



Study of Serum Ferritin in Newly Diagnosed Cases of Hypothyroidism

Dr. Salma Ahmed

Department of Biochemistry
Assam Medical College & Hospital, Dibrugarh, Assam, India

Abstract:

Ferritin is an iron storage protein found in the body tissues. Ferritin is very essential for normal thyroid hormone metabolism. Serum ferritin levels also have been reported to be altered in patients with thyroid disease. Thus changes in the serum concentration of ferritin reflect thyroid function. Aim of the study was to assess the serum levels of ferritin in newly diagnosed cases of hypothyroidism and compare with those of healthy controls & to assess any correlation between thyroid profile and ferritin in hypothyroidism. Ferritin levels were estimated in 30 newly diagnosed cases of hypothyroidism using immunoradiometric method. T_3 , T_4 and free T_4 were estimated using radioimmunoassay and TSH by immunoradiometric method. These were then compared with age and sex matched healthy controls. Results were correlated statistically. Serum ferritin levels were found to be significantly reduced in patients with hypothyroidism compared to normal subjects ($p < 0.001$). Hypothyroidism is associated with low serum ferritin levels. The estimation of serum ferritin may help in understanding the etiopathogenesis and monitoring of hypothyroid patients.

Keywords: Immunoradiometric, Ferritin, Hypothyroid

I. INTRODUCTION

For normal thyroid hormone metabolism, trace elements such as iodine, iron, selenium, and zinc are very essential. Low iron or more specifically, low ferritin is one of the most overlooked conditions of low thyroid function. [1] Ferritin is an iron storage protein found in almost all of the body tissues. Thyroid peroxidase is a membrane bound glycosylated haemprotein that plays a key role in the biosynthesis of thyroid hormone by organification which requires iron. Iron deficiency has been reported to impair the body's ability to make its own thyroid hormone. Iron deficient persons are diagnosed by serum ferritin level. And measuring serum ferritin may provide valuable insights on the mechanism of thyroid hormone action on peripheral tissues. Thyroid hormone (T_3) plays a central role in differentiation, development, and maintenance of body homeostasis. [2] The actions of T_3 , like the steroid hormones, are mediated through intracellular T_3 -receptor proteins (TRs) [3, 4] which act predominantly to modulate transcription by binding to specific T_3 -response elements in target genes. Several groups have documented an association between T_3 levels and ferritin expression. In earlier reports, hypothyroidism produced by thyroidectomy was associated with increased rat hepatic ferritin content, which was found to be due to post-transcriptional changes in the ferritin synthetic rate. [5, 6]. More recently, however, and in contrast, hyperthyroid rats with elevated T_3 and T_4 levels were found to have an increased liver ferritin protein synthesis rate (38% above control). [7] Part of this increase may be due to elevated IRE-mediated ferritin translation, although T_3 has also been shown to increase the transcription rate of H-ferritin mRNA in rat C6 glioma cells, [8] raising the possibility of a transcriptional effect in the liver. Of particular interest, are reports from several groups in which T_3 was shown to positively regulate serum ferritin measurements in humans, similar to the

changes reported in the rat. Elevated serum ferritin levels were observed in hyperthyroid individuals, and levels decreased significantly after anti thyroid treatment with normalization of T_3 levels. Furthermore, administration of T_3 to hypothyroid individuals produced a significant increase in the serum ferritin level [9]. Several groups have documented that there might be a possible positive correlation between T_4/T_3 levels and ferritin in the serum. Keeping this in view, this study was undertaken to assess the levels of ferritin in newly diagnosed cases of hypothyroidism and whether any such correlation exists with the thyroid profile.

AIMS AND OBJECTIVES

1. To study the serum levels of ferritin in newly diagnosed cases of hypothyroidism and compare the serum ferritin with those of age and sex matched healthy controls
2. To assess any correlation between thyroid profile and ferritin in cases.

MATERIALS & METHODS

A case control study was carried out in the Department of Biochemistry, Assam Medical College and Hospital for duration of one year. 60 subjects were selected for this study (30 cases and 30 controls). Ferritin and TSH were estimated by immunoradiometric method while T_3 , T_4 and free T_4 were estimated by radioimmunoassay method.

INCLUSION CRITERIA

- Age 18-70 years of either sex.
- Patients with high serum TSH and decreased T_3 , T_4 and free T_4 were considered as overt hypothyroid cases. Reference intervals: TSH (0.17–4.05 Miu/ml), T_3 (0.77–2.2 ng/ml), T_4 (55–135 ng/ml) and free T_4 (10–20 pg/ml) { BOARD OF RADIATION & ISOTOPE TECHNOLOGY (BRIT) CENTRE, ASSAM MEDICAL COLLEGE & HOSPITAL }

EXCLUSION CRITERIA

- Pregnancy
- <18 and >70 years of age and who do not give consent.
- Renal disorders, hepatic disorder, secondary causes of hypothyroidism.
- Patients on drugs for hypothyroidism and PCOS patients.

II. RESULTS

The study group was between 18 to 70 years and further subdivided into seven age groups that is <20,20-29, 30-39, 40-49, 50-59, 60-69, ≥70. The age group 30-39 showed the maximum number of cases with 46.67% of the total study population numbering 14 individuals and the age groups <20 (18 years) & ≥70 showed the minimum of one being only 3.33% of the total study population. Amongst the study population 73% were female and 26 % male and the ratio of male: female is 1:2.75 The study shows that mean and standard deviation of TSH of the hypothyroidism cases were significantly higher than the healthy controls; TSH being (11.36±10.40) in cases and 3.55±0.40 in controls respectively. Mean and standard deviation of T₃, T₄ and free T₄ were significantly lowered in hypothyroidism cases than controls; T₃ (0.96±0.51 and 1.50±0.35 in cases and controls); T₄ (68.37±26.11 and 100.23 ±14.70 in cases and control) and free T₄ (7.64±1.77 and 11.48± 1.87 in cases and controls) respectively.

Table.1. Comparison of Serum Ferritin between Cases and Controls

	CASES		CONTROLS		p value
	Mean	± S.D.	Mean	± S.D.	
Serum Ferritin	44.62	21.87	79.13	22.38	<0.001

From the above table, serum ferritin was found to be significantly lowered in hypothyroidism cases (44.62 ±21.87 in cases and 79.13±22.38 in controls respectively) with p value < 0.001

Table.2. Correlation Between T₃ And Serum Ferritin Levels In Hypothyroidism Cases

	Mean	± S.D.	r value	p value
T ₃	0.96	0.51	0.610	0.0003
Serum Ferritin	44.62	21.87		

Above table shows a positive correlation between T₃ and serum ferritin (r= 0.6104, p< 0.05).

Table.3. Correlation Between T₄ And Serum Ferritin Levels In Hypothyroidism Cases

	Mean	± S.D.	r value	p value
T ₄	68.37	26.11	0.412	0.024
Serum Ferritin	44.62	21.87		

The above table shows a moderate positive correlation between T₄ and serum ferritin in hypothyroid cases. (p value < 0.05).

Table.4. Correlation Between Tsh And Serum Ferritin Levels In Hypothyroidism Cases

	Mean	± S.D.	r value	p value
TSH	11.36	10.40	-0.3327787	0.073069
Serum Ferritin	44.62	21.87		

A negative correlation was found between TSH and serum ferritin in hypothyroid cases but is not significant statistically

Table.5. Correlation Between Free T₄ And Serum Ferritin Levels In Hypothyroidism Cases

	Mean	± S.D.	r value	p value
Free T ₄	7.64	1.77	0.413	0.023
Serum Ferritin	44.62	21.87		

The above table shows a positive correlation between free T₄ and serum ferritin in cases. (p value<0.05)

III. DISCUSSION

In this present study, serum ferritin level was found to be lower in hypothyroidism cases as compared with the controls (44.62 ± 21.87 in cases and 79.13±22.38 in controls). The study conformed to a study carried out by Ashuma Sachdeva *et al* where serum ferritin levels in 50 newly diagnosed cases of hypothyroidism were compared with equal number of age and sex matched healthy controls. They found that serum ferritin levels significantly decreased in hypothyroidism (21.08±3.18 in cases and 59.89±8.56 in controls respectively with p value < 0.001. [8] Gupta R *et al* (2015) found out that serum ferritin showed a significant relationship for hypothyroid cases when compared with controls (29.94±20.66 in cases and 93.72±50.66 in controls): p value<0.05. [9] Another study in agreement to this study was that of carried out by Deshpande U.R.*et al* where they showed a significant relationship of ferritin in hypothyroid cases: serum ferritin level significantly lowered in hypothyroid cases as compared with controls. [7] Ayhan *et al* (2003) carried out a study to determine the changes due to hyperthyroidism or hypothyroidism in serum ferritin, iron, transferrin and to investigate the interrelationships between these parameters. They found out that serum ferritin levels of hyperthyroid patients were higher than those of hypothyroid patients and healthy controls (p< 0.005) and decreased in hypothyroid patients. [10] This study showed a significant positive correlation between T₃ and ferritin, significant positive correlation between T₄ and ferritin, a negative correlation between TSH and ferritin and a significant positive correlation between free T₄ and ferritin. This study conformed with another study carried out by Eftekhari MH *et al* (2006) where there was significant correlation between T₄ and ferritin (r=0.52, p <0.001) and between TSH and ferritin (r=-0.3, p<0.05).[11] Another study in agreement to this present study was that carried out by Kiran Dahiya *et al* (2016) where ferritin level was estimated in 50 newly diagnosed cases of hypothyroidism and compared with age and sex matched healthy controls. Ferritin level was found to be very significantly

lowered in hypothyroid cases (18.46 ± 10.52 in cases and 34.63 ± 15.84 in controls). Moreover, ferritin was found to be negatively correlated with TSH ($R = -0.278$, $P = 0.178$) though statistically not significant. [12] Hypothyroidism is more prevalent in female population as estrogen has an anti-thyroid action. Ferritin is an iron storage protein found in all living organisms involved in iron sequestration with some anti-oxidant properties. High TSH as observed in clinical hypothyroidism is known to induce inflammatory cytokines and to decrease the concentration of antioxidants in the body. The expression of gene for ferritin has also been reported to be induced by T_3 hormone. Thyroperoxidase, the key enzyme in thyroid hormone biosynthesis is iron dependent. Thus iron deficiency or more typically low ferritin (storage form of iron) may be the underlying cause in the development of hypothyroidism. The negative correlation of TSH with ferritin observing as obvious association between thyroid hormones and ferritin level but it cannot be commented upon exclusively as our results were not statistically significant. This discrepancy may be due to small sample size and lack of follow up of these patients with treatment.

IV. CONCLUSION

In this small scale study and with limited time frame, it may be concluded that serum ferritin levels are lower in cases of hypothyroidism, as compared to the age and sex matched healthy controls. Also there is a positive correlation between serum ferritin and T_3 and T_4 (bound form). A positive correlation is also observed between serum ferritin and free T_4 . A negative correlation that is not statistically significant is also observed between serum ferritin and TSH. Hence, it may be assumed that serum ferritin, if additionally measured along with the tests for thyroid function routinely may help in an early diagnosis of an iron deficient state. Correction of this deficiency sufficiently early in the course of hypothyroidism will enable to reduce morbidity associated with this disease. However to conclusively establish this hypothesis, longer duration studies would be beneficial for future researchers.

V. REFERENCES

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