

Parathyroid hormone

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At the end of this presentation you will be able to

01

Define parathyroid hormone

02

Discuss the function and control of Parathyroid hormone

03

Explain mechanism of action of parathyroid hormone

04

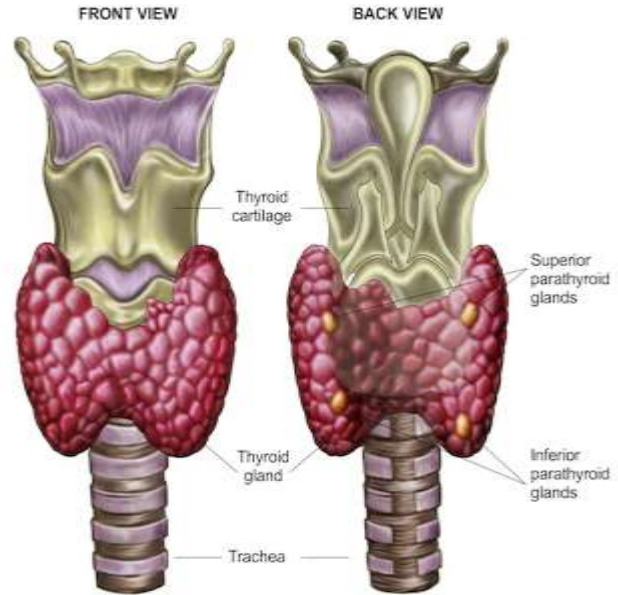
Disorder of parathyroid hormone





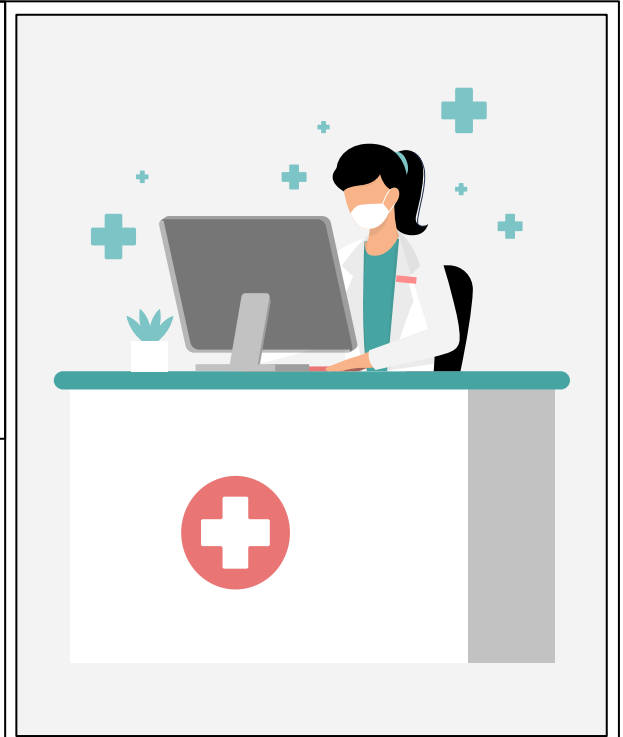
Introduction

There are typically four parathyroid glands, exist behind the thyroid gland, The two parathyroid glands on each side which are positioned higher are called the superior parathyroid glands, while the lower two are called the inferior parathyroid glands.



01

**Define parathyroid
hormone**



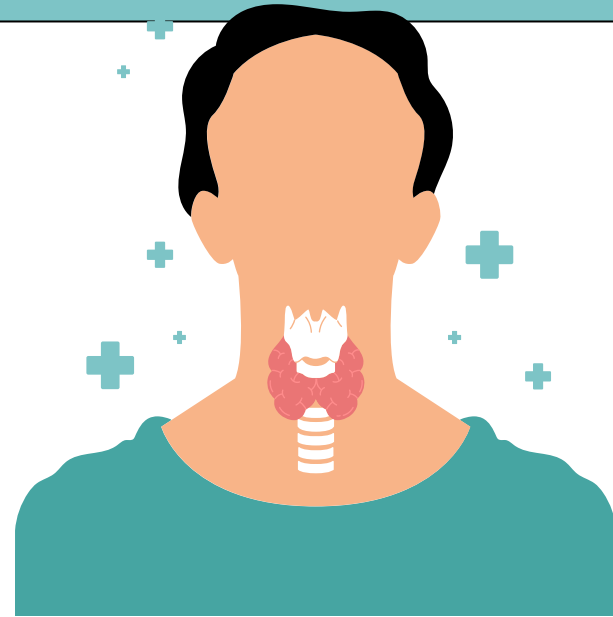
Parathyroid hormone (PTH), parathormone or parathyrin, secreted by chief cells of parathyroid glands to control calcium levels in blood. It also controls phosphorus and vitamin D levels.

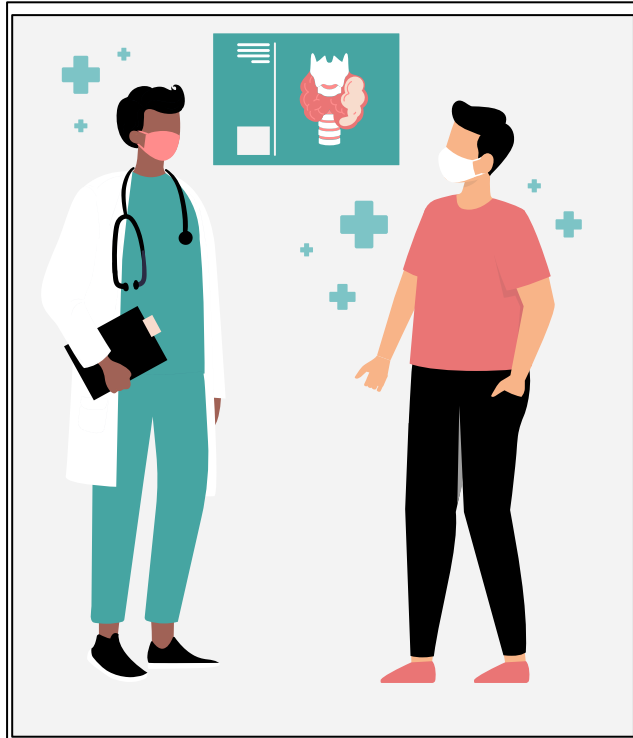
A polypeptide contains 84 amino acids.





- Normal blood calcium level ranges between 9 and 11 mg/dL
- Parathyroid hormone maintain and regulate calcium and phosphate level in blood so that hypercalcemia or hypocalcemia will not occur.





02

Function and control of parathyroid hormone



Function

1. **In Bones:** Parathyroid hormone stimulates the release of small amounts of calcium from bones into your bloodstream.
2. **In Kidneys:** Parathyroid hormone enables the production of active vitamin D (calcitriol) in kidneys. PTH also signals kidneys to retain calcium in body rather than flushing it out through urine
3. **In Small intestine:** Parathyroid hormone signals small intestine to absorb more calcium from the food eat.



Parathyroid hormone is so important because calcium is one of the most important and common minerals in body and has many important roles, including:

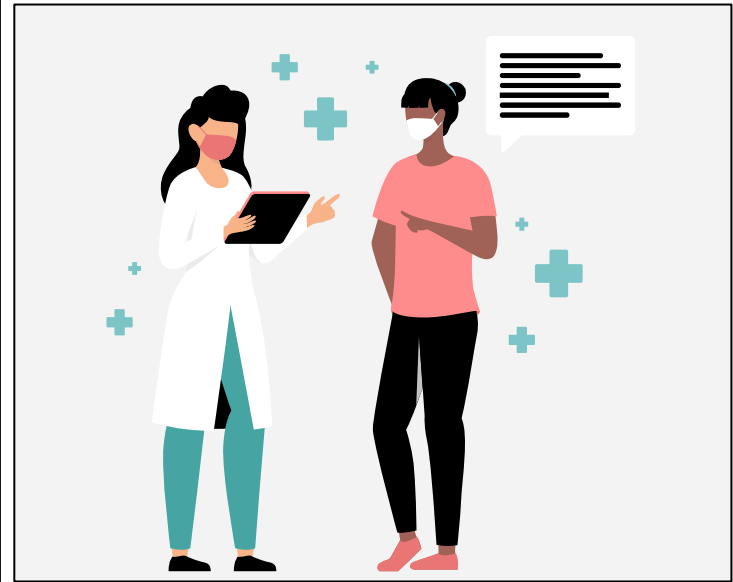
A. Helping nerves work.

Helping to make

B. muscles squeeze together (contract) so you can move.

C. Helping blood clot if you're bleeding.

D. Helping heart work properly.





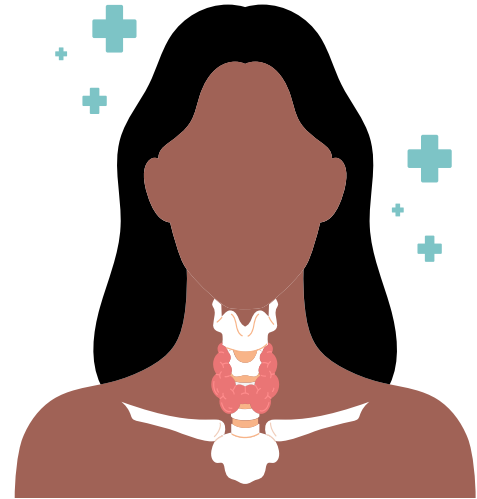
- And as for vitamin D Active vitamin D (calcitriol) helps to increase the amount of calcium your gut can absorb from the food you eat.
- and release it into your bloodstream.
- Parathyroid hormone (PTH) increases the activity of the enzyme that produces active vitamin D.



How does my body control parathyroid hormone levels?

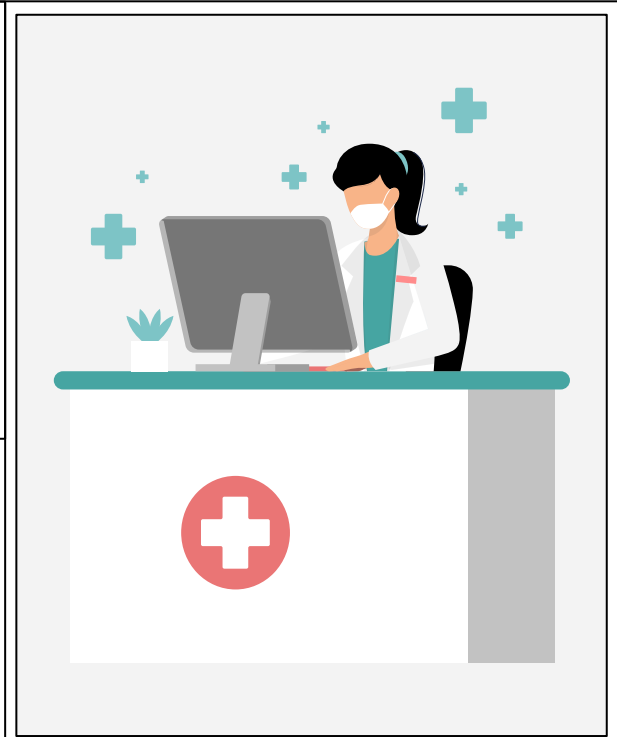
Parathyroid hormone (PTH) levels are mainly controlled by a feedback loop of calcium levels in blood to parathyroid glands. In other words, low calcium levels in blood stimulate parathyroid hormone release, whereas high calcium levels in blood prevent glands from releasing parathyroid hormone

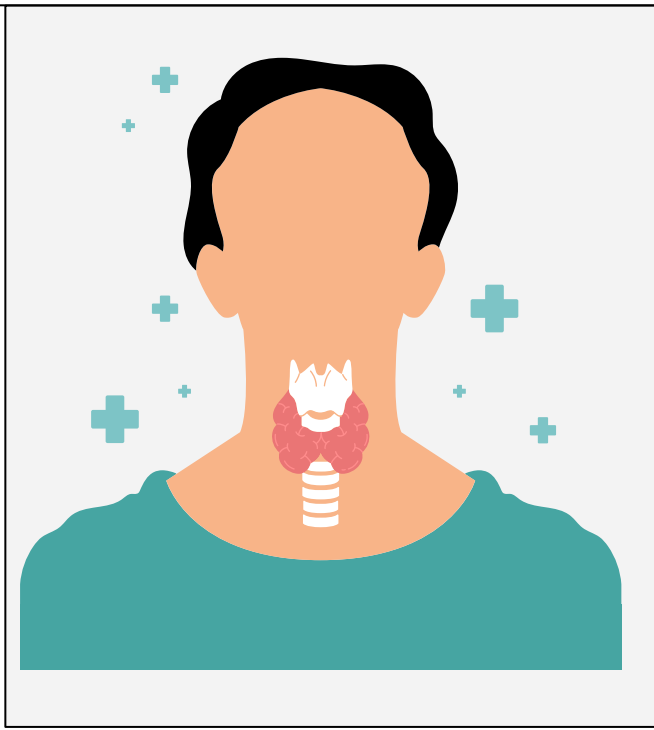
However, sometimes an issue with parathyroid glands, such as a tumor or damage to the glands, can cause them to release too much or too little of PTH, regardless of the feedback loop.



03

Mechanism of action of parathyroid hormone





PTH binds to a membrane receptor proteins on the target cells (in bones, kidney and intestine)

Actions of PTH on bone:

Rapid phase (1-3 hours)- Osteocytic osteolysis.

Slow phase(12-24 hours)- Osteoclastic osteolysis



Rapid phase:

PTH injected in large quantities

Calcium concentration in blood rises within minutes

Causing removal of bone salts from two areas

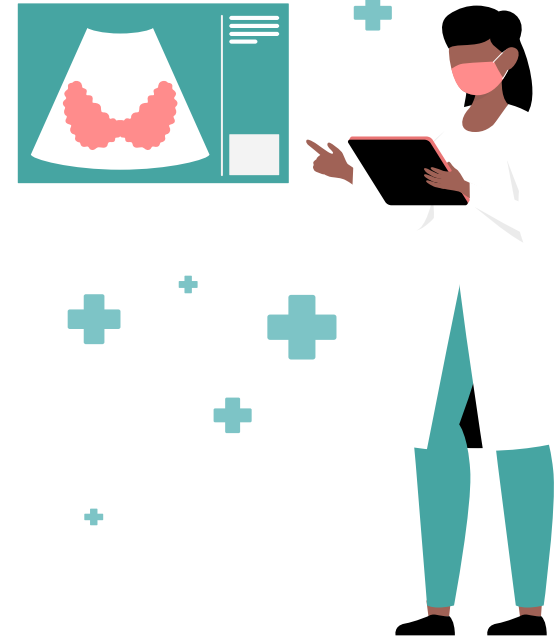
Bone matrix in vicinity of osteocytes

Bone matrix in vicinity of osteoblast.

But why these two?

Osteocytic membrane, pumps calcium from bone fluid to ECF.

Osteolysis occurs without resorption of bone fibrous and gel matrix





Slow phase:

Osteoclasts are activated

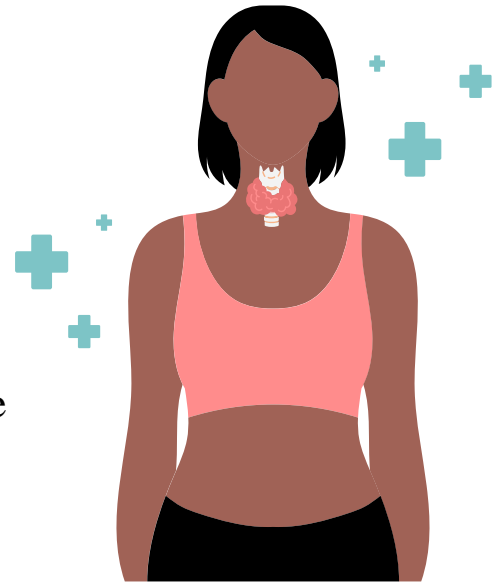
Osteoclasts have No membrane receptor proteins for PTH.

Secondary signals are received from osteoblasts

Activation occurs in two phases

Immediate activation of already existing in osteoclasts.

Formation of new osteoclasts from the osteoprogenitor initiate process of bone resorption in which calcium and phosphate are released from bone and are transferred to the ECF.





Action of PTH on Kidneys:

PTH is administered.

Calcium excretion is decreased.

PTH increases renal tubular reabsorption of calcium

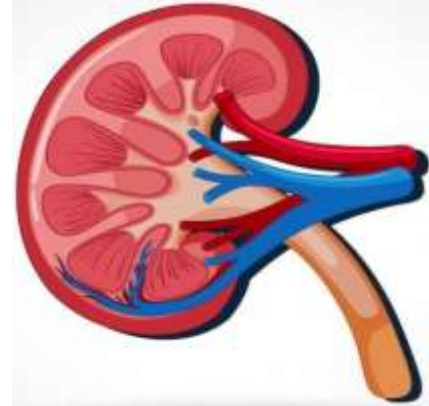
Phosphate excretion is increased.

PTH diminishes tubular reabsorption of phosphates.

Actions on kidney ..

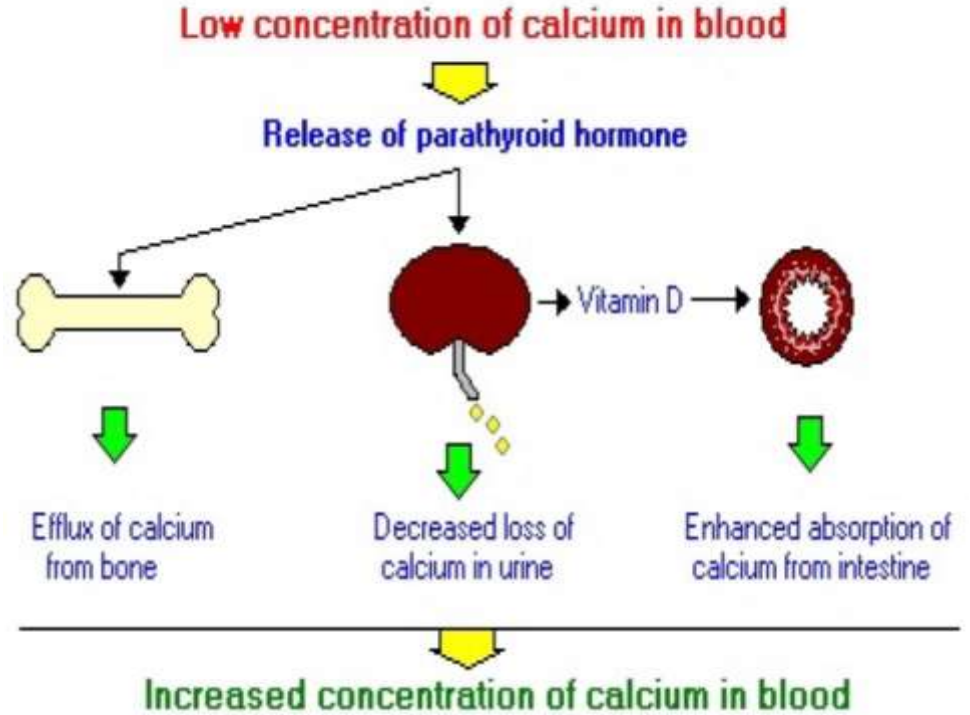
(iii) Stimulation of reabsorption of Mg^{2+} by the renal tubules.

(iv) Stimulation of synthesis of 1,25-dihydroxycholecalciferol is a very important action of PTH in the kidney.



Action of PTH on intestine:

- PTH enhances calcium and phosphate absorption from intestine indirectly.
- By increasing formation of 1,25 dihydroxycholecalciferol from vitamin D





04

Disorder of parathyroid hormone



hyperparathyroidism

Primary hyperparathyroidism

the unregulated overproduction of parathyroid hormone (PTH) resulting in abnormal calcium homeostasis.

Secondary hyperparathyroidism

- ❖ It can be due to vitamin D deficiency or renal failure.
- ❖ It can also occur in Paget's disease, multiple myeloma, bone metastases.
- ❖ Serum calcium is normal or low with high PTH level.
- ❖ Calcium and vitamin D supplements in case of vitamin D deficiency Calcitriol given in case of renal failure

Tertiary hyperparathyroidism

- ❖ A state of excessive secretion of parathyroid hormone after longstanding secondary hyperparathyroidism and resulting in hypercalcemia.
- ❖ Or secondary hyperparathyroidism that persists after successful renal transplantation



Lab Comparison

Hyperparathyroidism	Calcium	PTH	Vitamin D	Phosphate
Primary	↑	↑ →	↑	↓
Secondary	↓ →	↑	↓	↑ or ↓
Tertiary	↑	↑↑	↓	↑

Key: ↑ Elevated, ↓ decreased, → normal.

Source: Brashers. *Pathophysiology*. 2015.⁶

Hypoparathyroidism

Primary hypoparathyroidism is a rare endocrine disorder characterized by hypocalcemia due to absence or deficient production of parathyroid hormone (PTH) by parathyroid glands.

Secondary hypoparathyroidism is a physiologic state in which PTH levels are low in response to a primary process that causes hypercalcemia. The primary processes that lead to hypercalcemia are discussed in other articles (see Hypercalcemia)



Summary

- **Parathyroid hormone (PTH)** secreted by parathyroid glands to control calcium, phosphorus and vitamin D levels in blood.
- Function of parathyroid hormone in bones, kidneys, and intestines. PTH is very important because regulation (Ca) level in blood.
- Parathyroid hormone (PTH) levels are primarily controlled by a feedback loop from blood calcium levels to the parathyroid glands.
- Disorder of parathyroid hormone: Hyperparathyroidism and Hypoparathyroidism



Reference

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Thank you for listening