Original Article

The Status of Thyroid Hormones in Iron Deficient Patients in Bangladesh

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Abstract

To determine the relation between iron deficiency and the status of thyroid hormones in iron deficient patients.

This case control study was done in the Department of Biochemistry, Bangabandhu Sheikh Mujib Medical University (BSMMU), during July 2006 to the June, 2007. Iron deficiency patient was considered as case a healthy control subject was considered as control. A total of 80 subjects were selected for study from those who were attended in out patient department of the above mentioned hospital were enrolled in this study.

The mean (±SD) age of case and control were 33.48±11.03 years and 35.40±12.30 years with the range of 16-60 years and 15-60 years respectively. Male female ratio was 1:1.6 in the whole study subjects. Hemoglobin concentration, serum ferritin concentration were significantly ($p<0.05$) higher in control group but serum TSH level was significantly ($p<0.05$) higher in case group, however, serum FT3 was almost similar between case and control groups. In iron deficient patients, serum ferritin had no significant negative correlation ($r=-0212$; $p>0.05$) with serum TSH and no correlation with serum FT4 concentrations and serum FT3 concentration which were ($r=0.055$; $p>0.05$) and ($r=0.147$; $p>0.05$) respectively. In control subjects, serum ferritin revealed that there was significant negative correlation ($r=-0.337$; $p<0.05$) serum TSH. However, serum ferritin with serum FT4 concentration and serum ferritin with serum FT3 level showed no statistically significant correlation which were ($r=0.283$; $p>0.05$) and ($r=0.145$; $p>0.05$) respectively. On the other hand, there were no significant ($p>0.05$) correlation of hemoglobin concentration and serum ferritin with serum TSH, free T3 and free T4 concentrations both in case and control group. There were no significant ($p>0.05$) difference among serum TSH, free T3 and free T4 concentrations between male and female in both groups. Serum TSH level was significantly ($p<0.05$) higher in iron deficient patients and no significant negative correlation, serum ferritin level.

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Introduction

Iron deficiency is the most common preventable nutritional deficiency in the world, especially among and young children in developing countries. In South Asia the prevalence of iron deficiency anemia (IDA) among children under 5 years of age is estimated 75%, 55%, and 56% in India, Bangladesh and Pakistan respectively[1]. One study in Bangladesh showed the prevalence of anemia is 27%. Among them 7% was depleted iron strode and 32% was iron deficiency anemia[2]. Plasma ferritin is a measure of iron stores and the best single test to confirm iron deficiency. Low hemoglobin concentration is most readily available sign of anemia, but a significanct fall in circulating hemoglobin cannot be detected until the final stage of iron deficiency[3].

Thyroid peroxidase (TPO) is a membrane-bound, glycosylated hemoprotein that plays a key role in the biosynthesis of thyroid hormones. This enzyme is responsible for the oxidation of iodide and iodide and binding of iodine to tyrosyl residue of thyroglobulin (organification). Two di-iodotyrosine (DIT) molecules undergo an oxidative condensation for the formation of thyroxine (T4). Tri-iodothyronie (T3) is yielded from the coupling of one mono-iodotyrosine (MIT) and one di-iodotyrosine (DIT). A separate coupling enzyme has not been found and since this is an oxidative process, it is assumed that same thyroperoxidase catalyzes this reaction. This hypothesis is supported by observation that the same drug which inhibit iodiade oxidation also inhibit coupling[4]. The prevalence of prevalence of primary hypothyroidism is 1:100, but increases to 5:100 if patient with sub-clinical hypothyroidism. The female: male ratio is approximately[5,6].

Iron supplementation given to iron deficient women with low blood levels of thyroid hormones, partially normalized these levels[6]. The degree of iron deficiency may affect thyroid hormone status in iron deficient adolescent Iranian girls[7]. Anemia is a frequent finding in infants with congenital hypothyroidism and is depend on the degree of neonatal hypothyroidism and imply that during development hypothyroidism may produce persisting changes even after thyroid replacement has begun[8].

Iron supplementation improves the efficacy of iodized salt in goitrous children with iron deficiency in Cote d'Ivoire[9]. An interventional study in goitrous, iron deficient anemic children showed that iron supplementation may improve the efficacy of oral iodized oil[10]. An interventional double blind controlled trial with dual fortified salt containing iodine and micro-encapsulated iron in. northern Moroccan school children showed that a dual fortified salt can be effective fortification strategy[11].

In Turkey, a study on the relationship between iron and thyroid hormones in adolescents living in an iodine deficient area showed no correlation between iron status and thyroid

hormone levels[12]. In Bangladesh including a few severe anemia, the overall anemia prevalence among non pregnant rural women is high[13]. A survey conducted in Bangladesh in the year 1993, showed that prevalence of goiter was 47.1% and cretinism was 0.5%. They observed that 69% of Bangladeshi had biochemical iodine deficiency[14].

Materials And Methods

This study was carried out in the Department of Biochemistry, in the Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from the July 2006 to the June, 2007. This case control study included 80 subjects those who were attended in out patient department in the hospital. Diagnosed iron deficient patients were considered as case and healthy control was considered as control. Pregnancy, diagnosed Iodine deficiency, positive for Anti-TPO & Anti-TG, hepatic disorder and renal diseases were excluded from the study. Relevant information was collected from history, physical findings, laboratory investigations and recorded in pre designed data sheet. The whole procedure was explained to each patient and a written consent was taken from him or his attendant. Permission was taken from the concerned.

Departmental Ethical Committee in order to undertake the study. With all aseptic precautions from all study 5 ml of morning blood was collected from the median cubital vein by disposable plastic syringe. The needle was detached from the nozzle and blood was transferred immediately into dry clean plastic test tubes were allowed to clot and then was centrifuged. Separated serum were collected into plastic micro centrifuged tubes and were appropriately labeled and was stored in ultra freezer at 35^0C until analytical measurement of serum. Spot urine was collected in dry clean test tubes for estimation of urinary iodine.

Statistical Analysis: The results were presented in tables and figures. Unpaired t-test and Pearson's correlation coefficient test were performed. Level of significance was expressed as p value. P value of <0.05 was considered as significant.

Results

The mean (±SD) age of case and control were 33.48±11.03 years and 35.40±12.30 years with the range of 16-60 years and 15-60 years respectively. Male subjects were 14 in case group and 16 in control group. Male female ratio was 1:1.6 in the whole study subjects. The mean (±SD) of hemoglobin concentration in case and control were 6.35±2.05 gm/dl and 12.73 ± 1.01 gm/dl respectively. The mean serum ferritin concentration was 6.64±4.33 µg/L in case and 74.20 µg/L in control group. The mean serum TSH concentrations were 3.31 ± 1.49mlU/L and 1.91±0.85mlU/L in case and control respectively. The mean serum FT4 concentration was 11.81±1.77 pmol/L in case and 12.83±1.84 pmol/L in control group. The mean serum FT3 in case and control were 3.02 ± 0.63 pmol/L and 3.28±0.62 pmol/L respectively. There were significant (p<0.05) difference of hemoglobin, serum ferritin, serum TSH, and serum FT4 between case and control group but serum FT3 was not significant (p>0.05) between two groups.

In iron deficient patients, serum ferritin had no significant negative correlation (r=-0212; p>0.05) with serum TSH but no correlation was found between serum ferritin with serum FT4 concentrations (r=0.055; p>0.05). Simily, no correlation was found between serum ferritin with serum FT3 concentration (r=0.147; p>0.05).

In control, subjects serum ferritin revealed significant negative correlation (r=-0.337; p<0.05) with serum TSH. However, serum ferritin showed no statistically significant correlation with serum FT4 concentration and serum FT3 level which were (r=0.283; p>0.05) and (r=0.145; p> 0.05) respectively.

On the other hand, there were no significant (p>0.05) correlation of hemoglobin concentration and with serum TSH (r=-0.148; r=-0.173), free T3 (r=0.03; r=0.25) and free T4 concentrations(r=0.12; r=0.18) both in case and control group. There were no significant (p>0.05) difference among serum TSH, free T3 and free T4 concentrations between male and female in both groups.

Table I: Hemoglobin and serum concentration in study subjects.

Group	Case (n=40) Mean±SD	Control (n=40) Mean±SD	P value
Hemoglobin (gm/dl)	6.35±2.05	12.73±1.01	<0.001s
Serum Ferritin (µg/L)	6.64±4.33	74.10±47.20	<0.001s

Table II: Comparison of serum TSH, FT4 and FT3 cone in study subjects.

Group	Case (n=40) Mean±SD	Control (n=40) Mean±SD	P value
TSH mIU/L	3.31±1.49	1.91±0.85	<0.001s
FT4 pmol/L	11.81±1.77	12.83±1.84	<0.005s
FT3 pmol/L	3.02±0.63	3.28±0.62	>0.005s

Table III: Correlation between serum ferritin and TSH in study subjects.

Group	Case (n=40) Mean±SD	Control (n=40) Mean±SD	'r' value	p value
Serum ferritin (µg/L)	6.64±4.33	74.10±47.20	-0.212	>0.005s
Serum TSH (pmol/L)	3.31±1.49	1.91±0.85	-0.337	<0.005s

Table IV: Correlation between serum ferritin and FT4 in study subjects.

Group	Case (n=40) Mean±SD	Control (n=40) Mean±SD	'r' value	p value
Serum ferritin (µg/L)	6.64±4.33	74.10±47.20	0.06	>0.005s
Serum FT4 (pmol/L)	11.81±1.77	12.83±1.84	0.283	>0.005S

Table V: Correlation between serum ferritin and FT3 in case and in control.

Group	Case (n=40) Mean±SD	Control (n=40) Mean±SD	'r' value	p value
Serum ferritin (µg/L	6.64±4.33	47.10±47.20	-0.147	>0.005s
Serum FT3 (pmol/L)	3.02±0.63	3.28±0.62	0.145	>0.005s

Table X: Correlation between hemoglobin level and serum TSH in case & Control.

Group	Case (n=40) Mean±SD	Control (n=40) Mean±SD	'r' value	p value
Hemoglobin (gm/dl)	6.35±2.05	12.73±1.01	-0.148	>0.005s
Serum TSH (mlU/L)	3.31±1.49	1.91±0.85	-0.173	>0.005s

Discussion

This case control study was undertaken to determined the relationship between iron deficiency and thyroid hormone status. This study measured the serum free T3 free T4 and TSH level in iron deficient patients and in control healthy people.

The serum free T4 level was significantly ($p<0.05$) lowered in case than control group ($p<0.05$), which is consistent with Beard[6,7]. There was no statistical significant correlation between serum ferritin and free T4 in this study. However, Iftekhari, Keshavarz, Jalali[7]. showed positive significant correlation, which is not similar with the current study.

There was no significant ($p>0.05$) difference of free T3 in this study between case and control subjects. But Beard, Borel and Deer6 showed significant ($p<.05$) difference of free T3 between iron deficient and healthy control subjects.

This study showed that serum TSH concentration significantly ($p<0.001$) higher in case compared to control. Similar, findings obtained by Blum and Blum[15]. In this current study showed, there was negative correlation of serum ferritin with serum TSH in iron deficient patients but not significant ($p>0.05$). There was significant negative correlation between serum ferritin and serum TSH in control subjects ($p<0.05$). Though some authors have found that the thyroid profile was not significantly affected in iron deficient patient, Yavuz[12]. showed no correlation between iron status and thyroid hormone levels in Turkey's school children. In another study Tienboon and Unachak[16] showed that the thyroid hormones of IDA children before and after iron treatment were not significantly different from the control in children, Azizi[17]. Showed that free T3, free T4 and TSH levels were not significantly different between those with low and normal ferritin. But iron deficiency is associated with a high prevalence of goiter in Iranian school children. These variations may be due to different geographical, racial influences and different demographic characteristics of their study patients.

Hemoglobin level with serum TSH concentration, serum FT3 and serum FT4 revealed no correlation in both groups, which are not similar with other studies. This study suggested that the significant difference in thyroid status in iron deficient people could be a reflection of disturbed activities of iron depended enzymes such as thyroid peroxidase that impairs thyroid metabolism.

Due to time and financial constraint, we had to confine with small sample size and other indices that might influence thyroid status have not measured. Other indices to diagnose iron deficiency we could not perform due to financial constrain. If were could perform TRH test, it might be helpful to diagnose early primary hypothyroidism. So further study overcoming these limitations is recommended which may reveal more informative result in future.

This study was done to evaluate the relation between thyroid status and iron efficiency. Hemoglobin concentration, serum ferritin concentration were significantly decreased in iron deficient patient but serum TSH level was significantly increased in this group, however, serum FT3 was almost similar in both groups. Serum ferritin had no significant negative correlation with serum TSH and no correlation with serum FT4 concentrations and serum FT3 concentration in iron deficient patients. Serum ferritin had significant negative correlation with serum TSH but no correlation found with serum FT4 concentration and serum ferritin in healthy control subjects. There were no significant correlation of hemoglobin concentration and serum ferritin with serum TSH, free T3 and free T4 concentrations both in case and control group. Serum TSH, free T3 and free T4 concentrations were not almost similar between male and female in both groups. Therefore, it can be suggested that iron deficiency may alter the thyroid hormone status.

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