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ORIGINAL RESEARCH

Study of relationship between Iron profile and Thyroid profile in patients of Hypothyroidism

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ABSTRACT

Objectives: To study the prevalence, type and etiology of anemia in newly diagnosed cases of hypothyroidism and establish a correlation between iron profile and thyroid profile of patients. **Material and methods**: This case control study is conducted in a y tertiary care center of southern Rajasthan and includes 100 newly diagnosed cases of hypothyroidism as cases and 100 healthy volunteers as controls. Hemoglobin, serum iron, serum ferritin and thyroid profile (T3, T4, TSH) along with peripheral smear study was evaluated in all the study participants.The results of two groups were compared and correlated using pearson's formula. **Results:** Most of the study participants were from the age group 31-40 years (36.5%).Most of the study participants were female (81%).74% of cases and 16% of controls were found to have iron deficiency anemia. Peripheral smear study of the participants shows that 24% cases and 84% controls have normal study while mild microcytic hypochromic anemia was the commonest variety in cases (34%) followed by moderate microcytic hypochromic anemia (28%).Mean serum iron and serum ferritin in present study were 36.15±7.61µg/dl and 25.72±7.39 ng/ml. In present study, mean TSH of cases and controls was 19.83 ± 5.81 mIU/L and 2.86 ± 0.79 respectively. **Conclusion**: The prevalence of iron deficiency anemia is more common in hypothyroid patients than in general population and there exist a definite correlation between iron profile and thyroid profile.Thus, estimation of iron profile is important in hypothyroid patients for better management.

Keywords: Hypothyroidism, iron deficiency, anemia, iron, TSH

INTRODUCTION

Hypothyroidism is a common disorder characterized by deficiency of thyroid hormone production by thyroid gland. It is prevalent endocrine disorder in society. 15% of world's population suffers from hypothyroidism (1,2). In India, thyroid diseases affect approximately 42 million people and hypothyroidism is the most common among them(3, 4).

Synthesis and metabolism of thyroid hormones depends on many trace elements like iron, selenium, zinc and iodine. Therefore, deficiency of these trace elements can lead to disturbances in thyroid hormone synthesis (5,6).

Iron is one the important micronutrients of the body and is essential for oxygen transport via hemoglobin, cellular growth, various enzymatic reactions of body and immune function (7,8).

Iron is an essential component of thyroid peroxidase enzyme (TPO) enzyme essential for thyroid hormone production and involved in thyroid hormone synthesis initial steps (9). Firstly, TPO catalyses the iodide oxidation, and then it helps in attachment of oxidised iodide to tyrosine residue in thyroglobulin (10).

Iron deficiency also increases in vitro hepatic reverse T3 deiodination, which indicates increased thyroid metabolism (11). Therefore, iron deficiency may be a factor in hypothyroidism.

Hypothyroidism causes intestinal malabsorption, which can lead to iron deficiency due to related autoimmune disorders like coeliac disease (12). In some female patients, menstrual irregularity can cause iron deficiency, which is also present in hypothyroidism (13).

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Thus, it is observed that thyroid hormone profile may affect iron metabolism and vice versa.
The present study aims to establish and confirm the relationship between iron profile and thyroid profile among newly diagnosed cases of hypothyroidism.

MATERIAL & METHODS

This study was conducted in a tertiary care hospital of southern Rajasthan after approval from institutional ethical committee
This study included 100 patients with newly diagnose d hypothyroidismas cases who attended the outpatient clinic of medicine and endocrinology department and 100 healthy volunteers as controls.

Inclusion Criteria

Group A: Cases

1. Newly diagnosed patients of hypothyroidism.
2. Age: 15 to 60 years
3. Not taking thyroid medication or blood lipid-lowering medication
4. Hypothyroidism diagnosis according to TSH, FT 3 and FT4 values
5. Patient consented for participating in investigation

Group B: Control group

1. Healthy volunteers aged 15-60years
2. Patients willing for participation

Exclusion criteria

1. Patient of age <15 years or >60 years.
2. Pregnant or breastfeeding women
3. Patients already on thyroid medication or medication which can affect thyroid function or taking iron supplements.
4. Patients with chronic systemic diseases like liver diseases, cardiovascular disorders, renal disorders, diabetes mellitus, bone diseases, alcoholism, etc.

Sample collection and analysis

Serum T3, T4, & TSH levels have been measured for evaluating thyroid profile, while ferritin, total iron binding capacity (TIBC), along with serum iron are measured to evaluate the patient's iron profile. Hemoglobin and Peripheral smear study were evaluated to identify and classify the type of anemia.
5 ml of blood sample was collected form all the participants under universal aseptic condition. Serum was separated and stored for measuring serum iron, serum ferritin and TIBC. Plasma was separated to analyse CBC. T3 and T4 were measured by Cobas e411 immunoassay analyser using competition principal. TSH was measured by Cobas e402 immunoassay analyser using sandwich principal. Serum iron and TIBC were measured by autoanalyzer and serum ferritin was measured by immunoassay (Cobas e 411 analyser).
The results of two groups were compared using statistical analyses and coefficient of correlation was calculated using pearson’s formula.

RESULTS

The mean age of cases and controls in present study was 38.31 years and 36.63 years respectively. Most of the study participants were from the age group 31-40 years (36.5%).
Most of the study participants were female (81%). Age and gender wise distribution of participants is shown in table 1.

Table 1. Age & gender wise distribution of participants

Age	Male		Female		Percentage
	N	%	N	%	
<20	1	02.63	13	08.04	7
21-30	6	15.78	24	14.81	15
31-40	13	34.21	60	37.03	36.5
41-50	15	39.47	53	32.716	34
51-60	3	07.89	12	07.40	7.5
Total	38	19	162	81	100

74% of cases were found to have iron deficiency anemia which is much higher than controls in which only 16% have iron deficiency anemia.
Peripheral smear study of the participants shows that 24% cases and 84% controls have normal study while mild microcytic hypochromic anemia was the commonest variety in cases (34%) followed by moderate microcytic hypochromic anemia (28%) (table 2).

Table 2. Result of peripheral smear study of cases

Types of Anemia	Frequency	
	Cases	Controls
Normal Study	24	84
Normocytic normochromic Anemia	07	02
Mild microcytic hypochromic anemia	34	08

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Moderate microcytic hypochromic anemia	28	06
Severe microcytic hypochromic Anemia	05	0
Megaloblastic anemia	2	0
Total	100	100

Comparison of various thyroid and iron profile parameters among cases and controls is shown in table 3.

Table 3. Comparison of various thyroid parameters & iron profile parameters among cases & controls

Test Parameter	Control group (Mean±SD)	Cases group (Mean±SD)	p-value
T3 (ng/ml)	1.43±0.34	0.48±0.24	<0.001
T4 (µg/dL)	8.04±1.34	2.82±0.79	<0.001
TSH (mIU/L)	2.86±0.79	19.83±5.81	<0.001
Hb (gm/dl)	13.08±1.33	9.96±1.76	<0.001
Serum Ferritin (ng/ml)	220.52±97.91	25.72±7.39	<0.001
Serum Iron (µg/dL)	94.88±22.86	36.15±7.61	<0.001
TIBC (µg/dL)	227.22±58.94	336.13±62.2	<0.001

Correlation among various parameters using pearson's coefficient is shown is chart 1

	CHART 1. COMPARISON BETWEEN DIFFERENT ANALYTES USING PEARSON COEFFICIENT OF CORRELATION								
		Age	Hb	TSH	T3	T4	SF	SI	TIBC
Age	R	1	-.032	.030	.000	-.086	-.074	-.057	-.034
	P		.654	.672	.991	.225	.299	.419	.631
Hb	R	-.032	1	-.429**	.668**	.759**	.649**	.693**	-.523**
	P	.654		.000	.000	.000	.000	.000	.000
TSH	R	.030	-.429**	1	-.495**	-.485**	-.383**	-.408**	.442**
	P	.672	.000		.000	.000	.000	.000	.000
T3	R	.000	.668**	-.495**	1	.800**	.671**	.758**	-.639**
	P	.991	.000	.000		.000	.000	.000	.000
T4	R	-.086	.759**	-.485**	.800**	1	.763**	.789**	-.621**
	P	.225	.000	.000	.000		.000	.000	.000
SF	R	-.074	.649**	-.383**	.671**	.763**	1	.716**	-.523**
	P	.299	.000	.000	.000	.000		.000	.000
SI	R	-.057	.693**	-.408**	.758**	.789**	.716**	1	-.592**
	P	.419	.000	.000	.000	.000	.000		.000
TIBC	R	-.034	-.523**	.442**	-.639**	-.621**	-.523**	-.592**	1
	P	.631	.000	.000	.000	.000	.000	.000	
	**Correlation is significant at 0.01level(2-tailed). * Correlation is significant at 0.05level(2-tailed) Significant correlations could be observed among thyroid hormones & ferritin, iron, TIBC levels.								

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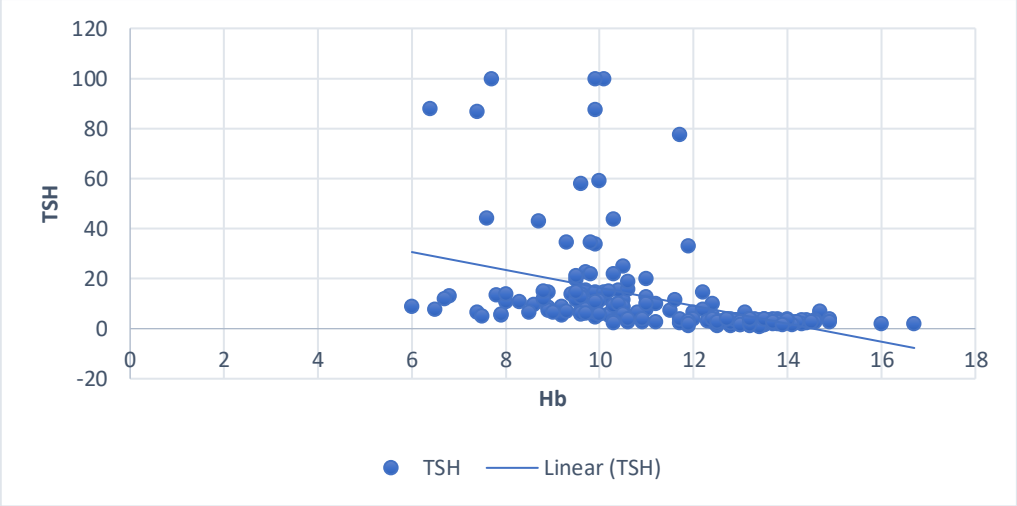

Fig 1. Scatter diagram showing comparison between TSH and Hb

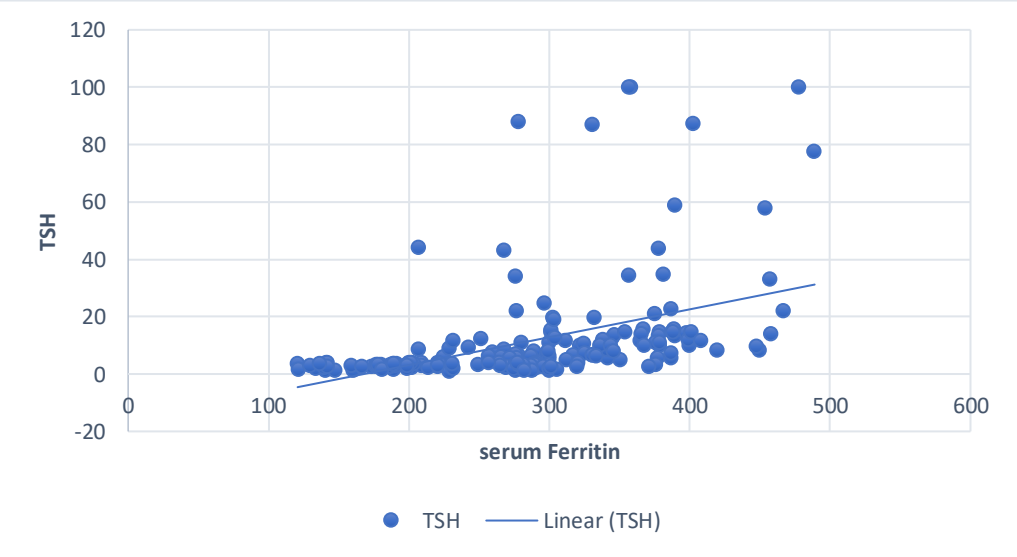

Fig 2. scatter chart showing correlation between TSH and ferritin

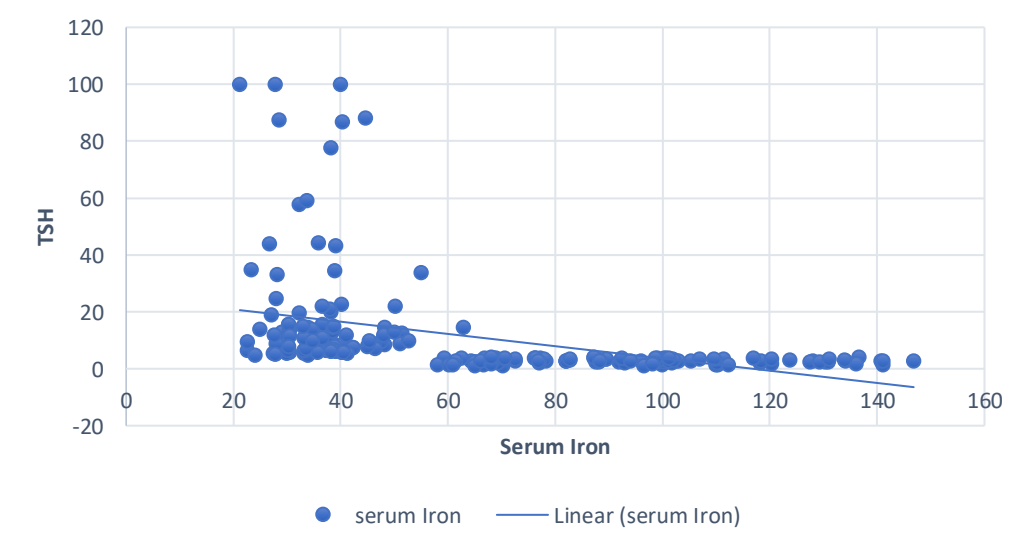

Fig 3. scatter chart showing correlation between serum iron and TSH

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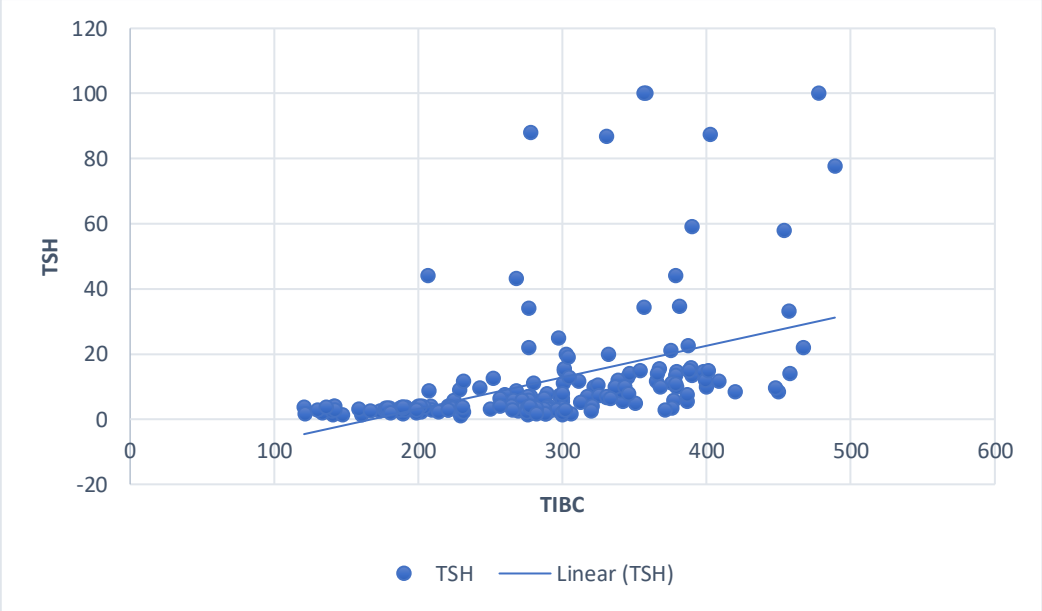

Fig 4. scatter plot showing correlation between TSH and TIBC

DISCUSSION

Present study aims to identify and establish a correlation between iron profile and thyroid profile of body.

The mean age of cases and controls in present study was 38.31 years and 36.63 years respectively. Most of the study participants were from the age group 31-40 years (36.5%). In a study performed by Mehmet et al, the mean age of cases and controls was 44.5 years and 45.3 years respectively. In similar study by Dorgalaleh et al the mean age of cases and controls was 14.1 years and 15.2 years respectively, as it was conducted in pediatric and adolescent patients (14, 15).

Most of the study participants were female (81%). The results were similar to study by Mehmet et al (88% female) (14).

In present study, the mean Hb of the hypothyroid cases was found to be 9.96 ± 1.76 gm/dl. The results were similar to study performed by Das et al and Mehmet et al. (13, 14).

Out of 100 hypothyroid cases, 74% had iron deficiency anemia while only 16% controls were found to have iron deficiency anemia.

Peripheral smear of the cases in present study shows that 24% cases have normal study while 7% cases have normocytic normochromic anemia, 34% cases have mild microcytic hypochromic anemia, 28% cases have moderate microcytic hypochromic anemia, 5% have severe microcytic hypochromic anemia and 2% cases have megaloblastic anemia. Most of controls (84%) have normal peripheral smear finding, 2% have normocytic normochromic anemia, 8% have mild and 6% have moderate microcytic hypochromic anemia.

The results of present study are in contrary to various other studies in which normocytic normochromic anemia was found to be the commonest type followed by mild and moderate microcytic anemia. Das et al found 51.6% of normocytic normochromic anemia in their study (13).

Mean serum iron and serum ferritin for cases in present study were 36.15±7.61µg/dl and 25.72±7.39 ng/ml and for controls, these were 94.88±22.86 and 220.52±97.91 respectively. The difference between cases and controls was found to be statistically significant. In similar study by Dahiya et al, the value of serum iron and serum ferritin was found to be 29.7±3.7 µg/dl and 104±3.3 ng/ml respectively. (7)

Serum TIBC of cases and controls was 336.13±62.2 and 227.22±58.94 respectively and the difference was found to be statistically significant.

In present study, mean TSH of cases and controls was 19.83 ± 5.81 mIU/L and 2.86±0.79 espectively. our mean TSH for cases was lower than TSH found in study by Mehmet et al (mean TSH: 43.1 mIU/ml) and higher than found in study by Dorgalaleh et al (mean TSH: 4.97 mIU/ml) (14,15).

In present study, hemoglobin, serum iron and serum ferritin were found to be negatively correlated with TSH and positively correlated with T3 and T4. While TIBC was found to be positively correlated with TSH and negatively correlated with T3, T4. The results were similar to study performed by Dahiya et al. (7)

CONCLUSION

Hypothyroidism is more common in middle aged females. The prevalence of iron deficiency anemia is more common in hypothyroid patients than in general population suggestive of existence of a definite correlation between iron profile and thyroid profile. Therefore, we conclude that iron deficiency anaemia can cause hypothyroidism and vice versa and estimation of iron profile in hypothyroid patients is important for better management of disease.

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