

Original Research Article

Relationship between iron metabolism and thyroid hormone profile in hypothyroidism

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ABSTRACT

Background: Iron and thyroid hormone metabolism are closely related with each other. 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 can lead to abnormal functioning of thyroid gland. Ferritin is storage form of iron in our body. Several studies in showed that nutritional iron deficiency can significantly decrease the circulating levels of both T4 and T3 and it can also reduce peripheral conversion of T4 to T3. So, the aim of the study is to find out whether there is any relationship between hypothyroidism and iron metabolism.

Methods: This cross-sectional descriptive study was conducted at Deben Mahata Government Medical College and Hospital, Purulia on 50 hypothyroid patients and 50 age and sex matched controls after imposing inclusion and exclusion criterias. Blood samples were collected and estimation of Serum TSH, fT4 and fT3, iron, ferritin and TIBC levels were done. Then the data obtained were analysed by proper statistical methods.

Results: Out of 100 subjects 68 were male and rest were female. The mean serum TSH level in study population was significantly higher than that of comparison group. While serum fT3 and fT4 level in study group were lower than the control group and both were statistically significant. In the other hand, the mean serum ferritin and iron levels in cases were lower than that in controls and the mean TIBS was higher in study group and all the differences were statistically significant. There were significant correlation between Serum ferritin and serum iron (positive correlation), Serum ferritin and TSH (negative correlation), Serum TSH and fT4 (negative correlation) but there was no significant relationship between serum TSH and iron.

Conclusions: The iron metabolism is disturbed in hypothyroidism reflected by low serum ferritin and iron.

Keywords: Serum TSH, FT3, FT4, Ferritin, Iron, TIBC

INTRODUCTION

Iron metabolism is closely related with that of thyroid hormone. The normal function of thyroid gland is dependent on the metabolism of many trace elements example: iron, iodine, selenium, and zinc for both the synthesis as well as metabolism.¹ Iron can act as a component of many enzymes including thyroid peroxidase (TPO) which is the main enzyme in the first two steps in

thyroid hormone synthesis.² Thyroid hormones are synthesized from thyroglobulin, a large iodinated glycoprotein which is iodinated on tyrosine residues after secretion into the thyroid follicle. Reuptake of thyroglobulin into the thyroid follicular cell can allow proteolysis and subsequent release of newly synthesized T4 and T3.³ So, deficiencies of these elements can impair thyroid functions.⁴ Low iron, or more specifically, low

ferritin, is one of the most overlooked causes of low thyroid function.⁵

Ferritin is an iron storage protein found in almost all of the body tissues. Normally, there is a small amount of ferritin in human serum proportionate to the total stores of iron in the body. Serum ferritin levels thus are considered to be an indicator of body iron stores.⁶

Several human and animal studies in showed that nutritional iron deficiency can significantly decrease the circulating levels of both thyroxine and triiodothyronine and can also reduce peripheral conversion of T4 to T3.⁷

Hypothyroidism can lead to poor gut absorption as a result of decreased levels of digestive acids/ enzymes which ultimately cause low iron levels or due to associated autoimmune conditions like celiac disease.⁸ Low iron level may be caused by menstrual irregularities in some female patients which is also very common in hypothyroidism.⁹ So, the aim of the study is to find out whether there is any relationship between hypothyroidism and iron metabolism.

METHODS

Study area

This cross-sectional descriptive study was conducted at in Department of Biochemistry, Deben Mahata Government Medical College and Hospital, Purulia.

Sample size

Total 100 samples including 50 cases and 50 controls.

Study duration

From September, 2019 to February, 2020.

Study subject

We included 50 patients with hypothyroidism from out patients department as well as in-patients department of the Department of General Medicine of Deben Mahata Government Medical College & Hospital, Purulia. They were physically examined and informed consents were taken from them. The study design was approved by the institutional ethical committee. 50 age and sex matched controls also were included in this study.

Inclusion criteria

All male and female subjects who were aged between 15 years to 70 years and not suffering from any acute illness.

Exclusion criteria

Persons suffering from any other documented endocrine disorders. Persons having history of acute/ chronic illness.

Pregnancy. Patients taking drugs (example: lithium or steroid) which can interfere with thyroid function tests.

Method of sample collection

5 mL of fasting venous blood samples were collected in plain vials and allowed to clot in a tilted position until the straw coloured clear serum was visible at the top of the clot in the vials. The vials were centrifuged at 3000 rpm for 10 minutes. The serum samples were pipetted out from the vials and stored in separate, appropriately labelled aliquots at -20 °C, until analysis was done.

Parameters under study

Thyroid function tests - Serum TSH, fT4 and fT3 done ELISA method. Parameters of iron metabolism- serum iron, ferritin and TIBC done by the auto analyzer.

Statistical analysis

Data obtained were codified and displayed by charts and tables. Data were described by mean, standard deviation etc. Statistical tests like independent 't' test with 95% confidence interval (CI), Spearman correlation coefficient (r) etc. were used to evaluate the relationship between variables. P<0.05 was considered significant to discard the null hypothesis at 5% precision and 95% confidence interval.

RESULTS

Out of 100 subjects 68 were male and rest were female (Figure 1).

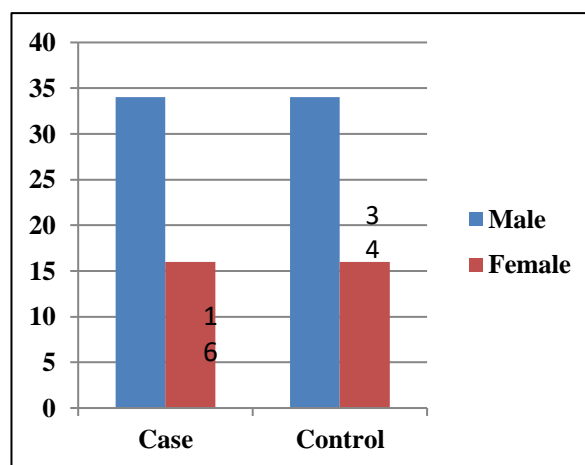


Figure 1: Distribution of subjects according to sex.

Table 1 showed that the mean serum TSH level in study population was 17.12 ± 5.25 μ IU/ml, which was significantly higher than that of comparison group. While serum fT3 (0.81 ± 0.23 pg/ml) and fT4 levels (0.71 ± 0.32 ng/dl) in study group were lower than the control group and both were statistically significant.

Table 2 revealed that the mean serum ferritin (13.97±01.27 ng/ml) and iron (45.66±09.81 µG/dl) levels in cases were lower than that in controls and the mean TIBS was higher

in study group (481.23±26.74 µG/dl) and all the differences were statistically significant.

Table 1: Distribution of participants according to serum thyroid profile (N=100).

Parameter	Study group (n=50)		Comparison group (n=50)		Unpaired 't' test, p at df 98
	Mean	S D	Mean	SD	
Serum TSH (µIU/ml)	17.12	5.25	2.17	1.43	5.129,0.000
Serum fT3 (pg/ml)	0.81	0.23	2.29	0.18	3.681,0.000
Serum fT4 (ng/dl)	0.71	0.32	1.24	0.11	3.423, 0.000

Table 2: Distribution of participants according to their serum, ferritin and TIBC status (N=100).

Parameter	Study group (n=50)		Comparison group (n=50)		Unpaired 't' test, p at df 98
	Mean	S D	Mean	S D	
Serum iron (µG/dL)	45.66	09.81	99.56	19.31	21.232,0.000
Serum ferritin (ng/mL)	13.97	01.27	102.09	39.04	10.281,0.000
TIBC (µG/dL)	481.23	26.74	280.38	18.08	8.794,0.000

Table 3: Distribution of thyroid disorders according sex.

Sex	Euthyroidism (50)	Hypothyroidism (50)		Total
		Subclinical	Overt (%)	
Male	34	14 (41.18%)	20 (58.82)	68
Female	16	7 (43.75%)	9 (56.25)	32

Table 4: Correlation between variables in study group.

Parameter	Group	Correlation Coefficient (r)	Significance (p value)
Serum ferritin Versus Serum iron	Study	0.835**	0.000
Serum ferritin Versus Serum TSH	Study	-0.343*	0.015
Serum ferritin Versus Serum fT4	Study	0.023	0.875
Serum ferritin Versus Serum fT3	Study	0.109	0.450
Serum iron Versus Serum TSH	Study	-0.271	0.057
Serum iron Versus Serum fT3	Study	0.073	0.615
Serum iron Versus Serum fT4	Study	0.157	0.275
Serum TSH Versus Serum fT3	Study	-0.178	0.215
Serum TSH Versus Serum fT4	Study	-0.307*	0.030

Table 3 showed majority hypothyroid patients belonged from male gender and maximum in the subclinical subgroup and this was valid for both male and female patients. Table 4 showed that there were significant correlation between serum ferritin and serum iron (positive correlation), serum ferritin and TSH (negative correlation), serum TSH and fT4 (negative correlation) but there was no significant relationship between serum TSH and iron.

DISCUSSION

Thyroid hormones play an important role in cell differentiation and development. The thyroid hormones also regulate ferritin expression. The normal ranges of

serum TSH, fT4, fT3, ferritin, iron and TIBC are respectively 0.50-5.50 µIU/mL, 0.8- 2.0 ng/dL, 1.4 – 4.2 pg/mL, (in males) 16- 220 ng/mL and (in females) 10- 124 ng/mL, (in males) 60-160 µg/dL and (In females) 35-145 µg/dL and 250-400 µg/dL.¹⁰ In this study, the levels of ferritin and iron were low while that of TIBC was higher in patients suffering from hypothyroidism as compared to healthy control group. These results were quite similar to other studies which showed that iron deficiency may be associated with low levels of thyroid hormones. But there was only few studies to comment on status of iron metabolism in patients of hypothyroidism. In our study, sixty eight percent of total hypothyroid patients were males. There were significant correlations between serum

ferritin and serum iron (positive correlation), serum ferritin and serum TSH (negative correlation), serum TSH and serum FT4 (negative correlation) but there was no significant relationship between serum TSH and iron. The findings of our study were similar that of study conducted by Dahiya et al and Sachdeva et al.^{11,12}

CONCLUSION

Our study revealed, that there were significant difference in serum iron and ferritin levels in hypothyroid patients and healthy controls. This is may be due to abnormal function of TPO which is an iron dependent enzyme of thyroid hormone synthesis. So, estimation of serum ferritin and iron levels before and after commencement of hormone replacement therapy can provide us the important clue about the both progress of the disease and the body iron storage.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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