

HUMAN ANATOMY & PHYSIOLOGY-II- BP201T

UNIT: 4 (ENDOCRINE SYSTEM)

CLASS: 5

TOPIC: FUNCTIONS OF THYROID HORMONES

Thyroid hormones have two major effects on the body:

- I. To increase basal metabolic rate
- II. To stimulate growth in children.

The actions of thyroid hormones are:

1. ACTION ON BASAL METABOLIC RATE (BMR):

Thyroxine increases the metabolic activities in most of the body tissues, except brain, retina, spleen, testes and lungs. It increases BMR by increasing the oxygen consumption of the tissues. The action that increases the BMR is called **calorigenic action**.

2. ACTION ON PROTEIN METABOLISM

Thyroid hormone increases the synthesis of proteins in the cells. The protein synthesis is accelerated by the following ways:

- i. By Increasing the Translation of RNA
- ii. By Increasing the Transcription of DNA to RNA
- iii. By Increasing the Activity of Mitochondria
- iv. By Increasing the Activity of Cellular Enzymes

3. ACTION ON CARBOHYDRATE METABOLISM

Thyroxine stimulates almost all processes involved in the metabolism of carbohydrate.

Thyroxine:

- i. Increases the absorption of glucose from GI tract
- ii. Enhances the glucose uptake by the cells, by accelerating the transport of glucose through the cell membrane
- iii. Increases the breakdown of glycogen into glucose
- iv. Accelerates gluconeogenesis.

4. ACTION ON FAT METABOLISM

Thyroxine decreases the fat storage by mobilizing it from adipose tissues and fat depots. The mobilized fat is converted into free fatty acid and transported by blood. Thus, thyroxine increases the free fatty acid level in blood.

5. ACTION ON PLASMA AND LIVER FATS

Thyroxine also increases deposition of fats in the liver, leading to fatty liver. Thyroxine decreases plasma cholesterol level by increasing its excretion from liver cells into bile.

6. ACTION ON VITAMIN METABOLISM

Thyroxine increases the formation of many enzymes. Since vitamins form essential parts of the enzymes, it is believed that the vitamins may be utilized during the formation of the enzymes. Hence, vitamin deficiency is possible during hypersecretion of thyroxine.

7. ACTION ON BODY TEMPERATURE

Thyroid hormone increases the heat production in the body, by accelerating various cellular metabolic processes and increasing BMR. It is called thyroid hormone induced thermogenesis.

8. ACTION ON GROWTH

Thyroxine is more important to promote growth and development of brain during foetal life and first few years of postnatal life. Deficiency of thyroid hormones during this period leads to mental retardation.

9. ACTION ON BODY WEIGHT

Thyroxine is essential for maintaining the body weight. Increase in thyroxine secretion decreases the body weight and fat storage. Decrease in thyroxine secretion increases the body weight because of fat deposition.

10. ACTION ON SLEEP

Normal thyroxine level is necessary to maintain normal sleep pattern. Hypersecretion of thyroxine causes excessive stimulation of the muscles and central nervous system. So, the person feels tired, exhausted and feels like sleeping. But the person cannot sleep because of the stimulatory effect of thyroxine on neurons. On the other hand, hyposecretion of thyroxine causes somnolence.

APPLIED PHYSIOLOGY – DISORDERS OF THYROID

GLAND HYPERTHYROIDISM

Increased secretion of thyroid hormones is called hyperthyroidism.

Causes of Hyperthyroidism Hyperthyroidism is caused by:

1. Graves' disease
2. Thyroid adenoma.

1. Graves' disease Graves' disease is an autoimmune disease and it is the most common cause of hyperthyroidism. Normally, TSH combines with surface receptors of thyroid cells and causes the synthesis and secretion of thyroid hormones. In Graves' disease, the B lymphocytes (plasma cells) produce autoimmune antibodies called thyroid-stimulating autoantibodies. These antibodies act like TSH by binding with membrane receptors of TSH and activating cAMP system of the thyroid follicular cells. This results in hypersecretion of thyroid hormones. Antibodies act for a long time even up to 12 hours in contrast to that of TSH, which lasts only for an hour or so. The high concentration of thyroid hormones caused by the antibodies suppresses the TSH production also. So, the concentration of TSH is low or almost zero in plasma of most of the hyperthyroid patients.

2. Thyroid adenoma Sometimes, a localized tumor develops in the thyroid tissue. It is known as thyroid adenoma and it secretes large quantities of thyroid hormones. It is not associated with autoimmunity. As far as this adenoma remains active, the other parts of thyroid gland cannot secrete the hormone. This is because, the hormone secreted from adenoma depresses the production of TSH.

Exophthalmos

Protrusion of eye balls is called exophthalmos. Most, but not all hyperthyroid patients develop some degree of protrusion of eyeballs.

HYPOTHYROIDISM

Decreased secretion of thyroid hormones is called hypothyroidism. Hypothyroidism leads to myxedema in adults and cretinism in children.

GOITER

Goiter means enlargement of the thyroid gland. It occurs **both** in **hypothyroidism** and **hyperthyroidism**.