum. Usually, levels below 3.6 are considered low, and below 2.5 mmol/L is life-threateningly low.

Symptoms of hypokalemia

Levels below 3.6 and below 2.5 mmol/L. At these levels, there may be signs and symptoms of :

- paralysis
- respiratory failure
- breakdown of muscle tissue
- ileus (lazy bowels)
- Kidney problems

Causes

- vomit a lot
- diarrhea
- kidneys or adrenal glands don’t work well
- medication that makes you pee (water pills or diuretics)
- Drinking too much alcohol
- Sweating a lot
- Folic acid deficiency