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SERUM FERRITIN LEVEL ESTIMATION IN HYPOTHYROID INDIVIDUALS

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ABSTRACT

Background: Triiodothyronine (T3) and thyroxine (T4) are the two primary hormones secreted by the thyroid gland, a bilobed endocrine gland. The pituitary gland's TSH (thyroid-stimulating hormone) controls the release and synthesis of these hormones. 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 cases 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's mean TSH levels were 1.25 ± 1.03 μ IU/mL in the control group and 14.43 ± 12.94 μ IU/mL in the study group. 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: The current study comes to the conclusion that 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: thyroid-stimulating hormone, serum ferritin, hypothyroid, enzyme-linked immunosorbent test, and thyroxine

INTRODUCTION

Thyroid disorders are thought to be the second most common endocrine disorder after diabetes, and they are highly prevalent around the world. According to data from the literature, the prevalence of subclinical hypothyroidism is substantial and varies between 4 and 10% depending on the community.

In India, the prevalence of self-reported thyroid disorders or goiter was 2.9% in NEHS-IV and 2.2% in NEHS-V. 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

The thyroid glands produce thyroid hormones, which control a number of essential metabolic processes in the body. Growth, metabolism, differentiation, and preserving the body's equilibrium all depend on thyroid hormones. Triiodotyrosine is created when DIT and monoiodotyrosine are coupled, while thyroxine is created by the oxidative condensation of two DIT (diiodotyrosine) molecules. The thyroid gland requires a variety of trace metals and minerals,

including zinc, selenium, iron, and iodine, to function normally. 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 found in every tissue in the body that stores iron. 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 participates in the iodide oxidation process as a membrane-bound enzyme. Additionally, it aids in iodide binding to thyroglobulin's tyrosyl residue. The gold standard for determining iron insufficiency is ferritin.⁴

Assessing the relationship between serum ferritin levels in hypothyroid individuals and normal, healthy controls was the goal of the current investigation.

MATERIALS AND METHODS

Assessing the relationship between serum ferritin levels in hypothyroid individuals and normal, healthy controls was the goal of the current investigation. 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 $\mu\text{IU/mL}$, 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 had 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 $\mu\text{IU/mL}$, which is within the normal range of 0–4.2 $\mu\text{IU/mL}$. The exclusion criteria for the study were subjects on iron therapy, patients with severe anemia (≤ 7 gm/dL), subjects with blood transfusion, renal diseases, and diabetes mellitus, pregnant females, subjects with liver diseases, and subjects aged >65 years.

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). Using the system pack, a completely automated analyzer was used to evaluate these characteristics.

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

Assessing the relationship between serum ferritin levels in hypothyroid individuals and normal, healthy controls was the goal of the current investigation. Based on the thyroid profile, 200 individuals with a confirmed laboratory diagnosis of hypothyroidism were evaluated in this study. The study also included 100 healthy control subjects. Regarding the gender distribution of the study participants, the study group consisted of 65% (n=1300) girls and 35% (n=70) males, whereas the control group had 62% (n=62) females and 38% (n=38) males. In total, 108 men and 192 women participated in this study (Table 1).

According to the study's findings, the normal ranges for serum ferritin levels in the two groups of research participants were 20–350 ng/ml for males and 10–200 ng/ml for females. With a p-value of less than 0.001, the study group's mean value was 9.93 ± 6.34 ng/mL, which was considerably lower than the control group's range of 18.08–392 ng/mL and mean value of 149.33 ± 3.14 ng/mL (Table 2).

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 $\mu\text{IU/mL}$, with mean values of 14.43 to 12.94 $\mu\text{IU/mL}$. TSH levels in the control study participants ranged from 0.17 to 4.83 $\mu\text{IU/mL}$, with a mean of 1.25 ± 1.03 $\mu\text{IU/mL}$. 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 μ IU/mL. The r-value was -0.494, indicating a significant negative correlation with $p < 0.001$ (Table 4).

DISCUSSION

Based on the thyroid profile, 200 individuals with a confirmed laboratory diagnosis of hypothyroidism were evaluated in this study. The study also included 100 healthy control subjects. Regarding the gender distribution of the study participants, the study group consisted of 65% (n=1300) girls and 35% (n=70) males, whereas 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 conducted by Kumar S et al. and Mahajan P et al, in which the authors evaluated hypothyroid patients and provided demographic information similar to that of the current investigation. 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.

The study group's mean value was 9.93 ± 6.34 ng/mL, falling within the range of 2.08-38 ng/mL. This was considerably lower than the control group's mean value of 149.33 ± 3.14 ng/mL, with a p-value of less than 0.001. These findings were in line with those of Sarin M et al and Kumar A et al, who observed 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 μ IU/mL, with TSH levels falling between 2.67 and 40 μ IU/mL. The TSH levels in the control study participants ranged from 0.17 to 4.83 μ IU/mL, with a mean of 1.25 ± 1.03 μ IU/mL. This was significantly lower than the study group ($p < 0.001$). These results were consistent with those of Taylor PN et al. (2016) and Krishnamurthy HK et al. (2016), who found that the blood TSH levels of participants with and without hypothyroidism were similar to those of the current study.

Serum ferritin and TSH levels were also found to correlate in two groups of study participants. The mean ferritin level was 9.93 ± 6.34 ng/mL, and the mean serum TSH level was 14.43 ± 12.94 μ IU/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

Considering its limitations, the present study concludes that hypothyroidism subjects had low serum ferritin levels and high serum TSH levels compared to subjects without hypothyroidism, and a negative correlation is seen in serum ferritin and TSH in subjects with hypothyroidism. Hence, assessing serum ferritin concentration in hypothyroid subjects can be useful in assessing the status of thyroid hormone.

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S. No	Gender	Study group		Controls		Total
		n=200	%	n=100	%	
1.	Females	130	65	62	62	192
2.	Males	70	35	38	38	108
3.	Total	200	100	100	100	300

Table 1: Gender distribution in study subjects

S. No	Parameter	Groups	Range	Mean ± S. D	p-value
1.	Ferritin (ng/ml)	Study group (n=200)	2.08-38	9.93±6.34	<0.01
2.	Normal value:				
3.	Males: 20-350ng/ml	Controls (n=100)	18.08-392	149.33±3.14	
4.	Female: 10-200 ng/ml				

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

S. No	Parameter	Groups	Range	Mean ± S. D	p-value
1.	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

S. No	Parameters	Mean ± S. D	r- value	p-value
1.	Ferritin (ng/mL)	9.93±6.34	-0.494	<0.001
2.	TSH (μIU/mL)	14.43±12.94		

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