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Original Research

Assessment of thyroid function in children with iron deficiency anemia

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ABSTRACT:

Background: Iron deficiency (ID) is the most common nutritional disorder worldwide and affects millions of infants and children. The present study was conducted to assess thyroid function in children with iron deficiency anemia. **Materials & Methods:** 84 child patients age ranged 4-15 years of both genders were included. Group I comprised of children with ID anemia and group II had control. Complete blood count, thyroid profile, ferritin, iron, Total Iron Binding Capacity (TIBC), Transferrin Saturation% (TFS%), unsaturated iron binding capacity and Urinary Iodine Excretion (UIE) were assessed. Thyroid profile and ferritin were measured using commercially available Enzyme Linked Immunosorbent Assay (ELISA) kits; **Results:** The mean hemoglobin (gm/dl) was 9.4 and 11.2, MCV (fl) was 61.3 and 78.4, MCH (pg) was 22.1and 27.9, RDW (%) was 16.5 and 14.2, ferritin (ng/mL) was 12.3 and 45.3, iron concentration (µg/dL) was 20.5 and 91.2, total iron binding capacity (TIBC) (µg/dL) was 480.2 and 314.7 in group I and group II respectively. The mean TSH (µIU/mL) was 4.31 and 0.78, free T3 (pg/mL) was 1.1 and 4.2 and free T4 (ng/dL) was 0.91 and 1.34 in group I and group II respectively. The difference was significant (P< 0.05). **Conclusion:** Primary hypothyroidism can occur among children suffering from iron deficiency anemia.

Key words: hypothyroidism, children, iron deficiency anemia.

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INTRODUCTION

Iron deficiency (ID) is the most common nutritional disorder worldwide and affects millions of infants and children. Several metabolic and functional consequences of iron deficiency have been described.[1] Studies in both animals and humans have shown poor thermoregulation to be one of these deleterious consequences and have implicated impaired thyroid hormone metabolism as a likely cause.[2] One of the worldwide concerns is ID and ID anemia, which commonly occurs among children in the developing countries. Depletion of the body's iron stores leads to ID which manifests early by elevated red cell distribution width (RDW) and finally by occurrence of IDA which is diagnosed by low haemoglobin level.[3] In a study by Beard et al, iron deficient anaemic rats had lower basal thyroid stimulating hormone (TSH) values and blunted TSH response to intravenous thyrotropin releasing hormone (TRH) injection.[4]

It is observed that ID impairs thyroid metabolism, that has been explained by the iron dependence of Thyroid Peroxidase (TPO), which is a haem containing enzyme, responsible for iodide oxidation into iodine, then its binding to tyrosine residue of thyroglobulin for formation of Mono-Iodotyrosine (MIT) and Di-Iodotyrosine (DIT).[5] Also, this enzyme is important for oxidative coupling of two molecules of DIT to form T4 or coupling of one MIT and one DIT to form T3. The present study was conducted to assess thyroid function in children with iron deficiency anemia.

MATERIALS & METHODS

The present study comprised of 84 child patients age ranged 4-15 years of both genders. The consent was obtained from their parents.

Data such as name, age, gender etc. was recorded. Group I comprised of children with ID anemia and group II had control. Complete blood count, thyroid profile, ferritin, iron, Total Iron Binding Capacity (TIBC), Transferrin Saturation% (TFS%), unsaturated iron binding capacity and Urinary Iodine Excretion (UIE) were assessed. Thyroid profile and ferritin were measured using commercially available Enzyme

Linked Immunosorbent Assay (ELISA) kits; while, iron, TIBC and UIE were measured using colorimetric methods. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Group I	Group II
Status	ID anemia	Control
M:F	30:54	40:44

Table I shows that there were 30 boys and 54 girls in group I and 40 boys and 44 girls in group II.

Table II Comparison of blood indices

Parameters	Group I	Group II	P value
Hemoglobin (gm/dl)	9.4	11.2	0.05
MCV (fl)	61.3	78.4	0.02
MCH (pg)	22.1	27.9	0.05
RDW (%)	16.5	14.2	0.04
Ferritin (ng/mL)	12.3	45.3	0.02
Iron concentration (µg/dL)	20.5	91.2	0.01
Total iron binding capacity (TIBC) (µg/dL)	480.2	314.7	0.01

Table II, graph I shows that mean hemoglobin (gm/dl) was 9.4 and 11.2, MCV (fl) was 61.3 and 78.4, MCH (pg) was 22.1 and 27.9, RDW (%) was 16.5 and 14.2, ferritin (ng/mL) was 12.3 and 45.3, iron concentration (µg/dL) was 20.5 and 91.2, total iron binding capacity (TIBC) (µg/dL) was 480.2 and 314.7 in group I and group II respectively. The difference was significant (P< 0.05).

Graph I Comparison of blood indices

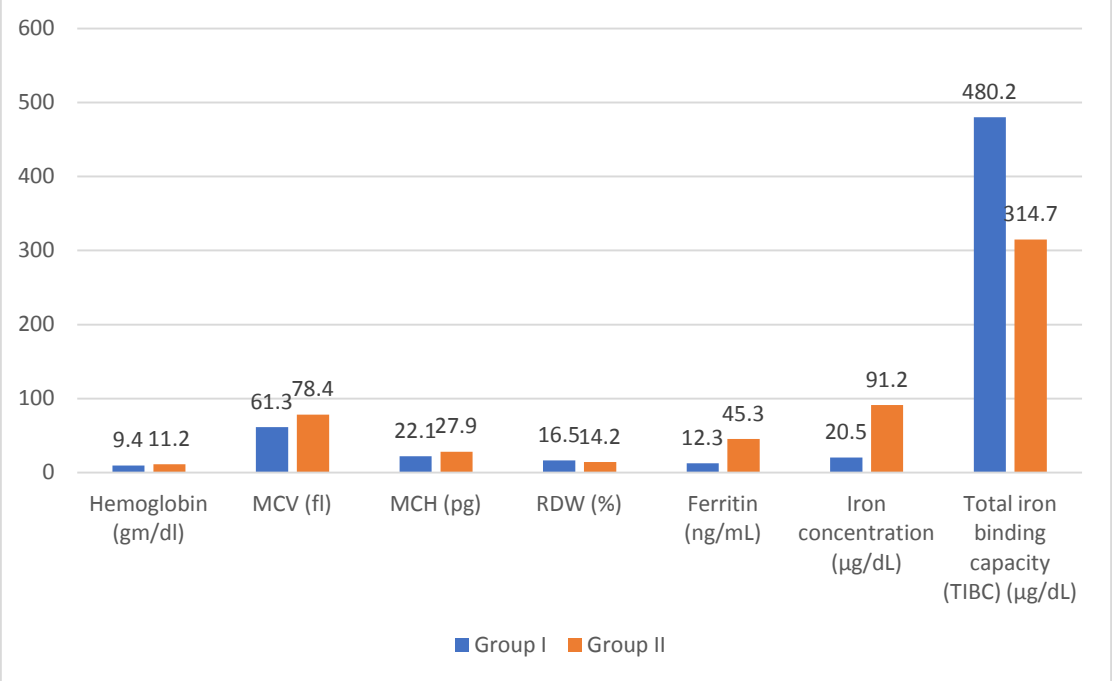
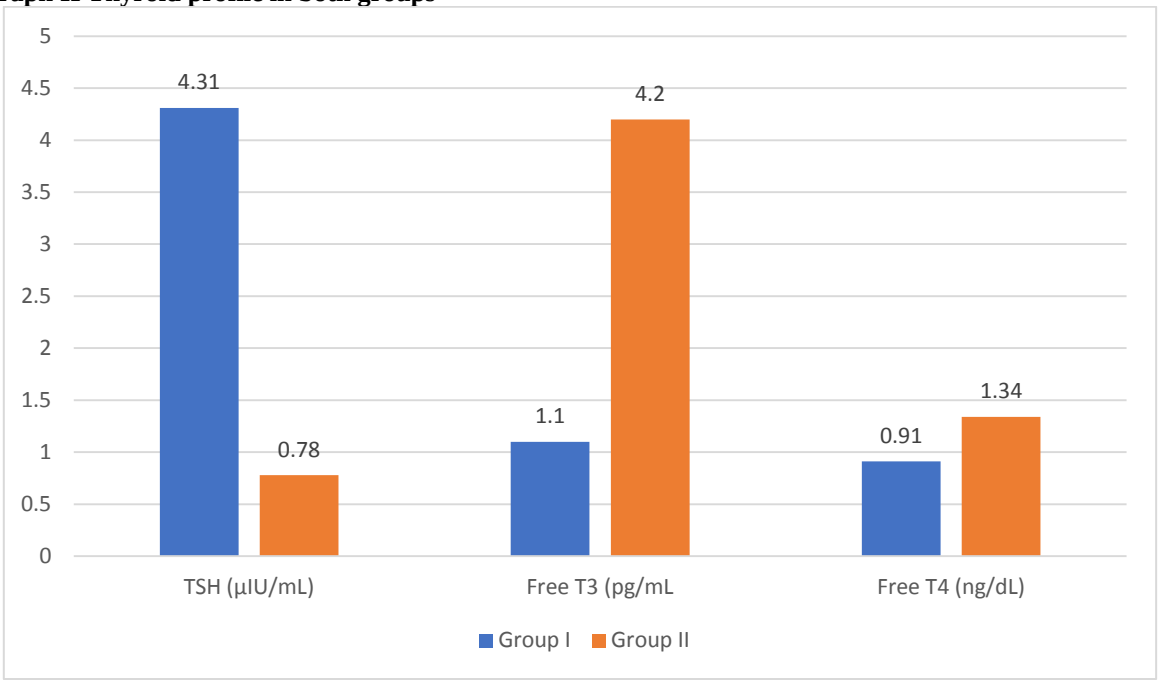


Table III Thyroid profile in both groups

Parameters	Group I	Group II	P value
TSH (µIU/mL)	4.31	0.78	0.01
Free T3 (pg/mL	1.1	4.2	0.03
Free T4 (ng/dL)	0.91	1.34	0.05

Table III, graph II shows that mean TSH (µIU/mL) was 4.31 and 0.78, free T3 (pg/mL) was 1.1 and 4.2 and free T4 (ng/dL) was 0.91 and 1.34 in group I and group II respectively. The difference was significant (P< 0.05).

Graph II Thyroid profile in both groups



DISCUSSION

The hypoxia of anaemia may cause or potentiate the adverse effect on the thyroid, perhaps by impairing the peripheral monodeiodinating system for thyroxine (T4) conversion to triiodothyronine (T3).6 Iron deficiency anaemia and hypothyroidism in the first years of life are both associated with deficits in mental and motor development and poor growth, yet a relationship between iron deficiency and hypothyroidism has not been explored.[7] Studies performed to date are highly suggestive of a causal relationship, but because of limitations in research design there is no conclusive evidence that iron deficiency anaemia results in abnormal thyroid function or hypothyroidism.[8,9] The present study was conducted to assess thyroid function in children with iron deficiency anemia.

In present study, there were 30 boys and 54 girls in group I and 40 boys and 44 girls in group II. We found that mean hemoglobin (gm/dl) was 9.4 and 11.2, MCV (fl) was 61.3 and 78.4, MCH (pg) was 22.1 and 27.9, RDW (%) was 16.5 and 14.2, ferritin (ng/mL) was 12.3 and 45.3, iron concentration (µg/dL) was 20.5 and 91.2, total iron binding capacity (TIBC) (µg/dL) was 480.2 and 314.7 in group I and group II respectively. El Masry et al[10] investigated the possible occurrence of thyroid dysfunction among children with isolated iron deficiency anaemia (IDA) of various severities. Significant higher serum thyroid Stimulating Hormone (TSH) levels with significant lower serum levels of Free Triiodothyronine (FT3) and Free Thyroxine (FT4) among patients versus controls.

We observed that mean TSH (µIU/mL) was 4.31 and 0.78, free T3 (pg/mL) was 1.1 and 4.2 and free T4 (ng/dL) was 0.91 and 1.34 in group I and group II respectively. Tienboon et al[11] determine the effect of iron deficiency anaemia on the thyroid function of young children. Concentrations of thyroxine (T4) and triiodothyronine (T3), free thyroid hormones (fT4 and fT3), thyroxine binding globulin (TBG), and thyroid stimulating hormone (TSH) were measured in the basal state and in response to an intravenous bolus of thyrotropin releasing hormone (TRH) in nine children one to three years of age with iron deficiency anaemia (IDA) before and after treatment with oral iron. Seven of the IDA and 6 of the control children were male. The mean haemoglobin (Hb) and serum ferritin (SF) in the IDA children at baseline were 93g/L (range 81-102) and 6g/L (range 1-12) which increased to 121g/L (range 114-129) and 54g/L (range 19-175), respectively, after a mean of 2.3 months (SD 0.5) of iron therapy. In the control group, mean Hb and SF were 125g/L (range 114-130) and 51 g/L (range 24-144), respectively. The basal values of TBG and thyroid hormones of the IDA children before and after iron treatment were not different from the control children. Similarly, there was no statistical difference in the thyroid hormones in the IDA children before compared to after resolution of the anaemia.

CONCLUSION

Authors found that primary hypothyroidism can occur among children suffering from iron deficiency anemia.

REFERENCES

1. Scrimshaw NS. Functional consequences of iron deficiency in human populations. J Nutr Sci Vitaminol (Tokyo) 1984; 30: 47-63.
2. Beard J, Tobin B, Smith SM. Norepinephrine turnover in iron deficiency at three environmental temperatures. Am J Physiol 1988; 255: R90-6.

3. Celani MF, Corradini MC, Rota C, Massolo F. A rise in haemoglobin levels may enhance serum triiodothyronine (T3) concentrations in prepubertal patients with beta-thalassaemia major. Exp Clin Endocrinol 1990; 96: 169-76.
4. Beard J, Green W, Miller L, Finch C. Effect of iron-deficiency anaemia on hormone levels and thermoregulation during cold exposure. Am J Physiol 1984; 247: R114-9.
5. Ramirez G, Bittle PA, Sanders H, Bercu BB. Hypothalamohypophyseal thyroid and gonadal function before and after erythropoietin therapy in dialysis patients. J Clin Endocrinol Metab 1992; 74: 517-24.
6. Lozoff B, Jimenez E, Wolf AW. Long-term developmental outcome of infants with iron deficiency. N Engl J Med 1991; 325: 687-94.
7. Chwang L, Soemantri AG, Pollitt E. Iron supplementation and physical growth of rural Indonesian children. Am J Clin Nutr 1988; 47: 496-501.
8. International Committee for Standardization in Haematology. Recommendations for reference method for haemoglobinometry in human blood and specifications for international haemoglobincyanide reference preparation. J Clin Pathol 1978; 31: 139-43.
9. Short MW, Domagalski JE. Iron deficiency anaemia: evaluation and management. Am Fam Physician. 2013;87:98-104.
10. El-Masry H, Hamed AM, Hassan MH, FAyEd HM, Abdelzaher MH. Thyroid Function among Children with Iron Deficiency Anaemia: Pre and Post Iron Replacement Therapy. Journal of Clinical & Diagnostic Research. 2018 Jan 1;12(1).
11. Tienboon P, Unachak K. Iron deficiency anaemia in childhood and thyroid function. Asia Pacific journal of clinical nutrition. 2003 Jun 1;12(2).