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Review Article

Role of Dietary Factors in Thyroid Disorders: A Primary Care Perspective

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Abstract

Thyroid disorders are one of the most common endocrine problems seen at primary care. Role of dietary factors in their prevention is largely unknown with inadequate scientific evidences. In this review, we examine the scientific evidences for the role of various dietary elements in causation, prevention and management of thyroid disorders.

Keywords: Thyroid disorders; Primary care; Dietary factors; endocrine problem

Introduction

Thyroid diseases including hypothyroidism, hyperthyroidism, and thyroid nodules are commonly seen in most primary care and endocrinology OPDs. Thyroid disorders are very common in the society, affecting about 10-15% of the population [1]. In routine clinical practice, patients suffering from thyroid diseases often enquire about dietary changes they are required to make for treatment or reverse their disease from their healthcare providers. The evidence is strongest for adequate but not excessive iodine intake to benefit thyroid health in general [2], as well as selenium supplementation for patients with Graves' disease [3]. The other micronutrients apart from iodine and selenium, playing an important role in thyroid hormone synthesis are iron and zinc [4]. Apart from these, there is sparse scientific data showing that dietary changes can significantly benefit hypo- or hyperthyroidism.

Previous observations also indicate toward the presence of certain goitrogenic substances in the diet, identifying an important role of dietary constituents in thyroidology [5]. The persistence of goitre even after the universal salt iodization led researchers to explore the relation of other dietary nutrients in the thyroid physiology [1].

In this review, we discuss the diet related factors influencing thyroid function and their role in causation, prevention and management of thyroid disorders based on the scientific evidences.

Common thyroid disorders

Hypothyroidism: Hypothyroidism affects up to 7% of the general population [6]. Although endemic iodine deficiency is the leading cause of hypothyroidism globally, the most common aetiology of hypothyroidism in developed countries like United States is Hashimoto thyroiditis, an autoimmune condition characterized by positive serum thyroid autoantibody titres and lymphocytic infiltration of the thyroid, which may lead to destruction of thyroid follicular cells, thereby increasing the risk for hypothyroidism.

Levothyroxine as thyroid hormone replacement remains one of the most commonly prescribed medications [7]. Many foods and substances interfere with the intestinal absorption of oral levothyroxine [8] and hence it is advised to the patients to take the medication separately from meal times [9,4].

Majority of patients with hypothyroidism experience symptomatic improvement upon treatment with Thyroid Hormone Replacement Therapy (THR). However, some may continue to experience and report hypothyroid symptoms despite the achievement of biochemical euthyroidism through THR [10,11]. Few Others remain dissatisfied with the current available treatment options and seek alternative therapies [12,13]. As such, patients may seek dietary interventions to ameliorate symptoms or reverse their hypothyroidism.

Popular interventions include supplementation with various micronutrients, vitamins, or minerals, or restricted intake of certain foods or food groups. Given the role of Hashimoto thyroiditis in the development of hypothyroidism, possible intervention to specifically decrease serum thyroid autoantibody titers is a common inquiry. However, none of the dietary interventions alone have shown promising results in reversal of hypothyroidism and Thyroid Hormone Replacement (THR) remains the cornerstone in management of hypothyroidism.

Hyperthyroidism: Hyperthyroidism is present in up to 1.3% of the general population [6]. Graves' disease is the leading cause of hyperthyroidism globally, but other aetiologies include toxic nodular goitre and the hyperthyroid phase of thyroiditis. Conventional therapies for the treatment of hyperthyroidism are anti-thyroid medications, radioactive iodine, and thyroid surgery, each with their respective potential risks and benefits [14].

Serum thyroid-stimulating antibodies drive the onset and course of Graves' disease. Dietary iodine and selenium are micronutrients that can modify the thyroid antibody titers. Further, iodine status is an important consideration in individuals with thyroid nodules who are at risk for iodine-induced hyperthyroidism.

Thyroid nodules: Thyroid nodules are detected incidentally on radiologic imaging. Criteria based on a combination of nodule size and sonographic characteristics inform the decision to pursue a thyroid nodule fine-needle aspiration biopsy, as there is an overall risk for malignancy of only 7%-15% in all nodules [15]. Thyroid surgery is recommended if malignancy is highly suspected or confirmed, or if benign nodules are large enough to be associated with compressive symptoms to the neck. Biopsy-benign or nonsuspicious nodules are

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monitored by ultrasound at regular intervals. Given the chronicity of monitoring needed for benign nodules, patients commonly seek dietary or other modalities to decrease the size of their thyroid nodules.

Specific Dietary Influences on Thyroid functioning

Iodine: The production of thyroid hormone within the thyroid follicular cell requires adequate levels of circulating iodide taken in through the diet. The Recommended Dietary Allowance (RDA) for iodine is 150μg/day in adults, and 220μg/day and 290μg/day in pregnant and lactating women, respectively [16]. Common dietary sources of iodine include iodized salt, seafood (including seaweed and fish), and some breads and grains.

Although eating a regular diet should meet nutritional iodine needs, some individuals may require supplementation in order to achieve RDA goals. Individuals with restricted diets, such as vegetarians and vegans, are at higher risk for inadequate iodine intake because vegetables are not a rich source of iodine [17].

Some "iodine for thyroid health" tablets, which are commonly available over the counter, may contain several hundred-fold the daily recommended amount of iodine in just a single dose. Other products labelled "for thyroid support" include tablets or liquid supplements containing spirulina (a superfood derived from blue-green algae) or kelp. Some alternative medicine practitioners recommend these—which are high in iodine — for people with hypothyroidism [18].

Taking supplements with high iodine content is unlikely to help the thyroid health, and in fact may even pose harm. In some individuals, excess iodine exposure or ingestion may induce hyperthyroidism or hypothyroidism [19], and chronic iodine excess may induce autoimmune thyroiditis, as highly iodinated thyroglobulin is immunogenic [20]. Iodine-induced thyroid dysfunction is found to be common in those who have a history of endemic iodine deficiency or pre-existing thyroid disease [21]. For this reason, the American Thyroid Association recommends avoiding supplements containing >500μg/day of iodine [22].

Goitrogens: The term "goitrogen" refers to any substance that can produce goitre, the enlargement of the thyroid gland [23]. This is usually accomplished through effects that decrease thyroidal iodine, but goitrogenic substances can also act by inhibiting any of the other components of normal thyroid hormone production. The most common examples of dietary goitrogens are cruciferous vegetables and soy products.

Cruciferous vegetables: Cruciferous vegetables are those in the Brassica genus and include broccoli, cabbage, Brussels sprouts, kale, turnips, cauliflower, collard greens, and bok choy. They are rich in glucosinolates, compounds that produce sulforaphane and the phenethyl and indolylic isothiocyanates associated with anti-cancerous properties [24]. However, glucosinolates also include the metabolite thiocyanate, which inhibits thyroid hormone production [24]. Thus, although eating cruciferous vegetables certainly has many health benefits, regular consumption of large quantities may induce or exacerbate hypothyroidism.

Data on the quantity of cruciferous vegetable consumption needed to adversely affect thyroid function are limited. In a study of five euthyroid volunteers who ingested 15.2 ozs of a commercial kale juice twice per day for 7 days, mean 6-hour thyroid radioiodine uptake decreased by 2.52% compared with baseline values, however serum thyroid function tests were unchanged [25]. It would be of much interest to see the results of a large study with long -term ingestion of larger amounts of kale consumed.

In life-threatening example, one case report described the development of myxoedema coma in an 88-year-old Chinese woman who consumed 1.0-1.5 kg of raw bok choy daily for several months in an attempt to improve her diabetes control [26]. These data suggest that frequent intake of large amounts of cruciferous vegetables may decrease thyroid hormone production, however no rigorous clinical studies exist to support.

Soy: Dietary soy products—including soy milk, tofu, soy sauce, tempeh, and miso- contain isoflavones. As isoflavones can inhibit the action of thyroid peroxidase, an important enzyme required for thyroid hormone synthesis, it has been proposed that dietary soy intake may increase the risk for hypothyroidism in euthyroid individuals or that a higher dose of thyroid hormone replacement may be required in patients being treated for hypothyroidism.

The available literature shows that in euthyroid individuals living in iodine-replete areas, consumption of soy probably has no adverse effects on serum thyroid function [27]. An exception is when soy-based infant formula is used for neonates with congenital hypothyroidism; an increase in dose of levothyroxine may be required to adequately address thyroid hormone needs [28].

Other Trace Minerals: Apart from iodine, data on other trace minerals and their effects on thyroid status remain inconsistent [29].

Selenium: Selenium a micronutrient- as an antioxidant- is important for thyroid hormone metabolism and function [30,31]. The RDA of selenium in men and non-pregnant, non-lactating women is 55μg [32]. The richest dietary sources of selenium are seafood and organ meats. Typical sources in the diet are breads, grains, meat, poultry, fish, and eggs.

The tolerable upper intake level for selenium is 400μg/day [32]. Although selenium toxicity is not commonly encountered in routine clinical practice, symptoms include nausea; nail discoloration, brittleness, and loss; hair loss; fatigue; irritability; and foul breath (often described as "garlic breath").

Some studies have shown benefit from selenium supplementation in individuals with autoimmune thyroid disease, and low selenium levels have been associated with increased risk for goitre and thyroid nodules in European women [33]. In areas of severe selenium deficiency, supplementation up to 100μg/day may be beneficial [34]. From the available evidence, however, routine selenium supplementation in individuals following unrestricted diets for the purpose of treating Graves' disease [35,36], decreasing serum thyroid antibody titers, or maintaining normal thyroid function is mostly unsupported.

Hence, selenium supplementation It routinely recommended selenium supplementation for the sole purpose of benefiting thyroid health. One exception is in patients with mild Grave's ophthalmopathy, in whom selenium may improve quality of life and the course of ocular disease [37]. Supplementation in these patients

is recommended by the European Thyroid Association/European Group on Graves' Orbitopathy as a 6-month course [38].

Other trace elements: The roles of zinc, copper, and magnesium in thyroid hormone synthesis and metabolism are even less well defined. In the US National Health and Nutrition Examination Survey (2011-2012), levels of zinc, copper, and selenium were inconsistently associated with free or total serum thyroid hormone levels [39], whereas a meta-analysis of eight studies suggested a relationship between levels of selenium, copper, and magnesium with thyroid cancer [40]. Given the available scientific evidence, supplementation of these trace minerals solely for the purpose of promoting thyroid function is not generally supported.

Other Dietary Considerations for Thyroid: Finally, a number of many other dietary factors, less rigorous- and in some cases with absent- scientific data, are proposed to affect thyroid health. Although coffee decreases the absorption of oral levothyroxine in individuals being treated for hypothyroidism, coffee, tea, and alcohol appear to have no effect on risk of thyroid cancer risk [41,42]. The potential role of vitamin D as a preventive or therapeutic agent for various thyroid diseases remains unclear [43].

Popular in the functional medicine community are interventions to treat leaky gut syndrome, the theory of increased intestinal permeability leading to various diseases. Gluten-free diets, sugar-free diets, and probiotics are advocated for promoting thyroid health. Although one small study demonstrated decreased serum thyroid antibody titers among 34 women who followed a gluten-free diet for 6 months [44], published data in the scientific literature on the effects of these interventions on thyroid health are lacking.

Conclusion

Apart from the definitive role of iodine and selenium deficiency in causation of hypothyroidism, the role of other dietary factors affecting thyroid health remains inconclusive based on available scientific evidences. Selenium supplementation has a definitive benefit in patients with grave's opthalmopathy, however its routine supplementation is not recommended. Further, d ata on the role of cruciferous vegetables and soy as goitrogens are also limited. Based on available scientific evidence, it is evident that dietary factors do have influence on thyroid health and all the primary care physicians and endocrinologists should consider it for their patients 'counselling. Public health measures may include giving more emphasis on the dietary factors for prevention and management of thyroid disorders through IEC & BCC activities apart from drug therapy. However, Much remains unknown about thyroid disease and that there are areas of uncertainty in modern medicine for which continued research is required.

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