



## CORRELATION BETWEEN IRON STORAGE AND THYROID PROFILE IN HYPOTHYROIDISM: A CROSS- SECTIONAL STUDY

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### ABSTRACT

The enzymatic activity of heme containing Thyroperoxidase, necessary for thyroid hormone production, is hampered in iron depleted states. Keeping that in mind, a cross-sectional tertiary care hospital based study was conducted at B.S. Medical College and Hospital, in Bankura with 62 hypothyroid participants and same number of age and sex matched controls. In that study, it was found that hypothyroidism was strongly and significantly associated with iron deficient state of body. It was also found that 48% of hypothyroid patients had low iron storage (ferritin < 25 ng/mL) when thyroid stimulating hormone (TSH) is more than 10 mIU/L. Ferritin level was found to be significantly lower in cases with respect to controls.

**KEYWORDS** : Ferritin, Hypothyroidism, Thyroperoxidase, TSH.

### INTRODUCTION

Several minerals are required for normal thyroid hormone synthesis, such as iodine, iron, selenium and zinc. Thyro-peroxidase (TPO) enzyme is a membrane-bound glycosylated hemoprotein, plays an important role in the biosynthesis of thyroid hormones. Thus iron deficiency leads to impairment of thyroid hormonogenesis and therapeutic iron supplementation improves hypothyroidism. Low ferritin, may be the reflection of hypothyroidism which is mostly overlooked. Differentiation, development, cellular metabolism and maintenance of body homeostasis are the main biological functions of thyroid hormone. Intracellular T3-receptor protein is the mediator of its action and gene expression is regulated post-transcriptionally. As ferritin is the storage form of iron, depletion of ferritin level is found in hypothyroidism. Recent trial shows, iron supplementation improves the low blood levels of thyroid hormones, in a female patient suffering from hypochromic anemia. To evaluate the function of thyroid hormone on peripheral tissues, measurement of serum ferritin can be done. A few studies are available till date, on the relationship between serum ferritin and thyroid profile in known hypothyroid patients and suggested an association between thyroid profile and ferritin levels. With this background, we framed a study to evaluate correlation between serum ferritin levels in known hypothyroid patients of in Bankura

district.

### MATERIALS AND METHODS

A cross-sectional, tertiary care hospital based study was conducted in the department of Biochemistry, B.S. Medical College, Bankura during period of 6 months (from November, 2017 to April, 2018). Sixty two newly diagnosed hypothyroid patients who were voluntarily willing to take part, were included in the study and same numbers of age and sex matched subjects were chosen as control. Venous blood samples were collected from each participant for the laboratory estimation of serum ferritin and thyroid-stimulating hormone (TSH) by sandwich ELISA and total thyroxine (tT4) by competitive ELISA method.

**Exclusion Criteria:** Age below 12 years and above 60 years, pregnancy, known iodine deficiency disorder, patients was on therapy for thyroid disorder, hepatic disorder, renal disease, malignancy and was on any drug that impair thyroid functions or suppress the bone marrow were excluded in present study.

### STATISTICAL ANALYSES AND RESULTS

Female preponderance was noted in both the cases (75.8%) and controls (64.5%).

**TABLE- 1: STATISTICAL ATTRIBUTES OF CASES AND CONTROLS**

Parameters	Age (years)		TSH (mIU/L)		tT4 (µg/dL)		Ferritin (ng/mL)	
	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls
Mean	36.47	30.26	9.88	2.70	6.50	7.76	36.88	130.81
Std. Error of Mean	1.47	1.12	0.43	0.16	0.14	0.12	1.40	3.90
Median	37.00	30.50	9.05	2.57	6.64	7.82	40.03	135.02
Std. Deviation	11.563	8.839	3.385	1.225	1.094	0.933	11.059	30.706
Variance	133.696	78.129	11.457	1.500	1.198	0.870	122.296	942.880
Minimum	13	18	5.63	0.95	4.64	6.16	16.32	72.15
Maximum	55	50	18.23	5.03	9.11	9.34	58.30	182.22
Significance of differences between groups (2-tailed)	0.001		<0.001		<0.001		<0.001	

**TABLE- 2: CROSSTABULATION: TSH GROUPS VS. FERRITIN GROUPS**

TSH groups (mIU/L)		Ferritin group (ng/mL)	
		<25	≥25
5.5- 10	Count	0	37
	% within TSH group	0.0%	100.0%
≥ 10	Count	12	13
	% within TSH group	48.0%	52.0%
Total	Count	12	50
	% within TSH group	19.4%	80.6%

Pearson's Chi-square <0.001.

Hypothyroid patients were found to be suffered from low ferritin level, i.e., low iron reserve in body.

The risk factor for development of low iron storage in hypothyroidism with respect to the control population was found to be 1.923 times (almost doubled).

Since, the data is not following normal distribution, non-parametric correlation is mandate.

**TABLE- 3: CORRELATION TABLE**

Spearman's Correlation		Age	TSH	tT4	Ferritin
Age (in years)	Rho	1.000	-0.067	0.021	0.109
	Sig. (2-tailed)		0.604	0.871	0.401
TSH (mIU/L)	Rho	-0.067	1.000	-0.801	-0.839
	Sig. (2-tailed)	0.604		<0.001	<0.001
tT4 (µg/dL)	Rho	0.021	-0.801	1.000	0.743
	Sig. (2-tailed)	0.871	<0.001		<0.001
Ferritin (ng/mL)	Rho	0.109	-0.839	0.743	1.000
	Sig. (2-tailed)	0.401	<0.001	<0.001	

## DISCUSSION

Thyroid peroxidase (TPO), a glycosylated hemoprotein, plays an important role in the biosynthesis of thyroid hormones. In organification, the enzyme plays a key role. Two molecules of diiodotyrosine (DIT) undergo an oxidative condensation to form thyroxine (T4) and triiodothyronine (T3) is formed when one monoiodotyrosine (MIT) and one DIT is condensed. The coupling reaction is catalyzed by the same iron containing thyroid peroxidase enzyme. It was documented that some groups of drugs can inhibit iodide oxidation as well as coupling process. In severe iron depleted state thyroid hormone synthesis is thus hampered and hypothyroidism establishes. Iron deficiency anemia can lead to decreased production of T4 and T3 and also reduces peripheral conversion of T4 to T3.

Differentiation, development and maintenance of body homeostasis are three main important biological functions of thyroid hormone. Many studies show a direct relationship between thyroid hormones and ferritin expression in biological systems. Thyroid hormones play a major role in the creation and metabolism of blood cells. Thyroid diseases affect hematopoiesis. Hypothyroidism can lead to the repression of the bone marrow, as well as lower erythropoietin production, mainly because of the decrease in oxygen requirements. Present study was corroborating with that result. But some studies in Bangladesh and Turkey found no significant correlation between iron deficient states and thyroid status which were contradicting to our result.

The iron regulatory protein (IRP) is a trans-acting RNA-binding protein that binds with high affinity to the conserved stem-loop structures, iron-responsive elements (IREs), present in ferritin and transferrin receptor (TfR). The IRP has a key role in the regulation of iron (Fe) homeostasis. In the absence of iron, the IRP binds to the IRE in the 5'-untranslated region (UTR) of ferritin and represses translation. Whereas, binding of the IRP to IREs in the 3'-UTR of TfR-mRNA stabilizes the mRNA and prevents its degradation. In iron-replete states, the reverse holds, which results in increased ferritin translation and decreased TfR mRNA stability. This reciprocal regulation is achieved at the post-translational level and is independent of new protein synthesis.

## CONCLUSION

A significant positive correlation was found in between hypothyroidism and depleted iron storage in body.

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