

Practise Enrichment Clinic Tool...

Thyroid Biomarkers

Text

Desk Reference Guide

Metabolic health depends on the thyroid gland, as it governs our basal metabolic rate (BMR), the rate at which the body converts oxygen and calories into energy in a resting state. The thyroid gland is a butterfly-shaped organ located below the Adam's apple in the neck and is responsible for the production and secretion of thyroid hormones, the main ones being thyroxine (T4) and triiodothyronine (T3).

Thyroid conditions are often under-diagnosed and conventional laboratory blood tests have different parameters with wide reference ranges, which don't necessarily pick up sub-optimal function.

Thyroid Profile	Standard LAB reference range*	Optimal range*
TSH	0.35 – 5.50 mIU/L	0.4 – 2.1
Free T3 (FT3)	3.5 – 6.5 pmol/L	5 – 6.5
Free T4 (FT4)	9 - 25 pmol/L	12 - 20
Reverse T3 (rT3)	0.04 - 0.29 nmol/L	The FT3/rT3 ratio should be 20 or higher (divide FT3 by rT3)
Thyroid Antibodies	Description	
TSab (Thyroid stimulating antibody)	An IgG antibody used in the diagnosis of Grave's disease. Thyroid-Stimulating Immunoglobulin (TSI /TSab), Long Acting Thyroid Stimulator (LATS) and TSH-Binding Inhibiting Immunoglobulin (TBII). These are different names for the same test.	
ATA (Antithyroglobulin Antibody)	Found in 70% of Hashimoto's Thyroiditis cases.	
TPO (Thyroid Peroxidase antibodies) & Antimicrosomal antibodies	Typically found in Hashimoto's Thyroiditis & found in up to 95% of cases.	

Key Natural Medicines for Thyroid Health

Iodine: An essential component forming all thyroid hormones (together with tyrosine). Iodine deficiency can lead to goitre (enlargement of the thyroid gland) and hypothyroidism.

Selenium: Is vital to the manufacture of thyroid hormones, as an integral part of the deiodinase enzymes, which remove an iodine molecule from T4 converting it into T3. Thyroid tissue contains the highest concentration of selenium in the body and without it, there would be no activation of thyroid hormone.

Tyrosine: A direct pre-cursor that also comprises approximately 35% of thyroxine (T4). Without sufficient tyrosine, the thyroid gland is simply unable to produce T4 and T3.

Withania: Demonstrates a strong ability to inhibit stress induced cortisol elevations and interestingly, has been shown to increase both T3 & T4 production, boost metabolic activity and normalise thyroid function.

Rhodiola: Has powerful adaptogenic activity, originally studied due to its ability to improve adrenal function and performance under stressful conditions. In addition to supporting adrenal function, neuroendocrine animal studies show that Rhodiola enhances thyroid function.

Zinc: Is an important cofactor needed for healthy thyroid hormone production. Taking supplemental Zinc may normalise serum T3 levels, decrease rT3 and normalise TSH levels.

Vitamin D: Deficiency increases risk of autoimmune thyroid disease. Further evidence suggests that vitamin D deficiency is more common among individuals with thyroid cancer or thyroid nodules, compared to the general population.

Vitamin E: Protects the enzyme that catalyses the conversion of T4 to T3 and is an important 'nourisher' for the adrenal cortex & pituitary gland (HPA axis). Vitamin E may also reduce the oxidative stress caused by hypothyroidism.

Vitamin C: Well known for its immune system benefits, vitamin C is also important for the nutritional support of adrenal insufficiency. Additionally, it is involved in the synthesis of thyroid hormones, increasing serum levels of T4 & T3 and also important for adrenal health.



Thyroid Hormones and Conditions Explained

TSH (Thyroid Stimulating hormone): Signals to the thyroid gland to make thyroid hormone. When circulating thyroid hormone levels are low, the pituitary gland releases thyroid stimulating hormone (TSH). When thyroid hormone levels increase, production of TSH decreases, which in turn slows the release of new hormones from the thyroid gland.

T4 (Thyroxine): Has four iodine atoms and it is a pro-hormone and becomes either T3 or Reverse T3 (rT3). Thyroxine or T4 in supplement form is common medically prescribed drug used for thyroid hormone replacement therapy.

T3 (tri-iodothyronine): When the body needs energy, it removes an iodine molecule from T4 and it becomes T3 which in turn signals the body's cells to produce energy (ATP). T3 allows the body to turn up metabolic energy production when needed. T3 is considered the active thyroid hormone (T4 being effectively a "prohormone"). 80% of T3 is formed from T4 in the tissues, particularly the liver & kidneys.

rT3 (reverse T3): Made by the body to regulate T3 energy production by removing a different iodine from T4. rT3 blocks the T3 from signaling the cell to make energy. It allows the body to turn down the energy when it needs to. Elevated rT3 will inhibit T3 and therefore slow thyroid function. Adrenal stress is thought to influence rT3 and increases in cortisol (a stress hormone) may elevate rT3 and reduce T3.

Free T4 and T3 vs Total T4 and T3: Total T4 and total T3 reflects the total amount of T4 and T3 present in the blood including the protein bound (unavailable) hormone. High levels of circulating estrogens (from birth control pills, non-bio-identical hormone replacement, pregnancy or estrogen dominance) can increase the amount of protein that binds T4 and T3, which may give misleading levels. Free T4 and Free T3 reflects the biologically active (free) form and is considered a more accurate reflection of activity within the body.

Thyroid conditions	Description	Biomarker Profile
Primary Hypothyroidism	Underactive thyroid function resulting in poor thyroid hormone synthesis & low basal metabolic temperature Considered an autoimmune disorder, more common in women.	TSH – elevated T4 – normal/low T3 – low
Sub-clinical hypothyroidism	Under activity of the thyroid gland resulting in low basal temperature and symptoms of low thyroid function, that is not detectable by standard lab tests.	TSH - Mildly elevated (>2.0) T3 & T4 - Often normal
Euthyroid sick syndrome	Often impaired peripheral conversion of T4 to T3. This conversion happens primarily in the liver, therefore poor liver function, toxic load and estrogen dominance may be a factor.	T3 - levels low T4 - may be normal or slightly elevated
Wilson's Thyroid Syndrome	Excessive production of Reverse T3 in the tissues of the body. Oral temperature presents as consistently lower than normal with symptoms of low thyroid function. Excessive production of rT3 may be due to excessive stress and or elevated cortisol levels.	TSH - often normal T3 – low rT3 – elevated T4 – normal/low
Hashimoto's Thyroiditis	A hypothyroid condition, however unlike primary hypothyroidism, instead of gland atrophy there is infiltration with lymphocytes and exudate causing inflammation and goitre. In the early stages, release of T4 and T3 into the blood stream can cause mild thyrotoxicosis but this leads to permanent hypothyroidism.	ATA – typically present TPO – typically present
Secondary Hypothyroidism	Due to hypopituitarism is very much less common but must always be considered in the puzzling situation where T4 and T3 are low and the TSH is normal or low instead of showing the expected elevation.	TSH – low or normal T4 – low T3 – low
NB: Some Nutrients and herbs may be contra-indicated in hyperthyroid conditions.		
Hyperthyroidism	Also known as Thyrotoxicosis. Over a period of time, mild hyperthyroidism can either progress to more obvious disease or revert to normal, hence the importance of monitoring levels at intervals of 1-6 months. T3 thyrotoxicosis will be missed if T3 is not measured in all patients with undetectable TSH, particularly if they are clinically hyperthyroid.	T4 – elevated T3 – elevated TSH – undetectable
Grave's disease	An auto-immune hyperthyroid condition, Graves' disease has a 65% incidence of diffuse hyperplasia associated with autoimmune TSH receptor antibodies and often with ophthalmopathy.	TsAb – present TSH – Undetectable T4 – Elevated T3 – Elevated

