e-ISSN: 2322-0139
p-ISSN: 2322-0120

Research and Reviews: Pharmacology and Toxicological Studies

Thyroid gland & associated disorders

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Short communication

Received: 15/10/2015
Accepted: 19/10/2015
Published: 31/10/2015

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Introduction

The thyroid is a small gland that makes and stores hormones, measuring about 2 inches (5 centimeters) across, that lies just under the skin below the Adam's apple in the neck [1], wrapped around the trachea (windpipe). It has the shape of a butterfly, two lobes (wings) attached to one another by isthmus (middle part). Thyroid hormones are essential for the function of each cell in the body. They help in regulating the growth and the rate of chemical reactions (metabolism) in the body. The thyroid gland secretes thyroid hormones [2], which control the speed at which the body's chemical functions proceed (metabolic rate). Thyroid hormones influence the metabolic rate in two ways:

- stimulating almost every tissue in the body to produce proteins
- increasing the amount of oxygen that cells use

Thyroid hormones affect many vital body functions [3]. Those are heart rate, respiratory rate, rate at which calories are burned, skin maintenance, growth, heat production, fertility, and digestion.

Thyroid hormones

Thyroid gland produces thyroid hormones [4]. These are peptides containing iodine. It uses iodine, a mineral found in iodized salt and some foods, to make its hormones. The two most important thyroid hormones are:

- T_4 (thyroxine, or tetraiodothyronine) [5]
- T_3 (triiodothyronine)

A normal functioning thyroid produces approximately 80% T_4 and 20% T_3. T_4 (the major hormone) produced by the thyroid gland (6) it has only a slight effect on speeding up the body's metabolic rate. T_4 is converted into T_3 (the more active hormone). The conversion of T_4 to T_3 occurs in the liver and other tissues. Most of the T_4 and T_3 hormones in the bloodstream are carried bound to a thyroxine-binding globulin (TBG) (protien). Only a small quantity of the T_4 and T_3 hormones are circulated freely in the blood. However, these free hormones those are active. When the free hormone is used by the body, some of the bound hormone is released from the binding protein.

The thyroid gland traps iodine [7,8] and processes it to produce the thyroid hormones. As thyroid hormones are used, some of the iodine contained in the hormones is released and these iodine (which returns to the thyroid gland) are recycled to produce more thyroid hormones. The thyroid gland releases slightly less of the thyroid hormones if there is high intake of iodine [9].

The body has a complex mechanism for adjusting the level of thyroid hormones. The hypothalamus which located just above the pituitary gland in the brain, secretes thyrotropin -releasing hormone, which causes the pituitary gland to produce thyroid-stimulating hormone (TSH). It stimulates the thyroid gland to produce thyroid hormones. The pituitary gland slows or speeds the release of TSH, depending on whether the levels of thyroid hormones circulating in the blood are getting too high or too low.

The thyroid gland also makes the hormone calcitonin [10], which is involved in calcium metabolism and stimulating bone cells to add calcium to bone.

Physiological impacts of thyroid hormone

The impacts of thyroid hormone are moderately enduring. Thyroid hormone has an extensive variety of physiological impacts. These are ordered into three fundamental classes:

1) General thermogenesis: [11] The essential metabolic rate of most tissues (cerebrum, spleen, lungs, gonads, and lymphocytes are special cases) is increased by thyroid hormone which would result in increased oxygen utilization, heat generation, cardiac output and respiration rate.
2) General metabolic effects: The turnover (chronic effects lead to increased breakdown) of protein and lipid as well as carbohydrate metabolism is stimulated by thyroid hormone. It also potentiates the effects of both insulin and epinephrine, and augments the growth hormone [12,13] secretion.

3) Growth and developmental impacts: Thyroid hormone is essential for typical improvement, particularly for development and for advancement of the brain during fetal and postnatal improvement. Maternal hypothyroid status because of absence of iodine must be redressed before origination to totally avoid fetal irregularities (because of both direct impacts of inadequate thyroid hormone in the baby and from other impacts of hypothyroid maternal metabolism). Deficiency of thyroid hormone during the critical period", which includes at least the last trimester of gestation and the first 1-2 years of postnatal life, and probably the entire period of pregnancy, which would result in irreversible deficits in brain function due to impaired development. Fetal hypothyroid [14,15] status during this period (i.e. thyroid hormone is available, yet just at low levels), additionally has major effects, however a long run treatment can eventually reverse most of the deficits. Thyroid hormone likewise stimulates growth, most likely both specifically and by means of increasing the secretion of growth hormone. Thyroid hormone is also essential for the normal function of the brain throughout the life.

The Thyroid During Pregnancy

During pregnancy, estrogen levels increase notably. Presumably as a consequence of this, thyroxine binding globulin (TBG) levels rise by ~3-fold. In mostof the women, free T3 and T4 levels remain constant and in few cases the levels come down markedly. The increment in thyroxine tying globulin (TBG) requires increased thyroid release to maintain the free T3 and T4 levels [16-18]. The subsequent increment in thyroid hormone generation, along with raised levels of thyroid hormone metabolism and with fetal iodine uptake for its own particular thyroid hormone combination implies that maternal iodine utilization increases during pregnancy. The need for more thyroid hormone during pregnancy might likewise create hypothyroidism in women evidently prior to conception, particularly in Hashimoto's syndrome. Before conception women being treated with thyroid hormone for thyroid deficiency require more supplementation during pregnancy. The placental hormone hCG [19] can initiate the TSH receptor. Albeit in most ladies this just results in euthyroid status with diminished TSH levels, the hCG impact can bring about pregnancy-induced hyperthyroidism. While the hyperthyroidism regularly determines as hCG levels decay taking after the first trimester, the people may oblige some treatment during that period, pregnancy-impelled hyperthyroidism might likewise be a manifestation of a sub-clinical thyroid issue.

Thyroid Disorders

Hypothalamic - Pituitary - Thyroid Axis: The thyroid organ is impacted by hormones delivered by two different organs:

1. The pituitary organ (located at the base of the mind) produces thyroid stimulating hormone (TSH).

2. The hypothalamus produces thyrotropin discharging hormone (TRH).

The hypothalamus and the pituitary gland indicates the low levels of thyroid home in the blood. TRH is then released, stimulating the pituitary to discharge TSH. Increased levels of TSH, thus invigorate the thyroid to secrete more thyroid hormone there by the deficiency levels noted by the hypothalamus and the pituitary gland are maintained to normal levels.
The three organs and the hormones make up the Hypothalamic - Pituitary - Thyroid axis. TSH builds the uptake of iodine by the thyroid organ and the release of thyroid hormone is increased. On the off chance that there is little iodine accessible (our eating routine), less thyroid hormone is delivered by the thyroid; hypothalamic TRH causes TSH to be discharged from the pituitary in more amounts. The pituitary also responds to the absence of thyroid hormone in the blood and so the TSH release is enhanced. This allows the thyroid to absorb and utilize the greater part of the iodine available in the diet and water.
TSH has another activity causing the growth of thyroid cells. The organ develops and turns out to be large as a result of increased levels of TSH. Once the thyroid hormone levels are restored, TSH release stabilizes at higher level.
In the healthy people and in those with goiter, the hypothalamic - pituitary [20-22] thyroid pivot maintains the controlled production of thyroid hormone and enables the thyroid to respond to situations requiring more or less thyroid hormone production and this condition of normal thyroid capacity is called euthyroidism).

The thyroid disorders are mainly caused due to the following reasons:
1. Production of an excessive amount of thyroid hormone (hyperthyroidism).
2. Production of less amounts of thyroid hormone (hypothyroidism).

Some of the most common thyroid disorders are as follows:

1. **Goiters:** A goiter is a bulge in the neck. There are two types of goiter: toxic goiter (associated with hyperthyroidism) and a non-toxic goiter [23-26], also known as a simple or endemic goiter (caused by iodine deficiency).
2. **Hyperthyroidism: [27]** Hyperthyroidism is caused by to an over-stimulated thyroid (too much thyroid hormone). The symptoms of hyperthyroidism [28-30] are often sensitive to heat, hyperactive, and eat excessively. Goiter is a side effect of hyperthyroidism (inflamed tissues).
3. **Hypothyroidism:** Hypothyroidism is a common condition caused by too little thyroid hormone. [31] Hypothyroidism condition in infants is known as cretinism(causes a very serious side effects). Its symptoms are abnormal bone formation and mental retardation. The symptoms of hypothyroidism as an adult are sensitivity to cold, little appetite, and an overall sluggishness [32].
4. **Solitary thyroid nodules:** Solitary nodules or lumps in the thyroid are common in more than half the population, who will have a nodule in their thyroid. The great majority of nodules is benign and sometimes may be malignant.
5. **Thyroid cancer:** Thyroid cancer is fairly common, though the long-term survival rates are excellent. The symptoms such as hoarseness, neck pain, and enlarged lymph nodes can be seen in people with thyroid cancer [33-35]. Thyroid cancer can affect anyone at any age, women and people over thirty are most prone to develop this condition [36,37].
6. **Thyroiditis:** Thyroiditis [38] is an inflammation of the thyroid with abnormal thyroid function (particularly in hyperthyroidism). Inflammation can damage the thyroid's cells (to die), making the thyroid unable to produce enough hormones required to maintain the body's normal metabolism.[39]There are five types of thyroiditis.
7. **Hashimoto's syndrome [40]:** in this condition, the goiter (inflammation) is caused by an accumulation of white blood cells and fluid in the thyroid gland, this leads to destruction of the thyroid cells and thyroid failure. As the gland is destroyed, thyroid hormone production decreases,thus TSH increases (making the goitre even larger).
8. **Graves' disease (thyrotoxicosis):** is caused due to a unique antibody called thyroid stimulating antibody which stimulates the thyroid cells to grow larger (to produce excessive amounts of thyroid hormones). In this condition, the goiter is not due to TSH but due to this unique antibody.

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