Original Article

Diet in Thyroid Disorders: A Survey among Clinicians and a Review of the Current Perspective

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Abstract

Physicians and endocrinologists commonly face various questions related to dietary interventions during clinical encounters with their patients with thyroid disorders. Indeed, both patients and treating physicians have various misconceptions regarding thyroid-specific diets, possibly because of misinformation circulated in lay media or grey literature and the misinterpretation of contradictory scientific data, respectively. In this review, we attempted to answer some frequently asked questions by the patients in the backdrop of contraindicatory perceptions of physicians observed in our survey. Additionally, we tried to put a perspective on dietary factors related to thyroid disorders through the available scientific evidence to help make an informed decision-making.

Keywords: Autoimmune, cruciferous, diet, goitrogens, iodine, thyroid

Introduction

Thyroid disorders are prevalent in the general population, affecting approximately 10–15% of individuals.[1-3] Patients with thyroid-related concerns often seek advice from various medical and surgical specialists, including alternative medicine practitioners. A study conducted in Poland revealed that as many as 85% of patients with thyroid disorders use some form of dietary supplements.[4] This widespread use may be influenced by traditional beliefs and misconceptions propagated in grey literature and social media, leading patients to harbour preconceived notions regarding the avoidance or incorporation of specific foods in thyroid disorders.[5] As practising physicians/endocrinologists, we frequently encounter patient inquiries regarding dietary recommendations for thyroid ailments.

To address this contemporary issue, we surveyed Indian physicians and endocrinologists to assess their current knowledge of specific dietary interventions in thyroid disorders. Subsequently, we delve into the scientific literature review to synthesize the existing evidence based on this topic. We aspire to provide comprehensive insights into the role of diet in managing thyroid disorders.

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Methods

We conducted an online survey using a Google Form distributed within a large WhatsApp group comprising Indian physicians and endocrinologists. The questionnaire had five closed-ended, single-response questions. Three questions related to diet in people with hypothyroidism and two questions related to diet in people with hyperthyroidism. Subsequently, we performed a Boolean literature search in the electronic database of PubMed using MeSH keywords until 27 January 2024. Keywords include (Diet) AND (Thyroid disorders [MeSH Major Topic]); (Diet) AND (Hypothyroidism [MeSH Major Topic]); (Diet) AND (Hyperthyroidism [MeSH Major Topic]); (Diet) AND (Goitre [MeSH Major Topic]) and (Diet) AND (Thyroid cancer [MeSH Major Topic]). After manually scanning the abstract of available literature, we retrieved the

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full text of key articles published in the English language and thoroughly reviewed them.

Results

Two hundred and forty-five physicians actively participated in the survey, and we recorded their responses while maintaining complete anonymity. Figure 1 revealed a notable divergence of opinions within the physician community regarding dietary interventions in thyroid disorders through this survey. These divergent opinions among clinicians could have emerged from the findings from some experimental studies that suggest certain food products can interfere with thyroid hormone synthesis. For example, consumption of raw vegetables of the Cruciferous family and smoking can interrupt iodide trapping at the thyroid follicular cell surface through the $Na^+/I-$ symporter. Similarly, soy products, phytoestrogen or isoflavone can interfere with the oxidation of iodide to iodine in colloid through thyroid peroxidase (TPO). Figure 2 schematically represents the purported effects of different dietary products on thyroid function in experimental studies.[6,7]

Nevertheless, given the discordant opinion, it was imperative to critically examine the best available scientific evidence to equip physicians with accurate information that will enable them to effectively educate patients on the appropriate dietary management of thyroid disorders.

Should we discourage our hypothyroid patients from taking soy products?

Soy proteins are commonly found in soy milk, tofu, soy sauce, tempeh and other soy-based products. Animal studies have indicated that soy-containing isoflavones, including genistein, daidzein and glycitein, can inhibit TPO [Figure 2]. However, these studies have not shown any significant impact on serum levels of thyroid hormones or the microarchitecture of the thyroid gland.[7] Concerns regarding the potential association between soy products and hypothyroidism emerged following reports of goitre in infants who were primarily fed soy-based formulas.[8,9] Subsequent research suggested that concomitant iodine deficiency or preexisting subclinical hypothyroidism may be necessary for the development of overt hypothyroidism in individuals consuming soy proteins.[10-12] A study focusing on pregnant women found no association between soy intake and the development of thyroid autoimmunity or dysfunction.[13] Therefore, the current consensus is that patients with hypothyroidism can safely consume soy-based foods unless they are already deficient in iodine.

However, a case report has highlighted that the ingestion of soy proteins in close temporal proximity to levothyroxine can interfere with the absorption of the latter.[14] Thus, it is advisable for individuals taking levothyroxine supplements to allow for a time gap between consuming soy products and ingesting their medication.

Should we advise our hypothyroid patient against taking Cruciferous vegetables?

Cruciferous or brassica vegetables (such as cauliflower, cabbage, kale, broccoli, brussels sprouts, bok choy etc.) are commonly used in different cuisines worldwide. This group of vegetables contains glucosinolates, which are converted into isothiocyanates and sulforaphane (progoitrins) by the action of the enzyme myrosinase or thioglycosidase (derived from adjacent plant cells) during the process of mastication. These

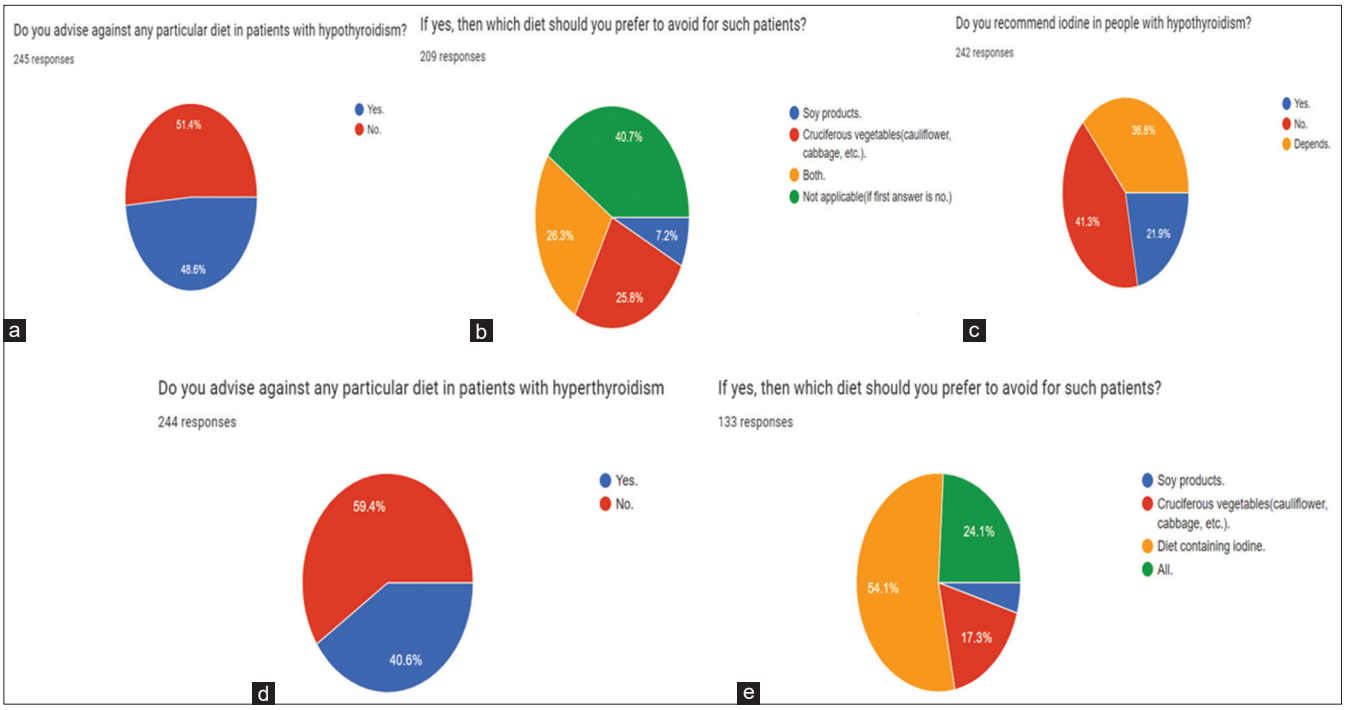

Figure 1: Results of a dietary survey on thyroid disorders among 245 Indian clinicians

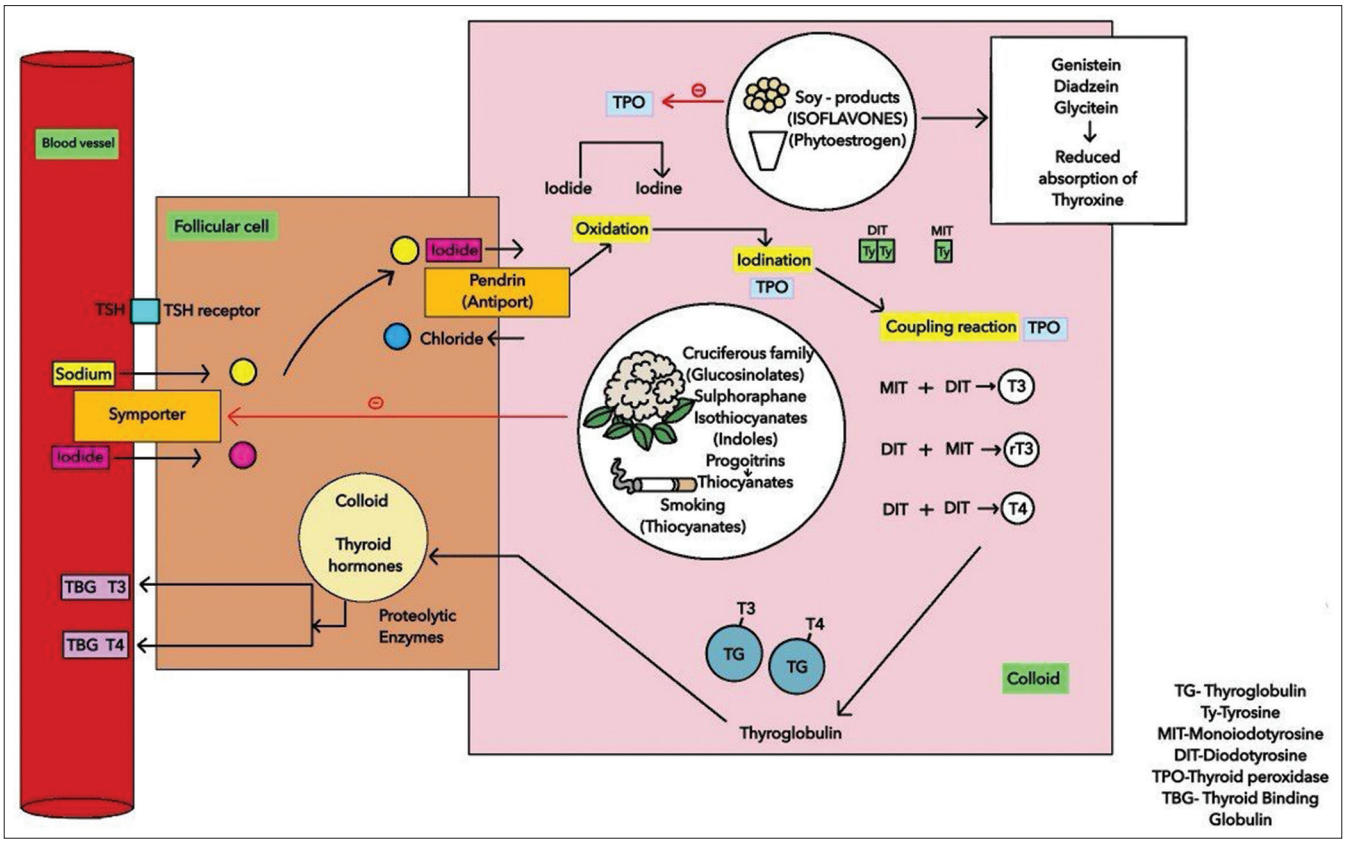

Figure 2: Purported effect of different dietary products on thyroid hormone synthesis in experimental studies

progoitrins spontaneously degrade into thiocyanates (goitrins), which decrease iodine transport into the thyroid follicular cells by competitively inhibiting sodium-iodide symporter.[15] Thus, from this mechanistic viewpoint and results from a few animal studies, concerns were raised regarding the anti-thyroid effects of cruciferous vegetables on humans.[5] In the present context, it is not uncommon to observe that many people ingest large amounts of brassica vegetables for their presumed health benefits. Interestingly, a case of myxoedema coma due to the consumption of unusually high (nearly 1.5 kg/day) raw bok choy for several months has been reported.[16] However, a short report by Kim *et al.*[17] revealed that among iodine-repleted individuals' daily intake of almost 430 g of kale juice (prepared from *Brassica oleracae* and *Brassica napus* leaves) for one week significantly increased serum and urinary thiocyanates, and decreased ^{123}I uptake, without significantly altering thyroid-stimulating hormone (TSH) and free thyroxine (fT4) levels. Furthermore, a randomized controlled trial (n = 267) showed that daily ingestion of broccoli sprouts (at the daily dose of 600 µmol of glucoraphanin and 40 µmol of sulforaphane) for 12 weeks did not affect serum TSH, fT4 and thyroglobulin levels.[18] Unfortunately, human data are lacking on whether cruciferous vegetables are safe in patients with underlying thyroid disorders. The overall impact of cruciferous vegetables on the thyroid gland seems to depend on the amount of isothiocyanate released upon mastication, which in turn depends on the type of brassica ingested and its glucosinolate contents, cooking method and baseline iodine status of the individual.[15,19] Thus, it is likely that well-cooked brassica vegetables are not contraindicated in individuals with or without thyroid ailments. However, one should be cautious while taking extraordinary amounts of raw brassica.

Should we advise our hypothyroid patient to consume a gluten-free diet?

Autoimmune thyroid diseases (AITDs) are a common accompaniment of gluten-sensitive enteropathy or celiac disease. Hypothyroid patients with celiac disease, non-compliant with gluten-free diet need 50% greater levothyroxine dosage to achieve target TSH.[20] However, there is no evidence that a gluten-free diet alters the natural history of autoimmune thyroid disorders unless it is associated with celiac disease.[5] Thus, a gluten-restricted diet is not recommended for usual hypothyroid patients. However, compliant patients requiring unusually high levothyroxine doses should be screened for underlying celiac disease in appropriate settings.[21]

Are dairy products safe for patients with thyroid disorders?

The notion of avoiding dairy products to mitigate autoimmunity stems from the concept of gut dysbiosis.[5] However, in the context of thyroid health, the decision regarding dairy product consumption is significant as they contain substantial amounts of iodine, calcium and lactose, which may affect thyroid gland physiology and the gut absorption of levothyroxine.

Studies have demonstrated that simultaneous intake of levothyroxine with cow's milk significantly impairs its absorption, likely due to interference from milk's calcium content.[22] Consequently, it is advised to avoid consuming cow's milk concurrently with levothyroxine. Additionally, patients with lactose intolerance, which is twice as prevalent among individuals with Hashimoto's thyroiditis compared to the general population,[23] may require a higher dose of levothyroxine to achieve optimal serum TSH levels.[24] Research by Asik *et al*.[25] indicated that levothyroxine-treated hypothyroid patients with lactose intolerance and Hashimoto's thyroiditis experienced a significant decrease in serum TSH levels upon abstaining from milk products. In summary, as there is insufficient evidence to support the notion that eliminating dairy products from one's diet improves clinical outcomes in patients with thyroid diseases (unless lactose intolerance is present), we do not recommend restricting dairy product intake in patients with hypothyroidism.

Is there any role of foods rich in iodine in patients with thyroid disorders?

The importance of maintaining optimal iodine levels for thyroid physiology cannot be overstated. Iodine deficiency disorder remains a significant cause of hypothyroidism, and it is the most common preventable cause of mental retardation, despite the successful implementation of universal salt iodization (USI) programs on a national and global scale.[26,27] However, excessive iodine intake is associated with an increased incidence of AITD, which can lead to both hypothyroidism and thyrotoxicosis depending on the underlying thyroid pathology and baseline iodine status.[5]

An individual's iodine status largely depends on their geographical location and the implementation of salt iodization programs at the population level. While some authors have proposed recommendations for different food items based on thyroid status,[1] it is not practical to assess an individual's iodine stores in clinical settings to make personalized decisions regarding iodine supplementation or restriction. Therefore, in individuals residing in iodine-sufficient geographical areas or under successful USI programs, we recommend against consuming specific iodine-rich foods for those with euthyroidism or hypothyroidism, except for pregnant and lactating mothers.[5] Similarly, we do not advocate any specific diet for hyperthyroidism, as there is insufficient evidence to support the avoidance of iodine-rich foods or the consumption of certain iodine-deficient foods or so-called goitrogens for management purposes. However, patients should adhere to an iodine-restricted diet for one to two weeks before the scheduled radioiodine dose for diagnostic and therapeutic purposes.[28,29]

Several studies have suggested that imposing a salt-restricted diet, for conditions such as hypertension and heart failure, does not significantly deplete the body's iodine stores.[30,31] Thus, there is currently insufficient evidence to recommend additional dietary sources of iodine for patients on salt-restricted diets for other medical indications.

Should patients with thyroid disorders be encouraged to take trace elements and vitamin supplements?

Trace elements, such as selenium, iron, zinc, magnesium, copper etc., play crucial roles as cofactors for enzymes involved in the biosynthesis of thyroid hormones and their metabolism. Consequently, there has been longstanding interest in exploring these molecules for the prevention and treatment of thyroid disorders.[32,33]

Selenium deficiency has been associated with an increased risk of hypothyroidism and thyroid autoimmunity.[34] However, supplementation with selenium has not shown consistent effects on TSH levels or the need for levothyroxine dosage reduction, although it may reduce thyroid autoantibody titres.[35,36] While some studies suggest a protective role of selenium in reducing the risk of AITDs during pregnancy, current guidelines do not advocate for its routine use due to conflicting results and its low therapeutic index.[37-39] Physicians need to exercise caution when considering selenium supplementation in individuals already deficient in iodine, as it may exacerbate hypothyroxinemia.[40]

Iron, an essential component of the haem-containing enzyme TPO, is crucial for thyroid hormone synthesis. Severe iron deficiency has been identified as a significant cause of hypothyroidism.[41,42] Conversely, iron deficiency may often accompany hypothyroidism due to associated malabsorption and autoimmune gastritis.[43] Iron deficiency should be addressed with appropriate supplements to achieve a better clinical response.[1,44] Double fortification of salts with both iodine and iron has been proposed as a strategy to address dual deficiencies at the population level.[45]

The relationship between zinc and thyroid function is bidirectional.[5] Zinc plays a critical role in various stages of thyroid hormone synthesis and action, while thyroid hormone is essential for zinc absorption from the gut.[46] Zinc regulates the synthesis of thyrotropin-releasing hormone, TSH, thyroxine and tri-iodothyronine.[47,48] Although zinc supplementation appears beneficial for hypothyroidism in individuals with Down syndrome, current evidence is insufficient to recommend for or against zinc supplementation in thyroid disorders.[5,49,50]

Magnesium deficiency has been linked to AITDs and Graves' disease.[51,52] However, trial results on magnesium supplementation and its effect on thyroid function are inconclusive.[53]

Retinoic acid has been implicated in multiple steps of thyroid hormone synthesis and function, as well as in the regulation of the hypothalamus–pituitary–thyroid axis.[54] Vitamin A supplementation in individuals with combined vitamin A and iodine deficiency has shown promising results in reducing TSH levels and goitre rates.[55,56] However, there are concerns regarding the development of hypothyroidism with long-term high-dose vitamin A supplementation, as observed in animal studies.[57] Overall, there is insufficient evidence to recommend

vitamin A supplementation for protecting thyroid health unless there is a documented deficiency.[54,58-60]

Vitamin D deficiency has been associated with an increased risk of thyroid autoimmunity in various studies. However, results from human interventional studies have been inconsistent.[61,62] Therefore, outside of established indications for vitamin D therapy, supplementation is not recommended solely for the prevention or treatment of thyroid disorders.

Summarily, there is insufficient evidence to support the routine use of trace elements and vitamin supplements in improving the natural course of thyroid disorders unless there is a documented deficiency. However, a balanced and nutritious diet containing these minor elements and vitamins is recommended to meet the recommended dietary allowance.[63]

Is there any association between certain dietary components and thyroid cancer?

Drawing conclusions from epidemiological studies on the influence of diet on thyroid cancer is challenging due to the multitude of confounding factors present.[64] Iodine, in particular, presents a complex relationship with thyroid cancer. While iodine deficiency has been linked to an increased incidence of thyroid cancer, excess consumption of iodine-rich foods in iodine-sufficient areas may also elevate the risk.[65,66] Although some suggestions have been made that cruciferous vegetables may increase the risk of thyroid cancer,[67] pooled analysis refutes such associations.[68] Additionally, while some studies have reported a positive association between processed meat consumption and thyroid cancer risk, others have not found such a relationship.[64,69] Interestingly, a large prospective study from Korea indicated that dairy products may have protective effects against thyroid cancer.[70] However, systematic reviews have not conclusively documented any significant risk or benefit of multivitamins and mineral supplements in the development of thyroid neoplasia.[71]

Given the heterogeneous and conflicting results observed in different epidemiological studies, it is currently not advisable to recommend for or against any diet concerning thyroid cancer. Further research is needed to elucidate the complex interplay between diet and thyroid cancer risk.

Conclusion

The topic of dietary intervention in thyroid disorders is often over-hyped, with a mixture of fads and facts. Despite widespread discussion, there is no scientific concept known as a 'thyroid diet'. While there is a substantial body of evidence regarding certain aspects of diet and thyroid health, the data are often mixed and contradictory. As such, it is not advisable to overly focus on consuming large quantities of specific dietary constituents while completely discarding others. Instead, patients should be counselled on maintaining a balanced and nutritious diet tailored to their individual needs, with attention to calorie intake based on their anthropometry and consideration of any comorbidities they may have. Additionally, any suspected nutritional deficiencies should be clinically investigated and treated accordingly.

Physicians and endocrinologists play a crucial role in guiding patients with thyroid disorders toward making informed decisions regarding their diet. Healthcare providers need to stay vigilant about the current state of knowledge in this area to provide accurate and evidence-based advice to their patients.

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Author's contribution

AKS conceptualized the idea. AKS and AS conducted the survey and searched the literature. SC wrote the first draft. AKS, AS and RB edited the subsequent and final draft. All authors agreed mutually to submit for publication.

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Conflicts of interest

There are no conflicts of interest.

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