

Minerals and Hypothyroidism

Hypothyroidism is one of the most common health issues encountered in the United States. Left untreated, hypothyroidism can contribute to the development of hypertension, dyslipidemia, infertility, cognitive impairment, and neuromuscular dysfunction. Hypothyroidism is a health condition or pathology in which the thyroid gland does not produce enough thyroid hormone (T4), causing a reduction in an individual's metabolic rate. Common symptoms of hypothyroidism are fatigue, weakness, increased sensitivity to cold, constipation, unexplained weight gain, dry skin, hair loss or coarse hair, muscle cramps, depression, and slow thought processes¹. This slow thought process is commonly referred to as "brain fog".

Hypothyroidism may occur as a result of primary gland failure or insufficient thyroid gland stimulation by the hypothalamus or the pituitary gland. This primary gland failure can be a result of congenital abnormalities, autoimmune destruction (Hashimoto's Thyroiditis), iodine deficiency, and infiltrative diseases. Hashimoto's Thyroiditis is the most common etiology of hypothyroidism in the United States. This disorder affects fourteen million people in the United States, and is believed to account for 90-95% of all cases of hypothyroid-

ism². In addition to the above mentioned cases of overt hypothyroidism, there is an often under-diagnosed thyroid disorder, referred to as subclinical hypothyroidism. These individuals are found to have elevated TSH (thyroid stimulating hormone) with normal T4 (thyroxine) and normal T3 (triiodo-L-thyronine)³. Triiodo-L-thyronine has roughly 4 times the metabolic activity of Thyroxine (T4). Certain nutrients are required to convert T4 into T3, and the inability to make this conversion happen will drastically slow down an individual's metabolic rate. An article in the American Family Physician⁴ has estimated that about 20% of women over the age of 60 suffer from subclinical hypothyroidism. Individuals with subclinical hypothyroidism are at greater risk of developing overt hypothyroidism. From this, it can be seen that the incidence of hypothyroidism is even greater than indicated above.

In most cases, patients with hypothyroidism are prescribed thyroid hormone replacement medications, such as levothyroxine sodium or actual thyroid hormone (extracted from porcine

source). This typical approach does not address the core issues underlying low thyroxine production, which revolve around deficiencies in the key nutrients the body needs to support the thyroid gland feedback loop (see figure 1 below). In Hashimoto's Thyroiditis, the most common nutrient depletions are selenium, vitamin D, vitamin B-12, iron, thiamine, and magnesium⁵. The following minerals play roles in the steps involved in the thyroid gland feedback loop, and therefore help maintain proper thyroid function: Iodine, magnesium, zinc, selenium, copper, iron, manganese, molybdenum, and boron. Other nutrients

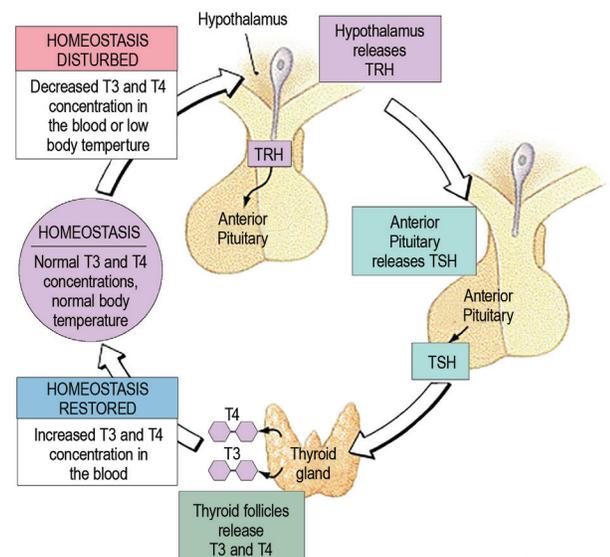


Figure 1. Thyroid Gland Feedback Loop - Negative Feedback Loop

[taken from <http://Antranik.org/thyroid-stim-hormone-thyrotropin>]⁶

involved are vitamin A, vitamin B-12, thiamine, vitamin D, riboflavin, vitamin C, and protein (phenylalanine found in protein is converted to tyrosine, a key component of thyroxine).

MINERALS AND THEIR IMPACT ON THE THYROID

As mentioned, many minerals have an impact on the control of the thyroid. In fact, nine minerals are involved in support of thyroid function. People, suffering from hypothyroidism need more than prescription medications for levothyroxine sodium or thyroid hormone. They need the nutritional support for overall thyroid health. Without proper nutrient supplementation, hypothyroid patients have been seen to complain about the way they feel, oftentimes leading to overmedication, which can lead to hyperthyroid symptoms, like rapid heart rate, night sweats, anxiety, insomnia, and so on. The following nine minerals are needed for thyroid support, along with their roles in support of thyroid gland performance.

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Iodine

Iodine is one of the most essential needs for the thyroid. Each molecule of thyroxine (T4) has four atoms of iodine, and each molecule of triiodo-L-thyronine (T3) has three atoms of iodine. A deficiency in iodine will result in hypothyroidism. Is iodine intake a problem in the United States? An article⁷ in the Journal of Clinical Endocrinology and Metabolism indicated that the overall iodine intake in the United States is adequate, as found in two NHANES evaluations.

The National Health and Nutrition Examination Surveys [NHANES I (1971-1974) and NHANES III (1988-1994)] measured iodine intake via urinary iodine concentrations. Although the overall intake of iodine was adequate in both surveys, the median iodine intake decreased by more than 50% between 1971-1974 and 1988-1994. Inadequate or low iodine intake had increased 4.5 fold to 11.7% of the populace. In women of child-bearing age, inadequate iodine intake was seen in 14.9% of this group. Iodine deficiency is the world's leading cause of intellectual deficiency. This level of iodine deficiency in women of child bearing age can increase the risk of producing offspring at risk for intellectual deficiency. This trend requires monitoring.

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Magnesium

It has been reported that up to 70% of the US populace suffer from marginal magnesium deficiency. Magnesium deficiency has been commonly seen in Hashimoto's Thyroiditis. Possibly due to the malabsorption problems seen in hypothyroid conditions. Magnesium plays vital roles in maintaining thyroid function⁸. It is involved in the formation of thyroid stimulating hormone (TSH) in the anterior pituitary, leading to an increase in T4 production. Thyroxine (T4) is the less active form of thyroid hormone. Triiodo-L-thyronine (T3) is the more active form, having 4 times the metabolic activity of T4⁹.

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Zinc

Research has indicated that zinc may be the most versatile nutrient in regards to thyroid function. Zinc has been shown to stimulate the hypothalamus to form

thyrotropin releasing hormone (TRH), which in turn stimulates the anterior pituitary to release thyroid stimulating hormone (TSH)¹⁰. The release of TSH causes the thyroid to increase production of thyroxine (T4). Zinc is needed for the conversion of Thyroxine (T4) into the much more active triiodo-thyronine (T3). Zinc is responsible for maintaining proper serum levels of T3, T4, and TSH¹¹.

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Selenium

It has been reported in the International Journal of Endocrinology¹² that the thyroid gland contains more selenium per gram of tissue than any other body component. Selenium is a key component of the iodothyronine deiodinases. The iodinases are involved in removing an iodine atom from thyroxine (T4) to form T3. In addition, selenium is important for the protection of the thyroid gland. In the process of the production of thyroxine, the thyroid gland generates hydrogen peroxide, which is damaging to the thyrocytes. Selenium is a component of glutathione peroxidase, which is an intracellular antioxidant. Glutathione peroxidase protects the thyroid from the free radical effects of hydrogen peroxide. It has been shown¹³ that high iodine content with inadequate selenium levels will lead to the destruction of thyroid cells.

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Copper

In an article by T.W. Bastian, et al, it is stated that copper is important to normal brain development. A copper deficiency renders the hypothalamus incapable of regulating thyroid gland activity. It has been seen in animals that copper deficiency during pregnancy

gives rise to offspring that have serum levels of triiodo-L-thyronine (T3) that are 48% less than normal animals. Published research¹⁵ has shown that copper helps catalyze the formation of tyrosine, and tyrosine is the amino acid backbone of thyroxine.

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Iron

Low iron is often seen in the hypothyroid patient. Hypothyroidism can lead to low iron, and low iron can worsen hypothyroidism¹⁶. Hypothyroidism can cause a decrease in the production of stomach acid, which can lead to a decrease in the absorption of vital nutrients. Iron is a mineral that requires stomach acid for its absorption. In addition iron is a component of many of the digestive enzymes. So low iron has multiple impacts on the hypothyroid patient. Iron is a component of the enzyme thyroid peroxidase, which catalyzes the first two steps in thyroid hormone production. The conversion of T4 to T3 results from deiodinase activity, which also requires the stimulus of thyroid peroxidase. Low iron will slow down thyroid activity through a decrease in thyroid hormone production and a lower rate of conversion of T4 to T3.

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Manganese

Manganese is involved in the formation of thyroxine¹⁷. Low manganese will result in poor thyroid gland function. In addition, manganese is part of the intracellular antioxidant enzyme, Manganese Superoxide Dismutase. This antioxidant enzyme is an important protector of the thyroid gland¹⁸. Hypothyroidism leads to poor absorption of manganese.

Molybdenum

Although the amount of molybdenum required by the human body is very low, it plays some very important roles. Molybdenum stimulates certain enzymes that help fight against autoimmune disease. It has been observed¹⁹ that molybdenum dependent enzymes operate in the oxidative system of the thyroid epithelial cell called thyrocytes. These are the cells of the thyroid responsible for the production and secretion of the thyroid hormones. Molybdenum plays a role in the release of triiodo-L-thyronine (T3) from the thyroid gland.

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Boron

According to a study done in Russia²⁰, boron plays a role in the conversion of thyroxine (T4) to triiodo-L-thyronine (T3).

SUMMARY

Minerals are of obvious importance to thyroid function, and their supplementation is an important consideration in treating people who are hypothyroidism. This disorder is of high incidence in the United States, as well as worldwide. As mentioned earlier, there are certain vitamins that are also of need in hypothyroidism: vitamin A, vitamin B-12, thiamine, vitamin D, riboflavin, and vitamin C. It is important to make sure that the nutritional needs of people with hypothyroidism be met. Just medicating with thyroid hormone or synthetic thyroid hormone (levothyroxine sodium) can result in a less than satisfactory treatment of hypothyroidism. In light of this, several companies are marketing

dietary supplements aimed at helping people suffering from hypothyroidism. ThyVita® and Thyrotain® are just two of the supplements that are being marketed to help people with hypothyroidism. People with this disorder have problems with their digestive tract, and have difficulty in absorbing minerals. It is for this reason that, when possible, Albion's TRAACS® mineral forms should be included in supplements for the hypothyroid.

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