CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187

https://zenodo.org/records/10158262

https://www.iajps.com/volumes/volume10-november-2023/10-issue-11-november-23/

Available online at: http://www.iajps.com ***Review Article***

A REVIEW OF NUTRITIONAL FACTORS IN FUNCTIONAL FOODS FOR HYPOTHYROIDISM THERAPEUTIC.

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Article Received: September 2023 Accepted: October 2023 Published: November 2023

Abstract:

This comprehensive review explores the intricate relationship between thyroid hormones especially in the context of Hashimoto's disease (HT) and various factors including genetics. Environmental influences micronutrients and dietary habits. The role of nutrients in managing thyroid conditions is pivotal for maintaining optimal thyroid function and overall health. The nutrients include iodine, selenium, zinc, iron, vitamins A and D, and omega-3 fatty acids, proper intake of these nutrients is essential for the synthesis of thyroid hormones and, the protection of the immune response. Additionally, the article provides practical dietary recommendations for individuals with HT. However, it is equally important for thyroid patients to be mindful of potential interactions between the nutrients and their medications this abstract also underscores the significance of a balanced and nutrient-rich diet in conjunction with medical treatment to effectively manage thyroid disorders and promote overall well-being.

Keywords: *Thyroid, Hashimoto Thyroiditis, Micronutrients, Nutritional diet.*

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Please cite this article in press ***Avuluri Pravallika*** *et al,* ***A Review Of Nutritional Factors In Functional Foods For Hypothyroidism Therapeutic,*** *Indo Am. J. P. Sci, 2023; 10 (11).*

INTRODUCTION:

Hashimoto Thyroiditis (HT) disease is one of the most frequently occurring autoimmune diseases, characterized by lymphocytic infiltration, destruction, and scarring of thyroid tissue and the presence of antibodies to thyroid peroxidase and thyroglobulin. The name "Hashimoto's disease" comes from the name of the Japanese surgeon Dr. Hakaru Hashimoto, who in 1912 described four cases of this disease. In a paper published in the Archiv für Klinische Chirurgie, Hashimoto presented the clinical and histological picture of the four cases, as he put it – 'the lymphocytic goiter, in which an intensive infiltrate of lymphocytes occurs with the formation of lymphoid follicles in the thyroid parenchyma'. The disease is more likely to affect women than men, most often in women aged 30–60, and the risk of its development increases with age [1]. The frequency of Hashimoto's disease is a growing trend and among Caucasians, it is estimated at approximately 5%. Dysfunction of the gland may be clinically evident (0.1–2% of the population) or subclinical (10–15%) The course of Hashimoto's disease is related to impairment of the immune system, where an excessive production of antibodies against thyroid antigens occurs – thyroid peroxidase and thyroglobulin. Under normal physiological conditions, the level of antibodies is kept constant, while it increases in the disease. Their elevated level was positively correlated with the symptoms of Hashimoto's disease [2].

PHYSIOLOGY:

Thyroid hormone and brain development:

Thyroid hormone is important for different body functions; however, it has a crucial role in the development of the fetal brain.

- Fetal brain development
- Skeletal maturation
- Increase basal metabolic rate
- Inotropic & chronotropic effects
- Increase sensitivity to catecholamines
- Stimulate gut motility
- Increase serum glucose
- Decrease serum cholesterol
- Conversion of carotene to vitamin A
- Play a role in thermoregulation

The process of fetal hormonal maturation is controlled by the thyroid receptors. Those receptors, including TRα and TRβ subtypes, are expressed in the cell nucleus and regulate the production of thyroid hormones through gene expression. The fetus depends upon maternal thyroid hormone up until 12 weeks of gestation when the thyroid receptors start to appear in the cerebral cortex and the cerebellum [2,3]. By then, the fetal thyroid is able to concentrate iodine in order to synthesize thyroxine. The fact that thyroxine was found to be detectable in infants with complete thyroid agenesis, indicates that transplacental passage of maternal thyroid hormones remains an important source for the fetus throughout the pregnancy. Maternal hormones are probably the reason behind maintaining a normal IQ in those infants who been treated early after newborn screening.

Synthesis and Metabolism of Thyroid:

The thyroid gland synthesizes two hormones: Thyroxine (T4) and triiodothyronine (T3) (Figure 1). After the absorption of Iodine, it circulates in blood bloodstream in the form of Iodide (I) and enters the thyroid follicular cells through the sodium-iodine symporter which is regulated by the thyroid stimulating hormone (TSH). TSH also stimulates the production of thyroglobulin, which is a glycoprotein produced inside the thyroid follicular cells and stored within the follicular lumen (the colloid space). Inside the cell, the iodide is oxidized via the thyroid peroxidase enzyme (TPO), and then goes through an organification process that incorporates iodine into thyroglobulin. Thus, forming monoiodotyrosine and diiodotyrosine residues that couple to form T4 and T3. Finally, TSH stimulates thyroglobulin proteolysis and subsequently releases both hormones into the bloodstream. Each step in the synthesis of thyroid hormone is catalyzed by enzymes which, when deficient, may lead to goiter and/or hypothyroidism [4]. Naturally occurring autosomal recessive mutations in many of the genes that encode these enzymes have been shown to cause congenital hypothyroidism. The vast majority of thyroid hormone in the circulation is bound to serum proteins which include thyroglobulin binding protein, transthyretin, and albumin. In euthyroid individuals, only 0.03% of T4 and 0.3% of T3 is unbound or 'free' and immediately available to enter cells and mediate thyroid hormone signaling. In the circulation, most of T4 is converted to T3, the active form of thyroid hormone, via the deiodination process of the outer ring. While inner- ring deiodination of T4 or T3 inactivates both hormones, forming reverse triiodothyronine (rT3) and diiodothyronine (T2) metabolites.

Effect of micronutrients on the absorption of thyroid medications:

It is important for general practitioners and pediatricians to know that common nutritional supplements can interact with the absorption of

thyroid medications. For instance, calcium supplements have the potential to interfere with the proper absorption of thyroid medications.

Therefore, spacing the intake of both of the medications at least 4 hours apart is recommended. Coffee and fiber supplements also should precede thyroid hormone intake by at least an hour so as not to interfere with the absorption of the thyroid medication [5]. Chromium picolinate, which is used as an alternative medicine to reduce blood sugar in children with diabetes and prediabetes status as well as for cholesterol lowering and weight loss, impairs the absorption of thyroid medications. Hence, the two medications should be consumed three to 4 hours apart. Flavonoids in fruits, vegetables, and tea could potentially affect the cardiovascular in a positive way, do suppress thyroid function in high doses. The Natural Standards Database provides an extensive list of supplements that have a potential impact on thyroid function that consumers can refer to for guidance. Dieticians should confirm that patients are adhering to these guidelines for optimal absorption of thyroid hormone supplements.

THYROID DISEASE:

Thyroid diseases are caused by an abnormal immune response to auto-antigens present in the thyroid gland. The three main types of autoimmune thyroid diseases are hypothyroidism, lymphocytic thyroiditis (Hashimoto's thyroiditis), and hyperthyroidism. Hypothyroidism is a condition in which the thyroid gland is under-active and produces too little thyroid hormone. Hashimoto's Thyroiditis (HT) is an autoimmune disorder in which the body's immune system attacks the thyroid. It will cause a decrease in thyroid function and eventually lead to the clinical disorder known as hypothyroid. Untreated hypothyroid can cause patients mild to severe symptoms ranging from hair loss, cold sensitivity, sleep disturbances, weight gain, depression, constipation, brain fog, fatigue, goiters (enlargement of the thyroid gland), and thyroid cancer. Women are 10 to 20 times more likely to be affected by HT disease than men [6].

Factors affecting the risk of thyroid diseases:

Most thyroid diseases are more prevalent in women than in men. Sex-specific differences in the microbiota composition are found only after puberty. The main differences between female and male immune systems are the sex hormones and the presence of two X chromosomes versus one X and one Y chromosome. To avoid a double dosage of X chromosome-derived proteins, one of the X chromosomes is randomly silenced in females in the early stages of embryogenesis. However, X chromosome inactivation is not complete and about 15% of the genes are still active, which leads to the over-expression of some X-linked genes in females. Moreover, sex hormones such as estrogens, progesterone, androgens, and pro-lectin can influence different aspects of immune system function and potentially affect the risk, activity, and progression of thyroid diseases. Many patients with HT, even in the euthyroid state, have excess body weight, metabolic disorders, and reduced quality of life. Metabolic disturbances, improper diet, frequent nutritional deficiencies, chronic inflammation and the oxidative stress that occurs have a negative effect on the course of the disease.

Overweight or Obesity and their Association with metabolic risk in HT:

Obesity has become a major health problem worldwide in the past decade. It is caused by the excessive intake of food, low physical activity, and several other environmental factors that interact with genetic predisposition [7].

Nutritional Factors Linked to Etiopathogenesis:

The nutritional deficit or excess of some minerals and other nutrients plays an essential role in the etiopathogenesis of hypothyroidism and TH . Iron and selenium participate in T3 (active hormone) and T4 (prohormone) formation, where iodine is a part of these molecules, and selenium is a cofactor of deiodinases that activates T4 by converting it into T3 or inactivates both T4 and T3 . Zinc is important for T3 receptor activation and can influence thyroid function via other mechanisms.

Cyanotoxins and thyroid functions:

drinking water and foods contaminated with cyanotoxins may indirectly influence plasma levels of free T3 and T4 via proinflammatory mucosal reaction and dysbiosis, or by a direct effect on the HPT axis and the thyroid in particular [8].

TABLE 1. Diets, inflammation, and microbiota

DIET	FOODS	ELIMINATED FOODS OR NUTRIENTS	EFFECTS
LOW RESIDUE DIET	Elimination of fruits , vegetables, whole grains, and legumes	reduced fiber intake	relieve obstructive symptoms, no effect on inflammation
ANTI INFLAMMATORY DIET	More prebiotic and probiotic foods, n-3 PUFA, wild fish, grass fed meat, vegetables, fruits, nuts, some saturated fat, meat (grass fed), fish, vegetables, excluding, nightshade, vegetables	restriction of gluten,lactose, total fat, refined carbohydrates, others	decreases of HBI or MTLWSI
AUTOIMMUNE DIET (MODIFIED PALEO DIET)	Sweet potatoes, fruits, coconut, milk, avocado, olive, coconut oil, dairy free fermented foods	Less or elimination of processed food, dairy , grains, refined sugars, legumes, cereals	Remission of gut inflammation
LEAKY GUT DIET	Glutamine, N-acetyl-L-cysteine, and zinc	Gluten and milk free, low carb and low sugar diet	Reduces gut derived inflammation, Ros and inflammatory cytokines IL-1beta, IL- 6, IFN-alpha,prevents bacterial translocation via enhancing weakened tight junctions
MEDITERRANEAN DIET	fish, ,lean meat, whole grains,legumes,nuts dairy,olive oil,vegetables,fruits,and moderate wine consumption	Heavily processed foods,I.e.,processed red meats,refined grains,refined\processed\hydrogenated oils,alcohol,butter	Lowers the inflammatory load and simultaneously balances gut microbiota
NORDIC DIET	High consumption of whole grains and unrefined sugars,fish and lean meat, dairy products, canola or rapeseed oil, and vegetables and fruits like cabbage and berries	Refined carbohydrates and processed foods	Lower blood pressure, normalized cholesterol, lose weight,or maintain a healthy weight.
PROTEINS (DIETARY)	Latex hevein,kamut,soy sauce,gelatin,scallops,cashew,Brazil nut	Reduction of other micronutrients	Cross creativity of dietary proteins with monoclonal antibodies against T4,T3,and Tg
PROTEIN (MICROBIAL)	Protein fermented food	N\A	Gastrointestinal pathogen yersinia enterocolitica have protein (porins)that

			mimic thyroid antigens and could lead to autoimmunization and stimulate precursor B cells for TSHR -Ab production
FATIGUE REDUCTION AND ANTI-INFLAMMATORY DIET	Foods rich in anti oxidative vitamins,omega-3 fatty acids,and in fibers, polyphenol-rich vegetables	Reduced inflammatory foods	Anti inflammatory effects,fatigue reduction
WESTERN DIETS	Rich in linoleic acid;high ratio of w-6 to w-3 FA	Diet is rich in calories	Inflammatory effects It may have several beneficial effects
WELLNESS UP DIET	Organic plant- based diet including various vegetables, fruits,whole grains,nuts,and phytonutrients, proteins;beef, chicken,eggs, fish, tempeh, amd tofu,whole grains Starches: white and brown rice, lentils, corn, oats, quinoa, cassava, and potatoes, Fruits: blueberries, raspberries,pineapple, honey dew, melon, cantaloupe, kiwi, limes, guava, star fruit, grapes	Elimination of meat, eggs,fish,dairy products, processed food refined sugars, oligosaccharides:wheat, rye, nuts, legumes, garlic, artichokes, onion, Disaccharides: lactose containing products milk, ice cream, yogurt, soft cheese, buttermilk, condensed milk, whipped cream, Monosaccharides: fructose containing fruits apples,pears, mango, watermelon	Such as body fat reduction and improving some of the detoxification elements through caloric restriction
FODMAP DIET	Vegetables : bean sprouts, bell peppers, radishes, bok choy, carrots, celery, eggplant, tomatoes, spinach, cucumber, pumpkin, zucchini, Nuts: almonds, macadamia nuts, peanuts, pecans, pine nuts, and walnuts Seeds: pumpkin, sesame, sunflower seeds, linseeds, diary, coconut and olive	sweeteners- honey, agave, nectar, and high fructose corn syrup Polyols: mannitol and sorbitol in apples, pears, cauliflower, stone fruits, mushrooms and snow peas, xylitol and isomalt in sweeteners, such as those in sugar free gum and mint	reduces symptoms of irritable bowel syndrome. May decrease both stomach pain and bloating. Helps manage flatulence, diarrhea, and constipation

	oils, peppermint tea		
ELIMINATION DIET	Common foods in the elimination diet are Gluten, dairy products, citrus, soy peanuts, eggs, corn , tree, nuts, beef, refined sugars	Eliminates certain food or group of foods cause an adverse food reaction,often referred to as a food intolerance	May reduce inflammation and allergy symptoms
VEGAN DIET	Plant based foods: fruits, vegetables, soy, legumes, nuts and nut bitter, sprouted or fermented plant foods, plant based dairy alternatives, and whole grains	excludes meat, poultry, eggs,dairy, and seafood	Associated with improved glycemic, control, lower total cholesterol, blood pressure, and BMI may prevent cancer

FACTORS CONNECTED WITH IS OF HASHIMOTO, 'S DISEASE:

Hashimoto's disease is a disease of genetic, environmental, and existential etiology such as gender, parenthood, and age. The genetic factors include major histocompatibility genes (encoding human leukocyte antigens), proteins regulating the immune system, and specific thyroid genes. Under the influence of environmental factors, they provoke the immune system to overproduce antibodies to thyroid antigens. The environmental factors include, inter alia, an excess or a deficiency of nutrients, exposure to heavy metals, and toxins, including endocrine disrupters, such as bisphenols, phthalates, drugs, and others, Molecular mimicry, and infections**.** Infections are considered important factors in the etiopathogenesis of Hashimoto's disease which, as a result of molecular mimicry, i.e. geometric similarity or amino acid sequence of microbial antigens to human antigens, can cause a cross-reaction of the immune system and can lead to the development of autoimmune disease Mental health, often overlooked in this aspect, is significant in the development of Hashimoto's disease. Chronic stress significantly affects the physiology of the entire body [10].

Oxidative Stress:

The causative factor behind the emergence of oxidative stress is free radicals. These are a group of oxygen and nitrogen compounds, which as a result of possessed unpaired electrons, are highly reactive and destructive molecules towards individual molecules, cellular structures, and consequently, the whole organism Their level in the body increases due to cigarette smoking, alcohol consumption, ionizing radiation and excessive concentration of heavy metals (iron, copper, zinc). Oxidative stress stimulates the release of inflammatory cytokines, which intensifies cellular destruction and ultimately can lead to programmed cell death – apoptosis. The thyroid is an organ constantly affected by the oxidative stress phenomenon. This fact results from the continuous formation of hydrogen peroxide in the production of thyroid hormones. Therefore, such an important role in thyroid protection is attributed to antioxidants, such as selenium [11]. In addition, the intensity of oxidative stress and the level of glutathione in the blood were correlated negatively with the level of antibodies against glutathione peroxidase, which suggests that the decrease in glutathione is a key factor for the emergence of oxidative stress and initiation of the autoimmune process. The mechanism of the relationship between oxidative stress and thyroid autoimmune is not well understood, although the over-production of free radicals, which lead to apoptosis, necrosis, and thyroid function disorders, is now considered to be the main key.

Nutritional Factors:

Due to the role of thyroid hormones in the regulation of metabolism, the resting metabolic rate in patients decreases with decreasing thyroid function, hence the possible accompanying increase in body weight resulting from excessive energy consumption. Due to the strong relationship between the developed adipose tissue and the intensity of oxidative stress, inflammatory and autoimmune processes. and the often occurring overweight or obesity in Hashimoto's disease, an important element of diet therapy is the individually determined energy value. This should take into account the lifestyle and physical activity recommended to increase in the case of existing obesity, rather than introduce energy restrictions. There were similar numbers of women with normal

body weight and overweight and obesity, which allows the conclusion that, regardless of the body weight, the energy intake in this group could be inadequate [12]. In addition, slightly higher than recommended consumption of protein and insufficient consumption of fat, including polyunsaturated fatty acids, especially omega-3 acids, and dietary fiber, were observed, which was accompanied by excessive consumption of food products containing easily digestible carbohydrates. Those abnormalities are common among the general population, although they need to be adjusted in the light of diet therapy. Hypothyroidism itself may cause disorders in the intestinal passage, leading to problems with defecation, hence attention should be paid to an adequate intake of water and fiber.

Protein:
One of the assumptions of the therapeutic diet is a sufficiently high intake of protein, meeting the daily requirement in the state of the disease. In the case of Hashimoto's disease, increasing the intake of whole meal protein from unprocessed products (meat, sea fish, especially fatty fish, eggs) can be helpful in reducing the excessively developed body weight

Iron:
Iron is necessary in the production of thyroid hormones, and its deficiency blocks the activity of thyroid peroxidase, for which iron is necessary. As a result, a reduction in the synthesis of thyroid hormones is observed, as well as an increase in TSH level and gland volume [11,12].

Iodine:
Iodine is a component necessary for the functioning of the entire organism, including the proper functioning of the thyroid, and in pregnant women for the development of the nervous system in the fetus. This increases the iodine demand in this group of women by 30%. Pregnant women should consume 250 μg of iodine per day, while children over 12 years of age and adults – 150 μg, as recommended by the World Health Organization Iodine deficiency is a known factor causing thyroid goiter, but its excessive intake, even in excess of 1 mg per day, may lead to weakening of the thyroid function and occurrence of the Wolff– Chaikoff effect. This effect defines the phenomenon of a decrease in thyroid function in response to absorption of a higher amount of iodine after its intake, and then return to normal synthesis of thyroxine and triiodothyronine over several days. The problem is that in some patients, the thyroid does not return to normal hormone production and a persistent hypothyroidism develops [12,13].

Selenium:
One of the toxic effects of excess iodine is the blockade of enzymes with selenocysteine residues, i.e. glutathione and thyroid peroxidases, which leads to a decrease in their activity, thus, besides a possible pro-oxidative effect iodine can also inhibit the activity of antioxidant enzymes. It turns out that this process can be stopped. In rats, which were given selenium along with an excess of iodine, no thyroid pathology was observed.

Data collected from studies in humans show that selenium concentration in blood below 60 μg/L and above 140 μg/L increases the risk of diseases caused by deficiency (e.g. autoimmune diseases, including Hashimoto's thyroiditis, cancer) or excess selenium (e.g. hyperlipidemia, type 2 diabetes) whereas the appropriate nutrition (60–140 μg/L) is necessary for health and may inhibit the toxic effect of excessive iodine. The content of selenium in food products is varied. There is a lot of it in yeast. However, in everyday products, it is contained mainly in combination with proteins, hence, meat, fish, animal offal, and unprocessed cereal products are good sources of selenium. Cereal products along with dairy products contain slightly smaller amounts, although they are still a better source than vegetables and fruit, containing a small amount of protein a high amount of water, and therefore little selenium.

Zinc:
Zinc is involved in the production of thyroid hormones, and its deficiency leads to disturbances in their level and to the increase in antibody titers against thyroid antigens. Improvement of the nutritional status of this mineral in patients with Hashimoto's disease restores normal thyroid function caused by its deficiency [14].

Magnesium:
Magnesium is one of several minerals, deficiencies of which are most common in the world. As a result of its extensive participation in human metabolism, including participation in the functions of several hundred enzyme proteins, magnesium deficiency is correlated with a higher risk of many diseases and their progression. As far as the immune system is concerned, magnesium has anti-inflammatory activity, including reducing the level of reactive C protein and the level of antibodies against thyroglobulin.

Vitamin D:
Vitamin D in the human body comes from 2 sources:

endogenous, which is the skin, where the vitamin is formed in the presence of sunlight, and exogenous, which is food. Rich sources of vitamin D are oily fish (sardines, salmon, cod) and mushrooms, especially when sun-dried. Hashimoto's disease, compared to healthy people, may have even a twice lower level of vitamin D in the blood, which may result from different eating habits or the occurrence of the disease itself.

Microbiota and Inflammatory Processes:
The intestines contain the largest amount of tissue and cells of the immune systems that are in close contact with the intestinal microbiota. The state of microbiota in adults is fairly stable, although it adapts constantly to eating habits and changes during illness. Fluctuation of thyroid hormone levels themselves can affect the composition of intestinal microbiota and its amount, and patients with Hashimoto's thyroiditis have a higher risk of developing intestine bacterial overgrowth. This works mutually because microbial disorders also lead to changes in metabolism because they participate in the circulation and deconjugation of thyroid hormones. type of fat consumed; excessive intake of saturated fatty acids can lead to changes in the microbiota in a direction conducive to the leaky intestinal syndrome, and molecular patterns associated with pathogens. In contrast, the intake of polyunsaturated fatty acids promotes the quality of microbiota and the improvement of metabolic functions. Whole grain products contain more dietary fiber in a mass unit, compared to refined products increasing the consumption of foods rich in secondary plant metabolites, including phenolic compounds. They modulate the composition of intestinal microbiota and the amount of omega-3 fatty acids consumed in the diet, due to their relation with the intestinal microbiota, and immunomodulatory and anti-inflammatory effects Consumption of oily fish is recommended twice a week. Omega-3 acids in the amount of ~1–2 g should be provided daily [14,15].

ELIMINATION NUTRITION IN HASHIMOTO:

Elimination of lactose:
A diet targeting the treatment of Hashimoto's disease often requires the elimination of dairy products containing lactose. Lactose intolerance is diagnosed in 75.9 % of the patients with HT.

Elimination of gluten:
Gluten is a particularly interesting factor because of its association with autoimmune diseases,
including Hashimoto. The use of a gluten-free diet should be supported by a dietician in order to avoid potential nutritional deficiencies found in the areas of iron, calcium, zinc, manganese, selenium, vitamin D, B12 and folate, and magnesium.

Nutritional tips to balance diet in HT:
Regular consumption of 4–5 meals daily which provide nutrients, the deficits of which are observed in patients:

- Vitamin D: fatty fish, fish oil, sun-dried mushrooms, Agaricus (and solar bath), chicken eggs.
- Vitamin B group: meat, fish, chicken eggs, wholegrain cereal products.
- Vitamin A: kale, carrot, pumpkin, liver, spinach, egg yolk, butter, dried apricot;
- Vitamin C: (although not a rich source, it raises the level in blood), black currant, kiwi, strawberry, orange, mango, lemon, melon, kale, spinach, tomatoes, peppers (especially red peppers); vegetables and fruit are basically the main sources;
- Vitamin E: avocado, fish oil, whole-grain cereal products, vegetable oils; magnesium: cocoa and bitter chocolate, pumpkin seeds, avocado, nuts, whole-grain cereal products, some fatty fish (salmon) and green vegetables, yogurt, kefir; Zinc: cocoa and bitter chocolate, meat, kefir, yogurt, pumpkin seeds, nuts, spinach, mushrooms, whole-grain cereals; iron: meat, animal offal, cocoa and bitter chocolate, spinach, sardines, seafood, pumpkin seeds;
- Iodine: iodized salt, fish (cod, tuna), and seafood as well as seaweed, iodized milk, and dairy products, if elimination is not required, chicken eggs, plums, especially dried plums, maize;
- Selenium: Brazilian walnut, fish (sardines, halibut, salmon, tuna), meat, spinach, liver.

TREATMENT:

Patients with hypothyroidism would need to depend on ongoing medication. Treatment for hypothyroidism focuses on replacing the thyroid hormone in the body, and one of the natural ways is by increasing salt-iodine in the patient's diet. Treatment comes in the form of the synthetic thyroid hormone thyroxine, leaving many patients of hypothyroidism and Hahimoto's thyroiditis to suffer from the symptoms of hypothyroid, despite their thyroid hormone levels being balanced [15].

Gut healing:
Restoring good digestive enzymes into the digestive system is important in preventing nutrient deficiency diseases. Enzyme levels can be increased naturally in four ways including eating raw foods, eating low calories, chewing food thoroughly, and avoiding

chewing gum. Raw foods are enzyme-rich, and consuming them decreases your body's burden to produce its own enzymes. Therefore, it is ideal to eat at least 75% of foods raw to supply our body with the amino acids and the enzyme cofactors needed to boost our own natural enzyme production. In fact, diets heavy in cooked, processed, and sugary foods, combined with the overuse of pharmaceutical drugs such as antibiotics, deplete the body's ability to make enzymes. Another way to lower the body's demand for enzymes is to reduce caloric intake. Reducing overall consumption will reduce the need for digestive enzymes, which allows the body to put more of its energy into producing metabolic enzymes. In addition, there are important physiological reasons to chew food well. Chewing stimulates saliva production and activates the digestive system by stimulating a reflex that sends a message to the pancreas and other digestive organs. Increasing chewing time causes saliva enzymes to work longer in the mouth which lessens the workload of stomach and intestine.

CONCLUSION:

A balanced diet is an important component of maintaining a healthy thyroid gland function. While iodine being on top of the list, it is not the sole micronutrient affecting the thyroid gland. Many patients with HT, even in the euthyroid state, have high oxidative stress, excess body weight and metabolic disorders. Oxidative stress may be a significant risk factor in the pathogenesis and progression of HT and the development of complications. Therefore, lifestyle changes, including body weight normalization, appropriate pharmacotherapy, along with adjusted nutrition and supple-mentation, are essential elements of medical care for patients with HT in improving health, life comfort and reducing the rate of complications. Some studies also indicated a beneficial role for Se supplementation, but there is insufficient evidence. So far, none of the European or American Endocrine/Thyroid Societies recommended Se supplementation. Additionally, HT patients should be educated about nutrition because a well-balanced diet is one of the most critical elements in preventing nutritional deficiencies. The cooperation of endocrinologists, nutritionists and other specialists is essential for the comprehensive care of HT patients and the prevention of complications, including metabolic disorders. Therefore, more studies are needed in this regard to show whether this observation is clinically relevant. Moreover, it was proved that excessive iodine intake is associated with a higher incidence of HT, while in areas with iodine deficiency, a lower prevalence has been demonstrated.

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