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# Thyroid imbalance and hypothyroidism: A review

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**ABSTRACT**

Hypothyroidism, which occurs when the thyroid gland in the neck is unable to produce enough thyroid hormone to fulfill the body's demands, is one of the most common disorders in the world. This can lead to heart problems, infertility, and poor brain development in infants. A person's quality of life may be impacted by hypothyroidism if they have depressed symptoms, weariness, weakness, and weight fluctuations. An inadequate consumption of iodine through diet is the main cause of hypothyroidism in developing countries. Therefore, iodizing salt is a common approach made by many countries to increase iodine consumption. This review discuss about the gland, position, hormone, features of hypothyroidism.

***Keywords:*** *Hypothyroidism, Thyroid gland, Iodine, Hormone, Menstrual cycle, Infertility, Diagnosis*



## 1. INTRODUCTION

One of the most prevalent diseases in the world is hypothyroidism, which happens when the thyroid gland in the neck is unable to generate enough thyroid hormone to meet the needs of the body. Heart disease, infertility, and subpar infant brain development can be outcomes of this. Hypothyroidism can affect a person's quality of life by causing weight changes, fatigue, weakness, and depressive symptoms. The primary cause of hypothyroidism in undeveloped regions of the world is an insufficient intake of iodine from food. As a result, many nations attempt to enhance iodine intake by iodizing salt.

Hashimoto's disease is the most prevalent cause of hypothyroidism in regions of the world whereindividuals consume adequate amounts of iodine. This autoimmune condition causes the thyroid gland to be attacked by immune system cells and antibodies. In addition, a lot of hypothyroidism sufferers are unaware of their condition. Thyroxine (T4) and triiodothyronine (T3) shortage is a chronic condition that is linked to hypothyroidism. Infertility, cardiovascular illness, neurological disorders, and musculoskeletal complaints are all effects of untreated or improperly treated hypothyroidism. Worldwide, environmental iodine shortage is the most frequent cause of thyroid problems, including hypothyroidism, although autoimmune thyroiditis (Hashimoto's disease) is the most frequent cause of primary hypothyroidism in iodine-sufficient regions (Chiovato et al., 2019).

When our thyroid is functioning properly, it continuously produces hormones, releases them, andthen produces new hormones to replace those that have been utilized. This keeps our body's systems in check and our metabolism running smoothly. The pituitary gland, which is found in the center of the skull beneath the brain, regulates the quantity of thyroid hormones in the blood. Thyroid stimulating hormone, or TSH, is adjusted by the pituitary gland and sent to the thyroidto correct any imbalances when it detects either too little or too much thyroid hormone. The entire body is affected if the amount of thyroid hormones is too high (hyperthyroidism) or too low (hypothyroidism) (*Hypothyroidism: Symptoms, Causes, Treatment & Medication*, 2022).

Most hypothyroid patients will need to take levothyroxine for a long time, possibly for the rest oftheir lives.

Levothyroxine replaces a person's thyroid hormone levels and makes them feel better,but the dose must often be adjusted for the best effect (Chiovato et al., 2019).

## 2. METHODS

**Research Design:**

This article employs a review design. This means the authors collect and analyze data and information from various relevant publication sources.

**Data Sources:**

Data were gathered from various reputable international journals and scientific publications. The authors selected literature that includes previous studies on hypothyroidism, including epidemiology, pathophysiology, as well as treatment and management of the condition.

**Inclusion Criteria:**

Publications included in this review generally focus on hypothyroidism, thyroid mechanisms, and related health impacts. The reviewed articles also encompass relevant epidemiological studies and meta-analyses.

**Data Analysis:**

After gathering relevant literature, the authors analyze the information to identify patterns, key findings, and gaps in the existing research. This also includes comparing results from various studies to provide a comprehensive overview of hypothyroidism.

**Synthesis of Findings:**

The authors organize the analyzed information into several categories, such as causes of hypothyroidism, symptoms, diagnosis, and the relationship between hypothyroidism and other conditions such as obesity and depression.

## 3. RESULT AND DISCUSSION

All the finding and functions are categorized by section to section and described below accordingly. Thyroid Gland

The thyroid is a little gland in the neck that is just under the skin below the Adam's apple and measures about 2 inches (5 cm) across. The thyroid gland resembles a bow tie because its two parts, or lobes, are joined in the center (via an isthmus). The thyroid gland is typically neither visible nor palpably felt. Doctors may easily feel it if it enlarges, and a noticeable protrusion (goiter) may develop beneath or to the sides of the Adam's apple if it does (Braustein,2022).

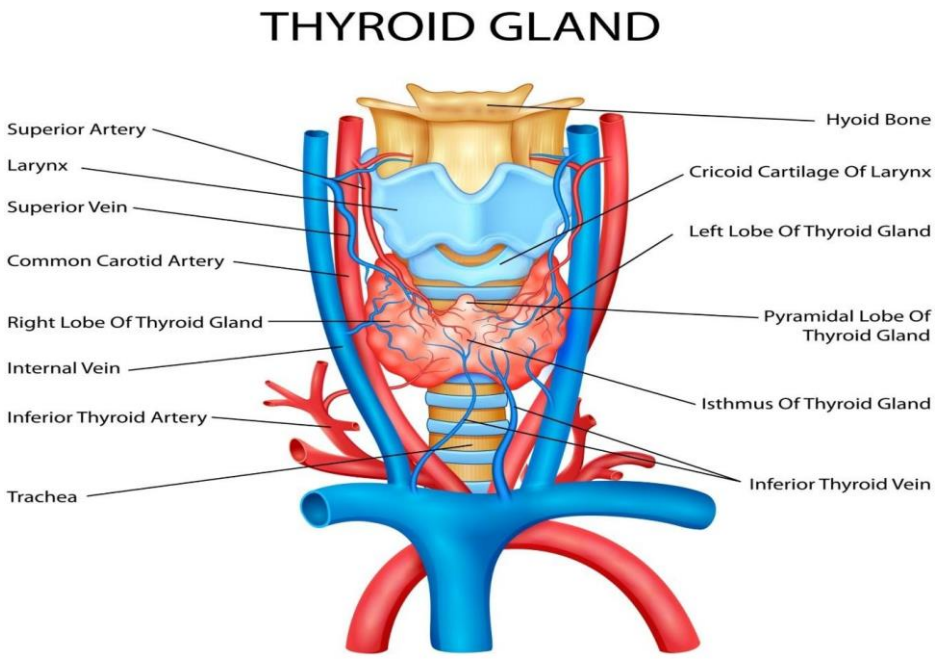


**Figure 1: Anatomy of thyroid gland** (*Illustration of Medical Education Drawing Chart of Human Thyroid Gland for Biology Study)*

Numerous follicular cells in the thyroid gland hold the thyroid hormones within the thyroglobulin molecule until the body needs them. The thyroid hormones, often known as the main metabolic hormones, have an impact on almost all body cells.

Iodine, tyrosine, and the development of the hypothalamic-pituitary-thyroid system are all necessary for the synthesis and production of thyroid hormones. When its development isinterrupted, as it is when a baby is delivered too soon, thyroxine and thyroid-stimulating hormone are not produced to the proper levels, which can cause a number of physiological disorders. When the thyroid gland is damaged or produces insufficient thyroid hormone, pathologic problems develop (Kirsten, 2000).

The thyroid gland, which comprises of follicles where thyroid hormone is created by iodinating tyrosine residues in the glycoprotein thyroglobulin, is the source of thyroid hormone. Thyroid stimulating hormone (TSH), which is released by the anterior pituitary in response to feedback from circulating thyroid hormone, interacts with the thyroid follicular cell basolateral membrane via the TSH receptor (TSH-R). TSH controls the sodium/iodide symporter-mediated uptake of iodide, which triggers a cascade of events required for healthy thyroid hormone production and secretion.

In addition to being necessary for amphibian metamorphosis, thyroid hormone is crucial for appropriate mammalian development, growth, brain differentiation, and metabolic regulation. When there is a lack of thyroid hormone throughout development, such as from maternal iodine shortage or untreated congenital hypothyroidism, these actions are most noticeable (Brent, 2012).

**3. Thyroid Hormone**

Thyroid hormone is the primary hormone in charge of regulating the rate of our body's metabolism. Thyroid hormone is essential for brain development in infants. Thyroid hormone isa combination of the two main hormones produced by one’s thyroid gland: thyroxine (T4) and triiodothyronine (T3) (T3). They're often referred to collectively as "thyroid hormone" because T4 is largely inactive, meaning it has no effect on our cells, whereas T3 is active. When someonethyroid produces T4, certain organs in our body convert it to T3 so that it can affect our cells andmetabolism.

Thyroid also produces calcitonin, a hormone that helps regulate calcium levels in our blood by decreasing it. Calcitonin is not classified as a "thyroid hormone," and it has no effect on our body's metabolism like T3 and T4.

A feedback loop system controls thyroid hormone production and release (thyroxine (t4) and triiodothyronine (T3)).

- Hypothalamus.
- The pituitary gland.
- Thymus gland
- Several hormones

To initiate the feedback loop, the hypothalamus secretes thyroid-releasing hormone (TRH),which stimulates the pituitary gland to produce and secrete thyroid-stimulating hormone (TSH). TSH then stimulates the thyroid to produce T4 and T3. T4 accounts for roughly 80% of the total amount of hormones released by TSH, while T3 accounts for 20%. To produce T4 and T3, your thyroid requires adequate amounts of iodine, which is obtained from food.

A feedback loop regulates this hormone chain reaction, so that as T3 and T4 levels rise, they prevent TRH release (and thus TSH). When T3 and T4 levels fall, the feedback loop restarts.This system allows our body to keep the level of thyroid hormones constant.

Any problems with our hypothalamus, pituitary gland, or thyroid can cause an imbalance in the hormones involved in this system, including T3 and T4.

### 3.1 Thyroid Hormone Metabolism:

The thyroid hormone (TH) controls adult metabolism as well as metabolic processes necessary for healthy growth and development.

The relationship between thyroid hormone level and body weight and energy usage is widely known. A hypermetabolic state characterized by increased resting energy expenditure, weight loss, decreased cholesterol levels, enhanced lipolysis, and gluconeogenesis is promoted by hyperthyroidism, or excess thyroid hormone.

On the other hand, hypothyroidism, or low thyroid hormone levels, is linked to hypometabolism, which is characterized by a low resting energy expenditure, weight gain, high cholesterol, a low lipolysis rate, and a low gluconeogenesis rate.

Although TH increases both lipogenesis and lipolysis, when levels are high, there is a net result of fat loss. By regulating energy storage and consumption, TH affects important metabolic processes that regulate energy balance. (Mullur et al., 2014).

Thyroid hormones are secreted by the thyroid gland and regulate the rate at which the body's chemical functions occur (metabolic rate).

Thyroid hormones have two effects on metabolic rate:

- ✓ By stimulating the production of proteins in nearly every tissue in the body
- ✓ By increasing the amount of oxygen consumed by cells

Thyroid hormones influence many vital body functions, including heart rate, calorie burn rate, skin maintenance, growth, heat production, fertility, and digestion (Braunstein,2022).

Thyroid hormones regulate vital body functions such as:

- Breathing
- Pulse rate
- Nervous systems, both central and peripheral
- Body mass index
- Muscular power
- Cycles of menstruation
- The body's temperature
- Levels of cholesterol (Brady,2019).

### 4. Risk factors of Hypothyroidism

People with hypothyroidism can be of any age, gender, or ethnicity. It's a prevalent condition, especially in women over 60. After menopause, women are typically more likely to acquire hypothyroidism than they are earlier in life (*Hypothyroidism: Symptoms, Causes, Treatment & Medication*, 2022). An underactive thyroid can occur in either a man or a woman, though womenare more likely to have it. An underactive thyroid can also develop in children, and some babies are born with it (*Underactive Thyroid (Hypothyroidism) - NHS*, 2022)

### 5. Differences between Hypothyroidism & Hyperthyroidism

The thyroid doesn't produce enough thyroid hormone when someone have hypothyroidism.Quantity is what distinguishes hypothyroidism from hyperthyroidism. The thyroid produces verylittle thyroid hormone when one has hypothyroidism. On the other hand, a person who has hyperthyroidism has a thyroid that

produces excessive amounts of thyroid hormone. Metabolism speeds up when someone have hyperthyroidism, which is caused by elevated thyroid hormone levels. Metabolism would slow down if anyone has hypothyroidism.

Many things are diametrically opposed between these two states. The patient may have difficultydealing with the cold as a result of hypothyroidism. Individuals may be unable to handle the heat if suffering from hyperthyroidism. They represent the polar opposites of thyroid function. Treatments for both of these conditions aim to bring thyroid function as close to normal as possible (*Hypothyroidism: Symptoms, Causes, Treatment & Medication*, 2022).

## 6. Causes of hypothyroidism

Both main and secondary causes can contribute to hypothyroidism. A disorder that directly affects the thyroid and makes it produce insufficient amounts of thyroid hormones is a key reason. The pituitary gland's malfunction, which prevents it from sending thyroid stimulating hormone (TSH) to the thyroid to regulate thyroid hormones, is a secondary reason.

There are a lot more prevalent primary causes of hypothyroidism. The most typical of these root causes is Hashimoto's disease, an autoimmune disorder. This inherited illness is also known as chronic lymphocytic thyroiditis or Hashimoto's thyroiditis (passed down through a family). The thyroid is attacked and harmed by the body's immune system in Hashimoto's disease. As a result,the thyroid is unable to produce and release adequate thyroid hormone.

Other common causes of hypothyroidism include:

i. Thyroiditis (inflammation of the thyroid).
ii. Hyperthyroidism treatment (radiation and surgical removal of the thyroid).
iii. Iodine deficiency (a lack of iodine in our body, which our thyroid uses to producehormones).
iv. Hereditary diseases (a medical condition passed down through our family).

Thyroiditis can occur after a pregnancy (postpartum thyroiditis) or as a result of a viral illness in some cases (*Hypothyroidism: Symptoms, Causes, Treatment & Medication*, 2022).

### 6.1 Congenital hypothyroidism

Hypothyroidism that was present at birth is known as congenital hypothyroidism (CH). The mostfrequent causes of thyroid hormone insufficiency at birth are disorders of thyroid hormone production or problems with thyroid gland development (dysgenesis) (*Hypothyroidism - Natural Treatment | LifeWorks*, n.d.). A lack of thyroid stimulating hormone causes secondary or central hypothyroidism at birth (TSH). Congenital TSH insufficiency is most frequently part of congenital hypopituitarism, which also includes other pituitary hormone deficits. Congenital TSH deficiency may occasionally be a standalone issue (caused by mutations in the TSHcomponent gene).

Congenital hypothyroidism is divided into two types: permanent and transient. Permanent CH is defined as a thyroid hormone deficiency that requires lifelong treatment. Transient CH is a temporary thyroid hormone deficiency discovered at birth and then recovered to normal thyroid hormone production. Typically, recovery to euthyroidism occurs within the first few months or years of life. Furthermore, some types of CH are associated with defects in other organ systems; this is known as syndromic hypothyroidism. Deficiencies in thyroid hormone transport, metabolism, or action cause peripheral hypothyroidism, a distinct category. Permanent CH is further subdivided into permanent primary and permanent secondary (or central) CH; transient primary CH has also been reported (Rastogi & LaFranchi, 2010).

### 6.2 Symptoms

The early signs of congenital hypothyroidism are inconspicuous, although the mother's and the baby's

pregnancy histories may offer some indications. Twenty percent of pregnancies last longer than 42 weeks. An iodine-deficient diet or maternal autoimmune thyroid disease may alsobe detected. Accidental radioactive iodine exposure during pregnancy is extremely uncommon. Once at home, these infants are content and may sleep soundly. Constipation and a harsh cry are further signs. More than three weeks of neonatal hyperbilirubinemia are not uncommon. This results from the hepatic glucuronyl transferase's infancy (Rastogi & La Franchi, 2010).

## 7. Types of Hypothyroidism

### 7.1 Primary hypothyroidism

A thyroid gland dysfunction that results in less thyroid hormone synthesis and secretion is what causes primary hypothyroidism. Chronic autoimmune thyroiditis is characterized by hypothyroidism, which is autoimmune in 50% of patients. Other factors or medicines are to blame for the remaining 50%. Recent research has suggested that postpartum thyroiditis and silent thyroiditis, which can result in hypothyroidism, are signs of persistent autoimmune thyroiditis.

Women, typically middle-aged or older, and children are three to five times more likely than males to have chronic autoimmune thyroiditis. The histological findings of diffuse lymphocytic infiltration of the thyroid gland and the circulation of certain antibodies in nearly all individuals suggest the role of autoimmunity.

### 7.2 Secondary (central) hypothyroidism

A pituitary or hypothalamic condition that results in decreased TSH secretion and, as a result, decreased thyroid hormone synthesis and production, is the root cause of secondaryhypothyroidism.

When the reasons are in the pituitary or the hypothalamus, respectively, secondary and tertiary hypothyroidism is described as well as being central. Secondary hypothyroidism can be brought on by several different diseases. Pituitary adenomas and the procedures required to treat them, including surgery and/or radiotherapy, are the most frequent causes (Kostoglou-Athanassiou & Ntalles, 2010).

## 8. Hypothyroidism during pregnancy

Women who experience hypothyroidism while pregnant typically have Hashimoto's disease. Thethyroid is attacked by this autoimmune illness, which causes thyroid destruction. When that occurs, the thyroid is unable to create and release sufficient amounts of thyroid hormones, which has an effect on the entire body. Hypothyroid pregnant women may feel extremely exhausted, struggle to handle chilly temperatures, and get cramping.

The growth of an unborn child in the womb depends on thyroid hormones. These hormones aidin the brain and nervous system's development. It's critical to manage our thyroid levels throughout pregnancy if anyone have hypothyroidism. The brain may not grow properly of a baby if they don't get enough thyroid hormone during development; this could lead to problems later. Hypothyroidism during pregnancy can cause issues including miscarriage or preterm labor if untreated or not adequately addressed.

It is generally established that untreated thyroid disorders increase the risk of adverse events, including miscarriage, preterm birth, and gestational hypertension. Thyroid disorders are frequent in women of reproductive age.

The link between subclinical disease, namely subclinical hypothyroidism, and unfavorable outcomes has yet to be completely established, despite the fact that substantial evidence clearly shows that overt dysfunctions (such as hypothyroidism) have harmful consequences on pregnancy.

A replacement therapy is still debatable for a number of additional diseases, including isolated hypothyroxinemia and thyroid autoimmunity in Euthyroidism (Negro & Mestman, 2011).

## 9. Signs & Symptoms of Hypothyroidism

The signs and symptoms of hypothyroidism typically appear gradually over months or even years. They may consist of:

i. Being worn out (fatigue)
ii. Having tingling and numbness in your hands
iii. Gaining weight
iv. Having pain in all parts of our body (can include muscle weakness)
v. Having blood cholesterol levels that are greater than usual
vi. Being depressed
vii. Being unable to stand in the cold
viii. Having hair and skin that is coarse and dry
ix. Losing interest in sexual activity
x. Enduring regular, heavy menstrual cycles
xi. Noticing facial physical changes (including drooping eyelids, as well as puffiness in theeyes and face).
xii. "Brain fog"-like" forgetfulness" (*Hypothyroidism: Symptoms, Causes, Treatment &Medication*, 2022)

### 9.1 Voice change

Changes in voice are one of the well-known signs of hypothyroidism, and the symptoms of hypothyroidism are much more subtle than those of hyperthyroidism. Since thyroid hormone receptors have been discovered in the larynx, proving that the thyroid hormone effects on the laryngeal tissue, voice alterations may happen even in cases of mild thyroid dysfunction. Voice changes that are noticeable, such as vocal tiredness, roughness, and a low voice, can be brought on by hypothyroidism (Junuzović-Žunić et al., 2019).

### 9.2 Irregular menstrual cycle

Hypothyroidism in adult women is typically accompanied by atypical menstrual periods, particularly anovulatory cycles and an increase in fetal wastage, which are mostly characterized by polymenorrhea (Doufas & Mastorakos, 2000).

### 9.3 Repeated miscarriage or stillbirth

The course of pregnancy could be complicated by thyroid illness. Regular menstrual cycles, subfertility, and recurrent miscarriages are additional common signs of thyroid disease. Developmental delay in infants born to moms who were hypothyroid during pregnancy has been linked. Untreated hypothyroidism may prevent offspring from developing to their full intellectual potential. This was particularly evident in moms who were born in iodine-deficient regions of thenation (iodine is required for the production of salt in our foods) and in mothers who had autoimmune thyroid conditions like Hashimoto's thyroiditis. On the other hand, complications with the current pregnancy can include stillbirth, early labor, and abortion (Iq, 2010).

### 9.4 Constipation

A common endocrine disease called hypothyroidism results in insufficient thyroid hormone production or insufficient thyroid hormone action on the target tissues. The typical gastrointestinal (GI) symptom of hypothyroidism is constipation. The gastroesophageal motility significantly reduces with hypothyroidism. Constipation may be aided by hypothyroidism's GI hypomotility (Patil, 2014).

### 9.5 Palpitation & shortness of breath

The most prevalent endocrine disorder, hypothyroidism, causes cardiac electrical remodeling thatserves as a substrate for ventricular arrhythmias. According to recent research, elevated thyrotropin (TSH) levels are linked to aberrant cardiac electrical activity and higher mortality rates (Fernandez-Ruocco et al., 2019).

## 10. Diagnosis

An enlarged thyroid, a rapid pulse, damp skin, and trembling in the hands or fingers are just a few of the symptoms that doctor may ask about as well as overall medical history. They may provide the following tests to oneself:

*Thyroid panel:* Using a blood test, thyroid hormone and thyroid-stimulating hormone levels are determined (TSH).

*Thyroid scan:* Ones blood is injected with a tiny amount of radioactive iodine by a technician. It is absorbed by our thyroid, which is photographed using a specialized camera to check for nodules or other indicators of abnormalities.

*Ultrasound:* A transducer is passed over our neck by a professional. It visualizes our thyroid via sound waves.

*Test of radioactive iodine uptake:* A little amount of radioactive iodine is ingested. How much iodine accumulates in our thyroid is determined with a gamma probe. Patients most likely have thyroid nodules or Graves' disease if this uptake is high.

The serum TSH test is the best laboratory evaluation of thyroid function in the outpatientcontext. Serum free thyroxine (T4) levels should be checked if TSH levels are elevated. When serum free T4 levels are low and TSH levels are elevated, overt primary hypothyroidism is identified. A patient is considered to have subclinical hypothyroidism (SH) if their serum TSH levels are increased but their serum free T4 levels are normal (usually > 4.0 mIU/l). In cases of subclinical hypothyroidism, TSH screening should often be repeated 1-3 months before a diagnosis of hypothyroidism is made. Low blood TSH and serum free T4 levels are indicative of secondary hypothyroidism and necessitate additional research into hypothalamic-pituitary insufficiency. It should be further studied if there is an obviously low serum T4 level along with an improperly normal or even slightly but disproportionately raised TSH. In these circumstances,a simple serum TSH level is insufficient to identify hypothyroidism.

Consequently, blood T4 or FT4 levels should be tested when the clinical situation suggests central hypothyroidism, and additional research may be necessary (Alzahrani et al., 2020).

## 11. Obesity and Hypothyroidism

Hypothyroidism and obesity are two prevalent clinical disorders that have a strong relationship. With the global prevalence of obesity experiencing an unprecedented surge, the connection has gained increasing significance. Patients typically believe that thyroid disease is a secondary cause of obesity. A novel perspective suggests that alterations in thyroid-stimulating hormone (TSH) may be a result of obesity. Recent research has also shown a relationship between thyroid autoimmunity and obesity, with the adipocyte hormone leptin appearing to be the primary mediator between these two diseases. It'll evaluate the intriguing connection between obesity andhypothyroidism in this essay, along with the resulting clinical implications.

Thyroid hormones and body composition appear to be linked. Thyroid hormones influence basal metabolism, thermogenesis, lipid and glucose metabolism, food intake, and fat oxidation. Thyroid dysfunction is associated with changes in body weight and composition, body temperature, total and resting energy expenditure (REE), and total and resting energy expenditure (REE) that are independent of physical activity.

Reduced metabolic rate, decreased thermogenesis, a higher body mass index (BMI), and a higherprevalence of obesity have all been linked to hypothyroidism. Clinical evidence points to subclinical hypothyroidism, a minor thyroid dysfunction, as a risk factor for overweight and obesity and is associated to major changes

in body weight. However, this remains a gray area. It has also been shown that in hypothyroid individuals, slight variations in blood TSH brought onby tiny adjustments to the L-T4 dosage during replacement therapy are linked to noticeably changed REE. Regarding the precise amount of weight gain and loss with L-T4 treatment in hypothyroidism, there is a dearth of information about fast therapy (Sanyal & Raychaudhuri, 2016).

## 12. Hypothyroidism & Depression

Since there is undeniable proof that hypothyroidism causes affective problems and psychologicalillnesses, it has been suggested that hypothyroidism causes depression. Both hypothyroidism anddepressive syndrome are more common in depressive patients and hypothyroidism patients, respectively. Significant changes in cerebral blood flow and glucose metabolism are seen in hypothyroidism. Furthermore, anatomical hippocampal anomalies in people with significantdepression may have an impact on memory function. In addition, trait indicators of depression have a favorable correlation with thyroid peroxidase antibodies. Variable depressive symptomatology is influenced by vulnerability and the degree of thyroid insufficiency, though not always (Scale & Index, 2011).

In hypothyroidism, the prevalence of depressive symptoms was nearly 50%. More than 40% of hypothyroid patients experience clinical depression. Antithyroid antibody titers have been found to be elevated in patients with clinical depression. Antithyroid antibody positivity is 20% in depressed patients, compared to 5%-10% in the general population. The discovery that depression frequently coexists with autoimmune subclinical thyroiditis suggests that depression may be caused by immune system changes or vice versa, or that it may be an autoimmune disorder in and of itself (Tayde et al., 2017).

A significant mood illness, such as melancholia, is brought on by overt hypothyroidism and may progress to dementia. Subclinical hypothyroidism (SCH) and its hidden neuropsychiatric and neurocognitive effects have recently been the topic of multiple reports, although these investigations have been unable to pinpoint the specific nature and severity of this association. SCH, also known as "mild hypothyroidism," is characterized by increased levels of the thyroid- stimulating hormone (TSH), normal levels of free thyroid hormones (FT4), and is a common thyroid axis dysfunction. Up to 17.6% of patients in the general community may experience SCH(Zhao et al., 2018).

Several studies have found a link between SCH and current depressive symptoms, current major depression, and a history of major depression. Meanwhile, other studies have found no evidence of this link. Furthermore, the relationship between depressive symptoms and SCH is debatable, especially in older patients, as the prevalence of SCH rises with age. SCH affects up to 22% of women over the age of 60 and is slightly less common in men (Zhao et al., 2018).

Antidepressant medications currently on the market primarily affect noradrenergic and serotonergic neurotransmission, but numerous studies have demonstrated that this illness also involves changes in hormonal systems, immune systems, and energy processes, which together impair synaptic plasticity and cause a variety of functional changes, including depressed mood (Głombik et al., 2020).

The lack of such research is primarily due to the misconception that after development, the brain is no longer a target tissue for the action of these hormones, despite the fact that thyroidhormones regulate many critical processes during development, including growth,differentiation, migration, neuronal integration, glial cell proliferation, myelination, and neurotransmitter synthesis. Because of this, it is unknown how thyroid hormones affect processesin the brain that happen after the developing period, despite the long-standing clinical observations linking thyroid dysfunction to mood disorders and cognitive performance (Głombiket al., 2020).

The fact that pro-depressive effects are shown not only in hypothyroidism but also occasionally in hyperthyroidism makes it difficult to comprehend the part thyroid hormones play in the pathophysiology of depression (Głombik et al., 2020).

## 13. Hypothyroidism & Bipolar disorder

Thyroid dysfunction is especially important in the clinical course of manic-depressive (bipolar) illness, particularly rapid cycling, which is a severe form of the illness. Patients with the rapid cycling pattern, 70% to 90% of whom are female, have more than four episodes of bipolar illness per year by definition. They have a much higher rate of hypothyroidism (25%), compared to depressed patients in general (2%-5%) or those taking lithium carbonate (9%). In otherwise untreated patients with rapid cycling bipolar disease, therapeutic doses of lithium carbonate, an established drug for the prophylaxis of bipolar disorder that also has antithyroid properties, resulted in significantly higher serum TSH responses to TRH stimulation when compared to normal subjects. This discrepancy implies that bipolar disorder patients' rapid cycle patterns are significantly influenced by even mild hypothyroidism. The rapid cycling pattern can be reversed and the frequency of episodes reduced in otherwise refractory bipolar illness when high doses of T4 are added to the standard treatment regimen with lithium and other psychotropic medications.

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## 4. CONCLUSION

Hypothyroidism can eventually result in a coma or even death if therapy is not received. It may carry a high risk of morbidity and mortality. If hypothyroidism in children is not treated, it can lead to severe mental impairment. Heart failure is a major cause of mortality in adults. It seems acceptable to monitor thyroid hormones in patients who have undergone neck radiation, are pregnant or just gave birth, have hypercholesterolemia in both sexes, have received medication such as amiodarone or lithium, or have received any of these conditions. Thyroxine is used as part of a long-term, typically lifelong therapy.

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