

# Relationship between Body Iron Status and Thyroid Profile in an Adult Population: A Hospital Based Study

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## ABSTRACT

**Introduction:** Several studies done on humans and animal have described the relationship between body iron and thyroid status. It has been found in many studies that iron metabolism and thyroid metabolism are closely inter connected as iron is a component of many enzymes including Thyroid Peroxidase (TPO) which takes part in the initial two steps in thyroid hormone biosynthesis.

**Aim:** The study was designed to evaluate the status of total body iron in patient of hypothyroidism

**Materials and Methods:** A hospital based study was carried out by Department of Biochemistry, Subharti Medical College in association with Endocrine and Metabolic OPD of Chatrapati Shivaji Subharti Hospital, Meerut, India. A total of 100, age and sex matched controls and 100 hypothyroid patients, 20 to 60

years of age group, were included in the study. Blood samples were collected in plain vials for fT3, fT4, TSH, TIBC, Iron and ferritin estimation on next day under overnight fasting state.

**Statistical Analysis:** Data analysis was done by using unpaired 't' test. Continuous variables were expressed as mean  $\pm$  SD, A p-value < 0.05 was considered significant.

**Result:** Haematological indices for iron status showed that all subjects having low thyroid profile were iron-deficient. TIBC, and ferritin were significantly decreased in subjects having altered thyroid profile. Values of TIBC, iron, ferritin, fT4 and fT3 were significantly lower in hypothyroid cases as compared to control (p-value < 0.05).

**Conclusion:** Our study was found to have a relation of body iron status with hypothyroidism, but a further large scale study will be required to consolidate our findings.

**Keywords:** Ferritin, Thyroglobulin, Thyroid hormone, Thyroid peroxidase, Total iron binding capacity

## INTRODUCTION

It has been shown in various studies that for adequate functioning of thyroid hormone, there is a requirement of various minerals and trace elements and iron is considered to be one of the important element in the metabolism of thyroid hormone [1].

Iron is considered as a co-factor in catalysis of various important biological enzymes including TPO [2]. This unique enzyme involve in catalyze the first two reaction of thyroid hormone biosynthesis [3]. This act as a membrane bound enzyme responsible for the oxidation of iodide and binding of iodine to tyrosyl residue of thyroglobulin [4]. Low levels of body iron status are going to decrease the efficiency of TPO and thereby affect the overall thyroid hormone metabolism [3]. Ferritin is an indicator of body iron stores, its serum level get altered in case of hypothyroidism [5]. Some worldwide studies has also reported the overall decrease in the level of iron storage markers in patients of hypothyroidism [6].

## MATERIALS AND METHODS

This case-control study was carried out in the Department of Biochemistry, Subharti Medical College in association

with Endocrine and Metabolic OPD of Chatrapati Shivaji Subharti Hospital, Meerut, UP, India, after obtaining ethical clearance from institutional ethical committee, study was carried out for a period of six months starting from March 2016 to August 2016. A total of 100, age and sex matched controls and 100 hypothyroid patients, 20 to 60 years of age group, were included in the study. Patients with pregnancy, lactation, hepatic disorder, renal diseases, and polycystic ovarian syndrome, chronic medical condition or on drugs supplements which may affect iron metabolism were excluded from the study. After an informed consent, all the subjects were advised to undergo overnight fasting and their blood samples were collected in plain red capped vacutainers under all aseptic condition for fT3, fT4, TSH, TIBC, iron and ferritin estimation on next day. Samples for thyroid profile and ferritin were processed by enzyme linked fluorescent assay technique using VIDAS fully automated immuno analyser from BioMérieux, France.

TIBC and iron was processed in fully automated fusion 5,1 by Ortho- Clinical-Diagnostic, USA.

## RESULTS

To find out the status of total body iron in patient of hypothyroidism, a total of 200 subject were included in our study. Out of total, 100 patients of hypothyroidism (males-24 and females 76) and 100 normal healthy control were selected (males 44 and females 56). Haematological indices for iron status show that all subjects having low thyroid profile were iron-deficient. TIBC, Fe and ferritin were significantly decreased in subjects having altered thyroid profile.

Mean±SD values of ferritin, TSH, fT4 and fT3 in cases were 18.45±3.83, 8.21±3.94, 5.48±2.66 and 2.34±1.48 respectively. Values of TIBC, Fe, ferritin, fT4 & fT3 were significantly lower in hypothyroid cases as compared to control (p-value <0.05) [Table/Fig-1].

Parameters	Controls	Cases	p-value
Ferritin (ng/ml) mean±SD	148.49 ± 31.67	18.45 ± 3.83	<0.05
Iron (µg/dl) mean±SD	78.29±26.44	30.2±11.3	<0.05
TIBC (µg/dl) mean±SD	344.12±43.2	125±38.13	<0.05
TSH (µIU/L) mean±SD	3.72 ± 1.96	8.21 ± 3.94	<0.05
fT4 (pmol/L) mean±SD	12.11 ± 3.25	5.48 ± 2.66	<0.05
fT3 (pmol/L) mean±SD	6.7 ± 1.56	2.34 ± 1.48	<0.05

**[Table/Fig-1]:** Comparison of ferritin, iron, TIBC, TSH, fT4 and fT3 in controls and cases.

## DISCUSSION

In our case control study we found a significant low levels of TIBC, iron and ferritin in subjects with altered thyroid profile indicated by decreased in blood levels of fT4 (p<0.05) and fT3 (p=0.05). This would explore the relationship between iron deficiency and thyroid status. Previous studies also reported similar finding in animal and human beings. Our results are in accordance with other studies which reported that low levels of thyroid hormones have been associated with altered body iron status [5]. Akhter S et al., reported that a significant difference in thyroid hormone status in iron deficient people could be a reflection of disturbed activities of iron depended enzyme such like TPO which disturb the overall metabolism of thyroid hormone [4]. A similar study was done by Hess SY et al., have found that thyroid peroxidase activity is significantly reduced in iron deficient rats [6]. They also mentioned the role of iron in transportation of thyroid hormone into the cells and lack of iron leads to pooling of thyroid hormone leading to metabolically hypothyroid condition. Christ-Crain M et al., found that external intake of thyroxine increases the overall rate of erythropoiesis by increasing the level of erythropoietin, which leads to increased requirement of iron and dealt in manifestation of iron deficiency anaemia [7]. Similar finding was observed by Endogan M et al., which state the increased occurrence of microcytic hypochromic anaemia in clinical and subclinical cases of hypothyroidism

as compared to controls [8]. Eftekhari MS et al., have notice an increase in rT3 is related to change in iron status and that the increased level of rT3 is inversely correlated with changes in plasma ferritin concentration, they also consolidate the relation between iron deficiency and altered thyroid profile [9]. Some other studies have established the inverse correlation between Hb (Haemoglobin) and thyroid hormone status, Bremmer AP et al., found the significant association between free T3 and Hb and inverse relationship of TSH with serum iron and transferrin saturation [10]. Bivolarska A et al., [11] reported the firm association between T4 level and Hb (r= 0.217, p=0.33). On the other hand some other study like Yavuz O et al., reported no association between thyroid hormone and iron deficiency [12]. Our study have tried to establish a relationship between total body iron status in patients of altered thyroid profile which will help the medical professional to have an account of iron profile assessment in patients of thyroid disorders.

## LIMITATIONS

Our study was conducted upon a small group of population which is not quite enough to establish a firm association between thyroid disorders and body iron status, another limitation is lack of assessment of anti thyroid peroxidase antibody (anti-TPO) in our study for exclusion of autoimmune thyroid disorders and to look for its association in iron deficient subject group. In our study we have not measured the level of haemoglobin and its association with transferrin saturation.

## CONCLUSION

The present study have tried to establish the association between body iron status and thyroid profile in an adult population and it has been seen that the patient having altered thyroid profile (by reflecting low level of thyroid hormone) shows paramount discrepancy in their body iron stores. Keeping an account of shortcoming of our study we have taken it as a future scope to carry forward our study in a large group of population that also include pregnant females and children's, with an estimation of haemoglobin, anti-TPO antibodies and transferrin saturation, it will going to reflect a better accountability of this association.

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