

# Electrolytes

## Estimation of Serum Calcium:

**Calcium (  $\text{Ca}^{2+}$  )** :- is one of the essential chemical elements of the body. Body cells, especially the brain, muscles and heart, need a healthy level of calcium in the blood to function properly. Calcium reaches the body through the food we eat and is absorbed from the digestive system into the body, where part of the calcium in the blood enters the cells

Calcium is stored in the teeth and bones while excess amounts are secreted into the urine. Calcium levels are controlled by several hormones, The 3 primary hormones are parathyroid hormone (PTH) 1,25-dihydroxyvitamin D-3 (Vitamin D3), and calcitonin.

The parathyroid glands release parathyroid hormone (PTH) in response to a decrease in serum calcium. PTH acts on the kidneys to increase calcium reabsorption. The kidney also responds to PTH by increasing secretion of Vitamin D3, which in turn stimulates calcium absorption through the gut. PTH acts on the bones to stimulate osteoclasts involved in bone reabsorption and the release of free calcium. All of these processes contribute to the rise in serum calcium.

Calcitonin is released by the thyroid parafollicular cells (C-cells) in response to an increase in serum calcium. Calcitonin acts on the bones to stimulate osteoblasts to deposit calcium in bones. Calcitonin also inhibits renal reabsorption of calcium, increasing urinary calcium excretion. Finally, calcitonin also inhibits calcium absorption in the intestines. These processes lead to a decrease in serum calcium. Almost all of your body's calcium is stored in your bones and teeth 99%. A very small amount about 1% is in your blood.

### Calcium in your blood comes in two forms:

- **Free calcium** is not attached to anything else in your blood.
- **Bound calcium** is attached to a protein called albumin or other substances in your blood.

There are two levels of calcium in the blood: total calcium and ionized calcium. 50% of the total calcium in the body is linked to albumin (a blood protein), and therefore can change the level of total calcium in the blood at high or low level of albumin

**There are two types of blood calcium tests:**

\*A total calcium test measures both free and bound calcium. It's the type of blood calcium test doctors order most often.

\*An ionized calcium test measures only free calcium.

**The roles of calcium**

1. Blood Coagulation .
2. Cofactor .
3. Maintenance of normal muscle contraction .
4. Transmission of nerve impulses.

**\*\*\*The real reduction of calcium ion caused tetany .**

**Clinical Significance**

**Causes of Hypercalcium**

1. Overactive parathyroid or thyroid gland
2. Cancer
3. Tuberculosis -- a lung disease caused by bacteria
4. Staying in bed for too long
5. Too much vitamin D in your diet
6. Kidney transplant
7. AIDS

## **Symptoms of Hypercalcium**

1. No desire to eat
2. Constipation
3. Always tired
4. Intense thirst
5. Nausea
6. Stomach pain
7. Vomiting
8. Weakness

## **Causes Hypocalcium :**

1. Low protein levels in your blood
2. Underactive parathyroid gland
3. low levels of magnesium and/or vitamin D in body
4. Too much phosphorus
5. Pancreatitis
6. Kidney failure

## **Symptoms of hypocalcium**

1. Irregular heartbeat
2. Muscle cramps or spasms
3. Tingling in your hands or feet
4. Muscle pain.

***\*Calculation***

$$C_{(\text{calcium})} = \frac{A(\text{sample})}{A(\text{standard})} * n$$

$$n = 10 \text{ mg /dL}$$

***\*Normal values:***

Newborn: **7.5 - 12 mg /dL**

Children: **10- 11 mg /dL**

Adult: **9 -10.6 mg /dL**

**Procedure**

	<b>Blank</b>	<b>Standard</b>	<b>assay</b>
<b>Reagent</b>	500 $\mu$ l	500 $\mu$ l	500 $\mu$ l
<b>standard</b>		10 $\mu$ l	
<b>sample</b>			10 $\mu$ l

Mix and let stand for 5 min and record A at 570nm