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Relationship between Calcium Ion Concentration and Thyroid Hormones in Iraqi Women

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Abstract:- The study was conducted to determine the relationship between calcium ion concentration with thyroid hormones T4, T3, and TSH in Iraqi women patients. Samples were collected from 40 healthy females and 40 samples from patients suffering from a decrease in the level of thyroid hormones t3 and t4 were diagnosed by endocrine gland physician. Patients' serum was used to measure the concentration of calcium ion using the PD-303 . The results showed that there was a significant decrease ($P \leq 0.5$) in the concentration of calcium ion in the serum of patients compared with the healthy group. The study concluded that there is a close correlation between thyroid gland levels and calcium ion concentration.

Keyword:- Calcium ion concentration, Thyroid hormones, Women

Supplementary information The online version of this article (https://doi.org/xx.xxx/xxx.xx) contains supplementary material,which is available to autho-rized users.

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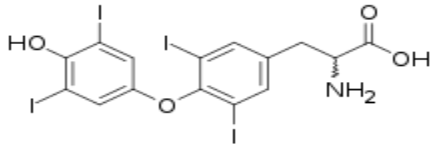
Introduction

All vertebrates have the thyroid gland, which is part of the endocrine system. Humans have this gland, which is actually two joined lobes, situated at the front of the neck just below the Adam's apple. The thyroid isthmus is a narrow tissue link that connects the lower two-thirds of the lobes. Thyroid vesicles are the unit of function of the thyroid gland. Each vesicle is made up of a single layer of epithelial cells called vesicular cells that surround the follicular space, which is filled with colloidal solution. In the spaces between the vesicles, you'll find other cells called paravesicular cells. Triiodinethyronine (T3) and thyroxine (T4), which include iodine, and the peptide hormone calcitonin are the three hormones secreted by the thyroid gland. In children, thyroid hormones influence development, growth, and protein synthesis. A proper calcium balance in the body is regulated by calcitonin. Anterior pituitary gland production of thyroid-stimulating hormone (TSH) and

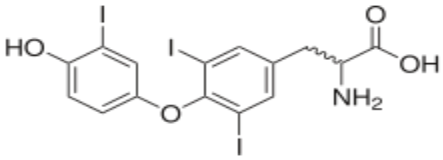
hypothalamic production of thyroid-releasing hormone (TRH) work together to control thyroid hormone output. [1]

Thyroid hormones

Thromadine (T4) and triiodine thyronine (T3) are two examples of the hormones sent into the bloodstream by the thyroid gland. They are tyrosine-derived hormones that play a major role in metabolic regulation. T3 and T4 both include some iodine. Reduced synthesis of thyroid hormones (T3 and T4), increased size of the thyroid gland, and the development of simple goitre are all symptoms of an iodine deficit. [2]



Thyroxine



Triiodothyronine

Thyroxine (T4) is the most abundant form of thyroid hormone in the blood, and its half-life is significantly longer than that of T3. In humans, the ratio of T4 to T3 in the blood is approximately 1:14. the third Cellular 5′ iodine dehydrogenase converts inactive T4 to active T3, which is three to four times more potent than T4. It can also be converted into thyronamine (T0A) and iodothyronamine (T1A) via decarboxylation and iodine removal. Because selenium is an enzyme component of all three isotopes of iodine dehydrogenases, selenium supplementation is necessary for thyroxine synthesis. In 1915, the first person to successfully isolate thyroxine was the American chemist Edward Calvin Kendal. [4] More than 105 million prescriptions for levothyroxine (a synthetic version of thyroxine) were written in the US in 2018, making it the second most prescribed medicine overall. The World Health Organisation Model List of Essential Medicines includes levothyroxine. [5]

Mechanisms of thyroid hormone action

Thyroid hormone is produced by the thyroid gland, which consists of follicles in which thyroid hormone is synthesized through iodination of tyrosine residues in the glycoprotein thyroglobulin [6,7]. Thyroid stimulating hormone (TSH), secreted by the anterior pituitary in response to feedback from circulating thyroid hormone, acts directly on the TSH receptor (TSH-R) expressed on the thyroid follicular cell basolateral membrane [8]. TSH regulates iodide uptake mediated by the sodium/iodide symporter, followed by a series of steps necessary for normal thyroid hormone synthesis and secretion [9]. Thyroid hormone is essential for normal development, growth, neural differentiation, and metabolic regulation in mammals[10,11,12] and is required for amphibian metamorphosis [13]. These actions are most apparent in conditions of thyroid hormone deficiency during development, such as maternal iodine deficiency or untreated congenital hypothyroidism, manifesting as profound neurologic deficits and growth retardation [14]. More subtle and reversible defects are present when ligand deficiency occurs in the adult [15].

Thyroid disorder

A thyroid disorder is an overactive thyroid gland where the production of hormones is very high. The cause may be Graves' disease or hyperthyroidism. Another cause may be some medications that contain an excessive amount of iodine that cause a thyroid disorder.Some of the different thyroid diseases include: Goiter, an

enlargement of the thyroid gland. Hyperthyroidism, which happens when your thyroid gland makes more thyroid hormones than your body needs. Hypothyroidism, which happens when your thyroid gland does not make enough thyroid hormones. Here we will talk about one of the types of diseases caused by thyroid disorders (15)

Hypothyroidism

Hypothyroidism, also called hypothyroidism or low thyroid hormone, is a disorder of the endocrine system in which the thyroid gland does not produce enough thyroid hormone. They can cause a number of symptoms, such as: poor tolerance to cold, feeling tired, constipation, depression, low heart rate, and weight gain. Sometimes there may be swelling in the front of the neck due to goiter. [16] Conditions that go untreated for hypothyroidism during pregnancy can lead to delays in fetal growth and mental development or congenital iodine deficiency syndrome. [17]

The presence of iodine in small amounts in the diet is the most common cause of hypothyroidism, this is universally recognized. [18] [19] In countries with adequate iodine in their diet, Hashimoto's disease is the most common cause of hypothyroidism. Less common causes of hypothyroidism include: previous treatment with radioactive iodine, injury to the pituitary gland, injury to the anterior pituitary gland, due to certain medications, decreased functioning of the thyroid gland during childbirth, or pre-thyroid surgery. [20] When hypothyroidism is suspected, it is possible to confirm blood tests that measure thyroid stimulating hormone (TSH) and its levels.

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Calcium

is a chemical element with symbol Ca and atomic number 20 (note 1) and belongs to the alkali earth metals, which are in group II of the periodic table of elements. This metal is characterized by its chemical activity, so it does not exist in its free form in nature, as a layer of oxide and nitride forms on its surface when exposed to air. This element is similar in chemical and physical properties to those of its heavier counterparts in the group of alkali metals: strontium and barium. Calcium is the fifth chemical element in terms of natural abundance in the earth's crust, and the third metal in that order after aluminum and iron; it is often found in the form of calcium carbonate, which is involved in the composition of limestone; it is also found in the form of other compounds in the minerals plaster, anhydrite, fluorite, and apatite, which are also natural ores for calcium [21, 22].

Calcium is found in many foods, such as:

- Dairy products, such as cheese, milk and yogurt

- Dark green leafy vegetables, such as broccoli and cabbage
- Fish that contain soft edible bones, such as sardines and canned salmon
- Calcium-fortified foods and beverages, such as soy products, cereals, fruit juices and milk substitutes

To absorb calcium, your body also needs vitamin D, and some foods naturally contain small amounts of vitamin D, such as canned salmon with bones and egg yolks. You can also get vitamin D from foods rich in it and through sun exposure. The recommended daily dose for vitamin D is 600 IU (15 mcg) per day for most adults.[23]

Relationship of calcium with thyroid hormones

Parathyroid hormone secreted by the thyroid glands helps maintain the proper balance of calcium in the bloodstream and calcium-dependent tissues in order to function properly. This is especially important for nerve and muscle function, as well as bone health. There are two types of hyperparathyroidism. The first type is primary hyperparathyroidism, in which an enlarged gland of one or more parathyroid glands leads to overproduction of the hormone. This causes calcium levels in the blood to rise, which can cause a variety of health problems. Surgery is the most common treatment for primary hyperparathyroidism. The second type is secondary hyperparathyroidism that occurs as a result of another disease that first leads to low levels of calcium in the body. Then, over time, an increase in parathyroid hormone levels occurs as the body struggles to raise calcium levels to a normal range. This is common in kidney disease and after certain bowel surgeries or diseases.

Material and Methods

1.samples collection

The specimens were collected from two hospitals, Al- Qasim hospital and AL-Sadique hospital in Babylon city Venous bloods were collected in a laboratory, as specimens, from 40 patients. The average age was 10–45 years

2.Separating Serum from blood.

First, blood taken from patients by syringe was placed in the plane tubes (not anticoagulant tube). Then, these tubes were centrifuged at 5000 rpm for 5 min. The serum thus separated from blood was transferred to another tube and gave a special number and name to the tube to avoid its loss

3-Measurement of calcium .

The first test is the measurement of calcium ion in the body via electrolytes instrument in both hospitals, Al-Qasim and Al-Sadique

4-Hormonal test procedure (TSH-T3-T4) by ELISA4

Information about the device used in scientific research

Spectrophotometer PD-303

Sufficient measurement is possible with a small sample volume (1.0 mL).

The light source lamp boasts a long life of about 2000 hours.

Both square cells and round test tubes can be used without using an adapter.

By adopting a regulated power supply, the power supply voltage is 100 to 240 VAC and can be used without switching.
Since the analog cable is a standard set, you can record the measured value with a recorder.

Results and Discussion

Results:

Table 1. Calcium concentration in control and patients

group	Concentration (mean ±S.E)(mgldl)
Control	9.31± 0.45
patients	4.62± 0.62*

Discussion:

The results in Table (1) above show a significant decrease in the concentration of the calcium ion, and the reason due to a decrease in the concentration of T4 and T3 hormones, as these two hormones are responsible for the process
of absorbing calcium from food to be stored in the bones inside the body (25)
The results were agreement with (26 ,27) which concluded decrease in calcium concentration in hypothyroidism patients compare with control. However, calcium and phosphorus levels are regulated through multiple hormonal mechanisms which include: parathyroid hormone, calcitonin, and 1,25di-hydroxy cholecalceferol(28).
Calcium and phosphorus represent the main minerals of bone matrix. Furthermore, skeleton is metabolically active organ which undergoes continuous remodeling during life and is the more affected organ in hyperthyroid patients(29). It has been found that excess thyroid hormones stimulates osteoclast cells and increase their activities to mobilize calcium and phosphorus from bone matrix into blood(30).
This decrease in calcium concentration may be because to disorder in calcitonin hormone which responsible from regulate calcium ion balance.

Conclusion:

- The results concluded that there is a close correlation between thyroid hormones levels and calcium ion concentration.
- The study revealed to healthy thyroid gland correlate with bone healthy muscles contraction and nerve impulse conduction inside body.

Recommendation:

- Additional research about thyroid gland and parathyroid gland hormones such as PTH and calcitonin.
- Correlation between other hormones inside body with thyroid hormones and calcium.

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