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Original Research Article

A comparative study of serum ferritin and thyroid stimulating hormone (TSH) levels in hypothyroid and euthyroid subjects

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ABSTRACT

Introduction: Thyroid hormones synthesized and released by the thyroid gland, have a vital role in regulating the metabolism of body. Synthesis of these thyroid hormones requires an iron containing enzyme Thyroid Peroxidase (TPO). Thus, iron inadequacy can affect the proper functioning of the TPO enzyme that further affect the thyroid hormone production. Serum ferritin, an index of iron store is present in almost all cells; however, it has been reported that an alteration in ferritin levels occurs in patients with thyroid disease. This study was conducted to determine serum ferritin and Thyroid Stimulating Hormone (TSH) levels in hypothyroid and euthyroid subjects and to compare the same.

Materials and Methods: The retrospective study was carried out in Amrita Institute of Medical Sciences (AIMS), Kochi, which included 30 hypothyroid subjects as cases and 30 age and gender matched healthy controls. TSH, Thyroxine (T4) and serum ferritin levels of the study groups were collected and recorded.

Results: The mean TSH of hypothyroid patients was found to be higher (16.12±17.00) than that of euthyroid group (2.35± 1.08) whereas the mean value of T4 (1.01± 0.25) and ferritin (43.80 ± 75.44) were found to be reduced in patients with hypothyroidism compared to normal subjects. All the parameters were statistically significant with p value <0.05.

Conclusion: The present study showed that hypothyroid subjects had significantly lower serum ferritin concentration than euthyroid subjects. Thus, serum ferritin measurement could be useful for the evaluation of thyroid diseases.

1. Introduction

Thyroid diseases are highly prevalent worldwide. Thyroid illness is a major problem in India as well. Thyroid disease affects roughly 42 million individuals in India, and it is more common among women.[1] Thyroid hormone has a key role in differentiation, development and maintenance of body homeostasis.[2] Hypothyroidism is a common endocrine disorder in which the thyroid gland doesn't produce sufficient thyroid hormones and the individuals typically have a slower metabolism. Iron is one of the essential elements for the thyroid gland to function properly and it is stored in the form of ferritin. Serum ferritin levels are observed to be varying in patients with thyroid disease. Thus, alterations in serum ferritin levels indicate thyroid function.

International studies notified an absolute decrease in the level of iron storage markers in hypothyroid subjects.[3] As reported by some authors, thyroid hormones have a considerable impact on oxidative stress. A study by G Lenaz et.al suggests a reduction in Reactive Oxygen Species (ROS) production as well as antioxidant activity

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in hypothyroidism which may result in oxidative stress.[4] Ferritin has a protective antioxidant role by sequestering the iron. With increasing TSH concentration in the body, the levels of antioxidants including Ferritin decreases.[5] This showed an obvious association of TSH with ferritin. These information lead us to take up the study with an aim to detect and assess the correlation between serum ferritin and thyroid hormone status among hypothyroid and euthyroid individuals. Hence, this study focus to find out correlation between serum ferritin and TSH levels in hypothyroidism.

2. Materials and Methods

Data was collected from the patients who visited the endocrinology department of Amrita Institute of Medical Sciences (AIMS), Kochi for thyroid hormone testing from December 2020 to May 2021.

2.1. Inclusion criteria

Data of 30 patients diagnosed for hypothyroidism and 30 healthy (controls) subjects of age between 20 to 70 years were collected from Clinical Biochemistry Laboratory, attached to the hospital.

2.2. Exclusion criteria

Subjects with acute illness, recent history of blood transfusion, anemia, diabetes mellitus, hypertension, renal and hepatic failure, history of thyroidectomy, radiotherapy, radioactive iodine therapy, pregnant women and those consuming drugs known to cause hypothyroidism were excluded from the study as they may influence thyroid hormone and ferritin levels.

2.3. Methods

The study included data from 60 subjects whose levels of TSH, T4 and serum ferritin were recorded. Individuals with a TSH value > 4.2μIU/ml were considered to be hypothyroids and those with TSH value 0.27-4.2 μIU/ml as euthyroids. TSH was estimated using Electro ChemiLuminescence ImmunoAssay (ECLIA) on cobas e immunoassay analysers using sandwich principle. T4 levels were estimated using Electro ChemiLuminescence ImmunoAssay (ECLIA) on Elecsys and cobas e immunoassay analysers using competition principle. Ferritin levels were estimated using Electro ChemiLuminescence ImmunoAssay (ECLIA) on Elecsys and cobas e immunoassay analysers via Sandwich principle. Correlation of results was analyzed statistically.

3. Results

Analysis of statistical data was performed using the SPSS software (Statistical Package for the social Sciences, version 20.0, SPSS Inc, Chicago, III, USA). Mean and Standard Deviation of Continuous variables were calculated. Data were analysed using independent student't' test for their level of significance. Correlation between variables was carried out using Pearson's coefficient of correlation. A p value <0.05 was considered statistically significant.

Our study included 30 hypothyroid and 30 euthyroid subjects. Among the hypothyroid patients, 10 (33.3%) were males and 20 (66.7%) were females (Table 1). The mean of T4, TSH and Ferritin in both euthyroid and hypothyroid patients are shown in Table 2. Pearson's coefficient of correlation was used to calculate the correlation between TSH and ferritin. Scatter diagram was plotted to show the correlation between TSH and Ferritin among study subjects (Figure 1).

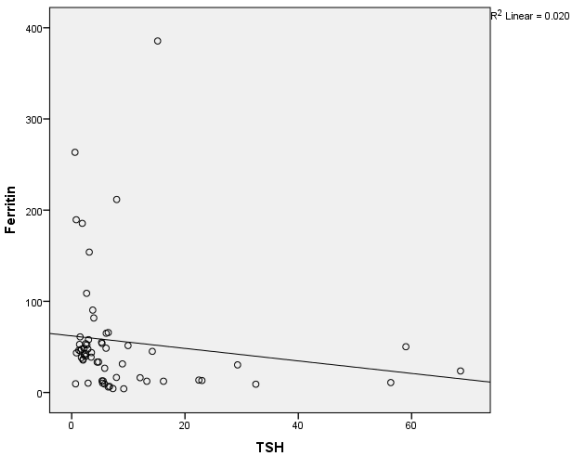

Fig. 1: Correlation scatter plot between tsh and ferritin among study subjects

4. Discussion

Thyroid hormones are essential for cell growth, differentiation and metabolism, as well as for maintaining bodily homeostasis. Serum ferritin levels have been observed to change in subjects with thyroid diseases, indicating a link between serum ferritin concentration and thyroid functions. This study focused to find correlation between serum ferritin and TSH levels in hypothyroid patients.

Present study compared biochemical parameters T4, TSH and Ferritin in serum of hypothyroid and euthyroid patients. It was observed that the mean TSH of hypothyroid (case) and euthyroid patients (control) was 16.12±17.00 μIU/ml and 2.35± 1.08 μIU/ml respectively. The comparison of TSH between two groups were statistically significant with P value <0.05. The mean T4 of cases and controls was 1.01±0.25 ng/ml and 4.14± 16.27 ng/ml respectively. The comparison of T4 between two groups was found to be statistically significant with P value <0.05. In our study, we found that mean value

Table 1: Distribution of study subjects

Sex	**Euthyroid** N (%)	**Hypothyroid** N (%)	**Total** N (%)
Male	6 (20%)	10 (33.3%)	16 (26.7%)
Female	24 (80%)	20 (66.7%)	44 (73.3%)
Total	30 (100%)	30 (100%)	60 (100%)

Table 2: Correlation of biochemical parameters among study population

Parameters	**Euthyroid Mean± SD**	**Hypothyroid Mean± SD**	**p value**
TSH	2.35± 1.08	16.12±17.00	0.000
T4	4.14± 16.27	1.01± 0.25	0.021
Ferritin	67.75± 57.47	43.80 ± 75.44	0.002

of serum ferritin concentration in euthyroid subjects was higher (67.75± 57.47 ng/ml)as compared to the mean value of serum ferritin among hypothyroid subjects (43.80 ± 75.44ng/ml) and it was found to be statistically significant.

Our findings were in agreement with the study conducted by Ashuma S et al[1] who observed that serum ferritin levels were substantially lower in patients with hypothyroidism as compared to healthy individuals. Similar results were reported by Dr. Sahana KR and Dr. Kruthi BN in their study.[6] Study conducted by Ashuma S et al[1] also came to a conclusion that Hypothyroidism is associated with low serum ferritin levels. Present study showed a weak negative correlation between TSH and ferritin levels in serum of hypothyroid patients which was statistically insignificant (r=-0.140, p= 0.285). Our findings are comparable to that reported by Farooq MS et al[7] who found negative correlation between serum ferritin and serum TSH which was statistically insignificant. The results were in concurrence with previous studies which reported the correlation of Ferritin with some diseases. Serum ferritin levels are altered in some condition of thyroid disease as per the study by Sachdeva et al[1] and the low serum ferritin levels can indicate hypothyroidism.

Increased oxidative stress has been reported in hypothyroidism. Hypothyroidism causes immunosuppression that may lead to oxidative stress. Ferritin has an important role in iron sequestration with some antioxidant properties.[8–10] TSH, at higher concentration is known to induce inflammatory cytokines and decrease the concentration of antioxidants in the body, as seen in clinical hypothyroidism.[11] This may be an additional reason for decrease in ferritin levels in these patients.

5. Conclusion

Present study observed a decrease in serum ferritin levels in patients suffering from hypothyroidism as compared to normal controls. Variations in thyroid hormones produce changes in ferritin levels in serum sample. Measurement of serum ferritin levels in patients with hypothyroidism is very important to minimize the problems occurring as a result of its deficiency. Hence, estimating serum ferritin levels could be beneficial in determining thyroid hormone status and monitoring of hypothyroid patients.

6. Source of Funding

None

7. Conflict of Interest

The authors declare no conflict of interest

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