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Research Article

TO EVALUATE THE RELATIONSHIP BETWEEN THYROID PROFILE AND IRON STATUS AMONG HYPOTHYROID PATIENTS

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ABSTRACT

Objective: Iron deficiency is very commonly seen among hypothyroidism patients. The study aimed to find out the relationship between thyroid profile and iron status among hypothyroidism patients, whether it is interdependent or not.

Methods: This retrospective study was conducted among hypothyroidism patients at the Department of Biochemistry, Government Medical College, Amritsar. One hundred study participants were included in this study. The study participants were divided into two groups. Fifty hypothyroidism patients served as cases and 50 normal healthy individuals as control. Serum thyroid-stimulating hormone (TSH), T3, and T4 levels and serum ferritin, iron, and TIBC levels were estimated and then compared between the two groups.

Results: In our findings, 70% of the females were hypothyroidism patients. Hypothyroidism patients' mean age±SD value was 37±15.1 whereas the healthy control group was 39±12.5. Most of the middle-aged people suffer from this disease, i.e., 52%. In this study, the levels of ferritin, and iron were found to decrease whereas that of TIBC increased in patients suffering from hypothyroidism as compared to healthy controls. Serum TSH levels were inversely correlated with ferritin. The levels of ferritin were found to be significantly decreased in patients as compared to controls.

Conclusion: Thyroid hormone insufficiency may lead to a deficiency of iron and vice versa. Other factors such as oxidative stress may also play a role. Thus, iron the estimation using the above parameters may be useful during diagnosing and treating hypothyroid patients.

Keywords: Hypothyroidism, Ferritin, Iron profile, Thyroid profile.

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INTRODUCTION

In India, we also have a major burden of thyroid diseases, the most prevalent of which is hypothyroidism, which is detectable and curable. Thyroid hormones play a critical role in regulating the human body's metabolism. Hypothyroidism is a clinical condition caused by low levels of thyroid hormones in the blood. Thyroid hormone levels depend on various trace elements, including iron, iodine, selenium, and zinc, for synthesis and metabolism [1]. Thyroid function can be impaired if certain nutrients are deficient [2]. Iron is a micronutrient that is essential for several bodily activities. It is required for cellular growth and differentiation, oxygen binding, transport and storage, enzymatic processes, immunological function, and cognitive activities such as mental and physical development. As a result, iron deficiency impairs both physiological and pathological growth, resulting in lower learning capacity and work efficiency [3]. In iron-deficient anemia, serum ferritin levels are declined. Ferritin is an intracellular iron storage protein whose synthesis is regulated by a mechanism involving the binding of cytoplasmic iron regulatory protein (IRP) to an iron-responsive element (IRE) in the 5' untranslated region of ferritin mRNA [4].

The major enzyme involved in thyroid metabolism, thyroperoxidase, has been well elucidated. Many cofactors are required for the synthesis of heme-containing enzymes. It is entirely dependent on iron [5]. As a result, an inadequate supply of iron can lead to impaired thyroperoxidase enzyme activity. This interferes with thyroid hormone synthesis, leading to hypothyroidism. It has also been demonstrated that iron deficiency has significant effects on the effectiveness of the 5' deiodinase enzyme [6]. This enzyme participates in the peripheral conversion of T4 to T3 and also reduces TSH sensitivity to thyroid-releasing hormone (TRH) [2]. This is the most common cause of iron deficiency that leads to hypothyroidism. Iron deficiency anemia is characterized by symptoms such as palpitation, elevated heart rate, menstrual irregularities, and anxiety. While supplementing thyroxine to hypothyroid patients with iron deficiency anemia, keep in mind that iron deficiency anemia promotes hypothyroidism. Because thyroxine promotes sympathetic activity, these individuals' symptoms of sympathetic overactivity may worsen. In addition, thyroxine supplementation improves erythropoiesis, resulting in higher erythropoietin levels. Increased erythropoiesis leads to increased RBC production, which necessitates even more iron in patients who are already iron-deficient. This causes iron-deficient anemia. This is the second cause of hypothyroidism and anemia due to iron insufficiency [7]. The current study is to determine whether iron deficiency anemia has been linked with hypothyroidism or vice versa.

METHODS

The retrospective study was undertaken in the Biochemistry Department of Government Medical College, Amritsar. A total of 100 study participants in the age group of 15–75 years, diagnosed cases of hypothyroidism patients were included in this study. After the Institutional Ethics Committee approves, a study has been started. The samples were collected after obtaining written informed consent. The study participants were divided into two groups: Group A 50 participants taken as hypothyroidism patients, and Group B 50 participants considered healthy control. Clinical examination and history were taken about the thyroid and recorded. Total/subtotal thyroidectomy, antithyroid drugs, Graves's disease, toxic multinodular goiter, toxic

adenoma and cancer patients, and gestational hyperthyroidism were excluded from the study.

A volume of 5 ml of venous blood sample was drawn from each subject under aseptic conditions. The sample was discharged into a plain vial and allowed to clot. The serum was separated and used for various investigations. Thyroid profiles and iron profiles were analyzed by chemiluminescence and compared in these two groups. The results are expressed as the mean ± SD of each variable. The comparison was done by the student's t-test on the number of variables of each parameter. The $p<0.001$ is considered statistically significant.

RESULT AND DISCUSSION

This study was conducted with the view to appraise iron levels in hypothyroidism patients and the control group. In this study, the study population is divided into two groups, i.e., 50 hypothyroidism patients as cases and 50 healthy individuals as controls. The following biochemical parameters were analyzed:-

As shown in Table 1, most of the percentage were female in both study groups i.e., hypothyroidism patients (70%) and healthy control (68%), whereas males have 30% and 32%, respectively (Fig. 1). The mean age ± SD value of hypothyroidism patients was 37±15.1 whereas the healthy control group was 39 ± 12.5. According to Dahiya *et al*. [7], hypothyroidism was observed in 60% of cases of females as compared to males. The reason may be that women have estrogen which has an anti-thyroid effect. Similar results were given by present findings, 74% of the females were found to be hypothyroid. There were studies that reported that iron deficiency may be associated with low levels of thyroid hormones [8,9].

Table 2 shows that the highest percentage of the age (36–55 years) for the patients was 52% and the controls were 48%. Most of the middle-aged people suffering from this disease. From the above data, we observed that hypothyroidism is more common among women aged 36–55 years i.e., (52%). Hypothyroidism is more prevalent among the female population [8].

In this study, the levels of ferritin, and iron were found to decrease whereas that of TIBC increased in patients suffering from hypothyroidism as compared to healthy controls (Table 3). The $p<0.001$ value was found statically significant. The underlying mechanism of interference of low ferritin levels in hypothyroidism is yet to be evaluated. In the case of iron deficiency anemia, serum ferritin is decreased and detects the fall in iron stores at an earlier stage [10]. However, since it is an acute phase reactant, low ferritin levels alone may not be equivocal to diagnose iron deficiency [11]. Our study observed that ferritin and TSH are negatively correlated and T3, T4 levels, and ferritin are positively correlated. The correlation was statistically highly significant ($p<0.01$). The results of our study are similar to the study conducted by Dahiya *et al*. [7] and Das *et al*. [9]. It revealed that iron deficiency may be associated with low levels of thyroid hormones. Serum ferritin levels were a better marker for diagnosing iron deficiency anemia. Iron deficiency anemia is a characteristic feature seen in hypothyroidism. From our study, we have observed the existence of a mutual relationship between hypothyroidism and iron deficiency anemia. Hence, we conclude that hypothyroidism may be a cause and effect of iron deficiency anemia and vice versa.

Limitation

Majority of the Indian women have nutritional iron deficiency. It is highly difficult to differentiate nutritional iron deficiency among them. Randomized control trials can be done on hypothyroid patients along with measuring thyroid hormones before and after iron supplementation.

Table 1: The distribution of study groups according to gender

Gender	Hypothyroidism patients (percentage) N=50	Healthy control (percentage) N=50
Male	15 (30)	16 (32)
Female	35 (70)	34 (68)

Table 2: The percentage of distribution of study groups according to age

Age groups	Hypothyroidism patients (percentage) N=50	Healthy control (percentage) N=50
15–35	7 (14)	5 (10)
36–55	26 (52)	24 (48)
56–75	17 (34)	21 (42)

Table 3: Comparison of Thyroid profile and Iron profile in both groups

Parameters	Hypothyroidism patients Mean±SD	Healthy control Mean±SD	p-value
TSH (mIU/mL)	27.68±5.68	2.99±0.82	<0.001
T3 (ng/dL)	0.78±0.28	1.42±0.25	<0.001
T4 (µg/dL)	4.02±1.65	7.94±2.39	<0.001
Iron (µg/dL)	39.14±8.19	72.19±13.7	<0.001
TIBC (µg/dL)	275.14±65.09	226.4±45.5	<0.001
Ferritin (µg/L)	18.47±10.49	35.63±15.79	<0.001

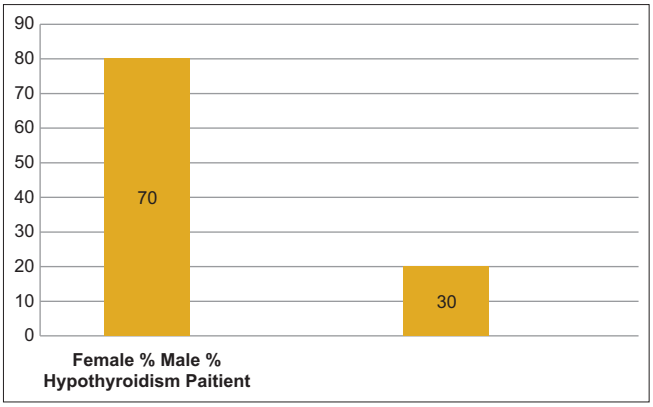

Fig. 1: Gender distribution of hypothyroid patients

CONCLUSION

The present study aimed to study the iron status among hypothyroid patients. Hypothyroidism is more common among the women aged 31–40 years. Ferritin levels were found to be decreased in hypothyroid cases as compared to the control group. It seems that ferritin decreases with the increase of TSH and is elevated with the decline of T3 and T4. Hence, the estimation of serum ferritin and iron levels before and after the commencement of hormone replacement therapy can provide us the important clues about the both progress of the disease and the body's iron storage. Monitoring iron profiles in hypothyroid patients can aid the treatment protocol and outcome of the disease.

AUTHORS CONTRIBUTIONS

Manuscript writing was accomplished by Tejinder Singh and the data collection and analysis were done by Garima Sehgal and Sangeeta Gupta.

The research was reviewed and edited by Jaspreet Kaur and statistical analysis was done by Garima Sehgal. The manuscript was finalized by Jaspreet Kaur and submitted for publication by Tejinder Singh.

CONFLICTS OF INTEREST

The authors affirm no conflicts of interest.

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