

Module 5, Lesson 2 Handout:

TSH, T3 & T4

You don't need to become an endocrinologist to have an understanding of hormones and how they may be affecting your clients. It's estimated that at least 12% of the population will be diagnosed with a thyroid condition at some point in their lives, so thyroid hormones are something you need to be familiar with. Get ready for some science. Let's go through the most important points of the three major thyroid hormones so you can feel confident in your conversations about these hormones with your clients, be able to understand their labs and discuss how to move forward in getting this client the best care possible.

Thyroid Stimulating Hormone (TSH)

TSH is a peptide hormone made in the pituitary gland. It's main job is to act as a messenger and tell the thyroid gland how much hormone to make. If there is too little thyroid hormone in the blood, the pituitary tells the thyroid gland to make more. If there is too much thyroid hormone in the blood, it tells the thyroid to slow down.

Here's how it works. First, your hypothalamus (a small region in the brain), is triggered to release TRH, or thyrotropin releasing hormone when it senses an imbalance of T3 and T4 hormones. Then, TRH triggers the pituitary gland to release TSH which binds to receptors on the thyroid gland, telling it to release T3 and T4 hormones due to the imbalance. This creates homeostasis, or a balance of hormones in the body in this case. This cycle continues over and over as needed - how cool are our bodies? When the thyroid gland is overstimulated by TSH due to issues with the pituitary gland or hypothalamus this may cause hypothyroidism and hyperthyroidism.

TSH is the lab value you're going to pinpoint if you suspect your client may have thyroid issues. TSH is going to be low in hyperthyroidism and high in hypothyroidism (conditions discussed in another handout.) Normal TSH Values are 0.5-6 uU/ml.

Triiodothyronine (T3)

T3 is the active thyroid hormone. It binds to thyroid hormone receptors (TR), then binds to DNA at certain sequences to regulate gene activity. In this process, T3 promotes the formation of ribonucleic acid (RNA) and protein synthesis. T3 plays an important role in regulating metabolism, along with heart rate, temperature, brain development and digestive function.

There is less T3 than T4 in your body, but T3 is super potent. T3 values are almost always normal, and abnormal values are most connected with hyperthyroid. In lab tests, total T3 is the total amount of triiodothyronine circulating in the blood, both bound and unbound by protein. Free T3 is bound to protein and considered the active form of triiodothyronine. Reverse T3 is another form that's inactive. Normal T3 values are 80-180 ng/dl.

Thyroxine (T4)

T4 is considered a “storage” hormone that carries around iodine, which is essential for your survival. T4 contains 4 iodine atoms, hence the 4 in its name. T4 regulates cell metabolism and growth and is converted into T3 in the kidneys, liver and spleen as needed. For this conversion, T4 loses an atom of iodine to become triiodothyronine (T3), which, you guessed it, has 3 iodine atoms. It's found in large quantities in the blood.

One way that T4 regulates cell metabolism and growth is through the polymerization of actin - sounds fancy, but it's easy to understand. Actin is a protein that is found in muscle cell fibers, and polymerization basically means a change in structure. When actin is polymerized it helps the cells communicate with one another, sends signals and helps cells move around the body, two processes known as cell adhesion and cell migration.

In labs, the T4 test is measuring two things. Total T4 is the total amount of thyroxine circulating in the blood, bonded or not bonded to protein. Free T4 is the type not bonded to protein and is considered the active form of thyroxine. These are combined in your standard blood tests and normal T4 values are 4.6-12 ug/dl. T4 levels are going to be low with hypothyroidism, covered in another handout

Putting it Into Practice

If you suspect a thyroid issue in a client, refer the client to a great endocrinologist for testing. At least right now, stay away from home testing kits and leave the diagnosing to a qualified endocrinologist. Home kits can often leave someone with too much information that they don't necessarily understand, and can just cause stress that the client doesn't need.

If a client comes back with an abnormal level, there are a few things you can do with the plans and recommendations you can make:

- Make sure the person is getting enough iodine (which isn't hard to do.) Iodine is found in iodized salt, seafood, dairy, most grains, and many fruits and vegetables depending on the soil they were grown in

- Recommend foods with magnesium, a nutrient that's commonly being under consumed. Top sources include Brazil nuts, cashews, almonds, peanut, hazelnuts, brown rice, spinach, chard, avocado, chickpeas, lima beans and bananas
- Focus on iron, which is found in animal proteins, spinach, chard, raisins, potatoes, quinoa, cashews, hazelnuts, beans and lentils
- Add more foods with selenium, found in Brazil nuts, seafood, animal protein, and some vegetables depending on soil content
- Ensure that they aren't going overboard on goitrogens, which block iodine absorption and are found in foods such as cruciferous vegetables, starchy vegetables and soy

Of course your clients may not be interested in the science behind what's going on in their bodies. However, when you have an understanding of the science it helps you be more confident in talking with them about the important roles these hormones play in thyroid disease regulation and many other conditions, contributing to a Nutritious Life.