

AN OVERVIEW OF HYPOTHYROIDISM

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ABSTRACT

The cause of hypothyroidism is low thyroxine hormone. The hormone thyroxine regulates the body's metabolism, and deficiencies in this hormone can cause problems with many body components. Primary hypothyroidism is characterized by elevated blood levels of thyroid-stimulating hormone (TSH). In regions where iodine levels are sufficient, the main cause of primary hypothyroidism is chronic autoimmune thyroiditis, also known as Hashimoto's thyroiditis. The two primary categories of increased anti-thyroid antibodies are thyroid peroxidase (TPO) and anti-thyroglobulin antibodies. weariness, weight gain, difficulty adjusting to the cold, aches, and pains in the muscles and joints, having receding hair or dry skin, experiencing irregular menstruation, issues with reproduction, a slowed heart rate, Depression Lethargic behavior, brittle nails bloating, enlarged thyroid gland, Lethargic behavior. While subclinical hypothyroidism is defined by a slight increase in TSH combined with normal T3 and T4 levels, high TSH suggests clinical hypothyroidism. Hypothyroidism can be effectively treated with levothyroxine (LT4). The best way to take levothyroxine is one tablet at a time, on an empty stomach. TSH levels should be monitored once a year after they have stabilized, or every six months.

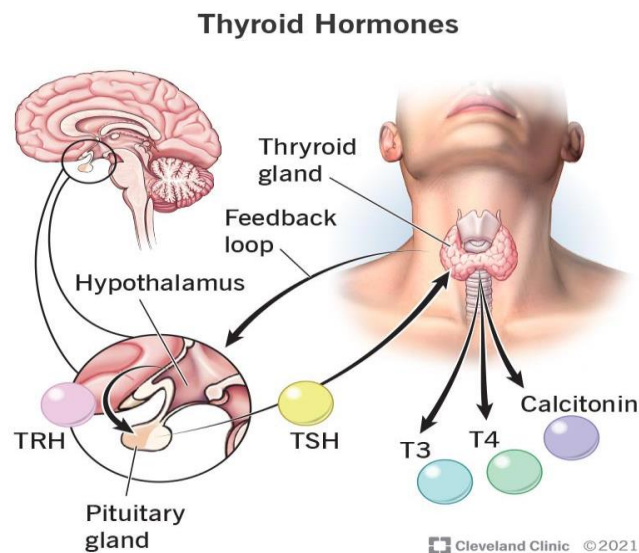
KEYWORDS: Hypothyroidism, Thyroid-stimulating hormone, Levothyroxine, Endocrine, Dosage, Iodine.

INTRODUCTION

Diseases of the thyroid gland are among the most common endocrine disorders worldwide, second only to diabetes. The thyroid gland may also be the site of various types of tumours and may be damaged by endogenous antibodies. Severe maternal hypothyroidism due to iodine deficiency may result in cretinism in newborns if left untreated.^[1] The thyroid gland regulates metabolism and the development of all tissues by producing triiodothyronine (T3) and tetraiodothyronine (T4) hormones. These hormones are mainly composed of iodine. In 1994, the Ministry of Health in Turkey initiated the Iodine Deficiency Disorders Control and Salt Iodization Programme, making the iodization of table salt mandatory by 1999. The goal of salt iodization was to eliminate iodine deficiency from the country by the end of

2005.^[2] For healthy growth and brain development, especially in the early years of life, thyroid hormone is crucial. The hormone thyroxine controls the body's metabolism, and a lack of it can lead to issues with different body parts. When thyroid hormone levels decline, blood concentrations of TSH and Thyroid-stimulating hormone (TSH) secretion rise. Reduced thyroidal secretion of thyroid hormone can also result from inadequate stimulation of a physically normal gland, which can be brought on by insufficient release of thyrotropin-releasing hormone (TRH) from the hypothalamus or by decreased pituitary TSH release (secondary hypothyroidism).^[3,4]

The general population has a large number of hypothyroidism patients, most of which do not exhibit any particular symptoms. Thus, the primary definition of hypothyroidism is biochemical. Thyroid-stimulating hormone (TSH) levels in the blood are high in primary hypothyroidism. Hypothyroidism is the condition in which the thyroid gland does not produce enough thyroid hormone. This disorder may be secondary/central (resulting from hypothalamic or pituitary dysfunction) or primary (arising from an issue with the thyroid gland itself).^[5,6,7]



Thyroid-stimulating hormone (TSH) levels in the blood are increased in "subclinical hypothyroidism," a form of primary hypothyroidism, whereas free thyroxine (T4) and triiodothyronine (T3) levels are normal. The Whickham survey estimates that each year, there are 0.6 cases of hypothyroidism per 1000 men and 4.1 cases per 1000 women. The typical treatment for hypothyroidism is replacing T4 with levothyroxine. The majority of instances result from surgery, radioactive iodine therapy, or persistent autoimmune thyroiditis (Hashimoto's thyroiditis), which causes primary thyroid gland failure. The discussion that follows will centre on primary hypothyroidism.^[9,10,13]

HYPOTHYROIDISM CAUSES

Primary hypothyroidism in areas with adequate iodine levels is primarily caused by persistent autoimmune thyroiditis, commonly referred to as Hashimoto's thyroiditis. Thyroid peroxidase (TPO) and anti-thyroglobulin antibodies are the main types of anti-thyroid antibodies that are elevated in the majority of Hashimoto's disease patients. Primary hypothyroidism is the most prevalent cause of hypothyroidism, accounting for 95% of cases.^[3,7,10]

Thyroid irradiation after Graves' disease, iodine deficiency, enzyme defects, thyroid surgery, late-stage invasive fibrous thyroiditis, chronic autoimmune thyroiditis, certain medications (like lithium, interferon), and infiltrative diseases like

sarcoidosis, amyloidosis, scleroderma, and hemochromatosis are some of the causes of this condition, which is usually the result of thyroid gland failure.^[3,7]

Some uncommon causes of secondary hypothyroidism include pituitary or hypothalamic neoplasms, congenital hypopituitarism, pituitary tumours, surgery, external pituitary radiation, autoimmune processes, TB, and pituitary necrosis (Sheehan's syndrome). Hypothyroidism can also result from anomalies related to the pituitary and hypothalamus. Individuals who have had surgery to remove a pituitary adenoma or cerebral radiation therapy are at an increased risk of developing specific endocrine issues.^[3,6]

SYMPTOMS

Individual differences may exist in the range of symptoms that hypothyroidism manifests. The following are some typical signs of hypothyroidism:^[3,8]

- Fatigue
- Gained weight
- Having trouble adjusting to the cold
- Having pain in the joints and muscles
- Dry skin or thinning hair
- Having irregular menstrual periods
- Reproductive problems
- Slowing heart rate
- Depression
- Lethargy
- Brittle nails
- Constipation
- Enlarged thyroid gland
- Sluggishness

DIAGNOSIS

Thyroid Function Test

	TSH	FREE T3	FREE T4
Normal thyroid function	Normal range 0.45 – 4.5 mIU/L	Normal range 12 – 30pmol/L	Normal range 2 – 7 pmol/L
Hyperthyroidism	Low	High	High
Mild hyperthyroidism	Low	Normal	Normal
Hypothyroidism (primary)	High	Low	Low
Hypothyroidism (Secondary)	Low/Normal	Low	Low
Mild hypothyroidism	High	Normal	Normal

Many of the symptoms of hypothyroidism are nonspecific and, especially in moderate cases, can be difficult to diagnose because they are frequently mistaken for other conditions or the natural ageing process. This is particularly difficult for the elderly because many symptoms, whether rightly or wrongly, are seen as normal parts of ageing, including dry skin, weariness, and difficulty concentrating. Endocrine problems are more likely to result from three distinct clinical conditions: depression, pituitary adenoma, and hypothyroidism. Hypothyroidism is easily diagnosed by

measuring the blood's TSH levels. While clinical hypothyroidism is indicated by high TSH, subclinical hypothyroidism is characterised by a small increase in TSH coupled with normal T3 and T4 levels.^[7,12,13]

TREATMENT

In most cases, levothyroxine (LT4) is a successful medication for hypothyroidism. Levothyroxine should ideally be taken one tablet at a time, empty stomach. It is crucial that you avoid eating for the next hour since eating could prevent the levothyroxine tablet from being absorbed or subtly low thyroid function. For stable persons, switching brands of levothyroxine pills is not advised. Individuals who have overt hypothyroidism ought to begin taking 1.5–1.8 mcg/kg of medicine every day. A complete replacement dosage of 2.0 to 2.4 mcg/kg of thyroxine is safe for pregnant women to take.^[7,15]

The recommended beginning dose for individuals with coronary artery disease is 12.5 to 25 mcg/day, with dosage changes contingent upon symptoms and TSH levels. While younger individuals without additional medical concerns may be allowed to begin with a full dose under close supervision to prevent overtreatment, older patients with numerous medical disorders are advised to follow this treatment regimen. Four to twelve weeks after the therapy begins, TSH levels should be checked every six months until they stabilise, and then once a year after that. It is important to note that even slight dose modifications can have a major impact on TSH levels in elderly and low-body-weight patients. Dosage adjustments should be based on the findings of lab tests. Even when TSH levels are elevated, it is unclear what clinical importance low T3 concentrations have.^[3,7,12]

CONCLUSION

Hypothyroidism is a prevalent endocrine disorder. It is present in individuals of all ages. It is more prevalent in older adults and women. This article lists the many issues related to hypothyroidism and provides an overview of the epidemiological risk factors and disease-prevention strategies and understand its underlying reason. Many patients have less than ideal symptom alleviation following L-T4 therapy. As a non-communicable illness, hypothyroidism is not a priority for the government. A diet that meets all nutritional requirements and is well-balanced may lower the risk of hypothyroidism. Thyroid function is supported by a sufficient diet of foods that enhance the thyroid. The primary diagnostic tests for identifying hypothyroidism are laboratory assays for TSH and free T4 levels. Replacement therapy with levothyroxine is the usual treatment for hypothyroidism. It is possible to prevent or treat hypothyroidism by alterations to lifestyle.^[1,3,4,5,7]

REFERENCES

1. C. C. Heuek, A.Kalner, A.S.Kanasabapathy, W.Reisen WHO Diagnosis and monitoring of diseases of the thyroid https://iris.who.int/bitstream/handle/10665/66342/WHO_DIL_00.4_eng.pdf?sequence=1&isAllowed=y
2. Volkan Atmis,1 Buket Bülbül,2 Remzi Bahşi Iodine concentration and prevalence of thyroid disease in older people after salt iodization in Turkey <https://www.emro.who.int/emhj-volume-27-2021/volume-27-issue-2/iodine-concentration-and-prevalence-of-thyroid-disease-in-older-people-after-salt-iodization-in-turkey.html>
3. Udit M. Zamwar, Komal N. Muneshwar Epidemiology, Types, Causes, Clinical Presentation, Diagnosis, and Treatment of Hypothyroidism <https://www.cureus.com/articles/175208-epidemiology-types-causes-clinical-presentation-diagnosis-and-treatment-of-hypothyroidism#!/>
4. Antonio C. Bianco Emerging Therapies in Hypothyroidism Emerging Therapies in Hypothyroidism | Annual Reviews.

5. Louise Knøsgaard, Stig Andersen, Annebirthe Bo Hansen, Peter Vestergaard, Stine Linding Andersen Maternal hypothyroidism and adverse outcomes of pregnancy <https://onlinelibrary.wiley.com/doi/full/10.1111/cen.14853>
6. Louise Knøsgaard , Stig Andersen , Annebirthe Bo Hansen , Peter Vestergaard , Stine Linding Andersen Maternal hypothyroidism and adverse outcomes of pregnancy <https://pubmed.ncbi.nlm.nih.gov/36414887/>
7. Gudisa Bereda* Department of Pharmacy, Negelle Health Science College, Negelle, Ethiopia <https://www.mathewsopenaccess.com/full-text/definition-causespathophysiology-and-management-of-hypothyroidism>
8. Heleen I. Jansen, Anita Boelen, Annemieke C. Heijboer , Eveline Bruinstroop and Eric Fliers Hypothyroidism: The difficulty in attributing symptoms to their underlying cause *Frontiers | Hypothyroidism: The difficulty in attributing symptoms to their underlying cause* (frontiersin.org)
9. Dana Alkhatib , Zumin Shi and Vijay Ganji , Dietary Patterns and Hypothyroidism in U.S. Adult Population *Nutrients | Free Full-Text | Dietary Patterns and Hypothyroidism in U.S. Adult Population* (mdpi.com)
10. Ulla Feldt-Rasmussen, Grigoris Effraimidis, Sofie Bliddal1 Marianne Klose Consequences of undertreatment of hypothyroidism <https://doi.org/10.1007/s12020-023-03460-1>
11. Komiljonova Oygul Olimjonovna Hypothyroidism and reproductive dysfunction in women <http://newjournal.org/index.php/01/article/view/10595>
12. Petros Perros, Endre Vezekeyi Nagy, Enrico Papini, Juan Abad-Madroñero, Peter Lakwijk, Alan J Poots, Floortje Mols, Laszlo Hegedüs Hypothyroidism and Type D Personality: Results From E-MPATHY, a Cross-sectional International Online Patient Survey <https://academic.oup.com/jcem/advancearticle/doi/10.1210/clinem/dgae140/7640726>
13. Vanderpump MP, Tunbridge WM, French JM, et al. The incidence of thyroid disorders in the community: a twenty-year follow-up of the Whickham survey. <https://pubmed.ncbi.nlm.nih.gov/7641412/>
14. Grozinsky-Glasberg S, Fraser A, Nahshoni E, Weizman A, Leibovici L. Thyroxine-triiodothyronine combination therapy versus thyroxine monotherapy for clinical hypothyroidism: randomized controlled trials meta-analysis. https://scholar.google.co.in/scholar?q=10.1210/jc.20060448&hl=en&as_sdt=0&as_vis=1&oi=scholar
15. National Institute for Healthcare and Excellence. Thyroid disease: assessment and management. NICE Guideline. 2019. <https://www.ncbi.nlm.nih.gov/books/NBK550859/>
16. McAninch EA, Bianco AC. The history and future of treatment of hypothyroidism. *Ann Intern Med.* 2016 <https://pubmed.ncbi.nlm.nih.gov/26747302/>
17. Meisinger C, Ittermann T, Wallaschofski H, et al. Geographic variations in the frequency of thyroid disorders and thyroid peroxidase antibodies in persons without former thyroid disease within Germany. <https://pubmed.ncbi.nlm.nih.gov/22700599/>
18. Yutaka Aoki, Ruth M. Belin, Robert Clickner, Rebecca Jeffries, Linda Phillips, and Kathryn R. Mahaffey Thyroxine-Triiodothyronine Combination Therapy Versus Thyroxine Monotherapy for Clinical Hypothyroidism: Meta-Analysis of Randomized Controlled Trials https://scholar.google.co.in/scholar?q=10.1210/jc.20060448&hl=en&as_sdt=0&as_vis=1&oi=scholar
19. Wang X, Mo Z, Mao G, et al. Geographical influences on thyroid abnormalities in adult population from iodine-replete regions: a cross-sectional study <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7806590/>
20. Wang C. The relationship between type 2 diabetes mellitus and related thyroid diseases <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8787293/>

21. Calissendorff J, Falhammar H. To treat or not to treat subclinical hypothyroidism, what is the evidence? *Medicine (Kaunas)* <https://pubmed.ncbi.nlm.nih.gov/31963883/>
22. Garber JR, Cobin RH, Gharib H, Clinical practice guidelines for hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. *Endocr Pract.* 2012 <https://pubmed.ncbi.nlm.nih.gov/23246686/>
23. Allan Chen Dong 1, Alex Stagnaro-Green 2 Differences in Diagnostic Criteria Mask the True Prevalence of Thyroid Disease in Pregnancy: A Systematic Review and Meta-Analysis DOI: 10.1089/thy.2018.0475
24. Katja Zaletel 1, Simona Gaberscek, Edvard Pirnat Ten-year follow-up of thyroid epidemiology in Slovenia after increase in salt iodization DOI: 10.3325/cmj.2011.52.615
25. Iyshwarya Bhaskar Kalarani, Ramakrishnan Veerabathiran Impact of iodine intake on the pathogenesis of autoimmune thyroid disease in children and adults DOI: <https://doi.org/10.6065/apem.2244186.093>
26. Centers for Disease Control and Prevention (CDC). Data Documentation, Codebook, and Frequencies for Physical Activity (PAQ) (2011–2012). National Health and Nutrition Examination Survey. 2012. Available online: <https://www.cdc.gov/nchs/nhanes/search/DataPage.aspx?Component=Examination&CycleBeginYear=2011>
27. M Krajcovicová-Kudláčková 1, K Bucková, I Klimes, E Seboková Iodine deficiency in vegetarians and vegans Iodine deficiency in vegetarians and vegans - PubMed (nih.gov)
28. Academy of Nutrition and Dietetics Iodine: A Critically Important Nutrient. Available online: <https://www.eatright.org/health/essential-nutrients/minerals/iodine-a-critically-important-nutrient>
29. Poultry in Human Nutrition|Gateway to Poultry Production and Products|Food and Agriculture Organization of the United Nations. Available online: <https://www.fao.org/poultry-production-products/products-processing/poultry-in-human-nutrition/en/>
30. J ROCHE, S LISSITZKY, R MICHEL[Triiodothyronine as an intermediate product in the transformation of diiodothyronine into thyroxine] <https://pubmed.ncbi.nlm.nih.gov/12979254/>
31. MB Zimmermann, K Boelaert Iodine deficiency and thyroid disorders [https://scholar.google.co.in/scholar?q=M.B.+Zimmermann,+K.+Boelaert,+Iodine+deficiency+and+thyroid%0D%0A disorders.+Lancet+Diabetes+Endocrinol.+3\(4\),+286%E2%80%93295+\(2015\)&hl=en&as_sdt=0&as_vis=1&oi=scholar](https://scholar.google.co.in/scholar?q=M.B.+Zimmermann,+K.+Boelaert,+Iodine+deficiency+and+thyroid%0D%0A disorders.+Lancet+Diabetes+Endocrinol.+3(4),+286%E2%80%93295+(2015)&hl=en&as_sdt=0&as_vis=1&oi=scholar)
32. George Ford, Stephen H LaFranchi Screening for congenital hypothyroidism: a worldwide view of strategies <https://pubmed.ncbi.nlm.nih.gov/24629860/>
33. Arash Derakhshan , Peter N Taylor Association of Thyroid Function Test Abnormalities and Thyroid Autoimmunity With Preterm Birth: A Systematic Review and Meta-analysis <https://pubmed.ncbi.nlm.nih.gov/31429897/>
34. Freddy J K Toloza 1, Arash Derakhshan 2 Association between maternal thyroid function and risk of gestational hypertension and pre-eclampsia: a systematic review and individual-participant data meta-analysis <https://pubmed.ncbi.nlm.nih.gov/35255260/>
35. M Ahsan Akhtar 1, Rina Agrawal, Julie Brown, Yasmin Sajjad, Laurentiu Craciunas Thyroxine replacement for sub fertile women with euthyroid autoimmune thyroid disease or subclinical hypothyroidism <https://pubmed.ncbi.nlm.nih.gov/31236916/>