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The relationship of hypothyroidism to iron deficiency in the body: Review Article

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A B S T R A C T

The lack of iron storage has a significant impact on the thyroid gland's efficiency, and its synthesis of hormones, which are required for biological activities in the body, has been compromised. Thyroid problems also have a harmful effect on the level and amount of iron stored in the body. Inactive gland activity leads to poor iron absorption, and it is often incorrectly diagnosed as hypothyroidism due to the similarity of symptoms between them. Although both hypothyroidism and iron deficiency are different diseases, their symptoms are sometimes related. Hypothyroidism sometimes leads to a weakness in the body's ability to absorb iron, causing iron deficiency anemia. Because both diseases cause similar symptoms, such as frequent fatigue and sometimes weakness, as well as paleness, a good diagnosis is important to discover the main cause of these symptoms. Iron deficiency is commonly connected with hypothyroidism. Current research has demonstrated that adding iron to hormonal therapy for the treatment of pathological hypothyroidism situations improved the pathological condition as compared to using hormonal therapy for the thyroid gland alone.

Introduction

Although hypothyroidism and iron deficiency are distinct medical diseases, they can be linked in some situations. Hypothyroidism is a disorder in which the thyroid gland does not generate enough thyroid hormone, causing the body's metabolism to slow and a variety of symptoms including fatigue, weight gain, constipation, and depression. Iron deficiency, on the other hand, is a condition in which the body lacks enough iron to produce hemoglobin, the protein found in red blood cells that transports oxygen throughout the body. Anemia can result, causing symptoms such as weariness, weakness, shortness of breath, and pale skin [1], [2].

The relationship of iron deficiency and hypothyroidism in animal's studies:

Prior research has revealed that iron deficient anemia causes decreased thyroid metabolism [1], [2]. Iron depletion in rats by iron-free food resulted in a decrease in T3-triiodothyronine synthesis and decreased norepinephrine metabolism [3].

In seven days, treatment with dextran 80% corrected the pathological condition by raising hematocrit and T3 production, as well as transfusion of similar amounts of blood, correcting the alterations in T3 levels [4].

Male mice on an iron-free diet had a 33% fall in TPO concentration, as well as a decrease in T3 and T4 levels in the blood and an increase in hepatic iodine clearance, indicating that iron deficiency disrupts the thyroid hormone pathway [5]. In a study to assess thyroid gland function throughout the perinatal period in rats, it was discovered that feeding an iron-deficient diet resulted in substantial changes in hemoglobin, packed cell volume, BCV, and TSH levels in the mothers [6].

The study found that mothers of rats with significant iron deficiency were unable to conceive again due to hypothyroidism after childbirth, and premature births occurred as well. It was also shown that rats born from iron-deficient mothers had a deficiency in the concentration of TH in the neonate's brain [7]. T4 metabolism is reduced compared to normal controls because thyroid hormone binding to nuclear receptors is relatively low in these animals [8],[9]. The coexistence of iron shortage and thyroid diseases results in aberrant functioning of the newborn thyroid gland, as well as TH expression [10], [11]. In infants, a decreased response to thyroid hormone expression in the brain leads to a shortage in thyroid hormones, which has a direct effect on the thyroid gland [12].

The relationship of iron deficiency and hypothyroidism in human studies:

The thyroid gland's function is regulated by the level of iron in the body; therefore, iron is a vital element for it and helps it carry out its activities through hormone production, conversion of the thyroid hormone T4 into the T3 hormone, and usage of hormone T3 in cells. Notably, the process of metabolism and thyroid hormone metabolism require nutrients such as iron, zinc, and iodine, and iron deficiency works to lower the activity of peroxidase and therefore the generation of thyroid hormones [13].

Those with thyroid problems have a severe loss of iron storage, which produces gland lethargy and low iron levels in the body. The stomach responds to thyroid gland lethargy by decreasing hydrochloric acid secretion, which leads to a drop in iron absorption and a fall in body temperature. As a result of thyroid gland lethargy, the bone marrow responds by decreasing red blood cell production. This depletes the body's iron stores and causes anemia [14].

One study on 90 children with iron insufficiency discovered a drop in the amount of the hormone T3 and 34 as compared to other children [15].

Another study found no difference in T-3 and T-4 levels in their free and bound forms, as well as thyroid hormone-binding globulin levels and TSH levels in anemic children treated with iron prior to thyroid hormone therapy [16]. Yet, they noted a substantial difference when taking iron before hormonal treatment in children with iron deficiency, as it was discovered that when the hormone TSH is given intravenously, it takes a long time to reach the peak in reaction.

When women with anemia owing to iron deficiency have a drop in temperature, their oxygen consumption drops compared to healthy women, and when treated with nutritional supplements, their T3 and T4 levels return to normal compared to control healthy women [17], [18].

This study [19] discovered a link between hyperthyroidism and ferritin insufficiency with the development of intellectual impairment in Iranian schoolchildren.

In one of the investigations, a three percent decrease in T3 hormone was observed in persons suffering from iron deficiency anemia as well as people suffering from dietary iron shortage [20].

Other studies' findings likewise revealed a significant drop in T4 levels [21]. The study was conducted on school pupils aged 6 to 12 in eastern Nepal's hilly districts. It was shown that students suffering from iron deficiency anemia had a lower concentration of iodine in their urine. They also developed hypothyroidism, which was linked to iron and ferritin deficiencies in the blood, as well as low IQ in the students that were evaluated [22].

The effect of iron on thyroid hormone metabolism is yet unknown, because dietary iron shortage causes anemia, which mimics the transfer of oxygen within the body [23], [24]. Thyroid peroxidase enzyme stimulates the first two steps in thyroid hormone production. Iron deficiency lowers serum T3 and T4 hormones, slows T4 to T3 conversion, reduces T3 metabolism, and may raise TSH activity [1], [2].

Hypothyroidism and anemia have been linked in studies [25]. A research on neonates with congenital hypothyroidism found a link with anemia, and that this shortage impaired growth even after thyroid replacement [26].

Natural anemia caused by nutritional deficit results in a lack of stimulation of red blood cells and a decrease of erythropoietin by thyroid hormones, lowering the amount of oxygen reaching the tissues. Uncomplicated anemia is defined as normal anemia characterized by erythrocyte hypoplasia and a decrease in the level of erythropoietin in cellular blood smears. It is caused by hypothyroidism in 90% of cases and may respond to thyroid replacement therapy alone [27], [28]. Menstrual bleeding caused by hormonal imbalance and a deficiency in vitamins and minerals. In patients with hypothyroidism, the percentage of pernicious anemia is 20 % (29). Thyroid function declines in thalassemia patients due to a poor response of the free T4 hormone to TSH, as the abnormality is primarily in the pituitary gland, which affects the thyroid gland [30].

An excess of unrelated iron promotes thyroid gland impairment, as excess iron generates free radicals that trigger fat oxidation and lipid oxide generation, resulting in cellular toxicity and cell injury [31]. When Transferrin saturated to bind with iron, thus, Iron cannot accesses specific tissues, and TSH activity is boosted by opening calcium channels and activating protein kinase [32]. Iron impacts the action of protein kinase, and the effect of iron becomes deleterious when there is a huge excess of it, which could explain why thalassemia has a deficit in TSH and T4 function, According to some accounts, excess iron is also accumulated in pituitary gland tissue [33].

Excess iron chelation in patients with subclinical hypothyroidism increased the level of free T3 and T4 hormones while decreasing TSH when thyroxin medication was stopped [34]. The incidence of hypothyroidism in children and adolescents has increased by 6% as a result of sickle cell anemia, whereas other studies have shown that sickle cell anemia has no effect on thyroid function [19].

Individuals who have frequent blood transfusions are at danger of iron overload, which occurs when excess iron deposits in the thyroid gland, causing hemosiderin and cellular damage to the gland [35].

Conclusion

The review concluded that hypothyroidism is associated with a dietary iron deficiency, which causes anemia and a decrease in the level of T3 and T4 hormones in the blood. In addition, that treating people with anemia by small doses of T4 improved the condition of the thyroid gland and the increase in the level of iron in the body. Recurrent blood transfusion in thalassemia disease, excess iron accumulates in the thyroid gland and hemosiderin accumulates, resulting in the formation of free radicals and the emergence of an oxidative stress state, which causes an increase in lipid peroxide and thus the harming of thyroid cells, as well as the occurrence of hypothyroidism and its complications.

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Competing Interests

Non.

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