Iodine

Common indications:

- Thyroid Health
- Preventative Breast Protection
- Fibrocystic Breast Disease and Cyclic Mastalgia
- Prevention of radiation-induced thyroid cancer
- Improved Cognitive Function During Childhood
- Antioxidant

General Comments:

Most information presented regarding iodine is regarding thyroid health. While iodine does play an important role in thyroid activity, there is data that shows that iodine also plays a role in other body functions. Iodine is also absorbed into and used in breast tissue, salivary glands, the pancreas, the stomach, the brain, cerebrospinal fluid, the thymus, and the skin.

Benefits & Mechanism of Action:

Thyroid Health

Iodine is a non-metallic trace element that is required for synthesis of thyroid hormones. Iodine is necessary component of thyroxine (T4) and triiodothyronine (T3). The synthesis of T4 and T3 is crucial to the body because they affect growth, maturation, thermogenesis, oxidation, myelination of the CNS and the metabolism of all tissues.[1]

Preventative Breast Protection

Animal models have shown that iodine deficiency changes the mammary gland making it more sensitive to the effects oestradiol.[2] Iodine is associated with the synthesis of alpha-oestrogen-receptors, down-regulation of several oestrogen-responsive genes, and increased expression of cytochrome P450 genes (increasing phase 1 detoxification).[2,3]

Fibrocystic Breast Disease and Cyclic Mastalgia

Hormone changes may trigger non-cancerous breast tissue changes. Studies observed that women who have hypothyroidism with nodular goiter, Hashimoto thyroiditis, or

anti-thyroid autoimmunity have a higher frequency of benign breast diseases.[4,5] Treatment with iodine has been shown to clinically significantly reduce pain (breast specific and overall) but doses are higher than the tolerable upper level and should be used with close supervision.[5,6,7]

Prevention of Radiation-Induced Thyroid Cancer

In the instance of a nuclear reactor accident, like Chernobyl, radioactive iodine is one of the elements that may be released in the environment. Persons in the affected areas are at greater risk for absorbing the radioactive iodine and developing cancer in the thyroid.[8] Large doses of potassium iodide (up to 130 mg for adults[9]) within 48 hours before or eight hours after exposure to radiation can significantly reduce the uptake of radioactive iodine into the thyroid.[10] The difference in instances of childhood thyroid cancer between nuclear accidents where potassium iodide was and was not used is significant. This has prompted the Nuclear Regulatory Commission (NRC) requires that consideration be given to the administration of potassium iodide in the event of a nuclear reactor accident.[11]

Improved Cognitive Function During Childhood

Iodine supplementation was shown to positively affect physical and mental development in a 2004 Cochrane review.[12] A 2009 randomized, placebo-controlled study from New Zealand looked at the effect of iodine supplementation in mild iodine deficiency. It showed significantly improved measures of perceptual reasoning and overall cognitive score.[13]

Antioxidant

Elevated levels of thyroid-stimulating hormone (TSH), from insufficient T4 and T3 hormone production, can lead to an increase of peroxide levels in the body.[14] Iodine acts indirectly as an antioxidant by helping the body to manufacture more T4 and T3 hormones (see Thyroid Health).

Dose:

Thyroid Health, Preventative Breast Health, Improved Cognitive Function During Childhood, Antioxidant

DRI[15]*

- 0-6 months: 110 mcg
- 7-12 months: 130 mcg
- 1-8 years: 90 mcg
- Boys 9-13 years: 120 mcg
- Girls 9-13 years: 120 mcg
- Boys 14-18 years: 150 mcg

- Girls 14-18 years: 150 mcg
- Men 19 years and older: 150 mcg
- Women 19 years and older: 150 mcg
- Pregnant women 14 years and older: 220 mcg
- Lactating women 14 years and older: 290 mcg

Tolerable Upper Limits[15]**

- 1-3 years: 200 mcg
- 4-8 years: 300 mcg
- 9-13 years: 600 mcg
- 14-18 years: 900 mcg
- 19 years and older: 1,100 mcg
- Pregnant women 14-18 years: 900 mcg
- Pregnant women 19 years and older: 1,100 mcg
- Lactating women 14-18 years: 900 mcg
- Lactating women 19 years and older: 1,100 mcg

Prevention of Radiation-Induced Thyroid Cancer

- 16-130 mg daily (depending on age)[9]

Fibrocystic Breast Disease and Cyclic Mastalgia

- 1.5-6 mg daily for 6-18 months[5,6,7]

* The Dietary Reference Intakes (DRI) are the most recent set of dietary recommendations established by the Food and Nutrition Board of the Institute of Medicine, 1997-2001. They replace previous RDAs, and may be the basis for eventually updating the RDIs.

** In an attempt to prevent symptoms of iodine toxicity, the **Institute of Medicine** established Tolerable Upper Intake Levels (TUL) for iodine.

Symptoms of Deficiency:

A deficiency of iodine results in the enlargement of the thyroid gland, a condition known as a goiter, and hypothyroidism.[15] Additional findings associated with iodine deficiency are fibrocystic breast changes[2] and cretinism.[16]

Conditions that leave a patient with an increased need for iodine include:

- Secondary prevention of goiter after thyroid surgery
- Pregnancy[17]
- Selenium deficiency[18]
- Exposure to radiation[8]
- Birth mother iodine-deficient during pregnancy[17,19]
- Smoking[20]

Foods and supplements that may decrease iodine (Goitrogens):

- Foods that contain compounds metabolized into thiocyanate, which block thyroidal uptake of iodine, include Brussel sprouts, almonds, rapeseed, beans, peanuts, cabbage, spinach, turnips, carrots, beets, broccoli, cauliflower, peaches, pears, flax, and kale.
- Soybeans contain genistein and daidzein, isoflavones that inhibit thyroid hormone synthesis.
- Bromine, fluoride and chlorine can displace iodine in the body.[21] Foods with higher amounts of chloride include rye, tomatoes, celery, olives, and tomatoes. Sucralose (Splenda) contains chlorinated table sugar. Fluoride is found in grape products, dried fruit and beans, cocoa powder, and walnuts. Bromine can be found in pasta, breads, and citrus-flavored soft drinks.

Environmental pollutants that may reduce iodine include perchlorate, resorcinol, and phthalic acid.[16,22]

Side Effects and Warnings:

Chronic excessive intake of iodine may cause an enlargement of the thyroid gland that resembles a goiter. The condition is called “iodine goiter”.

Symptoms that may indicate acute toxicity include:[23,24,25]

- Gastrointestinal irritation
- Abdominal pain
- Nausea and vomiting
- Diarrhea
- Burning mouth
- Weak pulse
- Cyanosis
- Increased salivation
- Swelling of the parotid and submandibular glands
- Metallic taste
- Soreness of the teeth and gums
- Severe Headache
- Pulmonary edema and angioedema
- Muscle pain and weakness
- Itching
- Transient increase in breast pain
- Acne-like skin lesions

Food Sources:

Seafood is rich in iodine because marine animals can concentrate the iodine from seawater. Contrary to what many people believe, shellfish does not contain the highest amounts of iodine.[26] Other salt water fish such as cod, perch, sea bass and haddock contain a much higher level of iodine than shrimp or lobster. In addition, things like kelp and seaweed are also great

sources of iodine. Other good sources of dietary iodine include eggs, fruit, grain products, and poultry.

Nutrient Interactions:

Selenium

Selenium is an integral part of the iodine recycling pathway. Conversion of T4 to T3 is completed using enzymes that contain selenium, iodothyronine deiodinases (DIOs). DIO1 may be used to regulate iodine homeostasis.[27] An additional selenium-based enzyme, glutathione peroxidase, protect the thyroid gland from hydrogen peroxide-induced damage during T4 and T3 synthesis.[28]

Iron

Thyroid metabolism is affected by iron multiple ways. A deficiency in iron can alter the TSH response of the pituitary gland and reduce the activity of thyroid peroxidases that catalyze the iodination of thyroglobulin for the production of thyroid hormones.[29] A deficiency in iron also affects iodine in the liver by limiting the conversion of T4 to T3, increasing T3 turnover, and decreasing T3 binding to the nuclear receptors.[29]

Vitamin A

A deficiency in Vitamin A can increase the synthesis and secretion of TSH, increase the size of the thyroid gland, reduce the iodine uptake by the thyroid gland, impair the synthesis and iodination of thyroglobulin, and increase the circulating concentrations of thyroid hormones.[30]

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Thyroid Health

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Preventative Breast Protection

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Fibrocystic Breast Disease and Cyclic Mastalgia

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Improved Cognitive Function During Childhood

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Antioxidant

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Dosage

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Symptoms of Deficiency

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Side Effects and Warnings

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