

Comparative Study of Serum Ferritin in Hypothyroid and Euthyroid Subjects

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Abstract- Background:- Thyroid hormones triiodothyronin (T3) and thyroxin (T4) are secreted by thyroid glands and secretion of these hormone is under feedback control of Thyroid Stimulating Hormone (TSH). Primary hypothyroidism is a state in which thyroid hormone T4 and T3 are reduced and TSH level increased in serum. Hypothyroidism affects haematopoietic system and causes anaemia. Iron is required for thyroid peroxidase enzyme which catalyses thyroid hormone biosynthesis. Ferritin is storage form of iron and its serum level reflects iron stores of body. Altered level of serum ferritin have been reported in patients with thyroid disease. So the present study was done to observe serum ferritin level in primary hypothyroidism and to compare it with euthyroid subjects and to determine correlation between serum ferritin and thyroid hormone level.

Material and Methods:- This cross sectional study was done in January 2019. On the basis of TSH values 40 hypothyroid subjects as case and 40 euthyroid subjects as matched controls were included. Informed consent was taken from all study participants. Subjects with TSH value >5.5 μ IU/ml were taken as hypothyroid and TSH value <5.5 μ IU/ml were taken as euthyroid. Serum was analyzed for freeT3, freeT4, Thyroid-Stimulating

Hormone (TSH) and ferritin by chemiluminescent immunoassay autoanalyser.

Results:- In our study we found that mean value of serum ferritin concentration in hypothyroid subjects was lower (13.51 ± 6.13 ng/ml) as compared to the mean value of serum ferritin among euthyroid subjects (41 ± 11.41 ng/ml) and it was found to be statistically significant. We observed a negative correlation between serum TSH and serum ferritin among study subjects ($r = -0.89$).

Conclusion:- Serum ferritin level decreases in hypothyroid patients and it further aggravates hypothyroidism, so ferritin level should be assessed in hypothyroid subjects.

Keywords:- Primary hypothyroidism, Euthyroidism, Serum ferritin, Free T3.

Introduction

Thyroid gland secretes thyroxin (T4) and triiodothyronine (T3) hormones and it is under the feedback control of a hormone produced by anterior pituitary Thyroid Stimulating Hormone (TSH) [1]. Several minerals like iodine, iron, selenium and zinc are required for normal thyroid hormone metabolism and their deficiency impairs thyroid hormone function. Thyroid hormones influence a number of

metabolic pathways and physiological process. Decreased thyroid hormone level is called hypothyroidism. Primary hypothyroidism is due to thyroid gland abnormality and secondary is due to hypothalamic or pituitary dysfunction. Low serum iron and low serum ferritin reduces thyroid function [2]. Hematopoietic system is affected by hypothyroidism and produces normocytic normochromic anemia and microcytic anaemia. Normocytic normochromic anemia is due to bone marrow suppression due to thyroid hormone deficiency which also causes defective erythropoietin production [3]. Microcytic anemia is due to iron deficiency caused by malabsorption observed in hypothyroidism. Low serum ferritin levels have been observed in hypothyroid patients [4].

Iron is a component of many enzymes including Thyroid Peroxidase (TPO) which is a haemoprotein bound to luminal membrane of thyroid follicular cells and takes part in the initial two steps in thyroid hormone synthesis [5]. Several studies have observed that nutritional iron deficiency may significantly lower the circulating levels of both thyroxine and triiodothyronine [6, 7]. Thus, the condition becomes a vicious cycle as iron deficiency may both be a cause and an effect of subclinical hypothyroidism. Thus, the relationship between subclinical hypothyroidism and iron deficiency is very complex and intriguing. Ferritin is storage form of iron and serum ferritin levels are decreased in iron deficiency. Serum ferritin is a measure of iron stores and the best single test to confirm iron deficiency. Many studies have observed the association of serum ferritin and thyroid hormone but due to limited number of large cohort studies, pathogenesis of low serum ferritin is still unclear. In a study increase in serum ferritin level was observed in hypothyroid patients following T3 administration [2.] Although the cause of this T3 -induced increase in the serum ferritin level is unclear, increased synthesis of ferritin in the liver may be an important contributor. These observations suggest possible association between serum thyroid hormone and serum ferritin. So the present study was done to observe serum ferritin level in primary hypothyroidism and to compare it with euthyroid subjects and to determine correlation between serum ferritin and thyroid hormone level.

Material and Methods

This cross sectional study was carried out in the SMS Medical College, Jaipur from January 2019 to April 2019. In the present study, based on TSH values 40 hypothyroid subjects as case and 40 euthyroid subjects as matched controls of age group between 18-60 years were included. Informed consent was taken from all study participants. Subjects with TSH value $>5.5 \mu\text{IU/ml}$ were taken as hypothyroid and TSH value $<5.5 \mu\text{IU/ml}$ were taken as euthyroid. Venous blood (3 ml) was taken from the antecubital vein under all aseptic conditions in a red capped plain vacutainer from the subjects and the serum was analyzed for freeT3, freeT4, Thyroid-Stimulating Hormone (TSH) and ferritin by chemiluminescent immunoassay autoanalyser on Advia Centaur XP; Siemens. Patients with pregnancy, hepatic disorder, renal diseases, anaemia, patients on thyroid drugs and polycystic ovarian syndrome were excluded from the study. Collected data was entered in Microsoft Excel and the data was analyzed by using primer software. Quantitative variables like mean, percentage, standard deviation and Inferential statistics such as chi square test, Independent t test were used. P value < 0.05 was considered as statistically significant.

Results

We observed that out of total 40 subjects in hypothyroid group 29 were female and 11 were male and among 40 euthyroid subjects 24 were female and 16 were male.

Table 1: Comparison of different biochemical parameters between Hypothyroid and Euthyroid group

Parameter	Euthyroid (N=40)	Hypothyroid (N=40)	P value
	Mean± SD	Mean± SD	
TSH ($\mu\text{IU/ml}$)	2.61±0.46	30.41±9.26	<0.001
FreeT3 (pg/ml)	3.72±0.51	2.59±0.49	<0.001
FreeT4 (ng/dl)	1.24±0.31	0.81±0.21	<0.001
Ferritin(ng/ml)	41±11.41	13.51±6.13	<0.001

It was noted that serum TSH level was elevated in hypothyroid group compared to euthyroid group and it was statistically significant (p value <0.001). Serum T3, T4 and serum ferritin level was low in hypothyroid group as compared to euthyroid group and difference was statistically significant (p value <0.001). We observed a negative correlation between serum TSH and serum ferritin among study subjects ($r=-0.89$). Serum TSH levels were increasing with serum ferritin levels decreasing.

Discussion

In our study we found that mean value of serum ferritin concentration in hypothyroid subjects was lower (13.51 ± 6.13 ng/ml) as compared to the mean value of serum ferritin among euthyroid subjects (41 ± 11.41 ng/ml) and it was found to be statistically significant. We observed a negative correlation between serum TSH and serum ferritin among study subjects ($r= -0.89$). As serum TSH levels were increasing serum ferritin levels were decreasing. Our results were in accordance with the study [8, 9, 10, 11, 12]. In a study by Arvind K et al it was observed that mean hemoglobin, serum ferritin and red blood cell indices were significantly decreased in subclinical hypothyroid patient in comparison to euthyroid group [8]. Another study conducted by Ashuma S et al, found low serum ferritin levels in patients with hypothyroidism as compared to normal subjects [9]. In a study conducted by Kiran D et al was noted that the levels of iron and ferritin were found to be significantly decreased while the levels of total iron binding capacity significantly increased in hypothyroid patients as compared to healthy individuals [10]. Deshpande UR et al observed that levels of serum ferritin were slightly lower in hypothyroids while levels were significantly higher in hyperthyroid subjects [13]. Henry Volzke et al observed that there was no association between thyroid functions and serum ferritin levels [14]. Thyroid functions are affected by the level of serum ferritin [15]. Some other studies have demonstrated that the thyroid performance is independent of the iron deficiency [16]. Akhter S et al demonstrated that the changes in the status of thyroid hormones in iron deficient patients could be due to the reduced activity of iron-dependent enzymes such as thyroid peroxidase that impairs thyroid hormone metabolism

[17]. Additionally, Hess SY et al noted that iron is an important part of the thyroid hormone function in the body cells and its lack causes poor function of thyroid hormone, which in turn results in deficient metabolic activity of hypothyroid even in presence of normal FT3 levels [18]. It is said that ferritin and its formation can protect against iron toxicity, thus causing decrease in oxidative stress. Lowering of ferritin levels accompanies release of free iron which may contribute to increasing oxidative stress thereby may oxidatively damaged thyroid follicular cells and reducing the synthesis of T3. The present study showed that hypothyroid subjects had significantly lower serum ferritin concentration as compared to euthyroid subjects.

Conclusion

Serum ferritin level decreases in hypothyroid patients and it further aggravates hypothyroidism, so ferritin level should be assessed in hypothyroid subjects. Further prospective type studies with large sample size are required to know the serum ferritin level in hypothyroid and effect on its level after thyroid hormone supplements.

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