Thyroid dysfunction

An integrative approach

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Hypothyroidism: An Introduction

Hypothyroidism is a condition in which the thyroid gland is unable to produce sufficient thyroid hormone, thyroxine (T4) and triiodothyronine (T3), to fulfill the body's metabolic demands. According to the National Health and Nutrition Examination Survey, hypothyroidism affects approximately one in every 300 individuals in the United States. Additionally, almost 13 million Americans are suspected to have undiagnosed hypothyroidism. [25]

Hypothyroidism is often described as *primary* or *secondary*.

Primary hypothyroidism, the most common form, is caused by a dysfunction of the thyroid gland. Hashimoto's thyroiditis, an autoimmune condition, is the most common cause of primary hypothyroidism. [52]

Secondary hypothyroidism is caused by pathogenic mechanisms involving the hypothalamus and/or pituitary gland. [52] Secondary hypothyroidism accounts for only about five percent of cases. [25]

Primary hypothyroidism may also be "overt" or "subclinical". [52] The typical thyroid marker presentation for overt, subclinical, and secondary hypothyroidism are provided on page 7 of this document.

Part 1: Clinical Manifestations: Signs, Symptoms, and Complications

As thyroid hormones play a key role in regulating numerous physiological processes, clinical manifestations are often broad and non-specific. Signs and symptoms may also vary depending on the gender and age of an individual. [25]

Signs and symptoms

The most common symptoms of hypothyroidism are cold intolerance and fatigue. Other possible signs and symptoms of hypothyroidism include:

- Alopecia (hair thinning, hair loss) and lateral eyebrow thinning
- Abnormal laboratory values
- Arthralgias (joint pain)
- Bradycardia (slow heart rate)
- Coarse facies (coarse facial features) [25]
- Carotenodermia [45]
- Constipation
- Delayed Achilles reflex
- Depression
- Diastolic hypertension
- Dry skin
- Edema, periorbital edema
- Elevated creatine kinase (CK) levels
- Elevated C-reactive protein (CRP) levels
- Elevated low-density lipoprotein (LDL) cholesterol
- Elevated triglycerides [25]
- Follicular hyperkeratosis [35]
- Goiter
- Hypothermia
- Hyperprolactinemia (elevated prolactin)
- Hyponatremia (low sodium) [25]
- Low basal body temperature [38]
- Low-voltage electrocardiography
- Macroglossia (unusually large tongue)
- Memory impairment
- Menorrhagia (menstrual irregularities)
- Myalgias (muscle pain)
- Normocytic anemia

- Pericardial effusion (accumulation of fluid in the pericardial cavity)
- Pleural effusion (excess fluid between pleura around the lungs)
- Poor concentration
- Proteinuria (elevated protein in urine)
- Weakness
- Weight gain [25]

Complications

Untreated hypothyroidism can result in a number of consequences, including:

- Cognitive impairment
- Dyslipidemia
- Hypertension
- Infertility
- Myxedema coma (rare, medical emergency)
- Neuromuscular dysfunction [25]

Other considerations

Some patients with other conditions (outlined below) may present with symptoms of hypothyroidism but normal TSH levels.

- Adrenal insufficiency (rare)
- Anemia
- Chronic kidney disease
- Liver disease
- Mental disorders (e.g., depression, anxiety disorder, and/or somatoform disorders)
- Nutrient deficiencies (e.g., B12, iron, vitamin D)
- Obstructive sleep apnea
- Viral infection (e.g., HIV/AIDS, Lyme disease, mononucleosis) [25]

Part 2: Causes and Contributing Factors

Primary thyroid gland failure or dysfunction may be attributed autoimmune destruction (e.g., Hashimoto's thyroiditis), congenital abnormalities, iodine deficiency, infiltrative cardiomyopathies, and a number of iatrogenic causes, such as thyroid surgery, radioiodine therapy, and neck irradiation. [25]

Hypothyroidism may also be the result of inadequate stimulation of the thyroid gland by the hypothalamus and/or pituitary gland (secondary hypothyroidism). In these cases, symptoms of hypothalamic-pituitary insufficiency would also be present. [25]

Transient hypothyroidism is characterized by a temporary deficiency in thyroid hormone. This form of hypothyroidism is associated with a number of disorders, including:

- Postpartum thyroiditis
- Subacute thyroiditis (acute inflammatory thyroid condition, likely caused by a virus)
- Silent thyroiditis
- Thyroiditis associated with TSH receptor-blocking antibodies [25]

Risk factors

Risk factors for hypothyroidism include:

- Age: higher risk with increasing age, particularly after age 60 [49 54]
- Gender: more common in females than males [49 54]
- Pre-existing thyroid-related condition (e.g., goiter)
- Certain medical procedures (e.g., thyroid surgery, radioiodine therapy, and irradiation)
- Genetic predisposition, family history
- Pregnancy within last six months
- Other medical conditions (e.g., Turner syndrome, Sjögren's syndrome, pernicious anemia, rheumatoid arthritis, type 1 diabetes, lupus) [49]
- Viral infections: may be associated with autoimmune thyroiditis (e.g., hepatitis C) [11 31 63 64]

The following tables further outline environmental toxins, dietary factors, and medications that may negatively impact thyroid function.

Environmental toxins

The following table outlines a number of toxins, their effects on thyroid function, and environmental sources.

Chemical	Effect	Sources
Bisphenol A (BPA)	Binds thyroxine receptor (antagonist), [13] increases serum T4 [26]	Water bottles, [13] liners in cans, plastics, thermal paper receipts, [26] food packaging, baby bottles, electronics, medical devices [48]
Chlorine	Inhibits iodide trapping; decreases serum thyroxine (T4) [9]	Chlorinated tap water, swimming pools, bleach, household chemicals [5]
Fluoride	Suppresses thyroid hormone (mechanism unknown); increases plasma TSH [36]	Fluoridated drinking water, fluoride toothpaste, fluoride dental treatments [3]
Mercury	Blocks conversion of T4 into T3 (5' deiodinase); [61] inhibits TPO enzyme [51]	Batteries, dental amalgams, mercury thermometers, [2] Thimerosal (i.e., flu and other vaccines), [15] ophthalmic solutions [56]
Perchlorate (ClO_4)	Blocks iodine uptake; [13] displaces T4 from thyroid-hormone binding serum proteins [58]	Contaminated drinking water, cow's milk, breast milk, vegetables (contaminated irrigation) [4]
Perfluorooctanoic acid (PFOA)	Possible thyroid disruptor [18]	Textiles, furniture, cookware, [26]
Phthalates	Thyroid disruptor (exact mechanism unknown) [26]	Plastics (PVC), children's toys, cosmetics, nail polish, perfumes, detergents, adhesives [26]

Chemical	Effect	Sources
Polybrominated biphenyls (PBB)	May increase FT3 and lower FT4; [19] associated with thyroid disease, particularly hypothyroidism [34]	Flame retardants found in plastics and electronics,[34] contaminated meat and dairy (from contaminated livestock feed)[19]
Polybrominated diphenyl ethers (PBDEs)	Disrupts thyroid hormone availability; may increase TSH and lower TT4; [48] inhibit binding of T3 to receptors [26]	Flame retardants found in building materials, electronics, furnishings, and fabrics [26]
Thiocyanate	Blocks iodine uptake by the NIS; [26] displaces T4 from thyroid-hormone binding serum proteins [58]	Cigarettes, [26] Brassica vegetables (i.e., broccoli, cauliflower, etc.) [58]

Medications

The following table outlines a number of pharmaceutical medications, their effects on thyroid function, and environmental sources.

Medication	Effect
Amiodarone	Decrease T3; increase rT3 [65]
Androgens (e.g., danazol)	Decreases concentration of TBG, level of T3 and T4 [58 65]
Estrogen (ERT)	Increases thyroid-binding globulin (TBG); possible elevation of TSH [58 65]
Interferons	Associated with autoimmune thyroid disease [65]
Interleukin-2	Associated with autoimmune thyroid disease [65]
Lithium carbonate	Inhibits thyroid hormone release; inhibits iodine binding; [65] associated with goiter [58]
Sulfonamides (e.g., acetazolamide)	Prevents intrathyroidal iodine binding [58]
Sulfonylureas (e.g., Carbutamide, tolbutamide, methahexamide)	Inhibits synthesis of thyroid hormone; goiter; inhibits iodide binding, blocks T4 binding to serum carrier proteins [58]
Tyrosine kinase inhibitors (e.g., sunitinib and sorafenib) [65]	Inhibits TPO activity, inhibits iodine uptake [65]

Dietary factors

The following table outlines several foods and compounds that may contribute to hypothyroidism, their effects on thyroid function, and common dietary sources.

Dietary factor	Effect	Sources
C-glycosylflavones	May have anti-thyroid effect; [7] when in context of an iodine deficiency, may contribute to goiter development [24]	Millet
Cyanogenic glycosides	Promotes iodine deficiency, goiter, and hypothyroidism [12]	Cassava, sorghum, maize, millet
Gluten	Associated with autoimmune thyroid disease (e.g., Hashimoto's); [43] may increase anti-TPO levels in individuals with celiac disease [17]	Wheat, rye, barley, spelt, and non-gluten-free oats; may be hidden in processed foods as natural flavorings
Iodine (in excess)	May trigger thyroiditis, may have a toxic effect on thyroid; [7] may increase thyroid antibodies (TPO-Ab and Tg-Ab; [60] fortification of salt may increase risk of hypothyroidism [14]	Dietary supplements, food additives (e.g., iodine in flour/bread, preservatives), iodinated salt, kelp, medicine (e.g., amiodarone) [7]
Isothiocyanates	Goitrogenic; interfere with iodine uptake in the thyroid gland; inhibition of TPO activity [16]	Brassica (cruciferae): cabbage, broccoli, kale, cauliflower, kohlrabi, turnips, rutabaga, mustard, horseradish
Isoflavones (e.g., genistein, daidzein)	Inhibits TPO; [13] goitrogenic [22]	Soy protein, peas, beans
Some flavonoids (e.g., quercetin, catechin, rutin)	Inhibit TPO, [21] inhibit Type I deiodinase activity [27]	Fruits, vegetables, green tea

Part 3: Developing a Diagnosis: Thyroid Markers and Functional Tests

The standard for diagnosing hypothyroidism is a serum thyroid-stimulating hormone (TSH) test and a serum free thyroxine (T4) test if TSH is elevated. [25] Measuring thyroid markers, tracking basal body temperature, and conducting an Achilles reflex test may assist in developing a diagnosis.

Thyroid markers [62]

Marker	Typical Ranges
Thyroid Stimulating Hormone (TSH)	0.3-4.0 mIU/L[62]
Total Thyroxine (TT4)	4.5-12.5 µg/dL[62]
Free Thyroxine Index (FTI)	5-12 mg/dL [66]
Free Thyroxine (FT4)	0.8-1.8 ng/dL [66]
Resin T3 Uptake (T3 Uptake)	25-35 percent [66]
Free Triiodothyroxine (FT3)	2.3 to 4.2 pg/mL [66]
Thyroid Binding Globulin (TBG)	14-31 µg/mL [62]
Thyroid Peroxidase Antibody (TPOAb)	<1.0 kIU/L [62]
Tg Autoantibody (TgAb)	<0.4 kIU/L [62]

Typical marker presentation [25] [53]

Form	Markers
Overt primary hypothyroidism	Elevated serum TSH Low serum free T4
Secondary hypothyroidism	Low or inappropriately normal serum TSH Low serum free T4 Evidence of hypothalamic-pituitary insufficiency
Subclinical hypothyroidism	Elevated serum TSH Normal serum free T4

Functional tests

Basal Body Temperature (BBT) test

Thyroid hormones play an important role in the regulation of energy homeostasis, metabolism, and thermogenesis, a process by which heat is produced in the body. [33] Hypothyroidism has been associated with reductions in oxygen consumption, nutrient oxidation, metabolic rate, heart rate, and body temperature. [57]

Tracking BBT over time may provide an indication of thyroid function. Based on patient preferences, BBT may be recorded using a phone app or a printable chart.

Download a BBT chart.

Achilles reflex test

The Achilles reflex test can assist in the diagnosis of hypothyroidism. An absent or decreased Achilles reflex provides evidence of a dysfunction of the deep tendon reflex of the S1 nerve, and may indicate the presence of certain conditions, such as hypothyroidism.

In order to perform the test, a reflex (neurological) hammer is needed. The following steps outline the standard technique and most commonly used method to conduct a reflex test:

1. Ask the patient to lie supine on the examination table, with knee flexed, hip rotated externally, and the Achilles tendon area exposed and relaxed.
2. With one hand, hold the hammer firmly by the handle. Typically, the dominant thumb and forefinger should be holding most of the weight. With the other hand, hold the patient's foot, slightly dorsiflexed from the plantar aspect.
3. Using the flat part of the top of the hammer, strike the Achilles tendon. Contraction of the calf muscle and plantarflexion of the foot indicates a positive result. [23]

Part 4: The Solution: Diet, Lifestyle, and Supplementation

Conventionally, the treatment approach to hypothyroidism aims to alleviate symptoms with lifelong administration of synthetic thyroid hormone (e.g., levothyroxine). [25] An integrative approach, however, may include evidence-based dietary and lifestyle interventions, supplementation, and detoxification support.

Core concepts of integrative treatment

1. Do no harm
2. Identify and treat the cause
3. Treat the whole person
4. Doctor as teacher
5. Prevention is the cure
6. The healing power of nature

General guidelines for patients

The following guidelines may be printed and shared directly with patients.

Diet and lifestyle guidelines for thyroid dysfunction

1. Follow a diet of whole, minimally-processed foods. Consider the autoimmune protocol diet, particularly in cases of autoimmune dysfunction (Hashimoto's thyroiditis). [2] Considering many individuals with celiac disease also present with thyroid dysfunction, a gluten-free diet may be an effective intervention in these cases. [59]

2. Avoid or reduce consumption of dietary factors that negatively affect thyroid function (see table above).

3. Consume adequate amounts of thyroid-supportive nutrients from dietary sources. Supplement when necessary to prevent or address deficiency.
    - Copper [10]
    - Iron [42]
    - Iodine* [6]
    - Selenium [7 10]
    - Vitamin A [70]
    - Vitamin B12 [7 33]
    - Vitamin C [47]
    - Vitamin D [37 44]
    - Zinc [10]

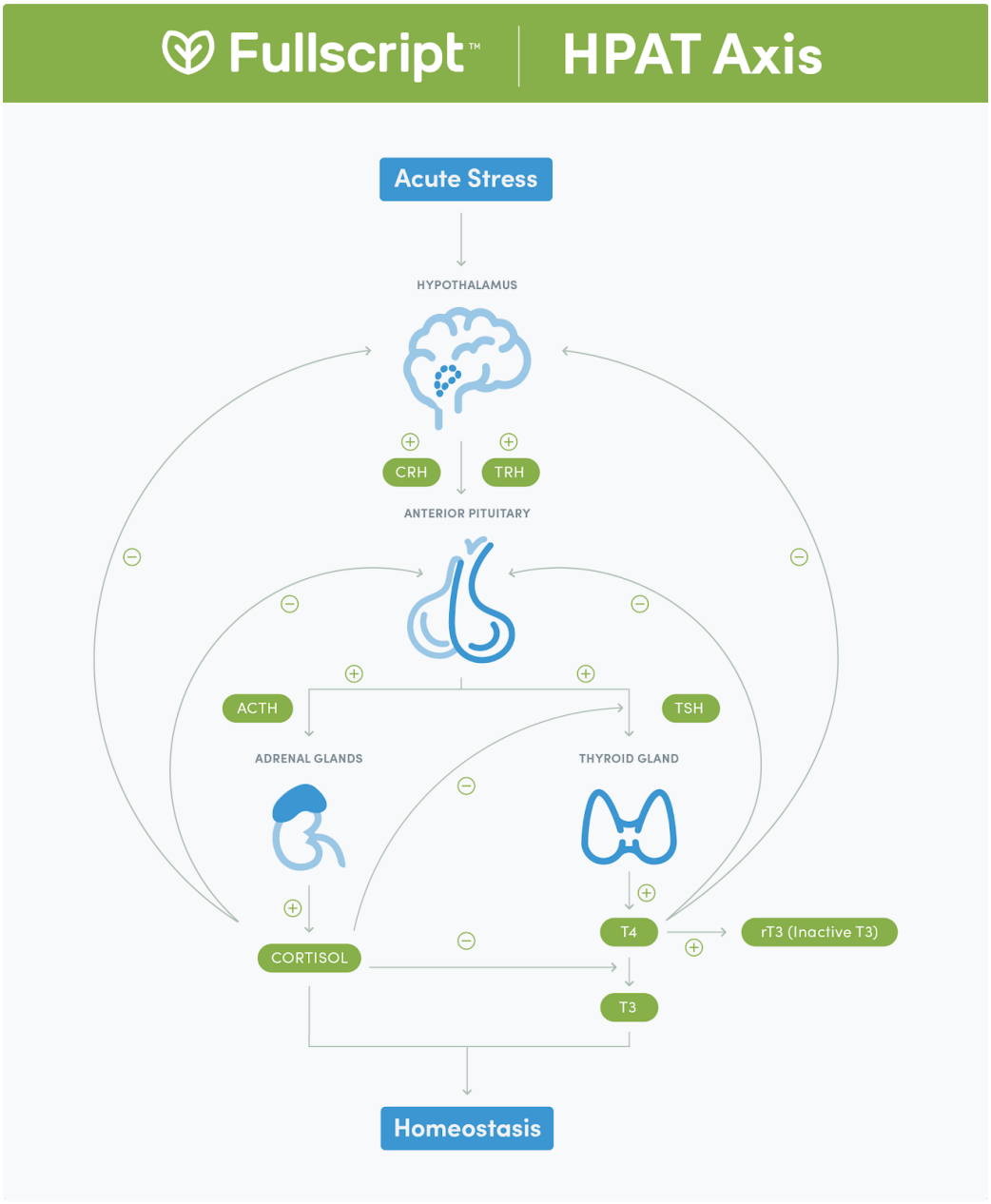
    *Caution: Excess iodine may also result in decreased thyroid hormones. [41]

4. Engage in regular physical activity. Regular physical activity has been shown to improve thyroid hormone levels (e.g., decreased TSH, increased T4 and T3). [8]

5. Increases in cortisol levels as a result of stress have been shown to affect thyroid hormone levels. More specifically, there appears to be a positive correlation between TSH and cortisol. [67] Learn to recognize signs of stress in your body (e.g., low energy, changes in mood, difficulty sleeping) and incorporate stress-reduction techniques, such as:
    - Mindfulness practices (e.g., meditation, yoga, tai chi)
    - Regular moderate exercise (e.g., 30 minutes of walking)
    - Realistic goal-setting to reduce overwhelm
    - Social support from family, friends, colleagues, and community or religious associations [50]

The hypothalamic-pituitary-adrenal-thyroid axis

The diagram below depicts the pathways between the hypothalamus, pituitary gland, adrenal glands, and thyroid gland.



Thyroid health protocol

Research examining the use of selenium, vitamin D, and *Cordyceps sinensis* have noted beneficial effects on thyroid function. A protocol incorporating natural ingredients may be used therapeutically on its own or as an adjunct to existing treatment.

Selenium
200 µg, total per day of selenomethionine, minimum 3 months [20 39 55]

Research findings:
- A decrease between 20% and 63.6% in anti-TPO marker was observed [20 39 55 69]

US: Selenium in the Fullscript catalog

CA: Selenium in the Fullscript catalog

Vitamin D
2000 IU, total per day, minimum 6 months [39 40 46]

Research findings:
- It has been demonstrated that low levels of serum 25-hydroxyvitamin D is related to autoimmune thyroid conditions (e.g., Hashimoto's thyroiditis) [68]
- Vitamin D has been shown to decrease concentrations of thyroid peroxidase and thyroglobulin antibodies [39 40 46]
- Vitamin D has been linked to a decrease in thyroid autoimmunity in Hashimoto's thyroiditis treated with levothyroxine. The impact is more significant for thyroid peroxidase than thyroglobulin antibodies [39]
- The combination of Simvastatin and vitamin D supplementation had a stronger effect in reducing concentrations of thyroid peroxidase and thyroglobulin antibodies then vitamin D supplementation alone [40]

US: Vitamin D in the Fullscript catalog

CA: Vitamin D in the Fullscript catalog

Cordyceps sinensis
6 g, total per day, minimum 24 weeks [28]

Research findings:
- Preliminary research shows that *Cordyceps sinensis* may balance the proportion between helper T cells and cytotoxic T cells
- In addition, *Cordyceps sinensis* may contribute to a significant decrease in anti-TPO antibodies in Hashimoto's thyroiditis patients [28]

US: *Cordyceps sinensis* in the Fullscript catalog

CA: *Cordyceps sinensis* in the Fullscript catalog

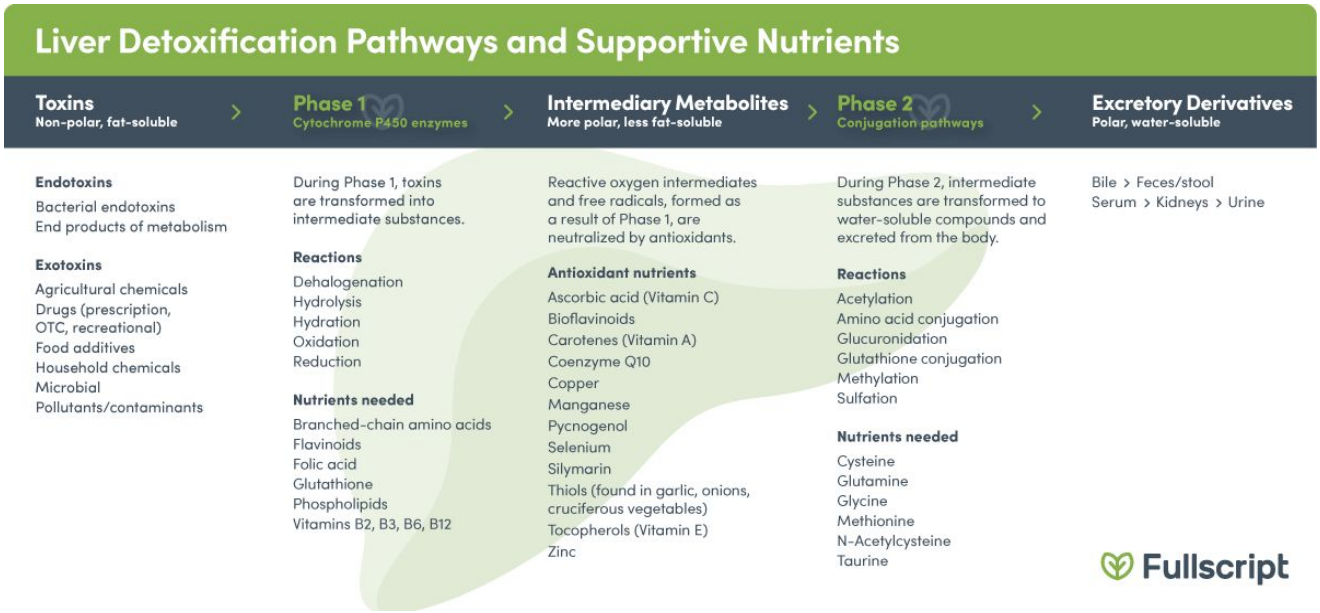
Disclaimer: The ingredients included in these protocols are based on a review of existing clinical research, with a priority placed on systematic reviews and meta-analyses.

These protocols are intended to form a foundation for developing individualized treatment plans. Clinician discretion is highly advised, as ingredients can vary in safety and effectiveness, depending on the needs of the individual patient.

Key nutrients to support detoxification

Thyroid conditions are often associated with liver dysfunction and test abnormalities, and vice versa. [30] The liver is an integral component of our body's detoxification system, and dysfunction may impair its ability to effectively remove potentially harmful toxins, including those associated with hypothyroidism. For example, environmental chemicals may affect thyroid hormone levels by decreasing the function of sulfotransferases, a family of enzymes involved in detoxification. [29]

The following graphic provides an overview of key nutrients that support liver function and the detoxification process.



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