Nutritional Supplements that Support and Improve Thyroid Health

Erik Lundquist, M.D.
ABIHM
Becoming an Integrative Practitioner

How did I get here?

- How I became an Integrative physician
- Set up a clinic (Opened Integrative Center in 2014)
Questions #1

1. How many of you order the following Thyroid labs?
   a. TSH
   b. TSH, FT4
   c. TSH, FT4, FT3
   d. TSH, FT4, FT3, RT3
Question #2

How often do you prescribe natural desiccated thyroid?

A. Never
B. Sometimes
C. Often
D. First Line Treatment for Thyroid
Question #3

How many of you check for iodine levels?

A. Never
B. Sometimes
C. Often
D. Every thyroid test
Question #4

Do you ever treat with a supratherapeutic dose of iodine? (ie. Iodine/potassium iodide 12.5 mg)

A. Yes
B. No
What is Reverse T3?
My Mom’s Story

- Why am I still so tired if my thyroid is normal?
- TSH was low, decreased levothyroxine
- 6 weeks later, TSH was even lower and she was feeling worse.
- Sent to Endocrinologist...
My Mom’s Story

Seriously, it’s all in her head. Her TSH is normal.
My Mom’s Story

Switched to natural desiccated thyroid and symptoms improved.
Objectives

- Understand the function and metabolism of thyroid hormones
- Understand what tests to order and how to interpret lab data for thyroid function
- Understand a holistic approach to treating thyroid disorders
- Look at and understand the evidence behind targeted nutritional supplements in the optimization of thyroid function.
Thyroid Disease Prevalence (TSH>4.5)

American Association of Clinical Endocrinologists (AACE.com)
The Colorado Thyroid Disease Prevalence Study, Arch Int Med: Feb 2000

- **30-35 Million**: The number of Americans estimated with Thyroid Disorders
- **15-17 Million**: The number of Americans estimated with undiagnosed Thyroid disorder
- **10-14 Million**: The number of Americans estimated to have Hashimoto’s disease
- **70-80%**: Number of individuals with thyroid disease who are women
- **25%**: Number of women estimated to develop permanent hypothyroidism.
Thyroid Hormone Function

**Hormones** produced by the thyroid gland influence virtually every cell, tissue and organ in the body and are responsible for:

- Helping to control your **body temperature**
- Increasing **heart rate** and stimulating heart muscle contraction
- Proper **brain function**
- Managing body energy expenditure, heat generation and **weight**
- Regulating the function of the **digestive tract**
Thyroid symptoms

Hypothyroidism:
- Cold intolerance, cold hands/feet
- Menstrual irregularities, infertility
- Fatigue, weight gain
- Constipation
- Hair changes, dry skin
- Frequency of urination
- Mental fog, dizziness, depression

Hashimotos:
- Nodular thyroid
- Arthralgias, myalgias

Hyperthyroidism:
- Heat Intolerance
- Diarrhea
- Rapid weight loss
- Goiter
- Anxiety, insomnia
- Heart racing, heart palpitations,
- Tremors
- Hair changes
Thyroid Metabolism

- Thyroid gland secretes TSH which stimulates the thyroid gland to release T4.
- 80-96% of T4 is converted to T3, and 4-20% is T3.
- 60% of T4 is converted to T3 in the liver.
- 20% of T4 is converted to RT3 in the liver.
- 20% of T4 is activated in the gut to T3.

IFM (The Institute for Functional Medicine)
>99% of circulating $T_3$ & $T_4$ are protein-bound, primarily to Thyroid-Binding-Globulin.

Thyroid function testing

- Thyroid panel: TSH, T4, FT4, T3, FT3, rT3
- Thyroid antibodies: TPO Ab, TG Ab, TSH receptor Ab, TSI, TBII
- Nutrients: Iodine, Selenium, Ferritin, CBC, Vitamin D 25-OH, RBC zinc, RBC Magnesium, Vitamin A
Thyroid function testing

- Adrenal panel, Female hormone panel
- Specialty labs: Nutritional evaluations, Iodine loading tests, Heavy metal testing, Intestinal function testing.
In NHANES III, of over 17,000 people evaluated, more than 80% had serum TSH below 2.5 mIU/L.

TPOAb prevalence was lowest (<3%) with TSH 0.1-1.5 mIU/L in women and 0.1 - 2.0 mIU/L in men and progressively increased to above 50% when TSH exceeded 20 mIU/L.

TSH upper reference limits may be skewed by TPOAb-negative individuals with occult autoimmune thyroid dysfunction.


Thyroid hormone replacement: an iatrogenic problem. - Dr. St. John O’Reilly

- The most contentious issue in clinical endocrinology.
- Early 1970s, on theoretical grounds and without proper assessment, the TSH concentration was adopted to measure of thyroxine replacement.
- TSH concentration is a poor indicator of clinical status.
- Recommendation: Give sufficient thyroxine to render them clinically euthyroid, while maintaining their serum T3 concentration within the reference range.

BMJ 2000; 321 doi: http://dx.doi.org/10.1136/bmj.321.7268.1080 (Published 28 October 2000)
Overlap between the statistically derived normal and abnormal ranges is accepted in diagnostic tests, giving rise to false positive and false negative results. These concepts have not been applied to measurements of thyroid stimulating hormone. Rather than accepting that the test can be fallible, we transfer the problem to the patient.

1. 2000;321:1080 (28 October) Thyroid function tests: time for a reassessment - Denis St. J. O'Reilly, consultant clinical biochemist
There is no data on the relative importance of biochemical thyroid function tests and clinical symptoms and signs in assessing thyroid dysfunction.

Secretion of thyroid stimulating hormone is influenced by many factors other than the negative feedback inhibition by thyroxine or triiodothyronine.

Changes in thyroid stimulating hormone, thyroxine, and triiodothyronine concentrations during systemic illness are poorly understood.
Labs T3/RT3 ratio

- 403 Elderly men looking at thyroid hormone concentrations related to changes in overall physical function
- Results: Serum rT3 increased significantly with age and the presence of disease.
- Low T3/rT3 ratio was associated with a lower physical performance score, independent of disease.
- Low FT4 was related with a better 4-yr survival; this may reflect an adaptive mechanism to prevent excessive catabolism
- “The T3/rT3 ratio is the most useful marker for the tissue hypothyroidism and as a marker of diminished cellular functioning.”
Why test Thyroid Antibodies?

- It is the most common autoimmune disease in the United States.
- It is the most common cause of hypothyroidism in the United States.

  It affects women four times more than men:
  - Up to 20% of menopausal women
  - Up to 24% of allergic women
  - 5-10% of postpartum women
Functional Ranges

TSH: <3.0 (some are using <1.5 for Hashimoto’s)
FT4: >1.2 ng/dl
FT3: >3.0 pg/ml
rT3: <20 ng/dl or <300
FT3/rT3 ratio: >20 T3/rT3 ratio: >10 (remember to use same units).
Iodine: serum >80
Ferritin: serum >70
Vitamin D: serum >50
Iodine levels checked at TCIM since 7/14

255 test ordered; (normal 52-109)

- 133 abnormal low (<52); 57%
- 214 functionally low (<80) 90%
- 18 functionally normal (>80) 10%
- 23 tests not performed
Factors that Affect Thyroid Function

- Factors that contribute to proper production of thyroid hormones:
  - Nutrients: iron, iodine, tyrosine, zinc, selenium, vitamin E, B2, B3, B6, C, D

- Factors that inhibit proper production of thyroid hormones:
  - Stress
  - Infection, trauma, radiation, medications
  - Fluoride (antagonist to iodine)
  - Toxins: pesticides, mercury, cadmium, lead
  - Autoimmune disease: Celiac

- Factors that increase conversion of T4 to RT3:
  - Stress
  - Trauma
  - Low-calorie diet
  - Inflammation (cytokines, etc.)
  - Toxins
  - Infections
  - Liver/kidney dysfunction
  - Certain medications

- Factors that increase conversion of T4 to T3:
  - Selenium
  - Zinc

- T3 and RT3 compete for binding sites

- Factors that improve cellular sensitivity to thyroid hormones:
  - Vitamin A
  - Exercise
  - Zinc
Treatment for Thyroid disorders

1- Stress management
   - Support the Adrenals
   - Reduce oxidative stress
Life is awesome!

UP BEET

Life is terrible.

DOWN BEET

SNIFF

SICK BEET

.....

DEAD BEET

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Stress response on Adrenal/Thyroid

[Diagram showing the interaction between the hypothalamus-pituitary-adrenal (HPA) and hypothalamus-pituitary-thyroid (HPT) axes in stress response]

- **Stimulatory**
- **Inhibitory**
Stress: Emotional, physical, chemical

Elevated and deficient Cortisol levels will increase conversion of T4 to rT3 and decrease the effectiveness of T3.

Textbook Functional Medicine, p. 649
Thyroid Metabolism

Influence of Oxidative Stress on thyroid hormone synthesis in thyrocytes

Vitale, G. et al. (2013) Oxidative stress and the ageing endocrine system
Nat. Rev. Endocrinol. doi:10.1038/nrendo.2013.29
Decrease Oxidative Stress

● Nutritional Detoxification diets that support mitochondrial function.
● Nutritional supplements that can support Glutathione production such as N-Acetyl Cysteine.
● Parenteral Glutathione
● Vitamin C
1- Stress management

2- Diet management:
   - reduce goitrogens
   - consider gluten free
   - eat a balanced, nutrient dense, alkaline diet
Stop eating so many vegetables. I can't seem to find anything wrong with you.
Goitrogens

- Foods that increase thyroid size by interfering with thyroid function, thus increasing TSH.
- Foods rich in sulfhydryl compounds and isoflavones that can interfere with iodination of thyroglobulin.
- Most common are Brassica Family and Soy.
Brassica Family

- Cabbage, Broccoli, Brussels sprouts, Kale, and Cauliflower
- Most studies have been done in animals with uncooked vegetables.
- Heat appears to alter sulfhydryl and isoflavones decreasing bioavailability.

Reference: TEXTBOOK of Functional Medicine, p.646
Soy and Thyroid

- Three soy powders containing different levels of isoflavones (one powder containing virtually none...a second a modest level (1 mg/kg) and a third with a high level (2mg/kg) were consumed in a crossover design study by 18 postmenopausal women for 3 months each.

- Thyroid hormones had only small changes between the groups, which authors suggested were so minor as to not be of physiologic importance.

14 trials were assessed. 13 showed either no or minimal effects of Soy on thyroid.

Some evidence suggests interference with absorption of T4 therapy by Soy.

Trends for worsening hypothyroidism with inadequate iodine levels when ingesting soy foods.

Messina M, Redmond G. Effects of soy protein and soybean isoflavones on thyroid function in healthy adults and hypothyroid patients: a review of the relevant literature. Thyroid. 2006 Mar;16(3):249-258
Yo soy bean.

Yo, what's up?
Effect of Caloric Restricted Diets

During caloric restriction

- Serum T3 concentrations decrease as a consequence of its reduced production rate from peripheral deiodination of T4.
- Serum RT3 concentrations markedly increase as a result of its decreased metabolic clearance rate.
- During caloric restriction and overfeeding serum T4 concentrations and its production and degradation are not modified.

Consider Gluten Free Diet

After 1 year on a gluten-free diet:

- Subclinical hypothyroidism normalized in 10 of 14 (71%) patients with non-autoimmune disease.
- In three of five (60%) patients with autoimmune thyroid disease (AIT), there was a shift to AIT with euthyroidism.
- In four of five subjects with no improvement in thyroid function, compliance with the diet was poor.

I don’t know, Hansel. It doesn’t look gluten free.
Treatment for Thyroid disorders

1- Stress management

2- Diet management:
   - reduce goitrogens
   - consider gluten free
   - eat a balanced, nutrient dense, alkaline diet
Treatment for Thyroid disorders

1- Stress management
2- Diet management
3- Look for and treat GI dysfunction
Testing for Intestinal Dysfunction

- Small Intestinal Bacterial Overgrowth (SIBO) is an abnormally high bacterial population in the small intestine
- Luminal bacterial modulate gastrointestinal symptoms and interfere with T4 absorption
- 54% of patients with hypothyroidism due to autoimmune thyroiditis were positive for SIBO.

Yersinia Linked to Thyroid disease

- Elevated antibody titers seen in 75% of patients with thyroid disorders compared to 8% in controls.
- Yersinia comes from contaminated meat, dairy and seafood. 2012 a consumer group found 67% of pork was contaminated with Yersinia.

Helicobacter Pylori Infection and Autoimmune Thyroiditis (AIT)

- 59 patients with AIT were evaluated.
- Prevalence of H. pylori infection was twice as high with AIT than with controls.
- Possibility exists that H. pylori may play a role in the development of autoimmune thyroid antibodies.
Treatment for Thyroid disorders

1- Stress management
2- Diet management
3- Look for and treat GI dysfunction

4- Thyroid replacement therapy
Thyroid hormone therapy

- **Synthetics:** levothyroxine (L-T4), liothyronine (T3)
- **Natural Desiccated Thyroid:** porcine glandular extracts containing 4:1 T4:T3 ratio; multiple different brands
- **Compounded thyroid combinations:** sustained release T3; as well as T4:T3 compounds
Levothyroxine effects on thyroid hormone production and metabolism

Wiersinga, W. M. (2014) Paradigm shifts in thyroid hormone replacement therapies for hypothyroidism
Nat. Rev. Endocrinol. doi:10.1038/nrendo.2013.258
Support for T3 treatment

- “Impaired psychological well-being, depression or anxiety are observed in 5-10% of hypothyroid patients receiving levothyroxine, despite normal TSH levels.”
- Increased FT4 and decreased FT3 serum concentrations, result in low FT4:FT3 ratios seen in 30% of patients.
- “Evidence is mounting that levothyroxine monotherapy cannot assure a euthyroid state in all tissues simultaneously, and that normal serum TSH levels in patients receiving levothyroxine reflect pituitary euthyroidism alone.”

Natural Dessicated Thyroid (NDT)

- NDT contain T4, T3, T2, T1 and Calcitonin.
- Prescription brands meet the strict guidelines of the US Pharmacopeia for over 100 years.
- NDT is measured in mg or grains (gr). 1 gr is typically 60-65mg of NDT
- 1gr = 38mcg (80%) T4 and 9mcg (20%) T3.
- 1gr typically = 100mcg L-T4 when converting
Nature-Throid® and WP Thyroid®

- Nature-Throid® utilizes hypoallergenic inactive ingredients and is free of dyes & coloring agents.
- Nature-Throid® is available in more strengths than any other NDT medication.
- WP Thyroid® contains only 2 inactive ingredients:
  - Inulin (from chicory root)
  - Medium Chain Triglycerides (from coconut)
- WP Thyroid® is available in 8 strengths.
More info on NDT

- Nature-Throid® and WP Thyroid® have never been recalled for inconsistent hormone content.
- Nature-Throid® and WP Thyroid® are blended at +/- 2% variance in hormone content. US Pharmacopeia allows up to +/- 10%.
- Nature-Throid® and WP Thyroid® are formulated to be gluten free and only uses hypoallergenic inactive ingredients.
- Armour® is formulated using dextrose/cornstarch, an inactive ingredient many corn sensitive patients try to avoid.
• NP THYROID®, “ACELLA”, is a newer generic brand of desiccated thyroid and can be taken sublingually.
• Nature-Throid® and WP Thyroid® are available to be sold in physician offices as well as pharmacies.
• Armour® and NP THYROID® are only available in pharmacies.
Natural Dessicated Thyroid vs L-T4

- 70 patients with hypothyroidism on L-T4.
- Randomized for 16 weeks on either NDT or L-T4 then switched for 16 more weeks.
- No difference in symptoms BUT
- NDT lost 3 lbs on average more than L-T4
- 48% of patients preferred NDT over L-T4

J Clin Endocrinol Metab. 2013 May;98(5):1982-90
Treatment for Thyroid disorders

1- Stress management
2- Diet management
3- Look for and treat GI dysfunction
4- Thyroid replacement therapy
5- Targeted nutritional supplementation
Factors that contribute to proper production of thyroid hormones

- Nutrients: iron, iodine, tyrosine, zinc, selenium, vitamin E, B2, B3, B6, C, D
Factors that increase conversion of T4 to T3
- Selenium
- Zinc

T3 and RT3 compete for binding sites

Factors that improve cellular sensitivity to thyroid hormones
- Vitamin A
- Exercise
- Zinc
Zinc

- This study evaluated T3 and T4 levels in 134 disabled individuals.
- 13 had low levels of serum free T3 with normal T4.
- 9 of 13 patients had mild to moderate zinc deficiency.
- After supplementation of zinc sulfate at 4 to 10 mg/kg of body weight for 12 months levels of serum free T3 and T3 normalized and serum rT3 decreased.
- The deiodinase type II enzyme is a zinc protein. Zinc containing cofactors may be needed for the deiodination process.

Two zinc-deficient, active, female college students received zinc supplementation (26 mg/day of zinc gluconate) for 4 months. After 4-months zinc deficiency was observed to be clinically corrected in both subjects.

Resting metabolic rate (RMR) and Total T3 increased in both subjects.

However there was decline in serum ferritin levels <20 in both subjects.

Conclusion: “Zinc supplementation appeared to have a favorable effect on thyroid hormone levels, particularly total T(3), and RMR.”
Selenium

- Selenium + iodine increases the regulatory immune cells which prevent the development of autoimmune diseases.

- Selenium plays an essential role in thyroid hormone synthesis because two enzymes involved in thyroid hormone production are selenoproteins: the deiodinases and glutathione peroxidase.

- Necessary for the body to produce glutathione peroxidase, which detoxes pesticides, mercury, chlorine and bromide.

Selenium

- Effect of selenium supplementation in hypothyroid subjects of an iodine and selenium deficient area: the possible danger of indiscriminate supplementation of iodine-deficient subjects with selenium.
- High amounts of iodine without selenium induces AIT (Autoimmune Thyroiditis) and goiter.
- Selenium + iodine reduces goiter and inflammation of the thyroid gland.
- Selenium supplementation reduces TgAb that may be elevated by taking iodine.
- TPOAb antibody levels were inversely associated with selenium levels (if you have high selenium, you have low antibodies and vice versa).

Selenium and Zinc

- Low T3/T4 ratio may be related to impaired zinc and/or selenium status.

- Supplementation was associated with modest changes in thyroid hormones, with an earlier normalization of T4 and RT3 plasma levels.

Iron deficiency impairs thyroid hormone synthesis by reducing the activity of heme-dependent thyroid peroxidase.

Iron-deficiency anemia blunts and iron supplementation improves, the efficacy of iodine supplementation.

Serum iron concentrations were lower in participants with subclinical hypothyroidism than euthyroid subjects. In euthyroid subjects, small differences in thyroid function are associated with significant differences in erythrocyte indices.

Iodine

Double Edged Sword

- Diets both low and high in iodine are associated with hypothyroidism
- Studies that have shown that both low and high urinary iodine excretion are associated with hypothyroidism
- High intake of iodine may increase the risk of Hashimoto’s thyroiditis

Duarte GC, et al., J Pediatr Endocrinol Metab. 2009 Apr;22(4):327-34.
Supraphysiologic levels of iodine

The effect of on patients with Cyclic Fibrocystic Mastalgia

- A randomized, double-blind, placebo-controlled, multicenter clinical trial was conducted with 111 otherwise healthy euthyroid women with a history of breast pain given either placebo, 1.5mg, 3mg or 6mg of molecular iodine for 6 months.
- Patients had to document severity of pain each menstrual cycle.
- Physicians assessed breast pain, tenderness, and nodularity each cycle; patients assessed breast pain and tenderness with the Lewin breast pain scale and with a VAS at each cycle.
- Reduced pain scores in the 3mg/6mg treatment groups after 3 months, with 50% of 6mg group responding significantly.
- Improvements in physical findings were documented after 5 months of treatment in 3mg/6mg groups only with NO ADVERSE EFFECTS in all groups.

Hyperthyroidism, Graves' Disease, Thyroid Storm:

- According to secondary sources, as an adjunct to prescription drug inhibitors of thyroid function (such as propylthiouracil or methimazole), saturated solution of potassium iodide, 1-5 drops by mouth every eight hours, or Lugol solution (8mg of iodide per drop), 2-6 drops (1mL) every eight hours, has been used.
- Lower doses may be used in pregnancy.
# Supratherapeutic Iodine Supplementation

## Effects of a Daily Dose of 100 mg Iodine/Iodide with and without Vitamins B₂ and B₃ on Thyroid Function Tests in 5 Subjects with Fibromyalgia

<table>
<thead>
<tr>
<th></th>
<th>TSH (mIU/L)</th>
<th>Total T₄ (µg/dl)</th>
<th>Free T₄ (ng/dl)</th>
<th>Total T₃ (ng/dl)</th>
<th>Free T₃ (pg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X ± SD</td>
<td>X ± SD</td>
<td>X ± SD</td>
<td>X ± SD</td>
<td>X ± SD</td>
</tr>
<tr>
<td><strong>Pre-Intervention</strong></td>
<td>1.35 ± 0.26</td>
<td>7.4 ± 2.7</td>
<td>1.1 ± .21</td>
<td>149 ± 35</td>
<td>3.1 ± .29</td>
</tr>
<tr>
<td><strong>Post-Phase I</strong></td>
<td>4.1 ± 1.4</td>
<td>6.6 ± 2.3</td>
<td>.93 ± .12</td>
<td>126 ± 24</td>
<td>2.9 ± .46</td>
</tr>
<tr>
<td><strong>Post-Phase II</strong></td>
<td>5.2 ± 2.1</td>
<td>7.1 ± 2.4</td>
<td>0.96 ± .18</td>
<td>151 ± 42</td>
<td>3.0 ± 0.5</td>
</tr>
<tr>
<td><strong>Pre vs Post-Phase I p Value</strong></td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>NS</td>
<td>&lt;0.05</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Pre vs Post-Phase II p Value</strong></td>
<td>&lt;0.05</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>
Vitamin B2/B3

- Supports production of adrenal hormones.
- Stimulates mitochondria to produce more energy.
- Aids proper organification of iodine in thyroid for AIT patients.
- Clears brain fog, chronic fatigue, pain and other symptoms associated with fibromyalgia.

The Original Internist, Vol. 15, No. 1, pg. 8-15, March 2008
Vitamins A and D: The Prohormones

- Like T3, Vitamin A (retinoic acid) and Vitamin D (1,25-dihydroxycholecalciferol) and hormones that affect gene expression by binding nuclear receptors.

- Research suggests that vitamin A may provide functional support that contributes to the regulation of thyroid hormone responsive genes.

Factors that either produce vitamin A (retinol) insufficiency or prevent the conversion of vitamin A to retinoic acid may result in reduced thyroid nuclear signaling

Vitamin D Link to Autoimmune Thyroid

- VDR Gene polymorphism was found to associate with autoimmune thyroid diseases (AITDs).
- The prevalence of vitamin D deficiency was significantly higher in patients with AITDs compared with healthy individuals.
- Significantly low levels of Vitamin D were documented in patients with AITDs that were related to the presence of anti-thyroid antibodies and abnormal thyroid function tests, suggesting the involvement of vitamin D in the pathogenesis of AITDs and the advisability of supplementation.

Vitamin D

“Our study revealed that impaired vitamin D3 metabolism may play an important role in thyroid follicular cell oncogenesis.”

Vitamin E

- Animal research suggests that vitamin E may support the conversion of T4 to T3 by influencing hepatic 5’-deiodinase activity.

- It may accomplish this by protecting the stability of cell membranes in which 5’ - deiodinase exists.

Are you guys like, European or something?
No, we’re organic.
Tyrosine

- Tyrosine is made from phenylalanine.
- Building block for epinephrine, norepinephrine, and dopamine as well as melanin.
- It combines with iodine in Thyroid gland to make MIT, DIT, T3 and T4.
- It's rare to be deficient in tyrosine. Low levels have been associated with low blood pressure, low body temperature, and an underactive thyroid.
- No clear evidence that taking tyrosine supplements will help with thyroid function and may boost dopamine levels potentially increasing RT3 levels.

http://umm.edu/health/medical/altmed/supplement/tyrosine
**Bladderwrack**

- A source of iodine, which supports thyroid hormone synthesis.
- May benefit thyroid function not only by providing iodine, but also because the iodine-containing compounds in bladderwrack may compete for uptake of potentially toxic compounds.
- There is also evidence that polysaccharides in bladderwrack may bind heavy metals, such as lead mercury and cadmium, which can interfere with thyroid function.

Ashwagandha (Withania Somnifera) -

- Animal testing suggests that ashwagandha enhances adaptability of both physical and chemical stress.
- Mice pretreated and subjected to swimming stress showed increased endurance as compared to untreated mice, without adrenal hypertrophy, ascorbic acid depletion, or corticosterone depletion typically seen in stress reactions.
- Anabolic activity and changes in stress related prostaglandin and catecholamine production are seen
Possible dosing - Expert opinion

- Iodine 300mcg - 100mg/day
- Selenium (selenomethionine) 150-300mcg
- Zinc 15-60mg (add 1-2mg Copper for long term therapy)
- Iron bisglycenate 30-65mg for low ferritin levels
- Vitamin A 10-20,000 iu per day
- Vitamin B2 (riboflavin) 50-100mg
- Vitamin B3 (niacinamide) 500-1000mg
- Vitamin D3 2000-5000 iu
- Ashwaganda 75-150mg/day
- Bladderwrack 150mg/day
- Vitamin C 1000mg per day
Treatment for Thyroid disorders

1- Stress management (support the Adrenals)
2- Diet management (reduce goitrogens, consider gluten free, eat a balanced nutrient dense alkaline diet, include sea salt)
3- Look for and treat GI dysfunction
4- Thyroid replacement therapy (Consider NDT first)
5- Targeted nutritional supplementation
6- Avoid or reduce exposure to thyroid disruptors and support their elimination
Factors that contribute to proper production of thyroid hormones
- Nutrients: iron, iodine, tyrosine, zinc, selenium, vitamin E, B2, B3, B6, C, D

Factors that inhibit proper production of thyroid hormones
- Stress
- Infection, trauma, radiation, medications
- Fluoride (antagonist to iodine)
- Toxins: pesticides, mercury, cadmium, lead
- Autoimmune disease: Celiac

Factors that increase conversion of T4 to RT3
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Factors that increase conversion of T4 to T3
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- Zinc

T3 and RT3 compete for binding sites

Factors that improve cellular sensitivity to thyroid hormones
- Vitamin A
- Exercise
- Zinc
# Thyroid disruptors

<table>
<thead>
<tr>
<th>Thyroid Disruptors</th>
<th>Mechanism</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perchlorates, thiocyanate, nitrate, bromates, phthalates</td>
<td>Blocking uptake of iodide into thyroid cell</td>
<td>Decreased synthesis of T3 and T4</td>
</tr>
<tr>
<td>Methimazole, amitrole, soy isoflavones, benzophenone 2</td>
<td>Blocking production of TPO in thyroid follicles</td>
<td>Decreased synthesis of T3 and T4</td>
</tr>
<tr>
<td>PCBs, pentachlorophenol, flame retardants, phthalates</td>
<td>Competitive binding to thyroid transport protein (TTR)</td>
<td>Possible effect on fetal brain T4 production</td>
</tr>
<tr>
<td>Dioxin, PBDE, chlordane</td>
<td>Altering transport across cell membrane</td>
<td>Increased biliary elimination of T3 and T4</td>
</tr>
<tr>
<td>Acetochlor (herbicide), PCBs</td>
<td>Enhanced hepatic metabolism</td>
<td>Increased biliary metabolism of T3 and T4</td>
</tr>
<tr>
<td>PCBs, triclosan, pentachlorophenol, dioxin, difuran</td>
<td>Inhibition of sulfation</td>
<td>Decreased sulfation of thyroid hormones leading to possible decrease of peripheral T3 synthesis</td>
</tr>
<tr>
<td>FD&amp;C red dye #3, PCBs, octyl methoxycinnamate</td>
<td>Inhibition of deiodinase activity</td>
<td>Decreased peripheral T3 synthesis</td>
</tr>
<tr>
<td>PCBs, bisphenol A, hexachlorobenzene, flame retardants</td>
<td>Altering binding to thyroid receptor</td>
<td>Altered thyroid hormone directed gene transcription</td>
</tr>
<tr>
<td>DDT, PCBs</td>
<td>Inhibiting TSH receptor</td>
<td>Decreased production of T3 and T4</td>
</tr>
</tbody>
</table>

Key: ↑ = up-regulation, ↓ = down-regulation, ↔ = interference.

- Hypothalamus
  - TRH
  - T3
  - T4
  - TSH
  - Pituitary
  - Thyroid gland
  - Bloodstream
  - Liver
  - NIS
  - TPO
  - T4, T3
  - Albumin
  - Cellular Transporters
  - Thyroid-sensitive cell
  - Peripheral conversion (liver, kidney, brain, etc.)

TTR = transthyretin, Tg = thyroglobulin, TSH = thyroid-stimulating hormone, TRH = thyrotropin-releasing hormone, TPO = thyroperoxidase, NIS = sodium-iodide symporter.
Heavy Metals and Halogens

- Cadmium
- Mercury
- Lead
- Fluoride
- Bromide

Factors that inhibit proper production of thyroid hormones:
- Stress
- Infection, trauma, radiation, medications
- Fluoride (antagonist to iodine)
- Toxins: pesticides, Hg, Cd, Pb
- Autoimmune disease: celiac

RT3   T3
Treatment options

1- Stress management
2- Diet management (reduce goitrogens, consider gluten free, balanced nutrient dense alkaline diet)
3- Look for and treat GI dysfunction
4- Thyroid replacement/support therapy
5- Targeted nutritional supplementation
6- Avoid or reduce exposure to thyroid disruptors and support their elimination
CASE #1 Melissa, Female age 39  
(Initial Visit 10/7/2014)

Patient Chief Complaints: (LT-4 75 ug, but not last 8 mos)  
Partial thyroidectomy for Graves Disease 18 months ago.  
Complains of extreme fatigue, malaise, insomnia, GI distress,  
depression, frequent headaches, dizziness, weight gain, hair changes,  
constipation.

Multiple Symptoms Questionnaire: 62

Tests ordered: Thyroid panel, ferritin, Iodine (serum/plasma), TPO and  
TG Ab, CBC, Adrenal panel: DHEA, DHEA Sulfate, Cortisol (a.m.),  
Comprehensive Metabolic Panel, GGT, Hemoglobin A1c
Care Plan:

- Natural Desiccated Thyroid 16.25 mg 3 tablets
- Herbal Adrenal Support
- Probiotic - (1 capsule per day)
- Omega 3 DHEA/EPA (1 capsule by mouth daily)
- Multivitamin (1 tablet by mouth daily)
- Methyl B12/methyl folate/B6/B complex injections once weekly for 10 weeks.
- Insomnia: Herbal tea with valerian root, chamomile and lemon balm.
Follow Up Visit: Two weeks later

Chief Complaints:
STILL - Fatigue, Insomnia, Headaches, Constipation, Nausea, and Cold Intolerance

Labs:
BMP, hs CRP, A1C, GGT - WNL, CBC (RBC 3.59), Hemoglobin A1C 5.5%, Ferritin low 13, TSH 8.38, Free T3 2.4, T3 83, Free T4 0.76, T4 4.7, RT3 15, TPO Ab >900, TG Ab 54, DHEA Sulfate 292, a.m. Cortisol 5.8
Follow up Care Plan:

- Natural Desiccated Thyroid 47.25 mg (¾ gr in am) and 16.25mg (¼ gr) at night
- Thyroid support supplement (Selenium, Iodine, Vitamin A, Vitamin B2, Vitamin B3, Zinc)
- Referral to Lifestyle Educator for 5-R gut repair.
Lifestyle Med visit - Two weeks later

Therapeutic approach:
Counselling on stress management techniques, reviewed therapeutic lifestyle treatment options
Continued previous Nutritional supplements
5-R Bowel Repair - Gluten Free, dairy free, soy free, sugar free and corn free diet.
Broad spectrum probiotic and a gut supporting anti-inflammatory medical food twice daily for 4-8 weeks.
Follow-up Visit 1/2/2015

Chief Complaints:
Headaches - much improved
Insomnia - much improved, anxiety improved as well
GI Distress - improved prior to holidays
Autoimmune Thyroid - Stable
Depression - Much improved
Multiple Symptoms Questionnaire: Score 14
CASE #2
Take home points

1- Scarcity of studies on nutritional supplements and thyroid
2- TSH measures pituitary function only therefore treat patients not labs.
3- RT3 helps in looking at T4 to T3 conversion and evaluating clinical hypothyroidism.
4- Free T3 can be helpful in looking at cellular function.
5- Support T3 levels in the body with triiodothyronine or natural desiccated thyroid.
6- Check for and replace iodine and iron stores.
7- Consider supra-physiologic doses of iodine/potassium iodide in hypothyroid patients who have fibrocystic breasts and fibromyalgia.
8- Consider Selenium and Zinc to help with T4- T3 conversion.
9- Ensure adequate Vitamin D and A levels for cancer prevention.
10- Improve gut function by treating infections, overgrowth and avoiding gluten, particularly in autoimmune thyroid patients.
11- Encourage optimal stress management and support hypothalamus-pituitary-adrenal axis.
12- Reduce exposure to thyroid disruptors and support their elimination.
References - Helpful Books

Textbook of Functional Medicine - The Institute for Functional Medicine 2010 (The Global Leader in Functional Medicine Education)

Overcoming Thyroid Disorders - David Brownstein, M.D.

Hashimoto’s Thyroiditis - Lifestyle Interactions for Finding and Treating the Root Cause - Izabella Wentz, PharmD, FASCP with Marta Nowosadzka, M.D.

Why Do I Still Have Thyroid Symptoms? When My Lab Tests are Normal - Datis Kharrazian, DHS, DC, MS