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Original Research Article

A Comparative Study of Body Iron Status in Hypothyroid Patients and Healthy Controls at SMS Medical College and Attached Hospitals, Jaipur, Rajasthan

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Abstract

Background: Iron plays an important role for both the synthesis as well as metabolism of thyroid hormones acting as a component of many enzymes including thyroid peroxidase (TPO). So, iron deficiency might lead to abnormal functioning of thyroid gland. So, our aim in this study was to compare the serum Iron, TIBC levels in newly diagnosed Hypothyroid patients and healthy individuals.

Methodology: After taking necessary permission study was conducted in Department of Biochemistry and Department of Endocrinology S.M.S. Hospital, Jaipur. 30 Hypothyroid patients compared with Euthyroids for serum iron and TIBC levels.

Observation:- Results were analysed statistically by student's t test and pearson correlation coefficient test. Mean Iron, TIBC in hypothyroid patients was 48.07 ± 12.89 µg/dl, 358.90 ± 56.64 µg/dl, respectively and in controls 96.07 ± 28.00 µg/dl, 298.37 ± 55.27 µg/dl respectively. This difference was statistically significant($p<0.01$).

Conclusion: In hypothyroid patients serum Iron TIBC levels may be deranged so estimation of Iron, TIBC should be done as a routine.

Keywords: Chronic Kidney Disease (CKD), Estimated Glomerular Filtration Rate (EGFR), Serum Amylase.

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Introduction

India as a developing nation is currently facing the burden of not only infectious diseases, but also of non-communicable and other metabolic diseases. Diseases like cardiovascular diseases, diabetes mellitus and hypertension are more prevalent and results in an increased morbidity and mortality. However, certain endocrine disorders, especially disorders of thyroid metabolism are also on the rise. In India, hypothyroidism has been recognized as a public health problem for the past several decades and has been termed as Iodine Deficiency Disorders (IDD).[1] Hypothyroidism affects up to 5% of the population according to European prevalence estimates,[2-5] while as many as 5% of the population may have undiagnosed thyroid failure.[3]

More than 2 billion people, mainly young women and children, are iron-deficient.[6] Over 90% of affected individuals live in developing countries.[7] Iron deficiency anaemia has adverse health consequences

for all age groups. In older children and adults it reduces work capacity and output and impairs immune function,[8] and is also known to be associated with reduced reproductive capacity.[9] The consequences of iron deficiency are more serious for women. Iron deficiency can be defined as occurring when the body's iron stores become depleted and a restricted supply of iron to various tissues becomes apparent,[10] and it results in the depletion of iron-dependent intracellular enzymes participating in many metabolic pathways.[10] Studies in animals and humans have shown that iron deficiency with or without anaemia impairs thyroid hormone metabolism. The westernization of lifestyle and nutrition transition in India has increased the burden of endocrine disorders including thyroid dysfunction. Both Iron deficiency and thyroid disease, due to their high prevalence and close association, are significant clinical problems often encountered by practitioners. The majority of the existing data regarding the association between Iron deficiency and thyroid dysfunction is mainly confined to children and adolescents or pregnant women whereas replication in wide samples of the general adult population has not been carried out. Therefore, this study aims to compare the levels of serum Iron and TIBC in newly diagnosed Hypothyroid patients and Euthyroid.

Material Methods

A hospital based cross sectional study conducted in Central Lab Biochemistry, S.M.S. Medical College and Hospital in collaboration with Department of Endocrinology SMS Medical College and Hospital, Jaipur. 30 patients of hypothyroid and 30 Euthyroid controls were included in this study. Both groups compared for serum iron and TIBC levels. Newly diagnosed Patients of 20 to 60 years age group suffering from Hypothyroidism and who gave written informed consent were included while Patients with pregnancy, lactation, Renal and Hepatic disease and age group other than 20 to 60 years of age group were excluded from the study.

Observation and Results

Mean age in this study for hypothyroid patients was 40.07 ± 10.60 years and in Euthyroid controls mean age was 41.87 ± 10.03 years. Out of 30 cases 10 were males and 20 were females.

Table 1: Comparison of Mean FT3, FT4, TSH, Iron and TIBC Levels between HYPOTHYROID Patients and controls

Test/ Parameters	Controls (n=30)	CASES (n=30)	P-value
Serum FT3 (pg/ml)	3.09 ± 0.46	2.26 ± 0.55	< 0.01 (S)
Serum FT4 (ng/dl)	1.22 ± 0.36	0.80 ± 0.23	< 0.01 (S)
TSH (µIU/L)	2.61 ± 1.31	14.75 ± 5.05	< 0.01 (S)
Serum Iron (µg/dl)	96.07 ± 28.00	48.07 ± 12.89	< 0.01 (S)
S. TIBC (µg/dl)	298.37 ± 55.27	358.90 ± 56.64	< 0.01 (S)

Mean FT3 ,FT4 ,TSH levels in patients of Hypothyroidism was 2.26 ± 0.55 pg/ml, 0.80 ± 0.23 ng/dl and 14.75 ± 5.05 µIU/L respectively and in controls it was 3.09 ± 0.46 pg/ml, 1.22 ± 0.36ng/dl and 2.61 ± 1.31 µIU/L respectively. Difference in FT3, FT4 and TSH between both groups was statistically significant($p<0.01$).

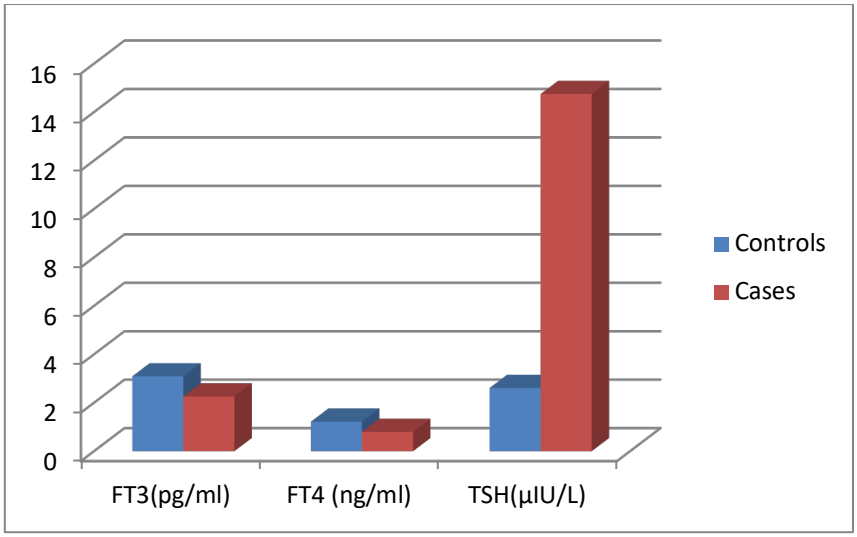

Figure 1: Comparison of Mean FT3, FT4 and TSH Levels between HYPOTHYROID Patients and controls

Mean Serum Iron and TIBC levels in patients of Hypothyroidism was 48.07 ± 12.89 µg/dl and 358.90 ± 56.64 µg/dl respectively while in controls it was 96.07 ± 28.00 µg/dl and 298.37 ± 55.27 µg/dl respectively. Difference in mean Serum Iron and TIBC levels between both groups was statistically significant($p<0.01$).

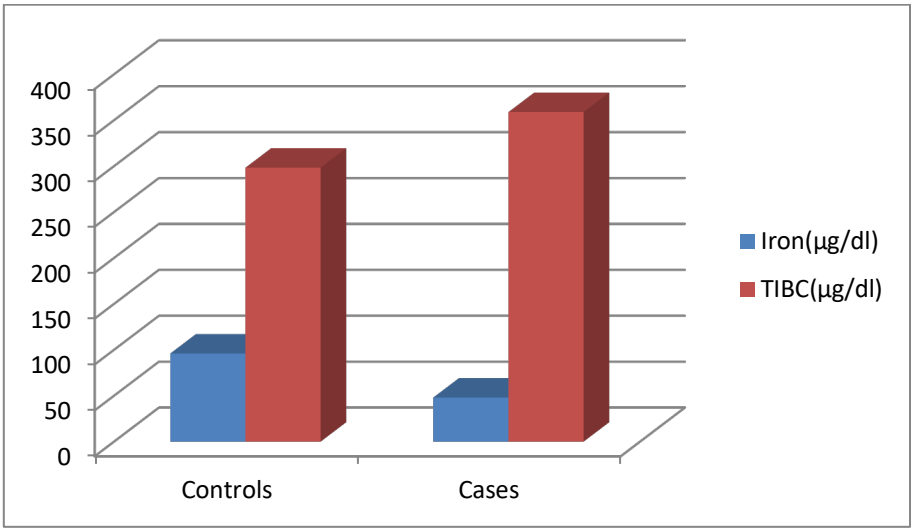

Figure 2: Comparison of Mean Iron and TIBC Levels between HYPOTHYROID Patients and controls

Table 2: Correlation of Serum TSH with Serum Iron and TIBC in HYPOTHYROID Patients

Parameter	P value	R Score	R^2	Significance
TSH vs IRON	<0.0001	-0.7584	0.5752	S
TSH vs TIBC	<0.0001	0.7756	0.6016	S

*Data analysis using Pearson correlation analysis

There was negative correlation(R= -0.7584) between TSH and IRON levels and positive correlation(R= 0.7756) between TSH and TIBC levels in patients with Hypothyroidism. These both correlations was statistically significant($p<0.0001$).

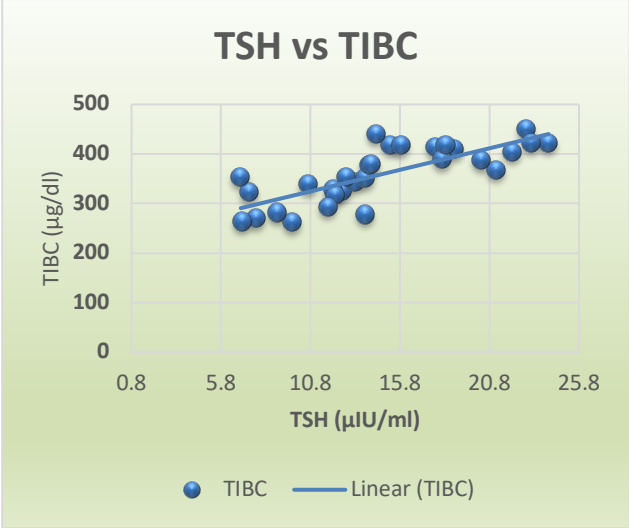

Figure 3 and 4 : Correlation of Serum TSH and Serum Iron and TIBC in HYPOTHYROID Patients

Discussion

Diseases of the thyroid are the most common afflictions involving the endocrine systems. Thyroid hormones play a critical role in cell differentiation during development and help to maintain thermogenic and metabolic homeostasis. Thyroid hormones regulate gene expression. Thyroid dysfunction is relatively a common disease which affects people, irrespective of their age and gender. Biochemical decrease in FT4 and FT3 lead to hyper secretion of pituitary thyroid stimulating hormone (TSH) and an amplified increase in serum TSH levels. This is a key laboratory finding, particularly in the early detection of thyroid failure.

Multiple micronutrient deficiencies are still a major public health problem faced by developing countries. Such deficiencies have adverse effects on growth and development, Deficiencies of trace elements like iodine, iron, zinc and selenium also impairs thyroid function. Iodine deficiency and iron deficiency are considered as the most common cause of preventable brain damage and anaemia respectively in developing countries like India. Anaemia and iron deficiency have been found to be highly prevalent among Indian school children, whereas iodine nutrition has been continuously improving in school children.[11,12] Iron deficiency with or without anaemia affects child development and also has multiple adverse effects on thyroid metabolism. So we planned an study with aim to estimate serum Iron and TIBC in patients with hypothyroidism.

30 hypothyroid cases similar number of age sex matched normal healthy controls were included in this study. Mean age for hypothyroid cases was 40.07±10.60 years and for controls it was 41.87±10.03 years. Male female ratio for cases and controls was 1:2. So here we can also suggest that hypothyroidism is more common females in comparison to males. Mean FT3, FT4, was significantly low ($p<0.001$) in cases 2.26± 0.55pg/ml, 0.80±0.23ng/dl, 14.75±5.05uIU/ml respectively in comparison to controls 3.09±0.46 pg/ml, 1.22±0.36 ng/dl, 2.61±1.31 uIU/ml respectively. Mean TSH was significantly high ($p<0.001$) in cases 14.75±5.05uIU/ml n comparison to controls 2.61±1.31 uIU/ml. These findings of our study was in accordance to the definition of overt hypothyroidism.

In this study we found significantly low($p<0.001$) value of serum iron and significantly high value of TIBC in hypothyroid patients with the mean iron

and TIBC level 48.07±12.89mcg/dl and 358.90 ± 56.64 mcg/dl respectively while in controls 96.07±28mcg/dl 298.37± 55.27mcg/dl respectively.

In this study we also found significant ($p<0.001$) negative correlation ($R = -0.7584$) between TSH and iron while significant ($p<0.001$) positive correlation ($R = 0.7653$) between TSH and TIBC. Our results correlates with study conducted by Saroj Khatiwada et al[13] in 2016, they observed significantly lower Hb level and iron status indicators in hypothyroids (overt and subclinical) than euthyroids, and iron deficiency and anaemia in larger fraction of hypothyroid (both overt and subclinical) children. their findings also suggest that anaemic subjects tend to have higher TSH than non-anaemic subjects, however, FT3 and FT4 does not seem to differ. Our finding also in accordance of previous studies Banday et al[14]. 2015 found serum iron concentrations significantly lower in participants with subclinical hypothyroidism than euthyroid subjects ($p = 0.001$), and Bremner et al[15] .2014 reported iron deficiency in a significant portion of patients with primary hypothyroidism. Similar finding was observed by Endogan M et al[16] 2012, which state the increased occurrence of microcytic hypochromic anaemia in clinical and subclinical cases of hypothyroidism as compared to controls. Eftekhari MS et al[17] 2006, 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. Contrast results were found in the study conducted by Ashish Shukla et al[18] in 2017 they found significantly 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. Possible mechanism for this may be It is believed that thyroid diseases affect the process of haematopoiesis and thyroid hormone deficiency may lead to bone marrow repression and/or decrease in erythropoietin production due to the reduction of O2 requirements. Thyroid hormones have also found to regulate the gene expression of transferrin.[16] Our finding demonstrates that anaemic and iron deficient persons have high risk for hypothyroidism, and hypothyroidism is associated with anaemic and iron deficient patients. Thus our findings suggests for the possibility that iron deficiency might impair thyroid metabolism as reported in previous studies. The two initial steps of thyroid hormone synthesis are catalyzed by heme containing enzyme, thyroid peroxidase. Severe iron deficiency may lower thyroid peroxidase activity and interfere with the synthesis of thyroid hormones thereby leading to hypothyroidism. Studies have revealed that iron deficiency anemia (IDA) impairs thyroid metabolism and also decreases plasma total T4 and T3 concentrations and reduces peripheral conversion of T4 to T3.[17]

Conclusion

Thyroid disorders have a systemic manifestation causing derangements in the functioning of various organs. Our study established a significant cause and effect relationship between iron deficiency and thyroid dysfunction. Hence it can be concluded that accessing levels of iron, TIBC and lipid profile is very important in patients with hypothyroidism in order to prevent iron deficiency anaemia. Since it may guide the treatment protocol in these patients.

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