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ORIGINAL ARTICLE

THYROID FUNCTION STATUS IN PATIENT WITH IRON DEFICIENCY ANAEMIA IN A TERTIARY CARE HOSPITAL OF LALITPUR, NEPAL

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ABSTRACT

Introduction: *Studies have found that iron deficiency anaemia(IDA) impairs thyroid hormone metabolism. The prevalence of thyroid dysfunction in adults in the general population ranges from 1 to 10 percent, and is even higher in selected groups. Thus in this study we would like to see thyroid function status in people with IDA.*

Methods: *It was Laboratory based cross sectional study conducted in the Department of Biochemistry of a tertiary care hospital of KIST Medical College and Teaching Hospital, lalitpu, Nepal. Secondary data of 162 patients available in laboratory database of 3 years' duration from August 2018 to August 2021 were taken. All Patients diagnosed with IDA whose thyroid profile was also done were included in the study. Data were entered in Microsoft Excel. Statistical analysis was performed using version 29 of the Statistical Package for Social Sciences (SPSS Inc, Chicago IL, USA).*

Results: *Among 162 IDA patients, 86.4% (n=140) were females and 13.62% (n=22) were males. Age ranged widely from 19 to 88 years and median age was 38 years. Out of 162 patients most of the patients 68.5% were euthyroid, 8.7% had euthyroid hypothyroxinemia, 7.4% had primary hypothyroidism,3.7% had subclinical hypothyroidism, 3.1% had secondary hypothyroidism, 1.2% had primary hyperthyroidism, 1.2% had T3 toxicosis, 0.6% had euthyroid hyperthyroxinemia. Based on multiple independent KW test, relationship between category of thyroid disorders and iron profile as well as thyroid disorder and Hb level were found not to be statistically significant. No category of thyroid dysfunction was associated with value of haemoglobin level or severity of anaemia. Irrespective of category of thyroid profile including euthyroid, hypothyroid and hyperthyroid, no category is particularly associated with IDA.*

Conclusions: *In patients with IDA, there is no significant association between Hb level or severity of iron deficiency irrespective of patient being euthyroid, hypothyroid or hyperthyroid.*

Keywords: *Iron Deficiency Anaemia, Thyroid Function Status*

INTRODUCTION

Anaemia is defined as haemoglobin (Hb) levels <12.0 g/dl in women and <13.0 g/dl in men.[1] Anaemia is one of the major public health problems with its global prevalence of 22.8% and dietary iron deficiency is the most common cause of anaemia.[2] Thyroid hormones (THs):Thyroxine (T4) and 3,53'-triiodothyronine (T3) are key determinants of cellular metabolism.They are important for optimal functioning of almost all tissues with major effects on metabolic rate and oxygen consumption.[3] Human study done by Grymula et.al. demonstrated for the first time that thyroid hormone receptors are present in human cord blood , peripheral blood and bone marrow CD34+ enriched cells. They have suggested that thyroid hormone, T3, is one of the factors that may play a role in regulation of cell population growth and the process of apoptosis of human haematopoietic cells.[4]Subsequent study by the their team indicate that both hypo- and hyperthyroidism significantly affect the proliferative potential of haematopoietic Progenitor Cells.[5] Normal thyroid status is dependent on the presence of many trace elements like iron, iodine, selenium, and zinc as these are required for both the synthesis and metabolism of thyroid hormones. Deficiencies of these elements can impair thyroid functions. Iron deficiency impairs thyroid hormone synthesis by reducing activity of heme-dependent thyroid peroxidase enzyme which catalyses initial step of thyroid hormone synthesis.[6] The thyroid function status can be categorized based on serum levels of free T3 (fT3), free T4 (fT4), and Thyroid stimulating hormone (TSH) into: [7,8,9]

- Euthyroid: normal fT3, fT4 and TSH
- Subclinical hyperthyroidism: normal fT3, normal fT4 with low TSH
- Subclinical hypothyroidism: normal fT3, normal fT4 with high TSH

- Primary Hyperthyroidism: high fT3, high fT4 with low TSH
- Primary hypothyroidism: low fT3, low fT4 with high TSH
- Secondary hypothyroidism: Low fT3, low fT4 low TSH
- Secondary hyperthyroidism: high fT3, high fT4, high TSH
- T3 thyrotoxicosis: high fT3, normal fT4, Low TSH
- Euthyroid hyperthyroxinemia: high fT3, high fT4 with normal TSH
- Euthyroid hypothyroxinemia: low fT3, Low fT4 with normal TSH

Studies have found that iron deficiency anaemia(IDA) impairs thyroid hormone metabolism.[10]8 with depleted iron stores (nonanemic The prevalence of thyroid dysfunction in adults in the general population ranges from 1 to 10 percent, and is even higher in selected groups.[11] Thus in this study we would like to see thyroid function status in people with IDA.

MATERIALS AND METHODS

It was Laboratory based cross sectional study conducted in the Department of Biochemistry of a tertiary care hospital of KIST Medical College and Teaching Hospital, Lalitpur, Nepal. Secondary data of 162 patients available in laboratory database of 3 years' duration from August 2018 to August 2021 were taken. Diagnosis of IDA was done by laboratory-confirmed evidence of anaemia indicated by low Hb, as well as evidence of low iron stores evidenced by low serum iron, a low serum ferritin, a low transferrin saturation, and a high total iron-binding capacity (TIBC).[12]All Patients diagnosed with IDA whose thyroid profile was also done were included in the study. Data with missing relevant demographic characters like age and sex and patients from department of Obstetrics and Gynaecology and paediatrics were excluded. Before commencing the study ethical approval was obtained from Institutional Review Committee of KIST Medical College and Teaching Hospital, Imadol, Lalitpur (Ref.No: 2077/78/73).

The biochemical parameters measured in our study were Hb, iron, ferritin, transferrin saturation, TIBC, fT3, fT4 and TSH. The reference ranges in our laboratory as per the manufacturer of the reagent kit were iron(3-193µg/dl), ferritin (30-400ng/ml), TIBC(250-450µg/dl), fT3 (2.3-4.2pg/mL), fT4 (0.89-1.76 ng/dl), TSH (0.35-5.5µIU/mL). Hb was measured using SysmexKX-21N cell counter. Biochemical parameters: Iron and TIBC were determined enzymatically by Siemens Dimension RXL. %iron saturation was calculated using formula (Iron / TIBC) x100. Ferritin, fT3, fT4 and TSH were determined using Simens' ADVIA Centaur CP Immunoassay.

Data were entered in Microsoft Excel. Statistical analysis was performed using version 29 of the Statistical Package for Social Sciences (SPSS Inc, Chicago IL, USA). Normality of data distribution was assessed by Kolmogorov- Smirnov test. Based on the observations of the test, most of the variables in the study were found to be highly skewed so median and median absolute deviation were calculated and further Independent-Samples Kruskal-Wallis tests were carried out to examine the relationship between category of thyroid disorder and haemoglobin including iron profile.

RESULTS

Among 162 IDA patients, 86.4% (n=140) were females and 13.62% (n=22) were males. Age ranged widely from 19 to 88 years and median age was 38 years

Level of significance for Kolmogorov-Smirnov (KS) value was observed to be less than 0.05 for all the variables and most of the variables in the study were found to be highly skewed which suggests that the observed data has non-normal distribution, so median and median absolute deviation were calculated as depicted in table 1.

Table 1: Descriptive data of patients' age, iron profile, haemoglobin and thyroid profile.

Descriptive statistics	Variables								
	Age	Ferritin	Iron	TIBC	Saturation	Hb	fT3	fT4	TSH
N (Frequency)	162	162	162	162	162	162	162	162	162
Median	38.00	9.00	22.00	360.90	6.00	9.10	2.80	1.09	2.16
Median Absolute Deviation (MAD)	12	4.2	6	60.135	2	1.2	.48	.17	1.13

Out of 162 patients most of the patients 68.5% were euthyroid, 8.7% had euthyroid hypothyroxinemia, 7.4% had primary hypothyroidism,3.7% had subclinical hypothyroidism, 3.1% had secondary hypothyroidism, 1.2% had primary hyperthyroidism, 1.2% had T3 toxicosis, 0.6% had euthyroid hyperthyroxinemia as shown in Figure 1.

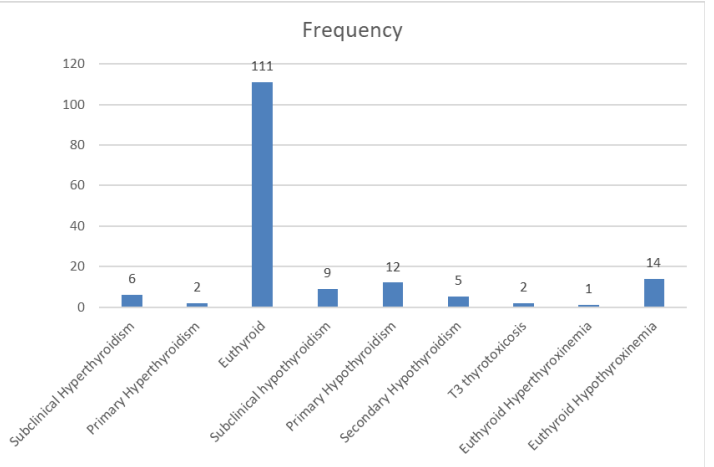

Figure 1: Bar diagram showing frequency of different categories of thyroid profile.

Independent-Samples Kruskal-Wallis tests were carried out to examine the relationship between category of thyroid disorder and Haemoglobin including iron profile. Based on multiple independent KW test, relationship between category of thyroid disorders and iron profile as well as thyroid disorder and Hb level were found not to be statistically significant. No category of thyroid dysfunction was associated with value of haemoglobin level or severity of anaemia. Irrespective of category of thyroid profile including euthyroid, hypothyroid and hyperthyroid. No category is particularly associated with IDA as depicted in table 2.

Table 2: Hypothesis test summary

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Hb is the same across categories of Thyroid disorder.	Independent-Samples Kruskal-Wallis Test	.470	Retain the null hypothesis.
2	The distribution of Ferritin is the same across categories of Thyroid disorder.	Independent-Samples Kruskal-Wallis Test	.439	Retain the null hypothesis.
3	The distribution of Iron is the same across categories of Thyroid disorder.	Independent-Samples Kruskal-Wallis Test	.571	Retain the null hypothesis.
4	The distribution of TIBC is the same across categories of Thyroid disorder.	Independent-Samples Kruskal-Wallis Test	.354	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

DISCUSSION

Iron deficiency anaemia and thyroid dysfunction are commonly encountered health problem in our country. Many studies on both IDA and thyroid dysfunctions are done on pregnant ladies and pediatric population which shows higher prevalence of hypothyroidism in those group and very few studies are done in nonpregnant adult population. So in this study we wanted to evaluate the thyroid function status in non-pregnant adult population.

In our study among 162 IDA patients, 86.4% were females and 13.62% were males. Worldwide, especially in developing and underdeveloped countries like Nepal, in general population the prevalence of any type of anaemia including IDA is higher in female compared to male. Similar finding was observed in a nationally representative household survey done in 29 states and seven Union Territories of India in 2015, where in men, the prevalence of any anaemia was 23·2% , while 53·2% of women had anaemia. Several factors like access to micronutrient and nutrition rich diet, physiological conditions like menstrual blood loss might be the causes of higher prevalence in female.[13]

We didn't find similar study like ours analysing prevalence of thyroid dysfunction in nonpregnant adult population with IDA. However, there are studies done on relationship of thyroid function and IDA in children and pregnant ladies. Also there are studies done on prevalence of

ID in various categories of thyroid dysfunction. In a study thyroid function in primary school age children in Damietta Governorate, Egypt, the frequency of hypothyroid status (both overt and subclinical) was elevated in the case group compared to control [24% vs. 6%; P=0.02].[14]In a systematic review and meta-analysis of 636 studies, which discussed the correlation of iron deficiency and thyroid disorder, the prevalence of overt (OR:1.60;95%CI:1.17; P=0.004) and subclinical (OR:1.37;95%CI:1.13,1.66; P=0.001) hypothyroidism in pregnant woman with iron deficiency was significantly increased.[15] In our study most of the patients 68.5% were euthyroid, 8.7% had euthyroid hypothyroxinemia, 7.4% had primary hypothyroidism,3.7% had subclinical hypothyroidism, 3.1% had secondary hypothyroidism, 1.2% had primary hyperthyroidism, 1.2% had T3 toxicosis, 0.6% had euthyroid hyperthyroxinemia. Irrespective of category of thyroid profile including euthyroid, hypothyroid and hyperthyroid. No category is particularly associated with IDA. In an epidemiological study done in 2011, to see the prevalence of thyroid function abnormalities in 971 adult subjects from a community study from Kerala, south India, it was found that 80%had normal TFT,4% had hypothyroidism,2%had hyperthyroidism,9%had subclinical hypothyroidism, 1%had subclinical hyperthyroidism and 4% had unclassifiable thyroid function status.[16] Thus from our study we can say that there is no statistically significant prevalence of thyroid dysfunction in patient with IDA.

CONCLUSION

In patients with IDA, there is no significant association between Hb level or severity of Iron deficiency irrespective of patient being euthyroid, hypothyroid or hyperthyroid.

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