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ANALYSING SERUM FERRITIN LEVELS IN HYPOTHYROIDISM CASES

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ABSTRACT

Background: For the thyroid gland to operate normally, iron is an essential component. Iron is stored in the human body as the intracellular protein ferritin.

Aim: The purpose of this study was to determine the serum ferritin levels in hypothyroid Indian participants.

Methods: Based on the thyroid profile, 200 individuals with confirmed laboratory diagnoses of hypothyroidism were evaluated in this study. The study also included 100 healthy control subjects. Serum TSH, T3, and T4 levels were estimated as part of the thyroid profile evaluation. Ferritin levels in the serum were measured in the patients and controls.

Results: The study group's mean TSH levels were 14.43±12.94 µIU/mL, while the control group's were 1.25±1.03 µIU/mL. Serum ferritin levels were 9.93±6.34 ng/mL in cases and 149.33±103.14 ng/mL in controls. TSH and serum ferritin levels were significant ($p<0.001$). Serum ferritin and TSH levels in hypothyroid individuals also showed a strong negative connection.

Conclusion: individuals with hypothyroidism had lower serum ferritin levels and higher serum TSH levels than those without the condition, and that there is a negative association between serum ferritin and TSH in hypothyroidism. Therefore, measuring the blood ferritin level in hypothyroid individuals can be helpful in determining the thyroid hormone status.

Keywords: Enzyme-linked Immunosorbent assay, Hypothyroid, Serum ferritin, Thyroid-stimulating hormone, Thyroxine

INTRODUCTION

Thyroid disorders are very frequent around the world and are regarded as the second most common endocrine disorder after diabetes. The prevalence of subclinical hypothyroidism varies from 4 to 10% depending on the community, while the literature currently in publication indicates a high frequency. In India, the prevalence of self-reported thyroid disorders or goiter was 2.9% in NEHS-V and 2.2% in NEHS-IV. Reduced thyroid hormone production is the hallmark of hypothyroidism, which can be primary or secondary. While subclinical hypothyroidism manifests as slightly elevated TSH (4–10 mIU/L) and normal T3 and T4 concentrations, overt hypothyroidism is characterized by elevated serum TSH (thyroid-stimulating hormone) levels >10 mIU/L and decreased T3 (triiodothyronine) and T4 thyroxine levels.[1]

Growth, metabolism, differentiation, and preserving the body's equilibrium all depend on thyroid hormones. While triiodothyronine is created by combining DIT and monoiodotyrosine, thyroxine is produced by oxidatively condensing two DIT (diiodotyrosine) molecules.[2]

For the thyroid gland to operate normally, it needs a variety of trace metals and minerals, including zinc, selenium, iron, and iodine. Thyroid hormone production depends critically on iodine. Because it is an essential part of deiodinase enzymes and has protective properties against excessive iodine exposure, selenium aids in the conversion of T4 to T3.3. Ferritin is a protein that stores iron in all bodily tissues. Ferritin levels are typically disturbed in conjunction with thyroid disorders.

Iron serves as a cofactor for thyroid peroxidase, or TPO. TPO plays a key role in two essential stages of thyroid hormone production. TPO is an enzyme that is membrane-bound and participates in the oxidation of iodides.

Additionally, it aids in iodide binding to thyroglobulin's tyrosyl residue. The gold standard for determining iron insufficiency is ferritin. The purpose of the current study was to evaluate the relationship between serum ferritin levels in hypothyroid individuals and normal, healthy controls.

MATERIALS AND METHODS

The study participants came from the Institute's outpatient department. Prior to participation, all individuals gave their written and verbal informed consent. Two hundred participants with a verified laboratory diagnosis of hypothyroidism made up the study group. Based on test findings showing TSH levels greater than 4.2 µIU/mL, the individuals were diagnosed. One hundred healthy participants, matched by age and gender to a research group, made up the control study group.

Participants in the study were to be between the ages of 20 and 65, be of either gender, and have a laboratory-diagnosed hypothyroid condition with blood TSH levels greater than 4.2 µIU/mL, which is within the normal range of 0–4–4.2 µIU/mL. Iron therapy participants, patients with severe anemia (≤7 gm/dL), blood transfusion recipients, patients with renal or diabetic mellitus, pregnant women, patients with liver illnesses, and participants older than 65 were excluded from the study.

Serum ferritin and TSH levels were estimated using the solid-phase sandwich ELISA method, serum samples were examined for regular biochemistry studies, and serum T4 and T3 levels were measured in all study participants using solid-phase competitive ELISA (enzyme-linked immunosorbent assay). The system pack's fully automated analyser was used to evaluate these parameters.

5–6 mL of aseptic venous blood from the antecubital vein was used to collect the sample. The obtained blood was stored in vacutainers with red tops. Blood was collected, allowed to clot, and then centrifuged for 10 to 15 minutes at 2200–2500 rpm in order to separate the serum. Analysis was conducted after samples were brought to room temperature. The serum was aseptically kept in aliquots at 2–8°C for five days and at -20°C for up to one month.

The collected data was statistically evaluated using the Student t-test, ANOVA (analysis of variance), Mann-Whitney U test, Chi-square test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA) for evaluating descriptive measures. The findings were presented as frequency, percentages, mean, and standard deviation. A p-value of less than 0.05 was taken into account.

RESULTS

The purpose of the current study was to evaluate the correlation between blood ferritin levels in hypothyroid people and normal, healthy controls. In this study, 200 people with a confirmed laboratory diagnosis of hypothyroidism were assessed based on their thyroid profiles. One hundred healthy control volunteers were also included in the investigation.

When serum TSH levels in two study groups were compared, it was observed that the study groups' TSH levels ranged from 2.67 to 40 µIU/mL, with mean values of 14.43 to 12.94 µIU/mL. TSH levels in the control study participants ranged from 0.17 to 4.83 µIU/mL, with a mean of 1.25±1.03 µIU/mL. This was considerably lower than the study group, with a p-value of less than 0.001 (Table 3).

Serum ferritin and TSH levels were found to correlate in two groups of study participants. The mean ferritin level was 9.93±6.34 ng/mL, while the mean serum TSH level was 14.43±12.94 µIU/mL. The r-value was -0.494, indicating a significant negative correlation with $p<0.001$ (Table 4).

DISCUSSION

Based on thyroid profiles, the current investigation evaluated 200 individuals with a confirmed laboratory diagnosis of hypothyroidism. The study also included 100 healthy control subjects. The research group consisted of 65% (n=1300) females and 35% (n=70) males, while the control group had 62% (n=62) females and 38% (n=38) males. In total, 108 men and 192 women participated in the current study. These findings were similar to those of studies by Kumar S et al. (5) and Mahajan P et al. (6), in which the authors evaluated hypothyroid individuals and provided demographic information similar to those of the current study.

Serum ferritin levels in two sets of research participants were found to be between 20 and 350 ng/ml for males and between 10 and 200 ng/ml for females. In comparison to a control group, which had a range of 18.08-392 ng/mL and a mean value of 149.33±3.14 ng/mL with a p-value of <0.001, the study group's mean value was 9.93±6.34 mL, which was considerably lower than the range of 2.08-38 ng/mL. These findings were similar to those of Sarin M et al. (2017) and

Kumar A et al. (2017), who revealed serum ferritin levels in people with and without hypothyroidism that were similar to the current study's findings.

The study's findings demonstrated that, when comparing the serum TSH levels of the two groups of participants, the study groups' mean values were 14.43±12.94 µIU/mL, with TSH levels falling between 2.67 and 40 µIU/Ml.

TSH levels in control study participants ranged from 0.17 to 4.83 µIU/mL, with a mean of 1.25±1.03 µIU/mL. This was significantly lower than the study group ($p<0.001$). These results were consistent with those of Krishnamurthy HK et al. (2018) and Taylor PN et al. (2018), who found that the blood TSH levels of participants with and without hypothyroidism were similar to those of the current study.

Additionally, the correlation between serum ferritin and TSH levels was observed in two groups of research participants. The mean ferritin level was 9.93±6.34 ng/mL, and the mean serum TSH level was 14.43±12.94 µIU/mL. The r-value for this correlation was -0.494, indicating a significant negative correlation with $p<0.001$.

These findings were consistent with those of Rushton DH et al. (2010) and Unni Krishan AG et al. (2011), who also identified a link between serum ferritin and TSH levels similar to the current study in their respective investigations.

CONCLUSIONS

Taking into account its limitations, the current study finds that subjects with hypothyroidism had higher serum TSH levels and lower serum ferritin levels than subjects without the condition, and that there is a negative connection between serum ferritin and TSH in hypothyroidism. Therefore, measuring the blood ferritin level in hypothyroid individuals can be helpful in determining the thyroid hormone status.

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Gender	Study group		Controls		Total
	n=200	%	n=100	%	
Females	130	65	62	62	192
Males	70	35	38	38	108
Total	200	100	100	100	300

Table 1: Gender distribution in study subjects

Parameter	Groups	Range	Mean ± S. D	p-value
Ferritin (ng/ml) **Normal value:** **Males: 20-350ng/ml** **Female: 10-200 ng/ml**	Study group (n=200)	2.08-38	9.93±6.34	**<0.01**
	Controls (n=100)	18.08-392	149.33±3.14	

Table 2: Serum ferritin levels in two groups of study subjects

Parameter	Groups	Range	Mean ± S. D	p-value
TSH (µIU/mL)	Study group (n=200)	2.67-40	14.43±12.94	**<0.001**
	Controls (n=100)	0.17-4.83	1.25±1.03	

Table 3: Comparison of serum TSH levels in two groups of study subjects

Parameters	Mean ± S. D	r- value	p-value
Ferritin (ng/mL)	9.93±6.34	-0.494	**<0.001**
TSH (µIU/mL)	14.43±12.94		

Table 4: Correlation of serum ferritin and TSH levels in two groups of study subjects