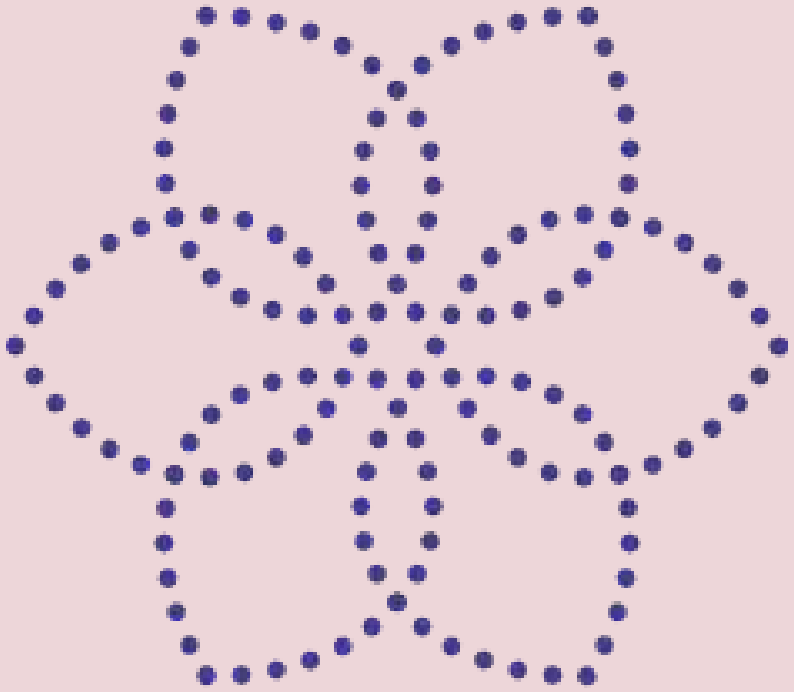
Thyroid Function Explained



DR SARAH DAVIES

Thyroid Function: A deeper look at your Functional Thyroid results

As part of your new patient blood screen, you have had a full set of Functional Thyroid tests. These encompass a much broader investigation of thyroid function than the standard tests and are not always simple to interpret. This information sheet is to support patients who have had an abnormal set of results.

Thyroxine (T4) has been measured as Total and Free T4. This is the main hormone made by the thyroid gland (the butterfly shaped organ in the neck just in front of the voice box).

• Total T4 levels tell us how well the thyroid gland is working. Low levels are suggestive of poor gland function or a lack of the nutrients needed to make this hormone (the amino acid Tyrosine and iodine). Some patients may find that their thyroid gland output will respond over time to general improvements in nutrition and reduction in stress and inflammation or toxicity.

• Free T4 tells us how much of the Thyroid hormone is available for use by the body (ie. not bound to protein s which stop it from binding to the receptors). Normal Levels of Free T4 may be sustained even when the total T4 is diminished as the body can reduce the production of Thyroid-binding Globulin proteins to compensate for low output.

Low levels of T4

• May sometimes be corrected by nutritional replacement (Iodine and Tyrosine) and Dr Sarah may recommend checking iodine levels.

• May respond over time to general improvements in nutrition and reduction in stress and inflammation or toxicity.

• May benefit from treatments to reduce antibodies against the thyroid gland (which may cause destruction of the gland and loss of output), especially in Hashimoto's Autoimmune Thyroid disease.

• May require hormonal replacement therapy with Levothyroxine to increase T4 levels (available on prescription), where nutritional support and detox are unsuccessful or if a patient requires rapid relief from symptoms of hypothyroidism.

High levels of T4

High levels of T4: This may be a sign of an overactive thyroid gland (hyperthyroidism), and require further investigation by a thyroid specialist (Endocrinologist), if this is a new diagnosis. Those referred on for specialist opinion will also be given a Functional Medicine Hyperthyroid Support programme. Causes of raised T4 include:

• Graves Disease: This is one of the causes of raised T4 levels and is due to Thyroid antibodies causing high T4 output. These antibodies can be screened for with a blood test. The aim of the Functional Medicine treatment plan in Grave's, is to reduce the antibodies to reduce the T4 over-production. However, medication to help the symptoms of hyperthyroidism are often also required. The amino acid Carnitine can be of help to some patients with hyperthyroidism.

• Poor T4 to T3 conversion: Sometimes we see unusually high T4 in conjunction with low levels of T3 (the active thyroid hormone). In this case the patient may not be hyperthyroid at all and the problem may be a 'blocking' of the conversion of T4 to T3. This is why we always look at the bigger picture when checking thyroid hormone levels.

Liothyronine (T3) is the active form of the thyroid hormone. Only tiny amounts of it are made in the thyroid gland and usually it is made in the liver and other organs via the 5-deiodinase enzyme when it is needed. Because it is very reactive, T3 has a short half-life and the body makes it as it is required, from the more stable T4 hormone.

Low levels of T4

• May be seen if T4 is low – action needs to be taken to support T4 levels with nutritional support or T4 replacement therapy.

• May be seen if T4 to T3 conversion is poor – leading to potentially normal (or even high) T4 alongside low levels of the active hormone.

• Low T3 levels will cause hypothyroidism regardless of T4 levels.

High levels of T4

• Genetic weakness in the 5-deiodinase enzymes which perform to conversion.

• Selenium or iron deficiency

• Liver disease or toxicity
·Stress (psychological and Physiological)

• Inflammation

• Acute viral illness (causes conversion of T4 to Reverse T3 – this state is also seen chronically in some patients with Chronic Fatigue)

High levels of T4

•This usually follows from raised T4 levels and has the same causes as raised T4 (especially Grave's Disease).

Thyroid Stimulating Hormone (TSH)

This is made in the pituitary gland in the brain and is the main way our brains control thyroid gland output (T4 production). Levels deemed 'normal' in clinical practice, may nevertheless be associated with significant abnormalities in the production of T4 and T3 (especially with chronically low Thyroid output levels). Patients who are symptomatic of hypothyroidism with normal TSH, may often have abnormalities in the rest of the thyroid panel and efforts to support these abnormal results will be suggested.

• TSH>4: Demonstrates hypothyroidism requiring Thyroid hormone support – especially in cases where there are symptoms of hypothyroidism.

• TSH 2-4: Demonstrates potential sub-optimal thyroid functioning. In those on Thyroid replacement therapy dose may need to be increased. In those with hypothyroid symptoms, the bigger picture should be examined to find the cause and treat this.

• TSH 0.5-2: Likely good thyroid function, interpret alongside the rest of the thyroid panel.

• TSH <0.5: You may be over-treated if on replacement therapy (although can be normal in those on T3 Medication). This may represent hyperthyroidism. Supressed TSH levels should be discussed with Dr Sarah as there is increased risk of loss of bone density and arrhythmias (abnormal heart rhythm).

Reverse T3 (RT3): This is an inactive thyroid hormone and the 'mirror image' of T3. It is made from T4 when the body is under stress of various sorts. While it has little functional activity, RT3 can block the hormone binding sites for T3 and reduce the ability of T3 to act. Therefore, the ratio of T3 to Reverse T3 is more important than the absolute values of either of these hormones.

It's important to understand that Reverse T3 has important protective physiological functions. In flu-like illness and other acute stresses, RT3 production often rises as T3 falls- inducing a hypothyroid state which is not due to low Thyroxine production. In these illness states, the person feels tired, their core temperature lowers and this encourages them to rest – to recover from the acute illness. However, where this hibernation-like state becomes the norm, chronic hypothyroidism is less beneficial and may be a cause of chronic fatigue.

• Low RT3: Associated with low T4 (it's precursor), and usually seen in patients on T3 therapy (where T4 production becomes suppressed). Of itself this doesn't cause any clinical symptoms.

• High RT3: Usually associated with a Low RT3 ratio and 'Functional Hypothyroidism' due to the blocking of T3 receptor sites in the nucleus of cells. This state is driven by psychological and physiological / metabolic stresses. Where this is seen, the focus of treatment is to identify the root cause and ameliorate the problem. In the meantime, support with T3 therapy may be of benefit to patients who are clinically hypothyroid.

Reverse T3 ratio:

• >20: Optimal range - hypothyroidism is unlikely if T4 is normal.

• 15-20: Mildly suboptimal - may respond to conservative measures to improve T3 and reduce RT3.

• <15: Low - suggests functional Hypothyroidism. We will undertake investigations to find cause of raised RT3, consider lowering T4 (if taken), and a trial of T3 therapy may be suggested.

Raised RT3 is a physiological response to chronic illness, the causes of low RT3 ratio are many including:

• Abnormal cortisol levels / Adrenal Dysfunction due to chronic psychological or metabolic / physiological stress (both high and low cortisol outputs)

• Iron and selenium deficiencies

• Liver problems

• Chronic heavy metals toxicity

• Chronic viral infection

Unfortunately, there are not necessarily any easy fixes for these issues and this is where a truly holistic treatment plan is needed. However, suggestions which may help include:

Adrenal support / Cortisol normalisation:

• Blackseed (Nigella Sativa) - 2g twice a day has been shown to help in clinical trials.

• Other 'Adaptogenic' herbal therapies such as Ashwagandha, Guggul and Forskohlin may also help some patients.

• Stress reduction – Mindfulness, meditation, breathing exercises and Heart Rate variability training techniques may all help in normalising cortisol output.

• Adrenal support with adrenal nutritional therapy such as Adrenal Cortex Extract (ACE).

• Reducing inflammation (low inflammatory diet, elimination of gluten and other allergens).

• Vitamin D and A optimisation and antioxidant support.

Adrenal support / Cortisol normalisation:

• Sauna / FIR sauna therapy
• Targeted reduction in heavy metals toxicity where present
• Selenium and iron optimisation

If you have problems with low RT3 ratio, then discuss treatment options with Dr Sarah to find the right solution for you. Treatment plans are guided by the severity of the problem, symptoms of hypothyroidism and whether testing reveals obvious causes for the problem which can be remedied through nutritional support.

For those on T4 therapy, the most straightforward way to tackle this problem is to reduce the Levothyroxine dose and add in T3 to 'bypass' T4 to RT3 conversion while the cause of the underlying issue is sought and treated.

Autoimmune Thyroid Disease:

The most common cause of Thyroid malfunction is the production of antibodies against the patient's own Thyroid gland. These are known as Autoantibodies and the 2 we routinely measure are:

Anti-Thyroid Peroxidase Antibodies (TPO):

These are most commonly seen in Hashimoto's Hypothyroidism. However, as well as causing destruction to the architecture of the thyroid gland and low thyroid output, TPO antibodies can also be responsible for intermittent hyperthyroid symptoms too – especially in the early stages of the disease.

Anti- Thyroglobulin Antibodies (TG):

Less common as a cause of hypothyroidism, these antibodies may be found in patients with both Graves Disease and Hashimoto's or in those with other autoimmune conditions such as lupus.

Common causes for thyroid disease are underlying food sensitivities (especially gluten, dairy and soy), and a family history of thyroid disease. While we can't alter the genetic predisposition, finding the diet which is right for you can help to 'switch off' thyroid antibody production (when used alongside a holistic functional medicine plan).

For patients for whom more conservative measures are ineffective (or where reducing antibodies quickly is needed – such as in Grave's Disease), then we may consider the use of prescribed immune-modulator Low Dose Naltrexone (LDN).

Clinical signs of Thyroid problems:

While blood testing is key to an understanding of thyroid hormone production and metabolism, results should be assessed alongside signs and symptoms of thyroid imbalance. Whether we are using diet and nutritional support or prescription hormone replacement, optimal function and wellbeing remain our goals. In this way we are not just 'treating the numbers' but the whole person.

Low Thyroid Function (Hypothyroidism), can present as:

- Feeling cold, intolerance to extremes of temperature
- Cold hands and feet
- Dry skin and hair
- Hair loss and loss of outer 1/3 of eyebrows
- Weight gain which is resistant to diet or exercise
- Period changes (in women), or unexplained infertility
- Low mood, depression and irritability
- Cognitive disturbance with 'brain fog' and memory loss
- Fatigue, muscle injuries, carpal tunnel syndrome
- Swelling in the tissue of the neck may become apparent as a 'goitre'
- Blood cholesterol levels may rise

Those with hyperthyroidism (too much thyroid hormone), may experience:

- Inexplicable weight loss.
- Hunger and sugar cravings.
- Anxiety and sometimes severe mental health disturbances.
- The antibodies associated with Grave's disease may also cause eye damage and puffiness behind the eyes.

Using Metabolic Mapping to monitor Basal metabolism:

For those with borderline Thyroid abnormalities or even normal hormone levels with multiple thyroid symptoms, one way of checking functional Thyroid and adrenal levels is through 'metabolic mapping'. Pulse, Blood Pressure and core temperature can be used to monitor effective thyroid levels in between blood tests and as a guide when titrating thyroid replacement therapy.
Dr Sarah will give tailored guidance on this where indicated but a quick test to see if you are hypothermic (a strong indicator of likely hypothyroidism is the following):

Use an 'under the-tongue' thermometer with a long equilibration time such as this one: Ana Wiz Basal Body Thermometer

Start by monitoring your temperature 3-4 times each day. Take care not to check a reading within 30 minutes of exercise or hot food over and continue readings over 3- 4 days (to get 10 readings minimum). Note down the results and calculate:

·The Average reading (add all the readings and divide by the number of readings): This should be above 37°C. Any lower suggests possible hypothyroidism.
·The Range (take the lowest reading from the highest reading): Ordinarily less than 0.5 degrees. This will vary more in states of adrenal dysfunction.

You can use the next page to record your blood results and metabolic mapping readings as needed.

My Thyroid Results:

Date:				
TSH				
Total T4				
Free T4				
Free T3				
Reverse T3				
RT3 Ratio				
Anti-TPO				
Anti-TG				

My Basal Metabolism Readings:

Date:				
Thyroid support				
Adrenal support				
Lowest reading				
Highest reading				
Average				
Range				
Notes				