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Experimental Investigation of Effects of T3 Hormones on Human Body and their Analysis

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Abstract: ***The diagnosis of thyroid disease fully depends on hormones. Generally doctors use medical history in diagnosis but it is not sufficient because without physical exam and medical hormonal test does not diagnose clearly. In any case if pituitary gland not properly works means T3 functions are not properly work. Thyroid function inter relate with every function in human body. If human body function not properly work then some symptoms overcome in human body as like fatigue, weight gain, mood issue, irregular period, muscle pain cold hand, dry and cracking skin neck swelling etc. Generally thyroid problems are two types' hypothyroidism, and hyperthyroidism. These two different problems have different own symptoms in human body. By the help of Iodine easily maintain thyroid gland hormones because thyroid gland converts Iodine in triiodothyroxine (T3). Many thyroid cells are in the human body. In this work we analysis the various age group T3 data for Female and Male patients.***

Keywords: T3 hormones, Human body, thyroid hormones, Metabolism

1. Introduction

Thyroid hormone is the hormone that's mainly responsible for controlling the speed of your body's metabolism. In infants, thyroid hormone is critical for brain development. Your thyroid, a small, butterfly - shaped gland located at the front of your neck under your skin, makes and releases thyroid hormone. It's a part of your endocrine system (Klein, I., &Ojamaa, K.2001).

Hormones are chemicals that coordinate different functions in your body by carrying messages through your blood to your organs, muscles and other tissues. These signals tell your body what to do and when to do it.

Metabolism is the complex process of how your body transforms the food you consume into energy. All of the cells in your body need energy to function (Mullur, R., Liu, Y. Y., & Brent, G. A.2014).

Thyroid hormone actually represents the combination of the two main hormones that your thyroid gland releases: thyroxine (T4) and triiodothyronine (T3). They're often collectively referred to as "thyroid hormone" because T4 is largely inactive, meaning it doesn't impact your cells, whereas T3 is active. Once your thyroid releases T4, certain organs in your body transform it into T3 so that it can impact your cells and your metabolism (Ormston, B. J., et al., 1971)

Your thyroid also releases a hormone called calcitonin to help regulate calcium levels in your blood by decreasing it. Calcitonin isn't grouped into the "thyroid hormone" name, and it doesn't impact your body's metabolism like T3 and T4 do (Korevaar, T. I., et al., 2019).

The production and release of thyroid hormone — thyroxine (t4) and triiodothyronine (T3) — is controlled by a feedback loop system that involves the following:

- Hypothalamus.
- Pituitary gland.
- Thyroid gland.
- Multiple hormones.

Your hypothalamus is the part of your brain that controls functions like blood pressure, heart rate, body temperature and digestion.

Your pituitary gland is a small, pea - sized gland located at the base of your brain below your hypothalamus. It makes and releases eight hormones.

Your pituitary gland is connected to your hypothalamus through a stalk of blood vessels and nerves. This is called the pituitary stalk. Through the stalk, your hypothalamus communicates with your pituitary gland and tells it to release certain hormones.

To start the feedback loop, your hypothalamus releases thyroid - releasing hormone (TRH) which, in turn, stimulates your pituitary gland to produce and release thyroid - stimulating hormone (TSH). TSH then triggers your thyroid to produce T4 and T3. Of the total amount of hormones that TSH triggers your thyroid to release, about 80% is T4 and 20% is T3. Your thyroid also needs adequate amounts of iodine, a substance you get from the food you eat, to create T4 and T3 (Dayan, C. M.2001).

This hormone chain reaction is regulated by a feedback loop so that when the levels of T3 and T4 increase, they prevent the release of TRH (and thus TSH). When T3 and T4 levels drop, the feedback loop starts again. This system allows

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your body to maintain a constant level of thyroid hormones in your body.

If there are any issues with your hypothalamus, pituitary gland or thyroid, it can result in an imbalance in the hormones involved in this system, including T3 and T4 (Rao, M. J., et al., 2022)

Once your thyroid releases thyroxine (T4) into your bloodstream, certain cells in your body transform it into triiodothyronine (T3) through a process called de - iodination. This is because cells that have receptors that receive the effect of thyroid hormone are better able to use T3 than T4. Therefore, T4 is generally considered to be the inactive form of thyroid hormone, and T3 is considered the active form of it.

Cells in the following tissues, glands, organs and body systems can convert T4 to T3:

- Liver.
- Kidneys.
- Muscles.
- Thyroid.
- Pituitary gland.
- Brown adipose (fat) tissue (This type of fat produces heat to help maintain your body temperature in cold conditions).
- Central nervous system.

Thyroid hormone (T3 and T4) affects every cell and all the organs in your body by:

- Regulating the rate at which your body uses calories (energy). This affects weight loss or weight gain and is called the metabolic rate.
- Slowing down or speeding up your heart rate.
- Raising or lowering your body temperature.
- Influencing the speed at which food moves through your digestive tract.
- Affecting brain development.
- Controlling the way your muscles contract.
- Managing skin and bone maintenance by controlling the rate at which your body replaces dying cells (a normal process).

Several blood tests can measure your thyroid levels and assess how well your thyroid is working. These tests are often called thyroid function tests and include:

- Total T4 (thyroxine) test.
- Free T4 (FT4) test.
- Total T3 (triiodothyronine) test.
- Free T3 (Ft3) test.
- Thyroid - stimulating hormone (TSH) test.

Your provider may order additional tests to assess your thyroid function, including:

- **Thyroid antibodies**: These tests help identify different types of autoimmune thyroid conditions.
- **Thyroglobulin**: This test is used to diagnose thyroiditis (thyroid inflammation) and to monitor the treatment of thyroid cancer.

Several conditions can result from or cause abnormal thyroid hormone levels. Thyroid disease is very common, with an estimated 20 million people in the United States having some type of thyroid condition. A person assigned female at birth is about five to eight times more likely to have a thyroid condition than a person assigned male at birth.

Thyroid conditions include:

- Hypothyroidism (underactive thyroid).
- Hashimoto's disease (an autoimmune condition that causes hypothyroidism).
- Hyperthyroidism (overactive thyroid).
- Graves' disease (an autoimmune condition that causes hyperthyroidism).
- Thyroiditis (thyroid inflammation).
- Thyroid nodules.
- Goiter (enlarged thyroid gland).
- Thyroid cancer.

Issues with your pituitary gland or hypothalamus can also cause abnormal thyroid hormone levels since they help control thyroid hormone levels.

Abnormal thyroid hormone levels usually cause noticeable symptoms. Since thyroid hormone is responsible for controlling the speed of your metabolism, too much thyroid hormone can make it faster than normal and too little thyroid hormone can slow it down. These imbalances cause certain symptoms, including:

- Unexplained weight gain or weight loss.
- Slow or fast heart rate.
- Intolerance to cold or heat.
- Dry or moist skin.
- Irregular menstrual cycles.

If you experience these symptoms, contact your healthcare provider. They can run some simple blood tests to see if your thyroid hormone levels are irregular.

Thyroid blood tests are used to tell if your thyroid gland is functioning properly by measuring the amount of thyroid hormones in your blood. They are done by withdrawing blood from a vein in your arm. These blood tests help to diagnose thyroid diseases.

The thyroid is a butterfly - shaped gland located in the front part of your neck. Its job is to produce thyroid hormones, which travel through your bloodstream and regulate many aspects of your body's metabolism, including temperature, weight, and energy.

Thyroid blood tests show if you have:

- Hyperthyroidism: Overactive thyroid producing more thyroid hormones than your body needs. Hyperthyroidism speeds up your metabolism, which can cause weight loss, rapid heartbeat, insomnia, puffiness around the eyes, anxiety and other symptoms. The most common cause of hyperthyroidism is Graves' disease.
- Hypothyroidism: Underactive thyroid producing too few thyroid hormones. Hypothyroidism slows down your metabolism, which can cause weight gain, menstrual irregularity, dry and puffy skin, fatigue and other

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symptoms. The most common cause of hypothyroidism is Hashimoto's disease.

Thyroid blood tests are used to diagnose thyroid disorders associated with hyper - or hypothyroidism. These include:

- Thyroiditis.
- Graves' disease.
- Hashimoto's disease.
- Thyroid tumors.
- Goiter.
- Thyroid nodule.
- Thyroid cancer.

Test Details

Thyroid blood tests include:

- **Thyroid - stimulating hormone (TSH)** is produced in the pituitary gland and regulates the balance of thyroid hormones – - including T4 and T3 - - in the bloodstream. This is usually the first test your provider will do to check for thyroid hormone imbalance. Most of the time, thyroid hormone deficiency (hypothyroidism) is associated with an elevated TSH level, while thyroid hormone excess (hyperthyroidism) is associated with a low TSH level. If TSH is abnormal, measurement of thyroid hormones directly, including thyroxine (T4) and triiodothyronine (T3) may be done to further evaluate the problem. Normal test range for an adult: 0.40 - 4.50 mIU/mL (milli - international units per liter of blood).
- **T4: thyroxine** tests for hypothyroidism and hyperthyroidism, and used to monitor treatment of thyroid disorders. Low T4 is seen with hypothyroidism, whereas high T4 levels may indicate hyperthyroidism. Normal range for an adult: 5.0 – 11.0 ug/dL (micrograms per deciliter of blood).
- **FT4: Free T4 or free thyroxin** is a method of measuring T4 that eliminates the effect of proteins that naturally bind T4 and may prevent accurate measurement. Normal test range for an adult: 0.9 - 1.7 ng/dL (nanograms per deciliter of blood)
- **T3: triiodothyronine** tests help diagnose hyperthyroidism or to show the severity of hyperthyroidism. Low T3 levels can be observed in hypothyroidism, but more often this test is useful in the diagnosis and management of hyperthyroidism, where T3 levels are elevated. Normal range: 100 - 200 ng/dL (nanograms per deciliter of blood).
- **FT3: Free T3 or free triiodothyronine** is a method of measuring T3 that eliminates the effect of proteins that naturally bind T3 and may prevent accurate measurement. Normal range: 2.3 - 4.1 pg/mL (picograms per milliliter of blood)

These tests alone aren't meant to diagnose any illness but may prompt your healthcare provider to do additional testing to evaluate for a possible thyroid disorder (Thumvijit, T., et al., 2022).

Additional blood tests might include:

- **Thyroid antibodies**: These tests help identify different types of autoimmune thyroid conditions. Common thyroid antibody tests include **microsomal antibodies** (also known as **thyroid peroxidase antibodies** or **TPO antibodies**), **thyroglobulin antibodies** (also known as **TG antibodies**), and **thyroid receptor antibodies** (includes **thyroid stimulating immunoglobulins [TSI]** and **thyroid blocking immunoglobulins [TBI]**).
- **Calcitonin**: This test is used to diagnose C - cell hyperplasia and medullary thyroid cancer, both of which are rare thyroid disorders.
- **Thyroglobulin**: This test is used to diagnose thyroiditis (thyroid inflammation) and to monitor treatment of thyroid cancer.

2. Research Methodology

T3 Method:

- Take a blood sample with help of injection.
- Taken blood sample centrifuge and separate serum from the blood sample.
- Take a vial and mix it 10 ml Blood serum mix with buffer solution.
- After mixing the blood serum with buffer and incubate 10 min and put it in instrument and check the result.

Data Analysis:

We collect three month of patients T3 test data for thyroid. In that data we get 35 patients in that we have 29 female patients and 6 male patients. As shown in table 1.1.

Table 1.1: Three month of patients T3 test data for thyroid

No.	Age	T3 Normal Range (0.60 - 1.81)	No.	Age	T3 Normal Range (0.60 - 1.81)
1	5F	0.73	19	38F	1.17
2	10F	1.1	20	39F	1.65
3	21F	1.3	21	40F	0.9
4	27F	2.19	22	42F	1.26
5	27F	2.19	23	42F	0.97
6	28F	0.9	24	43F	1.1
7	28F	1.23	25	44F	0.98
8	29F	1.44	26	45F	1.1
9	30F	1.78	27	45F	1.08
10	31F	1.08	28	49F	0.91
11	32F	2.12	29	50F	1.05
12	33F	1.39	30	9M	1.38
13	34F	1.48	31	15M	1.48
14	35F	1.6	32	20M	2.09
15	37F	1.21	33	24M	1.1
16	37F	1.2	34	32M	0.86
17	38F	0.96	35	33M	1.07
18	38F	1.18			

In this data we get 1 to 10 age range 2 female 21 to 30 age range 7 female 31 to 40 age range 12 female and 41 to 50 age range 8 female total we have 29 female as shown in table 1.2. and fig 1.1.

Table 1.2: Number of Female T3 Examine

1 - 10 Age	11 - 20 Age	21 - 30 Age	31 - 40age	41 - 50 Age
2	0	7	12	8

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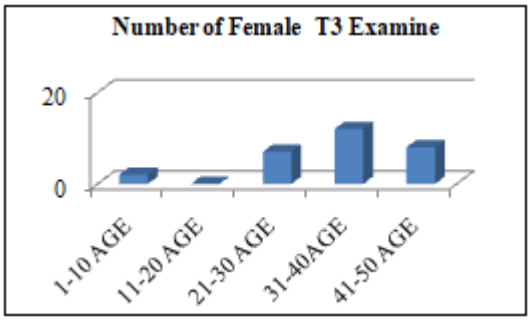

Figure 1.1: Number of Female T3 Examine

In this data we get 1 to 10 age range 1 male 11 to 20 age range 2 male 21 to 30 age range 1 male and 31 to 40 age range 2 male total we have 6 male as shown in table 1.3. and fig 1.2.

Table 1.3: Number of Male T3 Examine

1 - 10 Age	11 - 20 Age	21 - 30 Age	31 – 40 Age	41 - 50 Age
1	2	1	2	0

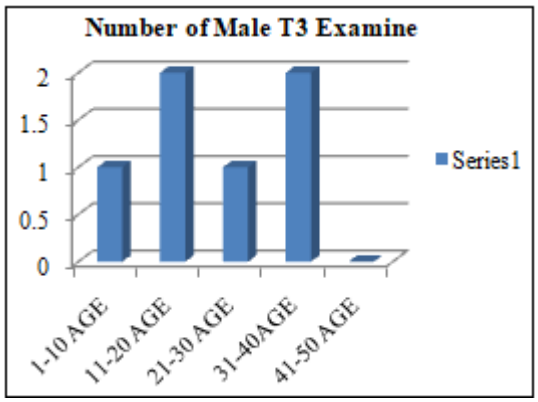

Figure 1.2: Number of Male T3 Examine

Here we analysis T3 value for various age group Female In this data we get 1 to 10 age range 2 female 21 to 30 age range 7 female 31 to 40 age range 12 female and 41 to 50 age range 8 female total we have 29 female as shown in table 1.4. and fig 1.3.

Table 1.4: T3 value for various age group Female

0-10 Age	T3	11- 20 Age	T3	21-30 Age	T3	31 – 40 Age	T3	41–50 Age	T3
5	0.73	-	-	21	1.3	31	1.08	42	1.26
10	1.1			27	2.19	32	2.12	42	0.97
				27	2.19	33	1.39	43	1.1
				28	0.9	34	1.48	44	0.98
				28	1.23	35	1.6	45	1.1
				29	1.44	37	1.21	45	1.08
				30	1.78	37	1.2	49	0.91
						38	0.96	50	1.05
						38	1.18		
						38	1.17		
						39	1.65		
						40	0.9		

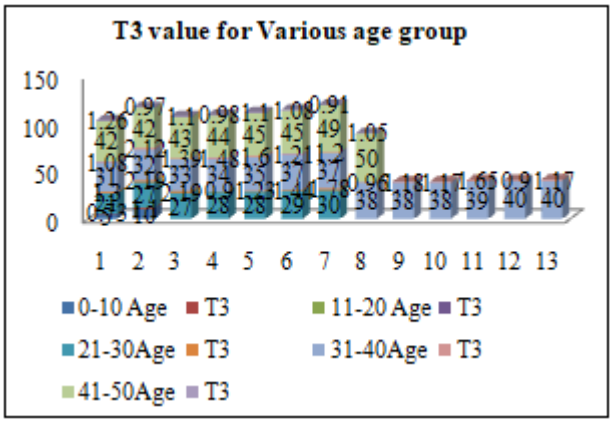

Figure 1.3: T3 value for various age group Female

Here we analysis T3 value for various age group Male In this data we get 1 to 10 age range 2 Male 21 to 30 age range 7 Male 31 to 40 age range 12 Male and 41 to 50 age range 8 Male total we have 29 Male as shown in table 1.5. and fig 1.4.

Table 1.5: T3 value for various age group Male

0-10 Age	T3	11-20 Age	T3	21-30 Age	T3	31-40 Age	T3	41-50 Age	T3
9	1.38	15	1.48	24	1.1	32	0.86	-	-
		20	2.09			33	1.07	-	-

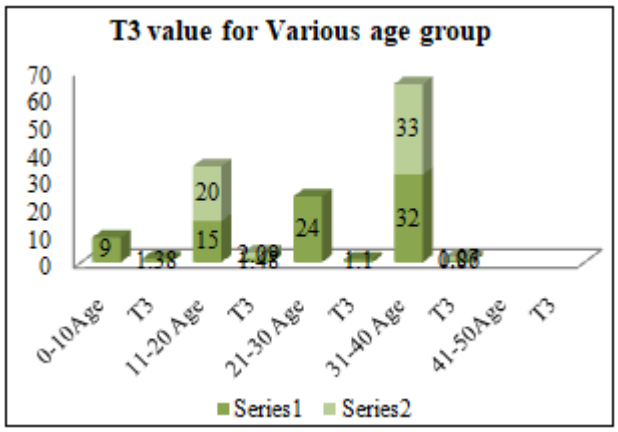

Figure 1.4: T3 value for various age group Male

3. Result

In study 35 patients T3 test in three months we find out 3 abnormal female (2.19, 2.19, 2.12) their T3 value is more than 1.81 so we get 10.34% abnormal female and we get 1 male (2.09) out of 6 male patients so 16.66% abnormal male. When T3 value is less than 0.60 or more than 1.81 this is the abnormal range of T3. If T3 value in this range cause If human body function not properly work then some symptoms overcome in human body as like fatigue, weight gain, mood issue, irregular period, muscle pain cold hand, dry and cracking skin neck swelling etc. Generally thyroid problems are two types' hypothyroidism, and hyperthyroidism. These two different problems have different own symptoms in human body.

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4. Conclusion

Our data indicate that T3 abnormal values are more find out in female more than male patient from that we conclude that female patients ratio have thyroid more than male patients.

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