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# Prevalence of iron deficiency anemia in newly diagnosed hypothyroidism patients

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**Abstract**

**Objective**: to estimate the prevalence of iron deficiency anemia in newly diagnosed patients of hypothyroidism in a tertiary care center of southern Rajasthan.
**Material and methods**: present study is a cross-sectional study conducted in a y tertiary care center of southern Rajasthan and includes 100 newly diagnosed cases of hypothyroidism excluding old cases who are already taking treatment or patients with chronic illnesses. Hemoglobin, serum iron, serum ferritin and thyroid profile (T3, T4, TSH) along with peripheral smear study was evaluated in all the cases.
**Results**: Most of the patients (71%) in the study group were from age group 31-50 years. 82% patients were female while 18% were male. Out of 100 hypothyroid cases, 74% had iron deficiency anemia. Peripheral smear revealed that mild to moderate microcytic hypochromic anemia is more common in newly diagnosed hypothyroid patients (62%). Mean TSH in present study was 19.83 ± 5.81 mIU/L. Mean serum iron and serum ferritin in present study were 36.15±7.61µg/dl and 25.72±7.39 ng/ml.
**conclusion**: The prevalence of anemia in newly diagnosed hypothyroid patients in present study was found to be 74% which is much higher than the global prevalence of anemia (i.e. 24.3%). Further controlled studies and meta-analysis are required to identify and establish a definite relationship between thyroid status and iron profile of patients.
**Key words:** Iron deficiency, Hypothyroidism, Anemia, iron metabolism

## Introduction

Hypothyroidism is a common disorder characterized by deficiency of thyroid hormone production by thyroid gland, resulting in hormone deficit. It is prevalent endocrine disorder observed in society. 15% of world's population suffers from this disease (1,2). In India, thyroid disease affects approximately 42 million people, & hypothyroidism is the most common thyroid disease affecting people (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).
Hypothyroidism can be primary (due to thyroid hormone deficiency), secondary (due to decreased production of TSH) or tertiary (due to deficiency of TSH-RH). Primary hypothyroidism is the most common variety and can result from autoimmune thyroiditis, iodine deficiency, use of iodine-containing drugs, radioactive iodine therapy, or hemithyroidectomy.
Another important cause of hypothyroidism can be disorders related to iron metabolism (6). Iron and thyroid

metabolism are related closely because iron is an important component of various enzymes which are involved in synthesis and metabolism of thyroid hormones (7). It has also been showed in various earlier studies that iron deficiency can impair thyroid metabolism (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.

The present study aimed to find the prevalence of iron deficiency anemia in newly diagnosed hypothyroidism patient.

**Material and methods**

The study was conducted in a tertiary care hospital of southern Rajasthan after approval from institutional ethical committee

This study included 100 patients with newly diagnosed hypothyroidism who attended the outpatient clinic of medicine and endocrinology department.

**Inclusion Criteria:**

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, FT3 and FT4 values
5. Patient consented for participating in investigation

**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.
4. Patients with chronic systemic diseases like liver diseases, cardiovascular disorders, renal disorders, diabetes mellitus, bone diseases, alcoholism, etc.
5. Patients taking iron supplements.

**Sample collection and analysis**

About 5ml blood obtained from all subjects under aseptic condition. 3 ml sample was transferred to serum tube & 2 ml sample transferred to K2 EDTA tube. Once there adequate clotting, blood had been centrifuged. Aliquots collected from serum that had been separated in tube. It was then employed to analyse serum ferritin, serum iron, & thyroid profiles. Plasma was separated from EDTA tube, and CBC was analysed. Blood was collected by needle prick for peripheral blood smear analysis. Sample aliquoted was kept at -20°C.

**Results**

The present study was conducted to find the prevalence of iron deficiency anemia in newly diagnosed patients of hypothyroidism.

Most of the patients in the study group were from age group 31-50 years (71%) (Table-1). 82% patients were female while 18% were male.

**Table 1. Age wise distribution of the study participants**

| Age group (in years) | Number | Percentage |
|---|---|---|
| <20 | 8 | 8 |
| 21-30 | 12 | 12 |
| 31-40 | 35 | 35 |
| 41-50 | 36 | 36 |
| 51-60 | 9 | 9 |
| Total | 100 | 100 |
| Mean Age | 38.31±10.24 (Mean±SD) | |

Peripheral smear study of the cases shows that 9% cases have normocytic normochromic anemia, 32% cases have mild microcytic hypochromic anemia, 52% cases have moderate microcytic hypochromic anemia, 5% have severe microcytic hypochromic anemia and 2% cases have megaloblastic anemia. (Table 2)

**Table 2. Result of peripheral smear study of cases**

| **Types of Anemia** | **Frequency** |
|---|---|
| Normal Study | 0 |
| Normocytic normochromic Anemia | 09 |
| Mild microcytic hypochromic anemia | 32 |
| Moderate microcytic hypochromic anemia | 52 |
| Severe microcytic hypochromic Anemia | 05 |
| Megaloblastic anemia | 2 |
| Total | 100 |

Out of 100 hypothyroid cases, 74% had iron deficiency anemia.(Table 3)

**Table 3. Correlation between iron deficiency anemia & hypothyroidism within investigation participants.**

| **Iron deficiency anemia** | **Hypothyroidism** | |
|---|---|---|
| | **Present** | |
| | **N** | **%** |
| Present | 74 | 74 |
| Absent | 26 | 26 |
| Total | 100 | 100 |

Various test parameters of study participants are shown in table 4.

**Table 4. Comparison of various thyroid parameters & iron profile parameters among study participants**

| S.No. | Test Parameter | Value |
|---|---|---|
| 1 | T3 | 0.48±0.24 |
| 2 | T4 | 2.82±0.79 |
| 3 | TSH | 19.83±5.81 |
| 4 | Hemoglobin (Hb) | 9.96±1.76 |
| 5 | Serum iron | 36.15±7.61 |
| 6 | Serum Ferriin | 25.72±7.39 |

Table 4 shows correlation between various analytes used in the study. Significant correlation could be found among thyroid hormones and hemoglobin, serum iron and serum ferritin levels.

Hemoglobin , serum iron and serum ferritin were found to be positively corelated with T3 and T4 values while negatively correlated with TSH.

**Discussion**

As per WHO 30% of women in the age group 15-49 is affected from iron deficiency anemia and this percentage is even more in underdeveloped and developing nations like India.

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.

It has been showed in various earlier studies that iron deficiency can impair thyroid metabolism as it is an important part of thyroid peroxidase enzyme which is necessary for thyroid hormone synthesis (8).

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).

In patients with hypothyroidism, thyroxine supplement increases erythropoietin levels, which increases erythropoiesis. This increases the demand for iron stores and thus leads to iron deficiency (7).

Thus, it is observed that thyroid hormone profile may affect iron metabolism and vice versa.

In present study, the mean age of the participant was 38.31 years with maximum patients were in the age group 31-50 years (71%). Similar study was performed by Das et al in 2012 and the mean age for hypothyroidism in their study was found to be 36.5 years (13). In another study performed by Mehmet et al, the mean age for hypothyroidism was found to be little higher (44.5 years) (37).

Male: female ratio in our study was 18:82 which was similar to study performed by Mehmet et al (12:88) (37).

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, 37)

Peripheral smear study of the cases Peripheral smear of the cases in present study shows that 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. 24% cases had normal peripheral smear picture. 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).

Out of 100 hypothyroid cases in present study, 74% had iron deficiency anemia which is similar to other past studies (13,14).

Mean TSH in present study was 19.83 ± 5.81 mIU/L. our mean TSH 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).

Mean serum iron and serum ferritin in present study were 36.15±7.61µg/dl and 25.72±7.39 ng/ml. in 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)

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

**Conclusion**

The prevalence of anemia in newly diagnosed hypothyroid patients in present study was found to be 74% which is much higher than the global prevalence of anemia (i.e. 24.3%). Peripheral smear revealed that the mild to moderate microcytic hypochromic anemia is more common in newly diagnosed hypothyroid patients (62%). TSH levels were found to be negatively correlated with hemoglobin, serum iron level and serum ferritin level suggestive of definite relationship between iron deficiency anemia and hypothyroidism.

**References**

1. Hallengren B. [Hypothyroidism--clinical findings, diagnosis, therapy. Thyroid tests should be performed on broad indications]. Lakartidningen. 1998 Sep 16;95 (38):4091-6.
2. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective.

Indian J Endocrinol Metab. 2011 Jul;15(Suppl 2):S78-81. http://doi: 10.4103/2230-8210.83329.

3. Vanderpump MP. The epidemiology of thyroid disease. Br Med Bull. 2011;99:39-51. http://doi: 10. 1093 / bmb/ldr030.
4. Gantus MA, Alves LM, Stipursky J, Souza EC, Teodoro AJ, Alves TR, Carvalho DP, Martinez AM, Gomes FC, Nasciutti LE. Estradiol modulates TGF-β1 expression and its signaling pathway in thyroid stromal cells. Mol Cell Endocrinol. 2011 Apr 30;337(1-2):71-9 Epub 2011 Feb 18. http://doi:10.1016/j.mce.2011.02.001.
5. Layal Chaker, Antonio C Bianco, Jacqueline Jonklaas, Robin P Peeters. Hypothyroidism. Lancet, 2017 Sep 23; 390(10101): 1550-1562.
6. Beard J, Tobin B, Green W. Evidence of thyroid hormone deficiency in iron-deficient anemic rats. J Nutr. 1989;119:772-78.
7. Dahiya K, Verma M, Dhankhar R, Ghalaut VS, Ghalaut PS, Sachdeva A, et al. Thyroid profile and iron metabolism: mutual relationship in hypothyroidism. Biomedical Research (2016) Volume 27, Issue 4.
8. Eftekhari MH, Keshavarz SA, Jalali M, Elguero E, Eshraghian MR, Simondon KB. The relationship between iron status and thyroid hormone concentration in iron deficient adolescent Iranian girls. Asia Pac J Clin Nutr. 2006;15(1):50-5.
9. Sonja YH, Michael BZ, Myrtha A, Wolfgang L, Richard FH. Iron deficiency anemia reduces thyroid peroxidase activity in rats. J Nutrition 2002; 132: 1951-1955.
10. Akhter S, Nahar ZU, Parvin S, Alam A, Sharmin S, Arslan MI. Thyroid status in [5] patients with low serum ferritin level. Bangladesh J Med Biochem. 2012;5:05-11.
11. Smith SM, Johnson PE, Lukaski HC: In vitro hepatic thyroid hormone deiodination in iron-deficient rats: effect of dietary fat. Life Sci. 1993, 53:603-9. 10.1016/0024-3205(93)90268-8
12. Jason WH, Stephen FH, Rajasehkar R, Govind B, Peter HRG. Anemia in celiac disease is multifactorial in etiology. Am J Hematol. 2007;82:996- 1000.
13. Das C, Sahana PK, Sengupta N, Giri D, Roy M, Mukhopadhyay P. Etiology of anemia in primary hypothyroid subjects in a tertiary care center in Eastern India. Indian J Endocr Metab. 2012;16(Suppl S2):361- 63.
14. Mehmet E, Aybike K, Ganidagli S, Mustafa K. Characteristics of anemia in subclinical and overt hypothyroid patients. Endocr J.2012;59(3):213- 20.
15. Dorgalaleh A, Mahmoodi M, Varmaghani B, Kia OS, Alizadeh S, Tabibian S, et al. Effect of thyroid dysfunctions on blood cell count and red blood cell indice. Iran J Pediatr Hematol Oncol. 2013;3(2):73