Promoting Healthy Thyroid Function with Iodine, Bladderwrack, Guggul and Iris

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ABSTRACT

Iodine is an essential component of thyroid hormones and is therefore essential for normal thyroid function. However, the therapeutic use of iodine requires careful evaluation because of its narrow range of intake to support optimal thyroid function. The combination of naturally occurring compounds such as Gum Guggul (*Commiphora mukul*), Blue Flag root (*Iris versicolor*) and seaweeds such as Bladderwrack (*Fucus vesiculosus*) has shown beneficial effects in the treatment of thyroid dysfunction. These compounds have different mechanisms of action and may act synergistically to support thyroid health in conditions such as Hashimoto's disease and subclinical hypothyroidism. *Fucus* provides iodine and upregulates the production of iodine-processing hormones, while *Commiphora* enhances the conversion of T4 to T3, and *Iris* is a detoxifying agent. These three agents have been used in combination with Nettle leaf *(Urtica),* Ashwagandha (*Withania*), Triphala, and Bacopa (*Bacopa monnieri*), and with supplements supporting basal metabolism and general thyroid function such as L-tyrosine, diiodotyrosine, magnesium, selenium, and iron. Reported side effects include the induction of iodine sensitivity by Bladderwrack and hypersensitivity reactions such as rash and pruritis caused by Guggul. The use of Guggul and Iris is not recommended during pregnancy.

Keywords: Thyroid function, Thyroid hormones, Iodine, Essential nutrient

CLINICAL IMPLICATIONS

Gum Guggul (*Commiphora mukul*), Blue Flag root (*Iris versicolor*) and seaweeds such as Bladderwrack (*Fucus vesiculosus*) are naturally occurring compounds that may aid in the treatment of hypothyroidism. Because these work via different mechanisms, they may be combined to synergistically support the thyroid—particularly in situations of thyroid hypofunction and Hashimoto's Disease. *Fucus* provides iodine and upregulates iodine-processing hormones; *Commiphora* enhances peripheral conversion of T4 to T3; *Iris* provides gentle glandular stimulation and detoxification. These three herbs nourish the thyroid gland by enhancing its normal metabolic functions. Individuals with high cholesterol, slow digestion, slow metabolism, or low body temperature may benefit from the use of these herbal remedies.

PRIMARY INDICATIONS

Hashimoto's Disease, Low Body Temperature, Subclinical hypothyroidism

ADJUNCTIVE OR STAND-ALONE TREATMENT

Adjunctive

DOSE OF BIOACTIVE CONSTITUENTS

Gum Guggul, or Guggul Myrrh extract (*Commiphora*) 80-900 mg per day; Bladderwwrack (*Fucus)* 100 mg to 5 grams a day. Blue Flag root (*Iris*) 400-2400 mg a day

SYNERGISTIC HERBAL FORMULA

Blue Flag root (*Iris*), Guggul Myrhh Gum; *(Commiphora)*, and Bladderwrack *(Fucus), Nettle leaf (Urtica),* Ashwagandha (*Withania*), Triphala, and Bacopa (*B. monnieri*) combine well together due to varied and complementary mechanisms of action. Other supplements that support basal metabolism and general thyroid function include L-tyrosine, diiodotyrosine, magnesium, selenium, and iron (for anemic patients).

SIDE EFFECTS (AND CAUTIONS)

Bladderwrack showed no toxicity on acute and subacute (4 weeks) testing.[1] Bladderwrack has induced iodine sensitivity in some patients. Guggul can cause hypersensitivity reactions including rash and pruritis. Guggul and Iris are not recommended in pregnancy.

UNSUBSTANTIATED THEORETICAL SIDE EFFECTS

Bladderwrack contains mucopolysaccharides which may inhibit the absorption of pharmaceutical medications, including strontium. It may also increase the risk of bleeding when used in combination with anticoagulants and anti-platelet medications. Guggul may increase the risk of bruising and bleeding if taken with anticoagulants or antiplatelet medications. Guggul may be additive or antagonistic with other herbs that have estrogenic activity.

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DISCUSSION

Centuries before the discovery of iodine in 1811 by Bernard Courtois (a French chemist and saltpeter manufacturer), seaweed was used to treat enlarged thyroid glands. K.E. Hung—a Chinese physician (A.D. 281-361)—used seaweed in the treatment of goiter. Five-hundred years later, Wang Tao had 36 formulas for the treatment of goiters, and 27 contained seaweed. In the nineteenth century, iodine was often called "the universal medicine", and considered a panacea for all human ills. It was included in the treatment of every infectious disease, and the common motto was "if nothing else works, try iodine".

In 1813, Gay-Lussac (who discovered chloride) named it 'iode', from two Greek words meaning violet-colored; it was changed in the 1930s to "iodin" which evolved into 'iodine'. J.F. Coindet, in 1819, discovered iodine to be the active ingredient in seaweed. In 1820, he first used tincture of iodine to treat simple goiters. In 1829, Jean Lugol added iodine to potassium and Lugol's iodine solution (potassium iodide [KI]) became the standard treatment for goiters. In 1850, the French physician, G.A. Chatin, demonstrated an association between low iodine intake and the prevalence of a goiter. In 1920, iodized salt became the norm for the treatment of goiters instead of Lugol's solution. Hungarian Nobel Laureate Szent-Gyorgyi ingested one gram of KI/day to stay fit. He stated:

"Nobody knew what it did, but it did something and did something good. We students used to sum up the situation in the little rhyme: If ye don't know where, what or why, prescribe ye then, K and I."

IODINE AS AN ESSENTIAL NUTRIENT

Iodine is essential to thyroid function and is a component of thyroid hormones. However, iodine needs to be maintained within a narrow range for optimal thyroid function. Both too little and too much iodine are well documented to suppress thyroid gland function (or, less often, over-stimulate the thyroid). Besides seaweed, rich sources of iodine are animal products such as milk, fish and eggs. Part of the iodine content in milk has been due to the use of iodine-containing disinfectants in dairy silos and processing equipment, but this has significantly diminished due to changes in both cattle feed and a phase-out of iodine dairy sanitizers. The iodine content of cow's milk can be increased by adding seaweed to the bovine diet.[2] Of note, strict vegans practitioners are at particular risk for iodine deficiency because of limited dietary sources.[3]

The thyroid gland actively absorbs iodine; it combines iodine with tyrosine in enzymatic reactions to synthesize thyroxine and triodothyronine, the active thyroid hormone. While small doses of iodine—in the range of micrograms —appear to stimulate thyroid function and induce the iodinase and thyroxine synthesis enzymes, large doses of iodine (in the range of 500 mg/day) will suppress thyroid function.

Even minute, physiologic doses of iodine should be administered with caution if a thyroid dysfunction is not well understood. Some people (especially peri-menopausal women) can develop a complex situation of 'on/off' hyperfunction/hypofunction thyroid disorder, where the use of therapeutic iodine must be carefully evaluated. Some individuals may also display a reaction to iodides such as KI solution, where tiny doses suppress and larger doses stimulate. Thus, administration of iodine in a hyperthyroid patient could produce a dangerous thyroid storm—not the desired result.

High doses of iodine may be effective in treating hypothyroidism if caused by iodine deficiency. However it can potentially exacerbate the autoimmune response in some patients. In these patients, iodine should be removed from the Complementary Alternative Medicine (CAM) treatment protocol. Herbal and nutritional medicine is not a substitute for thyroid hormone replacement therapy, although it may be complementary and used in tandem.

THE RELATIONSHIP OF IODINE INTAKE AND GOITER

Ongoing iodine deficiency will typically result in goiter and low thyroid function. Endemic goiter is defined as 10% or more of a given local population having enlarged thyroid glands. Enlarged

thyroid glands are typically associated with iodine deficiency in the local soil composition. Human populations in industrialized nations no longer eat locally; therefore, the occurrence of goiter may be more of an individual deficiency rather than a local deficiency in many parts of the world. However, in some parts of the world, endemic goiter may result from excessive iodine intake where seaweed is a staple part of the diet. The World Health Organization uses the term 'iodine deficiency disorder' and estimates that more than 800 million people are affected and at risk of health problems from inadequate iodine intake.[4] Goiter is only one sign of iodine deficiency. Iodine deficiency can produce systemic symptoms in adults but is particularly problematic during gestation and infancy, where iodine deficiency can lead to cretinism, other forms of mental retardation, congenital heart disease, reproductive problems, and a myriad of birth defects.

Iodine deficiency can also cause oxidative stress in the body.[5] When iodine is not present to produce thyroid hormones, high levels of TSH result and lead to free radical formation. This oxidative stress is particularly likely when selenium deficiency is also present. All of the iodinase and peroxidase enzymes are selenium-dependent; selenium and iodine work synergistically. Selenium can affect iodine metabolism, homeostasis, and bioavailability, and thereby play a role in thyroid function.[6]

Iodine deficiency during gestation can cause abnormal brain and endocrine development. In known iodine deficient areas of the world, iodine supplementation during pregnancy is recommended. On the other hand, excessive intake of iodine during pregnancy is known to lead to transient hypothyroidism in newborns due to suppressive effects on the thyroid. Maternal consumption of over 2 to 3 grams of iodine per day is associated with severe thyroid suppression.[7] Therefore, the current recommendation for pregnant women is 300 μg per day.[8]

However CAM practitioners will often safely prescribe 12 mg a day.

BLADDERWRACK AS A SOURCE OF IODINE

Bladderwrack (*Fucus vesiculosus* [a member of the *Fucaceae* family]) is a genus of brown algae found in intertidal, rocky seashores of the temperate zone—especially the Pacific Ocean. Bladderwrack has been used as food and medicine for centuries, particularly in Asian cultures. *Fucus* was termed "Bladderwrack" because little air-filled bladders (or flotation devices) keep it in the upper regions of the sea (*i.e.,* close to the ocean surface). *Fucus* is often known as kelp, the name given to the alkaline ashes that were used as an alkali agent to make soap. *Fucus vesiculosus* contains the flavonoid fucoxanthin [9] and is reported to have the highest antioxidant activity of the edible seaweeds.[10]

Seaweed, being high in numerous minerals and halides including iodine, may enhance thyroid function when consumed in appropriate amounts; however, it may suppress thyroid function when consumed daily and in large amounts. In Japan, where seaweed is a dietary staple, the daily average intake of iodine has been estimated between 2 to 12 mg per day[9,12] which is well above the US Recommended Daily Allowance (RDA).

In seaweeds tested, iodine content was highest in young, freshly-cut blades and lowest in sun-dried form.[13] In the 12 species tested, iodine levels varied from 16 μg per gram in nori (*Porphyra tenera*) to 8165 μg per gram in processed kelp granules made from *Laminaria digitata*. Because of the variable and sometimes large doses of iodine in these natural products, physicians should ask patients with hyper/hypothyroidism about seaweed consumption in their diet and or taken as supplements.

Fucus also has the ability to decrease transsialidase activity in the blood, an enzyme associated with cholesterol accumulation.[14] This may benefit patients with low thyroid function as decreased metabolism is associated with hyperlipidemia.

GUGGUL EXTRACTS TO SUPPORT THYROID FUNCTION

Commiphora mukul or Guggul may support thyroid function. *Commiphora mukul* (a relative of the myrrh gum tree in the *Burseraceae* family) is noted for its content of aromatic gummy resins that have many medicinal, culinary, aromatic, and spiritual uses. Guggul from *Commiphora mukul* is currently at risk of being endangered due to overharvesting in India and Pakistan.

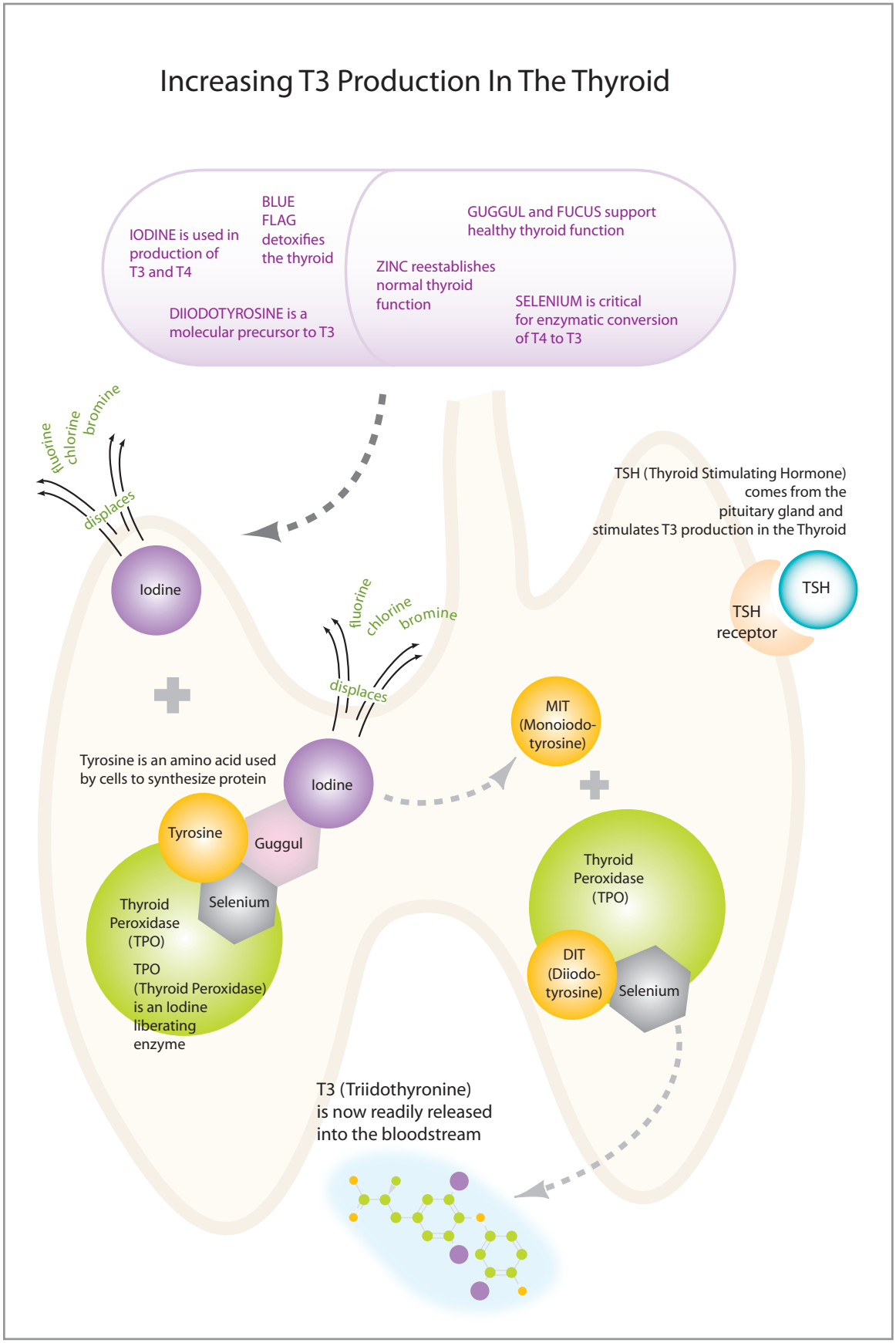

Figure 1

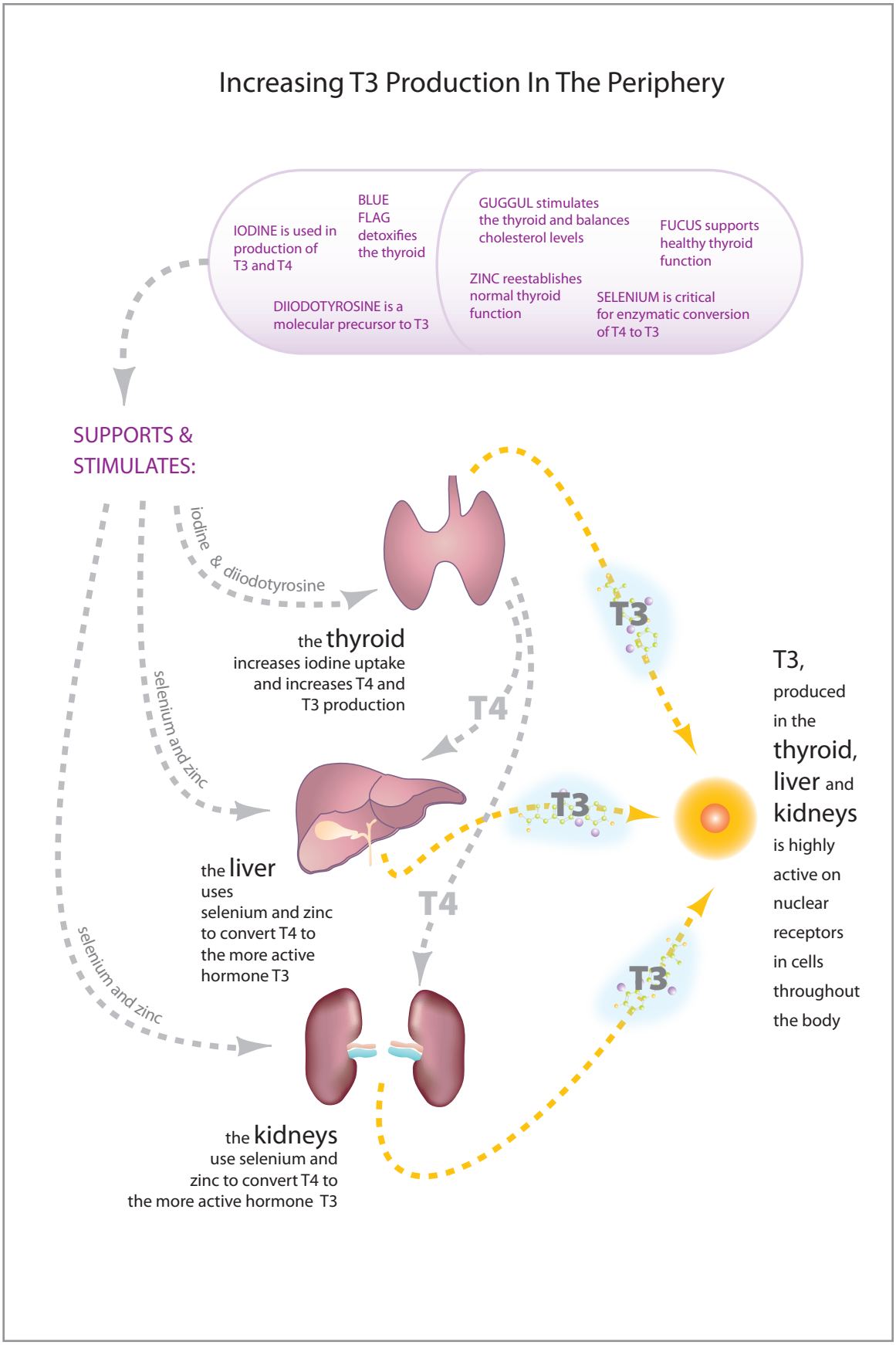

Figure 2

Germacrene (a volatile hydrocarbon found in the *Burseraceae* family) is a building block in the formation of resins.[15] *Commiphora mukul* a traditional Ayruvedic medicinal herb, has shown thyroid stimulating effects in animals[16] and is used to treat high cholesterol, obesity and sluggish metabolic functioning.

Commiphora mukul contains sterols (known as guggulsterones,) that act on bile acid receptors to process lipids and contribute to a its hypolipidemic effect.[17] In a randomized, double-blinded, placebo-controlled study in patients with moderate hyperlipidemia, supplementation significantly reduced total cholesterol after 12 weeks.[18] However, it should be mentioned that HDL cholesterol was significantly lower, while LDL cholesterol and triglycerides were unchanged. This finding of decreases in total cholesterol is of questionable clinical usefulness since most cases of dyslipidemia include LDL and triglycerides that are too high, and HDL levels that are too low. Importantly, *Commiphora mukul* inhibited LDL oxidation, which is a key mechanism of atherogenesis and atherosclerosis.[19] Thus, while LDL levels may be unchanged with *Commiphora* supplementation, the pro-plaque oxidation of LDL may be reduced.

Commiphora mukul may also lower lipid levels by supporting the thyroid's basic metabolic functions. Animal studies have shown *Commiphora mukul* to reduce the effects of thyroid suppressive medications, indicating a thyroid hormone-enhancing effect and utility in the treatment of hypothyroidism.[20]

Ketosteroids in *Commiphora*, found in the oleoresin, are reported to increase the uptake of iodine by the thyroid gland and enhance the activity of thyroid peroxidase enzymes.[16] T3 production was increased along with a healthy alteration in the ratio of T3 to T4 indicating a thyroid support effect.[21] Recent research found that guggulsterones may inhibit nuclear receptors involved with basic metabolic functions and cholesterol metabolism, contributing to the plant's hypolipidemic effect.[18] Hypoglycemic and hypolipidemic effects may occur following the consumption of guggulsterones. Animal studies have shown guggulsterones to inhibit maturation of adipocyte precursor cells.[22] In addition to slowing their formation adipocyte maturation, guggulsterones have also been shown to exert direct inhibitory effects on adipocytes by inducing apoptosis of individual fat cells and decreasing lipid accumulation. Interestingly, this effect is potentiated by xanthohumol a constituent of the hops (*Humulus lupulus*) plant.[23] Specific proteins associated with adipocyte functions are also down-regulated under the influence of *Commiphora* while lipolysis is also promoted. Animal studies have found that cholesterol is decreased in part due to enhanced uptake of LDL by the liver via a mechanism involving enhanced membrane receptor-mediated endocytosis. Binding sites for LDL may increase significantly under the influence of *Commiphora mukul.* While guggulsterones have posess several favorable and plausible mechanisms to reduce cholesterol, results of clinical trials have been inconclusive.[24-25]

IRIS VERSICOLOR TO SUPPORT THYROID FUNCTION

Iris was utilized and written about extensively by an organized group of physicians (members of the American eclectic physician movement) who from the 1830s to the 1940s heavily relied on the use of carefully prepared botanical medicines. *Iris versicolor* (also called "Blue Flag"), is a small wild *Iris* found in the marshy areas of North America. The plant contains volatile oils, resins, alkaloids, and the oleoresin iridin, but little molecular, cellular, or clinical research has been conducted on this plant. Nonetheless, this plant has a long history of medicinal use targeted to "moving the sluggish bodily fluids" (*i.e.*, saliva, lymph, bile, digestive secretions, bowels, congested tissues) and has been used to treat hepatomegaly, splenomegaly and thyroid dysfunction.

Iris is traditionally administered orally or topically—sometimes both simultaneously. It is specific for the treatment of thyroid enlargement and goiters, making a valuable contribution to botanical medicine as well as acting as a synergist in herbal formulations to support the thyroid.

CONCLUSION

Optimal thyroid function requires sufficient amounts of bioavailable iodine. Humans depend on dietary sources for of iodine including animal products, seaweed, and iodized salt. Iodine deficiency can cause a number of negative health consequences, especially during infancy. *Fucus vesiculosus* promotes thyroid function as an excellent source of iodine. *Commiphora mukul* increases uptake of iodine in the thyroid. *Iris versicolor* is less well studied than the other herbs but has historically been utilized in the treatment of goiter. Given their varied mechanisms of action, these naturally occurring compounds may provide benefits to promote thyroid function, and prevent the onset of adult thyroid dysfunctions (**Figures 1** and **2**). Further study is needed to determine the benefits of these herbal remedies to patients with Hashimoto's Disease and hypothyroidism.

DISCLOSURE OF INTERESTS

Dr. Saunders reports personal fees related to employment or seeing patients from CCNM, the Dundas Naturopathic Centre, and from Beaumont Health Systems, Troy Hospital, MI, outside the submitted work. Dr. Winston reports personal fees from Herbalist & Alchemist, Inc, outside the submitted work. Dr. Stansbury has nothing to disclose.

REVIEW ESSAY

Many nutrients and herbs that have not been the subject of randomized controlled studies are used regularly by clinicians. They have also been used traditionally for hundreds, sometimes thousands of years.

Iris versicolor of the Iridaceae family

Review Essays contain the opinions of professionals and experts in the fields of nutritional and botanical medicine on how to most effectively use herbs and nutrients in clinical practice. The dosages recommended are based on clinical experience. Side effects that are described in "Unsubstantiated Theoretical Concerns" have not been seen in clinical practice or clinical studies but are speculative based on, for example, possible mechanisms of action.

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